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Abstract

This paper investigates the change in the adjustment mechanism of Japan's labor market before and after the collapse of bubble economy around early 1990s. Comparison of Phillips curves among industrialized countries shows that Japan's Phillips curve has become much flatter in the 1990s. The steeper Phillips curve before the 1990s would be attributable to nominal wage flexibility reflecting flexible bonus payments or annual spring wage negotiations, slow employment adjustment, and the large discouraged worker effects. On the other hand, the flatter Phillips curve after 1990s and onward would be attributable to the existence of downward nominal wage rigidity under the low and negative inflation rate as well as a decline in discouraged worker effects. Therefore, it is concluded that while slow employment adjustment mechanism did not change so much, fast wage adjustment mechanism deteriorated to some extent due to downward nominal wage rigidity in the 1990s, and also flexible labor supply adjustment such as discouraged worker effects got smaller in the 1990s. We also explore the reasons for a persistent rise in Japan's unemployment rate after collapse of bubble economy, emphasizing a lack of nominal shock absorption due to downward rigidity in nominal wages that created unemployment, slow employment adjustment mechanism that prevented the employment from recovering, and weak discouraged worker effects that kept unemployment rate high.

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Keywords: Phillps curve; Unemployment; Labor market flexibility; Discouraged worker effect.
JEL classification: J30, J60

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1. Introduction

It is said that Japan's labor market was highly flexible and showed good performance from international perspectives before the 1990s. In the 1980s, while United States and European countries suffered from a high unemployment rate at around 10 percent, Japan in fact experienced a stable and extremely low unemployment rate at around 2 percent. However, with the collapse of the bubble economy, Japan's unemployment rate started gradually rising around 1992 and exceeded 5 percent in the 2000s. As unemployment rates in other industrialized countries have been falling in the same period, Japan even experienced a higher unemployment rate than the United States and the United Kingdom.

The question is why Japan experienced a persistent rise in the unemployment rate from the 1990s. If Japan's labor market were indeed flexible, the adjustment mechanism would have worked to avoid a persistent rise in unemployment rate. Did Japan's unemployment rate rise in the 1990s because the adjustment mechanism of labor market deteriorated due to the collapse of the bubble economy? Or, is it because Japan's labor market was indeed not so much flexible to be able to address a huge shock such as the collapse of the bubble economy? To answer these questions, this paper will discuss the nature of adjustment mechanism of Japan's labor market before and after the collapse of bubble economy, based on past research findings.

Adjustment mechanism in labor market can be summarized by wage adjustment and employment adjustment, which are illustrated by the Phillips curve with wage change as the vertical axis and unemployment rate as the horizontal axis. This paper will thus begin by looking at Phillips curves in several industrialized countries, and confirm that the Phillips curve in Japan dramatically flattened after collapse of the bubble economy. We then discuss why Japan saw a steeper Phillips curve until the 1980s, by focusing on the flexibility of the nominal wages and the discourage workers effects at that time. Next, we will examine the reason why the Phillips curve flattened in the 1990s. To identify possible factors, we will use New Keynesian Phillips curve. Since the New Keynesian Phillips curve has micro foundation, we will be able to theoretically sort out and discuss the reasons why the observed Phillips curve flattened. Specifically, we will focus on five possible theoretical factors: existence of downward nominal wage rigidity; rise in Frisch labor supply elasticity; increase in employment adjustment cost; decline in discouraged worker effects; and increase in other real rigidities in the

labor market.

Based on past research findings, we will discuss how much these theoretical possibilities were feasible to the Japanese economy in the 1990s or later. We investigate whether or not wage adjustment has been getting slower due to the existence of downward nominal wage rigidity; whether labor supply has been getting more sensitive to temporary wage changes; whether the nature of employment adjustment has changed due to the development of non-regular workers; whether the discouraged worker effect becomes weaker due to the later-marriage and non-marriage tendency for females; and whether unemployment due to mismatches has been increasing. Then, we will also briefly discuss what would bring about a persistent rise in unemployment rate in Japan since the 1990s.

The summary of this paper is as follows. First, when looking at Phillips curves of industrialized countries, Japan had, unlike others, an almost vertical Phillips curve in the 1980s. However, Japan has come to face a flatter Phillips curve since the 1990s after collapse of the bubble economy. Second, Japan's Phillips curve in the 1980s was steeper possibly because of the flexible nominal wage adjustment through bonus payments and spring wage negotiations ("shunto"); slow employment adjustment; and discouraged worker effects among married female workers. Third, from the New Keynesian Phillips curve incorporating labor market real frictions, five possible factors attributable to the flatter Phillips curve are derived: existence of downward nominal wage rigidity; rise in Frisch labor supply elasticity; increase in employment adjustment cost; decline in discouraged worker effects; and increase in other real rigidities in the labor market. Fourth, judging from past research findings, two of these possible factors are reasonably feasible for Japan's labor market in the 1990s: existence of downward nominal wage rigidity and a decline in discouraged worker effects. Therefore, it is concluded that while employment adjustment mechanism did not change so much, wage adjustment mechanism deteriorated to some extent due to downward nominal wage rigidity in the 1990s, and also labor supply adjustment such as discouraged worker effects got smaller. Fifth, as the reasons for a persistent rise in Japan's unemployment rate after collapse of bubble economy, we could derive a lack of nominal shock absorption due to downward rigidity in nominal wages that created unemployment, slow employment adjustment mechanism that prevented the employment from recovering, and weak discouraged worker effects that kept unemployment rate high.

