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What Determines Labour Costs in Slovenia?

An Empirical Analysis of Labour Costs in
the Period 2008–2024

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Abstract

The empirical analysis examines the impact of various factors on labour cost developments over the period 2008–2024. The results show that labour costs are statistically significantly associated with the number of employees, the level of labour productivity and the minimum wage, the age structure of employees, and labour market tightness. An increase in the number of employees is associated with an almost linear rise in labour costs. Higher labour productivity and the minimum wage, an increasing share of older employees, and greater labour market tightness are also positively, though more moderately, associated with labour costs. The results are robust across different model specifications.¹

JEL codes: E24, J21, J31, C33

Keywords: empirical analysis, labour costs, employment, labour market tightness, demographic trends

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Introduction

The spur for conducting more detailed empirical analysis of the factors affecting developments in labour costs at Slovenian firms was last year's rise in labour costs despite a fall in the number of employees. This conversely raises questions about structural changes in the labour market, and about the factors affecting labour costs independently of changes in the number of employees. A more detailed look at corporate performance in 2024 can be found in the analysis of Lindič (2025).

This analysis takes account of key variables that are assumed to have a significant impact on developments in labour costs, namely the number of employees, the level of labour productivity and the minimum wage, the age breakdown of employees, and the tightness of the labour market. It is mainly the last two that are significant from the perspective of structural changes on the labour market. Older employees generally earn higher wages on account of their longer years of service and the corresponding bonuses, which can be reflected in higher average labour costs. Given the expectation of an ageing working population over the years ahead, this trend could put additional pressure on labour costs, particularly in sectors with a higher share of older employees. Alongside demographic changes, developments in labour costs might also be influenced by the current tightness of the labour market, where workers' increased bargaining power leads to a rise in wages, fringe benefits and other costs related to labour, which is an additional factor driving up labour costs.

The purpose of the analysis is to empirically evaluate the influence of key factors on developments in labour costs at firms in Slovenia in the period between 2008 and 2024, by including demographic and structural factors in the analysis alongside economic indicators. In so doing this analysis aims to contribute to a better understanding of developments in labour costs, and to offer insight into the future challenges, particularly in connection with the expected demographic changes and the potential persistence of a tight labour market.

Literature review

Labour costs can have a significant influence on corporate performance. Past analysis shows that developments in labour costs do not depend solely on changes in the number of employees, which is one of the key drivers, but also on structural factors such as changes in the composition of the workforce, institutional changes such as the minimum wage, and the labour market situation.

In theory labour productivity is thought to be one of the key factors in developments in labour costs, as their evolution over the long term is thought to be aligned (Bakker, 1999). At the same time the inclusion of labour productivity in economic models also controls for factors at firm level that affect developments in labour costs, such as changes in the organisational structure, employee training or changes in wages (Cristescu et al., 2024; ILO, 2016).

In light of the growing challenges in connection with labour shortages, analysis of labour market tightness is vital to understanding the structural changes on the labour market. While the traditional Phillips curve emphasises an inverse relationship between unemployment and wage growth, more recent approaches suggest that alternative metrics of labour market tightness might be a better indicator of wage developments (Doornik, Igan & Kharroubi, 2023; Bonam, de Haan & Limbergen, 2021). Labour market tightness entails a surplus in demand for labour over supply, and is reflected in a mismatch between the number of vacancies and the labour willing to fill those vacancies (Lindič, 2023). The inclusion of a metric of labour market tightness is important, as in conditions of increased demand for labour, labour costs often rise as a result of the surplus demand for labour over supply, and the resulting increase in workers' bargaining power.

At the global level labour market tightness began to increase most notably during the post-pandemic economic recovery, in which several factors played a part. On the labour supply side, there is growing prominence of demographic factors in the form of the ageing population, which is shrinking the pool of available labour, while workers' preferences are also changing, in favour of shorter working hours. On the demand side, one way in which firms tried to resolve the aforementioned challenges was labour hoarding, which further increased labour market tightness (Doornik, Igan & Kharroubi, 2023).

The largest increases in labour market tightness in Slovenia during the observation period came during the recovery after the global financial crisis and after the pandemic. At the end of the observation period, i.e. in the final quarter of last year, a fall in the number of vacancies meant that it was down on the record level seen in the first quarter of 2023, but it was still well above its average over the observation period (see Figure 1). More detailed analysis of labour market tightness in Slovenia can be found in Lindič (2023).

