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Wage Dynamics in Europe: Drivers, Institutional Amplifiers, and Policy Spillovers

Kareem Ismail, Ana Lariau, and Théodore Renault

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Wage Dynamics in Europe: Drivers, Institutional Amplifiers, and Policy Spillovers
Prepared by Kareem Ismail, Ana Lariau, and Théodore Renault *

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ABSTRACT: This paper examines the drivers of wage growth in Europe and assesses whether the 2022–23 inflation surge has altered wage-setting dynamics, using cross-country macro evidence for 26 European economies, agreement-level collective bargaining data for Spain, and estimates of minimum and public sector wage spillovers. We find that the slope of the wage Phillips curve has not materially changed since the pandemic—labor market slack continues exerting a restraining influence on wage growth. However, post-pandemic wage growth was higher than predicted by historical relationships, reflecting the outsized inflation shock and a higher sensitivity of wages to past inflation. Wage-setting is found to differ markedly across regions. In Central, Eastern, and Southeastern European Economies (CESEE), wage formation remains more backward-looking, with past inflation playing a dominant role, whereas in Advanced Economies (AEs) inflation expectations are more important. In AEs, the recent wage response followed a sequential pattern: the wage drift rose early as employers granted ad hoc increases, while negotiated wages adjusted with a lag as collective agreements were renewed and workers recouped accumulated real wage losses. Micro evidence from Spain shows that institutional features of collective bargaining conditionally amplify inflation pass-through: CPI indexation clauses, sector-level bargaining, and shorter contract duration are each associated with stronger wage responses to past inflation. In parallel, minimum wage pass-through has strengthened markedly in CESEE since 2015, while public sector wages dampened aggregate wage growth in AEs but amplified it in CESEE during 2022–24. Taken together, these findings suggest that while the core Phillips curve mechanism remains intact, future inflation shocks could generate more persistent wage pressures where wage-setting is more backward-looking, inflation compensation becomes institutionalized (including through indexation that interacts with downward nominal rigidity), or discretionary minimum and public sector wage policies add impetus.

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WORKING PAPERS

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Glossary

AEs — Advanced Economies

CESEE — Central, Eastern, and Southeastern Europe

CPI — Consumer Price Index

EC — Error Correction

ECB — European Central Bank

GDP — Gross Domestic Product

HP — Hodrick-Prescott (filter)

LP — Local Projections

OLS — Ordinary Least Squares

PPP — Purchasing Power Parity

Executive Summary

The 2022-23 inflation surge led to the most significant rise in wages across Europe in decades. Despite the subsequent decline in inflation from its 2023 peak and the concomitant wage deceleration, nominal wage growth has remained above pre-pandemic averages, with the new global energy supply shock unfolding in 2026 raising risks of renewed wage pressures. Against this background, this paper reexamines the drivers of nominal wage growth across Europe, assesses potential shifts in the underlying wage-setting process, and explores implications for the inflation outlook. The analysis draws on a Phillips curve framework, implemented both at the macro level for European economies and at the micro level for collective bargaining agreements in Spain, supplemented by local projections to assess the aggregate wage spillovers from minimum and public sector wage policies.

Wage formation has remained more backward-looking in Central, Eastern, and Southeastern Europe (CESEE) compared to advanced economies (AEs), with past inflation being the dominant driver of nominal wage growth in the former and inflation expectations playing a more prominent role in the latter. These characteristics directly affect how supply shocks propagate: in CESEE second-round effects through wage growth may be more pronounced and persistent, while in AEs they can remain contained as long as inflation expectations stay anchored. Following the 2022-23 inflation surge, the wage acceleration in CESEE was in fact even greater than predicted by these historical fundamentals, as it outpaced forecasts based on pre-pandemic estimated model relationships. In AEs, recent aggregate wage growth dynamics concealed a sequential adjustment process: wage drift increases were predominant initially, as employers provided prompt discretionary pay rises ahead of formal negotiations; from 2023 onward, however, negotiated wages took over as contracts were renewed and workers succeeded in gradually recovering accumulated real wage losses.

Evidence from individual wage agreements in Spain shows that collective bargaining institutions shape the transmission of inflationary shocks to wage outcomes. Inflation indexation clauses—whose prevalence has risen recently, wage agreements of shorter duration, negotiations at above-the-firm (e.g., at sector) level and labor market tightness all amplify the pass-through of inflation to negotiated wage growth. Furthermore, agreement-level analysis of the drivers of consumer price inflation (CPI) indexation in Spain finds that a high-inflation episode significantly increases the likelihood that formal indexation be subsequently introduced—which would, in turn, amplify the pass-through of future inflationary shocks to wages. For Europe more broadly, this illustrates how changes in wage formation following a high-inflation episode might raise the responsiveness of wages, and thereby the persistence of inflation, in the aftermath of a subsequent inflation shock.

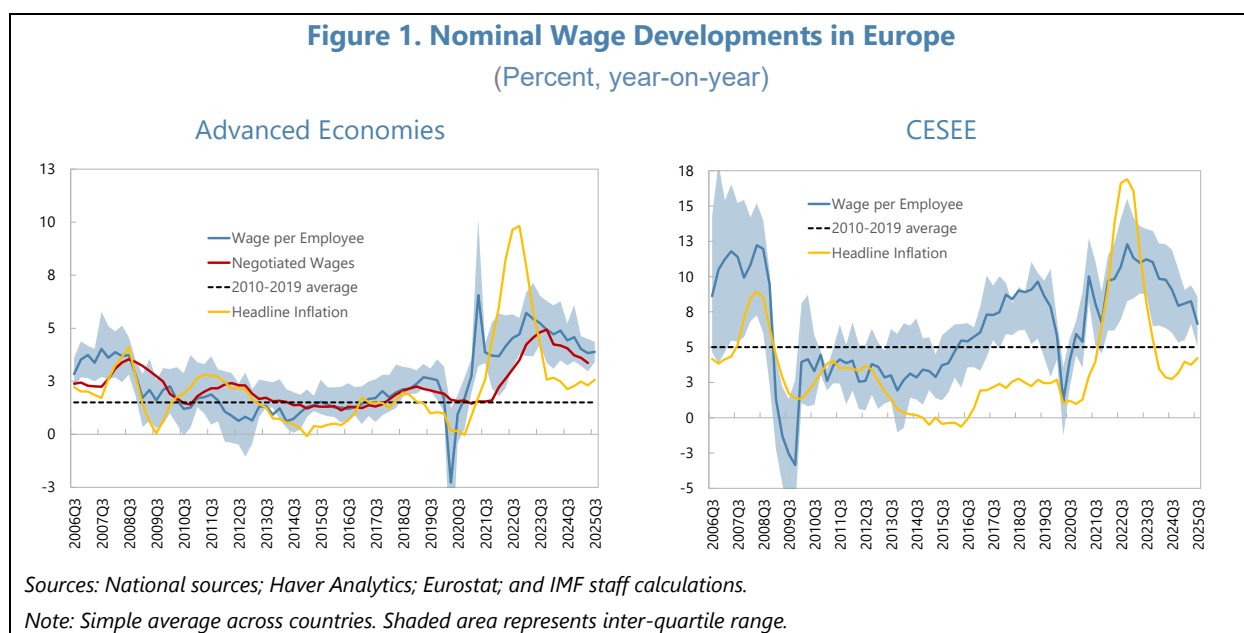
Discretionary minimum and public sector wage increases have also shaped wage dynamics in recent years, putting upward pressure on overall wages in CESEE. Minimum wage pass-through has strengthened notably in CESEE since 2015, while public sector wage restraint in AEs has slightly tempered overall wage inflation.

These findings carry important implications for the wage outlook amid renewed global supply shocks in 2026. The institutional mechanisms that underpinned the pickup in wage growth after the 2022-23 inflationary shock — indexation, sector-level bargaining, discretionary minimum and public wage hikes — could trigger a stronger price-wage inflation loop, leading to greater inflation persistence. While the paper also confirms that labor market slack still retains its moderating influence on wage growth even when inflation is elevated, a more persistent inflation shock and/or stronger price/wage inflation loops might require significantly tighter macroeconomic policies to bring inflation back to central bank targets. In this context, the reintroduction or

strengthening of backward-looking indexation clauses in collective agreements could heighten the persistence of inflation. In addition, discretionary increases in minimum wages and public sector wages may spill over into broader wage dynamics, with the potential to amplify inflationary pressures and necessitate tighter macroeconomic policy responses.

I. Introduction

The post-pandemic inflation surge in Europe has been accompanied by nominal wage growth that was more pronounced and persistent than the historical norms of recent decades. Following a prolonged period of subdued wage dynamics after the Global Financial Crisis, nominal wage growth increased sharply from 2022 onward, rising well above pre-pandemic averages in both AEs and CESEE (Figure 1). Wage inflation persisted even as inflation eased, but was gradually slowing in the run up to the war in the Middle East that erupted in early 2026. With global energy shocks now re-emerging, understanding the drivers and durability of wage pressures, the institutional channels through which they propagate, and whether the 2022 inflation episode durably altered wage formation, has become an urgent policy question.



Understanding the drivers of nominal wage growth matters for policy. If nominal wage growth primarily reflects a catch-up response to the real wage losses incurred during the inflation surge—a backward-looking, self-correcting adjustment—it may moderate naturally as inflation recedes and real wage gaps with productivity levels close. However, if the recent episode has altered the underlying wage-setting process—including by strengthening the inflation pass-through or by triggering institutional changes in collective bargaining that may affect wage negotiations—wage pressures could prove more persistent and generate stronger second-round effects in the aftermath of future energy supply (or broader cost-push) shocks, including following the war in the Middle East.

This paper examines the drivers of nominal wage growth using different, complementary approaches. First, it estimates a hybrid wage Phillips curve for 26 European countries over 2006–2024, then decomposes

aggregate wage growth into negotiated wages and the wage drift (for nine advanced economies), and tests for structural shifts in wage-setting dynamics following the pandemic. Second, it exploits a comprehensive agreement-level dataset of collective bargaining outcomes in Spain to examine how institutional features—indexation clauses, contract duration, and bargaining level—shape the transmission of inflation and labor market conditions to wage growth. Spain offers a useful case study given its high bargaining coverage, predominance of above-the-firm level (sector- and region-level) bargaining, rich variation across agreements, and the sharpness of the 2022-23 inflation shock. Third, the paper estimates the spillover effects of minimum and public sector real wage shocks to average and private sector real wages, respectively, using local projections, documenting how these effects have evolved over time and differ between AEs and CESEE.

The main findings are as follows. The slope of the wage Phillips curve has not materially changed since the pandemic – labor market slack has consistently restrained wage growth throughout. However, the high-inflation environment has essentially shifted nominal wage growth upward—nominal wage growth is higher for any given level of labor market slack when inflation is elevated, with evidence that wage sensitivity to past inflation increased post-pandemic. Wage formation remains more backward-looking in CESEE, where past inflation is the dominant driver, while inflation expectations play a more prominent role in AEs. This distinction has direct implications for how supply shocks propagate: second-round effects through wage increases are stronger and more persistent in CESEE, while in AEs they can remain contained as long as inflation expectations stay anchored. In AEs, the decomposition of aggregate wages reveals a sequential response of wage growth to higher price inflation: an increase in the wage drift initially, as employers granted discretionary compensation ahead of formal bargaining rounds; higher negotiated wages subsequently, from 2023 onward, as multi-year contracts were renewed and workers succeeded in gradually recouping real wage losses.

At the agreement level in Spain, past inflation raises negotiated wage growth and labor market slack lowers it, confirming that standard Phillips-curve forces also operate in a collective bargaining setting. Institutions can meaningfully affect the elasticity of wage growth to inflation: inflation pass-through is much stronger when agreements have CPI indexation clauses, sector-level bargaining, and annual (rather than multi-annual) contracts. Importantly, and at odds with the results from the macroeconomic data, microdata show that labor market tightness amplifies the pass-through of past inflation to wages, especially after the pandemic. Finally, the prevalence of indexed agreements rose sharply during the 2022-23 inflation episode, even though it remains far below the highs of the 1990s and 2000s. This development is consistent with the finding from agreement-level analysis of the drivers of CPI indexation in Spain that a high-inflation episode significantly increases the likelihood that formal indexation be subsequently introduced. This consequential institutional shift could potentially amplify the second-round effects of future inflationary shock, including the 2026 energy price shock following the war in the Middle East. For Europe more broadly, this illustrates how changes in wage formation following a high-inflation episode might raise the responsiveness of wages, and thereby the persistence of inflation, in the aftermath of a subsequent inflation shock.

Minimum wage hikes have a modest and short-lived effect on overall wages in the full sample, but since 2015 the pass-through has strengthened markedly in CESEE while remaining broadly stable in AEs. The analysis in the paper could not strictly pin down the precise mechanism(s) at play: no statistically significant association could be found between the passthrough and the minimum wage's bite on the wage distribution (as captured by the minimum-to-median wage ratio), union density or collective bargaining coverage. Public sector wage shocks have sizable and persistent spillovers to private wages, which are more front-loaded in AEs and more gradual in CESEE. During 2022-24, public wage policies are found to have acted as a modest stabilizer in AEs but an amplifier in CESEE.

The paper is organized as follows. Section II presents the macro-level wage Phillips curve analysis for AEs and CESEE, including for AEs the decomposition of overall wages into negotiated wages and the wage drift. Section III estimates a micro-level Phillips curve using Spanish microdata and assesses the role of institutional features of agreements in driving collectively bargained wage growth. Section IV estimates the spillover effects of minimum and public sector wage policies. Section V concludes.

II. Macro-Level Phillips Curves

This section estimates a hybrid wage Phillips curve for 26 European economies over 2006–2024, separately for advanced economies (AEs) and CESEE, and decomposes aggregate wage growth in AEs into negotiated wages and the wage drift. Four key findings emerge. First, wage formation differs markedly across regions: in CESEE, past inflation is the dominant driver of wage growth, whereas in AEs inflation expectations play a more prominent role. Second, while the slope of the Phillips curve — the restraining influence of labor market slack on wage growth — has not materially changed, wage growth at any given labor slack has shifted upward post-pandemic, with model-based projections systematically underpredicting post-pandemic wage growth in both AEs and CESEE. Third, rolling estimates and structural break tests point to a significant increase in the sensitivity of wages to past inflation after 2020 in both AEs and CESEE. Fourth, in AEs, the wage response post-pandemic followed a sequential pattern — the wage drift rose first as employers granted discretionary increases, before negotiated wages took over from 2023 onward as contracts were renewed and workers recouped accumulated real wage losses.

1. Empirical Framework

The starting point of our analysis is the wage Phillips curve, the workhorse inflation model in the literature, which characterizes the relationship between wage inflation and the state of the business cycle. Following IMF (2023), the benchmark specification takes the form of a hybrid wage Phillips curve augmented with an error correction term to account for deviations of real wages from their long-run equilibrium, captured by a simple trend. The estimation proceeds in two steps: (1) estimating the long-run equation and (2) using the residuals from the cointegrating regression to estimate the short-run wage equation.¹ The dependent variable in the long-run equation is real wages to capture the long-run cointegrating relationship with productivity, while the Phillips curve itself is estimated on nominal wage growth. The magnitude of the individual inflation coefficients should be interpreted as capturing short- to medium-run dynamics, while long-run wage determination is governed by the real wage equilibrium embedded in the error-correction term.

Long-run cointegrating equation. Following Engle and Granger (1987), the long-run relationship postulates that real wages are cointegrated with labor productivity and a deterministic trend. Specifically, for country i and quarter t , the following equation is estimated by OLS:

¹ As a robustness check, the long-run relationship was re-estimated using Dynamic OLS (Stock and Watson 1993), which corrects for finite-sample endogeneity bias, and using a one-step ARDL bounds-testing approach (Pesaran, Shin, and Smith 2001), which jointly estimates the long-run relationship and short-run adjustment dynamics. In both cases, the coefficients of the short-term wage equation are broadly similar across all three specifications.

$$\ln w_{i,t}/p_{i,t} = \gamma_{1,i} + \gamma_{2,i} \ln g_{i,t} + \gamma_{3,i} \tau_t + \varepsilon_{i,t} \quad (1)$$

where $w_{i,t}/p_{i,t}$ is the level of real wage (nominal wage per employee deflated by the CPI); $g_{i,t}$ is the level of real labor productivity; τ_t is a linear time trend; and $\varepsilon_{i,t}$ is the residual. All three parameters ($\gamma_{1,i}$, $\gamma_{2,i}$, $\gamma_{3,i}$) are estimated separately for each country, allowing heterogeneity in the long-run elasticity of real wages to productivity and in the deterministic trend.²

The residuals $\varepsilon_{i,t}$ capture the deviation of actual real wages from their long-run productivity-consistent equilibrium at each point in time.³ Positive values indicate that real wages exceed the level warranted by productivity and the trend, leading to downward pressure on future wage growth, all else equal. Negative values—which became large and widespread after the 2022-23 inflation surge as consumer prices outpaced nominal wages (Figure 1)—indicate a real wage gap that creates incentives for workers to seek some wage catch-up in subsequent years.

Short-run wage Phillips curve. In the second step, the following short-run equation of the wage Phillips curve is estimated by OLS on the panel of 26 countries, separately for AE and CESEE:

$$\Delta w_{i,t} = \alpha_i + \sum_{l=1}^4 \beta_{1,l} \pi_{i,t-l} + \beta_2 E_t[\pi_{i,t+1}] + \beta_3 EC_{i,t-1} + \beta_4 u_{i,t} + \beta_5 \Delta g_{i,t} + \beta_6 \Delta h_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $\Delta w_{i,t}$ is the quarter-on-quarter annualized nominal wage growth (measured by wage per employee⁴) in country i in quarter t ; $\sum_{l=1}^4 \beta_{1,l} \pi_{i,t-l}$ denotes the cumulative effect of four lags of quarter-on-quarter annualized headline inflation; $E_t[\pi_{i,t+1}]$ is the two-year-ahead Consensus inflation forecast; $EC_{i,t-1}$ is the lagged error correction term, corresponding to the residuals in equation (1), which comes with a negative coefficient β_3 ; $u_{i,t}$ is the unemployment gap⁵, whose coefficient β_4 represents the slope of the wage Phillips curve; $\Delta g_{i,t}$ is real labor productivity growth; and $\Delta h_{i,t}$ hours-per-employee growth, to control for the mechanical effect of fluctuations in working time on measured wage per employee. The specification also includes country fixed effects α_i , and standard errors are clustered at the country level.

² This country-specific estimation is important given that catching-up CESEE economies may exhibit systematically different long-run wage-productivity relationships than AEs.

³ The first-stage results indicate that the level of real wages co-moves with the level of real labor productivity. The coefficient $\gamma_{2,i}$, which is the one capturing this relationship, is positive and statistically significant in the majority of countries, averaging 0.51 across the sample. The time trend coefficient $\gamma_{3,i}$ is economically negligible, close to 0 for most countries.

⁴ Specifically, it corresponds to the “wages and salaries” component of compensation of employees.

⁵ The unemployment gap is defined as the deviation of the actual unemployment rate from its Hodrick-Prescott (HP)-filtered trend, using the standard smoothing parameter of 1,600 for quarterly data.

2. The Determinants of Wage Growth in Advanced Economies and in CESEE

The wage Phillips curve is estimated over the 2006Q1–2024Q4 period for a full panel of 26 European countries (see Table A.II.5 for the list) and, separately, for AE and CESEE, to examine whether the relationship between wage inflation and its determinants differ across the two groups. The panel estimation results are reported in Table A.II.1, with column 1 presenting the pooled estimates and columns 2 and 3 reporting results for AE and CESEE, respectively.

The coefficient estimates have the expected signs and are in line with the literature (Figure 2). The unemployment gap enters with a negative and statistically significant coefficient: on average, a 1 percentage-point rise in unemployment above its HP-filtered trend is associated with a -1.2 percentage-point decline in wage inflation across the full sample. Past price inflation is also a significant driver of wage dynamics, with a 1 percentage-point increase in the cumulative sum of lagged inflation associated with a 0.3 percentage-point increase in wage growth. The error correction term and labor productivity growth are likewise significant. Inflation expectations, by contrast, do not achieve statistical significance in the pooled specification, reflecting the offsetting effect of averaging across two groups with structurally different wage formation processes—they regain significance in a panel of AEs.⁶

The estimates by country group reveal significant differences between AEs and CESEE.⁷ In CESEE, the sensitivity of nominal wage growth to labor market slack is markedly higher — a feature that, on its own, would support faster wage adjustment during downturns. However, the more policy-relevant difference lies in the inflation pass-through: past inflation is a stronger driver of nominal wage growth in CESEE than in AEs, while inflation expectations — statistically significant in AEs — are not found to independently shape wage outcomes in CESEE. This pattern points to a more backward-looking wage formation process in CESEE, consistent with historically weaker anchoring of inflation expectations in the region and in line with previous findings (Baba et al., 2024; IMF, 2022; IMF, 2023). CESEE countries also exhibit stronger sensitivity of nominal wage growth to labor productivity and to the error correction term, consistent with ongoing structural convergence dynamics. Taken together, the more backward-looking nature of wage formation in CESEE implies that supply shocks that generate persistent inflation, similar to the energy price shocks unfolding in 2026, are expected to produce stronger and more durable second-round wage effects in CESEE than in AEs, where better-anchored expectations can provide a degree of insulation.