The rest of paper is organized as follows: in Section 2 we observe Phillips curves of industrialized countries, and explain characteristics of the adjustment mechanism in Japan's labor market until the 1980s. In Section 3, we theoretically explore the possible factors that would lead to a flatter Phillips curve. In Section 4, we discuss the feasibility of each of these factors for a flatter Phillips curve in Japan's 1990s. In Section 5 we summarize the paper and explore possible reasons why Japan's unemployment rate has been rising after collapse of the bubble economy.

2. Phillips curves : Japan and other industrialized countries

(1) Before collapse of bubble economy

We first look at Phillips curves of Japan, the United States, Canada, the United Kingdom, France and Italy, with wage inflation as the vertical axis and unemployment rate as the horizontal axis. We divide the sample period into 1980-92 and 1993-2006, which we refer "before collapse of bubble economy" and "after collapse of the bubble economy," respectively. We use annual data from *Main Economic Indicators* (OECD) for hourly nominal wages (inclusive of bonus and other various allowances; manufacturing industry workers) and unemployment rates.

Figure 1 (before collapse of bubble economy) and Figure 2 (after collapse of the bubble economy) show Phillips curves of industrialized countries. As illustrated in Figure 1, Japan is totally different from the other countries in that Phillips curve is very steep at low unemployment rates.[1] Why did Japan have such a steep Phillips curve, and why did Japan experience such a low and stable unemployment rate before collapse of bubble economy?

Many economists, including Sacks (1979), Gordon (1982), and Grub, *et al*. (1983) have pointed out the fact that Japan had a steep Phillips curve. They emphasis that Japan's wage fluctuations were significantly smaller than employment fluctuations, and also that the flexible wages would result in lower unemployment rate in Japan. Furthermore, it is stated that Japan's

[1] Italy also has a steep Phillips curve, but it is different from that of Japan because the curve is steep around the high-level unemployment rates.

flexible wage fluctuation was attributable to wage adjustment through bonus payments or wage revision through annual spring wage negotiations, so called “shunto” (Freeman and Weitzman (1987), Taylor (1989), etc.).

However, the labor market’s adjustment mechanism should not simply be measured with relative size of wage/employment fluctuations (or variance and coefficient of variation). They should be measured from other perspectives, such as adjustment speed to the equilibrium. Furthermore, it is important to distinguish between nominal and real wage flexibility since they have different economic implications. In this regard, Ohtake (1988) and Nakamura (1995) derived important findings. Ohtake (1988) estimates a partial adjustment model of wage and employment for several countries, and concludes that Japan’s real wage adjustment speed was rather slower from international perspectives, and it was even slower than employment adjustment speed. Nakamura (1995) confirms Ohtake’s findings, and also estimates the adjustment speed of nominal wages, concluding that Japan had a fast adjustment speed on nominal wage, but a slow adjustment speed on real wage.[2]

Taking into consideration these findings, it is reasonable to state that Japan’s wage adjustment mechanism before collapse of the bubble economy worked well at least in nominal terms.[3] This implies that Japan’s labor market was able to mitigate a nominal shock through quick adjustment of nominal wage, although it was vulnerable to a real shock.

Many economists have also estimated employment adjustment speed by employing a partial adjustment model. As typical examples, Muramatsu (1983) and Shinozuka (1989) make cross-country analysis on employment adjustment speeds and point out that Japan at least had slower employment adjustment speed than the United States. They also emphasis that Japan’s slower employment adjustment speed was attributable to the flexible adjustment of over-time working hours, a large quasi-fixed employment cost due to firm-specific skills, and lack of dismissal rules such as seniority.

The Japanese labor market before collapse of the bubble economy is also characterized by

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[2] This research finding is consistent with Branson and Rotemberg (1980), which points out that the United States has rather rigid nominal wages, while Japan and European nations have rather rigid real wages.

[3] Since the inflation rate stays at a relatively high level before collapse of the bubble economy, there is no need to push down the nominal wage level itself. Therefore, it would be more accurate that the nominal wage hike rate (not the nominal wage level itself) was flexible in Japan at that time. That is, the nominal wage level at that time was not necessarily downward flexible.

large discouraged worker effects among married female workers. That is, married female job seekers tend to cease searching for jobs during economic recession and leave the labor force. For example, Ono (1981) confirms the presence of discouraged worker effect among female workers by examining the ratio of workers by region. Higuchi, Seike and Hayami (1987) also point out that new participants in the labor market decrease during economic recession, while more job seekers shift away from the labor market. In addition, through international comparison of Okun's coefficients, Kurosaka and Hamada (1984) indicate Japan's discouraged worker effects was much larger that other countries'. Since discouraged workers are not counted into unemployment by definition, it is understood that such effects contributed to prevent unemployment rate from rising in Japan at that time.