Figure 1: Labour market tightness in Slovenia

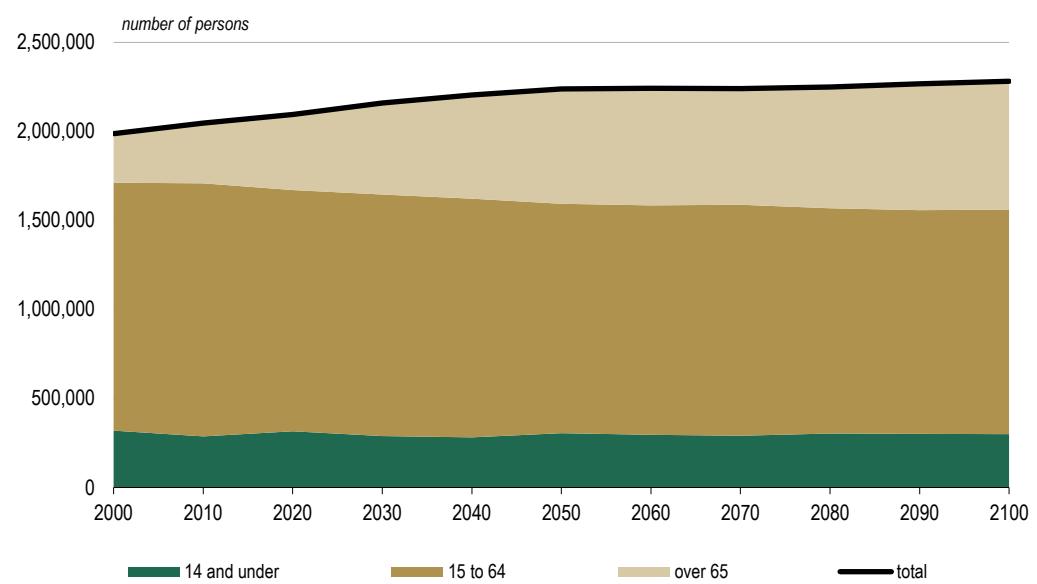


Sources: Eurostat, SORS, own calculations

Note: Labour market tightness is defined as the ratio of the number of vacancies to unemployment.

As stated earlier, demographic trends are an increasingly important factor in developments in labour costs, with many advanced economies seeing a shrinking pool of labour and an ageing population. Older employees usually earn higher wages, whether on the grounds of their experience, their longer years of service, or bonuses for their years of service. Some countries for example have wages based on the number of years spent in active work (seniority wages), which are raised according to years of service, and not according to the performance or productivity of the employee (OECD, 2019). The demographic trends in Slovenia are likely to be relatively unfavourable over the next decades and will have an adverse impact on the labour market on account of the declining share of the population aged 15 to 64 (see Figure 2). Projections for 2100 have the number of people in the age group aged 14 and under down 7.3% compared with this year, and the number of people aged 15 to 64 down 14.3%, but the number of people aged over 64 up 35.1%. A more detailed look at demographic trends for Slovenia can be found in Lindič (2023).

Figure 2: Demographic trends in Slovenia



Sources: Eurostat, SORS, own calculations

Note: The figure illustrates the EUROPOP2023 projections, which envisage increased cross-border migration. The EU-ROPOP2023 projections are based on assumptions with regard to fertility, mortality and cross-border migration, and alongside a baseline scenario also offer a choice of five additional sensitivity tests regarding fertility, mortality and migration.

In addition to age, wage developments and consequently labour costs are also affected by other structural factors in the workforce, such as gender, qualifications, type of employment, region, occupation, and working hours (Banka Slovenije, 2025). Some of them are consequently reflected in the average wage at firm level, which can be affected by several factors: the labour productivity, the type of business activity, employees' bargaining power, qualification levels, employees' age, the duration of employees' employment, wage policy at the firm, the institutional framework (e.g. collective agreements) and the broader economic situation. The level of the average wage might therefore be an indirect reflection in the empirical model of labour productivity, and could represent a proxy for it, while controlling for other structural factors at the same time.

