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The Normalization of Wage Dynamics

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The Normalization of Wage Dynamics

Prepared for Fortieth AEPR Conference, September 23, 2024

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ABSTRACT

Hoshi and Kashyap (2021) found that the linkage between wage inflation and labor market condition in Japan was disrupted after the late 1990s. The linkage between wage inflation and price inflation also disappeared around the same time. Two factors were identified as the main reasons why wages became less sensitive to the tightness of the labor market: the excess fulltime employment and the increasing proportion of part-time workers. Both of these factors started to disappear by the late 2010s. After confirming the main results in Hoshi and Kashyap (2021), this paper finds that wage inflation has started to respond to the labor market condition measured by the unemployment rate. We also find a weak evidence that the linkage between wage inflation and price inflation is being restored.

1. Introduction

The Japanese economy seems to have got out of the almost three decades of (mild) deflation. As of this writing (August 2024), the inflation rate has been almost always positive for more than 2 years, often exceeding the target rate of 2% set by the Bank of Japan (BOJ). The output gaps estimated by the BOJ and the International Monetary Fund (IMF) continue to be positive after the recovery from the COVID. The labor market condition continued to be quite tight even during the COVID-19 crisis, and the wages finally have started rising. In March 2024, the BOJ ended its extraordinary loose monetary policy framework known as the Quantitative and Qualitative Easing (QQE), which started in April 2013 and continued with expansion to include various unconventional monetary policy measures such as the negative interest rate policy (NIRP) and the yield curve control (YCC) for more than 10 years. Right after the end of QQE, the BOJ kept the overnight interest rate low at 0% to 0.1%, but the interest rate target was raised to 0.25% at the end of July. The BOJ has also started to reduce the amount of Japanese Government Bonds (JGBs) that it has been purchasing.

These recent developments are quite a contrast to the experience of the previous decade when the BOJ tried all sorts of unconventionally monetary policy measures in extreme magnitudes under Governor Haruhiko Kuroda and yet had very limited success in bringing the Japanese economy out of stagnation. Soon after Governor Kuroda announced the QQE, the general price level may have stopped falling and the yen reversed its ever appreciating trend, but the inflation target of 2% was not achieved. The wage level also continued to be stubbornly low despite very tight labor conditions.

This paper examines the wage dynamics in Japan during its overall deflationary period from the late 1990s to the late 2010s and how it has been changing in recent years. The paper confirms the findings in our earlier paper (Hoshi and Kashyap 2021) that the wages, especially those for fulltime workers, became less responsive to the labor market conditions starting in the late 1990s. At the same time, price inflation became less responsive to wage inflation.

Hoshi and Kashyap (2021) identified two main factors that led to the “disconnect” between wages and labor market condition. First, following the banking crisis in the late 1990s, many Japanese corporations started to hoard many fulltime workers that they found excessive. This made the fulltime wages stagnant even when the labor market were tight. Second, at the same time, many corporations started to hire more part-time workers, whose wages are much lower than those for fulltime workers. This applied downward pressure on the average wages regardless the labor market condition.

This paper finds that both of these factors were disappearing in the late 2010s. The number

of corporations that reportedly have excessive fulltime workers declined and stayed low even during the COVID-19 recession. The proportion of part-time workers also stopped rising and got stabilized. Reflecting these changes, the average wage has started to respond to labor market conditions again, and the "disconnect" seems to have disappeared.

The rest of the paper is organized as follows. Section 2 introduces the wages and other data used for this study. Section 3 examines the wage response to labor market conditions measured by the unemployment rate and how it changed over time. Section 4 looks at the relation between wage inflation and price inflation. Section 5 concludes.

2. Data

The source of wage data is the *Monthly Labour Survey* conducted by the Ministry of Health, Labour and Welfare (MHLW). Several time series datasets are available for download at the website of the Statistics Bureau of Japan: https://www.e-stat.go.jp/stat-search/files?page=1&toukei=00450071&tstat=000001011791. We use average number for enterprises with 30 or more employees for all industries.

We consider two wage series for two distinct components of earnings for a worker: salaries (including compensation for overtime) and bonuses. Both wage series are calculated by dividing the amount of earnings by the number of hours worked. As the earnings for salary wage series, we use the "contracted salary," which includes overtime pay but does not include bonuses. This earning series is divided by the total number of hours worked, which includes overtime. We aggregate monthly series into quarterly/annual series before calculating the wage series by taking average. To make the series comparable over time, we use the index series rather than the raw data series. When we want to look at the level of hourly wage in terms of yen, we convert the index series into yen series using the raw number for December 2018.

For the bonus wage series, we divide bonus payments received in the last twelve months by the total number of hours worked during the twelve months. We add up the bonus payments over the last twelve months because the bonuses are usually paid only twice a year: typically once in June or July and then in December. For the bonus payments, the data available at the Statistics Bureau of Japan do not include the index series. So we use the raw data series, and then convert the bonus wage series into index by normalizing its value at 2020Q4 to be 100.[1]

[1] The data set downloaded and used in Hoshi and Kashyap (2021) included the index series for bonus payments. We have checked the correlation between the raw (yen) number and the index for bonus payments using the old data set that we used for Hoshi and Kashyap (2021) and found the two series are almost perfectly correlated.

Throughout the analysis, we measure wage inflation by taking the four-quarter change in the natural logarithm of the wage or bonus index series. After 1994, the data are available for fulltime workers and part-time workers separately. The average wage and bonus series are also constructed for each of the two types of workers.

The measure of the labor market conditions is the unemployment rate. The seasonally adjusted data is downloaded from the CEIC Data (https://www.ceicdata.com/en).

For the price inflation indicator, we use the Consumer Price Index (CPI) for "all goods excluding food (except alcoholic drinks) and energy" constructed by the Statistics Bureau of Japan (available at: https://www.e-stat.go.jp/stat-search?page=1&toukei=00200573&bunya_l=07). To remove the mechanical impacts of consumption tax changes on CPI, we adjusted the CPI series in the following way. First, we calculate the twelve-month change in the CPI and note the change jumps up for the month when the consumption tax rate was increased and jumps down 12 month after the consumption tax increase. Then, we calculate the average size of the two jumps and add that to all the index values before the consumption tax increase. For example, the average size of the jumps for the consumption tax increase in October 2019 was 0.15 (for the CPI with the base-year 2020), which will be added to all the index values for and before September 2019. Similarly, the impact of the consumption tax increase in April 2014 is estimated to be 1.65. Thus, 1.80 (0.15+1.65) is added to all the index values for and before March 2014. We also measure the price inflation by taking the four-quarter log-difference of the adjusted CPI index.