⁶ Formal Wald tests of whether the coefficients on the unemployment gap, productivity growth, and past inflation differ across positive and negative realizations of each variable do not point to systematic asymmetry in either AEs or CESEE.

⁷ A Chow test of equality of coefficients between the AE and CESEE panels rejects the null for the model as a whole and individually for past inflation and the unemployment gap, confirming that the wage-setting process differs systematically across the two groups.

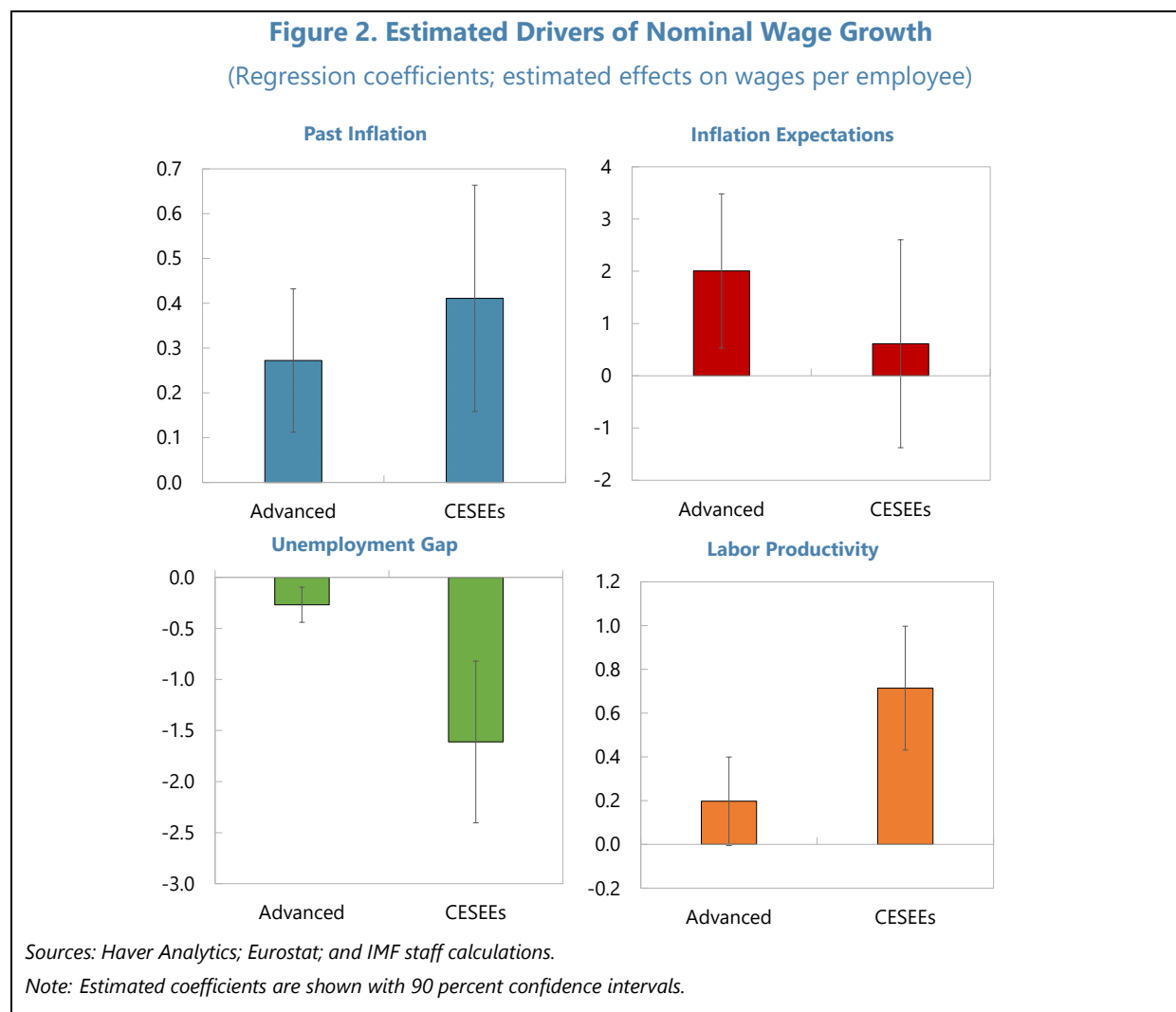
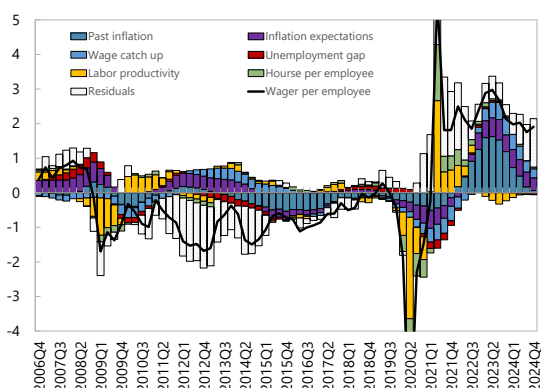


Figure 3 decomposes nominal wage growth across AEs and CESEE (in deviation from their mean) into the contributions of its main drivers using the parameters of the model estimated over the sample period. Both regions have seen higher-than-average nominal wage growth since 2021, but with differences in driving factors. In AEs, the contribution of past inflation to above-mean nominal wage growth mainly reflected the historically large magnitude of the inflation shock. Inflation expectations were largely anchored, which helped limit their contribution to nominal wage growth despite the high pass-through coefficient. The wage catch-up term also contributed positively, reflecting the closure of real wage gaps opened by the inflation surge. In CESEE, past inflation was a more prominent driver, while persistent positive residuals suggest that nominal wage growth also consistently exceeded what model fundamentals can explain. These persistent positive residuals may hint at structural shifts in wage formation following the pandemic, including a possible increase in the sensitivity of wage-setters to inflationary signals; a greater role for backward-looking expectations in economies where the inflation surge was most severe and where accumulated inflation experiences may have

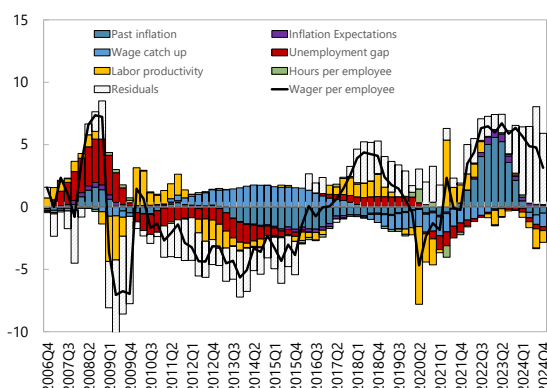
amplified responses to current price developments;⁸ or amplification through concomitant discretionary minimum and public sector wage increases examined in Section IV.

Figure 3. Estimated Contribution to Nominal Wage Growth Dynamics in AE and CESEE
(Deviation from mean growth rate; percentage point contributions, four-quarter moving average)

3a. Advanced Economies



3b. CESEE



Sources: National sources; Haver Analytics; Eurostat; and IMF staff calculations.

Note: Sample: 2006Q1–2024Q4. The black line shows deviations of wage per employee on quarter-on-quarter annualized growth from its model-implied mean. Contributions (including residuals) are also shown as deviations from their model-implied mean.

Countries are weighed by their GDP-PPP levels.

3. The Determinants of Negotiated Nominal Wage Growth and the Wage Drift in Selected AEs

In countries with collective bargaining systems such as most in Europe, aggregate nominal wage growth is the outcome of two additive components, namely negotiated wages and the wage drift. Negotiated wages capture the outcomes of collective bargaining processes, while the wage drift encompasses all wage components not covered by those agreements, including individual bonus payments, overtime pay, and increments linked to internal promotion (ECB, 2024). The breakdown is important for the inflation outlook, because each part may respond to economic shocks at different speeds and through distinct channels.

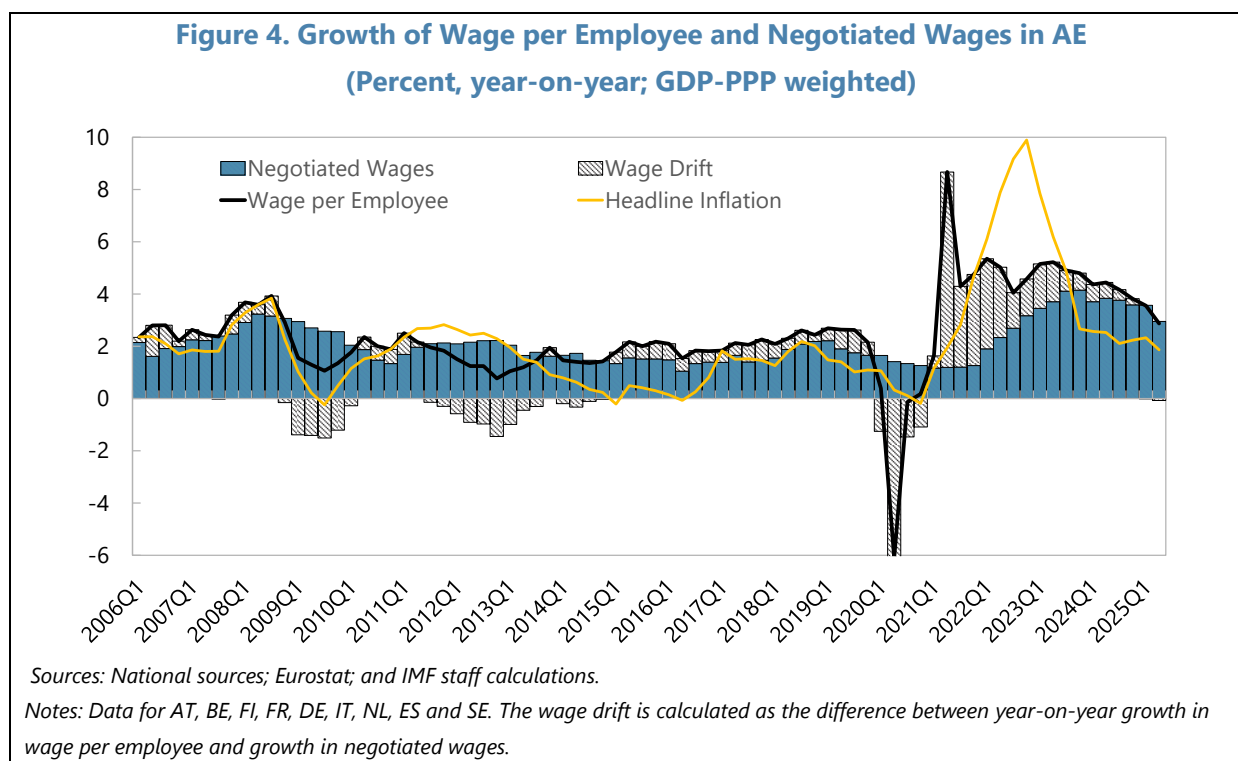
Negotiated wage data are collected at the quarterly frequency for nine advanced European economies using available national sources (Table A.II.2).⁹ The series capture the outcomes of collective bargaining processes in terms of changes in agreed base pay and correspond closely to the ECB's indicator of negotiated wages

⁸ A substantial macroeconomic literature documents that individuals' inflation expectations are shaped by accumulated inflation experience, with more recent episodes receiving disproportionate weight (Malmendier and Nagel, 2016). This mechanism could amplify backward-looking wage formation in CESEE, where the post-pandemic inflation shock was particularly severe and inflation volatility has historically been higher than in AEs, potentially contributing to the persistent positive residuals observed in the wage growth decomposition.

⁹ Data are collected for Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Spain and Sweden.

(Figure A.I.4). The wage drift is then defined simply as the difference between growth in actual wages per employee and growth in negotiated wages.¹⁰

The wage drift responded first to the 2022-23 inflation shock, with negotiated wages adjusting afterward. Amid the inflation surge, aggregate nominal wage growth rose well above its pre-pandemic average, but the phasing of adjustment differed sharply between these two components. In the early years of the pandemic, the pick-up in nominal wage growth in AE was mostly driven by an increase in the wage drift, contributing an average of 3 percentage points to annual nominal wage growth in 2021–22, well above the pre-pandemic average of around 0.1 percentage point (Figure 4). By 2023–24, as collective agreements were renewed and formal negotiations explicitly incorporated accumulated inflation, negotiated wage growth took over as the principal driver of aggregate wage pressures, though varying across countries, while wage drift moderated toward its historical average.



To assess the determinants of negotiated wage growth and the wage drift separately, the benchmark specification (2) is re-estimated by OLS with each component as the dependent variable.¹¹ Formally, the two auxiliary equations are:

¹⁰ The wage drift co-moves with hours-per-employee by construction, as negotiated wages are benchmarked to a representative full-time employee. This mechanical effect is controlled for in the econometric specification (equation 4).

¹¹ $EC_{i,t-1}$ corresponds to the residuals in equation (1). In a system of linear seemingly unrelated regression (SUR) equations with identical regressors, equation by equation OLS yield efficient estimates of the coefficient vectors (see Greene, 2019 for a textbook treatment).

$$\Delta w_{i,t}^{neg} = \alpha_i + \sum_{l=1}^4 \beta_{1,l} \pi_{i,t-l} + \beta_2 E_t[\pi_{i,t+1}] + \beta_3 EC_{i,t-1} + \beta_4 u_{i,t} + \beta_5 \Delta g_{i,t} + \beta_6 \Delta h_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$\Delta w_{i,t}^{drift} = \alpha_i + \sum_{l=1}^4 \beta_{1,l} \pi_{i,t-l} + \beta_2 E_t[\pi_{i,t+1}] + \beta_3 EC_{i,t-1} + \beta_4 u_{i,t} + \beta_5 \Delta g_{i,t} + \beta_6 \Delta h_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $\Delta w_{i,t}^{neg}$ and $\Delta w_{i,t}^{drift}$ are quarter-on-quarter annualized nominal negotiated wage growth and the wage drift, respectively; all other variables are as defined in equation (2).¹²

The panel estimation results for the negotiated wage and wage drift equations are reported in Table A.II.3, columns (2) and (3) respectively, with column (1) providing the benchmark aggregate estimates for the same nine-country AE sample as a reference.¹³

The decomposition reveals a striking asymmetry: the two components of aggregate wages respond to fundamentally different sets of drivers. The inflation pass-through is concentrated entirely on negotiated wages — consistent with the view that inflation compensation in the recent episode was progressively formalized through collective bargaining as contracts were renewed, rather than persisting as an ad hoc component of wage drift (ECB, 2024) — while labor productivity growth and hours-per-employee growth affect the wage drift but not negotiated wages.¹⁴ Labor market slack operates through both channels but only reaches statistical significance in the negotiated wage equation, where a 1 percentage point rise in the unemployment gap is associated with a 0.2 percentage point decline in negotiated wage growth. This pattern is economically intuitive: the wage drift captures the real-time adjustment of actual pay to firm-level and hours-driven conditions not yet reflected in contracted wages, while negotiated wages respond to economy-wide slack and inflation rather than to idiosyncratic productivity or hours variation.

Beyond these differences in drivers, the decomposition also points to an asymmetry in how the two wage components adjust over the cycle. Negotiated wages exhibit strict downward nominal rigidity—across the entire 2006–2025 sample spanning multiple recessions including the Global Financial Crisis and the COVID-19 pandemic, negotiated wage growth is never negative (Figure 4). In contrast, the wage drift component fluctuates in both directions, providing the only margin of downward adjustment during periods of adverse shocks. The absence of a statistically significant productivity effect in the negotiated wage equation, combined with its positive and significant role in wage drift, is consistent with this interpretation: when productivity shocks are predominantly negative or stagnant—as they were for much of the sample period—negotiated wages cannot adjust downward to reflect them, and the required adjustment occurs entirely through wage drift compression or moderation

¹² The negotiated wages series are seasonally adjusted using the X-13 ARIMA procedure.

¹³ The aggregate estimates in column (1) of Table 3 differ from the AE estimates in Table 1 because of the country sample.

¹⁴ Formal Wald tests indicate that wage drift responds asymmetrically to productivity growth — the coefficient is larger when productivity growth is positive than when it is negative, though the difference between the two estimates is small — and do not point to systematic asymmetry with respect to the unemployment gap or past inflation.

Figure 5. Drivers of Negotiated Wages

(Regression coefficients; estimated effects on negotiated wages and wage drift)



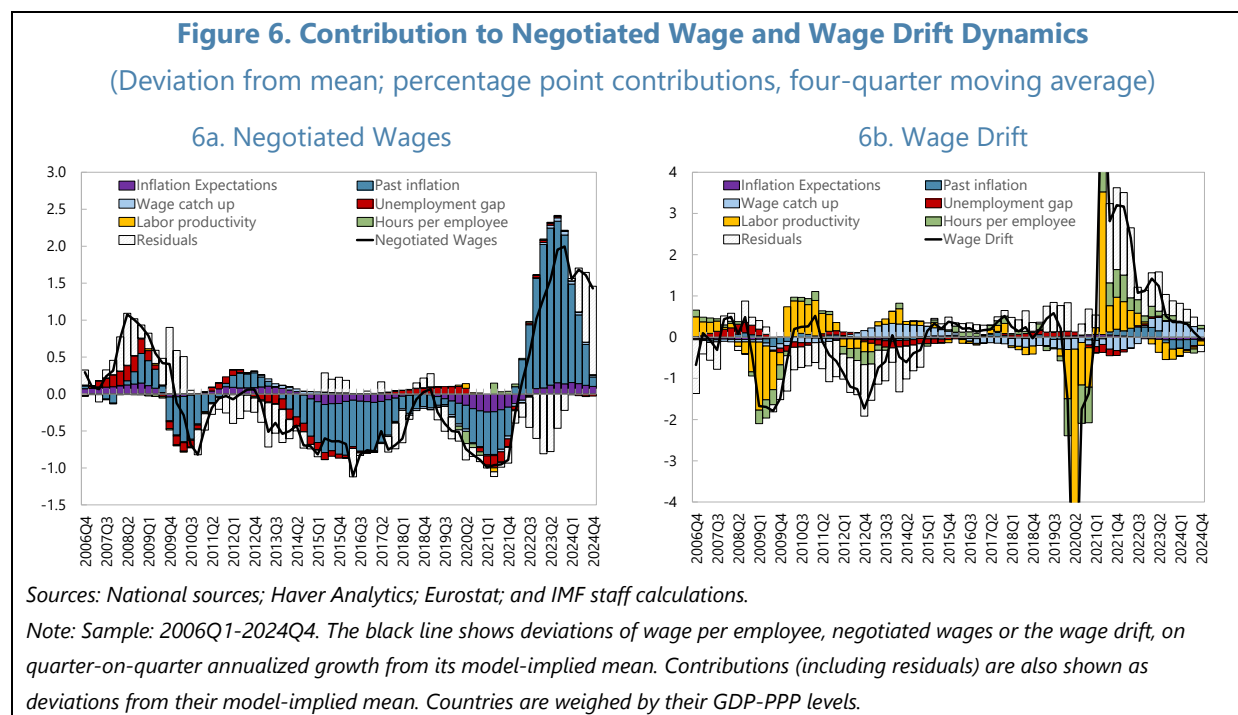
Sources: National sources; Haver Analytics; Eurostat; and IMF staff calculations.

Note: Estimated coefficients are shown with 90 percent confidence intervals.

The role of collective bargaining. To examine whether collective bargaining coverage shapes the sensitivity of negotiated wages to macroeconomic conditions, the benchmark equation (3) is augmented with interaction terms between the collective bargaining coverage ratio and, separately, the unemployment gap and lagged inflation (Table A.II.4).¹⁵ The results point to a significant amplifying role of collective bargaining along both dimensions. For labor market slack, the interaction term between collective bargaining coverage and the unemployment gap is significant at the 1 percent level: at low coverage (evaluated at the 25th percentile of the distribution) the response of negotiated wages to the unemployment gap is small and statistically indifferent from zero, while at high coverage (at the 75th percentile) the effect is statistically significant and reaches approximately -0.4 . A similar pattern holds for inflation pass-through: the interaction between collective bargaining and lagged inflation is statistically significant, with the sensitivity of negotiated wages to past inflation being about 0.3 for low coverage versus 0.5 for high coverage. This has important implications for the

¹⁵ The collective bargaining coverage ratio measures the percent of employees covered by collective bargaining agreements (OECD/AIAS database).

impact of the global energy supply shock unfolding in 2026. Countries with high collective bargaining coverage may see quicker and more lasting wage adjustments than those with low coverage, all else equal.