Developments in labour costs are also affected by growth in the minimum wage, which directly raises the pay of minimum wage recipients, and also the pay of those workers who were previously receiving wages lower than the newly introduced minimum. At the same time a rise in the minimum wage can spill over into higher wages, as employees

and employers aim to preserve the ratios between wages of employees with different skill levels, where this spillover is usually more evident at lower wage levels (ILO, 2016). Minimum wages track the cost of living in the majority of OECD countries. Furthermore in recent years the minimum wages stipulated by law have risen by more than average wages, which has helped to reduce pay disparities at the lower end of the income scale (OECD, 2025).

Under the amendment to the Minimum Wage Act of November 2018, the minimum wage in Slovenia is required to exceed the minimum cost of living by no less than 20% and no more than 40%. In January 2024, i.e. at the end of the observation period for this analysis, the minimum wage was nominally raised by 4.2% to EUR 1,253.90 gross, which ranked Slovenia in the middle of the euro area countries (Banka Slovenije, 2024). It rose by EUR 682.6 gross or 119.5% over the entire observation period, having mostly outpaced growth in the average wage. Consequently, the wage distribution is concentrated at lower levels of pay, mostly around the minimum wage. Minimum wage earners are more often young people, those with lower qualifications, those working in less demanding occupations, and foreign nationals. At the same time the minimum wage is more often paid by less-productive and more-indebted firms, and a rise in the minimum wage has a greater impact on firms with a higher share of minimum wage employees (Perko & Rogan, 2025).

Analysis of the Slovenian data provides further evidence of the rise in the minimum wage spilling over into rises in other wages. Laporšek, Vodopivec and Vodopivec (2019) estimated that the spillover effect on wages reaches up to a level 50% higher than the new minimum wage, with the effect gradually diminishing with greater distance from the minimum wage. A slightly smaller minimum wage spillover effect was estimated by Perko and Rogan (2025), who found that a rise in the minimum wage would have its greatest impact on wages just above its new level, with the effect gradually diminishing up to a level 20% above the minimum wage. According to their estimates, wages are extremely concentrated around the new level of the minimum wage.

3

Methodology

The analysis of the factors affecting growth in labour costs at firms in Slovenia uses data from closing accounts (AJPES) at firm level for the period of 2008 to 2024, augmented by selected macroeconomic variables and variables at sector level, which are available to the public on the SORS website.²

² The analysis covers corporations in Slovenia (all those belonging to the institutional sectors of non-financial corporations, general government, and financial corporations). The basis is data from the annual reports that firms submitted to the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES) for the purposes of government statistics or the monitoring of economic development at various levels in accordance with the Companies Act (ZGD-1). The analysis was conducted based on unaudited and unconsolidated AJPES data and excludes all firms that failed to report any values in the year in question (all items in the balance sheet are zero).

3.1 Baseline model

The baseline model is estimated by means of the following regression equation:

$$\text{labour costs}_{ijt} = \beta_1 \text{employees}_{ijt} + \beta_2 \text{productivity}_{ijt} + \beta_3 \text{minimum wage}_t + \beta_4 \text{share of older}_{jt} + \beta_5 \text{tightness}_t + \gamma_i + \delta_j + \varepsilon_{ijt} \quad (1)$$

Where:

- i denotes the firm,
- j denotes the sector,
- t denotes the year,
- γ_i are fixed effects of the firm,
- δ_j are fixed effects of the sector (structured according to SKD 2008),
- ε_{ijt} is the error.

The dependent variable in equation (1) $\text{labour costs}_{ijt}$, is the logarithm of labour costs at firm level, while the explanatory variables are the following:

- employees_{ijt} is the logarithm of the number of employees at the firm, where the variable discloses the number of working hours in an accounting year for which employees received wages and wage compensation.³
- $\text{productivity}_{ijt}$ is labour productivity at firm level, calculated as the ratio of value-added to the number of employees, where value-added is defined as gross operating profit minus costs of goods, materials and services and other operating expenses. The variable is expressed as EUR thousand per employee.
- minimum wage_t is the logarithm of the nominal minimum wage at national level.
- $\text{share of older}_{jt}$ is the share of older employees at sector level, expressed as a percentage, where older employees are defined as those aged over 55.
- tightness_t is labour market tightness, calculated as the ratio of the number of vacancies to the number of unemployed persons, expressed as a percentage. To increase the robustness of the results, the unemployment rate was used as an alternative metric of labour market tightness.

A panel regression model was used to estimate the effects, which allows the inclusion of multiple dimensions of fixed effects (e.g. at firm level and sector level), and thus control over invariant attributes of individual units and a robust standard error (at firm level).

