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The inflation loop is not a myth

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Abstract

This paper is part of the current debate around the wage-price spiral as inflation surges rapidly, and it assesses empirically whether the prevalence of wage indexation arrangements and the balance of bargaining power between workers and firms can explain cross-country differences in the dynamics of the inflation spiral. To this end, we estimate an IPVAR model on a sample of 37 OECD and non-OECD economies over the period 1960Q1-2019Q4. The results indicate that wage indexation, trade union density, wage bargaining coverage and a high degree of coordination in the wage-setting process exacerbate the persistence of inflation following an initial price shock. Our findings then suggest that central banks should take the institutional features of the labour market and wage bargaining into consideration in the conduct of their monetary policy.

JEL Codes: E24, E31, J51, J52.

Keywords: Inflation loop, Wage bargaining, Wage indexation, Union density, Interacted Panel VAR.

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1 Introduction and motivation

The recent sharp rise in inflation has put an end to three decades of price stability and is challenging central banks around the world in their conduct of monetary policy. The current global surge in inflation has largely been driven by three key factors, which are the strong recovery from the Covid-19 pandemic, the disruptions to global supply chains, and the fast rise in energy and commodity prices.

These shocks are by their nature temporary and should not cause inflation to remain persistently high. However, the fear of central bankers is that this temporary inflation shock could generate significant upward pressure on wages that increases the risk of a wage-price spiral emerging, where wage growth and inflation both rise over an extended period of time. The European Central Bank (ECB) expects that upcoming wage negotiation rounds mean that wage growth will be much stronger over the next few quarters than its historical patterns (Bodnár et al., 2022).

A wage-price loop has two phases. Following an initial price shock, workers negotiate pay rises to preserve their living standards, which then leads firms to adjust their selling prices to cover those higher wages; this in turn can generate higher and more persistent inflation. In other words, an inflation shock can trigger mutually reinforcing feedback effects between wages and prices, so amplifying the effects of an initial shock to inflation. This mechanism refers to the so-called second round effects and the Great Inflation of the 1970s in most advanced economies is the archetypal case of such an inflation loop. The recent surge in inflation has put the spotlight back on the danger of the inflation loop, and it is currently at the heart of the debate among academics and practitioners. However, recent empirical studies provide mixed results for this issue and do not give any clear answers (Alvarez et al., 2022, Baba and Lee, 2022).

The intensity of the pass-through from a price shock to wages obviously depends on several factors. Among these factors are inflation expectations, the pricing power of firms, and, more importantly, the prevalence of wage indexation arrangements and the balance of bargaining power between workers and firms (BIS, 2022). High rates of trade union membership or collective bargaining coverage will tend to strengthen the bargaining power of workers, which is likely to influence whether an initial shock to inflation turns into a wage-price spiral. However, most of the existing empirical literature focuses on the link between the characteristics of collective bargaining and the level of inflation (Bowdlert and Nunziata, 2007, Jaumotte and Morsy, 2012), but does not assess whether wage bargaining is a significant determinant of the dynamics of the inflation spiral.

Against this background, our paper tries to fill this gap in the literature by formally assessing for a large sample of OECD and non-OECD economies whether different aspects of collective wage bargaining can explain cross-country differences in the magnitude of the inflation loop. To avoid confusion, the evidence of an inflation loop is captured here as the intensity and the dynamics of the response of prices to an inflation shock. The model that we estimate is the interacted panel VAR (IPVAR) model originally developed by Towbin and Weber (2013), which is an empirical framework that has attracted growing interest in the academic literature over the

past decade. Such a multivariate framework is suitable in our case as it augments the traditional panel VAR model with an interactive term to assess whether the intensity of the response of prices to an inflation shock is conditional on the prevalence of wage indexation arrangements and on the balance of bargaining power between workers and firms.

Our results confirm that the institutional features of wage bargaining are an important driver of the intensity of the inflation loop. We find specifically that the prevalence of wage indexation arrangements, higher trade union density, and wider wage bargaining coverage exacerbate the inflation loop. Furthermore, we also find evidence that the degree of coordination in the wage-setting process plays a key role in shaping the response of prices to an initial inflation shock. Our findings then suggest that the characteristics of the labour market and of wage bargaining cannot be ignored by central banks in their conduct of monetary policy.

The reminder of the paper is organised as follows. Section 2 describes the data and the econometric framework, Section 3 presents and discusses the empirical results, and Section 4 provides some concluding remarks.