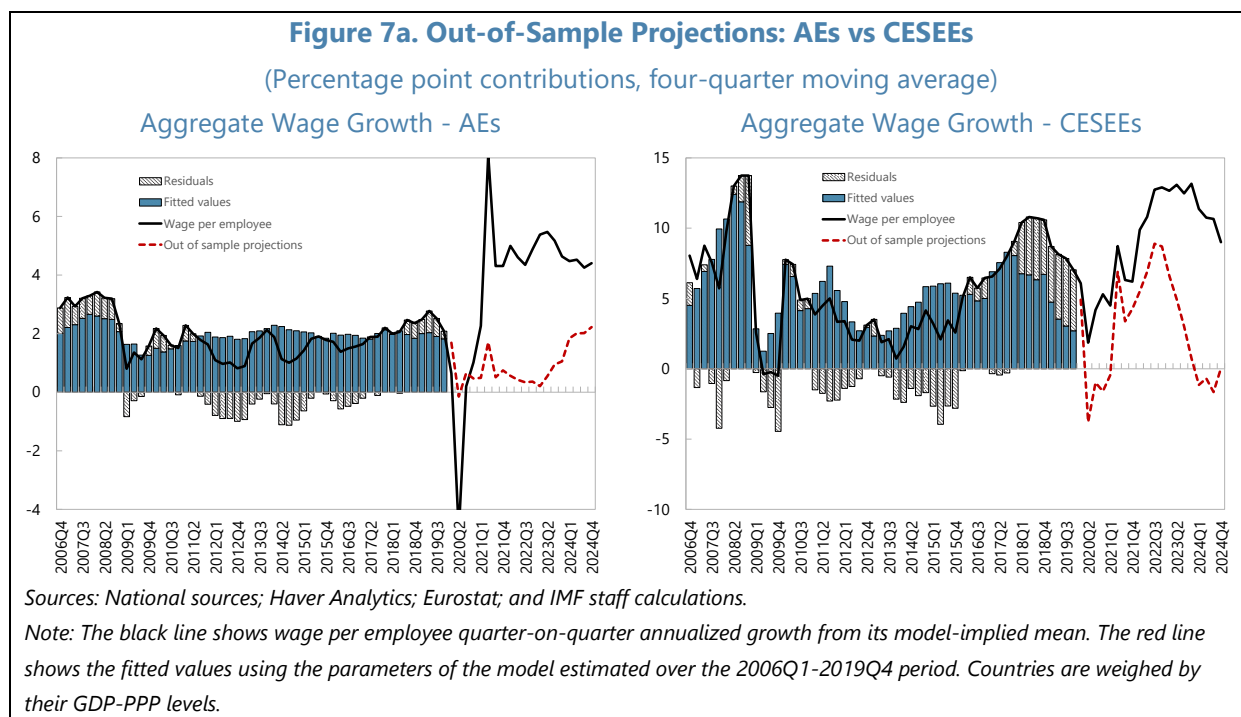
Distinguishing between negotiated wage growth and the wage drift for AEs also reveals a difference in their dynamic response to shocks (Figures 6a and 6b). For negotiated wages, past inflation accounts for the bulk of post-pandemic deviations from mean, while contributions from the unemployment gap, hours per employee, and labor productivity are comparatively modest throughout. The residuals are informative about the sequencing of adjustment: initially negative after 2020, they reflect the dampening effect of contract stickiness (renegotiation lags) on the immediate pass-through of the inflation shock; turning positive from 2022 onward, they point to unions successfully bargaining wage increases above those predicted by the model to recover accumulated real wage losses, suggesting a delayed but ultimately forceful response of collective bargaining to the inflation surge. Wage drift tells a markedly different story. Immediately after the pandemic, it quickly jumped above average, driven by the recovery in hours worked as job-retention schemes were unwound (ECB, 2024) and because individually negotiated compensation responded to the inflation shock faster and more forcefully than the model fundamentals imply (as shown in positive residuals). This could be, for instance, because employers granted discretionary pay rises ahead of formal bargaining rounds, which was made possible by their overall solid profit margins (Hansen et al., 2023). From 2023 onward, however, the wage drift moderated even as negotiated wages remained elevated, pointing to a gradual reabsorption of inflation compensation into collective agreements.

4. Post-Pandemic Model Performance and Shifts in Wage Sensitivity

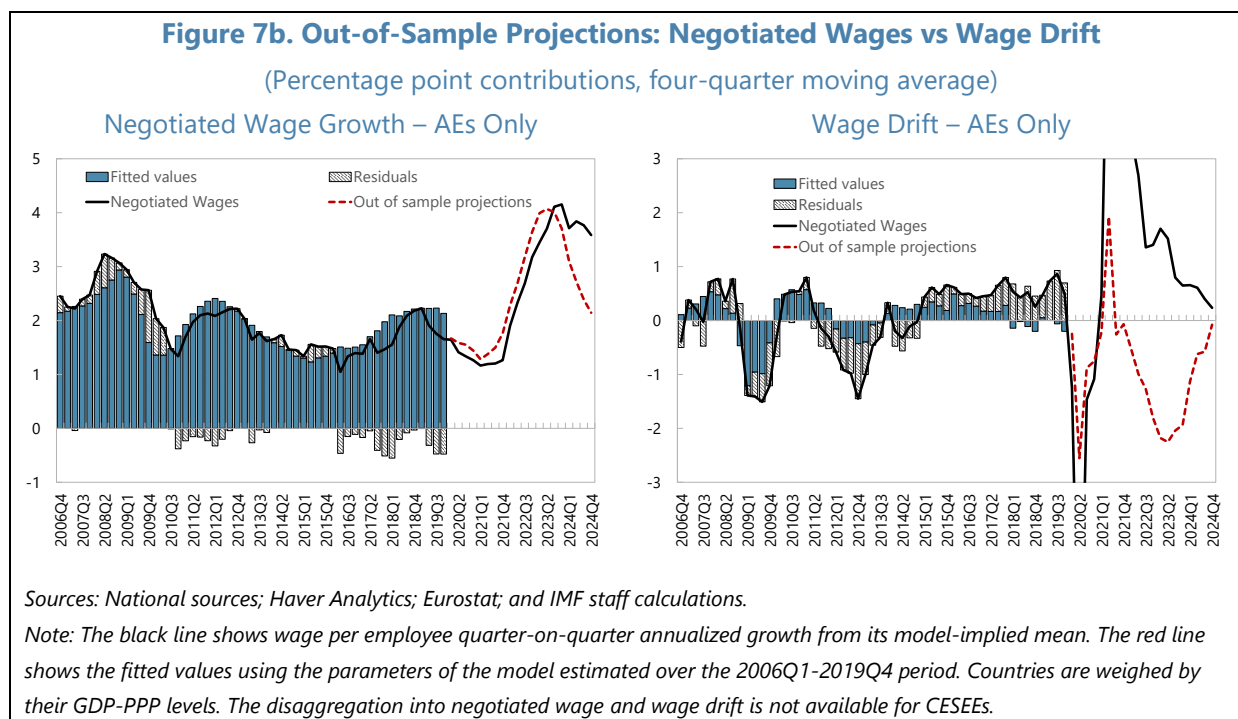
The evidence in Sections 2 and 3 points to a potential shift in wage-setting dynamics after 2020: wage growth has persistently exceeded model-implied values, and residuals remained large by end-2024. This section

examines whether such change is indicative of a structural break in the wage Phillips curve, using out-of-sample projections and formal break tests.

Out-of-sample projections. To explore this, the model is re-estimated over 2006Q1–2019Q4 and out-of-sample projections are generated by applying the pre-pandemic parameter estimates to the actual post-2019 values of the regressors (Figures 7a and 7b). The out-of-sample projections show a widening gap between actual and expected wage growth after 2020 in both panels of Figure 7a: the gap averages 3.4 percentage points in AE between 2022 and 2024, and widens considerably in CESEE, where it reaches 8.5 percentage points over the same period.



For AEs, disaggregating between negotiated wage growth and wage drift, as shown in Figure 7b, reveals a sequential pattern: the aggregate underprediction in 2021–22 was driven primarily by wage drift, whereas from mid-2023 onward the persistent residuals reflected an underprediction of negotiated wage growth. In fact, projections track negotiated wage growth reasonably well through most of the post-pandemic period, with deviations emerging only from 2022–23 onward as unions bargained more aggressively than pre-pandemic relationships would predict during contract renewals. As discussed in Section II.3, the total wage gap largely reflects the model's inability to account for the behavior of the wage drift in the post-pandemic period.



For CESEE, the misalignment between actual and projected wages appears to predate the pandemic. Large in-sample residuals are already evident from 2017 onward, suggesting that the structural drivers identified over the full pre-pandemic estimation window were insufficient to capture wage dynamics in the region even before 2020. The post-pandemic divergence in CESEE may therefore reflect an amplification of pre-existing misalignments rather than a structural break.

Taken together, these out-of-sample results point to meaningful underprediction in both regions, though the gap is considerably larger in CESEE. In AEs, the underprediction was initially concentrated in the wage drift — reflecting discretionary pay increases ahead of formal bargaining — but shifted from 2023 onward to negotiated wages, as unions secured larger increases than pre-pandemic relationships would have predicted. This systematic underprediction motivates a formal investigation of structural change in the wage Phillips curve.

Testing for shifts in the wage Phillips curve

AE and CESEE. The wage Phillips curve is first re-estimated on a rolling basis over 16-quarter windows, separately for AE and CESEE, following Baba et al. (2024). This approach identifies when shifts in the sensitivity of wage growth to its drivers may have occurred (Figures A.I.2a and A.I.3a). The rolling estimates suggest that: (i) *inflation expectations* played a stronger role in wage formation in AE earlier in the sample but became a less important driver after around 2015; (ii) the sensitivity of wage growth to *past inflation* increased over time in both groups, particularly after 2021; (iii) *the slope of the wage Phillips curve* appears to have flattened temporarily during the post-pandemic period, but by 2025 have reverted to its average value.

To assess the statistical significance of these shifts, the wage Phillips curve is re-estimated over the full sample with interactions between the key explanatory variables and a post-pandemic dummy equal to one from 2020Q1 onward (Figures A.I.2b and A.I.3b). The interaction results confirm a statistically significant rise in the

pass-through of past inflation to wage growth after 2020, and a temporary flattening of the Phillips curve slope with respect to labor market slack. The key question is whether these post-2020 differences reflect a durable parameter change or a response contingent on the inflation environment. Several pieces of evidence point to the latter. First, threshold analysis conditioned on the inflation environment reveals that the slope of the wage Phillips curve with respect to the unemployment gap is statistically indistinguishable between high- and low-inflation regimes; only the intercept differs (Figure A.I.8), consistent with a level shift in wage growth when inflation becomes salient, rather than a fundamental change in how wages respond to labor market slack. Second, rolling estimates show that the wage drift inflation coefficient—which surged during 2022–2023—returned to approximately zero by end-2024 as contracts were renewed and the inflation environment normalized. Finally, the pre-2020 insensitivity of wage growth to past inflation is consistent with the broader literature on state-dependent Phillips curve behavior, in which wage and price responsiveness to inflation rises when inflation itself is high and salient (Bobeica et al, 2019; Benigno and Eggertsson, 2023; Bernanke and Blanchard, 2025). Together, these patterns point to a regime-dependent behavior: wage-setters become more responsive to past inflation when it is salient and persistent, but revert to forward-looking behavior anchored on expectations when inflation normalizes.¹⁶

Negotiated wages and the wage drift. Rolling regressions and formal structural breaks are also used to analyze potential shifts in the sensitivity of negotiated wage growth and of the wage drift for AEs. Coefficients for all drivers of *negotiated wages* appear to have remained broadly stable before and after 2020. This stability is corroborated by subsample analysis conditioned on the inflation environment: negotiated wage growth is uniformly higher at any given level of the unemployment gap when past inflation is above its historical median, but the slope of the relationship is statistically indistinguishable across the two regimes (Figure A.I.8). Therefore, the post-pandemic surge in negotiated wage growth reflects a standard pass-through to an unusually large inflation shock under stable bargaining parameters, rather than a change in those parameters themselves. By contrast, the structural break test shows that *wage drift* became more sensitive to past inflation after 2020, shifting from almost zero to a distinctly positive coefficient with non-overlapping confidence intervals. It also became more sensitive to changes in hours-per-employee growth, likely reflecting the large COVID-related swings in hours worked. These findings suggest that the wage drift allowed for some early inflation compensation before formal renegotiations. Rolling estimates confirm that by end-2024, the inflation coefficient returned to zero as existing collective bargaining contracts expired and new ones took over. The reversion of wage drift sensitivity as inflation normalized, combined with the stability of negotiated wage parameters and the absence of slope changes in the Phillips curve, reinforces the interpretation that post-2020 changes reflect state-dependent responses to an extreme inflation environment rather than a fundamental or permanent alteration in European wage-setting institutions.

¹⁶ A potential contributing mechanism is that wage-setters may respond more to their direct experience of inflation than to professional forecaster expectations during high-inflation episodes (Malmendier and Nagel, 2016), though testing this channel directly would require quantitative measures of household inflation expectations that are consistent across the full country sample, which are not available for the estimation period in this analysis.

III. Negotiated Wages at the Micro Level: The Case of Spain

This section uses a comprehensive agreement-level dataset on collective bargaining agreements in Spain to study how detailed institutional features shape negotiated wage outcomes. Spain provides unusually rich microdata, with near-universal bargaining coverage and detailed information on contract characteristics, allowing us to link negotiated wage increases to inflation, labor market conditions, and agreement design in a unified framework. This granular approach addresses two key limitations of the macro analysis. First, aggregate data may mask substantial within-country heterogeneity in wage outcomes that depend on specific features of bargaining agreements. Second, important institutional details of wage-setting are not captured in macro-level datasets, making it difficult to identify the precise mechanisms through which inflation and labor market conditions transmit to wages. Spain is not intended to be representative of all European labor markets; rather, it serves as an illustrative case of a high-coverage, institutionally rich collective bargaining system that allows these mechanisms to be studied in detail, including possible recent changes that might strengthen the response of wages to inflation shocks.

1. Data

The empirical analysis draws on a comprehensive dataset from the Spanish Ministry of Labor encompassing all collective bargaining agreements registered in Spain between the first quarter of 2013 and the second quarter of 2025. The dataset provides agreement-level information, including the negotiated wage increases as well as a wide array of institutional features.¹⁷ Our analysis focuses exclusively on the characteristics of each agreement at the time it was signed. Among these characteristics examined are the presence of inflation indexation clauses, the duration of the agreement (annual versus multiannual), and the level of bargaining (firm-level versus above firm-level). These features are central to our investigation of how institutional arrangements shape the relationship between past inflation, labor market slack, and nominal negotiated wage growth. To capture local macroeconomic conditions, the econometric analysis controls for inflation and labor market indicators—specifically, lagged quarterly inflation and the unemployment gap—in the region (autonomous community) where the agreement considered applies, using data from the National Statistics Institute (INE).

Sample composition. The sample comprises about 21,000 collective bargaining agreements signed between 2013Q1 and 2025Q2. Approximately 30 percent of them contain indexation clauses, of which about half—around 15 percent of all agreements—are linked to the CPI. In addition, agreements concluded above the firm level (rather than within individual firms), account for about 20 percent of the total number of agreements but 90 percent of workers covered by collective bargaining agreements.¹⁸ Finally, nearly 14 percent of agreements are annual, with the remainder spanning multiple years.

¹⁷ For a detailed description of the collective bargaining system in Spain using collective bargaining data at the agreement level, see Izquierdo, Moral and Urtasun (2003).

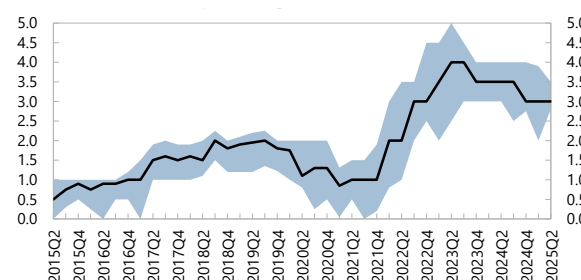
¹⁸ In the agreements data, firms covered by firm-level agreements are treated as being governed by that agreement, rather than simultaneously by both firm- and sector-level agreements. Accordingly, differences in clause content across bargaining levels are considered to be differences in wage-setting practices across levels, rather than additive application of multiple agreements.

Negotiated wage dynamics. The median nominal wage increase agreed in collective bargaining remained remarkably stable before the pandemic, fluctuating narrowly around 1.5 percent annually between 2013 and 2019. This stability continued even during the pandemic. However, negotiated wages accelerated sharply beginning in 2022, coinciding with the surge in inflation. By 2023, the median nominal negotiated wage increase reached approximately 3.5 percent—more than double the pre-pandemic median—before moderating slightly to around 3 percent by mid-2025.

Institutional features of collective bargaining agreements.

The prevalence and structure of indexation clauses, bargaining levels, and contract durations reveal important patterns in how collective bargaining institutions in Spain have responded to macroeconomic shocks.¹⁹ Prior to 2020, the use of indexation clauses was relatively limited, particularly in the case of CPI-based indexation, which covered only about 15 percent of agreements and workers.²⁰ The inflation surge of 2021–2023, however, triggered a notable increase in the adoption of indexation mechanisms, which peaked in 2023–2024. The share of agreements with any form of indexation rose from 27 percent in the pre-COVID period to 31–33 percent in 2023–2024, while CPI-based indexation increased from 15.6 percent to 21–22 percent. The shift is more pronounced when measured in terms of worker coverage: general indexation rose from 22 percent pre-COVID to a peak of 41 percent in 2023, and CPI-based indexation from 15 percent to over 30 percent. This is consistent with indexation becoming particularly prevalent in larger agreements, amplifying its impact on aggregate wages.

Figure 8. Spain: Agreed Wage Increases in Collective Bargaining
(Percent; median and interquartile range)



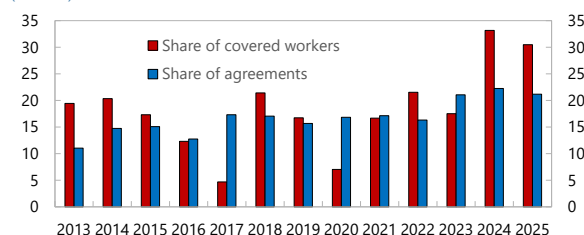
Sources: IMF staff calculations based on agreement-level collective bargaining microdata from the Spanish Ministry of Labor.
Note: The date corresponds to the quarter of signature of the agreement, which may not coincide with the date of economic effects of the agreement.

¹⁹ Bank of Spain (2022a, 2022b) analyzes the impact that the inflation surge in 2021–22 had on collective bargaining agreements, including the content of the indexation clauses.

²⁰ Indexation clauses in Spanish collective bargaining agreements—both at the sector and firm level—predominantly feature partial indexation mechanisms linked to the CPI, with caps to limit employer exposure to high inflation. The standard structure combines a fixed annual salary increase with a conditional CPI revision clause that activates only when actual inflation exceeds the agreed increase, often applying non-retroactively to future salary tables. Firm-level agreements display greater diversity, including regional CPI references (e.g., Navarra, País Vasco, Catalonia), multi-year cumulative revision mechanisms, floor guarantees, and salary-tiered differentiation (e.g., higher increases for lower earners). Non-CPI indexation clauses account for a minority of agreements, but they take several distinct forms: public sector budget linkage, floors linked to the minimum wage, fixed increases without revision, company performance conditionality, and reference to national bargaining guidelines (*Acuerdo para el Empleo y la Negociación Colectiva*, AENC). These alternatives are particularly common in public-sector-linked companies, small firms with limited inflation exposure, or agreements where parties prefer predictability over inflation protection.

Figure 9. Spain: CPI Indexation in Wage Bargaining**Spain: Incidence of CPI Indexation Clauses in Collective Bargaining Agreements**

(Percent)



Sources: IMF staff calculations based on agreement-level collective bargaining microdata from the Spanish Ministry of Labor.

Note: The date corresponds to the year of signature of the agreement, which may not coincide with the date of economic effects of the agreement. Data for 2025 only covers the first half of the year.

Spain: Selected Characteristics of Collective Bargaining Agreements

	2013-19	2020	2021	2022	2023	2024	2025
<i>Share of Agreements (Percent)</i>							
Indexation	27.1	27.8	27.2	25.9	30.6	32.7	29.6
CPI Indexation	15.6	16.8	17.1	16.3	21.0	22.2	21.2
Annual	13.7	15.2	11.7	10.5	9.4	10.9	13.8
Above-Firm-Level	19.1	16.0	20.1	21.4	22.5	21.3	22.8
<i>Share of Covered Workers (Percent)</i>							
Indexation	22.0	19.6	21.1	30.2	40.9	37.8	34.9
CPI Indexation	14.5	7.0	16.7	21.5	17.5	33.2	30.5
Annual	11.7	21.7	8.1	21.7	3.0	10.8	3.9
Above-Firm Level	92.4	87.1	94.1	92.2	91.8	91.2	94.7

Sources: IMF staff calculations based on agreement-level collective bargaining microdata from the Spanish Ministry of Labor.

Note: The date corresponds to the year of signature of the agreement, which may not coincide with the date of economic effects of the agreement. Data for 2025 only covers the first half of the year.

Although the resurgence of indexation in Spanish wage-setting practices has been less than initially feared and cannot compare to the 1990s or 2000s, it nonetheless marks a significant structural shift which suggests that the transmission of future inflationary shocks—such as the ongoing global energy supply disruption in 2026—could be quicker and more pronounced. A higher prevalence of indexation clauses may lead to automatic wage adjustments that amplify the second-round effects of inflationary shocks. At the same time, since many of these clauses incorporate caps or thresholds, the resulting wage increases may only partially reflect inflation surprises, thereby tempering the overall impact.

