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Wage and Inflation Dynamics in Denmark

Raju Huidrom

SIP/2023/052

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on June 1, 2023. This paper is also published separately as IMF Country Report No 23/228.

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Wage and Inflation Dynamics in Denmark
Prepared by Raju Huidrom

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Author's E-Mail Address:	RHuidrom@imf.org

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DENMARK

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Prepared by Raju Huidrom support from Fuda Jiang (all EUR).

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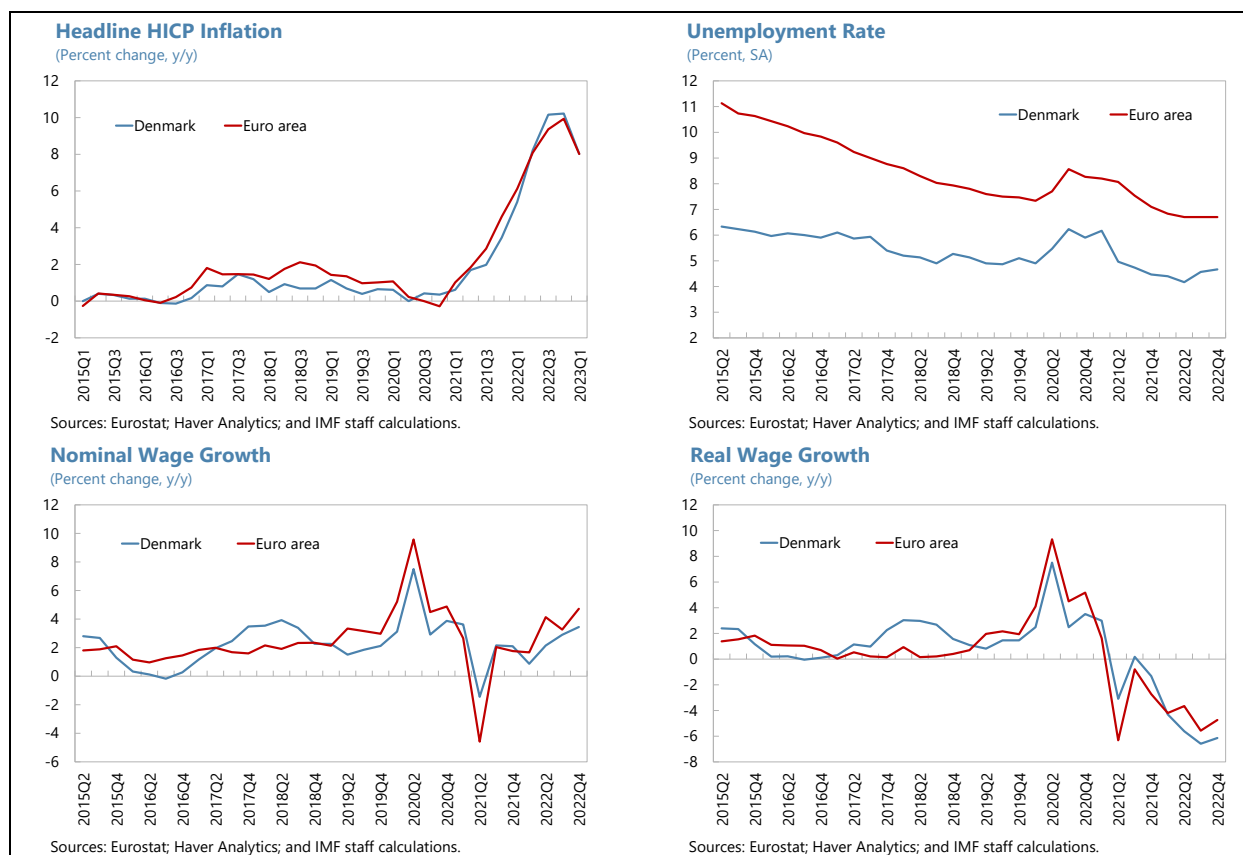
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WAGE AND INFLATION DYNAMICS IN DENMARK¹

Nominal wage growth in Denmark has so far been modest and outpaced by high inflation, putting real wage growth in negative territory. Amid still-tight labor markets, this has raised concerns about wage pressures going forward and the eventual impact on inflation. The analysis suggests that wage formation in Denmark has historically been partly backward-looking, and economic slack also has played a role. Given these, high inflation realized thus far and the tightness in the labor market implies that wage pressures are expected to remain elevated in the near term. Some of these wage pressures, in turn, are expected to be passed on to core inflation, sustaining high inflation. Thus, determined policies to fight inflation are important.