To summarize, Japan's labor market before collapse of the bubble economy had the three following characteristics: flexible adjustment of nominal wage change has mitigated nominal shocks; a slow employment adjustment speed has prevented actual reduction of the employment even during recession; and as a labor supply adjustment, discouraged worker effect contributed to prevent unemployment rate rise during recession.

(2) After collapse of bubble economy

Looking at Figure 2, one can find that Japan's steep Phillips curve shown in Figure 1 disappeared after collapse of the bubble economy. The Phillips curves became flatter in many countries, and Japan is no exception. Japan experienced a lower wage change rate and a rise in unemployment rate, which resulted in a flatter Phillips curve.

Such flatter Phillips curves has been pointed out by many economists, including Kimura and Ueda (2001) and Ohtake and Ohta (2002). Although this paper mainly focuses on the wage-version Phillips curve, many studies point out a flatter price-version Phillips curve as well after collapse of the bubble economy (Fuchi and Watanabe (2002) and Kuroda and Yamamoto (2006), etc.).

What brought about such a flatter-shaped Phillips curve as shown in Figure 2? Did the lower inflation rate prevent flexible nominal wage adjustment? Did employment adjustment speed change? Did the discouraged worker effect become weaker? We will address these questions in the following sections.

3. Possible reasons for a flatter Phillips Curve

To examine possible factors that would yield a flatter Phillips curve, we use New Keynesian Phillips curve. In a standard New Keynesian model, with the assumptions of monopolistically competitive product market and Calvo-type staggered price setting, it is known that the inflation dynamics around steady state equilibrium are described as follows:

$$\pi_t = \kappa_p E_{t-1} m_t + \gamma \pi_{t-1} + (1-\gamma) E_{t-1} \pi_{t+1} \tag{1}$$

$$\kappa_p = \frac{(1-\beta\alpha_p)(1-\alpha_p)}{(1+\beta)\alpha_p} \tag{2}$$

$$\gamma = \frac{1}{(1+\beta)} \tag{3}$$

where π_t represents inflation rate in period t (deviation from steady state value), m_t refers to real marginal cost (deviation from steady state value), β is discount rate, $(1-\alpha_p)$ refers to the probability of price revision for each period. It is assumed that the price of the period t is optimized with probability $(1-\alpha_p)$ as shown in Calvo (1983), and indexed to the previous period's inflation rate with probability α_p as Christiano, Eichenbaum, and Evans (2005). Here, in line with Gali (2002), we derive the following New Keynesian Phillips curve by describing the real marginal cost as a function of output gap:

$$\pi_t = \kappa_p (\sigma^{-1} + \eta^{-1}) E_{t-1} \tilde{y}_t + \gamma_p \pi_{t-1} + (1-\gamma_p) E_{t-1} \pi_{t+1} \tag{4}$$

where $\tilde{y}_t$ represents output gap (deviation from the output level when price is flexible), σ refers to intertemporal elasticity of consumption, and η means intertemporal elasticity of labor supply (Frisch elasticity).

In this standard New Keynesian Phillips curve, we can identify the factors that would flatten the Phillips curve from the slope parameter ($\kappa_p(\sigma^{-1}+\eta^{-1})$). However, because standard New Keynesian models do not incorporate nominal wage stickiness or imperfection of labor market, we further explore some extensions that incorporate these aspects.

For nominal wage stickiness, as discussed in many models including Erceg, Henderson, and Levin (2000), it is often assumed that monopolistically competitive households revise wage with the probability of $(1-\alpha_w)$. Then, price and wage version of New Keynesian Phillips curves can be derived as shown in the equations (5) and (6).[4]

$$\pi_t = \kappa_p(\sigma^{-1}+\eta^{-1})E_{t-1}\tilde{y}_t + \kappa_p E_{t-1}\tilde{\mu}_t + \gamma\pi_{t-1} + (1-\gamma)E_{t-1}\pi_{t+1} \tag{5}$$

$$\pi_t^w = \kappa_w(\sigma^{-1}+\eta^{-1})E_{t-1}\tilde{y}_t - \kappa_w E_{t-1}\tilde{\mu}_t + \gamma\pi_{t-1}^w + (1-\gamma)E_{t-1}\pi_{t+1}^w \tag{6}$$

$$\kappa_w = \frac{(1-\beta\alpha_w)(1-\alpha_w)}{(1+\beta)\alpha_w} \tag{7}$$

where π_t^w is nominal wage change rate in period *t* (deviation from steady state value), and $\tilde{\mu}_t$ is real wage gap (deviation from the real wage when nominal wage is flexible).