2 Data and econometric methodology

To assess whether the response of prices to an initial inflation shock depends on the prevalence of wage indexation arrangements and on the balance of bargaining power between workers and firms, we consider a multivariate framework using the interacted panel VAR (IPVAR) model recently developed by Towbin and Weber (2013). The IPVAR model that we consider is parsimonious and comprises four quarterly macroeconomic variables, which are the consumer price index (CPI), real gross domestic product (GDP), the real outstanding amount of bank credit ($credit$), and the policy interest rate (pr). The credit series is taken from the Bank for International Settlements (BIS), while for reasons of data availability, the other macroeconomic series are taken from the BIS, the Organisation for Economic Co-operation and Development (OECD), and Refinitiv Eikon. All the series except for the policy rate are first seasonally adjusted using the X-12-ARIMA US Census Bureau seasonal adjustment methodology.

Since we aim to assess whether a temporary shock to inflation drives price dynamics, we remove the trend and isolate the cyclical component of the CPI by considering the percentage gap between the observed values and the trend values. The GDP and credit series are also detrended to ensure that the variables are stationary. The trend is found using the recent regression filter proposed by Hamilton (2018). The Hamilton filter addresses the main drawbacks of the widely used HP filter (Hodrick and Prescott, 1997), especially the end-of-sample bias and the phenomenon of spurious cycles.

Formally, the structural form of the IPVAR that we estimate is given by:

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ \alpha_{0,i,t}^{21} & 1 & 0 & 0 \\ \alpha_{0,i,t}^{31} & \alpha_{0,i,t}^{32} & 1 & 0 \\ \alpha_{0,i,t}^{41} & \alpha_{0,i,t}^{42} & \alpha_{0,i,t}^{43} & 1 \end{pmatrix} \begin{pmatrix} CPI_{i,t} \\ GDP_{i,t} \\ credit_{i,t} \\ pr_{i,t} \end{pmatrix} = \mu_i + \sum_{l=1}^{L} \begin{pmatrix} \alpha_{l,i,t}^{11} & \alpha_{l,i,t}^{12} & \alpha_{l,i,t}^{13} & \alpha_{l,i,t}^{14} \\ \alpha_{l,i,t}^{21} & \alpha_{l,i,t}^{22} & \alpha_{l,i,t}^{23} & \alpha_{l,i,t}^{24} \\ \alpha_{l,i,t}^{31} & \alpha_{l,i,t}^{32} & \alpha_{l,i,t}^{33} & \alpha_{l,i,t}^{34} \\ \alpha_{l,i,t}^{41} & \alpha_{l,i,t}^{42} & \alpha_{l,i,t}^{43} & \alpha_{l,i,t}^{44} \end{pmatrix} \begin{pmatrix} CPI_{i,t-l} \\ GDP_{i,t-l} \\ credit_{i,t-l} \\ pr_{i,t-l} \end{pmatrix} + \varepsilon_{i,t} \tag{1}$$

with

$$\alpha_{l,i,t} = \beta_l + \eta_l \, Z_{i,t-1} \tag{2}$$

$CPI_{i,t}$, $GDP_{i,t}$, $credit_{i,t}$ and $pr_{i,t}$ correspond to the inflation gap, the output gap, the credit gap and the policy rate respectively. The sub-index i stands for countries, while the sub-index t indicates quarters. L is the number of lags. Based on the Akaike information criterion, we consider two lags. μ_i is a set of country fixed effects that captures time-invariant cross-country heterogeneity. Finally, $\varepsilon_{i,t}$ is a vector of uncorrelated *iid* shocks.

Of particular importance is $Z_{i,t-1}$, which is an exogenous variable that captures various institutional characteristics of the wage-setting framework. Unlike in a traditional panel VAR model, the response coefficients are functions of $Z_{i,t-1}$, and this allows us to assess whether the orthogonalised impulse response function of prices to a shock to inflation varies according to these characteristics and their relative evolutions. This makes a framework of this type suitable in our case for evaluating formally whether cross-country heterogeneity in the intensity of the inflation loop can be explained by the institutional features of wage bargaining.

The OECD/AIAS database on the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) provides comprehensive and comparable information on the evolving nature and scope of collective bargaining for a large sample of OECD and non-OECD economies. In this paper, we focus more particularly on the nature and extent of wage indexation and wage bargaining. We consider three categories of variables that measure: *(i)* the existence of general price indexation or cost-of-living clauses in agreements; *(ii)* the union or bargaining coverage rate; and *(iii)* the characteristics of wage-setting and the existence of extension procedures. More details about the variables used are provided in the next section.