Other institutional dimensions exhibited greater stability over the sample period, though with some noteworthy dynamics:

- Above-firm-level agreements have continued to represent about 20 percent of all agreements but 90 percent of workers, highlighting the continued importance of sector-level bargaining in shaping wage outcomes in Spain.
- Annual contracts make up a small, steady portion of total agreements, with little recent change. However, the portion of workers covered by annual agreements exhibits more pronounced variation, particularly in times of macroeconomic stress. The share of workers under annual contracts rose sharply during the pandemic in 2020, and then again in 2022 amid the inflation surge, indicating a preference for more frequent contract renegotiation in rapidly changing economic conditions. These dynamics suggest that while the institutional structure of bargaining remains relatively stable in terms of agreement counts, the characteristics of the agreements that cover the majority of workers can shift meaningfully in response to macroeconomic shocks.

The analysis that follows estimates a micro-level Phillips curve for wage growth at the individual agreement level to explore the impact of specific institutional features on wage-setting outcomes, including indirectly through how inflation is reflected in wages.

2. Empirical Framework

We model the negotiated wage increase in each agreement as a function of inflation, labor market slack, and agreement-specific attributes. Formally, the dependent variable $\hat{w}_{isrt}$ is the nominal negotiated wage growth stipulated by agreement i , in sector s , region r , signed in quarter t .

The empirical specification is as follows:

$$\hat{w}_{isrt} = \alpha_{isr} + \sum_{l=1}^4 \beta_{1,l} \pi_{r,t-l} + \sum_{l=1}^4 \beta_{2,l} \pi_{r,t-l} \times \mathbf{X}_{isrt} + \gamma u_{rt} + \delta_1 \mathbf{X}_{isrt} + \delta_2 \mathbf{Z}_{isrt} + \varphi_{sr} + \varepsilon_{isrt} \quad (5)$$

where $\pi_{r,t-l}$ is lagged (quarter-on-quarter, annualized) inflation in region r , capturing recent local price dynamics; u_{rt} is the regional unemployment gap, defined as the difference between the region's unemployment rate and its historical average, capturing labor market slack. The vector $\mathbf{X}_{isrt}$ includes the individual agreement characteristics that are interacted with past inflation: an indicator variable for one-year (annual) agreements (vs. multi-year contracts), a dummy for whether the agreement contains an indexation clause (automatic cost-of-living adjustment), and a dummy for whether the agreement is negotiated at the sectoral level (1) or at a single firm (0). The vector $\mathbf{Z}_{isrt}$ includes other individual agreement characteristics, such as the logarithm of the number of workers *affected* by the agreement and the logarithm of the number of firms covered. We also incorporate different combinations of sector and region fixed effects (φ_{sr}) to control for unobserved heterogeneity in wage-setting across industries and locations—such as the higher trend productivity growth rates in certain sectors and/or regions, for example. Different from the macro specification, equation (5) does not explicitly control for inflation expectations given the lack of a reliable measure at the regional level; its average impact is captured by the region fixed effects and its fluctuations will go into the residuals.

This empirical framework mirrors the logic of the aggregate wage Phillips curve but at a microeconomic level. By linking agreed wages to lagged inflation and unemployment at the local level, it allows us to assess whether the core macroeconomic relationships hold at the level of individual wage contracts, while explicitly conditioning on institutional features that macro data cannot observe. The model thus provides a means to test how collective bargaining features shape the response of wages to inflation and slack, complementing the earlier cross-country evidence.

3. Results: Core Determinants of the Wage Phillips Curve

Table A.II.6 presents the baseline micro-level Phillips curve regressions. The results confirm that standard macroeconomic determinants of wage growth—past inflation and labor market slack—are operative at the agreement level.

Labor market slack. The regional unemployment gap enters with a negative and highly significant coefficient of approximately -0.16 across all specifications, indicating that a 1-percentage-point increase in unemployment relative to its historical average is associated with a 0.16-percentage-point decline in agreed wage growth. This estimate is remarkably stable across specifications, and broadly in line with, albeit slightly smaller than the 0.2 cross-country macro estimate presented above. This suggests that even under Spain's collective bargaining framework, negotiated wages show some responsiveness to changes in unemployment.

Past inflation. The sum of the coefficients associated with four quarters of lagged regional inflation is positive and significant across all specifications in Table A.II.6. In column (1), which excludes interaction terms, the sum of the coefficients on past inflation is 0.10 and statistically significant at the 1-percent level. While this coefficient is small and far below 1, this direct effect of inflation comes over and above that of CPI indexation, which is controlled for in the regressions, and that of inflation expectations, whose average impact is captured by the region fixed effects. In columns (2) through (4), where past inflation is interacted with institutional features, the direct coefficient varies as explanatory power is absorbed by the interaction terms, reflecting how institutional characteristics mediate the inflation-wage link.

4. Results: Role of Institutional Features of Collective Bargaining

The distinctive contribution of the microdata analysis lies in its ability to uncover how institutional features of collective bargaining shape the inflation-wage relationship. To this end, the baseline specification is augmented with interaction terms between lagged inflation and three key agreement characteristics: the presence of a CPI indexation clause (column 2), the level of bargaining (sectoral versus firm-level, column 3), and contract duration (annual versus multi-year, column 4). All three interaction terms are positive and statistically significant, indicating that these features amplify the pass-through of inflation into negotiated wages.

CPI indexation clauses. Column (2) of Table A.II.6 shows that the interaction between past inflation and the presence of a CPI indexation clause is 0.08. This implies that indexation approximately doubles the total inflation pass-through, from 0.08 to 0.16. This result is both economically intuitive and quantitatively important. In non-indexed agreements, wage negotiators must explicitly bargain over inflation compensation, and the outcome depends on the relative bargaining power of unions and employers, the state of the labor market, and firm-level conditions. In indexed agreements, by contrast, inflation compensation is automatic and contractually guaranteed. As a result, indexed contracts exhibit a more complete "catch-up" to inflation, which can contribute to stronger and faster wage pressures following an inflationary shock. Somewhat surprisingly, the direct effect of indexation (excluding the interaction) is also large and positive, at 0.14 in column (2), indicating that indexed agreements deliver substantially higher wage growth even after controlling for inflation, possibly because the presence of indexation clauses correlates with stronger worker bargaining power.

Sector-level bargaining. Column (3) indicates that the responsiveness of negotiated wages to past inflation is significantly shaped by the level at which bargaining takes place. While the direct effect of past inflation is not statistically distinguishable from zero, the interaction term with sector-level agreements is positive (0.10) and significant. The results point to a clear institutional gradient in the inflation-wage link, with sector-level bargaining driving the transmission of past inflation into wage outcomes. Sector-level negotiations cover entire industries and typically involve large unions with substantial bargaining power. In these settings, unions are more focused on preserving purchasing power across the workforce and more likely to anchor wage demands on macroeconomic indicators such as aggregate inflation. By contrast, firm-level agreements are more closely tied to firm-specific conditions such as productivity, profitability, and competitive position. In these negotiations, employers have greater scope to resist inflation-based wage demands by pointing to weak firm performance or competitive pressures, and workers may prioritize job security or firm-specific benefits over inflation compensation. As a result, firm-level agreements exhibit substantially lower inflation sensitivity.

Contract duration. Column (4) shows a significant interaction between past inflation and annual contract duration of 0.06, which implies a total impact of a 1 percent inflation shock of $0.06 + 0.09 = 0.15$ percent, about two-thirds larger than the 0.09 impact under multi-year contracts. This finding is in line with more frequent renegotiation allowing wages to adjust more quickly to recent inflation developments. Multi-year agreements

typically lock in wage paths for two or more years, and negotiators may be more willing to accept partial inflation compensation in exchange for predictability and stability over the contract horizon. Even with provisions for inflation adjustment—such as scheduled increases or indexation clauses—compensation in these agreements is typically smoothed over time and based on forecasts rather than actual inflation. This result suggests that changes in the typical contract duration—whether driven by policy, institutional evolution, or union pressure following an inflationary shock, for example—can materially alter aggregate wage dynamics.

Additional agreement characteristics. Beyond the interaction effects, Table A.II.6 reports coefficients on agreement-level control variables that provide additional insights into Spanish wage-setting. Agreement size, measured by the logarithm of the number of workers affected, enters with a positive and highly significant coefficient of approximately 0.11–0.12 across all specifications. This indicates that larger agreements—covering more workers—are associated with higher negotiated wage growth. One interpretation is that larger agreements involve more powerful unions with greater capacity to extract wage gains. Alternatively, larger agreements may cover sectors or industries with stronger labor demand or productivity growth. The logarithm of the number of firms covered enters with a negative and significant coefficient of approximately –0.09, suggesting that agreements covering more firms—holding constant the number of workers—tend to negotiate lower wage increases. This may reflect greater heterogeneity in firm performance and bargaining capacity when many firms are involved, making it harder to secure uniformly high wage gains.

Indexation as an endogenous outcome. While the presence of a CPI indexation clause is treated as an explanatory variable in the wage regressions above, indexation itself is likely endogenous to the wage-setting environment. In particular, the inclusion of a CPI indexation clause may respond to macroeconomic conditions (recent inflation and labor market slack) and to agreement features (bargaining level and agreement scope). Table A.II.10 shows that higher past inflation materially increases the probability of CPI indexation (by about 0.4 percentage points for each 1 percentage point increase in inflation), while a wider unemployment gap reduces it (by about 1 percentage point for each one percentage point higher gap). CPI indexation is also 5–7 percentage points less likely in sector-level agreements, and it is less prevalent in agreements covering more workers but more likely in agreements spanning more firms. While the negative association with sector-level bargaining may appear counterintuitive, unions at the sector level that are strong enough may be able obtain some wage catchup on inflation without the need to resort to formal indexation. Indeed, Table A.II.6 indicates that sector-level agreements are associated with higher negotiated wage growth and stronger inflation pass-through. Taken together, these patterns suggest that CPI indexation is an endogenous bargaining outcome, reinforcing the feedback between inflation and negotiated wage dynamics.

5. Results: The Impact of Labor Market Tightness on the Pass-Through of Past Inflation to Wages

Table A.II.7 explores how the sensitivity of wage growth to past inflation has varied under different labor market environments, shedding light on the interplay between inflation, labor market conditions, and worker bargaining power. The key innovation is the inclusion of an interaction term between the sum of past inflation and the unemployment gap. The analysis is conducted for two distinct periods: the full sample, which includes the most recent inflationary episode, and the pre-pandemic period through 2019Q4, which excludes COVID and the recent surge in inflation. The results suggest that, by strengthening workers' hand in wage negotiations, a tight labor market might amplify the passthrough of past inflation to wages.

Full sample results and interpretation. In the full sample covering 2013–2025 (column 1), the direct effects of past inflation and the unemployment gap are in line with those in Table A.II.6, but critically, the interaction term between past inflation and the unemployment gap is material and statistically significant. The negative interaction between past inflation and the unemployment gap can be understood through the lens of worker bargaining power and inflation compensation dynamics. In a high-inflation environment, purchasing power becomes a central concern for workers, but their ability to secure such catch-up depends critically on labor market conditions. In regions with tight labor markets—low unemployment—workers have strong bargaining power and credible outside options, enabling them to translate inflation into wage gains more effectively. Employers facing difficulties recruiting and retaining workers are more willing to grant inflation-compensating wage increases to avoid costly turnover. The combination of high inflation and low unemployment thus proves particularly potent for wage gains, generating larger wage increases than would be predicted based on either factor alone.

Pre-COVID comparison. To assess whether this interaction effect is a recent phenomenon or a long-standing feature of Spanish wage-setting, column (2) restricts the sample to the pre-COVID period (2013–2019). In this subsample, the interaction term becomes essentially zero and statistically insignificant. This suggests that it is only in recent years, as inflation became central to wage negotiations again, that workers with stronger bargaining power due to more favorable local labor market conditions managed to obtain greater compensation for higher inflation. This regime shift is consistent with the broader finding from the macro analysis that wage formation became more sensitive to past inflation during the post-2020 period—a pattern observed across European economies.

6. Robustness

This subsection assesses the robustness of the micro-level Phillips curve results to alternative identification choices, measures of labor market slack, and geographic aggregation of macroeconomic variables. Key results are found to be robust to these exercises.

Alternative fixed effects structures. Tables A.II.8 and A.II.9 examine sensitivity to alternative combinations of fixed effects. Across all specifications, the coefficient associated with the unemployment gap remains negative, highly significant, and close in magnitude to the baseline estimate of around -0.16 . The interaction terms between past inflation and CPI indexation, sector-level bargaining, and annual contract duration remain positive and statistically significant, with magnitudes very close to the baseline.

Alternative measures of labor market slack. To address potential concerns regarding the measurement of slack during periods of large labor market disruption, Tables A.II.11 and A.II.12 replace the unemployment gap with a labor market tightness indicator defined as the vacancy-to-unemployment ratio at the autonomous community level. As expected, higher tightness—corresponding to tighter labor markets—enters with a positive and statistically significant coefficient across all specifications. Importantly, the coefficients on past inflation and its interactions with CPI indexation, bargaining level, and contract duration remain stable and statistically significant.

Geographic aggregation of macroeconomic variables. Finally, Tables A.II.13 and A.II.14 redefine inflation and labor market slack at the provincial level rather than at the autonomous community level. Because the collective bargaining agreements data does not directly identify provinces, province-level macroeconomic variables are linked using the location (province) of the Ministry of Labor branch where each agreement is

registered. Despite the added measurement noise inherent in this approximation, the main results are preserved. The unemployment gap remains strongly negative and statistically significant, while the interaction terms between past inflation and CPI indexation as well as sector-level bargaining remain positive and significant with similar magnitudes to the baseline. The interaction between past inflation and annual contract duration becomes statistically insignificant in these specifications. Given that the direct effect of agreement duration is also statistically insignificant (as in the baseline results), duration of agreements does not seem to affect negotiated wage growth at the province level.

Taken together, these robustness checks support the overarching finding that institutional characteristics of collective bargaining play a central role in shaping wage-inflation dynamics in Spain, reinforcing the broader conclusions drawn from the macro-level analysis.

7. Discussion

In sum, the micro evidence from Spain demonstrates that institutional features of wage-setting can significantly shape wage dynamics. The presence of indexation clauses, above-firm-level bargaining, and frequent contract renewals all strengthen the link between past inflation and wage growth, contributing to more persistent wage-price dynamics in the face of inflation shocks. We also find that indexation clauses themselves can endogenously emerge when inflation is high. These findings are particularly relevant for countries with widespread collective bargaining coverage and sector-level agreements that already have or may see a resurgence of indexation clauses. In such cases, past inflation can feed into wages more strongly and rapidly, potentially sustaining inflationary momentum.

In contrast, in CESEE where collective bargaining coverage remains low and bargaining mostly takes place at the firm level, such mechanisms have historically been less prevalent, and wages have been more flexible and less influenced by formal indexation. However, this could evolve over time. Therefore, it will be important to ensure that initiatives, such as the Directive (EU) 2022/2041 on adequate minimum wages, which is aimed at increasing collective bargaining coverage, do not lead to the widespread adoption of institutional features (e.g., formal indexation clauses) that would strengthen price-wage loops and increase inflation persistence.

IV. Spillovers from Minimum and Public Wage Policies

Beyond inflation and labor market conditions, discretionary government wage policies can also materially shape overall wage formation. We examine two policy instruments: statutory minimum wages, which set a binding floor for low-wage workers, and public sector wages. While both may respond to overall wage developments, such as through wage policies that seek to maintain a particular ratio of the minimum-to-median wage, for example, they may also be actively deployed in and of themselves, in which case they will generate spillovers to overall wages. Indeed, both have undergone significant changes in recent years—minimum wages have risen markedly in real terms and vis-à-vis the median wage in some cases, while public wages saw sharp real declines in the aftermath of the inflation shock, mostly in AEs, followed by catch-up increases mostly in CESEE.

Prior empirical work on minimum wage spillovers has found heterogeneous and overall modest average pass-through to aggregate wages. The U.S. literature, while influential in establishing the methodology, points to more limited effects than early estimates suggested: Autor, Manning, and Smith (2016) substantially revised downward the large distributional impacts documented by Lee (1999), finding that apparent spillovers above the minimum may partly reflect measurement artifacts. A plausible structural explanation is that the U.S. federal minimum wage has long maintained a *Kaitz* ratio (the ratio of minimum wage to median wage) of roughly 0.35 — among the lowest in the advanced economy peer group — leaving limited scope for spillovers to propagate upward through the wage distribution.

European evidence is somewhat more supportive, and notably stronger where minimum wages are set closer to the median. In France, where the Kaitz ratio has consistently exceeded 0.55, Aeberhardt, Givord, and Marbot (2016) find spillovers extending to the seventh wage decile for men, amplified further by a legal requirement that industry-level collective wage floors remain above the national minimum (Fougère, Gautier, and Roux, 2018). In the United Kingdom, Butcher, Dickens, and Manning (2012) documented spillovers reaching the 25th wage percentile. In Germany, the introduction of a statutory minimum wage in 2015 generated wage compression across the lower half of the distribution, contributing to a narrowing of east-west wage differentials partly supported by re-allocation of labor towards more productive jobs (Dustmann et al., 2022). Portugal provides the sharpest illustration: Oliveira (2023) finds spillovers extending to the 54th percentile following sustained minimum wage increases that pushed the Kaitz ratio well above 0.60, with pass-through explaining more than half of the observed decline in wage inequality. Across these cases, spillover reach and magnitude increase with the binding intensity of the minimum wage relative to the median — the regime into which many CESEE economies have moved in the post-pandemic period. For CESEE specifically, IMF (2016) estimated modest and short-lived pass-through using a VAR-based approach, providing the most directly comparable prior benchmark for the estimates reported here.

On public sector wages, European evidence points to positive but highly heterogeneous spillovers to the private sector, often attributed to the wage leadership role of the state. Afonso and Gomes (2014) documented this pass-through across a panel of OECD countries, attributing the effect to worker mobility and bargaining spillovers operating through search and matching frictions in the labor market. Using a Bayesian VAR framework for the five largest euro area economies, Attinasi, Berardini, and Palazzo (2019) found that the response of private wages to public wage shocks is positive, temporary, and heterogeneous across countries — a result the analysis below will extend to CESEE using a local projection framework. Abdallah, Coady, and Jirasavetakul (2023) provide broader cross-country evidence using local projections, finding that both private wages and inflation respond positively to public wage changes, with significant heterogeneity across countries. Both analyses here utilize the local projection approach of Jordà (2005), which is robust to misspecification of the dynamic adjustment path and has become the standard for estimating heterogeneous impulse responses in panel data settings.

1. Common Empirical Framework

Both policies are analyzed using local projections (Jordà, 2005) estimated over a horizon of three years, tracing the cumulative change in real wages from period $t - 1$ to period $t + h$ as a function of the real (minimum or public) wage shock of interest. To abstract from the role of price inflation dynamics, all—minimum, public, private, overall—wage variables are written in real terms, which nets out the common inflation response when

estimating spillovers from real minimum and public sector wage changes. The shared baseline specification at each horizon h takes the form:

$$\ln y_{i,t+h} - \ln y_{i,t-1} = \beta_h \Delta \ln(\text{shock}_{i,t}) + \sum_{k=1}^L \theta_{h,k} \text{ugap}_{i,t-k} + \sum_{k=1}^L \varphi_{h,k} \Delta \ln p_{i,t-k} + \omega_{h,k} X_{i,t} + \sum_{k=1}^L \rho_{h,k} \Delta \ln(\text{shock}_{i,t-k}) + \sum_{k=1}^L \sigma_{h,k} \Delta \ln y_{i,t-k} + \alpha_i + \gamma_{t+h} + \varepsilon_{i,t} \quad (6)$$

where $y_{i,t+h}$ is the outcome variable, $\text{shock}_{i,t}$ is the shock to the relevant policy instrument, $\text{ugap}_{i,t-k}$ controls for cyclical labor market conditions, $lp_{i,t-k}$ denotes labor productivity, $X_{i,t}$ are additional country time-varying controls and α_i and γ_{t+h} are country and time fixed effects, respectively. Endogeneity is mitigated by writing the specification in real terms—which controls for the response of all wages to inflation, implicitly assumed to be common to all wage concepts—as well as through lag structures and country and time fixed effects, rather than through instrumentation given the unavailability of a clear instrument for our samples. We also estimate group-specific impulse responses by adding to the specification $\beta_{h,g}(\Delta \ln(\text{shock}_{i,t}) \times 1_{i \in g})$ and extracting the linear combination $\text{IRF}(h,g) = \beta_h + \beta_{h,g}$, where g denotes the country group, with AE and CESEE as mutually exclusive categories—to which end CESEE Euro Area members are considered only a member of the CESEE group. Standard errors are clustered by country throughout.

The two applications of this framework differ in their shock variable, outcome, sample, and controls, as summarized in Table 1.²¹ Confidence intervals are constructed using t-statistics rather than the Z-statistics produced by Stata's built-in local projection routine, as the latter rely on asymptotic normality assumptions that can overstate precision when the number of country clusters is small.