According to the slope parameter $\kappa_w(\sigma^{-1}+\eta^{-1})$ in the equation (6), we can identify a lower probability of wage changes (a rise in α_w), a larger intertemporal elasticity of consumption (σ), and a larger intertemporal elasticity of labor (η) as the possible factors that make Phillips curve flatter. Among these factors, we deal here with an increase in wage stickiness and a rise in intertemporal elasticity of labor (Frisch elasticity) as they are related to the labor market. More specifically, if downward rigidity of nominal wage becomes more obvious due to lower inflation rate (which increases the degree of wage stickiness), or if labor supply becomes more sensitive to temporary wage fluctuation (which raises Frisch labor supply elasticity), the Phillips curve will become flatter.[5]

For imperfection of labor market, as attempted by Blanchard and Gali (2006) and Thomas (2007), there are recently some developments: New Keynesian models incorporate the Mortensen-Pissarides type equilibrium search theory to consider real frictions in labor market,

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[4] In order to introduce the concept of nominal wage stickiness, Erceg, Henderson, and Levin (2000) applied Calvo's (1983) price stickiness assumption to wages as well, but it should be carefully examined whether or not the assumption such as monopolistically competitive households would be realistic.

[5] It should be also noted that an increase in wage stickiness would lead to a larger real wage gap $\tilde{\mu}_t$, resulting in downward shift of Phillips curve. However, as the equation (6) has κ_w in its second term in the right-hand side, wage version New Keynesian Phillips curve would shift in different manners, depending on relative magnitude of a decreased κ_w and an increased $\tilde{\mu}_t$. For simplicity, we assume that the increase/decrease in the right-hand side's second term of formula (6) would be small, with a decreased κ_w and an increased $\tilde{\mu}_t$ resulting from an increased wage stickiness mutually cancelled out.

which would generate a large real marginal cost gap.[6] To be more specific, they incorporate into a New Keynesian model a standard equilibrium search model as discussed by Pissarides (1985, 2000), in which labor demand and supply match through a matching function, and wages are determined with a Nash bargaining solution. Taking Thomas (2007) as an example, with a parameter ϕ representing the degree of imperfection or real frictions in labor market, equation (2) would be modified as follows:

$$\kappa_p = \frac{(1-\beta\alpha_p)(1-\alpha_p)}{(1+\beta)\alpha_p}\frac{1}{1+\phi} \tag{8}$$

Although the degree of real friction in labor market is summarized by a single parameter ϕ in equation (8), we can assume that the parameter ϕ consists of several elements, including employment adjustment costs, workers' bargaining power, real wage inertia, matching efficiency, and others. At any rate, equation (8) implies that the greater the real frictions in labor market which would prevent labor market's adjustment mechanism, the flatter the price-version New Keynesian Phillips curve would be. Using the same logic, we can conjecture that wage-version New Keynesian Phillips curve would also become flatter by the increase in real frictions of labor market.

To discuss the changes in Japan's labor market in the 1990s, we focus on three factors that would increase real frictions in the labor market ϕ: an increase in employment adjustment costs; a decline in discouraged worker effects; and an increase in other real rigidities.

First, employment adjustment costs include recruiting/training costs and workers' dismissal costs. As discussed in Section 2, since Japan had slower employment adjustment speed than other countries before the collapse of the bubble economy, it is inferred that employment adjustment costs were large in Japan from the 1980s. If the employment adjustment costs rose further in the 1990s, Japan's Phillips curve would become flatter.

Next, as stated in Section 2, discouraged worker effects used to be very evident in Japan, possibly reflecting low participation of females: many married females only search and work during economic boom. In the framework of equilibrium search model, the discouraged

[6] Similarly, Muto (2006) takes into consideration the imperfection of Japan's labor market in the New Keynesian model.

worker effect can be interpreted as the part of the endogenous fluctuation of search intensity. Since the search intensity means the degree of seriousness for job seekers to find a new job, larger search intensity is associated with higher job finding rate. In an equilibrium labor search model, it is known that the search intensity would procyclically fluctuate around the equilibrium, depending on the labor market tightness (see Shimer (2004) for example). That is, job seekers reduce search intensity during economic recession because of the low marginal return to job search; and in contrast, they increase search intensity during boom because of the high marginal return to job search. Therefore, it seems reasonable to regard the discouraged worker effects as the result of worker's efficient search behavior over the business cycle. In this framework, we suppose that a decline in the discouraged worker effects in Japan, which means that married females tended to stay in the labor market even during recession, would be consistent with a decline in the efficiency of job search if it is brought by any constraints such as a liquidity constraint. For example, if households experience husband's wage decrease or job loss during recession and they face a liquidity constraint, the wife would be forced to keep searching for their jobs even during recession, which may lead to inefficiency of job search. In this case, a decline in discouraged worker effects would increase real frictions, which contributes to a flatter Phillips curve.

Finally, as for other real rigidities, we focus on worker's bargaining power, unemployment insurance payments, and matching inefficiency (mismatches). Workers' stronger bargaining power and increased unemployment insurance payments (which raise reservation wage) would push up the real wage levels, and therefore increase real frictions. In addition, an increase in the mismatches of labor supply and demand in terms of age, region and occupation, as well as a decrease in the quality of public or private job placement services, would lower matching efficiency, which in turn increase real frictions associated with the flatter Phillips curve.

To summarize, according to New Keynesian Phillips curve incorporating labor market real frictions, a flatter Phillips curve would be attributable to the following five factors: existence of downward nominal wage rigidity; higher labor supply elasticity; increase in employment adjustment cost; a decline in discouraged worker effects; and an increase in other real rigidities in the labor market. The next section will examine whether or not each of these possible factors would be feasible in Japan's labor market after collapse of the bubble economy.

