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Recent Wage Trends and the Pass-Through of Wages

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Nominal wages have shown a steep upward trend since 2021, exceeding pre-pandemic levels. In this paper, we evaluate the upward trend in wages through the lens of the wage Phillips curve and estimate the effects of rising wages on producer prices.

The findings are as follows. First, the rise in nominal wages has been mainly driven by the uptick in regular payments made to permanent employees. Since the second quarter of 2022, the growth rate of regular payments to permanent employees has hovered sharply above the long-term average.

Second, the rise in regular payments to permanent employees is largely attributed to the tight labor market and to high inflation expectations. When decomposing the growth rate of regular payments to permanent employees using the wage Phillips curve, compared to the fourth quarter of 2019, it has increased 0.30 percentage points and 0.45 percentage points thanks to the rises in the job openings rate and to the expected inflation rate, respectively.

Third, a wage increase, coinciding with rising input prices, appears to have led to a higher impact on prices. When wages rise 10 percent in the goods sector, producer prices rise 2.0 percent in the post-COVID period, compared to only 0.1 percent increases in earlier periods. This shows that a joint rise in wages and input costs can have an amplified effect on prices.

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■ Disclaimer: The views expressed herein are those of the authors, and do not necessarily reflect the official views of the Bank of Korea. When reporting or citing this paper, the authors' names should always be explicitly stated.

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I. Introduction

Nominal wages, which had contracted sharply in the first half of 2020 due to the impact of the pandemic, have shown a steep upward trend since 2021. Although the rise has plateaued since the second quarter of 2022, the growth rate of nominal wages remains above pre-pandemic levels. Moreover, the four-quarter moving average growth rate of nominal wages hovers above 2018 levels, when wages rose sharply (see <Figure 1>).

<Figure 1> Growth rate of nominal wages



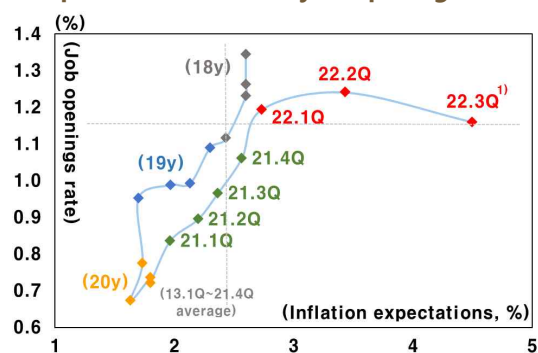
Note: 1) 22.3Q refers to the average value of July and August 2022.

Source: Labor Force Survey at Establishments

Since the rise in nominal wages would have been influenced by various factors, including the base effect from the pandemic-hit period, a tight labor market, and higher inflation expectations, a quantitative assessment is necessary of each factor to evaluate the upward trend in wages.

In 2022, labor market tightness (i.e., the job openings rate¹⁾) and inflation expectations (consumers' expectations for the following year) have shot above the long-term averages (see <Figure 2>). In particular, inflation expectations picked up markedly in 2022, which can be translated into high prices.²⁾

<Figure 2> Movements of inflation expectations and the job openings rate



Note: 1) 22.3Q refers to the July-Aug. 2022 average.

Source: KOSIS, Labor Force Survey at Establishments

Moreover, the sharp rise in wages has been unprecedentedly accompanied by rising input prices. A joint shock to wages and to input prices could have affected the price-setting behavior of firms. (Amiti et al. 2022a, 2022b). When wages and input costs go up at the same time, firms have less room for substitution, which can lead to higher pass-throughs from marginal costs to prices.³⁾

This paper evaluates the upward trends of nominal wages and regular payments to

1) The job openings rate is defined by the number of job openings/ (the number of salary workers + the number of job openings).

2) Using the wage Phillips curve, Jorda et. al (2022) shows that high wage growth in the U.S. has been influenced more by inflation expectations than by past inflation or the unemployment gap. Similarly, IMF (2022) also demonstrates that the recent rise in wages has been driven by high inflation expectations in developed countries.