Figure 1 shows the price and two types of wage series from 1980 to 2023 at annual frequency. For both price and salary wage series, we can identify three distinct phases. Before around 1998, both series showed upward trends. After 1998, both series stopped rising and stayed flat until the mid-2010s. Then, recently both series started to rise again. The bonus series also show a similar pattern, but its rise before 1998 and the decline after that are more pronounced than the other two series. Recently, the bonus series also show the upward trend.

Wages and bonuses can be calculated separately for fulltime workers and part-time workers for the years after 1994. Figure 2 shows the movements of the level of salary wages for different types of workers. The figure shows the level of wages in yen so that we can compare the levels of different wages. The wage level of part-time workers are measured on the right axis, while the level for fulltime workers as well as the average level for all workers are measured on the left axis. Comparing the two vertical axes, we can immediately see the wage level for part-time workers is much lower than that for fulltime workers. The figure also shows that the stagnant wages between 1998 and the mid-2010s were due to the stagnation of wages for fulltime workers. For part-time

workers, the wage level rose gradually through the entire sample period.

Figure 3 shows the level of bonuses for different types of workers. The bonus level of fulltime workers and the average for workers are measured on the left axis, and the level for part-time workers are measured on the right axis. Comparing with Figure 2a, we see that bonuses account for roughly 20% to 35% of the contracted wage for fulltime workers. For part-time workers, bonuses are very small: roughly 5% to 10% of the contracted wage, which is already much smaller than that for fulltime workers. For both fulltime workers and part-time workers, the movement of bonus (per hour) over time is similar. The bonus declined between 1998 and the mid-2010s, when the wages for fulltime workers stagnated. After the mid-2010s, bonuses for both types of workers started to rise, but they are at levels still lower than those in the late 1990s.

Figure 4 shows a simple scatterplot of salary wage inflation against the unemployment rate (seasonally adjusted) for three sub-periods: 1981-1997, 1998-2018, and 2019-2023. The line is the simple regression line for each sub-period. Here the quarterly data are used. The figure shows that the relation between wage inflation and the unemployment rate became weaker during the period 1998-2018. Recently, the relation seems to have been restored. We will examine the relation between wage and the unemployment rate more in details later.

Figure 5 shows a similar plot replacing salary wage inflation with bonus inflation. The relation between bonus wage inflation and the unemployment rate also became somewhat weaker, but the difference is very small. Recently, the slope seems to have become even larger than the first sub-period. We will examine this relation in details later, too.

When we look at the changes in the relation between wage inflation and price inflation over the three sub-periods, we also find the relation was somewhat weak during 1998-2018. Figure 6 shows such a scatterplot. We do not find, however, that the relation has been restored, yet. Figure 7 shows a similar plot for bonus inflation and price inflation. Here we find the relation became a lot weaker during 1998-2018 and got stronger again recently.

3. Wage Dynamics and the Labor Market

This section studies the relation between labor market condition and wage inflation and how it changed over time. Here we follow our approach in Hoshi and Kashyap (2021) and start by estimating an ARMAX model for wage inflation with a measure of labor market tightness for each sub-period. As the ARMA part of the model, we found AR(2) model is a good fit for the wage inflation series and AR(1) model is suitable for the bonus inflation series for the 1981-1997 period.

Table 1 reports the result of estimating the model for the salary wage inflation during three sub-periods: 1981-1997, 1998-2018, and 2019-2023. As the measure for labor market tightness, we use the unemployment rate (seasonally adjusted). Looking at the coefficient estimate on the lagged unemployment rate, we confirm that the relation between wage inflation and labor market tightness changed around 1997.[2] The wage inflation became less responsive to the unemployment rate. The result is consistent with the finding of flattening of the wage Phillips curve by some studies including Muto and Shintani (2020). The last column of Table 1 reports the estimation results of the same model for the sample period from 2019Q1 to 2023Q4. The fit of the model is not good, but the coefficient estimate on the unemployment rate is fairly accurate. The coefficient estimate suggests that wage inflation may have again started to respond to the labor market condition.

Table 2 shows the result of a similar analysis using the bonus inflation instead of the salary wage inflation. The point estimate suggests that the bonus showed the tendency to go down when the unemployment rate rose during the 1981-1997 period, but it is not statistically significant. During the 1998-2018 period, the bonuses became *more* responsive to the labor market condition, and the result is statistically significant. This is quite a contrast to the results for the salary wage inflation in Table 1. The last column of Table 2 shows the result for 2019-2023 period. The bonus continues to be responsive to the labor market condition, although the coefficient is not statistically significant at the conventional level.

In Hoshi and Kashyap (2021), we identified two reasons why the average wage inflation stopped responding to the labor market conditions around 1998. First, many corporations started to hoard excessive number of fulltime workers after the banking crisis. Second, many corporations started to increase the reliance of part-time workers, whose wage levels are much lower than those for fulltime workers. The hypothesis focuses on the dual labor markets for fulltime/regular and part-time/non-regular jobs/workers in Japan. Several chapters in Genda (2017), which asks a similar question of why the wages for Japanese workers did not go up in the mid-2010s despite the tight labor market, also stress the importance of the dual market.

Figure 8 shows the proportion of corporations that report having excessive workers. The data come from *Survey of Labour Economy Trend* conducted by the Ministry of Health, Labour, and

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[2] The specification is exactly the same as that in Table 7.2 Panel A of Hoshi and Kashyap (2021), but the coefficient estimates are not numerically the same. It is because the wage data are slightly different. In Hoshi and Kashyap (2021), we estimated the values for some series in some years that were revealed in 2019 to have been miscalculated by the MHLW. After the miscalculation incident, the MHLW recalculated the affected series and published the corrected series for the entire period. This paper uses the corrected series. Although the coefficient estimates are not exactly the same, they are very close and does not change the results obtained in Hoshi and Kashyap in any significant way.

Welfare in February, May, August, and November of each year. The data are available at: https://www.e-stat.go.jp/stat-search/files?page=1&toukei=00450072&tstat=000001018522. Panel A shows the series for two types of workers: *jyōyō rōdōsha* (ordinary workers) and *sei-shain* (regular workers). Ordinary workers exclude temporary workers but include many part-time workers, while the regular workers are almost always fulltime workers. Thus, we should look at the series for regular workers in order to examine the excessiveness of fulltime workers, but the series is available only after 2008. Panel A shows, however, these two series have been almost identical when both series are available. Thus, we can safely assume the series for ordinary workers captures the magnitude of excess fulltime workers. The figure shows the excess is clearly cyclical. The excess employment of fulltime workers jumped in 1998 following the most acute phase of the Japanese banking crisis and was very slow to decline. In the moment after it came down to the pre-crisis level, the excess employment jumped again surely as a result of the global financial crisis. We argue that the prolonged excess employment of fulltime workers after 1998 made their wages less responsive to the labor market condition. The excess employment increased slightly again during the COVID-19 crisis but the size of increase was very small.