4. Examining possible reasons for a flatter Phillips curve in the 1990s

As discussed in Section 2, Japan saw a flatter Phillips curve after the collapse of the bubble economy. As explained in Section 3, such flatter Phillips curve could have resulted from several factors. This section examines the feasibility for each of the possibilities suggested in Section 3.

(1) Existence of downward nominal wage rigidity

One of the possible factors that contributed to Japan's flatter Phillips curve in the 1990s would be a change in wage adjustment mechanism, possibly brought by the downward nominal wage rigidity. More specifically, as the inflation rate had declined, downward rigidity in nominal wages might have made nominal wage stickier, which would result in a less steep Phillips curve. As discussed in Section 2, Japanese wages were flexible at least on nominal basis before collapse of the bubble economy. If such flexibility contributed to a low unemployment rate at that time, downward nominal wage rigidity under the low inflation in the 1990s could deteriorate wage adjustment mechanism and created unemployment, which resulted in a flatter Phillips curve.

Since 2000, many economists including Ohtake (2001) have pointed out that downward rigidity of nominal wage would increase unemployment under deflation or low inflation. They also argue that monetary policy should aim at a slightly positive inflation rate so that downward nominal wage rigidity would not bind as a constraint. In response to these arguments, Kimura and Ueda (2001) and Kuroda and Yamamoto (2003a-c, 2005, 2006) have examined whether or not downward nominal wage rigidity did exist and actually pose negative impacts such as unemployment increase in Japan.

For individual worker' wages, Kuroda and Yamamoto (2003a, b) investigate whether or not nominal wage is downwardly rigid by examining the micro data of *Japanese Panel Survey of Consumers* (Institute for Research on Household Economics). After examining distributions of nominal wage change rates from several perspectives and estimating a friction model incorporating the downward nominal wage rigidity from 1993 to 1998, they derive the following conclusions: (1) Despite a varying degree depending on working status (full-time or

part-time worker) and wage types (with or without bonuses and overtime pay), all types of nominal wage were downwardly rigid; (2) Annual earnings had smaller degree of downward rigidity, suggesting flexibility in bonus and/or overtime payments; and (3) Annual earnings and monthly regular salary could be significantly reduced when it is necessary to do so. Similarly, by using recent micro data of *Keio Household Panel Survey* (Keio University), Yamamoto (2007) examines whether or not Japan has been still experiencing downward rigidity in nominal wages since 2000, and how large the degree of Japan's rigidity is from international perspectives. As a result, Yamamoto (2007) points out that monthly regular salary for full-time workers remains downwardly rigid in recent Japan; its degree of rigidity is larger than other countries; but annual earnings inclusive of bonus and overtime payments are more flexible than those of other countries.

As for firm-level or macro-level nominal wages, it has been shown that they were downwardly rigid at least until 1997. For example, by examining whether or not nominal wage fluctuation has a nonlinear relationship with real GDP or labor market tightness, Kimura and Ueda (2001) argue that (1) nominal wage was downwardly rigid up until 1998 based on the data *Basic Survey on Wage Structure* (Ministry of Health, Labour and Welfare); and (2) nominal wage was not downward rigid if the estimated period is extended to the 1st quarter of 2000 by using the time-series data of *Monthly Labour Survey* (Ministry of Health, Labour and Welfare). Furthermore, using prefecture data of *Basic Survey on Wage Structure* disaggregated at firm size, age group, and sex, Kuroda and Yamamoto (2005) examine nominal wage change distribution, and conclude that downward rigidity in nominal wages (annual earnings for full-time workers) was observed from 1992 to 1997, but it became unobservable since 1998.

Kuroda and Yamamoto (2005) also point out that downward nominal wage rigidity observed from 1992 to 1997 may have raised firms' real payroll (adjusted for labor productivity) during a period in which both inflation and labor productivity growth were low. In addition, Kuroda and Yamamoto (2006) consider the relation between downward nominal wage rigidity at macro-level and the increase in part-time workers, indicating that although average nominal wage became more flexible due to the substitution from full-time to part-time workers, the average nominal wage did not decrease until 1998.

There is also some research that examines the impacts of downward nominal wage rigidity on unemployment in the 1990s. For example, Kuroda and Yamamoto (2003c) incorporate the

estimated degree of Japanese downward nominal wage rigidity into the general equilibrium model suggested by Akerlof, Dickens, and Perry (1996). Then, based on the simulation results, they indicate the possibility that downward nominal wage rigidity could raise unemployment rate by a certain amount. Furthermore, by estimating a (price-version) Phillips curve incorporating downward nominal wage rigidity, Kuroda and Yamamoto (2005) also confirm that nominal wage downward rigidity could have raised the unemployment rate in Japan.

From the viewpoints stated above, one can point out that wage stickiness should have increased after collapse of the bubble economy in Japan, due to the existence of downward nominal wage rigidity under the low inflation environment. Before collapse of the bubble economy when inflation rate was relatively higher, downward rigidity of nominal wage was not a binding constraint in wage setting. When the inflation rate got lower and even negative after collapse of the bubble economy, however, nominal wage cut became necessary to reduce real wages. Then, downward nominal wage rigidity started to serve as a binding constraint. Since this is consistent with the increase in nominal wage stickiness in New Keynesian Phillips curve, we can conclude that downward nominal wage rigidity contributed to the flatter Phillips curve after collapse of the bubble in Japan.