3) Please refer to Chapter 4 "Pass-through of wages" for more details.

permanent employees through the lens of the wage Phillips curve. In addition, we look at how the synchronized increases in wages, intermediate goods prices, and competitors' prices of final goods during the economic recovery period have all influenced the pass-through of wages to producer prices.

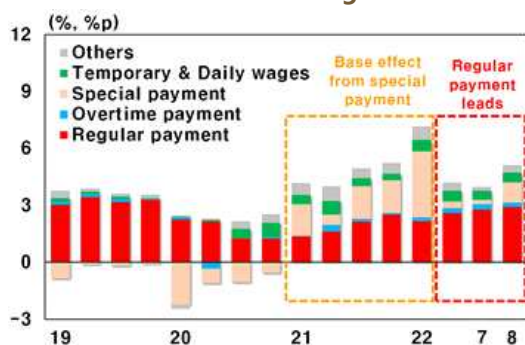
uncertainty, special payments decreased in 2020, which was followed by a significant rebound after 2021 due to the base effect. At an industry level, special payments fell across most industries in 2020, but rose throughout 2021 through to the first quarter of 2022 without exception in these industries (see <Figure 4>).

II. Recent wage trends

1. Nominal wages

From the first quarter of 2021 to the first quarter of 2022, the increase in nominal wages appears to be mainly attributed to a surge in special payments. Of the gain in nominal wages in the first quarter of 2022 (up 7.2%, YoY), about half (3.5%) stems from the rise in special payments.

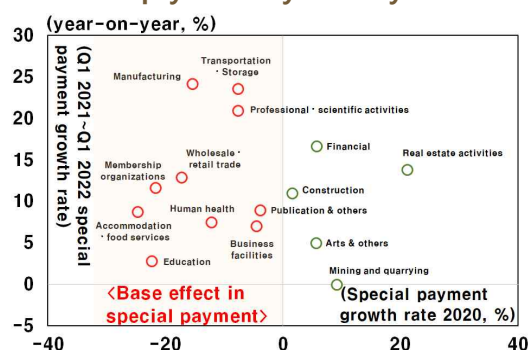
<Figure 3> Decomposition of growth rate of nominal wages



Source: Labor Force Survey at Establishments

The rise in special payments from 2021 to the first quarter 2022 seems to have been caused by two factors. The first is the base effect in the recovery stages from the pandemic-hit period. As employers adjusted special payments in response to business

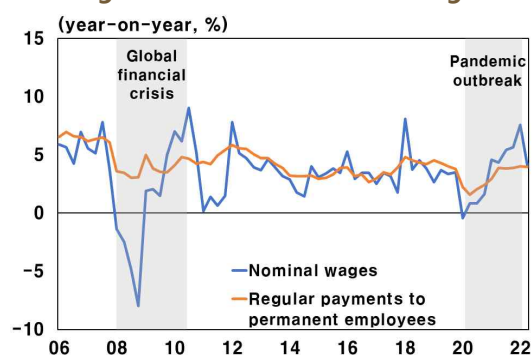
<Figure 4> Growth rate of special payments by industry



Source: Labor Force Survey at Establishments

The sharp drop and rise in nominal wages due to special payments is a phenomenon that happened during the 2008 global financial crisis as well, indicating that a large fluctuation in special payments is a common feature during crises (see <Figure 5>).

<Figure 5> Growth rates of wages¹⁾



Note: 1) Establishments that have five or more employees
Source: Labor Force Survey at Establishments

The second factor is the boom seen in some industries. Due to the boom in asset prices such as stocks and real estate, special payments in the financial and insurance sector and in the real estate sector increased in 2020 and 2021. In addition, some industries, such as manufacturing and transportation/warehousing, showed larger increases in special payments between 2021 and the first quarter of 2022 than the decreases in 2020 due to the boom in the automobile, semiconductor, delivery and logistics, and sea transportation industries.

2. Regular payments to permanent employees

Unlike nominal wages that have been highly volatile during the pandemic recovery period, regular payments to permanent employees have shown a consistent upward trend since the second quarter of 2020. They rose by 4.5 percent in the third quarter of 2022, hovering above the long-term average of 3.5 percent (see <Figure 6>).

