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Wage-Price Spirals: What is the Historical Evidence?

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ABSTRACT: How often have wage-price spirals occurred, and what has happened in their aftermath? We investigate this by creating a database of past wage-price spirals among a wide set of advanced economies going back to the 1960s. We define a wage-price spiral as an episode where at least three out of four consecutive quarters saw accelerating consumer prices and rising nominal wages. Perhaps surprisingly, only a small minority of such episodes were followed by sustained acceleration in wages and prices. Instead, inflation and nominal wage growth tended to stabilize, leaving real wage growth broadly unchanged. A decomposition of wage dynamics using a wage Phillips curve suggests that nominal wage growth normally stabilizes at levels that are consistent with observed inflation and labor market tightness. When focusing on episodes that mimic the recent pattern of falling real wages and tightening labor markets, declining inflation and nominal wage growth increases tended to follow – thus allowing real wages to catch up. We conclude that an acceleration of nominal wages should not necessarily be seen as a sign that a wage-price spiral is taking hold.

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Prepared by **Jorge Alvarez, John Bluedorn, Niels-Jakob Hansen, Youyou Huang, Evgenia Pugacheva, and Alexandre Sollaci**[1]

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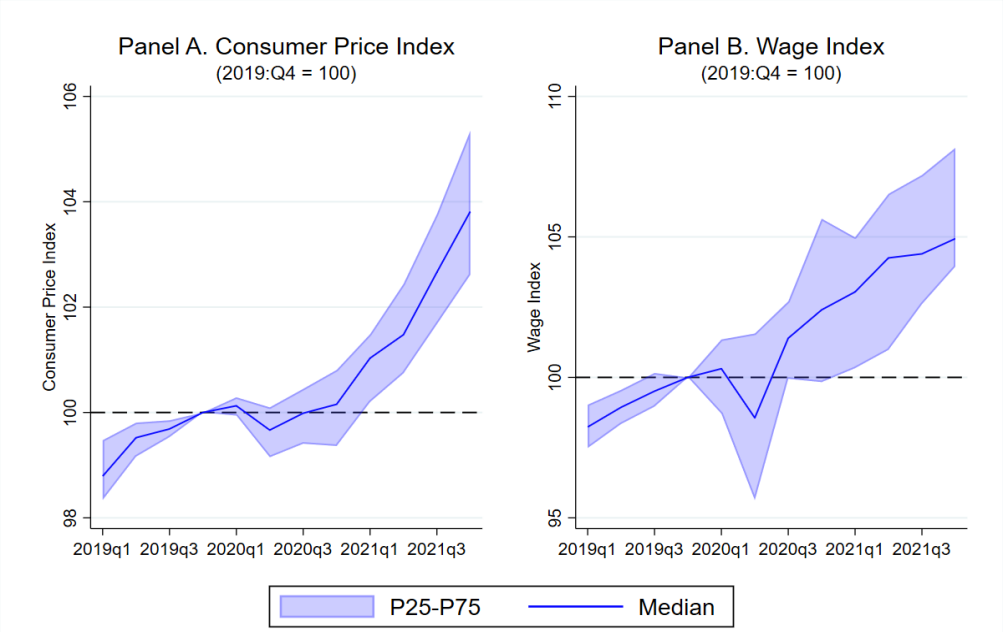
1. Introduction

With the recovery picking up steam after the acute COVID-19 shock, inflation in 2021 rose to levels that had not been seen in almost 40 years in many economies (Figure 1.1, panel A). At the same time, the economic recovery has brought a resurgence in demand for labor in many sectors. Labor supply was slow to respond, with some workers hesitant to reengage because of ongoing health concerns and difficulties finding child and family care, among other factors. This demand-supply imbalance led to tighter labor markets and increased wage pressures, with average nominal wages (per worker) rising (Figure 1.1, panel B) and the unemployment rate falling from the second half of 2020 across economy groups.[2]

Figure 1.1: Recent Behavior of Price and Nominal Wage Indices



Sources: Haver Analytics; International Labour Organization; Organisation for Economic Cooperation and Development; IMF WEO Database; and IMF staff calculations.
Note: The chart shows the cross-economy median and interquartile range of the consumer prices and nominal wage index. Indices are normalized to that 2019:Q4 = 100. See Table 2.1 and Annex Table A.1 and A.3 for economy-coverage of the sample.

These recent developments have caused observers to worry about a potential wage-price spiral, with rising inflation and tight labor markets prompting workers to demand nominal wage increases that catch-up to or even exceed inflation (Blanchard, 2022). Domash and Summers (2022) have also alerted that vacancy and quit rates in the US have substantial predictive power for wage inflation. This would suggest that current labor market tightness is likely to significantly contribute to inflationary pressures in the years to come. In addition, a higher inflation level might itself have an effect on the sensitivity of workers and firms to the price level. Schwartzman and Waddell (2022) find that from July 2021 to January 2022, business leaders not only report paying more attention to aggregate inflation measures, but also report incorporating those measures into their own pricing decisions. Similarly, there is a concern that the responsiveness of non-union wages to inflation increases with

[2] The distinction between wages per worker and wages per hour became relevant during the pandemic's acute phase, as hours worked were sharply adjusted for many workers (particularly in advanced economies). A similar chart for wages per hour shows a spike in the second quarter of 2020 on average across economy groups, but quickly returning to trend. Similar to the patterns for wages per worker, wages per hour fell short of price inflation by the end of 2021.

higher inflation, feeding further into wage-price dynamics (Holland, 1988).[3] Altogether, these arguments force us to contend with the possibility that wage and price inflation could start feeding on each other and create a spiral, where both wages and prices accelerate over several quarters. But how often have such situations occurred in the past, and what has happened in the aftermath of such episodes?

We address these questions by creating an empirical definition of a wage-price spiral and applying this on a cross-economy database of past episodes among advanced economies going back to the 1960s. Unfortunately, a precise consensus definition of wage-price spirals is lacking in the literature. Blanchard (1986) is perhaps the most known treatment of such phenomenon, where he defines the wage-price spiral as the consequence of the following mechanisms: (a) workers wish to preserve or increase real wages; (b) firms wish to preserve or increase markups over their costs (wages); and (c) nominal wages and prices take time to adjust. Thus, an inflationary shock takes time to dissipate, as workers and firms bargain over wages and prices in rounds. The wage-price spital could therefore be understood as something that prolongs inflation, but does not necessarily accelerate it (Zeira, 1989; Helpman and Leiderman, 1990; Ball, 1994; Musy and Pereau, 2010). In contrast, the current discussion (Blanchard, 2022; Boissay et al, 2022) seems to focus on the possibility that higher wage inflation constitutes a new cost-push shock to firms and therefore inflation could accelerate in the near future. This is the interpretation we adopt in this paper as well.

Specifically, we define a wage-price spiral as an episode where at least three out of four successive quarters saw accelerating consumer prices and nominal wages. Using this definition on our dataset, we identify 79 such episodes in our baseline database and 100 episodes when using a narrower wage concept covering a longer time period. We first illustrate the behavior of key macroeconomic indicators around these episodes and then decompose wage dynamics through the lens of a wage Phillips curve. The latter allows us to link wage growth to inflation and labor market dynamics. It also permits us to evaluate the degree to which wage-price spiral episodes deviate from established relationships observed during normal times.

We find that the great majority of the episodes identified in this manner are *not* followed by a sustained acceleration in wages and prices, with only a few exceptions. Instead, inflation and nominal wage growth tended to stabilize in the following quarters, leaving real wage growth broadly unchanged. Moreover, although nominal wage growth deviates from established wage Phillips curve relationships during the initial acceleration stage, this eventually stabilizes to levels consistent with observed inflation and unemployment levels. Wage-price spiraling dynamics appear to have short lives.

Our findings stem from a different approach but are not inconsistent with previous historical investigations. Analyzing the dynamics of wages and prices in 12 industrialized economies following a demand shock, Kandil (2007) observes that the relationship between wage and price inflation is intimately linked to labor and product market conditions. Furthermore, this relationship also depends on the nature of the shock: there is no evidence of any relationship between wages and prices after a negative demand shock, but they do seem to be positively correlated (although not necessarily accelerating) after a positive shock. In more extreme cases, such as the German hyperinflation episode in the post-World War I period, wage claims did provide an important conduit through which higher inflationary expectations were accommodated by faster rates of monetary expansion (Burdekin and Burkett, 1992).

Finally, we look more closely at historical events that mimic the current macroeconomic situation in an attempt to assess the risk of an upcoming wage-price spiral. Recent developments have been characterized by accelerating inflation, increasing nominal wages and, crucially, falling real wages and unemployment. We find

[3] In contrast, the share of private sector wage contracts that include a formal role for inflation in wage setting fell dramatically in recent decades (Koester and Grapow, 2021). This could indicate a low pass-through from wage inflation to price inflation (Heise et al., 2022).

that similar past episodes were followed by a period of declining inflation while nominal wage growth increased thus allowing real wages to catch up. Decompositions through the lens of the wage Phillips curve suggest that labor market tightening resulting from real wage falls are a significant driver of sustained—but eventually stabilizing—nominal wage growth after such episodes. Acceleration of nominal wages should therefore not be seen as a sign that a sustained wage-price spiral is necessarily taking hold. Indeed, history indicates that nominal wages can accelerate while inflation recedes from its high levels. In fact, on average this has happened after similar macroeconomic episodes in the past.

The rest of the paper proceeds as follows. Section 2 presents our data. Section 3 identifies past episodes of wage-price spirals and analyzes how the economy unfolded after those episodes. Section 4 analyzes wage dynamics following those episodes through the lens of a wage Phillips curve. Section 5 discusses the set of episodes more similar to current macroeconomic conditions to assess wage-price spiral risks. Section 6 concludes.