(2) Higher labor supply elasticity (Frisch elasticity)

The second possible factor for a flatter Phillips curve is a rise in Frisch labor supply elasticity. Frisch elasticity is derived from standard dynamic models that solve the intertemporal utility maximization problem of a representative agent. Frisch elasticity indicates the extent to which people change their labor supply in response to temporary wage changes. A larger value of Frisch elasticity means a less steep labor supply curve because labor supply is more sensitive to temporary wage fluctuation due to business cycle. In this case, demand shocks would produce larger employment fluctuation and smaller wage fluctuation, which implies a flatter Phillips curve.

Then, did Japan's Frisch elasticity increase after collapse of the bubble economy? In the first place, only a few studies have estimated Frisch elasticity in Japan thus far. In recent years, Kuroda and Yamamoto (2008) estimate Frisch elasticity based on the semi-aggregated data since the 1990s, while Sugo and Ueda (2007) estimate Frisch elasticity as one of the parameters

in their dynamic general equilibrium model. Kuroda and Yamamoto (2008) also examine the possible change in Frisch elasticity in the 1990s, and conclude that Frisch elasticity is unlikely to rise in the 1990s; rather it takes a downward trend in the 1990s. Judging from this empirical result, we may regard that a flatter Phillips curve after collapse of the bubble economy is not attributable to a rise in Frisch elasticity.

(3) Increase in employment adjustment cost

As emphasized by Oi (1962), a change in employment will bring about adjustment costs due to quasi-fixed costs such as recruitment costs and training costs. In the model discussed in Section 3, an increase in employment adjustment costs will intensify real frictions, and therefore flatten Phillips curve. To examine whether or not this happened in Japan after collapse of the bubble economy, it is necessary to compare the estimated employment adjustment costs before and after the bubble. However, to my best knowledge, there are no empirical examples in Japan that structurally estimated the employment adjustment costs or an adjustment cost function. Alternatively, there are many empirical studies estimating employment adjustment speed from the reduced form employment adjustment function in Japan. Since larger employment adjustment costs indicate a slower employment adjustment speed with other conditions constant, we investigate whether or not there was any change in employment adjustment speed in the 1990s.

Higuchi (2001) estimates the employment adjustment speed in Japan and the United States by using aggregated data. He concludes that Japan's employment adjustment speed was still much slower than the United States from 1985 to 1999, and also that Japan's employment adjustment speed became faster in 1990s. Regarding the reasons for faster employment adjustment speed, he points out changes in industrial structure such as the growth of service sector, increase in non-regular workers, long and serious economic recession, and changes in the type of corporate governance.

Alternatively, Miyamoto and Nakata (2002), who estimate employment adjustment speed by using the data of large-scale retailers (department stores and supermarkets), point out that employment adjustment speed became slower for regular full-time workers in the late 1990s. They state that it is probably because an increase in non-regular workers has strengthened

scarcity of regular workers and that scarcity lead to the increase in their employment adjustment costs. However, by estimating employment adjustment speed including the data for recent years, Nakata (2007) reports that adjustment speed for regular full-time workers got faster around 2000 for large firms in wholesale, retail and manufacturing industries.

Judging from these findings, it would be reasonable to suppose that the employment adjustment speed in Japan was still slow even after collapse of the bubble economy, but recently it may have been getting faster. Therefore, if we assume employment adjustment speed reflects employment adjustment costs, it is unlikely that a flatter Phillips curve in Japan is attributable to the increase in employment adjustment costs.

(4) A decline in the discouraged worker effects

In the equilibrium search model such as Pissarides (2000), individual worker's search intensity endogenously decreases in economic recession, by which the efficient search is achieved. As stated in Section 3, it is possible to regard such procyclical fluctuation of search intensity is observed as the discouraged worker effects: job seekers give up their job search and get out of labor market during economic recession since it becomes difficult to find jobs when labor market is less tight. From this perspective, the decline in discouraged worker effects or decline in the degree of procyclicality of search intensity (i.e. workers continue to search jobs even during recession) can be regarded as the decrease in job search efficiency if it is brought by any constraints such as a liquidity constraint. In this case, the decline in discourage worker effects could increase real frictions in labor market and contribute to the flatter Phillips curve in Japan.

In fact, many economists point out a decline in the discouraged worker effects since the 1990s. For example, Kuroda (2002) and Ohta and Teruyama (2003) examine the labor force flow data of *Labour Force Survey* (Ministry of Internal Affairs and Communications), and confirm that a flow from "job searching" to "being out of labor force" decreased among females in the 1990s, suggesting the decline in discouraged worker effects.

Furthermore, by estimating female labor supply function with micro data of *Japanese Panel Survey of Consumers*, Higuchi and Abe (1999) point out that the possibility that added worker effects (i.e., wife's labor supply increases due to a decline in husband's permanent income) has become larger so as to dominate discouraged worker effects. Kuroda and Yamamoto (2007)

confirm this finding by using more recent data, and also point out that discouraged worker effects are only observed among married females, which implies that the later-marriage and no-marriage tendency would bring about the decline in discourage worker effects.