<Figure 6> Growth rate of regular payments to permanent employees

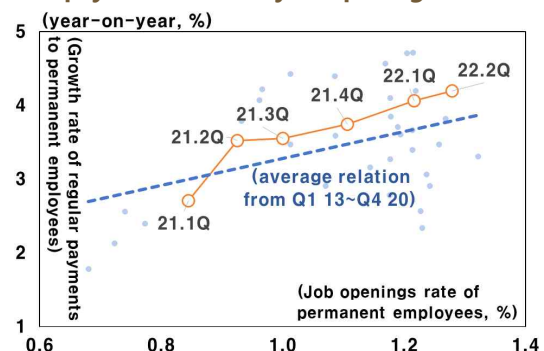


Note: 1) 22.3Q refers to the July-Aug. 2022 average.
Source: Labor Force Survey at Establishments

The rise in regular payments to permanent employees has been affected by both a tight labor market and high inflation expectations. The growth rate of regular payments to permanent employees maintained a positive relationship with the job openings rate and inflation expectations between 2013 and the fourth quarter of 2020, and has not deviated largely from this positive relationship since 2021 (see <Figure 7>).

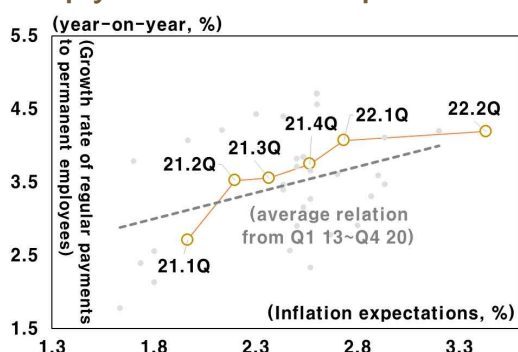
The growth rate of regular payments to permanent employees hovered slightly above the average association between the job openings rate and the growth rate of regular payments since the second quarter of 2021. This is because both a tight labor market and high inflation expectations have affected the rising trend of regular payments to permanent employees (see <Figure 8>).

<Figure 7> Growth rate of regular payments vs the job openings rate



Source: Labor Force Survey at Establishments

<Figure 8> Growth rate of regular payments vs inflation expectations



Source: KOSIS, Labor Force Survey at Establishments

Overall, the rise in regular payments to permanent employees has been associated closely with the tight labor market and high inflation expectations. Since both labor market tightness and inflation expectations have been hovering above the long-term average, it can be reasonably argued that the growth rate of regular payments would exceed the long-term average.

III. Wage growth rate based on Phillips curve

1. Wage Phillips curve estimation

To quantify the effects of inflation expectations and labor market tightness on the growth rate of wages, we estimate a wage Phillips curve using the methodologies of IMF (2022) and Jorda et.al (2022).

$$\pi_t = \alpha + \delta\pi_{t-1} + \beta x_t + \gamma E_t(\pi_{t+4}) + \lambda Z_t + \epsilon_t.$$

Here, π_t refers to the year-on-year wage growth rate, x_t denotes the job openings

rate, $E_t(\pi_{t+4})$ represents consumer expectations of inflation in the following year, and Z_t is other control variables. The time lag for each independent variable is determined by the lags correlation with the wage growth rate.

The growth rate of nominal wages or that of regular payments to permanent employees is employed as a dependent variable. The job openings rate and inflation expectations are the primary independent variables. The 12-quarter moving average of the growth rate of labor productivity, and the growth rate in the population of 15+-year-olds (the labor supply index), are included as control variables.

<Table 1> Estimation results of the wage Phillips curve

	Nominal wages growth rate ¹⁾	Regular payments growth rate ¹⁾
Lag of dep. variable	0.07	0.42***
Inflation expectations	0.06	0.39**
Job openings rate	0.58**	0.27**
Population growth rate ²⁾	-0.28	-0.38**
Labor productivity growth rate ³⁾	0.49**	0.31**
Number of observations	41	41
R ²	0.38	0.85

Note: 1) The regression coefficient is the standardized regression coefficient.