2. Data

We collect and harmonize data on inflation, energy prices, nominal wages, unemployment, GDP, and productivity from numerous sources to construct a wide-spanning data covering a rich set of advanced economies going back to the 1960s. Table 2.1 describes the main variables used in our analyses, along with the frequency and span of time at which they are collected, the number of economies for which they are available, and their sources. Annex table A.1 lists all economies in our sample. Quarterly series are seasonally adjusted using the X-13ARIMA-SEATS procedure from the U.S. Census Bureau if the data was not already seasonally adjusted by the source.

Table 2.1. Variable Description

Indicator	Unit	Frequency	*N*	Sources
Price level	Consumer price index	Quarterly, 1960:Q1 – 2021:Q4	36	Haver Analytics; IMF; OECD
Energy price index	Period average end-use energy price index	Quarterly, 1960:Q1 – 2021:Q4	38	Haver Analytics; IEA; IMF
Nominal wage	Average per person (local currency, index)	Quarterly, 1960:Q1 – 2021:Q4	31	Haver Analytics; OECD
Nominal wage (manufacturing)	Avg hourly earnings (local currency, index)	Quarterly, 1960:Q1 – 2021:Q4	29	OECD
Unemployment	Rate	Quarterly, 1960:Q1 – 2021:Q4	38	Haver Analytics; ILO; IMF; OECD
Real GDP	Output-side, Chained PPP (mil. 2017 USD)	Annually, 1950 – 2019	31	PWT
Productivity	TFP level at current PPP (USA=1)	Annually, 1950 – 2019	31	PWT

Note: *N* indicates the number of economies for which data is available. IMF: International Monetary Fund; OECD: Organisation for Economic Co-operation and Development; ILO: International Labour Organization; PWT: Penn World Table 10.0
Source: IMF staff compilation.

We combine data from various sources into the same series to extend the coverage of our data. In those cases, we prioritize data from the OECD as the primary source; then, if possible, we extend the data forwards and backwards using the growth rates from the same variable obtained from other sources (typically ILO, Haver, or the IMF). The procedure is straightforward: suppose that we have two series, $\{w_t\}_{t=t_0}^{T_0}$ and $\{z_t\}_{t=t_1}^{T_1}$, representing the same object but available for different ranges of time $(t_0 < t_1 \leq T_0 < T_1)$. By calculating the growth rates $g_t^z = (z_t/z_{t-1} - 1)$, we can extend the series w_t forward as

$$\widetilde{w_t} = \begin{cases} w_t, & t_0 \leq t \leq T_0 \\ w_{T_0} \prod_{r=T_0+1}^{T_1} (1 + g_r^z), & T_0 < t \leq T_1. \end{cases}$$

When possible, the same principle is applied to extend each series backwards as well.[4]

The dataset we compile contains 38 advanced economies and covers the period between 1960:Q1 and 2021:Q4. In some analyses (e.g., Section 4), the number of economies in the sample drops to 31, as data for all variables is required.[5] Details on the measurement of inflation, wage growth, and unemployment are presented below.

1) Inflation is computed on a quarterly level and measured as the year-on-year growth of the consumer price index. The CPI series from the OECD is extended using data from Haver Analytics and World Economic Outlook databases.

2) Nominal wages are calculated as average earnings per worker in local currency units The primary source is the wage rate indicator from the OECD Economic Outlook. The wage rate is defined as the aggregated wages paid to employees over the total number of employees. To broaden the coverage we extend this data with average earnings per employee from Haver Analytics.[6] For consistency across data sources, all earnings data are in local currency and annualized. [7]

3) Unemployment is measured as the ratio between the number of people unemployed and the total active labor force. Once again, the main data source is the OECD, and we extend the unemployment rate series using data from the ILO, Haver Analytics and International Financial Statistics databases.

4) Finally, we use real GDP per worker from the Penn World Table 10.0 as an aggregate productivity measure in the wage Phillips curve analysis. We calculate a five-year moving average as a proxy for slow-moving productivity trends.

3. Historical Experiences

How often have wage-price spirals happened in the past and how did the economy develop after these episodes? To answer these questions, this section identifies episodes with accelerating prices and wages within the dataset introduced in the previous section. We identify a wage-price spiral as *an episode where both price and nominal wage inflation (measured as year-over-year) increase successively for at least three out of four consecutive quarters*. If these criteria hold several times within three years, we only select the first episode. This is motivated by the definition of a wage-price spiral used in this paper: a situation where price and wage inflation both accelerate in the short run.

[4] Measuring inflation, nominal wages, and unemployment across economies, especially when combining data across multiple sources, also presents challenges. Because of that, we individually verify that each series does not have abnormal spikes or sudden changes in level that cannot be easily explained by changes in the underlying features of each economy (particularly close to the dates when two series from different sources are joined).

[5] Due to data availability, the sample used across empirical exercises in this paper changes slightly. In annex table A.2, we list all economies included in each exercise, while annex table A.3 graphically represents the sources used to construct each variable in the data, for each economy, and during each quarter of the sample.

[6] Specifically, we identify the most comparable concept for average wages (or earnings) per worker for each economy within the Haver Analytics database.

[7] We favor wagers per worker, instead of per hour worked, as the former allows a broader coverage across economies and time. In some applications (noted below), we use the average hourly earnings in manufacturing (from the OECD) to compute nominal wage growth. This concept is narrower than the aggregate nominal wage concept but enables broader coverage across time and economies.

We apply this definition to a subset of our dataset (Section 2), for which we have data on both consumer prices and aggregate nominal wage. Table 3.1 presents the available time series for each economy in our dataset. Barring a few economies, the data series start in the 1980s or 1990s. This limited sample risks excluding important episodes following the oil-price shocks in the 1970s. Thus, we also use an alternative sub-sample based on hourly nominal wages for the manufacturing sector. This wage concept is narrower than the aggregate nominal wages but allows us to include the 1970s for a wider set of economies.[8]

Table 3.1. Data Sample for Historical Episodes

	Aggregated Wages		Manufacturing Wages			Aggregated Wages		Manufacturing Wages	
Economy	Start	End	Start	End	Economy	Start	End	Start	End
Australia	1976:Q3	2021:Q4	1983:Q4	2021:Q4	Israel	1995:Q1	2021:Q2	1995:Q1	2021:Q4
Austria	1995:Q1	2021:Q4	1967:Q1	2021:Q4	Italy	1980:Q1	2021:Q4	1960:Q1	2021:Q4
Belgium	1995:Q1	2021:Q4	1960:Q1	2021:Q4	Japan	1980:Q1	2021:Q4	1960:Q1	2021:Q4
Canada	1981:Q1	2021:Q4	1978:Q4	2021:Q4	Korea	1989:Q1	2021:Q4	1992:Q1	2021:Q4
Switzerland	1995:Q1	2021:Q3			Lithuania	1995:Q1	2021:Q4	2000:Q1	2021:Q4
Czech Republic	1995:Q1	2021:Q4	1993:Q1	2021:Q4	Luxembourg	1988:Q1	2021:Q4	1988:Q1	2021:Q4
Germany	1985:Q1	2021:Q4	1969:Q1	2021:Q4	Latvia	2002:Q1	2021:Q4	2002:Q1	2021:Q4
Denmark	1990:Q1	2021:Q4	1971:Q1	2021:Q4	Netherlands	1995:Q1	2021:Q4	1970:Q1	2021:Q4
Spain	1981:Q1	2021:Q4	1981:Q1	2021:Q4	Norway	1995:Q1	2021:Q4	1972:Q1	2021:Q4
Estonia	1995:Q1	2021:Q4	2000:Q1	2021:Q4	New Zealand	1989:Q1	2021:Q4	1989:Q1	2021:Q4
Finland	1975:Q1	2021:Q4	1973:Q1	2021:Q4	Portugal	1995:Q1	2021:Q4	2000:Q1	2021:Q4
France	1990:Q1	2021:Q4	1990:Q1	2021:Q4	Slovak Republic	1995:Q1	2020:Q3	1993:Q1	2021:Q4
United Kingdom	1992:Q2	2021:Q3	1971:Q1	2021:Q4	Slovenia	1995:Q1	2021:Q4	1998:Q1	2021:Q4
Greece	1995:Q1	2021:Q4			Sweden	1993:Q1	2021:Q4	1971:Q1	2021:Q4
Ireland	1995:Q1	2021:Q4	1983:Q1	2021:Q4	United States	1960:Q1	2021:Q4	1960:Q1	2021:Q4
Iceland			2005:Q1	2021:Q4					

Sources: Haver Analytics; International Labour Organization; Organisation for Economic Co-operation and Development;and IMF staff calculations.

Applying our definition to the data sample with aggregate nominal wages identifies 79 episodes. The first episode is identified in 1973, and the last in 2017 (Table 3.2). When using the narrower but more widely available wage concept covering only the manufacturing sector, 100 episodes are identified (Table A.4). Episodes with price and wage accelerations has become less prevalent since the 1970s (Figure 3.1). This pattern is clearest when using the narrower wage concept, given the longer time-coverage of this variable (Figure 3.1, panel B).

Figure 3.2 (panel A) shows the distribution of macroeconomic outcomes around the identified episodes. In this and subsequent figures presenting the dynamics following an identified episode, period 0 is defined as the first period where the criteria that define a wage-price spiral are met. Both consumer price inflation and nominal wage growth increases for all episodes before period 0, which is not surprising given how the episodes are selected. We also find that the initial dynamics, on average, are not followed by further sustained acceleration in wages and prices. In fact, inflation and nominal wage growth on average tended to stabilize in the quarters following the wage-price spiral, leaving real wage growth broadly unchanged. At the same time, the

[8] The choice of wage concept does matter for the timing of the identified episodes. Aggregate wages is our preferred measure, why we emphasize the results based on this measure below. We rely on the sample with manufacturing wages as robustness.

unemployment rate tended to edge down slightly. These patterns are robust to using the longer sample with the narrower wage concept covering the manufacturing sector only (Figure 3.2, panel B).