²¹ Attinasi et al (2019) use a broadly similar structure in analyzing spillovers from public sector wages, but the approach here extends the list of controls.

Table 1. Empirical Framework Summary

	Minimum Wages	Public Sector Wages
Outcome variable ($y_{i,t+h}$)	Real compensation per worker (CPI-deflated) $\ln_r comp_{i,t} = \ln(ncomp_{i,t}) - \ln(CPI_{i,t})$	Real private sector wages per hour $\ln_r prv_wageh_{i,t} = \ln(prv_wageh_{i,t}) - \ln(CPI_{i,t})$
Shock Variable	Real statutory minimum wage per month $\ln_r minwage_{i,t} = \ln(minwage_{i,t}) - \ln(CPI_{i,t})$	Real public sector wages per hour $\ln_r pub_wageh_{i,t} = \ln(pub_wageh_{i,t}) - \ln(CPI_{i,t})$
Sample	22 European countries with statutory minimum wages (Table A.II.15); 2001H2–2024H2; semesterly	27 countries (Table A.II.16); 2004Q2–2024Q3; quarterly;
Common controls	Lagged unemployment gap, union density, collective bargaining coverage, country effects, time effects	
Additional controls	Labor productivity per worker	Labor productivity per hours, public sector employment share, public sector vacancy rate
Lags of dependent variables (L in eq(6))	2 semesters	4 quarters
Horizon	3 years (6 semesters)	3 years (12 quarters)
Sources: Eurostat; OECD; Haver Analytics; IMF staff calculations.		
*Public sector wages per hour computed from detailed employment NACE Rev.2 (Eurostat) defined as public administration, education, and health. Private sector wages correspond to the mean for the remaining sectors.		

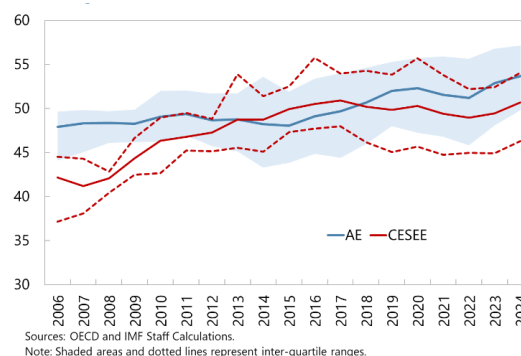
2. Minimum Wages

Statutory minimum wages have risen markedly across Europe in recent years, with minimum-to-median wage ratios converging notably in CESEE toward AE levels, which have themselves increased (Figure 10). Against this backdrop, we examine whether and how these increases have spilled over into broader wage dynamics.

Beyond the group-specific responses described above, we allow pass-through to differ across two sub-periods — 1999H1–2014H2 and 2015H1–2024H2 — motivated by the marked convergence of minimum-to-median wage ratios in CESEE toward AE levels around 2015 and by the availability of prior IMF estimates for a comparable pre-2015 sample (IMF, 2016). We further test through interactions whether the observed heterogeneity can be explained by the bite of the minimum wage relative to the wage distribution, or by collective bargaining coverage and union density.

Figure 10. Minimum Relative to Median Wage

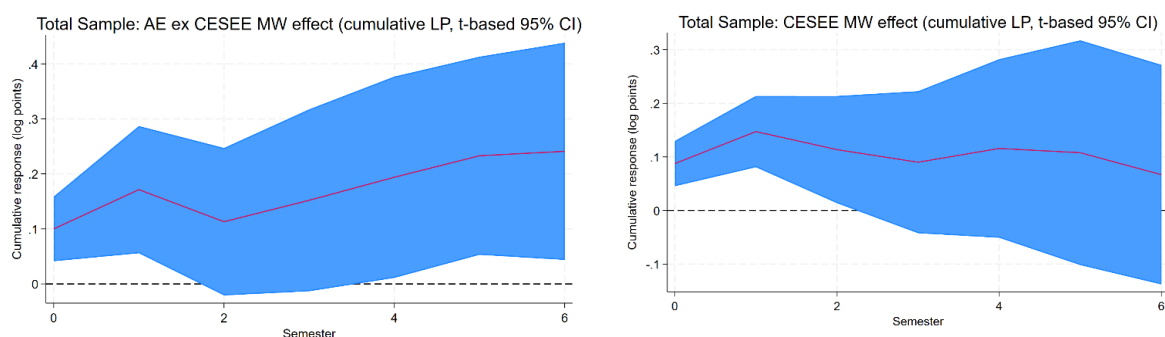
(Percentage)



Full sample: moderate average pass-through with significant heterogeneity between AEs and CESEE

For the full sample, the estimated pass-through of minimum wage shocks to average real compensation is modest and short-lived as shown in Figure A.I.9. The impact is statistically significant for only up to one year (two semesters), with the peak elasticity reaching approximately 0.15. Beyond one year, the response is not statistically distinguishable from zero, suggesting that the average minimum wage increase overall generates only a temporary and limited boost to average wages.

Figure 11. Impulse Response in AE and CESEE for 1 Percent Increase in Real Minimum Wages



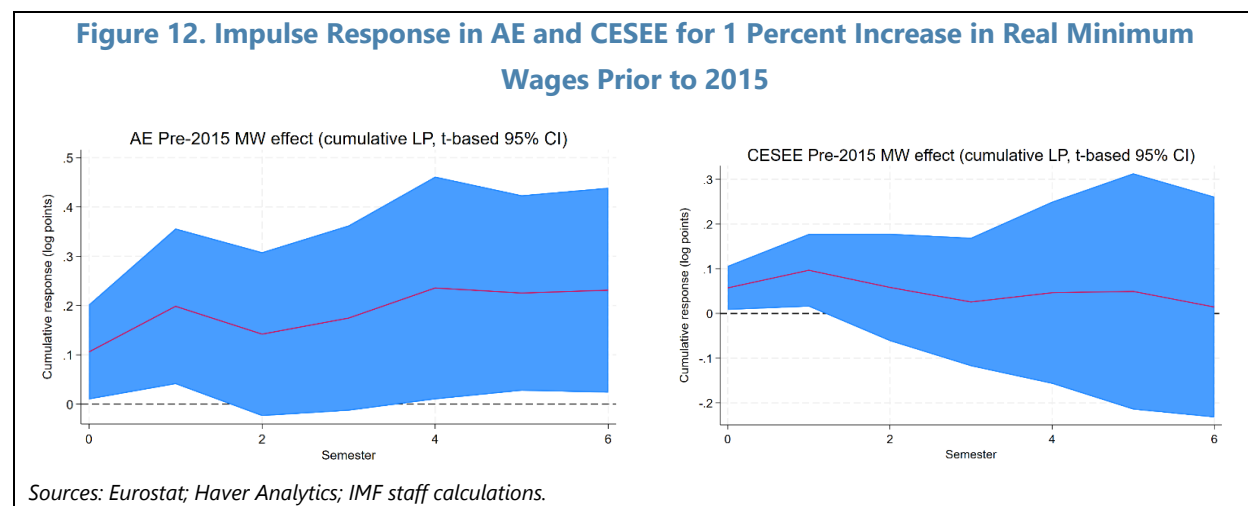
Sources: Eurostat; Haver Analytics; IMF staff calculations.

However, this aggregate result masks substantial heterogeneity across country groups. Allowing the impact to vary between AEs and CESEE economies reveals different dynamics. In AEs, the minimum wage impact is stronger and more persistent: the elasticity rises over time and reaches approximately 0.25 by the end of year

three—a pattern consistent with gradual wage adjustment and possible secondary effects through the compression of the wage distribution. In CESEE, the initial response is slightly smaller, peaking at around 0.15 in the first semester, but then declines and loses statistical significance at longer horizons, pointing to a more transitory adjustment.

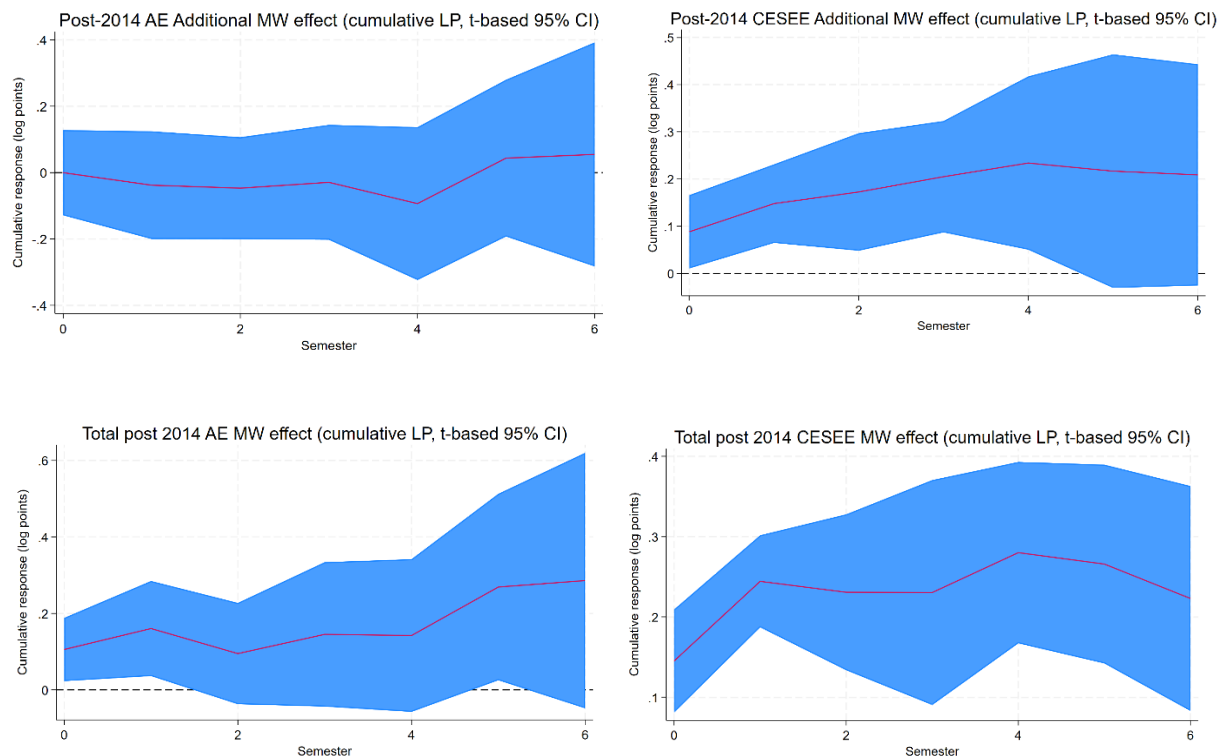
Recent period: higher pass-through in CESEE, which has caught up to AEs

The re-estimation of pass-through by time period reveals important changes over time, particularly in CESEE. Between the late 1990s and the mid-2010s (1999H1–2014H2), estimated elasticities were limited, peaking at approximately 0.11 and concentrated in the first six months. Decomposed by group, AEs exhibited a larger and more persistent response, peaking at around 0.25 after three years, while CESEE elasticities were considerably smaller — peaking at approximately 0.1 in the first semester and quickly losing statistical significance as shown in Figure 12. The limited CESEE pass-through in this earlier period is consistent with prior work (IMF, 2016), which estimated an impact of around 0.1 for a comparable sample.



Since the mid-2010s (2015H1–2024H2), estimated elasticities are notably higher, with statistically significant pass-through across all horizons and a peak impact of approximately 0.28 at five semesters for the full sample as shown in Figure 13 and Table A.II.17. The increase is concentrated in CESEE economies, where the peak elasticity rises to approximately 0.38 after eighteen months and is now statistically significant and persistent across horizons. For AEs, by contrast, the elasticity shows no statistically significant change across the two sub-periods, with the additional post-2014 interaction statistically insignificant across all horizons. The total post-2014 pass-through remains positive and statistically significant at short horizons, but confidence bands widen substantially beyond the second semester. For CESEE, the marked strengthening of minimum wage pass-through since 2015 coincides with a convergence of minimum-to-median wage ratios in the region toward AE levels which, in principle, should generate spillovers from minimum wage shocks up to higher percentiles of the wage distribution.

Figure 13. Impulse Response in AE and CESEE for 1 Percent Increase in Real Minimum Wages Post 2014

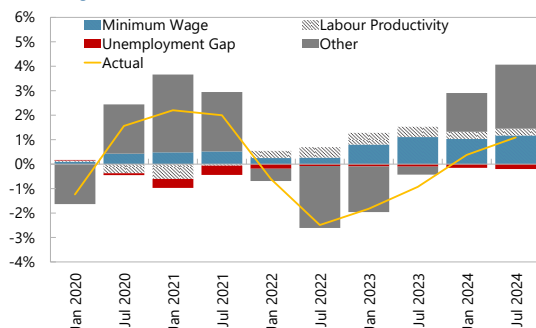


Sources: Eurostat; Haver Analytics; IMF staff calculations.

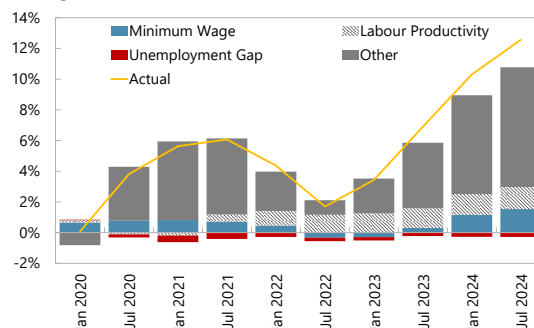
Based on the model with differentiated slopes starting 2015H1 (impulse responses from Figure 13), real minimum wage shocks since 2022H1 have contributed cumulatively approximately 0.9 percentage point to real wage growth by 2024H2 in AE (accounting for 53 percent of real cumulative wage growth) and 1.1 percentage points in CESEE (accounting for 13 percent of cumulative real wage growth) (Figure 14).

Figure 14. Minimum Wage: Contributions to Real Wages

AE: Cumulative Contribution to Real Wages (2019H2=0)
(Percentage)



CESEE: Cumulative Contribution to Real Wages (2019H2=0)
(Percentage)



Sources: OECD, Haver Analytics, Eurostat and IMF Staff Calculations.

Sources: OECD, Haver Analytics, Eurostat and IMF Staff Calculations.

Exploring the sources of the CESEE shift

Here, the analysis examines several candidate explanations for the strengthening of minimum wage pass-through in CESEE since 2015 but does not find statistically significant support for the most commonly hypothesized channels (see below). While this limits conclusions about the precise mechanism, it usefully narrows the field: the shift does not appear to operate through the standard structural variables emphasized in the literature (such as labor market institutions), pointing instead toward channels that aggregate cross-country data are less well-suited to identify.

Minimum wage bite. The first and a priori most compelling hypothesis concerns the *bite* of the minimum wage — its position relative to the wage distribution. The marked strengthening of minimum wage pass-through in CESEE since 2015 coincided with a convergence of minimum-to-median wage ratios in the region toward AE levels. Higher minimum wages relative to median wages would directly affect a larger share of the workforce and, through ripple effects up to higher percentiles of the wage distribution, generate broader upward pressure on overall wages. With this mechanism in mind, we test for interactions between real minimum wage shocks and: (i) the 1-year lagged minimum-to-median wage ratio (also called the *Kaitz* index); (ii) its pre-2015 average (2005–2013) as a baseline; and (iii) the change in the ratio between the 2020–2024 and 2005–2008 averages. None of these interactions yields statistically significant coefficients as shown in Figure A.I.10. While the convergence in minimum-to-median ratios in CESEE toward AE levels coincided with the rise in elasticities, the econometric analysis could not confirm its role.

Labor market institutions. The second hypothesis concerns collective bargaining, as captured by union density or bargaining coverage, two indicators that relate to union power. Union power could amplify minimum wage spillovers if minimum wage increases serve as a reference point in wage negotiations. However, no statistically significant evidence could be found that either variable is associated with a higher pass-through as shown in Figure A.I.11.

Taken together, the evidence suggests that the strengthening of the CESEE minimum wage pass-through since 2015 reflects a structural shift whose origins are difficult to pin down with confidence using aggregate cross-country data. The standard explanatory channels — relative bite, role of unions as captured by union density or collective bargaining coverage — are not found to significantly correlate with the shift.

3. Public Sector Wages

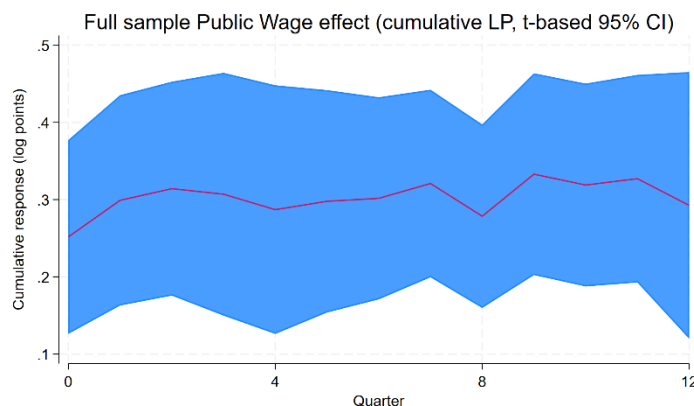
As with minimum wage changes, the potential endogeneity of public sector wage changes—governments may raise public wages in response to tight labor markets or surging private sector wages—is mitigated by the richness of the control set, including eight lags of both public and private wage growth, four lags of the unemployment gap, and labor productivity growth. These substantially reduce the scope for simultaneity bias by conditioning on the state of the economy, including recent private sector wage dynamics, at the time of each public wage adjustment.

Full sample: front-loaded and persistent spillovers

In the full sample (Figure 15), public sector wage shocks are associated with a statistically significant, front-loaded positive impact on real private sector wages. The impact of a 1 percent shock in real public sector

wages already materializes in the first quarter after the shock and quickly reaches approximately 0.3 percent, remaining broadly stable afterwards. This pattern is consistent with a persistent level shift in real private wages rather than a transitory adjustment, suggesting that public wage changes have lasting effects on private sector wage norms.

Figure 15. Impulse Response of 1-Percent Increase in Real Public Sector Wages (Full Sample)



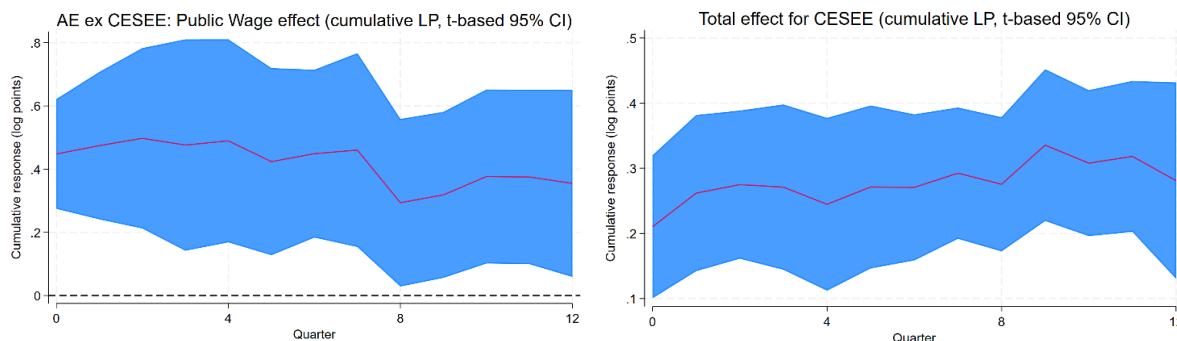
Sources: Eurostat; Haver Analytics; IMF staff calculations.

Heterogeneity between AEs and CESEE

There is marked heterogeneity in the dynamics of the spillover across country groups. In AEs, the response is more front-loaded: the impulse response peaks at approximately 0.4 to 0.5 percent within the first two to three quarters and then moderates gradually, remaining persistently elevated at around 0.35 percent by year three (Figure 16, Table A.II.18). This front-loading likely reflects the role of public sector wage agreements as reference points in private sector negotiations in AEs, where collective bargaining arrangements are more formalized and cross-sector wage coordination is more prevalent. Union density may amplify this mechanism, as discussed below.

In CESEE, the initial response is smaller—approximately 0.2 to 0.25 percent in the first quarter—but builds more gradually over time, converging toward the full-sample trajectory and peaking near 0.35 percent around the ninth quarter. The more gradual pattern is consistent with transmission operating primarily through labor market competition and worker mobility rather than through formal wage-setting benchmarks: public wage increases shift the relative attractiveness of public employment, prompting private employers to adjust wages over time to retain workers—a mechanism that unfolds over longer horizons than direct bargaining-based transmission.