A. Introduction

1. Nominal wage increases in Denmark have been modest despite elevated inflation and still-tight labor markets. As in many countries in Europe, headline inflation in Denmark surged during 2022 mainly due to high energy prices. Given moderating energy prices, headline inflation has eased from a peak of 11½ percent (year-over-year) in October 2022; nonetheless, it remains elevated. Labor markets remain relatively tight with the unemployment rate in the lowest range since the late 2000s. At the same time, nominal wage growth has remained modest, around 3½ percent (year-over-year) in 2022:Q4—well below headline inflation, thus placing real wage growth into negative territory.



¹ Prepared by Raju Huidrom with support from Fuda Jiang (all EUR).

2. This has raised concerns about wage pressures going forward, and the eventual impact on inflation. Wage pressures will likely arise from workers' demands to compensate for the erosion of real incomes sustained thus far. Indeed, recent collective agreements called for wage growth of about 5 percent annually over the next two years, higher than in the past. These wage pressures could feed into inflation, which—along with the still-tight labor market—could make the elevated inflation to persist. In an extreme case, higher wages and inflation could be self-reinforcing, resulting in a wage-price spiral. Thus, understanding the drivers of wage and inflation is imperative since this underpins the appropriate policy response.

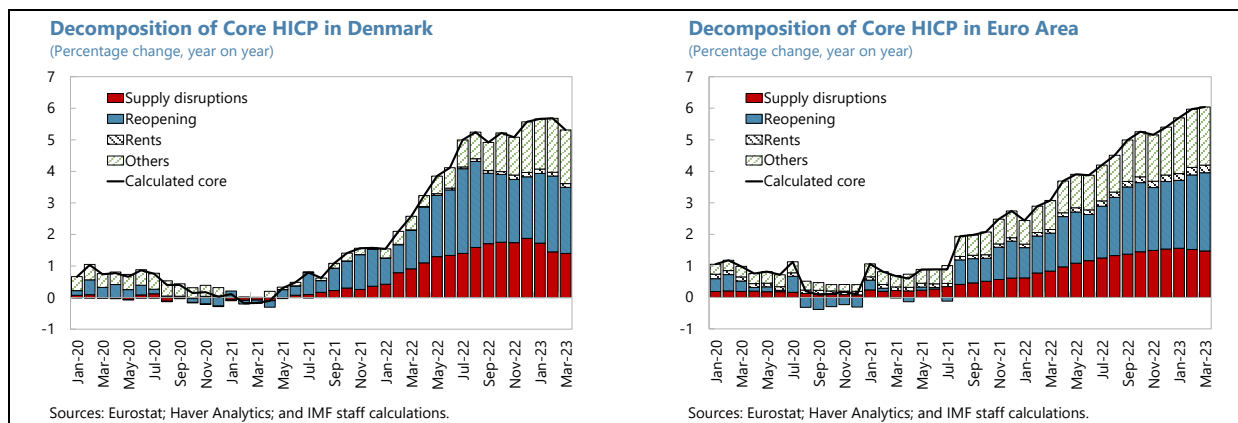
3. This chapter analyzes wage and inflation dynamics in Denmark. The main questions explored are as follows. First, what are the historical drivers of nominal wages in Denmark, and how important are the roles of inflation and economic slack? Second, how would inflation and slack matter for wages in the near term? Third, how would these wage dynamics, in turn, impact inflation? Finally, what are the key policy priorities?