3.2 Alternative model specifications

Other potentially significant macroeconomic variables were also included for the purpose of testing the robustness of the model and checking the stability of the results. As stated in the previous subsection, the unemployment rate was used as an alternative metric of labour market tightness.

³ The number of employees is defined in the AJPES database as the number of hours worked in the calendar (financial) year for which employees received wages and allowances divided by the number of possible hours worked for the calendar (financial) year.

In addition, the average wage was included in the alternative model specification as a proxy of labour productivity. The regression equation of the alternative model specification with average wage included as one of the explanatory variables is as follows:

$$\begin{aligned} \text{labour costs}_{ijt} = & \beta_1 \text{employees}_{ijt} + \beta_2 \text{average wage}_{ijt} + \beta_3 \text{minimum wage}_t \\ & + \beta_4 \text{share of older}_{jt} + \beta_5 \text{tightness}_t + \gamma_i + \delta_j + \varepsilon_{ijt} \end{aligned} \quad (2)$$

The average wage at firm level is calculated as the ratio of wage costs to the number of employees, where labour costs (dependent variable) also include contributions and other employer obligations. This approach allows for a separate estimate of the influence of changes in paid wages on aggregate labour costs.

Because the original purpose of the analysis was an empirical assessment of various factors that might explain why labour costs increased last year despite a fall in the number of employees, aggregate labour costs at the firm were used in the basic analysis as a dependent variable, while the number of employees was used as an independent variable. Nevertheless, as the use of aggregate labour costs as a dependent variable also includes a mechanical correlation with the number of employees, as labour costs are in essence the sum of individual labour costs, this means that their variability is largely dependent on the number of employees at the firm. Consequently changes in the number of employees in the baseline model can partly conceal the influence of other factors affecting labour costs at the level of the individual employee.

Accordingly, labour costs per employee were used as a dependent variable in the alternative specification. This allows for analysis of factors that directly influence the labour costs of the individual employee. The two models – the baseline model with aggregate labour costs (1) and the alternative model with labour costs per employee (3) – complement each other; the first sheds light on the dynamics in aggregate labour costs with regard to changes in the number of employees, while the second allows for the estimation of determinants of labour costs at the level of the individual person.

The regression equation of the alternative model specification with labour costs per employee as the dependent variable is as follows:

$$\begin{aligned} \text{labour costs per employee}_{ijt} = & \beta_1 \text{productivity}_{ijt} + \beta_2 \text{minimum wage}_t \\ & + \beta_3 \text{share of older}_{jt} + \beta_4 \text{tightness}_t + \gamma_i + \delta_j + \varepsilon_{ijt} \end{aligned} \quad (3)$$

Given the potential high correlation between certain control variables, great care was taken in examining multicollinearity via analysis of correlations and responses in regression coefficients under various model specifications.

Results

4.1 Baseline model results

During the estimation of the baseline model (1), the results showed a relatively high correlation between the share of older employees and labour market tightness (approximately 0.7), which hinders the separate interpretation of their effects in the same model. Certain models are excluded in the results for this reason. Time invariant effects are also excluded, as it was shown that their inclusion, via which differences between firms within the year were estimated, would exclude the demographic trend of an ageing population, which is confirmed by the high correlation between the share of older employees and the time variable (approximately 0.8). In addition, with the inclusion of time invariant effects the variable for minimum wage, which does not vary over the course of the year, was excluded.

The results in Table 1 show the expected statistically significant links between developments in labour costs and the control variables. Increases in the number of employees, labour productivity, the minimum wage, the share of older employees and labour market tightness show a positive correlation with labour costs, while the unemployment rate shows a negative correlation. Here it should be noted that the results show correlation between individual control variables and the dependent variable, and do not prove causative effects.

Table 1: Baseline model (1) results

	(1)	(2)	(3)
employees	0.997*** (0.001)	0.992*** (0.001)	0.990*** (0.001)
labour productivity	0.028*** (0.000)	0.027*** (0.000)	0.027*** (0.000)
minimum wage	0.758*** (0.005)	0.585*** (0.004)	0.721*** (0.003)
share of older	0.006*** (0.000)		
tightness		0.004*** (0.000)	
unemployment rate			-0.026*** (0.000)
constant	-2.165*** (0.028)	-1.007*** (0.026)	-1.670*** (0.021)
number of observations	722,314	722,314	722,314
R ²	0.975	0.975	0.976

Sources: AJPES, SORS, own calculations.