The survey also asks about excessiveness or shortage of part-time workers specifically. Panel B of Figure 8 plots the difference between the proportion of corporations that report excessive ordinary workers and that of corporations that report excessive part-time workers. The time series pattern is quite similar to the figure in Panel A, suggesting the prolonged excess of workers mostly came from fulltime workers. Interesting, the difference did not rise during the COVID-19 crisis.

As Figure 2 shows, the wage level for part-time workers is much lower than that for fulltime workers. Thus, increasing proportion of part-time workers tend to dampen wage inflation regardless the labor market condition. Figure 9 shows the annual average of the proportion of part-time workers reported in the *Monthly Labour Survey*. The proportion started to increase especially after 1998 until it was stabilized around the mid-2010s.

To further investigate the hypothesis that the change around 1998 in the relation between wage inflation and labor market condition came from increased excess fulltime employment, we repeat the analysis in Tables 1 and 2 separately for fulltime workers and part-time workers. Since the wage and bonus series for fulltime workers and part-time workers separately are available only after 1994, we estimate the regressions only for two sub-periods: 1998-2018 and 2019-2023.

The results for salary wage inflation are reported in Table 3. Those for bonus inflation are in Table 4. Again we use the unemployment to measure the labor market condition. For the sample period of 1998 to 2018, we find the fulltime wage responded less than the part-time wage. The model fit is also poorer for the fulltime wage inflation. Thus, we confirm the findings in Hoshi and Kashyap

(2021). It is likely that the prolonging excess fulltime employment after the banking crisis disconnected the wage dynamics of fulltime employees from the labor market condition after 1998. Although part-time wage inflation continued to respond to the labor market condition after 1998, the level of part-time wages was much lower than fulltime wages. Combined with the increasing proportion of part-time workers that proceeded after 1998, the trend created the situation where the average wage does not rise even when the labor market was very tight in the mid-2010s.[3]

As Figure 8 shows, the excess fulltime employment disappeared by the mid-2010s. The proportion of part-time workers also stopped rising by late 2010s. With these two factors gone, wage inflation may have now restored its responsiveness to labor market conditions. To examine this possibility, the last columns of Table 3 estimates the ARMAX model for the most recent period. Although the model is not estimated reliably, there is a suggestive evidence that the connection between fulltime wages and the labor market condition is being restored. The coefficient on the lagged unemployment rate for fulltime wage inflation is now much larger and statistically significant.

Table 4 repeats the same analysis for bonus inflation. For the 1998-2018 period, we find the responsiveness of the bonuses for the fulltime workers to the unemployment rate was as large as that for the part-time workers. For the most recent period, the bonuses for fulltime workers continued to respond to the labor market tightness, but the bonuses for part-time workers seem to have stopped responding. We should note, however, bonuses are very small part of the compensations for part-time workers, representing only 5% to 10% of total earnings.

4. Wage Inflation and Price Inflation

Hoshi and Kashyap (2021) found a disconnection also between wage inflation and price inflation. This section confirms that disconnect and examines if there is any sign that the relation is now restored.

To examine the relation between wage inflation and price inflation, we estimate a simple VAR (Vector Auto-Regression) system that consists of the price inflation series, the wage inflation series, and the bonus inflation series. The number of lags in the system is assumed to be four. We also include the time trend as an exogenous variable to the system. We focus on three standard diagnostics of a VAR system: Granger causality tests, impulse response functions, and variance

[3] The problem was studied by many Japanese economists. An important study that collects several attempts to explain what happened is Genda (2017).

decompositions. In calculating impulse responses and variance decompositions, we ordered price inflation first, wage inflation second, and bonus inflation last, and applied a standard Cholesky decomposition.

Panel A of Table 5 reports the result of Granger causality test for wage inflation and bonus inflation to cause price inflation from 1981 to 1997. During this period, both wage inflation and bonus inflation help predicting price inflation significantly. The impulse response functions of price inflation are in Figure 10. The solid line shows the estimated mean response at each quarter, and the shaded areas show 95 percent confidence intervals. A shock to the wage inflation rate is estimated to have positive impacts on price inflation. The impact is statistically significant after three quarters up to 8 quarters. A shock to the bonus inflation rate also has positive influence on price inflation. The impact is statistically significant from 3rd quarter to 5th quarter. Panel B of Table 5 shows the decomposition of the variance of price inflation. By 10th quarter, more than a half of the variance of price inflation is explained by wage inflation (35%) and bonus inflation (19%). Overall, the results in Table 5 and Figure 10 provides an evidence that wage inflation and bonus inflation both influenced price inflation before 1997.

After 1997, the linkage between wage inflation and price inflation disappeared. Table 6 and Figure 11 show the results of estimating the VAR system with same specification for 1998Q1-2018Q4 period. The Granger causality test in Panel A of Table 6 shows that neither wage inflation or bonus inflation does not predict price inflation. The impulse responses of price inflation to wage inflation and bonus inflation reported in Figure 8 are not significantly different from zero at every quarter. Consistent with these, Panel B of Table 6 shows that more than 96% of the variance of price inflation is explained by its own dynamics even at quarter 10. Wage inflation and bond inflation did not matter for price inflation during this period.

Table 7 and Figure 12 show the results of estimating the same VAR system for the recent period from 2019Q1 to 2023Q4. The Granger causality test in Panel A of Table 7 suggests that wage inflation again predicts price inflation but bonus inflation does not. The variance decomposition in Panel B shows wage inflation together with bonus inflation about a quarter of the variation of price inflation at quarter 10. The impulse response of price inflation to wage inflation in Figure12 shows, however, the magnitudes of impacts of wage inflation and bonus inflation to price inflation is small and statistically insignificant. We may need more observations from this regime to get a clear idea of what is happening.

Another approach that we used in Hoshi and Kashyap (2021) to examine how the connection between price inflation and wage inflation changed overtime uses a simple unobserved components model. We update the analysis to see if we can find some sign of change during the

recent period. We start by estimating the following simple unobserved components model for each of price inflation, wage inflation and bonus inflation:

$$y_t = \mu_t + \sigma^y \varepsilon_t$$
$$\mu_t = \mu_{t-1} + \sigma^y \nu_t$$

where y is the series (price inflation or wage inflation), μ is the unobserved trend, and ε and ν are identical and independently distributed normal random variables with mean zero and variance one. Note that σ^y enters both equations. This means that we are imposing that the variances of noises in the signal equation and the state equation are the same.

Then, we calculate the correlations between the estimated state variable (μ) for price inflation and wage (or bonus) inflation for rolling windows of twenty-five quarters. The result is shown in Figure 13. Here each point shows the correlation computed from twenty five observations centered on that date. For example, the y-axis value for 2010Q1 is the correlation calculated over [2007Q1, 2013Q1].