In contrast, we do find some episodes that were followed by more extreme outcomes. For example, the 1973:Q3 episode for the United States—spurred by the first OPEC oil embargo of the 1970s—saw price inflation surging for five additional quarters before it started to come down in 1975 (Figure 3.1, red lines). However, nominal wage growth did not increase, leading real wage growth to decline.

Table 3.2. Past Periods with Accelerating Wages and Prices

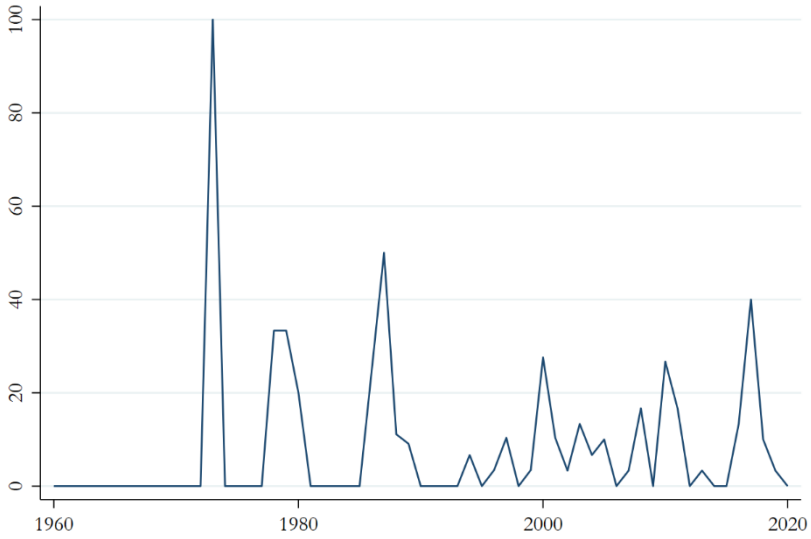
	Economy	Time		Economy	Time		Economy	Time
1	Australia	1979:Q3	30	Estonia	2017:Q2	59	Luxembourg	2017:Q3
2	Australia	1986:Q1	31	Finland	1980:Q3	60	Latvia	2010:Q4
3	Australia	2000:Q3	32	Finland	1987:Q2	61	Netherlands	2008:Q2
4	Australia	2010:Q2	33	Finland	2000:Q1	62	Netherlands	2019:Q2
5	Austria	2011:Q1	34	Finland	2005:Q2	63	Norway	2001:Q2
6	Austria	2018:Q2	35	Finland	2018:Q3	64	Norway	2011:Q3
7	Belgium	1999:Q4	36	France	2001:Q2	65	Norway	2018:Q4
8	Belgium	2005:Q3	37	France	2008:Q2	66	New Zealand	2004:Q3
9	Belgium	2010:Q2	38	France	2011:Q4	67	New Zealand	2016:Q1
10	Belgium	2016:Q1	39	United Kingdom	2003:Q4	68	Portugal	2017:Q2
11	Canada	1987:Q2	40	United Kingdom	2016:Q1	69	Slovak Republic	2003:Q3
12	Canada	1997:Q3	41	Greece	2008:Q2	70	Slovak Republic	2017:Q2
13	Canada	2011:Q1	42	Greece	2017:Q1	71	Slovenia	2016:Q4
14	Canada	2017:Q4	43	Ireland	2000:Q2	72	Sweden	2002:Q1
15	Switzerland	2000:Q4	44	Ireland	2011:Q1	73	Sweden	2008:Q3
16	Switzerland	2004:Q4	45	Israel	2008:Q3	74	United States	1973:Q3
17	Switzerland	2013:Q3	46	Italy	1987:Q4	75	United States	1978:Q4
18	Switzerland	2017:Q1	47	Italy	2003:Q3	76	United States	1987:Q3
19	Czech Republic	2000:Q3	48	Italy	2010:Q2	77	United States	1996:Q4
20	Czech Republic	2010:Q2	49	Italy	2017:Q1	78	United States	2000:Q3
21	Czech Republic	2017:Q1	50	Japan	1988:Q4	79	United States	2017:Q3
22	Germany	1989:Q4	51	Japan	1997:Q1			
23	Germany	2010:Q4	52	Japan	2003:Q1			
24	Germany	2017:Q1	53	Japan	2010:Q2			
25	Denmark	1994:Q3	54	Korea	2010:Q3			
26	Spain	1986:Q1	55	Lithuania	2000:Q4			
27	Spain	2000:Q2	56	Lithuania	2005:Q1			
28	Estonia	2001:Q2	57	Lithuania	2017:Q1			
29	Estonia	2007:Q1	58	Luxembourg	1997:Q4			

Sources: International Labour Organization; Organisation for Economic Co-operation and Development; US Bureau of Economic Analysis, and IMF staff calculations.

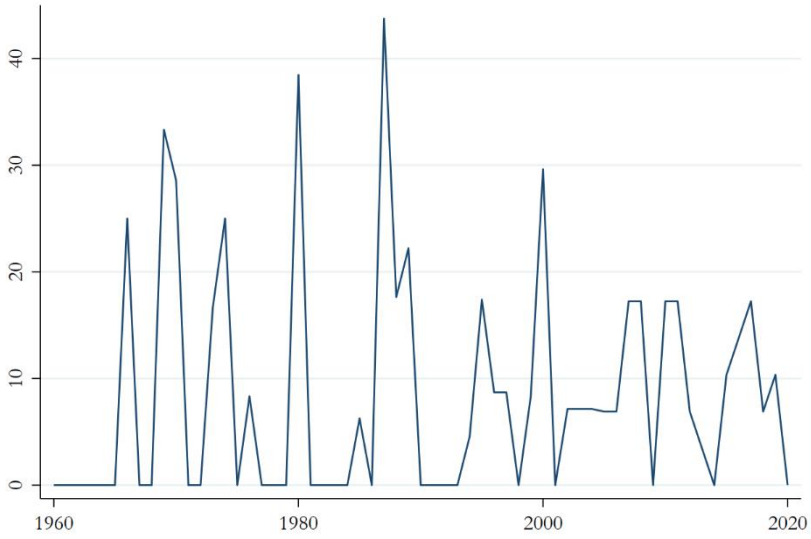
Note: The table shows the identified episodes where at least three of the four last quarters had (1) accelerating prices, and (2) accelerating nominal wages.

Figure 3.1: Share of economies with accelerating prices and wages
(Percent)

Panel A. Sample with aggregate nominal wages



Panel B. Sample with hourly manufacturing wages

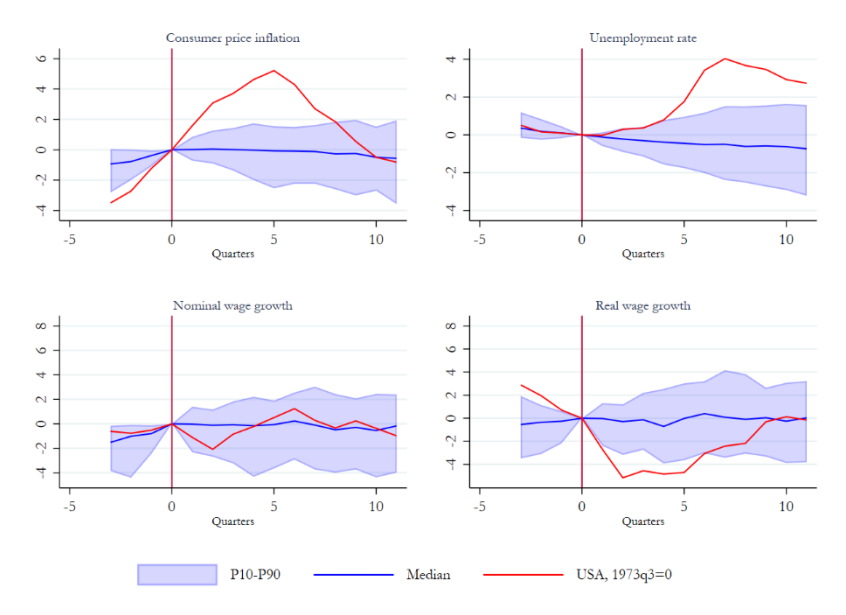


Sources: International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; and IMF Staff Calculations.

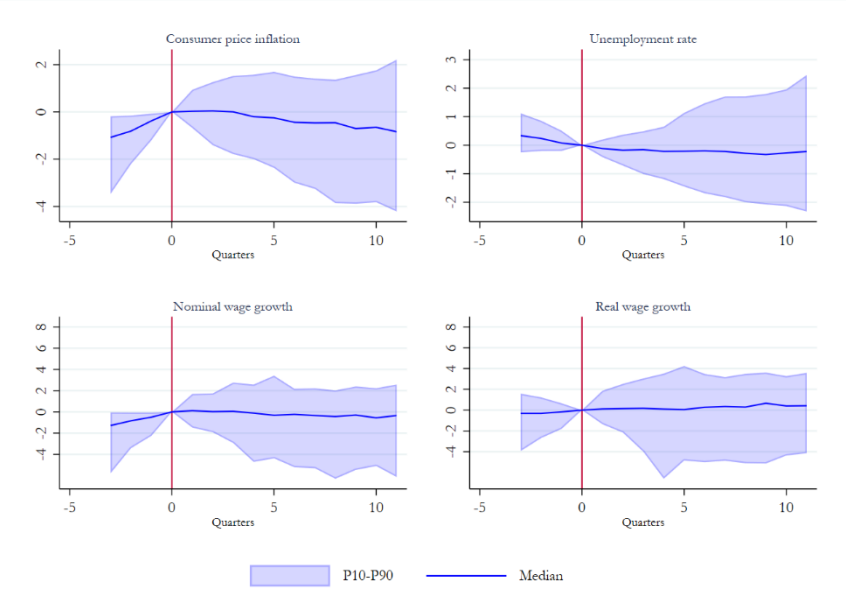
Note: The chart shows the share of economies (for which data is available) that experienced accelerating prices and wages for at least three out of the four preceding quarters in a given year. In panel A, the identified episodes are listed in Table 3.2. In Panel B, the identified episodes are listed in Annex Table A.4.