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Dependent variable: the logarithm of labour costs at firm level. Independent variables: employees: the logarithm of the number of employees at the firm; labour productivity: the ratio of value-added to the number of employees expressed as EUR thousand per employee; minimum wage: the logarithm of the level of the nominal minimum wage at national level; share of older: the share of employees aged over 55 at sector level, expressed as a percentage; tightness: labour market tightness calculated as the ratio of the number of vacancies to the number of unemployed, expressed as a percentage; unemployment rate: the surveyed unemployment rate. Period of estimation: 2008 to 2024.

The coefficient of the logarithm of the number of employees was close to 1, which indicates that labour costs are virtually linearly correlated with the number of employees. The result in column (1) of Table 1 shows that a 1% increase in the number of employees is correlated with a 0.997% rise in labour costs *ceteris paribus*.

An increase in labour productivity is also correlated with a rise in labour costs. The result in column (1) of Table 1 shows that an increase of EUR 1,000 per employee in labour productivity is correlated with a 2.8% rise in labour costs.

The coefficients for minimum wage also show a positive correlation with labour costs. The result in column (1) of Table 1 shows that a 1% rise in the minimum wage is correlated with a 0.758% rise in labour costs.

The share of older employees at sector level is also positively correlated with labour costs. The result in column (1) of Table 1 shows that a 1 percentage point increase in the share of older employees is correlated with a 0.6% rise in labour costs.

The results for both metrics of labour market tightness are also statistically significant. The higher ratio of the number of vacancies to the number of unemployed persons (a positive coefficient for the tightness variable in column (2) of Table 1) and the lower unemployment rate (a negative coefficient for the unemployment rate variable in column (3) of Table 1) confirm that an increase in labour market tightness is positively correlated with a rise in labour costs. The coefficient of labour market tightness in column (2) of Table 1 shows that a 1 percentage point increase in labour market tightness is correlated with a 0.4% rise in labour costs, while the coefficient of the unemployment rate in column (3) shows that a 1 percentage point increase in the unemployment rate is correlated with a 2.6% fall in labour costs.

4.2 Results of alternative specifications

Table 2 illustrates the results of alternative model specification (2), where the control variable for labour productivity is replaced with the average wage. Because the latter cannot be a direct proxy for labour productivity, the results including average wage as a control variable are primarily used as an additional test of the robustness of the results. The statistical significance and the signs of the coefficients in the alternative model specification are consistent with the results of the baseline model, thereby confirming its robustness.

Table 2: Results of alternative model specification (2)

	(1)	(2)	(3)
employees	0.986*** (0.001)	0.986*** (0.001)	0.985*** (0.001)
average wage	0.903*** (0.003)	0.901*** (0.003)	0.899*** (0.003)
minimum wage	0.076*** (0.003)	0.059*** (0.003)	0.071*** (0.003)
share of older	0.001*** (0.000)		
tightness		0.000*** (0.000)	
unemployment rate			-0.003*** (0.000)
constant	0.091*** (0.015)	0.208*** (0.011)	0.160*** (0.011)
number of observations	723,539	723,539	723,539
R ²	0.995	0.995	0.995

Sources: AJPES, SORS, own calculations.

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Dependent variable: the logarithm of labour costs at firm level. Independent variables: employees: the logarithm of the number of employees at the firm; average wage: the ratio of wage costs to the number of employees expressed as a logarithm; minimum wage: the logarithm of the level of the nominal minimum wage at national level; share of older: the share of employees aged over 55 at sector level, expressed as a percentage; tightness: labour market tightness calculated as the ratio of the number of vacancies to the number of unemployed, expressed as a percentage; unemployment rate: the surveyed unemployment rate. Period of estimation: 2008 to 2024.

The coefficient of the number of employees is close to 1: it stands at 0.986 in column (1) of Table 2, which means that a 1% increase in the number of employees is correlated with a 0.986% rise in labour costs *ceteris paribus*.

Replacing the control variable labour productivity with the average wage shows the latter to be positively correlated with labour costs, which is expected, given that wage costs make up part of the definition of labour costs. The coefficients of the average wage in Table 2 show that a 1% increase in the average wage is correlated with a rise of approximately 0.9% in labour costs.