Figure shows that the correlation between price inflation and wage inflation was quite high (above 0.8) and stable between the late 1980s and 2000. After 2000, which is the point pre-1997 observations move out of the rolling window, the correlation fell and stayed low. The correlation between price inflation and bonus inflation followed a similar pattern, although the timing of the declined correlation happened somewhat earlier (late 1990s). We observe the correlation is picking up during the recent period, especially for bonus inflation. The last observation is the correlation calculated over [2017q4, 2023q4], so we may need more observations before we see definite changes.

Recent paper by Ueno (2024) also examines the linkage between price inflation and wage inflation in Japan using a similar but somewhat more sophisticated approach that can examine disaggregated wages and prices by industry simultaneously. Examining the common trends of 17 industry level price inflation rates and 15 industry level wage inflation rates, he makes similar findings. The linkage between wage inflation and price inflation was disrupted after 1998, but recently the connection has been recovering.

5. Conclusions

This paper has examined if the wage dynamics, which was disconnected from labor market condition from the late 1990s to the late 2010s, is regaining the relation to labor market tightness. The paper finds the main factors responsible for the disconnection identified by Hoshi and Kashyap (2021)

have changed in recent years. The excess fulltime employment disappeared and the proportion of part-time workers stopped rising. Both of changes happened around the mid-2010s. The investigation of wage inflation and labor market condition using the recent observations after 2018 reveals some evidence that the connection is being restored. We also find the disconnection between wage inflation and price inflation is also reappearing, but the result is not very strong. We need further research and more observations to get a clearer picture.

Table 1. ARMAX Models for Wage Inflation (for all workers) with labor market condition

	Sample: 1981-1997		Sample: 1998-2018		Sample: 2019-2023	
Variable	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Constant	0.1071	0.0136	0.0276	0.0080	0.0988	0.0369
AR(1)	0.2917	0.1130	0.0790	0.1036	-0.2809	0.3292
AR(2)	0.2563	0.1351	0.1894	0.1206	-0.0272	0.5447
Lagged UNEMP	-0.0273	0.0050	-0.0060	0.0018	-0.0326	0.0139
R^2	0.75		0.26		0.28	

Table 2. ARMAX Models for Bonus Inflation (for all workers) with labor market condition

	Sample: 1981-1997		Sample: 1998-2018		Sample: 2019-2023	
Variable	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Constant	0.0736	0.0509	0.1351	0.0426	0.1066	0.0746
AR(1)	0.8628	0.0819	0.7855	0.0796	0.7821	0.1604
Lagged UNEMP	-0.0137	0.0200	-0.0348	0.0091	-0.0347	0.0281
R^2	0.78		0.74		0.74	

Table 3. ARMAX Models for Wage Inflation with labor market condition: Fulltime vs. Part-time Workers

	Sample: 1998-2018				Sample: 2019-2023			
	Fulltime workers		Part-time workers		Fulltime workers		Part-time workers	
Variable	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Constant	0.0205	0.0083	0.0491	0.0105	0.1057	0.0267	0.1014	0.0848
AR(1)	0.0390	0.1063	0.4243	0.0833	-0.3201	0.3161	0.0554	0.5889
AR(2)	0.2327	0.1270	0.1563	0.1415	-0.0467	0.4336	-0.0656	0.6450
Lagged Unemp	-0.0041	0.0019	-0.0091	0.0025	-0.0359	0.0100	-0.0293	0.0320
R^2	0.13		0.57		0.35		0.18	

Table 4. ARMAX Models for Bonus Inflation with labor market condition: Fulltime vs. Part-time Workers

	Sample: 1998-2018				Sample: 2019-2023			
	Fulltime workers		Part-time workers		Fulltime workers		Part-time workers	
Variable	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.	Coef.	Std. err.
Constant	0.1226	0.0385	0.1117	0.0595	0.1382	0.0701	-0.7470	0.1990
AR(1)	0.7843	0.0794	0.6787	0.1051	0.7885	0.1590	0.7304	0.2027
Lagged Unemp	-0.0308	0.0083	-0.0343	0.0132	-0.0474	0.0257	0.3024	0.0776
R^2	0.73		0.61		0.77		0.77	

Table 5. VAR System with Price Inflation, Wage Inflation, and Bonus Inflation: 1981Q1 – 1997Q4

Panel A. Granger Causality from Wage Inflation to Price Inflation Included observations: 64			
Excluded	Chi-sq	Degree of freedom	Probability
Wage Inflation	9.8304	4	0.0434
Bonus Inflation	15.2791	4	0.0042
All	25.8199	8	0.0011

Panel B. Variance Decomposition of Price Inflation:			
Quarter	Price Inflation	Wage Inflation	Bonus Inflation
1	100.00%	0.00%	0.00%
2	97.15%	0.40%	2.45%
3	84.52%	9.08%	6.40%
4	74.68%	10.53%	14.79%
5	65.00%	18.09%	16.92%
6	58.85%	23.59%	17.56%
7	54.47%	27.19%	18.34%
8	50.52%	31.37%	18.11%
9	48.36%	33.45%	18.20%
10	46.94%	34.55%	18.51%

Table 6. VAR System with Price Inflation, Wage Inflation, and Bonus Inflation: 1998Q1 – 2018Q4

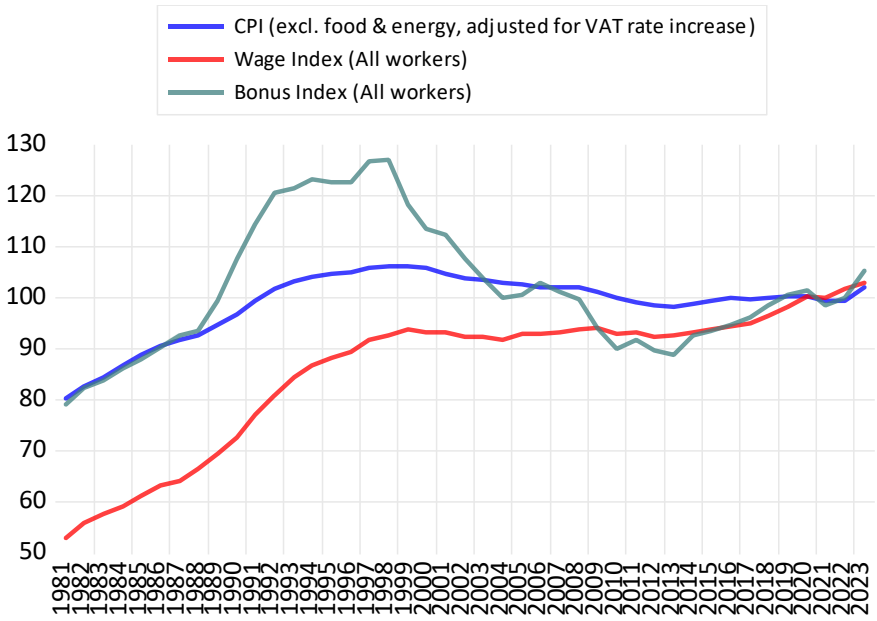
Panel A. Granger Causality from Wage Inflation to Price Inflation Included observations: 84			
Excluded	Chi-sq	Degree of freedom	Probability
Wage Inflation	2.7299	4	0.6040
Bonus Inflation	2.5476	4	0.6361
All	4.7608	8	0.7828