2) 15-years-old and older

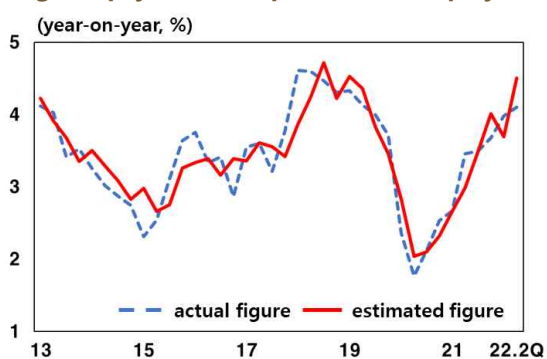
3) 12-quarter moving average

4) Inflation expectations are applied with a time lag of 1, the population growth rate with a time lag of 4, and the labor productivity growth rate with a time lag of 3.

5) ** and *** each means statistically significant within 5% and 1%.

Source: Authors' calculations.

<Figure 9> Estimates of the growth rate in regular payments to permanent employees



Source: Labor Force Survey at Establishments

The results of the wage Phillips curve estimation can be summed up by two main features. First, the wage Phillips curve clearly explains the changes in regular payments to permanent employees ($R^2=0.85$). On the other hand, it also has low explanatory power for nominal wages ($R^2=0.38$). The lags of the dependent variable and of inflation expectations are not statistically significant (see <Table 1>).

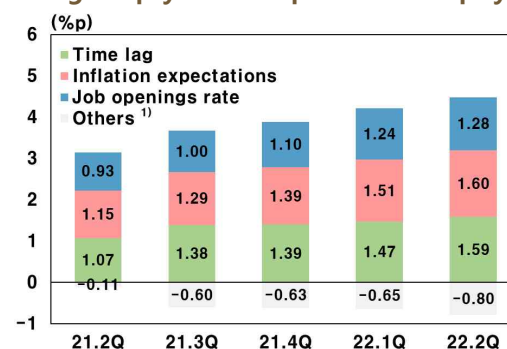
Second, apart from the lag of dependent variables, inflation expectations among the independent variables did influence the uptick in regular payments to permanent employees. According to the estimated standardized coefficient in Table 1, the effect of the lag of dependent variables on the growth rate of regular payments to permanent employees is the biggest. In addition to this, between inflation expectations and the job openings rate, the former's influence is greater. The growth rate in the population of 15+ and the growth rate of labor productivity also have a significant impact on regular payments to permanent employees.

2. Decomposition of wage growth rate

(Decomposition results by period)

Next, we decompose the growth rate of regular payments to permanent employees with the estimated Phillips curve. The decomposition results show that the rise in the job openings rate and in the expected inflation rate bumped up the growth rate of regular payments to permanent employees by a 0.8 percentage points in the second quarter 2022 compared to the period one year earlier (0.35%p by the job openings rate and 0.45%p by inflation expectations) (see <Figure> 10).

<Figure 10> Decomposition of growth rate in regular payments to permanent employees



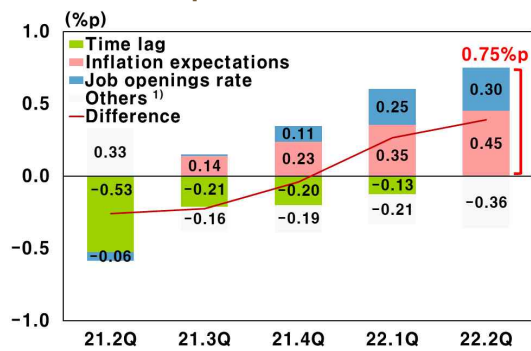
Note 1) Others include the labor productivity growth rate, the population growth rate and an error term contribution.

Source: Authors' calculations

Moreover, compared to the fourth quarter of 2019, the rise in regular payments to permanent employees in the second quarter of 2022 is totally attributed to the rises in the job openings rate and in inflation expectations. The growth rate of regular payments to permanent employees in the second quarter of 2022 increased by 0.75 percentage points due to the job openings

rate and to inflation expectations compared to the fourth quarter of 2019 (0.3%p by the job openings rate and 0.45%p by the expected inflation rate). It is cut back by 0.36 percentage points from other factors (see <Figure> 11).