3 Empirical results

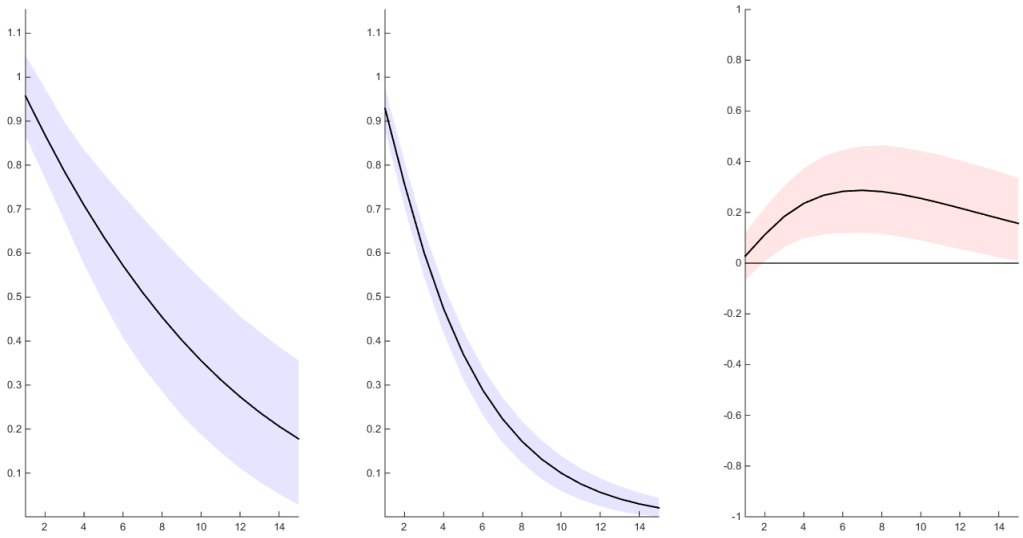
The data that we consider cover a sample of 37 OECD and non-OECD countries over the period 1960Q1-2019Q4. The composition of the sample is driven by the availability of the bank credit and collective bargaining series. The sample of countries and the time span depend on the interactive variable considered. The list of countries is detailed in the Appendix.

3.1 Wage indexation

We start our empirical investigation by assessing whether a statutory wage indexation system is associated with an inflation shock having a stronger second-round effect. Intuitively, formal indexation means that wages are adjusted automatically and quickly following a rise in the price level, which then leads to a cost-push shock and to higher average selling prices.

Historical experience shows that wage indexation was an important issue in the 1970s following the first oil crisis, since it was a powerful force in the price-wage loop in the industrialised economies. During this period, the wage-price spiral was more likely to emerge as firms were not able to absorb all of the increase in their costs without passing it on in their selling prices. Wages and prices chasing each other then fuelled a decade of double-digit inflation. This explains why some governments chose to reform their wage indexation system in the early 1980s. Hofmann et al. (2012) show for the United States that the decline in wage indexation has implied a significant reduction in the long-run impact of supply and demand shocks on prices.

Figure 1: Impulse response function of prices to an inflation shock: wage indexation



Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation by distinguishing between the existence (chart on the left) or otherwise (chart in the centre) of a formal wage indexation system. The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

Wage indexation in our case is captured by a binary variable that is equal to 1 if most or many collective agreements contain automatic or semi-automatic index or cost-of-living escalator clauses, and 0 if the use of index clauses is rare or forbidden in a given country. The results are reported in Figure 1, in which the impulse response functions (IRFs) represent the dynamic response of prices to a shock of one percentage point to inflation. The chart on the left displays the IRF when the interactive variable, namely the wage indexation dummy, is equal to 1, while the chart in the centre shows the IRF when the dummy is equal to 0. In both cases the solid line corresponds to the average impulse response, and the coloured band is the 95% confidence

interval computed by a bootstrap with 1,000 draws. The chart on the right is our graph of interest. It represents the difference between the two IRFs, and then allows us to assess formally whether the interactive variable considered in the IPVAR model is a significant driver of the inflation loop.