Panel B. Variance Decomposition of Price Inflation:			
Quarter	Price Inflation	Wage Inflation	Bonus Inflation
1	100.00%	0.00%	0.00%
2	98.95%	0.84%	0.21%
3	98.90%	0.89%	0.21%
4	98.94%	0.87%	0.19%
5	98.99%	0.79%	0.22%
6	98.70%	0.87%	0.43%
7	98.14%	1.08%	0.78%
8	97.49%	1.27%	1.24%
9	97.04%	1.33%	1.63%
10	96.77%	1.35%	1.88%

Table 7. VAR System with Price Inflation, Wage Inflation, and Bonus Inflation: 2019Q1 – 2023Q4

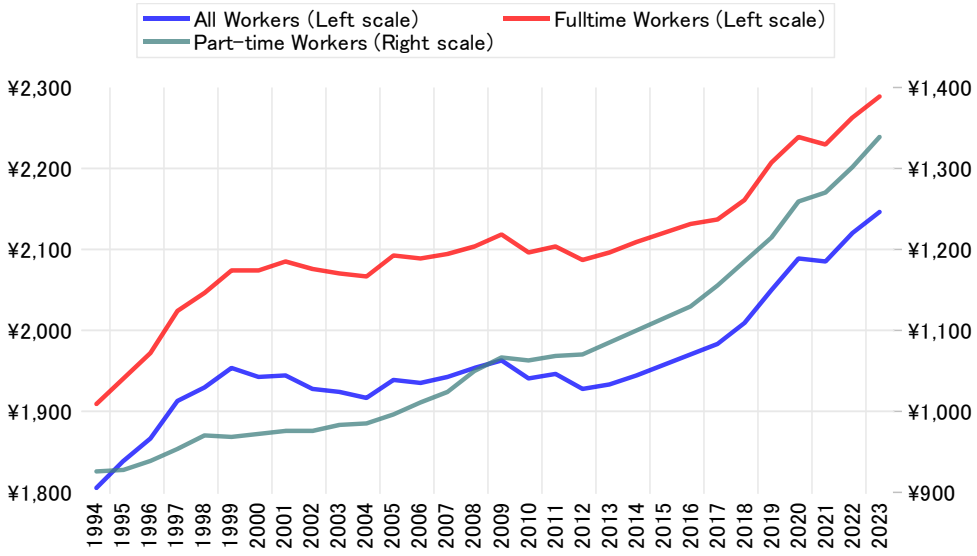
Panel A. Granger Causality from Wage Inflation to Price Inflation			
Included observations: 20			
Excluded	Chi-sq	Degree of freedom	Probability
Wage Inflation	9.1495	4	0.0575
Bonus Inflation	5.0784	4	0.2793
All	51.4850	8	0.0000
Panel B. Variance Decomposition of Price Inflation:			
Quarter	Price Inflation	Wage Inflation	Bonus Inflation
1	100.00%	0.00%	0.00%
2	95.08%	3.32%	1.60%
3	94.86%	2.94%	2.20%
4	91.93%	5.36%	2.72%
5	78.39%	16.59%	5.01%
6	80.06%	10.87%	9.07%
7	78.55%	10.96%	10.49%
8	67.68%	23.34%	8.98%
9	60.35%	22.04%	17.62%
10	74.80%	11.67%	13.52%

Figure 1. Japanese Price, Wage and Bonus Levels: 1980-2023



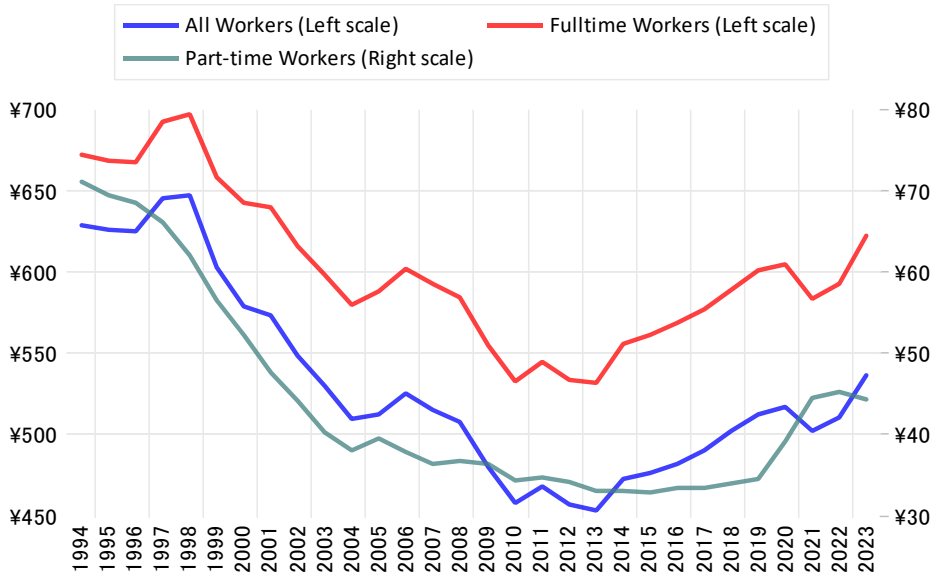
Source: Authors' calculation based on *Consumer Price Index* (Statistics Bureau of Japan) and *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 2. Wages for Fulltime Workers and Part-time Workers: 1994-2023



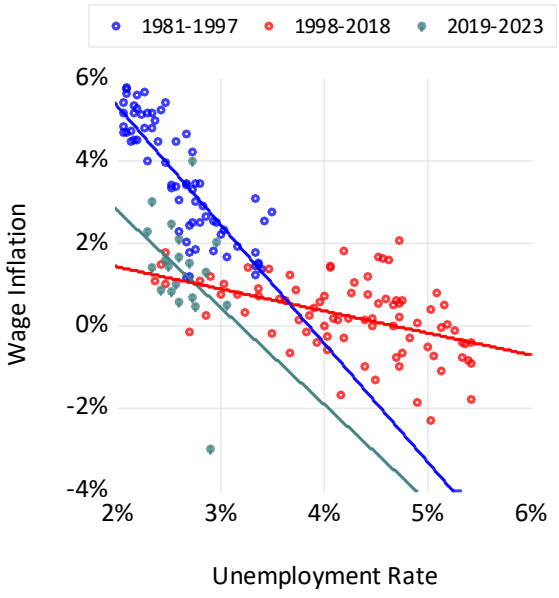
Source: Authors' calculation based on *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 3. Bonuses for Fulltime Workers and Part-time Workers: 1994-2024