B. Inflation Dynamics: A Deeper Dive

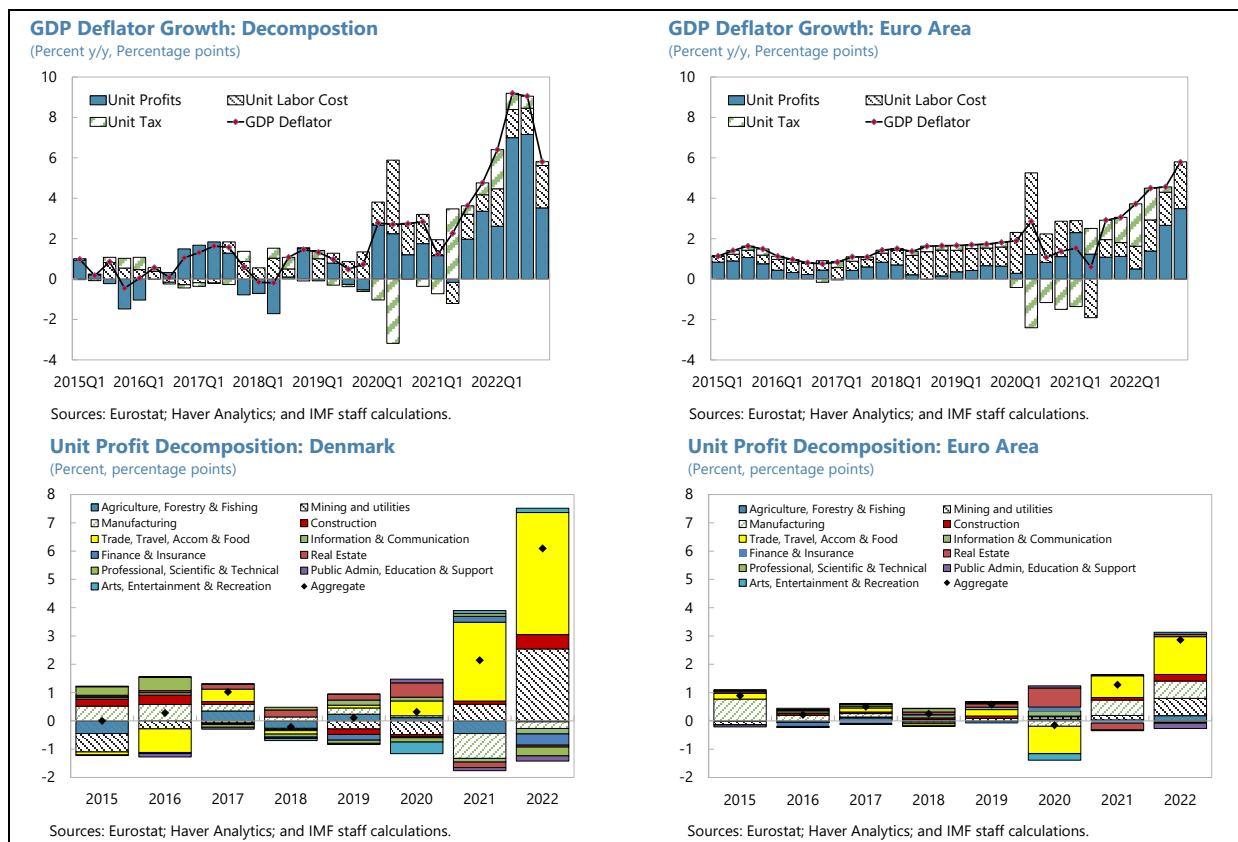
4. To assess the key drivers of inflation, factors contributing to core inflation and the GDP deflator are decomposed. Energy prices are expected to continue moderating, and this should help to reduce headline inflation mechanically. To gauge inflationary pressures in the near term, the more relevant indicator is core inflation. Importantly, the extent to which core inflation is driven by demand and supply factors is crucial in the conjuncture. Another relevant aspect is the role of profit margins and wages for inflation. For this, the analysis looks at inflation from the production side and decomposes the GDP deflator.

5. Pent-up demand contributed to core inflation. Following Gonçalves and Koeste (2022), core inflation is decomposed into a group that is deemed sensitive to post-pandemic reopening—reflecting pent-up demand—and the other that is sensitive to supply chain disruptions. This is a bottom-up approach that categorizes the disaggregated components of core inflation depending on their sensitivities to reopening and supply chain disruptions.² The analysis suggests that supply chain disruptions contributed to core inflation in Denmark, particularly in 2022. Pent-up demand, however, had a more sizable contribution to core inflation. The relative split between the two components in Denmark is broadly similar to that in the euro area. The analysis does not directly account for second-round effects from energy prices; hence, the precise contribution of demand and supply factors is hard to pin down. Nonetheless, it suggests that demand factors were likely at play, consistent with the view that Denmark's strong recovery from the pandemic contributed to high inflation.

² See Annex I.A for details. Rent for housing and the remaining others make up the rest of core inflation.



6. High profit margins contributed to growth in the GDP deflator. Based on a national account identity, GDP deflator is decomposed into unit labor cost (employee compensation), unit profit (gross operating surplus and mixed income), and taxes. In Denmark, as in the euro area, the contribution of unit labor cost was relatively small in 2022, consistent with the fact that wages remained moderate. On the other hand, unit profit in Denmark had a sizable contribution relative to its unit labor cost and also relative to unit profit in the euro area. While unit profit in the aggregate is driven by the energy sector (mining and utilities), a sizable portion is explained by the trade, travel, accommodation, and food sector.³ All in all, these results suggest that the role of profits should be acknowledged for inflation dynamics (Hansen, Toscani, and Zhou, Forthcoming).



³ Based on Eurostat data, sectoral profits are derived as sectoral GVA minus employee compensation.

7. Historical evidence suggests that the contribution from wages to price deflators will likely pick up. The experience of the euro area during the first and second oil price shocks suggests that unit labor cost, while relatively muted initially when hit by energy price shocks, will likely increase subsequently (Hansen, Toscani, and Zhou, Forthcoming). Workers will likely recoup the loss in real incomes sustained thus far, consistent with the fact that recent collective bargaining agreed on wage growth at around 5 percent annually over the next two years, higher than in the past. Thus, wage pressures and how they feed into inflation are key. These issues are discussed in the next section.