<Figure 11> Decomposition of growth rate in regular payments to permanent employees: difference from the growth rate in the fourth quarter of 2019



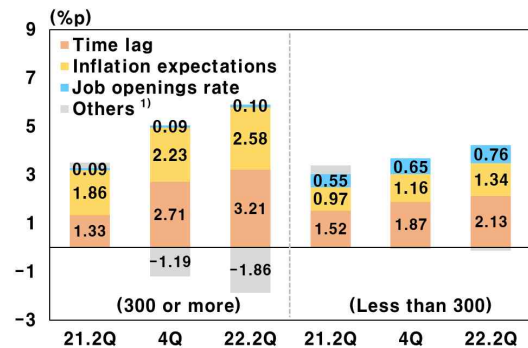
Note 1) Others include the labor productivity growth rate, the population growth rate and an error term contribution.

Source: Authors' calculations

(Decomposition results by size of establishment)

The job openings rate and inflation expectations have influenced regular payments to permanent employees differently by the size of the establishment. The effect of the job openings rate on regular payments to permanent employees is larger at small establishments (less than 300 employees) than at larger ones (with 300 employers or more). This could be because the level and volatility of the job openings rate at large establishments is relatively low compared to those at small establishments.⁴⁾

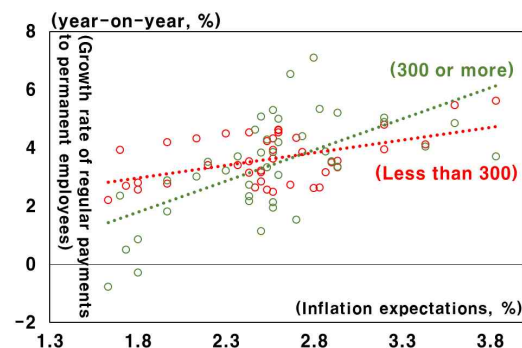
<Figure 12> Decomposition of the growth rate of regular payments to permanent employees: by firm size



Note 1) Others include the labor productivity growth rate, the population growth rate and an error term contribution.

Source: Authors' calculations

<Figure 13> Growth rate of regular payments and inflation expectations: by firm size



Source: KOSIS, Labor Force Survey at Establishments, Ministry of Employment and Labor

Inflation expectations, on the other hand, have a greater impact on regular payments to permanent employees at large establishments than at smaller ones (see <figures 12 and 13>). This could be because employees' bargaining power to reflect inflation in wages is stronger at large establishments. The rise in inflation expectations did play a factor in pushing up

4) From the first quarter of 2012 to the second quarter of 2022, the job openings rate at large and small establishments averaged at 0.3% and 1.2%, respectively. The standard deviations are 0.1% and 0.23% for the same period, respectively.

the growth rate of regular payments to permanent employees in small establishments, by 1.34 percentage points in the second quarter of 2022, while contributing a greater 2.58 percentage points at large establishments.

IV. Pass-through of wages

1. Recent price-setting conditions

Wage growth amid the recovery from the pandemic has been accompanied by a jump in import prices of intermediate goods and in competitors' prices. First of all, a global supply chain bottleneck, the protracted Russia-Ukraine war, and a rapid appreciation of the Korean won all helped to fuel prices of imported inputs. Amiti et al. (2022a, 2022b) shows that firms have less room for substitution when wages and input costs rise at the same time. In addition, as the high inflation situation has been shared globally,