Figure 3.2: Changes in Macroeconomic Variables after Past Episodes with Accelerating Prices and Wages
(Percentage points differences relative to first quarter in which criteria are fulfilled)

Panel A. Sample with aggregate nominal wages



Panel B. Sample with hourly manufacturing wages



Sources: International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; and IMF Staff Calculations.

Note: The chart shows the developments following episodes where at least three out of for last quarters has accelerating prices and accelerating nominal wages. Quarter 0 is the first period where the criteria defining a wage-price spiral hold. In panel A, the outcomes are based on the 79 episodes identified in Table 3.2. In Panel B, the outcomes are based on the 100 episodes identified in Annex Table A.4.

4. A Historical Decomposition through the Lens of a Wage Philips Curve

A natural question when examining wage-price dynamics in the episodes described above is: to what extent did they break away from expected relationships that characterize economies in equilibrium? We explore this question using a standard wage Phillips curve framework, which relates wage dynamics to inflation, labor market slack, and trend productivity growth. The Philips curve captures the equilibrium wage formation in the economy, where nominal wages are pushed up by higher price levels, tighter labor markets, and a higher productivity level.[9] Our goal in this section is not to estimate these relationships causally, but to provide a simple statistical device that decomposes wage dynamics into its key components.

The approach is conducted in two stages. First, we estimate the following baseline wage Phillips curve:

$$\pi^{w}_{c,t} = \alpha_c + \phi_t + \beta\pi^{p}_{c,t-1} + \gamma_1 u_{c,t} + \gamma_2 \Delta u_{c,t} + \theta g_{c,t} + \varepsilon_{c,t}$$

where $\pi^{w}_{c,t}$ is the year-on-year change in nominal wages in local currency in economy *c* and quarter *t*, $\pi^{p}_{c,t-1}$is lagged price inflation, $u_{c,t}$ is the unemployment gap,[10] $g_{c,t}$ is trend productivity growth over the preceding five-year window,[11] α_c are economy fixed effects, and ϕ_t are time (quarter-year) fixed effects. The coefficients on inflation and the unemployment gap are identified using cross-economy variation in wage growth changes up to 2019:Q4. The post 2020:Q1 pandemic period is excluded from estimation to focus on how pre-COVID-19 relationships explain movements observed in past episodes.[12]

In the second stage, we use the estimated coefficients to decompose wage growth during each of the wage-price spital episodes identified in the preceding section. We start by computing the difference between the current value of each component in the wage Phillips curve and their value in the period at which a wage-price acceleration episode is identified. The cumulative difference in quarterly *wage growth* in economy *c* from the start of the episode window can thus be decomposed as:

$$\Delta_t \pi^{w}_{c,t} = \pi^{w}_{c,t} - \pi^{w}_{c,-3} = \beta\left(\pi^{p}_{c,t-1} - \pi^{p}_{c,-3}\right) + \gamma_1(u_{c,t} - u_{c,-3}) + Other_t,$$

where the first term in the right-hand side is the nominal wage growth component that is driven by inflation, the second is the component driven by the unemployment gap level, and the third encompasses all other components including quarterly changes in the unemployment gap, changes in productivity, time effects and the residual. We conduct this decomposition for all of the episodes identified in Section 3 for which we have the full set of variables, and aggregate each component by taking their average across episodes.

Table 4.1 shows the regression results for different wage Phillips curve specifications. The first five columns use a sample of 31 advanced economies from 2000—2019, when data covers a wider set of economies. The last column extends the sample back to 1990 for a limited set of economies. Throughout all specifications we see positive and significant coefficients on lagged inflation with negative and significant coefficients on the unemployment gap. The coefficient on inflation is relatively large, implying that a one percent point increase in inflation is associated with a 0.6-0.7 percentage point increase in nominal wages in the following period. Similarly, a decrease of one percent in the unemployment gap (labor market tightening) is associated with a 1.1-1.5 percentage point increase in nominal wage growth. Coefficients on the change of the unemployment gap as well as the slow-moving productivity component are not statistically significant and therefore not a focus of the decompositions to be presented. In what follows, coefficients from column (5) are used as a baseline.

[9] See Gali (2011) for a structural interpretation of wage Phillips curve parameters.

[10] The unemployment gap is defined as the difference between the observed unemployment rate and the hp-filtered unemployment rate using a parameter of 1,600.

[11] Real GDP per worker is used as the productivity measure.

[12] The pre-COVID-19 coefficients are also used in decompositions of the COVID-19 episode in section 5.

Table 4.1. Wage Phillips Curve Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Inflation	0.734***		0.585***	0.582***	0.593***	0.718***
	(0.142)		(0.0873)	(0.0902)	(0.0876)	(0.0709)
Unemployment gap		-1.497***	-1.321***	-1.329***	-1.326***	-1.100***
		(0.352)	(0.306)	(0.310)	(0.317)	(0.274)
Unemployment gap change				0.0795	0.0786	-0.117
				(0.222)	(0.222)	(0.186)
Productivity					0.0843	0.114
					(0.0943)	(0.0956)
Economy fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarterly fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	2,400	2,392	2,392	2,391	2,391	3,289
Adjusted R^2	0.488	0.523	0.567	0.566	0.567	0.602
First year of sample	2000	2000	2000	2000	2000	1990

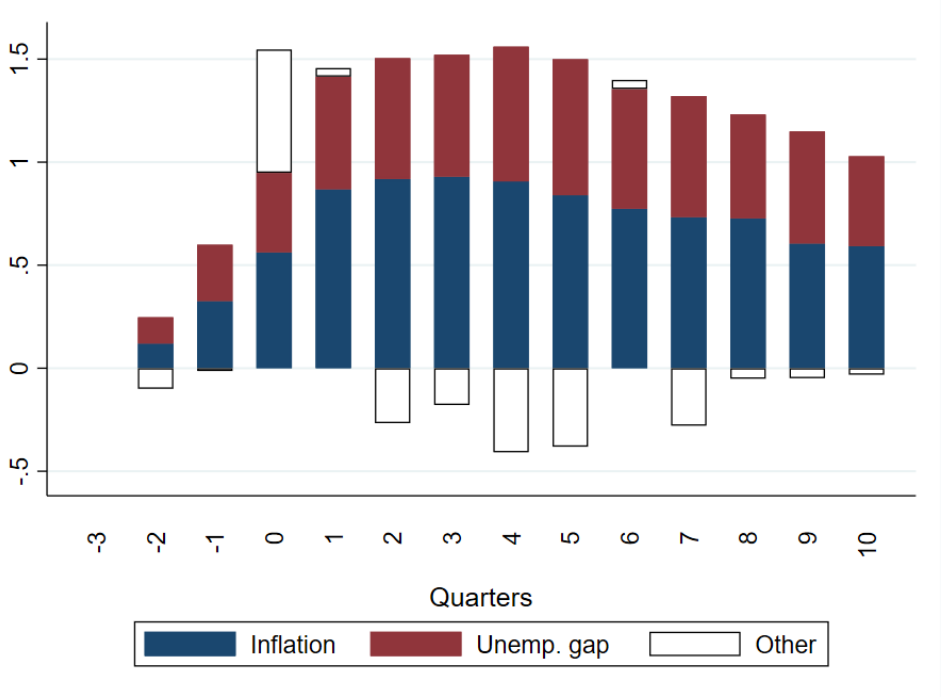
Source: IMF staff calculations.

Note: Unbalanced sample of 31 advanced economies. Columns 1-5 cover the period from 2000Q1 to 2019Q4. Column 6 extends the sample, for available economies, back to 1990Q1. Clustered standard errors reported in parentheses. Significance at the 95 percent level is unchanged when using Driscoll-Kraay standard errors that allow for both temporal and cross-sectional dependence. *** p<0.01; ** p<0.05; * p<0.1.

Figure 4.1 shows the decomposition of wage growth changes (relative to the start of the identified episodes) into the inflation and unemployment gap components. The figure portrays the average contributions and changes across the 31 advanced economies in the sample using purchasing-power-parity GDP as weights. As shown in Section 3, wage growth tends to decelerate and stabilize after the initial 6-8 quarters that follow the identified episodes. Wage growth remains, however, at a higher level than it was at the start of the episode. The decomposition indicates that this development is driven by both increases in inflation and labor market tightness, with either component increasing and stabilizing at a level above the start of the episode. On average, the contribution of inflation to wage growth is moderately greater, explaining around 60 percent of the total increase in total wage growth from the start of the episode window up until the end of the forecast horizon. Unemployment gap movements can explain near all the rest.

In contrast, the behavior of the other components (i.e., not explained by inflation and unemployment gap movements) is different, as they increase rapidly during the start of the wage-price acceleration episode but subside thereafter. That is, wage growth just after the start of the episodes is above what would be expected by inflation and unemployment dynamics alone. After these initial quarters, however, the residual components shrink, and wage dynamics appear to be well explained by inflation and labor market tightness changes near the end of the episode horizon. Wage growth is indeed higher than at the start of the episode window, but wages are not accelerating and wage growth is slightly below that expected from higher persistent inflation and tighter labor markets—at least on average.