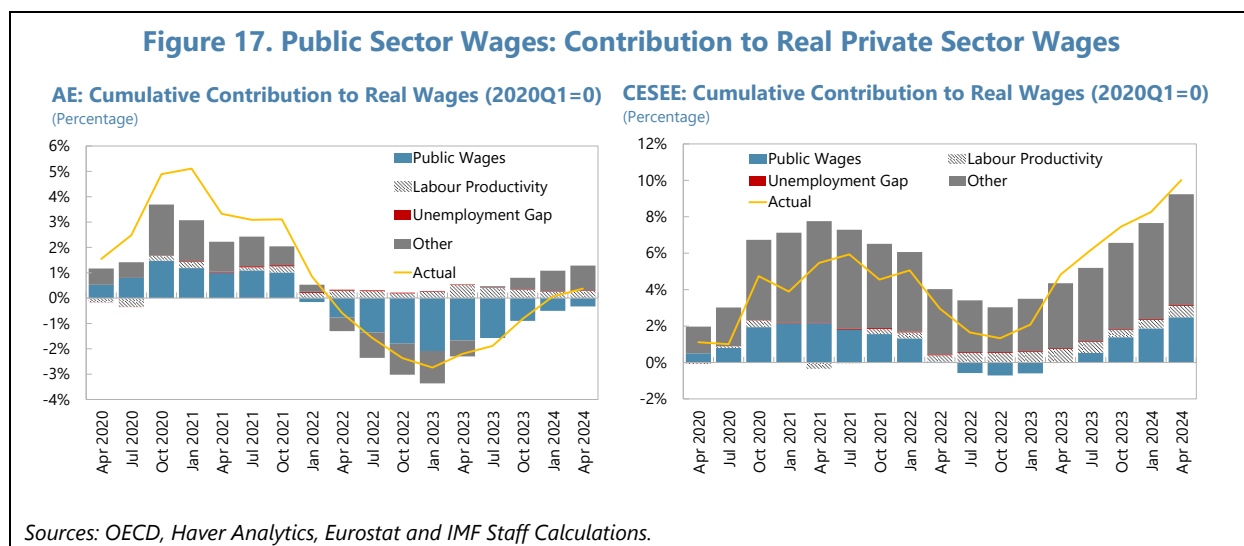
Figure 16. Impulse Response of 1-Percent Increase in Real Public Sector Wages (AEs vs CESEE)



Sources: Eurostat; Haver Analytics; IMF staff calculations.

The AE–CESEE difference is statistically significant at the 95 percent confidence level during approximately the first six months, and at the 90 percent level up to the seventh quarter, confirming that the relative front-loading in AEs is a robust feature of the data. Beyond this horizon, the two impulse responses converge and are statistically similar, implying that both groups reach a comparable medium-term pass-through despite different short-run dynamics. The front-loaded pass-through for AEs can be explained by their higher public sector share of total employment compared to CESEE. The interacting of the 1-quarter lagged public sector's share of employment with the public sector wage shock has a significant and higher coefficient in the first year (Figure A.I.12, left panel). The public sector's employment share is on average 5.8 percentage points higher in AEs compared to CESEE. Accounting for this interaction, the difference between AE and CESEE becomes statistically insignificant (Figure A.I.12, right panel).

Using fitted values from the estimated model, we decompose the contribution of public sector real wage shocks to private sector real wage growth since the onset of the 2022–2023 inflation episode. Over the 2022Q1–2024Q2 window, the cumulative fitted contribution was approximately –0.2 percent in AEs, accounting for 29 percent of the cumulative real private wage decline as shown in Figure 17. This reflects nominal public sector wage growth persistently lagging CPI inflation from 2022 onward, generating declines in real public wages during the inflation surge that has only been gradually recovered by late 2024. This subtracted modestly from private real wage growth over that period. In CESEE, several governments granted public sector wage increases that outpaced inflation, boosting private wages through the estimated pass-through. The estimated contribution there is 1.2 percent, accounting for 23 percent of the actual real private wage increase over that period. Public wage policy thus operated asymmetrically during the recent episode: as a modest stabilizer in AEs and an amplifier of wage pressures in CESEE.



The role of labor market institutions: union density

To investigate whether structural features of labor markets may account for the heterogeneity in public wage spillovers, we test for interactions of the public wage shock with three institutional variables: union density, collective bargaining coverage and the public sector employment share. We find some mild evidence of a persistent positive association between high union density and the pass-through from public sector wages into the private sector as shown Figure A.I.13, though statistical significance peaks at the first quarter at no more than 90 percent. Other tested structural features show no conclusive evidence of affecting the pass-through.

V. Conclusion

This paper has examined wage dynamics in Europe through three complementary approaches: a macro-level cross-country Phillips curve analysis for 26 European economies, micro-level evidence on collective bargaining agreements in Spain, and local projections estimates of spillovers from minimum and public sector wage policies. Together, the findings point to a wage-setting landscape that has been shaped — but not fundamentally transformed — by the 2022-23 inflationary episode.

There is a structural asymmetry between AEs and CESEE. Wage formation in CESEE remains significantly more backward-looking, with past inflation as the dominant driver of wage settlements, while inflation expectations play a more prominent role in AEs. The 2022-23 inflationary episode confirmed this asymmetry: wage acceleration was not only larger in CESEE but also harder to explain with pre-pandemic model estimates, suggesting that the sensitivity of wage-setters to inflationary signals may have increased. In AEs, the wage drift responded first, before negotiated wages took over from 2023 onward as multi-year contracts were renewed and real wage losses gradually recovered.

The varying sensitivity of wages to past inflation across countries can reflect differences in the degree of anchoring of inflation expectations but also specific institutional features of the wage-setting process. The micro-level evidence from Spain illuminates these institutional channels. Evidence from individual collective bargaining agreements suggests that CPI indexation clauses, annual agreement duration, and sector-level

bargaining each amplify the pass-through of inflation into wages. Furthermore, the analysis suggests that some of these features, such as indexation clauses, may (re)emerge endogenously in response to a large inflationary shock such as the 2022-2023 energy crisis. Indeed, the share of Spanish workers covered by indexed agreements roughly doubled between the pre-pandemic period and 2023 — an illustration of how shifts in wage-setting behavior following one shock might durably alter the response of wages to subsequent shocks, leading to greater second-round effects on inflation. Indexation matters not only because it accelerates inflation pass-through, but because it interacts with the near-complete downward nominal rigidity of negotiated wages documented in Section II: positive shocks transmit rapidly through indexed contracts, while the symmetric downward adjustment that would stabilize real wages around productivity must run through the wage drift or unemployment.

Both minimum and public sector wages have generated significant spillovers to average wage and private sector wage growth respectively in Europe, with larger and more dynamic effects in CESEE. By now, the bulk of the pass-through from policy decisions taken in the aftermath of the 2022-23 inflation surge has fed through, but any new discretionary increases would constitute a fresh impulse to wage growth.

Looking ahead, and in an environment of heightened geopolitical uncertainty prone to renewed supply shocks, the paper's findings offer some reassurance that labor slack continues to support disinflation but also identify specific mechanisms through which supply shocks might now generate more persistent wage pressures than pre-pandemic experience would have suggested. The Phillips curve mechanism is intact, and labor market slack retains its moderating force. The heightened sensitivity of wages to past inflation observed during 2022–2024 appears to be state-dependent rather than structural: as inflation has normalized, rolling estimates show wage drift sensitivity returning to pre-pandemic levels. However, allowing inflation to remain elevated or experiencing repeated inflation surprises could entrench backward-looking behavior and indexation norms, converting a state-dependent response into a more durable structural feature.

But the structural sensitivity of wages to past inflation in CESEE, the institutional drift toward indexation in countries such as Spain, and the demonstrated spillover capacity of minimum and public wages, together mean that a renewed inflationary shock could feed into stronger wage dynamics than historical relationships would predict. A priori, this amplification risk is more acute in CESEE compared to AEs, where better-anchored expectations and a smaller weight of energy in consumption baskets would be expected to generate a smaller response. These considerations are particularly relevant in the presence of indexation mechanisms, especially those that are fully backward-looking, and when discretionary minimum or public sector wage adjustments add to wage pressures already elevated by the inflation environment. How wage policy decisions relate to the inflation environment, and how wage-setting institutions amplify second-round effects, therefore bear closely on the macroeconomic outlook amid heightened uncertainty.

Annex I. Additional Figures

Figure A.I.1. Real Wage Gaps in AE and CESEE

Figure A.I.1 (a): Advanced Economies

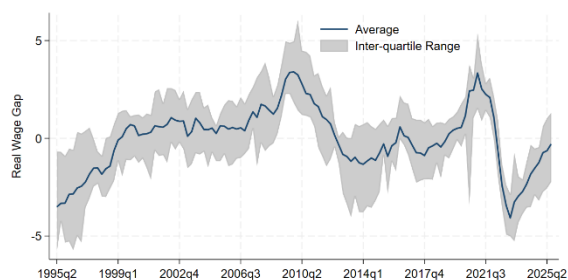
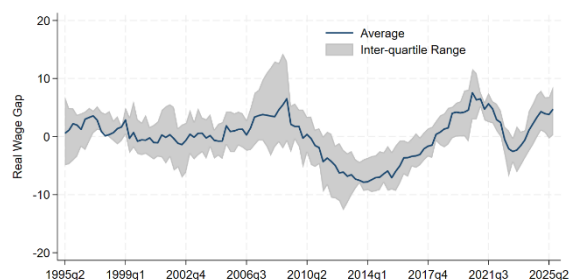


Figure A.I.1 (b): CESEE



Sources: Eurostat, Haver Analytics, and authors' calculations.

Figure A.I.2. Shifts in the Wage Phillips Curve in AE

Figure A.I.2 (a). Rolling regressions for AE

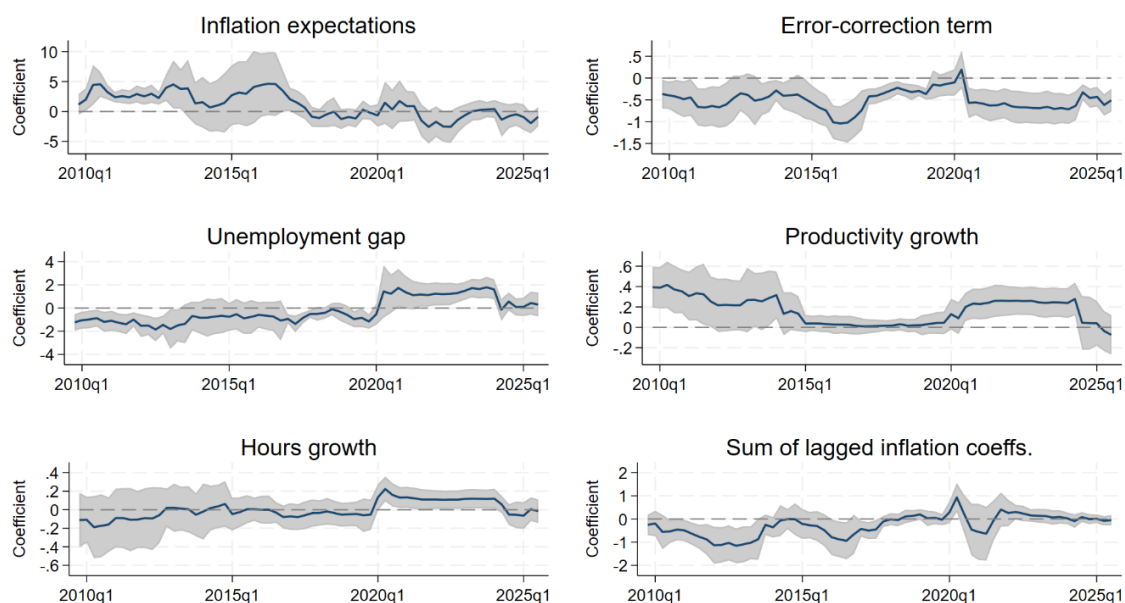
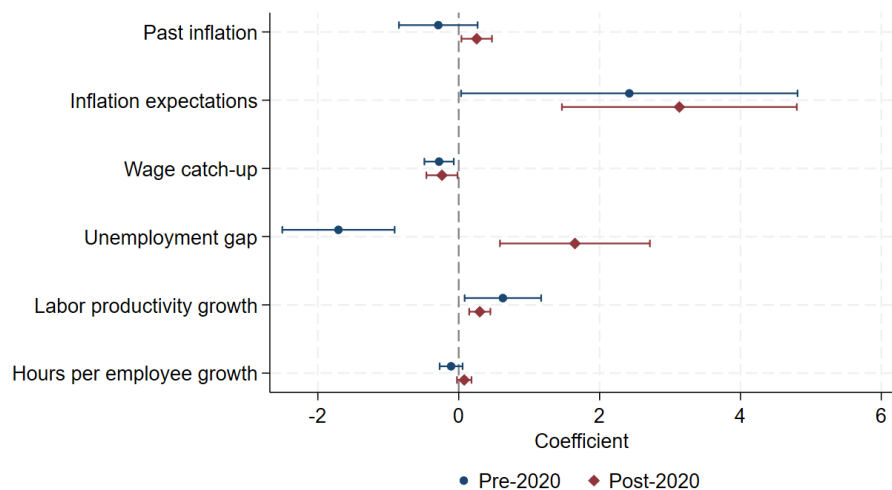


Figure A.I.2 (b). Structural break for AE



Sources: IMF staff estimates.

Note: Unbalanced panel data for 15 AE (excl. CESEE). The model is estimated on a rolling window (16 quarters) over the 2006Q1-2024Q4 period. Upper panel: shaded areas represent 90 percent confidence intervals.

Figure A.I.3. Shifts in the Wage Phillips Curve in CESEE

Figure A.I.3 (a). Rolling regressions for CESEE

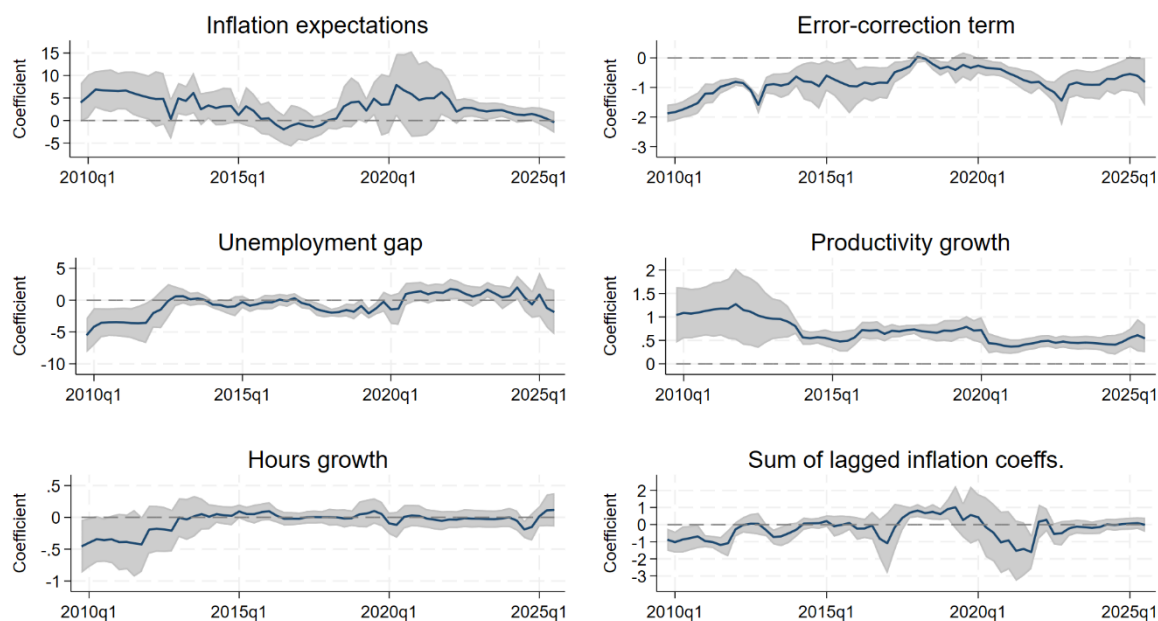
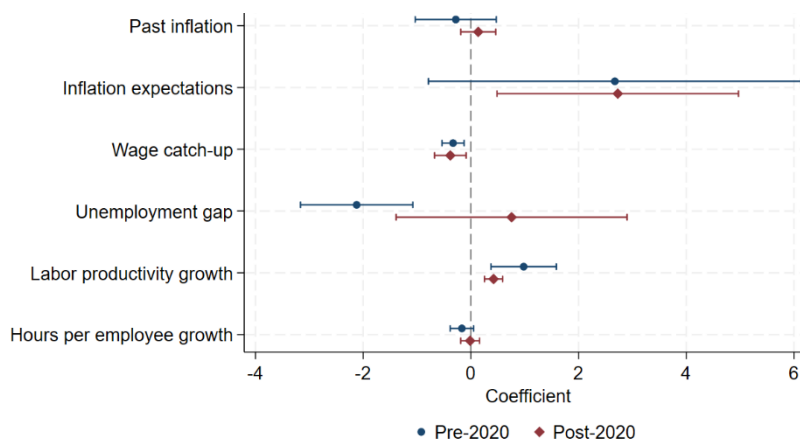


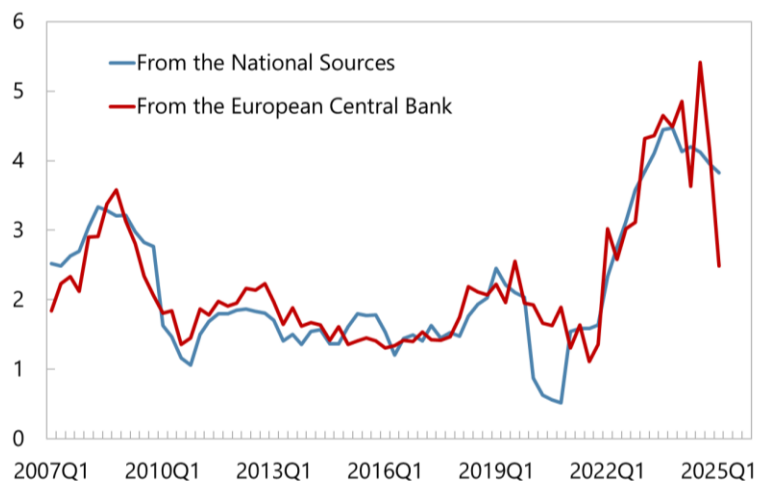
Figure A.I.3 (b). Structural break for CESEE



Sources: IMF staff estimates.

Note: Unbalanced panel data for 15 AE (excl. CESEE) and 11 CESEE countries. The model is estimated on a rolling window (16 quarters) over the 2006Q1-2024Q4 period. Shaded areas represent 90 percent confidence intervals.

Figure A.I.4. Comparison of Indices on Negotiated Wages
(Percent, year-on-year)



Sources: National sources; Haver Analytics; and IMF staff estimates.

Note: the blue line shows the weighted average growth (using GDP-PPP weights) in negotiated wages for nine 9 EU countries.

Figure A.I.5. Shifts in the Wage Phillips Curve for Negotiated Wages

Figure A.I.5 (a). Rolling regressions for Negotiated Wages

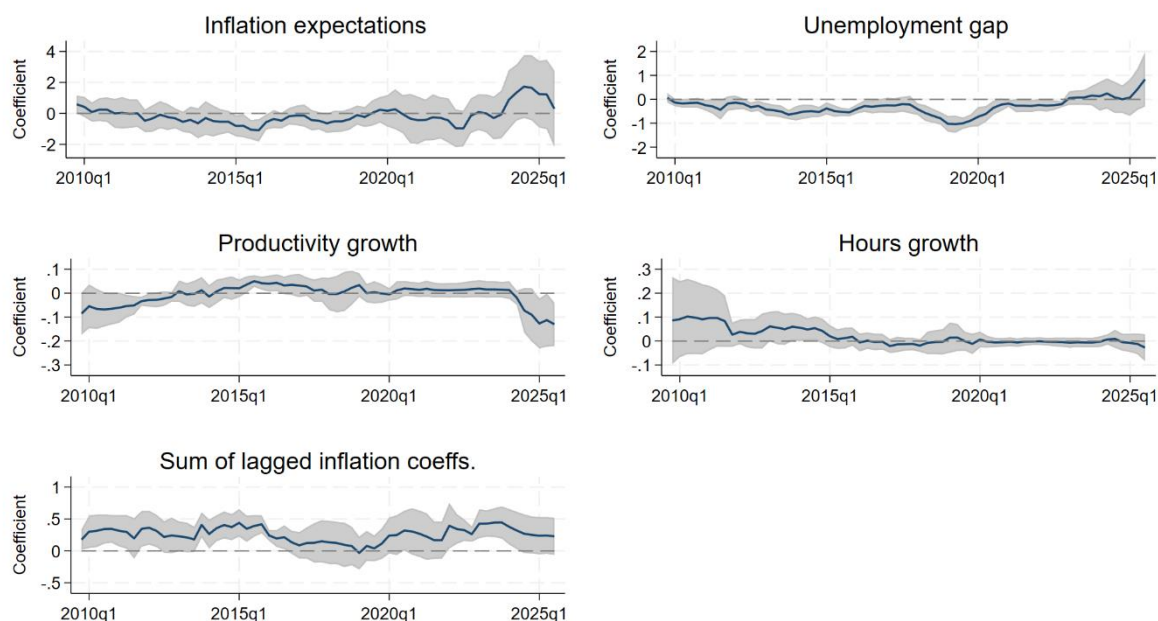
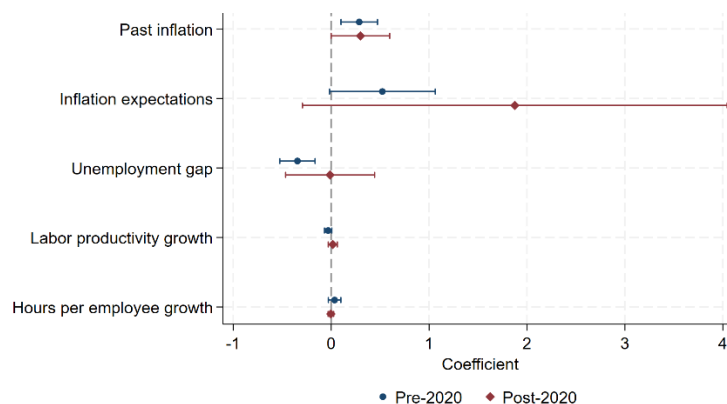


Figure A.I.5 (b). Structural break for Negotiated Wages



Sources: IMF staff estimates.