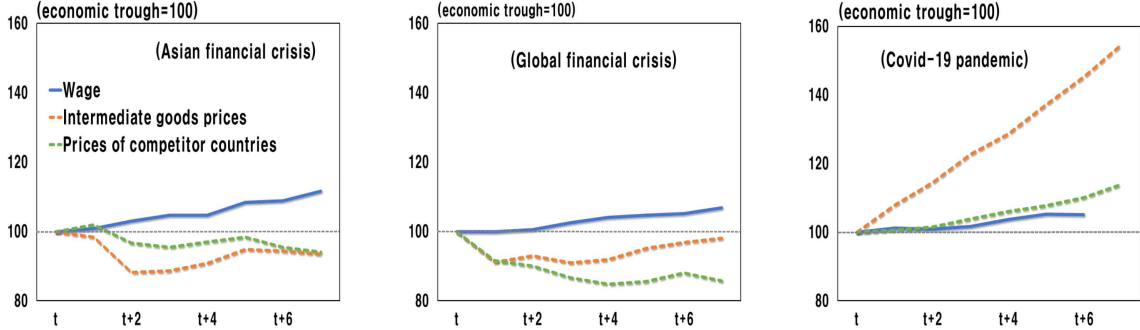
a strategic complementarities channel has also been working. Amiti et al. (2019) finds that domestic firms can raise prices more easily if competitors' prices (prices of imported final goods) rise. Therefore, the co-movement of labor costs, imported input prices, and competitors' prices is a rare phenomenon that has not been seen in past recovery episodes (see <Figure 14>). These exceptional conditions can affect price-setting behavior at firms.

2. Empirical analysis

We now estimate the effects of wages and rising input prices on producer prices via strategic complementarities and the marginal cost channel. Our reduced-form equation based on Amiti et al. (2022a, 2022b) is

$$\begin{aligned}
 p_{it} = & \delta_i + \psi_t + \beta_1 wage_{it} + \beta_2 input_{it} \\
 & + \beta_3 competitor_{it} + \beta_4 A_{it} \\
 & + \beta_5 (D \times wage_{it}) + \beta_6 (D \times input_{it}) \\
 & + \beta_7 (D \times competitor_{it}) \\
 & + \beta_8 (D \times A_{it}) + \epsilon_{it}
 \end{aligned}$$

<Figure 14> Price-setting conditions in post-crisis periods



Note: 1) Quarterly basis
 2) Intermediate goods prices refers to prices of imported intermediate goods, and prices of competitor countries refers to prices of imported finished goods.
 Source: Labor Force Survey at Establishments, Export-Import Price Index, Bank of Korea

Going forward, we denote industry-level variables using the subscript i . p_{it} is the change in producer prices in period t . $wage_{it}$ is the wage increase rate per employee. $input_{it}$ represents the rate of increase in the input price. $competitor_{it}$ is the rise in foreign competitor's price (the import price of final goods). A_{it} refers to the rise in productivity (the value of goods and services produced/input labor hour). D is a dummy variable that identifies the post-COVID period (2021:Q1 to 2022:Q2). With the interaction effect, we allow the pass-through to differ relative to the earlier period. Finally, δ_i is an industry fixed effect and ψ_t is a time fixed effect.

Of them, we construct input prices ($input_{it}$) as a weighted average of domestic input prices ($p_{it}^{domestic}$) and imported input prices (p_{it}^{import}). First, the domestic input price ($p_{it}^{domestic}$) of industry i is calculated by a weighted average of input prices (producer price index) of all industries (except industry i) that provide inputs to industry i , where the input share of industry $j (\neq i)$ is λ_{jt}^i ⁵. Next, we construct the imported input prices (p_{it}^{import}) of industry i analogously as a weighted average over the imported input prices of all industries (except industry i) that provide inputs to industry i , where the input share of industry $j (\neq i)$ is μ_{jt}^i ⁶. Lastly, we derive the variable $input_{it}$ by weighting $p_{it}^{domestic}$ and p_{it}^{import} with the share of intermediate

imported inputs in total marginal costs, α_{it} .

$$input_{it} = (1 - \alpha_{it}) p_{it}^{domestic} + \alpha_{it} p_{it}^{import} \\ = (1 - \alpha_{it}) \sum_{j \neq i} \lambda_{jt}^i p_{jt}^{domestic} + \alpha_{it} \sum_{j \neq i} \mu_{jt}^i p_{jt}^{import}.$$

Our sample comprises 28 industries for the period 2013:Q1 to 2022:Q2. We now estimate our regression specification separately for goods (18 industries) and services (10 industries).