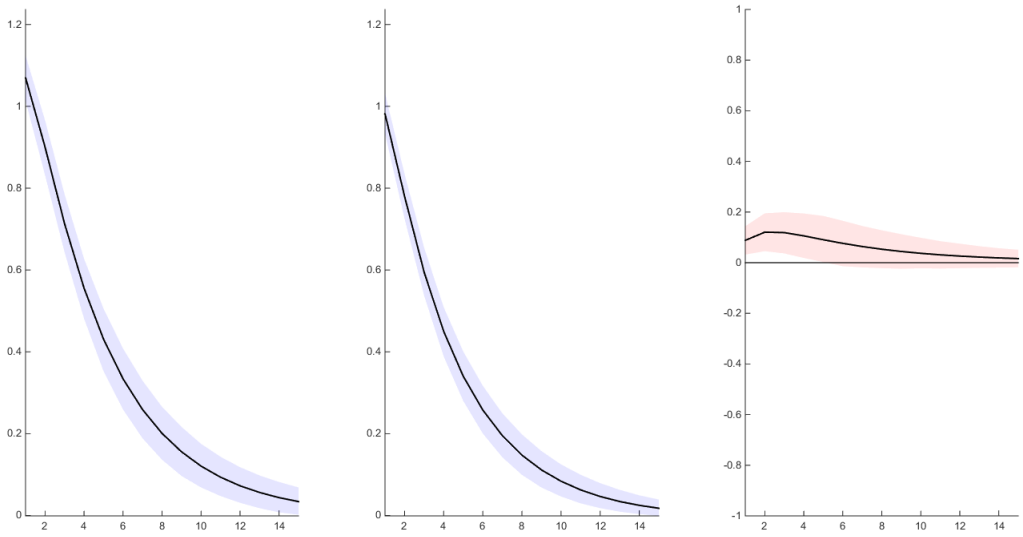
As expected, the interval bounds on the right-side chart are both above the zero line. This is in line with the arguments presented above and confirms that the response of prices to an initial inflation shock is stronger in countries that have a formal wage indexation system.

Although our findings support the argument that formal wage indexation exacerbates the inflation loop, it is clear that nominal wages can catch up with prices without any need for explicit indexation, and this depends above all on the wage bargaining power of workers. This issue is addressed below.

3.2 Trade union density and wage bargaining coverage

The wage bargaining power of workers is usually proxied in the empirical literature by trade union density. If a large share of workers within a country are members of a trade union, they can have a significant bargaining power in pushing up wages. This explains why a number of studies find a positive relationship between trade union density and the level and persistence of inflation (see, for instance, Bowdlert and Nunziata, 2007, Jaumotte and Morsy, 2012).

Figure 2: Impulse response function of prices to an inflation shock: union density



Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation evaluated at the 80^{th} percentile (chart on the left) and at the 20^{th} percentile (chart in the centre) of the sample distribution of the union density variable. The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

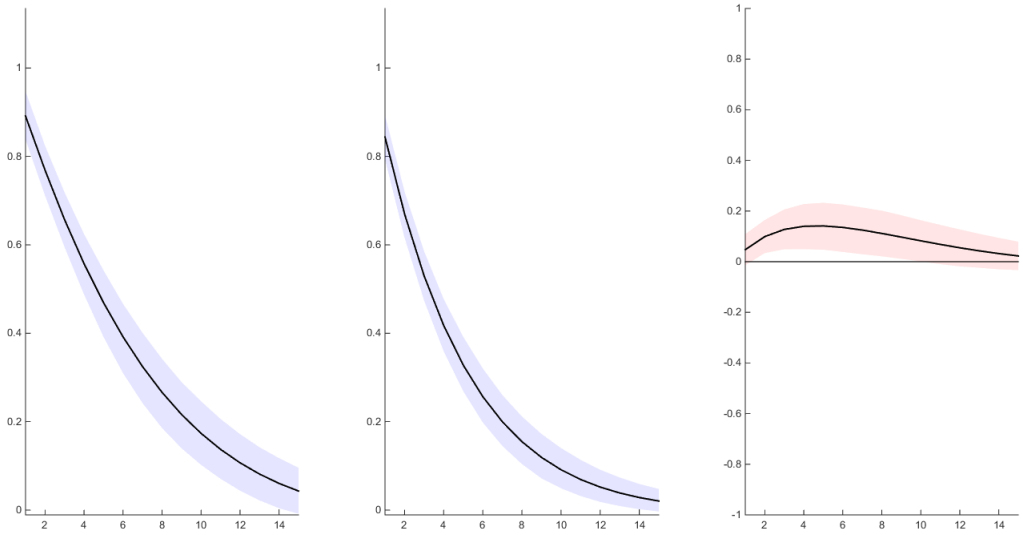
It might consequently be expected that the intensity of the response of prices to a shock to inflation will depend on trade union density, and that this could explain cross-country heterogeneity in the price dynamics following such a shock. Trade union density is defined as the

proportion of employees who are members of a trade union among all employees in a given country.