From these findings, we can think that discouraged worker effects among married females are becoming weaker in Japan after the collapse of the bubble economy.[7] The decline in discouraged worker effects would have reduced the efficiency of job search, increased real frictions of labor market, and as a result contributed to a flatter Phillips curve in the 1990s.

(5) A rise in other real rigidities

Finally, we examine a rise in other real rigidities as a possible factor for increasing real frictions or yielding a flatter Phillips curve. Here, we focus on an increase in bargaining powers, an increase in unemployment insurance payments, and a decline in matching efficiency.

If wage is determined at a Nash bargaining solution between employers and workers, a rise in worker bargaining powers will push up real wage, leading to increase in real frictions. However, as the number of labor union members has been falling in Japan, worker bargaining powers are unlikely to rise in Japan after collapse of the bubble economy.

An increase in unemployment insurance payments would raise worker's reservation wage, which would increase real frictions. However, this is also unlikely because the unemployment insurance program was amended in 2001 to shorten the insurance benefit duration. In fact, Kohara (2004) point out that the 2001 amendment to the unemployment insurance program has posed impacts to decrease long-term unemployment.

A decline in matching efficiency would be associated with an increase in mismatches between labor demand and supply, and a decline in the quality of public and private job placement services. However, it is not easy to judge whether or not matching efficiency declined after collapse of the bubble economy. We review several approaches to measure matching efficiency or mismatches.

The first approach is building a "mismatch" index by aggregating mismatches between job seekers and employers in the same age groups or job groups as suggested by Jackman and

[7] However, it is worth noting that the discouraged worker effects are recently observed for young people.

Roper (1987). Tachibanaki, Fujiki, and Nakada (2000) and Ministry of Health, and Labour and Welfare's white paper in 2001 attempt this type of approach. According to them, mismatches did not significantly increase in the 1990s in any of the categories in Japan.

The second approach is identifying the matching efficiency by estimating a matching function, which represents how many new jobs are created from the same number of unemployment and job openings. For example, Nakamura (2002), Ohta (2002), and Kano and Ohta (2005) employ this approach. Among them, Nakamura (2002) estimates a matching function based on the data of public job-placement office, and suggests that public job-placement office's matching efficiency may have decreased due to congestion effects in the late 1990s. However, by estimating similar matching functions for several age groups, Ohta (2002) finds no decline in the matching efficiency. Thus, it is not certain whether or not the matching efficiency measured with this approach declined in the 1990s.

The third approach is identifying an extent of mismatches based on a UV curve (Beveridge curve). This approach employs a UV curve with unemployment (U) as the vertical axis and vacancy rate (V) as the horizontal axis, and assumes that the point where U and V meet each other should indicate the extent of mismatches. Much of research, including Higuchi (2001), and Ohtake and Ohta (2002) estimate the extent of mismatches based on a UV curve, and point out the upward trend of the identified mismatches in the 1990s. However, there is less theoretical foundation to regard as an extent of mismatches the point where U and V meet each other. It is therefore unclear that the extent of mismatches identified by this approach is consistent with the matching efficiency or the parameter of real friction (ϕ) in Section 3.

As is shown above, we have mixed results regarding the change in matching efficiency or mismatches during the 1990s. However, we could at least say that we cannot conclude that the real frictions arising from matching inefficiency or mismatches have significantly increased in Japan since the 1990s.

5. Concluding remarks

Based on past research findings, this paper has investigated the nature of labor market adjustment mechanism in Japan before and after the collapse of bubble economy around early

1990s.

In section 2, we observed Phillips curves of several industrialized countries, and discussed that Japan saw a steeper Phillips curve unlike other countries before the 1990s, but faced a flatter Phillips curve in the 1990s and onward. A steeper Phillips curve in Japan before collapse of the bubble economy was attributable to the following labor market characteristics: nominal wage flexibility reflecting flexible bonus payments or spring wage negotiations, slow employment adjustment, and the large discouraged worker effects.

In section3, we considered theoretically possible factors that could bring about a flatter Phillips curve in line with a New Keynesian model. A flatter Phillips curve is possibly attributable to the following factors: the existence of downward rigidity in nominal wages; rise in Frisch labor supply elasticity; increase in employment adjustment cost; decline in discouraged worker effects; and increase in other real rigidities of the labor market.

In section 4, we verified the feasibility of these factors for a flatter Phillips curve in the context of Japan's labor market in the 1990s. As a result, Japan's flatter Phillips curve in the 1990s was mainly attributable to the existence of downward nominal wage rigidity under the low and negative inflation rate as well as a decline in discouraged worker effects.

Therefore, it is concluded that while slow employment adjustment mechanism did not change so much, fast wage adjustment mechanism deteriorated to some extent due to downward nominal wage rigidity in the 1990s, and also flexible labor supply adjustment such as discouraged worker effects got weaker in the 1990s.