Figure 4.1: Average Decomposition of Wage Growth across Episodes with Accelerating Prices and Wages



Sources: IMF staff calculations.
Notes: Contributions using pooled wage Phillips Curve coefficients from column (5) of Table 4.1 Bars illustrate average contributions, across episodes, of each component relative to contributions observed at the start of the episode window (t=-3). 'Other' includes the contributions from short-term changes in unemployment gap, productivity growth, time effects and the residual. Horizontal access defined as in section 3, where zero is the first quarter where the selection criteria holds.

5. A look at Episodes Similar to the COVID-19 Shock

An important question in the current juncture is whether advanced economies are on the verge of entering a wage-price spiral. In this section, we shed light on this by focusing on a subset of historical episodes that are more closely aligned with the macroeconomic dynamics recently observed. We then analyze how these episodes proceeded to unfold.

A notable feature of the most recent wage-price rise is one of negative real wage growth accompanied by labor market tightening. We therefore select a subset of the episodes identified in Section 3 which, in addition to accelerating wages and prices, also present these characteristics. Specifically, we identify episodes where at least three out of four consecutive quarters are characterized by (i) increasing year-on-year inflation, (ii) positive nominal wage growth, (iii) negative real wage growth, and (iv) flat or falling unemployment. Applying those criteria to our dataset with aggregate nominal wages yields the 22 episodes as presented in Table 5.1.[13]

[13] These 22 episodes are identified when using aggregate wages per worker as the relevant wage concept. The conclusions below are robust to using the alternative sample with hourly manufacturing wages as the relevant wage concept, see Figure A.1. Appendix B shows the conclusions are also robust to conditioning on an acceleration in energy prices rather than the CPI headline.

Table 5.1. Similar Past Episodes

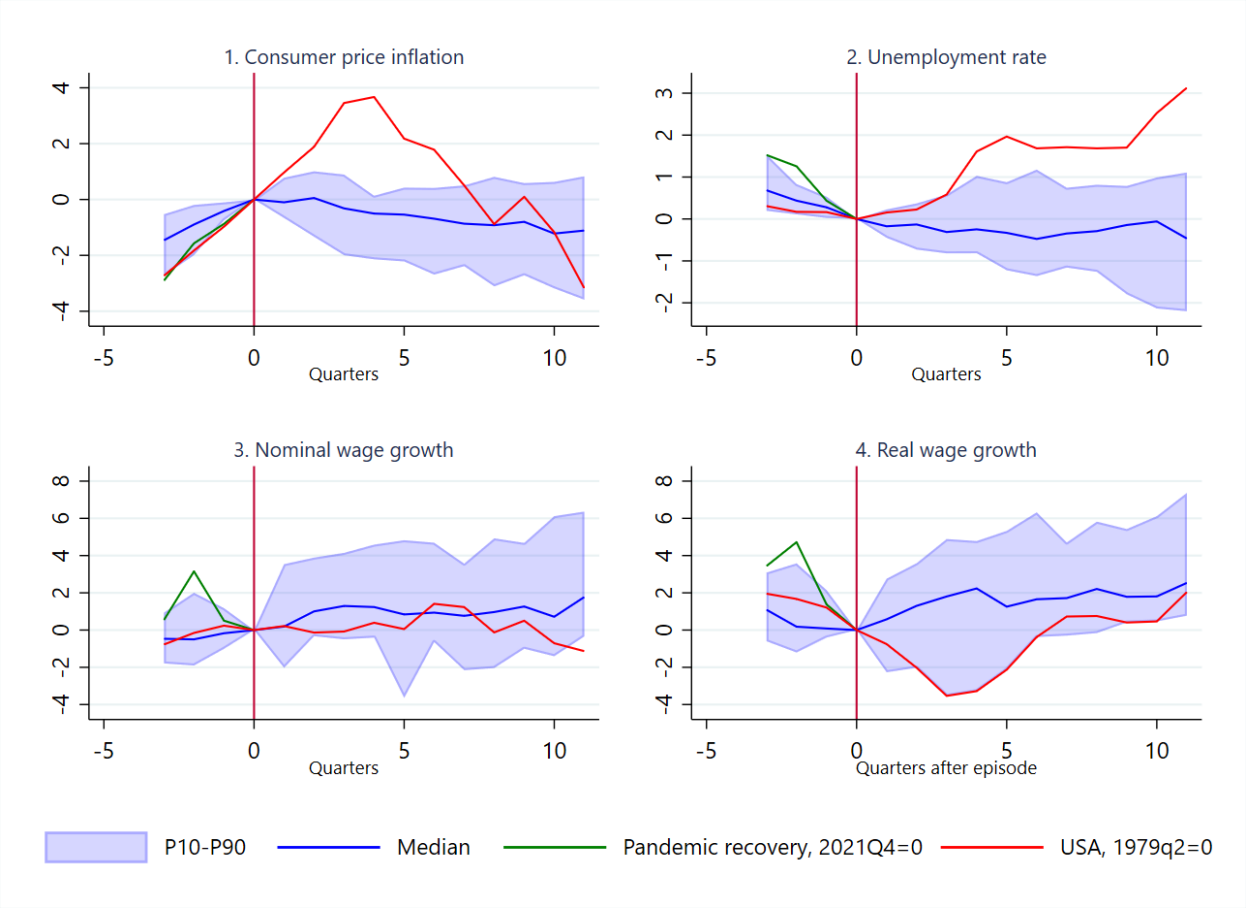
	Economy	Time		Economy	Time
1	Australia	1979:Q4	12	France	2000:Q4
2	Australia	1985:Q3	13	Germany	1989:Q4
3	Australia	1995:Q2	14	Israel	2008:Q3
4	Austria	2011:Q3	15	Luxembourg	2000:Q4
5	Austria	2017:Q4	16	Netherlands	2006:Q3
6	Belgium	2010:Q4	17	Slovenia	2000:Q4
7	Belgium	2016:Q2	18	Spain	1989:Q2
8	Canada	2003:Q1	19	Spain	2000:Q1
9	Denmark	1994:Q3	20	Sweden	2011:Q2
10	Denmark	2011:Q2	21	United States	1979:Q2
11	Estonia	2011:Q1	22	United States	2017:Q1

Sources: International Labour Organization; Organisation for Economic Co-operation and Development; US Bureau of Economic Analysis, and IMF staff calculations.
Note: The table shows the identified episodes where at least three of the four last quarters had (1) accelerating prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment.

The episodes were on average followed by an increase in wage growth, but not a wage-price spiral. Figure 5.1 shows the distribution of macroeconomic developments before and after these episodes. Nominal wage growth tended to increase (Figure 5.1, panel 3), while inflation tended to decline (Figure 5.1, panel 1) after such episodes. In combination, this allowed real wages to start increasing again (Figure 5.1, panel 4), and the unemployment rate tended to fall (Figure 5.1, panel 2). Overall, the episodes shown here were followed by a higher increase in wage growth than in the wider set of episodes (section 3), but wage growth eventually stabilized.

There is however heterogeneity across the identified historical episodes. A notable example is the United States in the second quarter of 1979, where inflation was on a sharp upward path in the immediate sequel of the episode, rising rapidly for four quarters before starting to decline. The unemployment rate also rose more than during the other identified episodes. Underlying these changes was an aggressive monetary tightening that began around the time of the inflation peak: the so-called Volcker disinflation. Nominal wage growth—which had not shown signs of continuing its upward path—was relatively flat during this period, leading to a decline in real wages early on. But as inflation came down, the deterioration in real wages decreased.

Figure 5.1: Changes in Macroeconomic Variables after Episodes Similar to 2021



(Percentage points differences relative to first quarter in which criteria are fulfilled)

Sources: International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; and IMF staff calculations.
Note: The chart shows the developments following episodes where at least three out of for last quarters has (1) accelerating prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment. Quarter 0 is the first period where the criteria hold. The outcomes are based on the 22 episodes identified in Table 5.1.

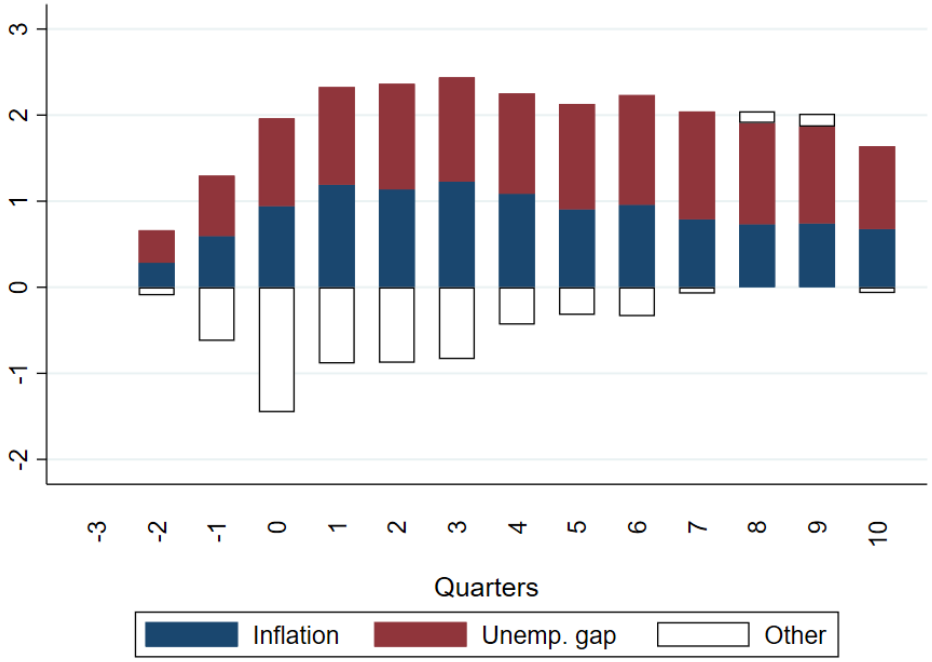
On average, nominal wage growth two-years after the episodes seems broadly consistent with inflation and labor tightening dynamics. We show this through a decomposition of nominal wage growth using the estimated wage Phillips curve (described Section 4) on this new subset of episodes. Figure 5.2 shows the average decomposition across episodes. In the periods where wage-price acceleration is identified (up to period zero), wage growth lagged that expected by inflation and unemployment gap movements alone – consistent with the fall in real wages and similar to post-COVID-19 dynamics. [14] This can be seen in the negative and decreasing 'other' component in the chart. After period zero, nominal wage growth starts to catch-up to return to that consistent with higher inflation and tighter labor markets by two years later. This is illustrated by the shrinking 'other' component near the end of the episode window.