The results of the IPVAR model that considers trade union density as an interactive variable are displayed in Figure 2. To assess whether the orthogonalised responses of prices to an inflation shock are statistically different at different levels of union density, we focus on the 80^{th} percentile and the 20^{th} percentile of the variable, as these reflect a high level of wage bargaining power for the unions and a low level, respectively. The chart on the left displays the IRF obtained when we set the interactive variable at the 80^{th} percentile of its sample distribution, while the chart in the centre shows the IRF evaluated at the 20^{th} percentile of the variable. As above, the chart on the right reports the two IRFs with a 95% confidence interval. It shows a positive and statistically significant difference between the two IRFs. This suggests that price shocks are more likely to be reflected in wage rises when union density is high, which in turn leads to higher and more persistent inflation.

The trade union density gives a first picture of the wage bargaining power of workers, but another important aspect of collective wage bargaining is the coverage rate of agreements and negotiations. It refers to the percentage of workers in an economy whose terms and conditions of employment are determined by collective bargaining, whether or not the worker is a member of a union. More precisely, in our case it is defined as the number of employees covered by collective (wage) agreements as a percentage share of all the wage and salary earners in employment who have the right to bargain. This rate is adjusted to account for some sectors or occupations being covered by a statutory regulation that excludes them from the right to bargain.

Figure 3: Impulse response function of prices to an inflation shock: coverage rate



Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation evaluated at the 80^{th} percentile (chart on the left) and at the 20^{th} percentile (chart in the centre) of the sample distribution of the coverage rate variable. The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

By capturing the extent to which collective bargaining is inclusive, the coverage rate gives

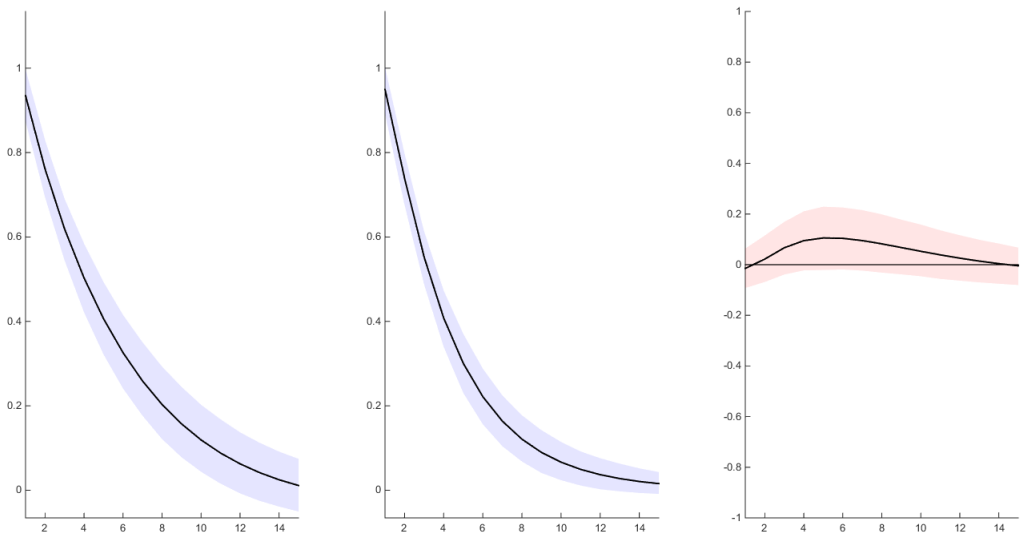
an overview of the magnitude of wage rises expected within an economy following a price shock. We can consequently expect that in countries with a high bargaining coverage rate, the response of average wage changes will be larger after an inflation shock, amplifying the cost-push shock and so increasing the risk of inflation becoming persistent.

The results displayed in Figure 3 confirm this intuition. The intensity of the response of inflation to an initial inflation shock appears to be higher for the IRF evaluated at the 80^{th} percentile of the coverage rate than for the IRF evaluated at the 20^{th} percentile. The difference between the two IRFs is statistically significant at the conventional level.

3.3 Characteristics of wage bargaining

One other important institutional feature of wage bargaining that could drive inflation is the level at which bargaining takes place, meaning how centralised the bargaining is, and also how coordinated it is.