Note: The model is estimated on a rolling window (16 quarters) over the 2006Q1-2024Q4 period. Upper panel: shaded areas represent 90 percent confidence intervals.

Figure A.I.6. Shifts in the Wage Phillips Curve for the Wage Drift

Figure A.I.6 (a). Rolling regressions for the Wage Drift

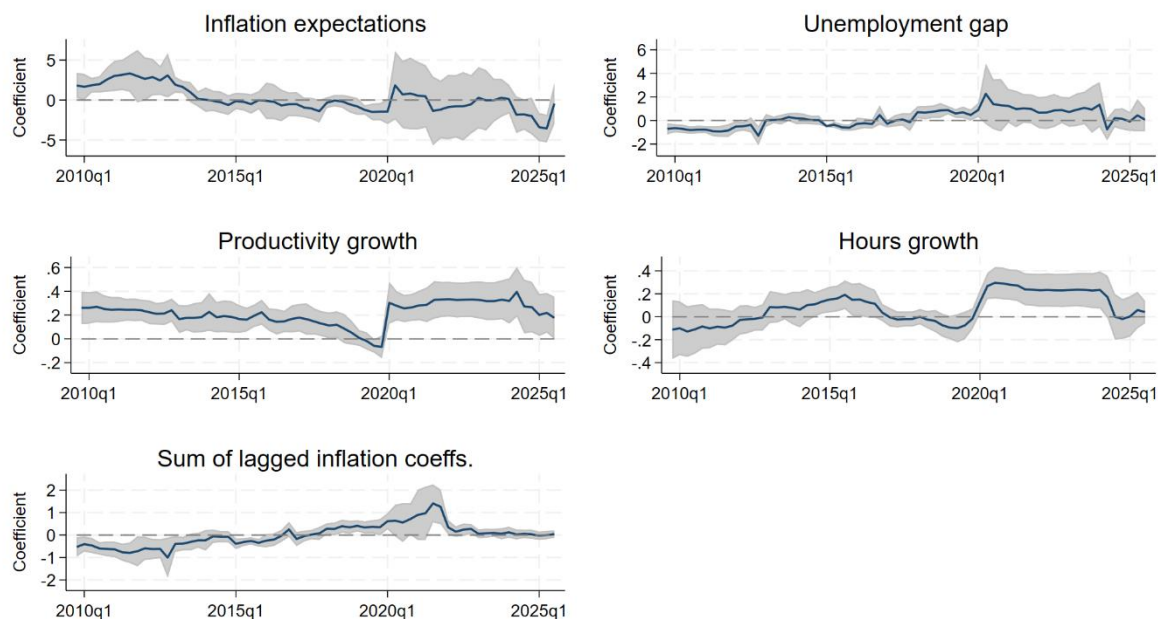
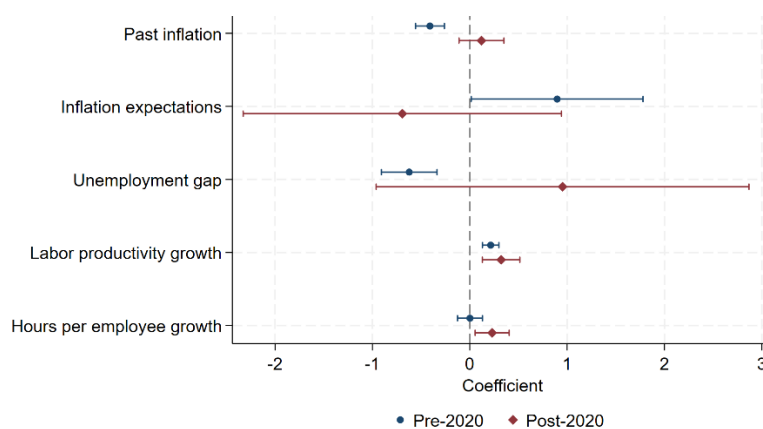


Figure A.I.6 (b). Structural break for the Wage Drift



Sources: IMF staff estimates.

Note: The model is estimated on a rolling window (16 quarters) over the 2006Q1-2024Q4 period. Upper panel: shaded areas represent 90 percent confidence intervals.

Figure A.I.7. Effects of Collective Bargaining Coverage on Negotiated Wages

Figure A.I.7 (a). Effect of a 1 Percentage Point Increase in Unemployment Gap on Negotiated Wages

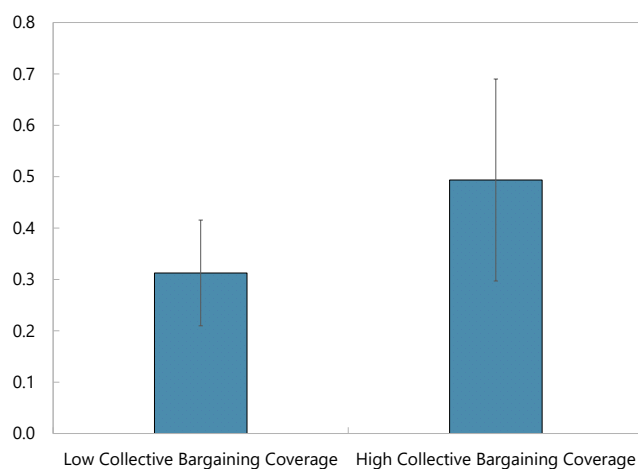
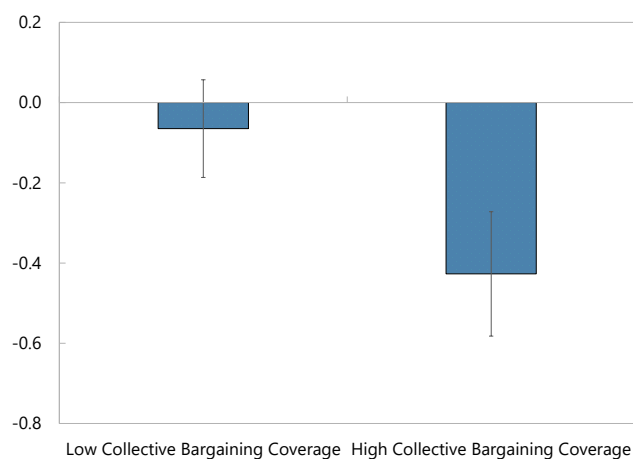


Figure A.I.7 (b). Effect of a 1 Percentage Point Increase in Annual Inflation on Negotiated Wages



Sources: IMF staff estimates.

Note: Low = 25th percentile; High = 75th percentile. 90 percent confidence interval.

Figure A.I.8. The Slope of the Wage Phillips in High and Low Inflation Environment

(x-axis: percentage points; y-axis: percent)

Figure A.I.8 (a). Binscatter Plots for Negotiated Wages

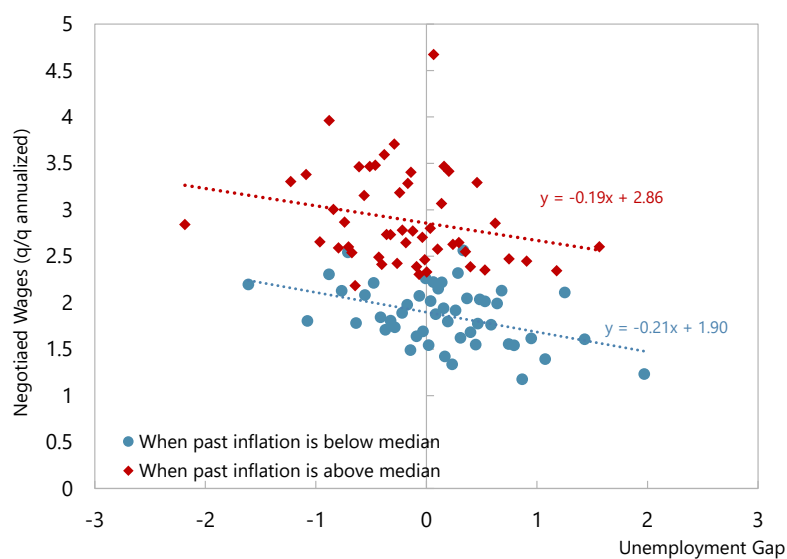
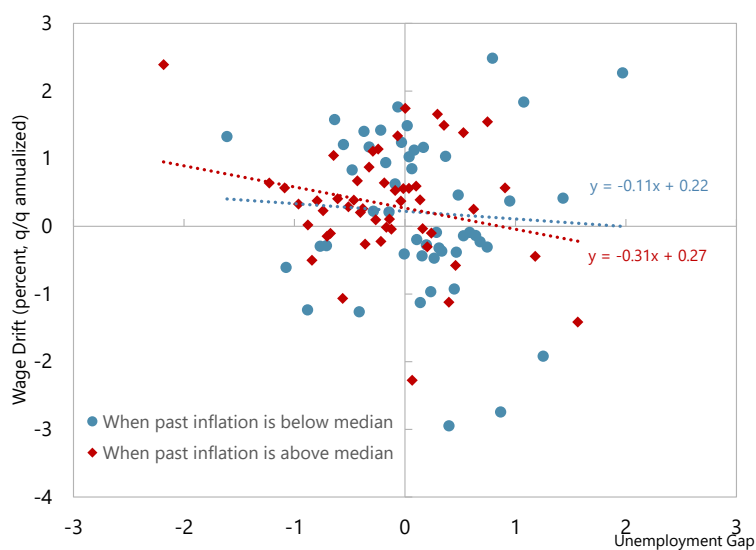
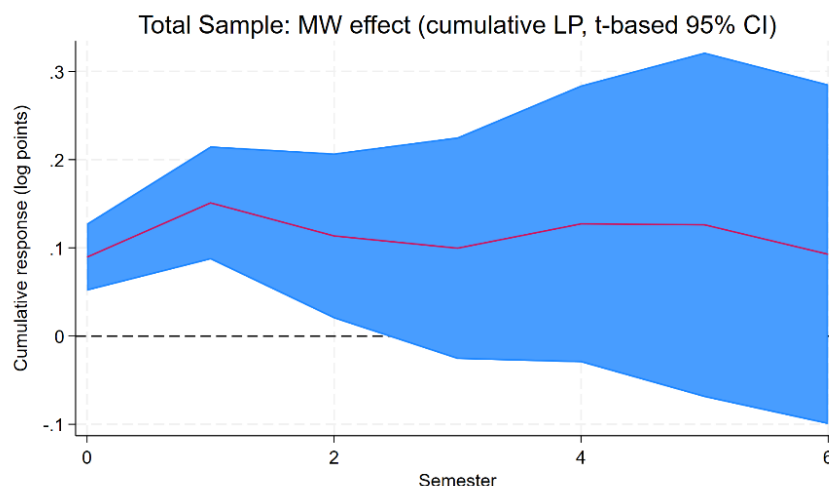


Figure A.I.8 (b). Binscatter Plots for Wage Drift

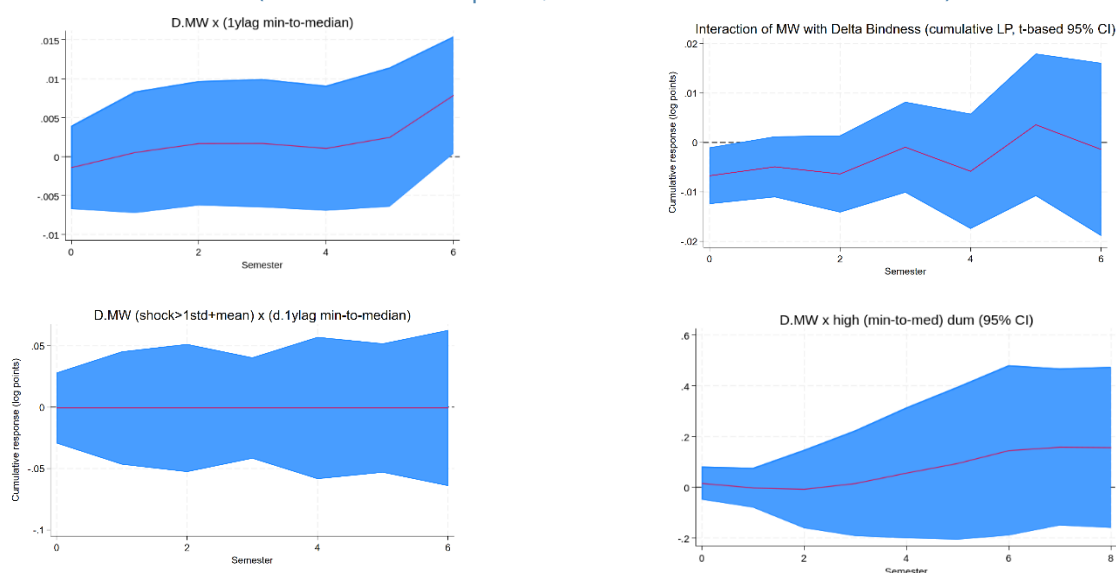


Sources: National sources; Haver Analytics; and IMF staff estimates.

Note: Binscatter plots with 50 bins, controlling for country fixed effects, inflation expectations, labor productivity, wage catch up and hours per employee growth.

Figure A.I.9. Impulse Response for 1 Percent Increase in Real Statutory Minimum Wages**Figure A.I.10. Minimum Wage Interactions with Median Wage Relative Bite**

(Cumulative LP response; t-based 95% confidence intervals)

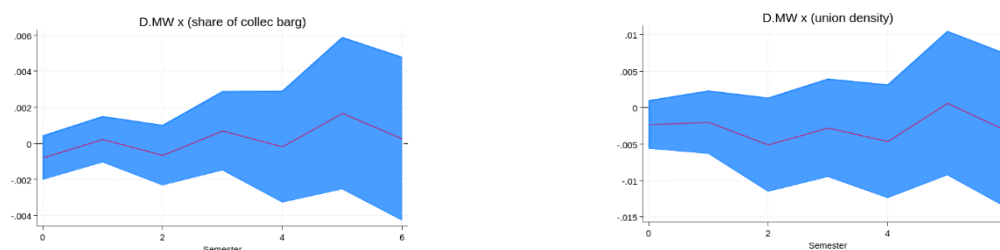


Sources: OECD; Eurostat; Haver Analytics, author calculations

Note: Clockwise from top left each chart shows interaction of median wage with: i) lagged minimum-to-median ratio; ii) the change in the average Kaitz index between 2015-24 and 2005-2013; iii) a dummy that takes the value of 1 if the shock is greater than 1 standard deviation from mean minimum wage growth times the lagged Kaitz index; iv) a dummy that takes values 1 if the Kaitz index is higher than the sample median.

Figure A.I.11. Minimum Wage Interactions with Labor Market Institutions

(Cumulative LP response; t-based 95% confidence intervals)

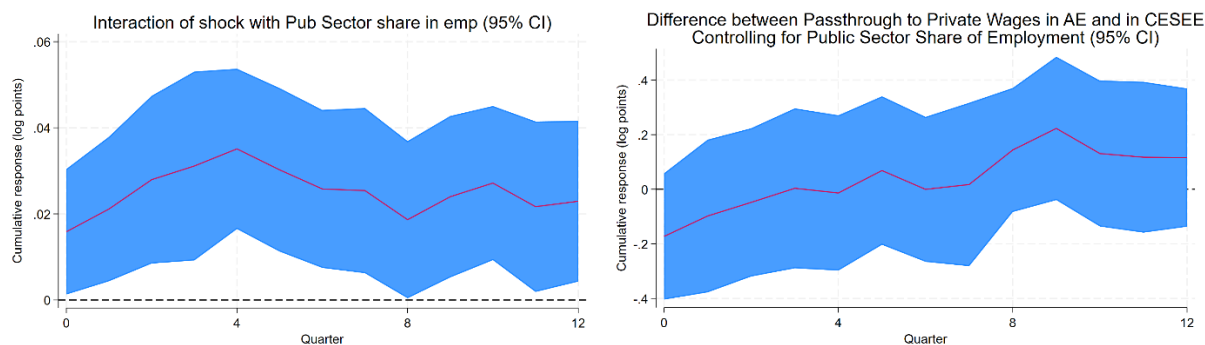


Sources: OECD/AIAS ICTWSS; Eurostat; Haver Analytics; IMF staff calculations.

Note: Left panel shows interaction with collective bargaining coverage; right panel with union density ratio. Neither interaction is statistically significant.

Figure A.I.12. Public Sector Wage Interactions with Public Sector Share of Employment

(Cumulative LP response; t-based 95% confidence intervals)

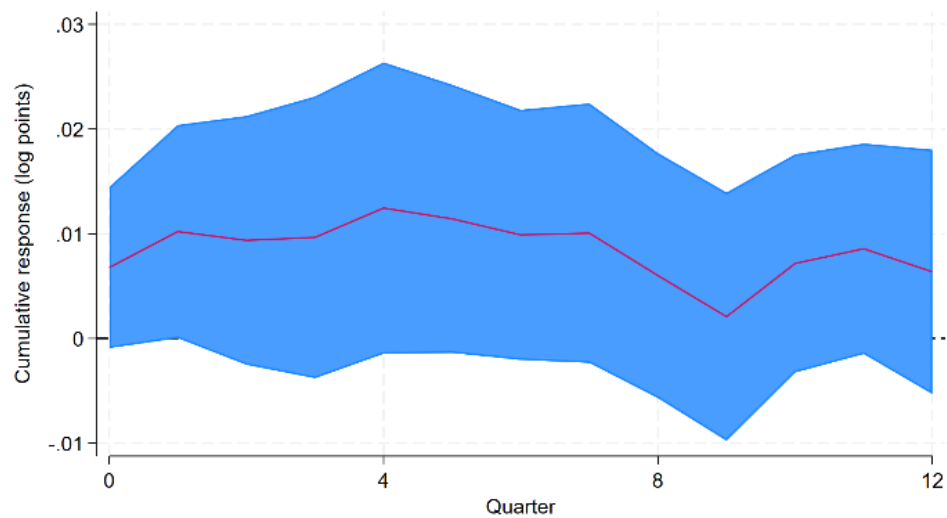


Sources: OECD/AIAS ICTWSS; Eurostat; Haver Analytics; IMF staff calculations.

Note: Left panel shows the coefficient of the interaction between the 1-quarter lagged share of the public sector in total employment by number of workers and the contemporaneous change in real public sector wages; right panel shows the difference between the unconditional passthrough (i.e. the coefficient on the contemporaneous change in real public sector wages) of AEs minus that of CESEE.

Figure A.I.13. Interaction of Public Wage Shock with Union Density Ratio

(Cumulative LP response; t-based 90% confidence intervals)



Annex II. Additional Tables

Table A.II.1. Benchmark Wage Phillips Curve Estimation in AE and CESEE

(Dependent variable: Wage growth, quarter-on-quarter annualized)

VARIABLES	(1) All	(2) AE	(3) CESEE
Lagged inflation (Sum of coefficients)	0.309** (0.120)	0.256** (0.0918)	0.406* (0.182)
Inflation expectations	1.358 (0.918)	1.998** (0.879)	0.801 (1.347)
Wage catch up	-0.246*** (0.078)	-0.152** (0.065)	-0.272** (0.094)
Unemployment gap	-1.156*** (0.372)	-0.298** (0.104)	-1.666*** (0.522)
Labor productivity growth	0.495*** (0.164)	0.213* (0.116)	0.766*** (0.210)
Hours per employee growth	-0.028 (0.086)	0.125 (0.091)	-0.192* (0.099)
Observations	1,952	1,140	812
R-squared	0.243	0.284	0.304
Number of countries	26	15	11
Country FE	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: IMF staff estimates.

Note: Unbalanced panel data for 15 AE (excl. CESEE) and 11 CESEE countries. The model is estimated over the 2006Q1-2024Q4 period. Standard errors, reported in parentheses, are corrected for heteroscedasticity and autocorrelations. All regressions include country fixed effects.

Table A.II.2. Data Sources for Negotiated Wages

Country	Source	Indicator	Data availability
Austria	Statistics Austria	Index of agreed minimum wages/Negotiated standard wage rate index	Since 1986
Belgium	Federal Public Service Employment, Labour and Social Dialogue	Indice des salaires conventionnels	Since 1959
Finland	Statistics Finland	Index negotiated wages and salaries	Since 2005
France	Banque de France	Negotiated wages	Since 2006
Germany	Destatis	Indices of agreed earnings	Since 1995
Italy	Istat	Wages according to collective bargaining agreements	Since 2005
Netherlands	Statistics Netherlands	Negotiated wages	Since 1990
Spain	Ministry of Labor and Social Economy, Haver Analytics	Collective bargaining agreed wages	Since 1995
Sweden	Swedish National Mediation Office	Negotiated wages	Since 1992

Sources: National sources.