C. Empirical Approach

8. Two complementary approaches are deployed. First, a wage Phillips curve model: this investigates how nominal wage dynamics depend on headline inflation, slack, and other determinants. Second, an interacted panel vector autoregressive (IPVAR) model: this is used to assess how wage pressures are passed on to core inflation and how that passthrough depends on inflation expectations and corporate profitability.

Wage Phillips Curve

9. The baseline regression model is:

$$w_t = \beta_0 + \beta_1 w_{t-1} + \beta_2 ugap_{t-1} + \beta_3 \pi_{t-4} + \beta_4 prod_t + \beta_5 ecm_{t-4} + \varepsilon_t,$$

where w denotes nominal wage growth. The unemployment gap ($ugap$) is based on a trend unemployment rate estimated using the Hodrick-Prescott (HP) filter. Headline inflation (π)—which is lagged in the regression—is a proxy for adaptive inflation expectations.⁴ The error-correction term (ecm) is based on an estimated long-term relationship between the level of real wages and productivity (Annex I.B). Levels of real wages and productivity tend to be cointegrated; thus, any deviation of real wages from that long-term relationship should correct over the short term (IMF 2019). Finally, the regression controls for contemporaneous productivity growth ($prod$) and lagged nominal wage growth. The model is estimated using quarterly data for Denmark during 2000–22.⁵

10. The estimated wage Phillips curve is consistent with priors. The slope of the Phillips curve—the estimated coefficient before the unemployment gap—is negative. Lagged inflation correlates positively with nominal wage growth. Though wages are not formally indexed to inflation in Denmark, this suggests that wage formation historically tends to be partly backward looking. The coefficient of the error-correction term is negative—it puts downward pressures on nominal wage growth if real wages are above its estimated long-run relationship with productivity, and upward pressures if they are below. All estimated coefficients are statistically significant. The model is robust to alternative specifications (Annex I.C). Rolling (16-year) regressions suggest the rising importance of slack and (lagged) inflation for wage dynamics in recent periods.

⁴ See Annex I.C for a discussion on forward-looking inflation expectations. Whether economic slack is determined by supply and demand is important. But the wage Phillips curve approach is agnostic on this.

⁵ Details of the variables and data sources are presented in Annex I.C.

Wage Phillips Curve Regression¹

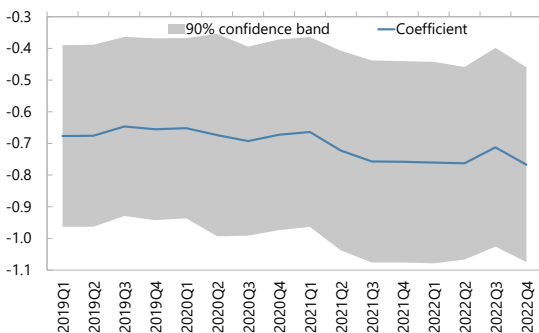
Variables	Nominal wage growth										
	Baseline	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Lagged nominal wage growth	0.191** (0.092)	0.268*** (0.091)	0.198** (0.094)	0.188** (0.091)	0.222** (0.090)	0.264*** (0.093)	0.270*** (0.091)	0.334*** (0.104)	0.270*** (0.090)	0.179* (0.094)	0.154 (0.097)
Unemployment gap	-0.704*** (0.166)	-0.547*** (0.167)	-0.817*** (0.159)	-0.758*** (0.169)	-0.625*** (0.162)	-0.579*** (0.172)	-0.534*** (0.171)	-0.352* (0.201)	-0.583*** (0.165)	-0.738*** (0.174)	-0.735*** (0.181)
Lagged headline inflation	0.538*** (0.146)	0.538*** (0.149)	0.538*** (0.149)	0.555*** (0.145)						0.597*** (0.170)	0.715*** (0.171)
Productivity growth	0.451*** (0.092)	0.405*** (0.090)	0.457*** (0.094)	0.489*** (0.095)	0.421*** (0.087)	0.378*** (0.090)	0.389*** (0.089)	0.329*** (0.116)	0.411*** (0.090)	0.450*** (0.093)	0.510*** (0.093)
Error correction term	-0.117** (0.059)	-0.132** (0.061)		-0.133** (0.059)	-0.123** (0.059)	-0.120* (0.062)	-0.125** (0.061)	-0.195** (0.077)	-0.139** (0.061)	-0.111* (0.060)	-0.130** (0.062)
Inflation expectations		0.275 (0.213)								-0.157 (0.231)	0.285 (0.171)
Germany lagged wage growth				0.15 (0.100)							
Consumer inflation expectations					-0.0248*** (0.009)						
Germany inflation expectations						-0.0375 (0.158)					
Euro area 1-year SPF inflation expectations							0.23 (0.256)				
Euro area 2-year SPF inflation expectations								1.135 (0.802)			
Euro area 5-year SPF inflation expectations									2.403 (1.487)		
Constant	1.067*** (0.322)	1.212** (0.488)	1.009*** (0.327)	0.664 (0.418)	2.073*** (0.316)	1.791*** (0.443)	1.307** (0.540)	-0.447 (1.416)	-2.846 (2.837)	1.286*** (0.457)	0.365 (0.319)
Observations	84	87	84	84	87	87	87	64	87	84	84
R-squared	0.45	0.367	0.422	0.466	0.406	0.354	0.36	0.41	0.374	0.453	...