Figure 4: Impulse response function of prices to an inflation shock: degree of centralisation



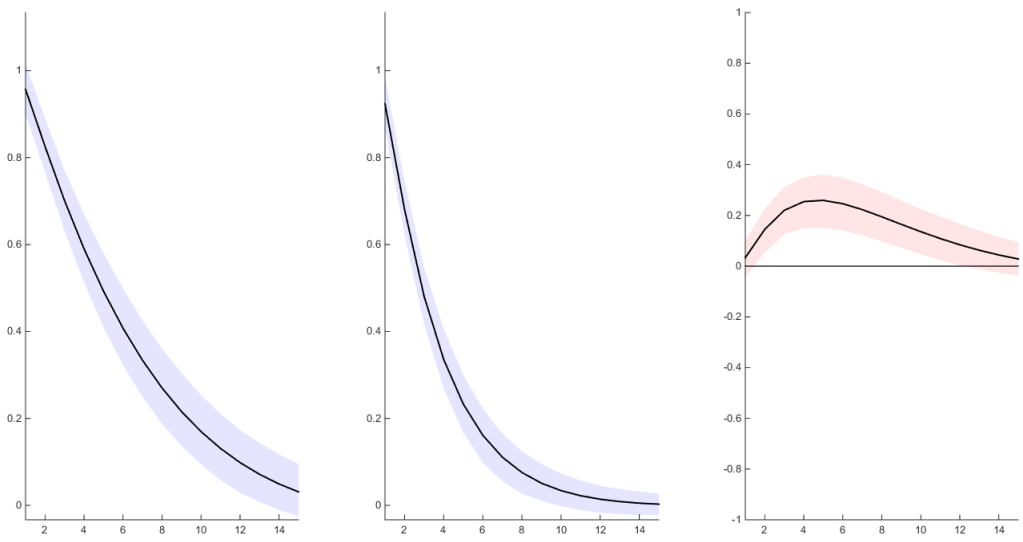
Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation by distinguishing between a high degree of wage bargaining centralisation (chart on the left) and a low degree of wage bargaining centralisation (chart in the centre). The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

The decentralisation of bargaining structures has been the main trend in labour markets and industrial relations in many countries since the 1980s (Visser, 2016). This trend has resulted in the bargaining power of workers and unions becoming weaker relative to that of employers, resulting in reduced wage dynamics. Wage growth can then be expected to be sluggish in response to an inflation shock in countries that have a lower degree of centralisation, reducing the risk of a wage-price loop emerging. How centralised wage bargaining is can be measured through an ordered categorical variable that ranges from 1 to 5, where a higher value corresponds to a higher degree of centralisation. In our case, we compare the IRF obtained when wage bargaining

takes place centrally or at the industry level (modalities 4 and 5) to the IRF obtained when bargaining predominantly takes place at the firm level (modality 1).

Figure 4 displays the two IRFs and the difference between them. As expected the difference is positive but not statistically significant at 5%.[1] There can be two explanations for this result. The first is that the link between centralisation and inflation performance might be non-linear and characterised by an inverse U-shaped relationship. As shown by Cukierman and Lippi (1999), a high degree of centralisation does not necessarily mean that there is a larger real wage premium and higher inflation. Calmfors and Driffill (1988) argue that trade unions are less likely to be militant when there is a higher degree of centralisation as they are more aware of how their actions will affect inflation. The second explanation is that it is widely accepted in the literature that one important factor that drives wage developments is bargaining coordination rather than bargaining centralisation. Indeed, centralisation refers to the "vertical ordering" of wage bargaining, while coordination aims to capture the "horizontal" relations between distinct bargaining units or actors (Soskice, 1990). In other words, bargaining coordination measures more precisely how synchronised the wage claims of different bargaining units are and how stringent the collective wage agreements are. Coordination can be viewed as the general attitude of consensus between trade unions and employers' associations in wage negotiations, and so a high level of coordination could be expected to result in higher wage and price increases.