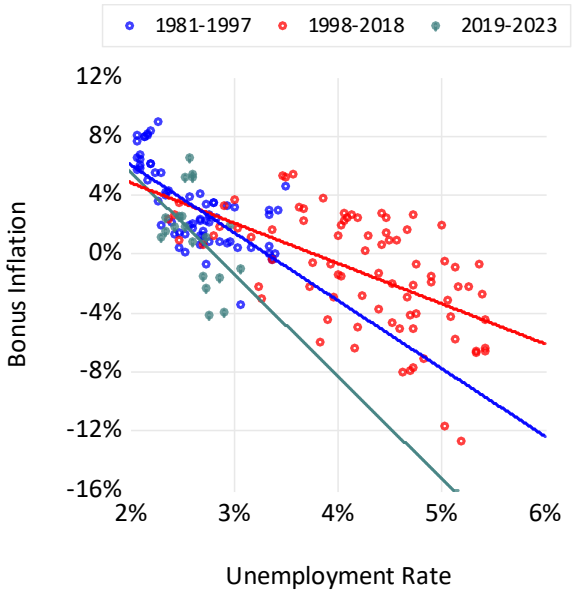
Source: Authors' calculation based on *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 4. Unemployment Rate and Wage Inflation



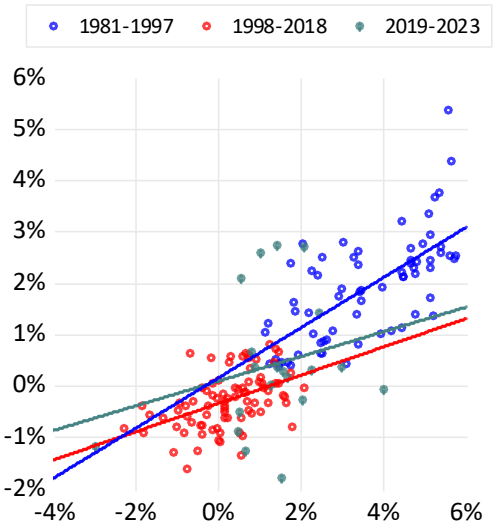
Source: Authors' calculation based on *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 5. Unemployment Rate and Bonus Inflation



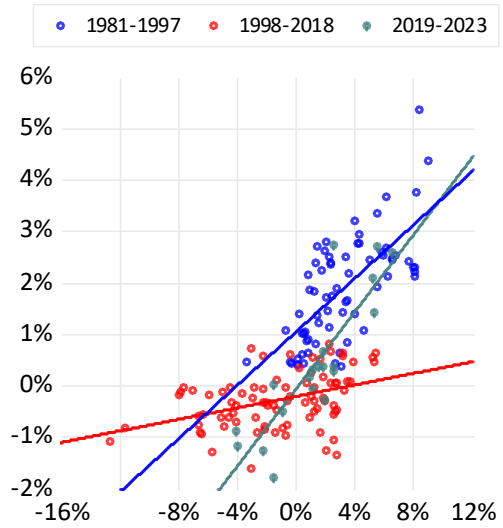
Source: Authors' calculation based on *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 6. Wage Inflation and Price Inflation



Source: Authors' calculation based on *Consumer Price Index* (Statistics Bureau of Japan) and *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

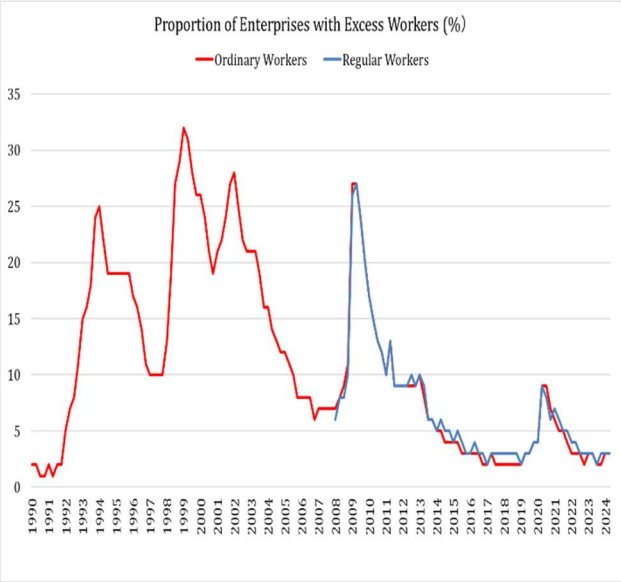
Figure 7. Bonus Inflation and Price Inflation

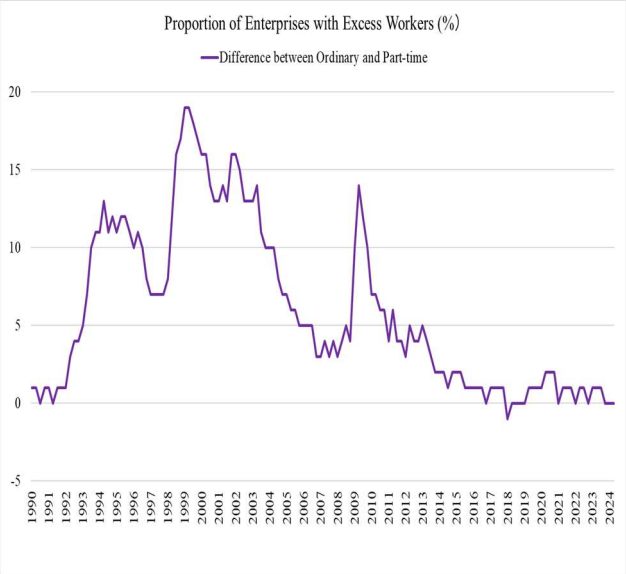


Source: Authors' calculation based on *Consumer Price Index* (Statistics Bureau of Japan) and *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 8. Proportion of Firms that Report Excess Workers