Source: IMF staff estimates.

1/ Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Model 10 constrains the sum of coefficients on lagged inflation and expected inflation to unity.

Unemployment Gap: Coefficients

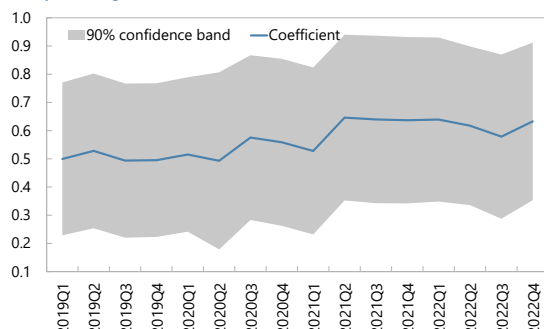
(16-year rolling window)



Source: IMF staff estimates.

Lagged Inflation: Coefficients

(16-year rolling window)

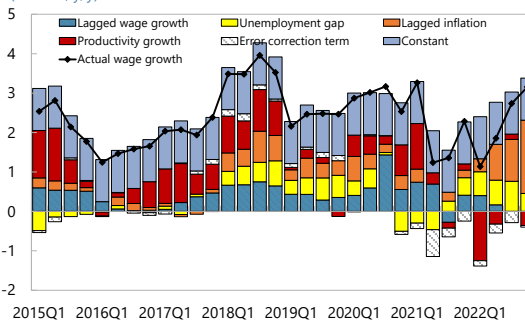


Source: IMF staff estimates.

11. Lagged inflation has strongly underpinned nominal wage dynamics in recent periods, and there is a role for slack. Lagged inflation explained as much as half of the nominal wage growth during 2022. Tightness in the labor market also contributed to wage increases. In 2022, real wage deviated negatively from the estimated long-run relationship, but given that the error correction term enters the regression with a lag, this would feed into wage increases in the future. Productivity growth mostly asserted a downward wage pressure in 2022.

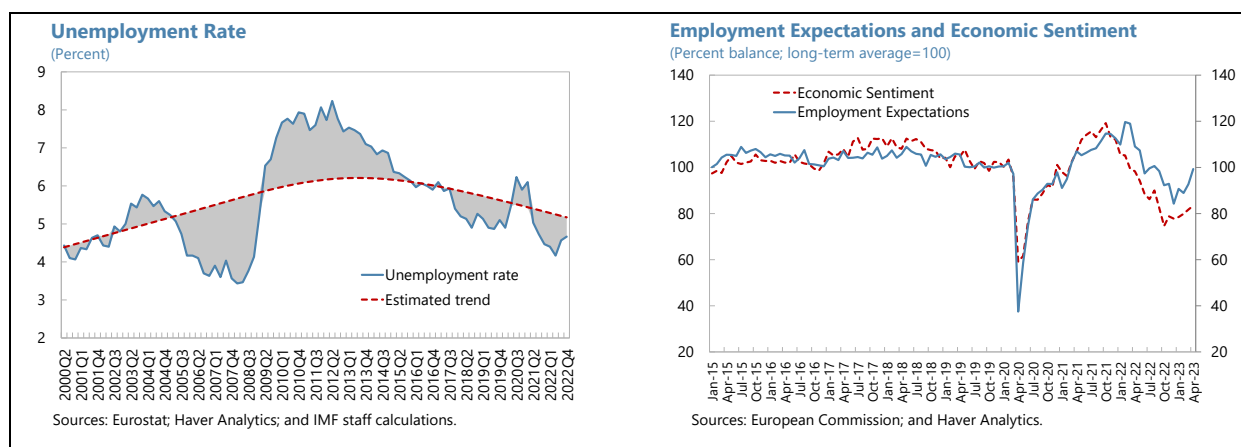
Nominal Wage Growth

(Percent, y/y)



Sources: Haver Analytics; and IMF staff estimates.

12. Given the high inflation realized thus far and still-tight labor markets, wage pressures are expected to remain elevated in the near term. As wage formation is partly backward looking, high (headline) inflation that is already realized would assert wage pressures in the near term. This would be reinforced by the fact that the labor market remains tight, as indicated by the negative unemployment gap. More forward-looking indicators confirm this. For instance, the survey of employment expectations is turning around after dipping during 2022:Q4 suggesting a pick-up in labor demand; other indicators, such as the job vacancy rate and labor shortages, paint a similar picture (see Staff Report Recent Developments). The outcome of recent collective bargaining—about 5 percent growth annually during 2023–24—is broadly in line with the wage formation process that the wage Philips curve model suggests.