Figure 5: Impulse response function of prices to an inflation shock: degree of coordination



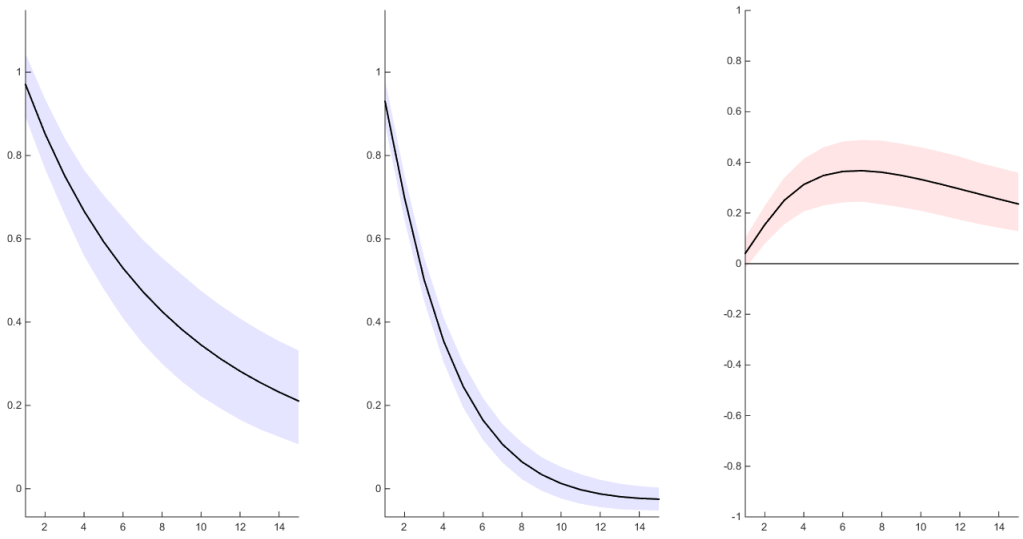
Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation by distinguishing between a coordinated wage bargaining framework (chart on the left) and a fragmented and uncoordinated framework (chart in the centre). The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

The variable that we consider is a *de facto* measure of wage bargaining coordination (Bowdlert and Nunziata, 2007). It measures how effective the coordination is by considering the behaviour

[1] We obtain similar results when we consider two alternative variables measuring the degree of wage bargaining centralisation provided by the OECD/AIAS database on the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts. The results are available upon request.

of the bargainers and the stringency of the outcome of the bargaining process. The variable is an ordered categorical variable that ranges from 1 to 5, where 1 corresponds to fragmented wage bargaining with no coordination, and 5 to a centralised bargaining framework that has a high level of coordination and where the decision-making process leads to binding norms being adopted. In our case, we compare the IRF obtained when the wage bargaining framework is coordinated (modalities 4 and 5) to the IRF obtained when this framework is fragmented and not coordinated (modality 1). The two IRFs and the difference between them are reported in Figure 5. The difference appears positive and statistically significant, which confirms that a high level of wage bargaining coordination exacerbates the response of prices to an initial inflation shock.

Figure 6: Impulse response function of prices to an inflation shock: sectoral agreements binding



Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation by distinguishing between the case where sectoral agreements define the minimum and actual levels of wages (chart on the left) and one where sectoral agreements only set the framework for enterprise bargaining (chart in the centre). The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

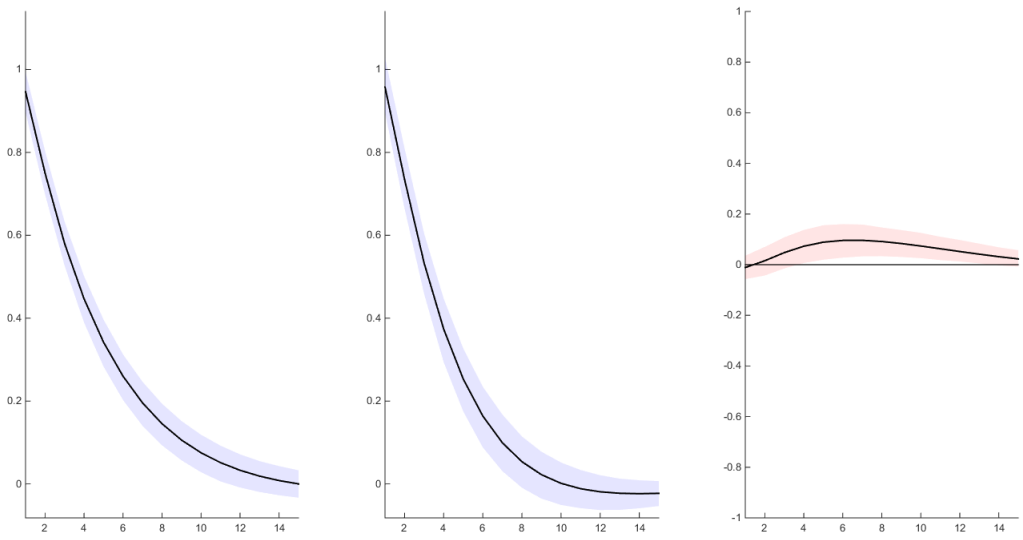
Finally, we take one further step in order to have a complete view of the actual level of wage bargaining, and we consider two alternative interactive variables that capture the potential additional bargaining leverage of unions at firm level. The first variable measures the space that sectoral agreements allow for enterprise bargaining, while the second variable captures the frequency and scope of additional firm-level bargaining and pay-setting.