The pattern of shrinking residuals is similar to the behavior following the wider set of wage-price acceleration episodes shown in section 4. Unlike those, however, the wage growth observed in Figure 5.2 is stronger and lasts for longer, which is consistent with a catch-up of nominal wages needed to recoup the initial decline in real

[14] A full decomposition of wage growth around the 2021 wage-price episode following the pandemic cannot yet be done at the same horizon However, analysis on data up to 2021Q4 suggest that rising inflation and labor market tightening has acted to increase nominal wage growth, while other factors (including deviations from the historical Phillips curve relationship) have kept nominal wage growth contained.

wages. This process is in part enabled by a tighter labor market witnessed by a positive contribution from the unemployment gap. The role of tighter labor markets is greater than that observed in the wider set of episodes documented in section 4. Furthermore, the initial fall in real wages seems to have led to tighter labor markets that co-existed with decelerating inflation.

Figure 5.2: Average Decomposition of Wage Growth after Episodes Similar to 2021



Sources: IMF staff calculations.
Notes: Contributions using pooled wage Phillips Curve coefficients from column (5) of Table 4.1 Bars illustrate average contributions, across episodes, of each component relative to contributions observed at the start of the episode window (t=-3). 'Other' includes the contributions from short-term changes in unemployment gap, productivity growth, time effects, and the residual. Horizontal axis defined as in section 3, where zero is the first quarter where the selection criteria hold.

6. Conclusion

Wage-price spirals, at least defined as a sustained acceleration of prices and wages, are hard to find in the recent historical record. Of the 79 episodes identified with accelerating prices and wages going back to the 1960s, only a minority of them saw further acceleration after eight quarters. Moreover, sustained wage-price acceleration is even harder to find when looking at episodes similar to today, where real wages have significantly fallen. In those cases, nominal wages tended to catch-up to inflation to partially recover real wage losses, and growth rates tended to stabilize at a higher level than before the initial acceleration happened. Wage growth rates were eventually consistent with inflation and labor market tightness observed. This mechanism did not appear to lead to persistent acceleration dynamics that can be characterized as a wage-price spiral.

It is still too early to say whether the recovery from the COVID-19 pandemic will play out like these past similar episodes. However, an important takeaway from the analysis is that an acceleration of nominal wages should not necessarily be seen as sign that a wage-price spiral is taking hold. Indeed, history suggests that nominal wages can accelerate while inflation recedes from high levels. In fact, on average, this has happened after similar macroeconomic episodes in the past.

Annex A: Extra Tables and Figures

Table A.1. Economies in Sample

Economy	ISO 3 Code	Economy	ISO 3 Code	Economy	ISO 3 Code
Australia	AUS	United Kingdom	GBR	Malta	MLT
Austria	AUT	Greece	GRC	Netherlands	NLD
Belgium	BEL	Hong Kong SAR	HKG	Norway	NOR
Canada	CAN	Ireland	IRL	New Zealand	NZL
Switzerland	CHE	Iceland	ISL	Portugal	PRT
Cyprus	CYP	Israel	ISR	Singapore	SGP
Czech Republic	CZE	Italy	ITA	San Marino	SMR
Germany	DEU	Japan	JPN	Slovak Republic	SVK
Denmark	DNK	Korea	KOR	Slovenia	SVN
Spain	ESP	Lithuania	LTU	Sweden	SWE
Estonia	EST	Luxembourg	LUX	Taiwan Province of China	TWN
Finland	FIN	Latvia	LVA	United States	USA
France	FRA	Macao SAR	MAC		

Source: IMF Staff compilation

Table A.2. Samples by Empirical Exercise

A. Full Selection Criteria

AUS	CYP	EST	HKG	JPN	MAC	PRT	SWE
AUT	CZE	FIN	IRL	KOR	MLT	SGP	TWN
BEL	DEU	FRA	ISL	LTU	NLD	SMR	USA
CAN	DNK	GBR	ISR	LUX	NOR	SVK	
CHE	ESP	GRC	ITA	LVA	NZL	SVN	

B. Limited Selection Criteria

AUS	CYP	EST	HKG	JPN	MAC	PRT	SWE
AUT	CZE	FIN	IRL	KOR	MLT	SGP	TWN
BEL	DEU	FRA	ISL	LTU	NLD	SMR	USA
CAN	DNK	GBR	ISR	LUX	NOR	SVK	
CHE	ESP	GRC	ITA	LVA	NZL	SVN	

C. Wage Phillips Curve

AUS	CZE	FIN	IRL	LVA	SGP	USA
AUT	DEU	FRA	ITA	NLD	SVK	
BEL	DNK	GBR	JPN	NOR	SVN	
CAN	ESP	GRC	KOR	NZL	SWE	
CHE	EST	HKG	LTU	PRT	TWN	

C. Full Selection Criteria Using Manufacturing Wages

AUS	CYP	EST	HKG	JPN	MAC	PRT	SWE
AUT	CZE	FIN	IRL	KOR	MLT	SGP	TWN
BEL	DEU	FRA	ISL	LTU	NLD	SMR	USA
CAN	DNK	GBR	ISR	LUX	NOR	SVK	
CHE	ESP	GRC	ITA	LVA	NZL	SVN	

Source: IMF Staff compilation

Table A.3. Data Coverage (Quarters Between 1960:Q1 and 2021:Q4)