Table 2 shows how prices would be affected if wages, input prices, and competitor's prices were to rise by 10 percent, separately for traded and non-traded industries. In the goods sector (traded industries), we find a positive and significant pass-through from marginal costs to producer prices. A 10 percent increase in wages increased producer prices by 0.1 percent pre-2021 and by 2.0 percent in the post-COVID period. In addition, the pass-through from input prices to producer prices has also strengthened (from 5.3 percent to 8.2 percent). In sum, a 10 percent increase in both labor and input costs is associated with a 10.3 percent increase in PPI in the post-COVID period, compared to only a 5.4 percent increase in the past. Moreover, we see that a strategic complementarities channel has also become stronger, contributing to the rise in producer prices domestically. An increase of 10 percent in prices of competitor goods now leads to a 0.2 percent rise in producer prices, compared to only a 0.1 percent increase pre-2021.

5) Domestic trade tables from input-output tables from 2010, 2015, and 2019 are used for calculations.

6) Import trade tables from input-output tables from 2010, 2015, and 2019, are used for calculations.

We next turn to the service sector (non-traded industries). By definition, the strategic complementarities channel does not work for non-traded industries. The service sector, likewise, has seen a greater pass-through from labor costs. A 10 percent rise in wages is associated with a 3.0 percent rise in PPI in the post-COVID period, compared to a 1.6 percent rise in prior years. In contrast to the traded sector, however, we do not find a significant increase in input price pass-through compared to prior years.

employees. Specifically, the growth rate of regular payments to permanent employees rose by 0.75 percentage points from a higher job openings rate and inflation expectations in the second quarter of 2022, compared to the fourth quarter of 2019. Moreover, wages and input prices have had a significant effect on producer prices in the post-COVID period. This large effect stems from the joint increase in marginal costs. The double burden has undermined firms' ability to absorb any rise in costs by muting the substitution channel.

<Table 2> Changes in pass-through of marginal costs⁷⁾

Impact from a 10% rise from each factor	Goods (Traded)		Services (Non-traded)	
	13~20	21.Q1~22.Q2	13~20	21.Q1~22.Q2
Marginal cost (A+B)	5.4	10.3	2.1	3.7
Wages (A)	0.1	2.0	1.6	3.0
Input prices (B)	5.3	8.2	0.5	0.7
Competitor's prices ¹⁾	0.1	0.2	-	-

Note: 1) The industrial average import share in final goods (7.4%, based on 2019 input-output statistics) is applied.

Source: Authors' calculations

V. Conclusion

Regular payments to permanent employees have been the main driver of the rise in nominal wages since 2021. A wage Phillips curve provides strong grounds to assume that a higher job openings rate and higher inflation expectations both feed into increases in regular payments to permanent

7) Further details can be found in <Box 1> "Pass-through for goods and services."

<Box 1>

Pass-through for goods and services

We first estimate a basic model without interaction terms. Then we add interaction terms and allow the pass-through to differ relative to the earlier period.

<Table A-1> Estimation results ¹⁾²⁾

	Goods (Traded)		Services (Non-Traded)	
	Basic model	Including Dummy variable	Basic model	Including Dummy variable
Wages	0.111*** (0.026)	0.008 (0.026)	0.200* (0.105)	0.164* (0.085)
Wages × Post-COVID (dummy) ³⁾	- -	0.196** (0.092)	- -	0.134** (0.054)
Input	0.823*** (0.125)	0.531*** (0.050)	0.052** (0.020)	0.045** (0.016)
Input × Post-COVID (dummy) ³⁾	- -	0.290* (0.157)	- -	0.026 (0.058)
Competitor's prices	0.201** (0.073)	0.106** (0.047)	- -	- -
Competitor's prices × Post-COVID (dummy) ³⁾	- -	0.107*** (0.035)	- -	- -
Productivity	-0.021 (0.031)	-0.049** (0.020)	0.017 (0.018)	-0.019 (0.025)

Note: 1) The heteroskedasticity-constant standard errors are in parentheses.

2) *** p<0.01, ** p<0.05, * p<0.1

3) Post-COVID refers to 2021.Q1 to 2022.Q2.

Source: Author's calculations

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