Wage Passthrough to Core Inflation

13. The degree of wage passthrough to inflation can be affected by (i) how anchored inflation expectations are; and (ii) how profitable corporates are. Theory suggests that better-anchored inflation expectations can limit wage passthrough as firms may be reluctant to raise their prices even when faced with higher wage costs as they expect increases in costs to be only temporary (Taylor 2000). Regarding corporate profitability, firms are likely to absorb wage costs (conditional on demand) when corporate profitability is more robust. In the conjuncture, the extent to which inflation expectations are anchored and corporate profitability robust would determine wage passthrough to core inflation.

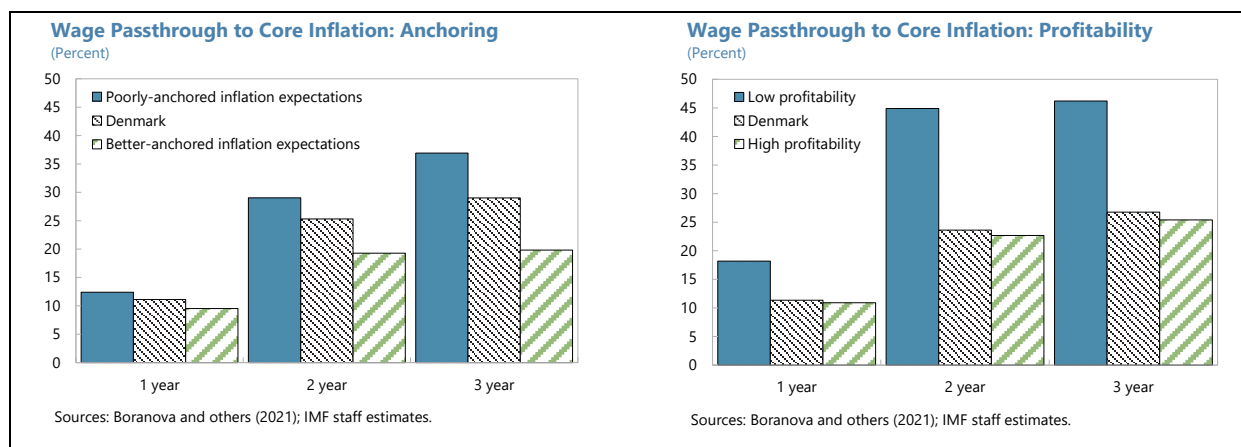
14. An IPVAR model is deployed to analyze the role of inflation expectations and corporate profitability for wage passthrough. The model is:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ \alpha_{0,it}^{21} & 1 & 0 & 0 \\ \alpha_{0,it}^{31} & \alpha_{0,it}^{32} & 1 & 0 \\ \alpha_{0,it}^{41} & \alpha_{0,it}^{42} & \alpha_{0,it}^{43} & 1 \end{bmatrix} \begin{bmatrix} \pi_{it}^m \\ w_{it} \\ \pi_{it} \\ u_{it} \end{bmatrix} = \sum_{l=1}^L \begin{bmatrix} \alpha_{l,it}^{11} & \alpha_{l,it}^{12} & \dots & \alpha_{l,it}^{14} \\ \alpha_{l,it}^{21} & \alpha_{l,it}^{22} & \dots & \alpha_{l,it}^{24} \\ \alpha_{l,it}^{31} & \vdots & \ddots & \alpha_{l,it}^{34} \\ \alpha_{l,it}^{41} & \alpha_{l,it}^{42} & \dots & \alpha_{l,it}^{44} \end{bmatrix} \begin{bmatrix} \pi_{it-l}^m \\ w_{it-l} \\ \pi_{it-l} \\ u_{it-l} \end{bmatrix} + X_i + U_{it}, \text{ where}$$

$$\alpha_{l,it}^{jk} = \beta_{1,l}^{jk} + \beta_{2,l}^{jk} factor_{it}$$

For a given country i in period t , π^m represents import price inflation, w nominal wage growth adjusted for trend productivity, π core consumer price inflation, and u the unemployment gap. The IPVAR model is essentially a panel VAR but with model coefficients evolving deterministically according to an “observed” factor (conditioning variable). Thus, model dynamics are conditional on the chosen factor. In our analysis, the anchoring of inflation expectations and corporate profitability are used one at a time as the conditioning factor to generate conditional wage passthrough estimates.⁶ The model is estimated for a panel of 27 European countries, covering both advanced and emerging (to exploit cross-sectional and time series variation in the factors) using quarterly data before the pandemic (up to 2019:Q1). The main goal is to present some general results and deduce some inference for Denmark. A detailed discussion of the model—including identification and variable definitions—is in Boranova and others (2021).