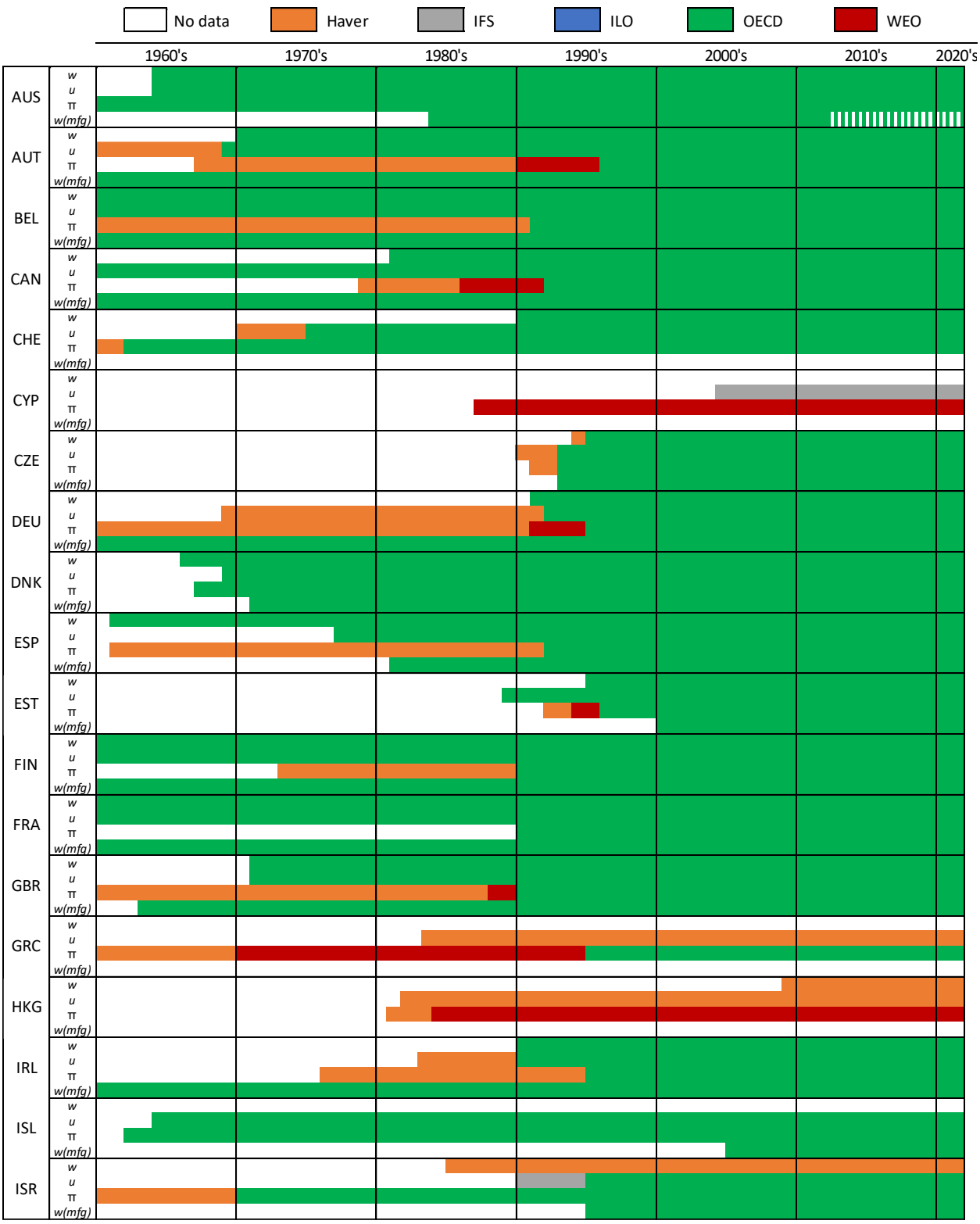
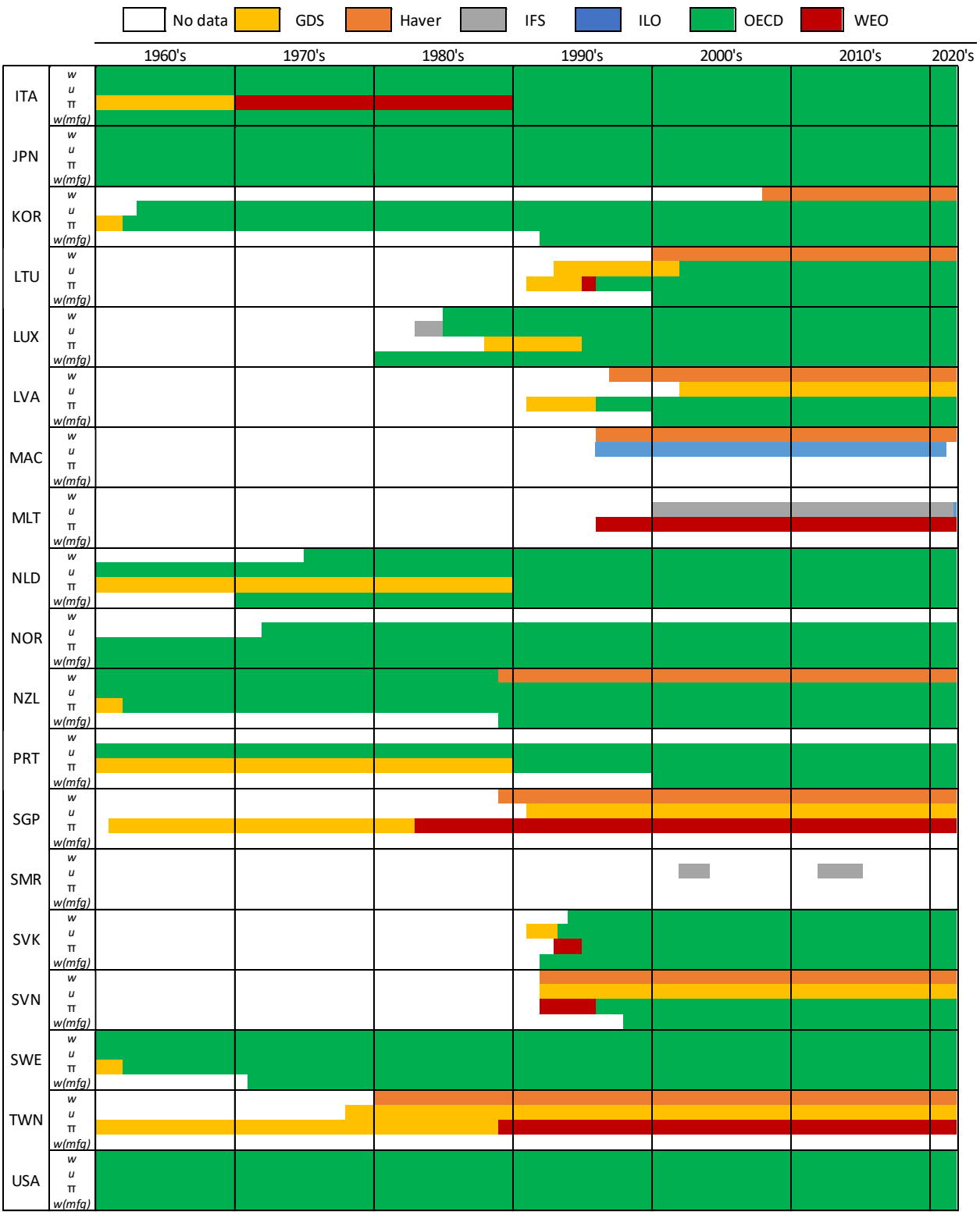


Table A.3 (continued). Data Coverage (Quarters Between 1960:Q1 and 2021:Q4)



Note: each square represents one quarter. *w* indicates average nominal wages per worker, *u* indicates unemployment rate, π indicates CPI inflation, and *w(mfg)* indicates hourly nominal wages in manufacturing. GDS is the IMF's Global Data Source; IFS is the IMF's International Financial Statistics database; Haver, ILO and OECD each indicate the respective organization's databases; and WEO is the IMF's World Economic Outlook database.

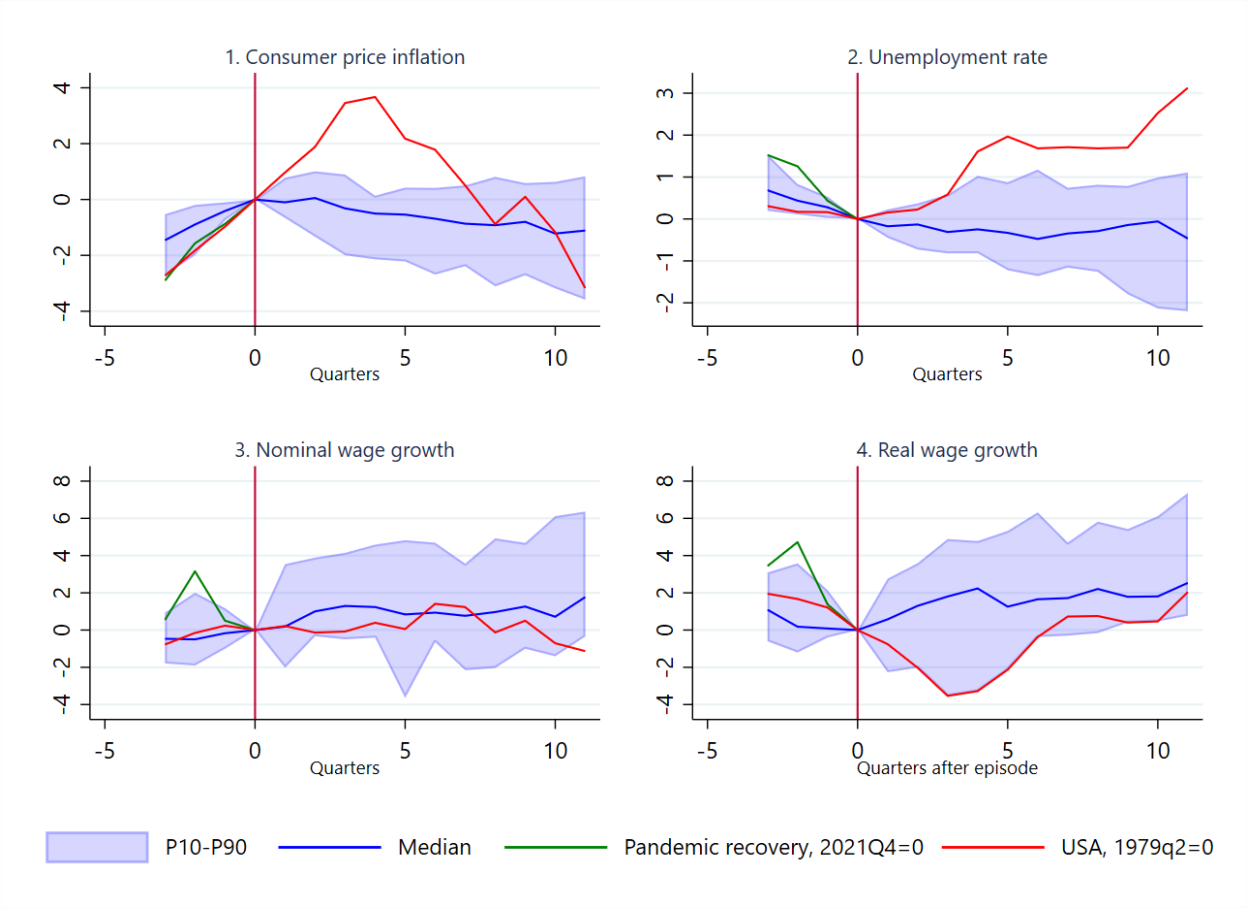
Table A.4. Past Periods with Accelerating Wages and Prices, Based on Hourly Manufacturing Wages