Table A.II.3. Benchmark Wage Phillips Curve Estimation with Negotiated Wages and Wage Drift

(Dependent variable: Wage growth, quarter-on-quarter annualized)

VARIABLES	(1) Wage per employee	(2) Negotiated wages	(3) Wage drift
Lagged inflation	0.368***	0.363***	0.005
(Sum of coefficients)	0.0996	0.106	0.0952
Inflation expectations	0.466 (0.262)	0.690 (0.373)	-0.224 (0.427)
Wage catch up	-0.157* (0.082)	-0.017 (0.036)	-0.141 (0.094)
Unemployment gap	-0.482* (0.254)	-0.223*** (0.038)	-0.259 (0.271)
Labor productivity growth	0.311*** (0.052)	-0.005 (0.019)	0.316*** (0.068)
Hours per employee growth	0.236** (0.076)	0.012 (0.012)	0.224** (0.080)
Observations	683	683	683
R-squared	0.622	0.296	0.607
Number of countries	9	9	9
Country FE	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: IMF staff estimates.

Note: Country sample includes Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Spain and Sweden. The model is estimated over the 2006Q1-2024Q4 period. Standard errors, reported in parentheses, are corrected for heteroscedasticity and autocorrelations. All regressions include country fixed effects.

Table A.II.4. Estimation with Negotiated Wages and Collective Bargaining Coverage
(Dependent variable: Negotiated Wage growth, quarter-on-quarter annualized)

	(1)	(2)	(3)	(4)
Lagged inflation	0.363***	0.361**	0.358***	-0.657**
(Sum of coefficients)	0.106	0.108	0.104	0.382
Unemployment gap	-0.223*** (0.038)	-0.208*** (0.049)	1.879** (0.618)	-0.166** (0.053)
Labor productivity growth	-0.005 (0.019)	-0.005 (0.019)	-0.006 (0.020)	-0.004 (0.020)
Inflation expectations	0.690 (0.373)	0.659 (0.365)	0.690* (0.338)	0.738* (0.363)
Wage catch up	-0.017 (0.036)	-0.020 (0.039)	-0.025 (0.034)	-0.021 (0.038)
Hours per employee growth	0.012 (0.012)	0.012 (0.012)	0.015 (0.012)	0.012 (0.013)
Cov. Bargaining		-2.408 (3.238)	-2.642 (3.051)	-7.509** (2.889)
Cov. Bargaining x Unemployment gap			-2.356*** (0.695)	
Cov. Bargaining x Lagged inflation (Sum of coefficients)				1.174** (0.382)
Observations	683	683	683	683
R-squared	0.296	0.297	0.303	0.353
Number of countries	9	9	9	9
Country FE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: IMF staff estimates.

Note: Country sample includes Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Spain and Sweden. The model is estimated over the 2006Q1-2024Q4 period. Standard errors, reported in parentheses, are corrected for heteroscedasticity and autocorrelations. All regressions include country fixed effects.

Table A.II.5. List of Countries in the Sample

Advanced Economies	CESEE
Austria	Bulgaria
Belgium	Croatia
Denmark	Czech Republic
Finland	Estonia
France	Hungary
Germany	Latvia
Greece	Lithuania
Ireland	Poland
Italy	Romania
Netherlands	Slovak Republic
Norway	Slovenia
Portugal	
Spain	
Sweden	
United Kingdom	

Table A.II.6. Micro-Level Phillips Curve: Baseline Regressions

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)
Sum of Past Inflation	0.10*** (0.01)	0.08*** (0.01)	0.00 (0.03)	0.09*** (0.01)
Sum of Past Inflation × CPI Indexation		0.08*** (0.02)		
Sum of Past Inflation × Sector-Level			0.10*** (0.03)	
Sum of Past Inflation × Annual				0.06** (0.03)
Unemployment Gap	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)
Annual	0.10** (0.05)	0.11** (0.05)	0.10** (0.05)	-0.01 (0.04)
CPI Indexation	0.35*** (0.04)	0.14*** (0.04)	0.35*** (0.04)	0.36*** (0.04)
Sector-Level	0.27* (0.14)	0.26* (0.14)	0.10 (0.14)	0.27* (0.14)
Ln(Affected Workers)	0.11*** (0.02)	0.11*** (0.02)	0.11*** (0.02)	0.11*** (0.02)
Ln(Affected Firms)	-0.09*** (0.03)	-0.09*** (0.03)	-0.09*** (0.03)	-0.09*** (0.03)
R^2	0.27	0.27	0.27	0.27
Observations	9,399	9,399	9,399	9,399
Sector FE	yes	yes	yes	yes
Region FE	yes	yes	yes	yes
Region-Sector FE	no	no	no	no

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.7. Micro-Level Phillips Curve: Interplay of Past Inflation and Unemployment Gap

(Dependent variable: Wage growth agreed in collective bargaining)

	Full Sample	Pre-COVID
	(1)	(2)
Sum of Past Inflation	0.079*** (0.01)	0.078*** (0.01)
Unemployment Gap	-0.15*** (0.00)	-0.12*** (0.00)
Sum of Past Inflation × Unemployment Gap	-0.006*** (0.00)	-0.001 (0.00)
Annual	0.11** (0.05)	0.10*** (0.03)
CPI Indexation	0.36*** (0.04)	0.17*** (0.03)
Sector-Level	0.29** (0.14)	-0.18* (0.11)
ln(Workers)	0.12*** (0.02)	0.05*** (0.02)
ln(Firms)	-0.10*** (0.03)	-0.02 (0.02)
R^2	0.27	0.34
Obs	9,399	5,783
Sector FE	yes	yes
Region FE	yes	yes
Region-Sector FE	no	no

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.8. Micro-Level Phillips Curve: Different Combinations of Fixed Effects

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)	(5)	(6)
Sum of Past Inflation	0.08*** (0.01)	0.08*** (0.01)	0.01 (0.03)	0.01 (0.03)	0.09*** (0.01)	0.09*** (0.01)
Sum of Past Inflation × CPI Indexation	0.06*** (0.02)	0.06*** (0.02)				
Sum of Past Inflation × Sector-Level			0.09** (0.03)	0.09** (0.03)		
Sum of Past Inflation × Annual					0.05** (0.02)	0.05** (0.02)
Unemployment Gap	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)	-0.16*** (0.00)
Annual	0.11** (0.05)	0.11** (0.05)	0.11** (0.05)	0.11** (0.05)	0.01 (0.05)	0.01 (0.05)
CPI Indexation	0.22*** (0.04)	0.22*** (0.04)	0.37*** (0.04)	0.37*** (0.04)	0.37*** (0.04)	0.37*** (0.04)
Sector-Level	0.25 (0.18)	0.25 (0.18)	0.10 (0.18)	0.10 (0.18)	0.25 (0.17)	0.25 (0.17)
Ln(Affected Workers)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)
Ln(Affected Firms)	-0.08*** (0.03)	-0.08*** (0.03)	-0.08*** (0.03)	-0.08*** (0.03)	-0.08*** (0.03)	-0.08*** (0.03)
R^2	0.39	0.39	0.40	0.40	0.40	0.40
Observations	9,239	9,239	9,319	9,319	9,319	9,319
Sector FE	no	yes	no	yes	no	yes
Region FE	no	yes	no	yes	no	yes
Region-Sector FE	yes	yes	yes	yes	yes	yes

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.9. Micro-Level Phillips Curve: Interplay of Past Inflation and Unemployment Gap for Different Combinations of Fixed Effects

(Dependent variable: Wage growth agreed in collective bargaining)

	Full Sample		Pre-COVID	
	(1)	(2)	(3)	(4)
Sum of Past Inflation	0.069*** (0.01)	0.069*** (0.01)	0.081*** (0.01)	0.081*** (0.01)
Unemployment Gap	-0.15*** (0.00)	-0.15*** (0.00)	-0.12*** (0.00)	-0.12*** (0.00)
Sum of Past Inflation × Unemployment Gap	-0.007*** (0.00)	-0.007*** (0.00)	-0.002 (0.00)	-0.002 (0.00)
Annual	0.11** (0.05)	0.11** (0.05)	0.09*** (0.03)	0.09*** (0.03)
CPI Indexation	0.38*** (0.04)	0.38*** (0.04)	0.18*** (0.03)	0.18*** (0.03)
Agreement Sector-Level	0.27 (0.17)	0.27 (0.17)	-0.20 (0.12)	-0.20 (0.12)
ln(Workers)	0.09*** (0.02)	0.09*** (0.02)	0.05*** (0.02)	0.05*** (0.02)
ln(Firms)	-0.08*** (0.03)	-0.08*** (0.03)	-0.01 (0.01)	-0.01 (0.01)
R^2	0.40	0.40	0.47	0.47
Obs	9,319	9,319	5,626	5,626
Sector FE	no	yes	no	yes
Region FE	no	yes	no	yes
Region-Sector FE	yes	yes	yes	yes

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.10. Determinants of CPI Indexation in Collective Bargaining Agreements

(Dependent variable: Indexation to CPI Dummy)

	(1)	(2)	(3)
Sum of Past Inflation	0.004** (0.00)	0.006*** (0.00)	0.006*** (0.00)
Unemployment Gap	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Annual	-0.01 (0.01)	0.02 (0.01)	0.02 (0.01)
Sector-Level	-0.05** (0.02)	-0.07** (0.03)	-0.07** (0.03)
ln(Workers)	-0.01*** (0.00)	-0.01** (0.00)	-0.01** (0.00)
ln(Firms)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
R^2	0.12	0.23	0.23
Obs	10,274	10,194	10,194
Sector FE	yes	no	yes
Region FE	yes	no	yes
Region-Sector FE	no	yes	yes

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.11. Micro-Level Phillips Curve: Robustness with Alternative Measure of Labor Market Slack

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)
Sum of Past Inflation	0.09*** (0.01)	0.07*** (0.01)	0.02 (0.03)	0.08*** (0.01)
Sum of Past Inflation × CPI Indexation		0.07*** (0.02)		
Sum of Past Inflation × Sector-Level			0.07** (0.03)	
Sum of Past Inflation × Annual				0.06** (0.03)
Labor Market Tightness (V/U)	3.81*** (0.11)	3.81*** (0.11)	3.81*** (0.11)	3.81*** (0.11)
Annual	0.10** (0.05)	0.12** (0.05)	0.10** (0.05)	-0.01 (0.05)
CPI Indexation	0.41*** (0.04)	0.21*** (0.04)	0.41*** (0.04)	0.41*** (0.04)
Sector-Level	0.32** (0.15)	0.30** (0.15)	0.20 (0.15)	0.32** (0.15)
Ln(Affected Workers)	0.13*** (0.02)	0.12*** (0.02)	0.12*** (0.02)	0.13*** (0.02)
Ln(Affected Firms)	-0.09*** (0.03)	-0.08*** (0.03)	-0.09*** (0.03)	-0.09*** (0.03)
R^2	0.27	0.28	0.27	0.27
Observations	9,004	9,004	9,004	9,004
Sector FE	yes	yes	yes	yes
Region FE	yes	yes	yes	yes
Region-Sector FE	no	no	no	no

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.12. Micro-Level Phillips Curve: Robustness with Alternative Measure of Labor Market Slack and Different Combinations of Fixed Effects

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)	(5)	(6)
Sum of Past Inflation	0.07*** (0.01)	0.07*** (0.01)	0.02 (0.03)	0.02 (0.03)	0.08*** (0.01)	0.08*** (0.01)
Sum of Past Inflation × CPI Indexation	0.05** (0.02)	0.05** (0.02)				
Sum of Past Inflation × Sector-Level			0.07* (0.03)	0.07* (0.03)		
Sum of Past Inflation × Annual					0.05** (0.03)	0.05** (0.03)
Labor Market Tightness (V/U)	3.72*** (0.11)	3.72*** (0.11)	3.72*** (0.11)	3.72*** (0.11)	3.71*** (0.11)	3.71*** (0.11)
Annual	0.13*** (0.05)	0.13*** (0.05)	0.11** (0.05)	0.11** (0.05)	0.03 (0.05)	0.03 (0.05)
CPI Indexation	0.32*** (0.04)	0.32*** (0.04)	0.45*** (0.05)	0.45*** (0.05)	0.44*** (0.05)	0.44*** (0.05)
Sector-Level	0.30* (0.18)	0.30* (0.18)	0.21 (0.18)	0.21 (0.18)	0.32* (0.18)	0.32* (0.18)
Ln(Affected Workers)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)
Ln(Affected Firms)	-0.07*** (0.03)	-0.07*** (0.03)	-0.07*** (0.03)	-0.07*** (0.03)	-0.07*** (0.03)	-0.07*** (0.03)
R^2	0.40	0.40	0.40	0.40	0.40	0.40
Observations	8,856	8,856	8,936	8,936	8,936	8,936
Sector FE	no	yes	no	yes	no	yes
Region FE	no	yes	no	yes	no	yes
Region-Sector FE	yes	yes	yes	yes	yes	yes

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.13. Micro-Level Phillips Curve: Robustness with Macro Variables Defined at Province**Level**

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)
Sum of Past Inflation	0.11*** (0.01)	0.09*** (0.01)	0.02 (0.04)	0.11*** (0.01)
Sum of Past Inflation × CPI Indexation		0.10*** (0.02)		
Sum of Past Inflation × Sector-Level			0.09*** (0.04)	
Sum of Past Inflation × Annual				0.05 (0.03)
Unemployment Gap	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)
Annual	0.06 (0.05)	0.08* (0.05)	0.07 (0.05)	-0.02 (0.05)
CPI Indexation	0.40*** (0.04)	0.14*** (0.05)	0.40*** (0.04)	0.40*** (0.04)
Sector-Level	0.29* (0.16)	0.28* (0.16)	0.11 (0.17)	0.27 (0.16)
Ln(Affected Workers)	0.15*** (0.02)	0.15*** (0.03)	0.15*** (0.03)	0.15*** (0.02)
Ln(Affected Firms)	-0.12*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)
R^2	0.28	0.29	0.28	0.28
Observations	8,936	8,936	8,936	8,936
Sector FE	yes	yes	yes	yes
Region FE	yes	yes	yes	yes
Region-Sector FE	no	no	no	no

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.14. Micro-Level Phillips Curve: Robustness with Macro Variables Defined at Province Level and Different Combinations of Fixed Effects

(Dependent variable: Wage growth agreed in collective bargaining)

	(1)	(2)	(3)	(4)	(5)	(6)
Sum of Past Inflation	0.09*** (0.01)	0.09*** (0.01)	0.04 (0.04)	0.04 (0.04)	0.10*** (0.01)	0.10*** (0.01)
Sum of Past Inflation × CPI Indexation	0.08*** (0.02)	0.08*** (0.02)				
Sum of Past Inflation × Sector-Level			0.07* (0.04)	0.07* (0.04)		
Sum of Past Inflation × Annual					0.03 (0.03)	0.03 (0.03)
Unemployment Gap	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)	-0.15*** (0.00)
Annual	0.10** (0.05)	0.10** (0.05)	0.09* (0.05)	0.09* (0.05)	0.03 (0.05)	0.03 (0.05)
CPI Indexation	0.28*** (0.05)	0.28*** (0.05)	0.50*** (0.05)	0.50*** (0.05)	0.51*** (0.05)	0.51*** (0.05)
Sector-Level	0.26 (0.21)	0.26 (0.21)	0.13 (0.21)	0.13 (0.21)	0.26 (0.21)	0.26 (0.21)
Ln(Affected Workers)	0.11*** (0.03)	0.11*** (0.03)	0.11*** (0.03)	0.11*** (0.03)	0.11*** (0.03)	0.11*** (0.03)
Ln(Affected Firms)	-0.10*** (0.04)	-0.10*** (0.04)	-0.10*** (0.04)	-0.10*** (0.04)	-0.10*** (0.04)	-0.10*** (0.04)
R^2	0.44	0.44	0.43	0.43	0.43	0.43
Observations	8,636	8,636	8,717	8,717	8,717	8,717
Sector FE	no	yes	no	yes	no	yes
Region FE	no	yes	no	yes	no	yes
Region-Sector FE	yes	yes	yes	yes	yes	yes

Notes: Standard errors in parenthesis. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A.II.15. List of Countries in the Minimum Wage Analysis Sample

Advanced Economies	CESEE
Belgium	Bulgaria
France	Croatia
Germany	Czech Republic
Greece	Estonia
Ireland	Hungary
Luxembourg	Latvia
Malta	Lithuania
Netherlands	Poland
Portugal	Romania
Spain	Slovak Republic
United Kingdom	Slovenia

Table A.II.16. List of Countries in the Public Sector Wage Analysis Sample

Advanced Economies	CESEE
Austria	Bulgaria
Belgium	Croatia
Cyprus	Czech Republic
Finland	Estonia
France	Hungary
Germany	Latvia
Greece	Lithuania
Ireland	Poland
Italy	Romania
Luxembourg	Slovak Republic
Malta	Slovenia
Norway	
Netherlands	
Portugal	
Spain	
Sweden	

Table A.II.17. Local Projections for Minimum Wage: Pre and Post 2015 (Figure 13)

(Dependent variable: Average Wages)

Advanced Economies (AE)				
Horizon (h)	Dln Min Wage (pre-2015)	Dln Min Wage (post-2015)	Ugap (L1)	Labor Prod. (L1)
0	0.106** (0.046)	0.106** (0.040)	-0.003 (0.002)	0.087* (0.047)
1	0.198** (0.076)	0.161** (0.060)	-0.005 (0.004)	0.197*** (0.057)
2	0.142* (0.080)	0.095 (0.064)	-0.006 (0.004)	0.161** (0.074)
3	0.175* (0.090)	0.145 (0.091)	-0.005 (0.005)	0.188 (0.119)
4	0.236** (0.109)	0.142 (0.096)	-0.004 (0.006)	0.277* (0.141)
5	0.225** (0.095)	0.269** (0.117)	-0.002 (0.006)	0.277 (0.197)
6	0.231** (0.100)	0.286* (0.161)	-0.002 (0.007)	0.256 (0.219)
CESEE				
Horizon (h)	Dln Min Wage (pre-2015)	Dln Min Wage (post-2015)	Ugap (L1)	Labor Prod. (L1)
0	0.057** (0.024)	0.145*** (0.031)	-0.003 (0.002)	0.087* (0.047)
1	0.097** (0.039)	0.245*** (0.028)	-0.005 (0.004)	0.197*** (0.057)
2	0.058 (0.058)	0.231*** (0.047)	-0.006 (0.004)	0.161** (0.074)
3	0.026 (0.069)	0.231*** (0.067)	-0.005 (0.005)	0.188 (0.119)
4	0.046 (0.098)	0.280*** (0.054)	-0.004 (0.006)	0.277* (0.141)
5	0.049 (0.127)	0.266*** (0.059)	-0.002 (0.006)	0.277 (0.197)
6	0.014 (0.119)	0.223*** (0.067)	-0.002 (0.007)	0.256 (0.219)

Notes: Coefficients from local projections (Jorda 2005). Standard errors (adjacent columns) clustered at the country level.
 *** p<0.01, ** p<0.05, * p<0.1.

Table A.II.18. Local Projections for Public Sector Wage: (Figure 16)

(Dependent variable: Average Hourly Private Sector Wages)

Horizon (h)	Public Wage Spillover		Controls (L1)	
	Dln Pub Wage (AE)	Dln Pub Wage (CESEE)	Ugap	Labor Prod.
0	0.451*** (0.084)	0.212*** (0.063)	0.001 (0.002)	-0.134*** (0.042)
1	0.474*** (0.115)	0.268*** (0.068)	0.003 (0.002)	-0.053 (0.060)
2	0.497*** (0.141)	0.278*** (0.066)	0.000 (0.005)	0.002 (0.067)
3	0.477*** (0.165)	0.271*** (0.075)	-0.004 (0.004)	0.021 (0.058)
4	0.487*** (0.161)	0.249*** (0.076)	-0.001 (0.005)	-0.030 (0.064)
5	0.418*** (0.149)	0.273*** (0.070)	-0.003 (0.005)	0.000 (0.064)
6	0.446*** (0.134)	0.272*** (0.062)	-0.005 (0.007)	-0.034 (0.063)
7	0.454*** (0.153)	0.297*** (0.057)	-0.003 (0.006)	-0.085 (0.070)
8	0.290** (0.132)	0.280*** (0.054)	-0.003 (0.007)	0.013 (0.073)
9	0.314** (0.130)	0.338*** (0.064)	-0.003 (0.008)	0.018 (0.085)
10	0.374** (0.135)	0.308*** (0.056)	-0.003 (0.008)	-0.037 (0.090)
11	0.375*** (0.134)	0.317*** (0.058)	-0.003 (0.007)	-0.202** (0.098)
12	0.353** (0.144)	0.277*** (0.076)	-0.004 (0.007)	-0.193** (0.085)

Notes: Coefficients from local projections (Jorda 2005). Standard errors (adjacent columns) clustered at the country level.
 *** p<0.01, ** p<0.05, * p<0.1.

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