A rise in the minimum wage is also correlated with higher labour costs in the alternative model specification, although the coefficients are smaller than in the baseline model (see Table 1). This might indicate that part of the effect of the minimum wage is reflected via changes in the average wage, something that is confirmed by past analysis. The remaining results in Table 2 are in line with the results of the baseline model in Table 1, and thus confirm its robustness.

Table 3 illustrates the results of alternative model specification (3), where the dependent variable is labour costs per employee. Comparing the results in Table 1 and Table 3 shows the signs, magnitudes and statistical significance of the estimated coefficients to be very similar, which confirms the robustness of the results of the baseline model (1).

Table 3: Results of alternative model specification (3)

	(1)	(2)	(3)
labour productivity	0.029*** (0.010)	0.028*** (0.010)	0.028*** (0.009)
minimum wage	0.758*** (0.005)	0.586*** (0.004)	0.721*** (0.003)
share of older	0.006*** (0.000)		
tightness		0.004*** (0.000)	
unemployment rate			-0.025*** (0.000)
constant	-2.167*** (0.028)	-1.024*** (0.026)	-1.679*** (0.021)
number of observations	722,314	722,314	722,314
R ²	0.712	0.717	0.720

Sources: AJPES, SORS, own calculations.

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Dependent variable: the logarithm of labour costs per employee. Independent variables: labour productivity: the ratio of value-added to the number of employees expressed as EUR thousand per employee; minimum wage: the logarithm of the level of the nominal minimum wage at national level; share of older: the share of employees aged over 55 at sector level, expressed as a percentage; tightness: labour market tightness calculated as the ratio of the number of vacancies to the number of unemployed, expressed as a percentage; unemployment rate: the surveyed unemployment rate. Period of estimation: 2008 to 2024.

5

Conclusion

Empirical analysis of factors driving developments in labour costs at firms in Slovenia during the period of 2008 to 2024 showed that labour costs display a statistically significant correlation with the number of employees, the level of the minimum wage and labour productivity, the age structure of employees, and labour market tightness, where the conclusions were robust irrespective of the model specifications used.

According to the results of the analysis, developments in labour costs display an almost exact positive linear correlation with developments in the number of employees, which indicates that the number of employees is a significant factor driving labour costs. Positive correlations in labour costs are also evidenced with labour productivity and the minimum wage. According to the literature, the first raises labour costs through increased bonus payments, while a rise in the minimum wage raises the base for payments to people on the minimum wage. In addition, a rise in the minimum wage often spills over into wages above the minimum level, where the impact is usually greatest in the lower reaches of the wage distribution. Replacing labour productivity with the average wage as an independent variable also shows a positive correlation with labour costs, which confirms that the latter are sensitive to changes in the firm's wage policy.

A positive correlation with developments in labour costs is also displayed by the share of older employees, which might be attributable to their longer years of service, richer working experience and higher level of wages as a result of past promotions, while older employees can also be eligible for additional bonuses, such as extra days of leave, severance pay upon retirement, and jubilee bonuses. This result is particularly

significant in light of the expected demographic trends, which in Slovenia are predicted to see the population age markedly, thereby reducing and ageing the active population, and consequently putting further upward pressure on labour costs.

In the current situation of a persistently tight labour market, another significant result is that the increased labour market tightness may be linked to difficulties in recruiting personnel owing to workers' increased bargaining power, which is strengthening pressures on firms to offer higher wages and better working conditions. The two alternative metrics of labour market tightness, namely the number of vacancies per unemployed person and the unemployment rate, both display a consistent correlation with labour costs.

The statistical significance of the results was confirmed by the alternative models, where labour costs per employee were used as the dependent variable, and where the independent variable of labour productivity was replaced with the average wage, with an alternative metric of labour market tightness being used.

To more precisely assess the impact of an ageing workforce on labour costs, it might be recommendable for future research to obtain more detailed data at firm level and at employee level, which would facilitate more detailed analysis of demographic effects. It would furthermore be important to employ additional methods that focus on seeking causative effects among the variables.

The results of the analysis offer up a number of potential suggestions for guiding policy on the labour market. Given the persistent tightness of the labour market, it would make sense to continue activities aimed at improving the matching of supply of and demand for labour, with a focus on improving the skills and mobility of workers. In light of the trends of ageing population, it would also be recommendable to develop strategies to encourage young people to enter the labour market more quickly, to extend the working lives of older people, and to adapt jobs, which could all contribute to controlling labour costs over the longer term.

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