	Economy	Time		Economy	Time		Economy	Time
1	Australia	1989:Q2	35	Finland	2000:Q1	69	Lithuania	2005:Q1
2	Australia	2010:Q2	36	Finland	2005:Q1	70	Lithuania	2016:Q4
3	Austria	1970:Q1	37	Finland	2012:Q3	71	Luxembourg	1997:Q4
4	Austria	1974:Q2	38	Finland	2018:Q3	72	Luxembourg	2010:Q2
5	Austria	1988:Q1	39	France	1995:Q4	73	Latvia	2010:Q4
6	Austria	2000:Q4	40	France	1999:Q3	74	Netherlands	1988:Q4
7	Austria	2004:Q3	41	France	2006:Q2	75	Netherlands	1996:Q3
8	Austria	2010:Q2	42	France	2011:Q2	76	Netherlands	2008:Q2
9	Austria	2017:Q1	43	France	2017:Q1	77	Netherlands	2019:Q2
10	Belgium	1969:Q2	44	United Kingdom	1974:Q4	78	Norway	1980:Q3
11	Belgium	1980:Q1	45	United Kingdom	1987:Q3	79	Norway	1987:Q1
12	Belgium	1989:Q2	46	United Kingdom	2003:Q4	80	Norway	1995:Q2
13	Belgium	2004:Q2	47	United Kingdom	2017:Q4	81	Norway	2018:Q4
14	Belgium	2008:Q3	48	Ireland	1989:Q4	82	New Zealand	2000:Q3
15	Belgium	2016:Q3	49	Ireland	2000:Q2	83	New Zealand	2011:Q2
16	Canada	1987:Q3	50	Ireland	2012:Q2	84	Portugal	2006:Q2
17	Canada	2002:Q4	51	Iceland	2011:Q4	85	Portugal	2015:Q3
18	Canada	2007:Q4	52	Iceland	2016:Q1	86	Slovak Republic	2000:Q2
19	Czech Republic	2000:Q3	53	Israel	2008:Q3	87	Slovak Republic	2017:Q3
20	Czech Republic	2016:Q4	54	Israel	2019:Q1	88	Slovenia	2007:Q3
21	Germany	1973:Q2	55	Italy	1969:Q4	89	Sweden	1976:Q2
22	Germany	1987:Q4	56	Italy	1973:Q1	90	Sweden	1980:Q1
23	Germany	1999:Q4	57	Italy	1987:Q4	91	Sweden	1989:Q1
24	Germany	2007:Q4	58	Italy	1995:Q3	92	Sweden	1995:Q1
25	Germany	2011:Q2	59	Italy	2008:Q3	93	Sweden	2002:Q1
26	Denmark	1987:Q1	60	Japan	1970:Q1	94	Sweden	2007:Q4
27	Denmark	1994:Q3	61	Japan	1980:Q1	95	Sweden	2015:Q3
28	Denmark	2003:Q1	62	Japan	1985:Q3	96	United States	1966:Q3
29	Spain	2000:Q1	63	Japan	1997:Q1	97	United States	1974:Q4
30	Estonia	2007:Q1	64	Japan	2000:Q2	98	United States	1987:Q4
31	Estonia	2011:Q1	65	Japan	2008:Q1	99	United States	1996:Q4
32	Estonia	2017:Q3	66	Japan	2013:Q4	100	United States	2015:Q4
33	Finland	1980:Q3	67	Korea	2010:Q3			
34	Finland	1988:Q3	68	Korea	2019:Q2			

Sources: International Labour Organization; Organisation for Economic Co-operation and Development; US Bureau of Economic Analysis, and IMF staff calculations.

Note: The table shows the identified episodes where at least three of the four last quarters had (1) accelerating prices, and (2) accelerating nominal wages.

Figure A.1: Changes in Macroeconomic Variables after Episodes Similar to 2021, sample with hourly manufacturing wages
(Percentage points differences relative to first quarter in which criteria are fulfilled)



Sources: International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; and IMF staff calculations.
Note: The chart shows the developments following episodes where at least three out of for last quarters has (1) accelerating prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment. Quarter 0 is the first period where the criteria hold.

Annex B: Conditioning on Accelerating Energy Prices Instead of Headline Inflation

The recent period of inflation acceleration has in part been driven by higher energy prices, particularly in Europe. Because of that, we extend our analysis in Section 5 by changing the selection criteria to capture episodes with increasing energy inflation rather than headline inflation. Thus, we identify episodes with (i) increasing year-on-year energy inflation, (ii) positive nominal wage growth, (iii) negative real wage growth, and (iv) flat or falling unemployment.

To measure energy prices, we use the energy component of consumer prices for OECD economies as compiled by the International Energy Agency. For the United States, we use the energy component of consumer prices as compiled by the U.S. Bureau of Labor Statistics, which allows for a longer coverage. Adding this variable to our sample and restricting on its availability does not change the time coverage of our sample (as presented in Tables 3.1 and B.1).

Table B.1. Similar Past Episodes

	Economy	Time		Economy	Time
1	Australia	1979:Q4	8	Luxembourg	2000:Q4
2	Australia	1985:Q4	9	Netherlands	2006:Q1
3	Canada	2002:Q4	10	New Zealand	2006:Q2
4	Canada	2010:Q4	11	Slovenia	2000:Q4
5	Spain	1989:Q1	12	United States	1979:Q2
6	Spain	2000:Q1	13	United States	2017:Q1
7	France	2000:Q4			

Sources: International Energy Agency; International Labour Organization; Organisation for Economic Co-operation and Development; US Bureau of Economic Analysis, US Bureau of Labor Statistics; and IMF staff calculations.
Note: The table shows the identified episodes where at least three of the four last quarters had (1) accelerating energy prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment.

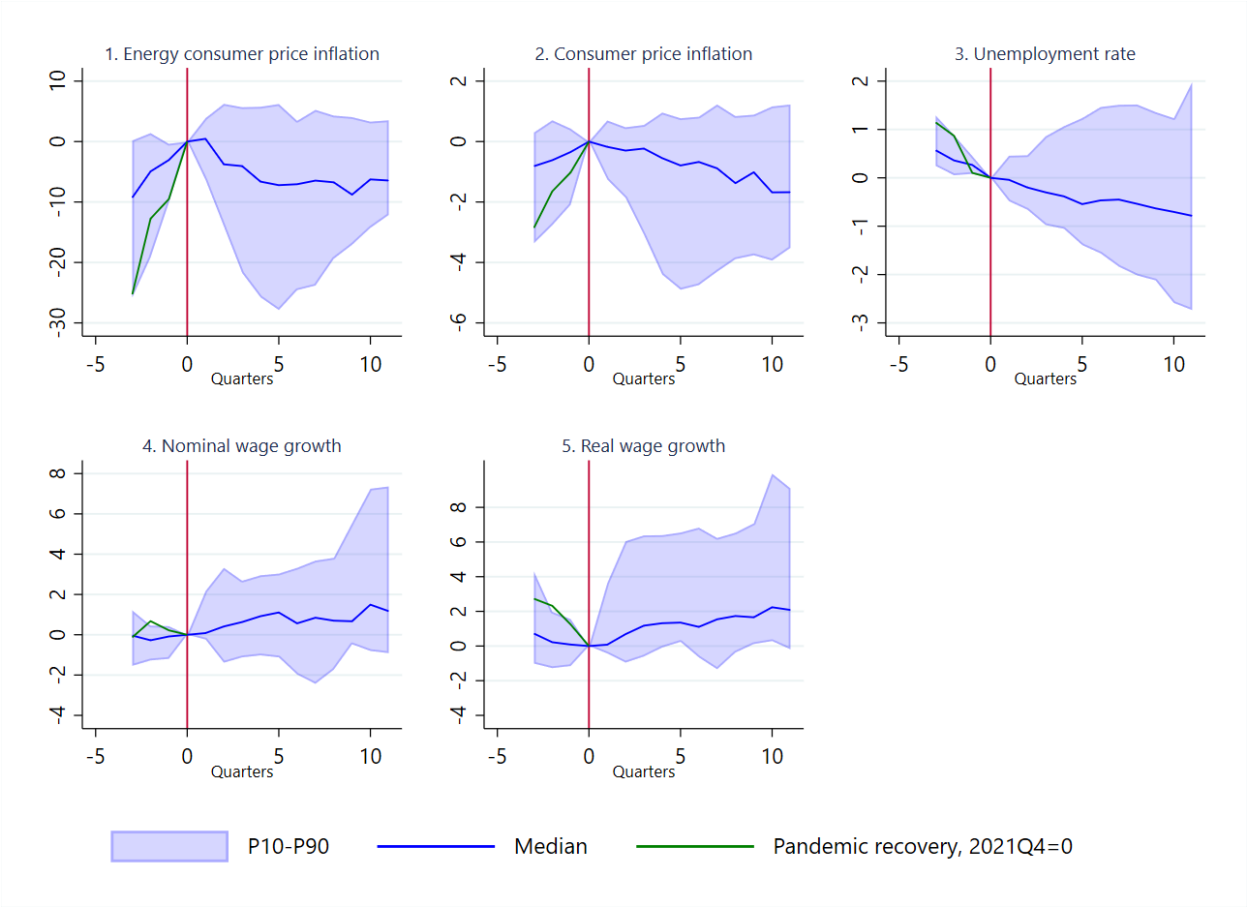
Applying the modified selection criteria to our data sample, we identify 13 potential wage-price spital episodes (as opposed to the 22 episodes found in Section 5). These episodes were on average followed by macroeconomic conditions akin to those presented in Section 5. That is, nominal wage growth tended to increase (Figure B.1, panel 4), while headline and energy inflation tended to decline (Figure B.1, panels 1 and 2). In combination, this allowed real wages to start increasing again (Figure B.1, panel 5), and the unemployment rate tended to fall (Figure B.1, panel 3).

One might be concerned that these results are affected by the sample length, which does not cover the 1970s for many European economies. To investigate this, we repeat the analysis for a longer sample – using a narrower concept for wages covering only the manufacturing sector and extrapolating backwards the energy prices for economies outside the United States using the growth rates in the energy prices for the United States and accounting for changes in the relevant exchange rate (sourced from the International Financial Statistics). Figure B.2 shows that the patterns found in Figure B.1 are robust to this extension.

Figure B.1: Changes in Macroeconomic Variables after Episodes Similar to 2021
(Percentage points differences relative to first quarter in which criteria are fulfilled)

Sources: International Energy Agency; International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; US Bureau of Labor Statistics; and IMF staff calculations.
Note: The chart shows the developments following episodes where at least three out of for last quarters has (1) accelerating energy prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment. Quarter 0 is the first period where the criteria hold. The outcomes are based on the 13 episodes identified in Table B.1.

Figure B.2: Changes in Macroeconomic Variables after Episodes Similar to 2021, Extended Sample
(Percentage points differences relative to first quarter in which criteria are fulfilled)



Sources: International Energy Agency; International Labour Organization; Organisation for Economic Cooperation and Development; US Bureau of Economic Analysis; US Bureau of Labor Statistics; and IMF staff calculations.
Note: The chart shows the developments following episodes where at least three out of for last quarters has (1) accelerating energy prices, (2) positive nominal wage growth, (3) falling or constant real wages, and (4) declining or flat unemployment. Quarter 0 is the first period where the criteria hold.

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PUBLICATIONS

Wage-Price Spirals: What is the Historical Evidence?

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