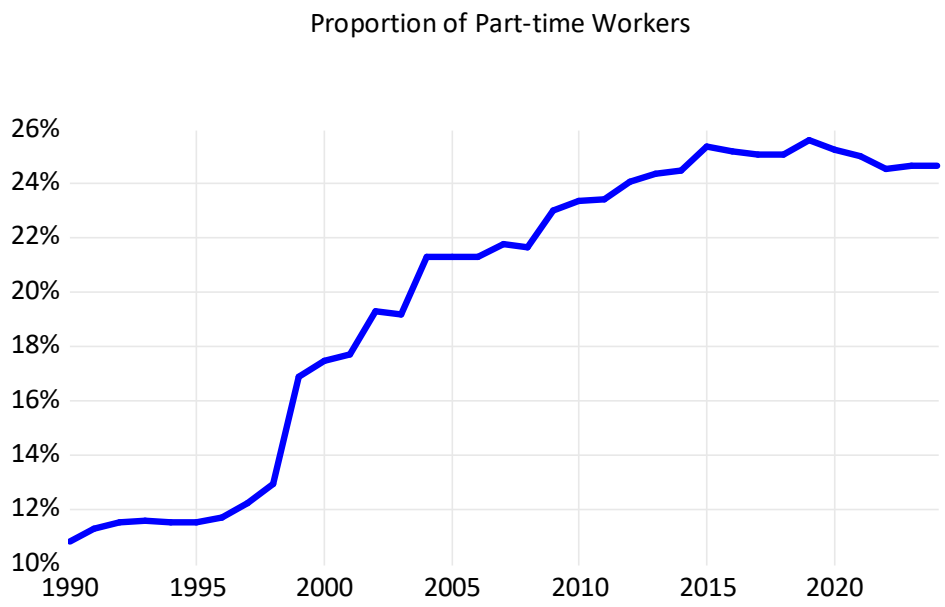
Panel A. Ordinary and Regular **Panel B. Ordinary minus Part-time**





Source: *Survey of Labour Economy Trend* (Ministry of Health, Labour and Welfare)

Figure 9. Proportion of Part-time Workers: 1990-2024



Source: *Monthly Labour Survey* (Ministry of Health, Labour and Welfare)

Figure 10. Impulse Response of Price Inflation to Cholesky One Standard Deviation Innovation: 1981Q1-1997Q4

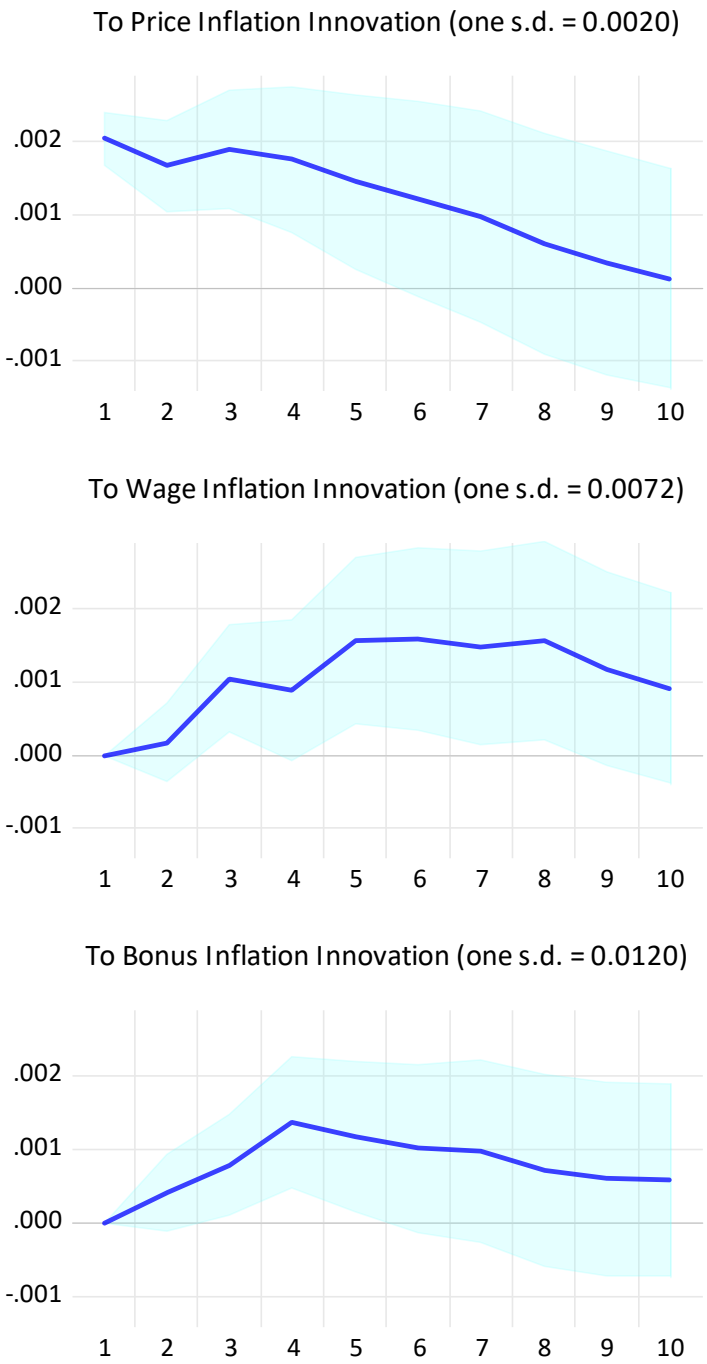


Figure 11. Impulse Response of Price Inflation to Cholesky One Standard Deviation Innovation: 1998Q1-2018Q4