The first variable is an ordered categorical variable that ranges from 0 to 2, where a higher value indicates that sectoral agreements are less binding. The variable is equal to 2 when sectoral agreements only set the framework for enterprise bargaining, and it is equal to 0 when sectoral agreements define the minimum and actual levels of wages, meaning the terms of agreements between workers and employers are legally binding on all the firms within the sector. A stronger response from prices to an inflation shock would be expected when sectoral agreements are more binding and automatically apply to all the employers covered by the scope of the agreement.

The IRFs reported in Figure 6 and the difference between them confirm this hypothesis.

The second interactive variable that we consider captures whether there is any additional enterprise bargaining about wages. We compare the response of prices to an inflation shock by considering two cases, which are the case where additional bargaining is common and covers at least 10% of the employees covered by collective agreements, and the case where there is no additional enterprise-level bargaining about wages. We can intuitively expect that the response of prices to an initial inflation shock will be more pronounced in countries where there is additional enterprise bargaining than in countries where there is no such bargaining or where it is explicitly forbidden. Our findings confirm this. Figure 7 shows that the difference between the two IRFs is positive and statistically significant, which confirms that the inflation spiral tends to be stronger when there is additional enterprise bargaining about wages.

Figure 7: Impulse response function of prices to an inflation shock: additional enterprise bargaining about wages



Note: The figure shows the impulse response functions of inflation to an initial shock of one percentage point to inflation by distinguishing between the case where additional enterprise bargaining exists and covers at least 10% of the employees covered by collective agreements (chart on the left) and the case where there is no such bargaining or it is explicitly forbidden (chart in the centre). The chart on the right represents the difference between the two. The coloured bands represent the 95% confidence bands generated by bootstrapping (1,000 draws).

4 Concluding remarks

The current record-high inflation in advanced economies is turning up the heat on central banks. With wage growth expected to be strong in 2023 (Bodnár et al., 2022), they face a difficult trade-off between ignoring the overshoot to protect the post-COVID economic recovery, and shifting to a hawkish monetary policy stance to fight inflation and avoid a potential wage-price spiral. As argued by Blanchard (2022) and Boissay et al. (2022), the current price shock could take time to dissipate as higher wage inflation becomes a new cost-push shock, forcing companies to

raise their selling prices to preserve their margins, and so leading to a feedback loop between wages and prices. The inflation spiral is one of the principal concerns of the current debate among monetary policy practitioners, and some economists consider it a time bomb ticking for central bankers.

In this context, our paper tries to give a first formal answer on the issue. Our empirical investigation assesses whether the prevalence of wage indexation arrangements and the balance of bargaining power between workers and firms can explain the cross-country differences in the dynamics of the inflation spiral. To this end, we estimate an IPVAR model on a sample of 37 OECD and non-OECD economies over the period 1960Q1-2019Q4. Our results confirm that wage indexation, trade union density, wage bargaining coverage and a high degree of coordination in the wage-setting process all positively influence the persistence of inflation following an initial price shock.

Our findings consequently suggest that the institutional features of the labour market and wage bargaining should be taken into consideration by central banks in the conduct of their monetary policy. This argues in favour of tightening policy rates quickly and firmly to avoid a wage-price spiral emerging that would add fuel to the fire.

More largely, a high and persistent inflation environment can also have a strong impact on financial markets. It is widely recognised that higher interest rates induced by a restrictive monetary policy are most likely accompanied by lower stock market returns (Chiang, 2022). As shown by Vukovic et al. (2022), this negative relationship between inflation and stock returns has important practical implications for the design of portfolio allocation strategies and the cross-market risk management. Furthermore, as stock prices are less informative in a high inflation environment, Farooq and Ahmed (2018) show that it reduces the ability of managers to use information from the stock market to make value enhancing investment decisions. Consequently, the fear of an inflation loop is not only a macroeconomic issue, as it is expected to significantly drive microeconomic decisions and change the behaviour of investors and firms.

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Appendix

Sample of countries

OECD countries (31): Australia, Austria, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.
Non-OECD countries (6): Argentina, Brazil, China, Indonesia, Russia, South Africa.