15. The analysis suggests that wage passthrough to core inflation is smaller when inflation expectations are better anchored and when corporate profitability is higher. The immediate impact of a wage shock on core inflation is relatively small but increases over time. The passthrough ratio—the ratio of the cumulative response of core inflation due to a wage shock over the cumulative response of wage to its own shock—is much larger at the end of the third year than at the end of the first year. Importantly, the passthrough is smaller when expectations are better anchored: less than 20 percent of wage growth would be passed on to core inflation (at the end of the third year) when expectations are better anchored, but that ratio can reach close to 50 percent when expectations are poorly anchored. Similarly, wage passthrough is smaller when corporate profitability is more robust. Indicative wage passthrough ratio for Denmark—based on the latest available anchoring and corporate profitability—is in the range of 25–30 percent (at the end of the third year).



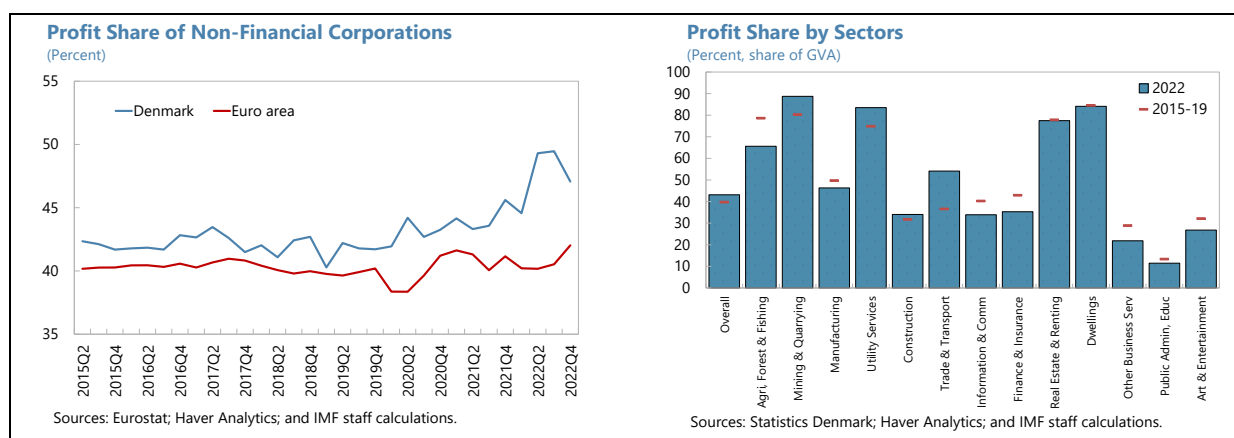
⁶ Anchoring of inflation expectations is based on Bems and others (2021) and measures the deviation of Consensus inflation forecasts from the inflation target—less deviation implies better anchoring. Corporate profitability is defined as the gross operating surplus and mixed income of nonfinancial corporations as a share of their GVA.

16. Near-term inflation expectations remain elevated, albeit a slight decline most recently.

Inflation expectations for Denmark over the next 12 months (derived from Consensus Forecasts) remain elevated at around 4½ percent. It has, however, edged down most recently—the direction is also consistent with surveys of consumer expectations of inflation. Beyond the near term, inflation expectations in the euro area—key for gauging Denmark’s inflation outlook under its fixed exchange rate regime against the euro—remain well anchored: for instance, the 5-year expectations from the Survey of Professional Forecasters—around 2¼ percent—are close to the 2 percent target. Taken together, these suggest that high inflation would persist in the near term, even though expectations remain anchored for now.



17. Corporate profitability remains relatively high. Aggregate corporate profitability in Denmark remains high relative to the euro area. The increase in corporate profitability during 2022 was driven by the energy and transport sectors. Analysis by the Danmarks Nationalbank suggests that without these sectors, aggregate profitability in 2022 (around 46 percent) would be below the pre-pandemic level. Nonetheless, it would still be higher than that in the euro area (around 42 percent). Thus, corporate profitability in Denmark remains broadly robust. This should help allow firms to absorb some of the expected wage pressures, thus attenuating the passthrough to inflation. Beyond the aggregate picture, though, there could be more variation in profit margins at the firm level. For firms with thin profit margins, the passthrough from wages could be higher. Wage discipline in these firms is, therefore, important for keeping a lid on inflation.



D. Conclusions and Policies

18. Wage pressures are expected to remain elevated in the near term, sustaining high inflation. Even though wages are not formally indexed to inflation in Denmark, the empirical analysis suggests that wage formation has historically been partly backward looking. Economic

slack—i.e., labor market tightness—also has played a role; thus, the wage Phillips curve is alive. Given this historical account of wage dynamics, high (headline) inflation realized thus far and still-tight labor markets imply that wage pressures are expected to remain high in the near term. Some of these wage pressures, in turn, are expected to be passed on to core inflation, thus making inflation persistent. The passthrough would be larger if inflation expectations become deanchored.