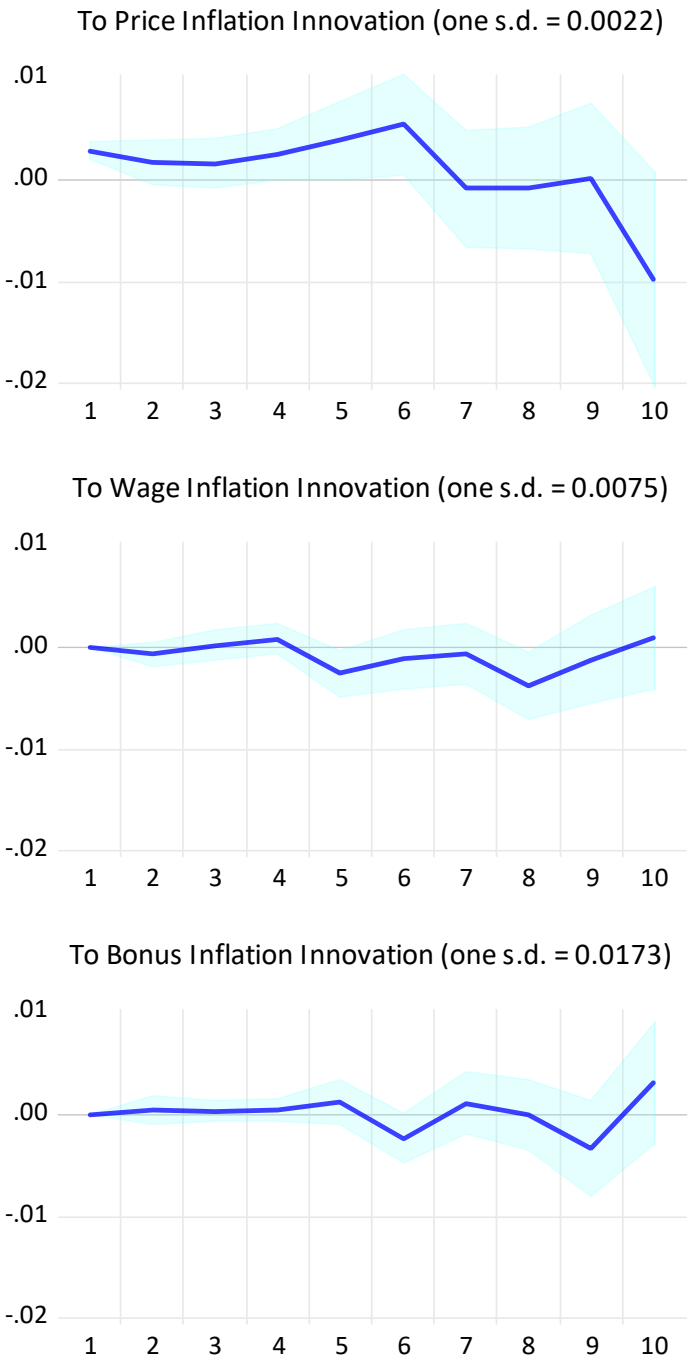


Figure 12. Impulse Response of Price Inflation to Cholesky One Standard Deviation Innovation: 2019Q1-2023Q4

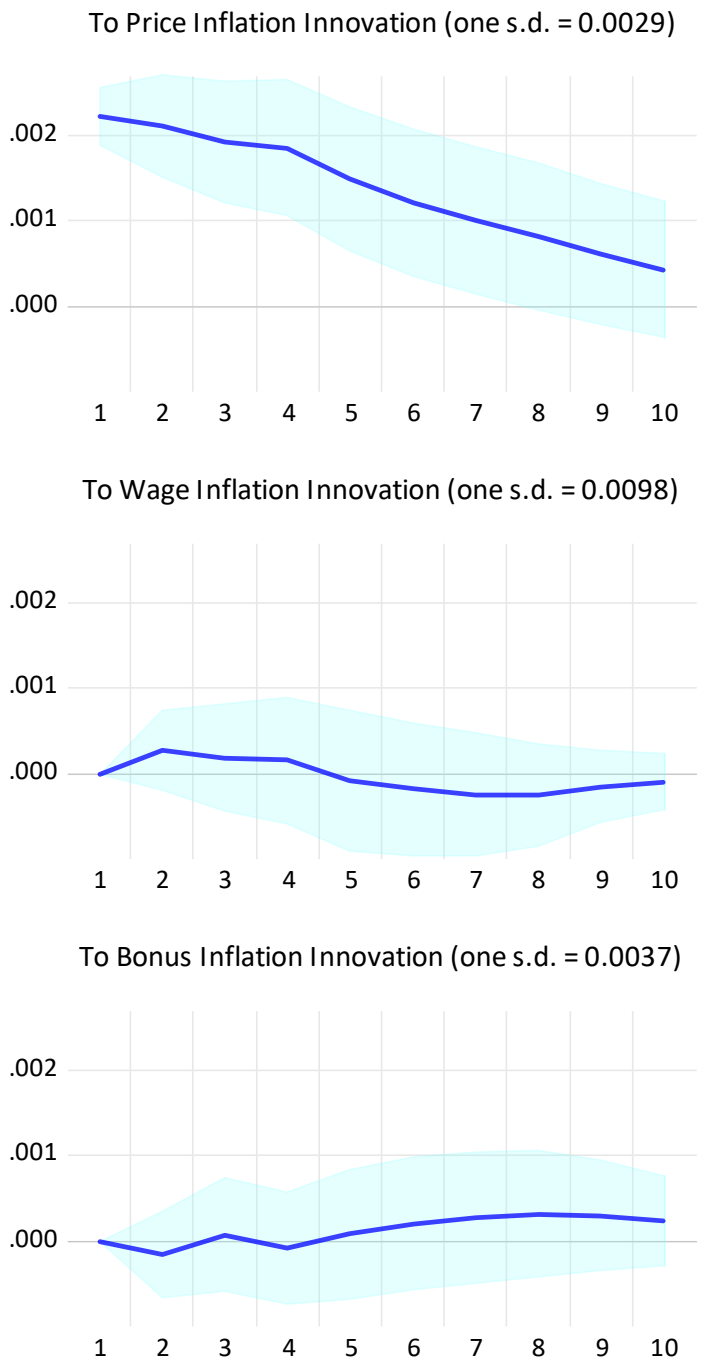
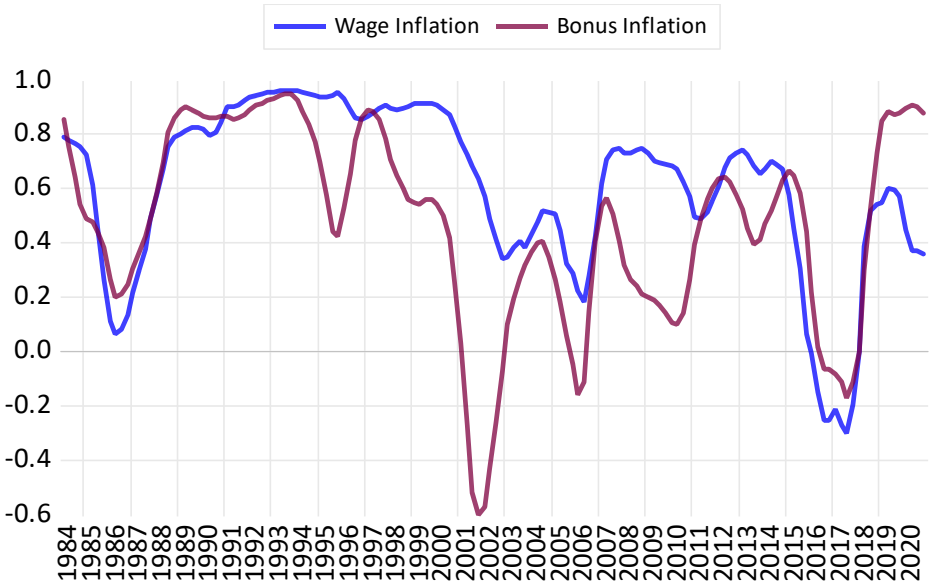


Figure 13. Correlation between Unobserved Trends for Price Inflation and Wage Inflation



Source: Author's estimation

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