19. Thus, determined policies to fight inflation are important. These will also have a direct impact on the slack. Importantly, near-term fiscal policy should therefore support disinflation.

Annex I. Technical Details

A. Decomposition of Core Inflation

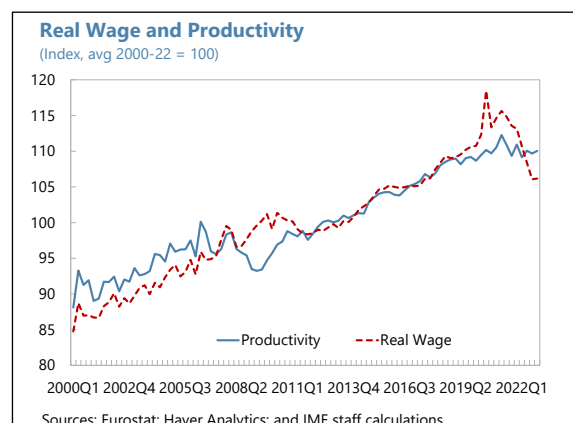
1. Following Gonçalves and Koeste (2022), the components of HICP core inflation at the 2-digit level are categorized into four groups: (i) sensitive to supply chain disruptions; (ii) sensitive to re-opening, reflecting pent-up demand; (iii) rent; and (iv) and the remaining. The components in each category are then aggregated using the corresponding HICP weights.

Categorization of Core Inflation Components			
Category	HICP Details	Category	HICP Details
Reopening	Clothing Footwear Transport services Recreational & cultural services Package holidays Catering services Accommodation services	Others	Maintenance & repair of the dwelling Water supply & miscellaneous services relating to the dwelling Medical products, appliances & equipment Out-patient services Hospital services Other services in respect of personal transport equipment Postal services Telephone & telefax equip. & telephone & telefax services Audio-visual, photographic & information processing equip. Other major durables for recreation & culture Other recreational items & equipment, gardens & pets Newspapers, books & stationery Education Personal care Personal effects n.e.c. Social protection Insurance Financial services n.e.c. Other services n.e.c.
Supply Chain Disruptions	Furniture & furnishings, carpets & other floor coverings Household textiles Household appliances Glassware, tableware & household utensils Tools & equipment for house & garden Goods & services for routine household maintenance Purchase of vehicles Spare parts & accessories for personal transport equipment Maintenance & repair of personal transport equipment		
Rent	Rent for housing		

Source: Gonçalves and Koeste (2022); and IMF staff.

B. Long-Run Regression

2. The log-level of real wage is regressed on the log-level of real productivity. To derive real wage, the nominal wage level is deflated using headline HICP, which is then converted into an index by setting the long-term average (2000–22) as 100. The index of real productivity level is defined similarly. The estimated coefficient for real productivity is close to unity—consistent with the view that in the long run, real productivity determines real wages—and statistically significant.



Long-Run Wage Regression ¹	
Variables	Real wage level (log)
Productivity level (log)	1.173*** (0.043)
Constant	-0.799*** (0.197)
Observations	92
R-squared	0.893

Source: IMF staff estimates.
1/ Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

C. Wage Phillips Curve: Database and Robustness

3. Database. Nominal wage is defined as gross wages and salary per hour. Productivity is similarly defined as gross value added per hour. Headline inflation is based on the harmonized HICP index. Nominal wage, productivity, and headline inflation are transformed as year-on-year growth rates of the corresponding levels/indices. The unemployment gap is the deviation of the actual unemployment rate from a trend unemployment rate estimated using the Hodrick-Prescott (HP) filter. These variables are sourced from Eurostat (for cross-country consistency) via Haver Analytics. Inflation expectations in the next 12 months are derived from Consensus Forecasts using a weighted average of current and one-year ahead inflation forecasts, following Buono and Formai (2018). Consumer expectations of inflation for Denmark are from the OECD and SPF (Survey of Professional Forecasters) inflation expectations for the euro area are from the European Central Bank.

4. Robustness. The main results are robust to alternative specifications of the regression model (Table in para 10). In addition to lagged inflation, which is a proxy for adaptive expectations, forward-looking inflation expectations in the near term are included in the regression. The estimates are either statistically insignificant or have the “incorrect” sign, plausibly reflecting identification issues since near-term inflation expectations tend to correlate with lagged inflation. In addition to inflation expectations for Denmark, inflation expectations for Germany and for the euro area (both near and medium terms) are also considered; but they turn out to be statistically insignificant. Separately, including German wages produces a positive and statistically significant coefficient, indicating that wage dynamics in Germany matter for wages in Denmark.

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