We then lastly examine possible reasons why Japan's unemployment rate had been rising after collapse of the bubble economy. Since Japan's labor market had rather flexible nominal wage adjustment mechanism up until the 1980s, nominal shocks were absorbed by nominal wages fluctuations to some extent. In addition, slow employment adjustment also kept unemployment rate low because employment was less sensitive to moderate negative shocks. Furthermore, there were significant discouraged worker effects among married female workers, which effectively prevented unemployment rate from going up during recessions. However, in the 1990s after collapse of the bubble economy, downward rigidity of nominal wages has become more obvious as the inflation rate became lower or even negative, leading to more difficulty in flexible adjustment of nominal wages. Without nominal shock absorption, employment was forced to fluctuate in response to nominal shocks, and as a result the

unemployment rate rose during the 1990s. In the meantime, since employment adjustment still remained slow, the increase in the employment was very limited even during the recovery in the 2000s. Then, unemployed persons accumulated in the labor market and long-term unemployment increased as well. In addition, the later-marriage and non-marriage tendency in Japan made the discouraged worker effect weaker, which also kept unemployment rate high. Recently, however, the unemployment rate has been becoming lower, which is probably because aggregate demand has recovered and because wage/employment adjustment mechanism has been working since the end of the 1990s.

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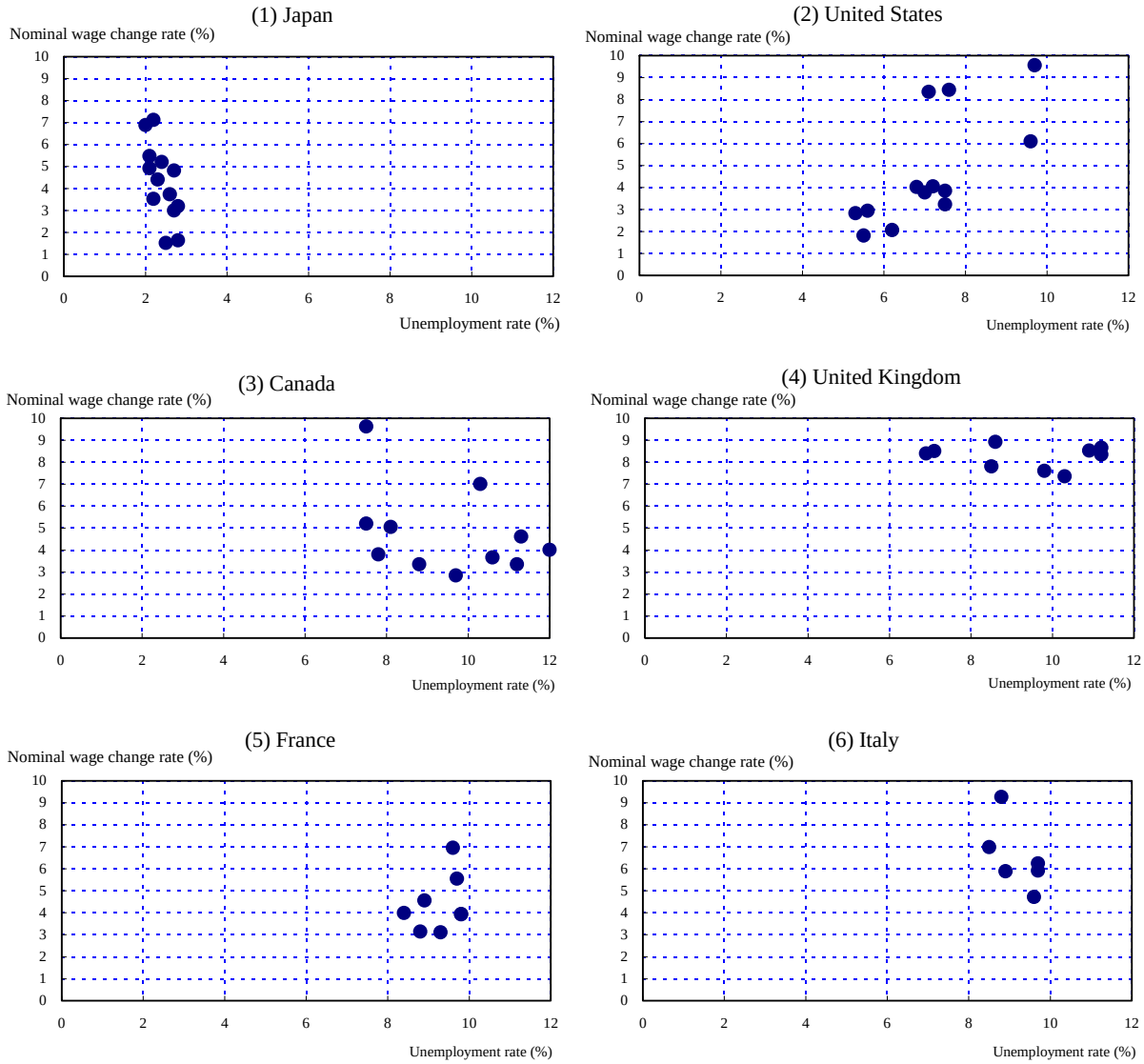
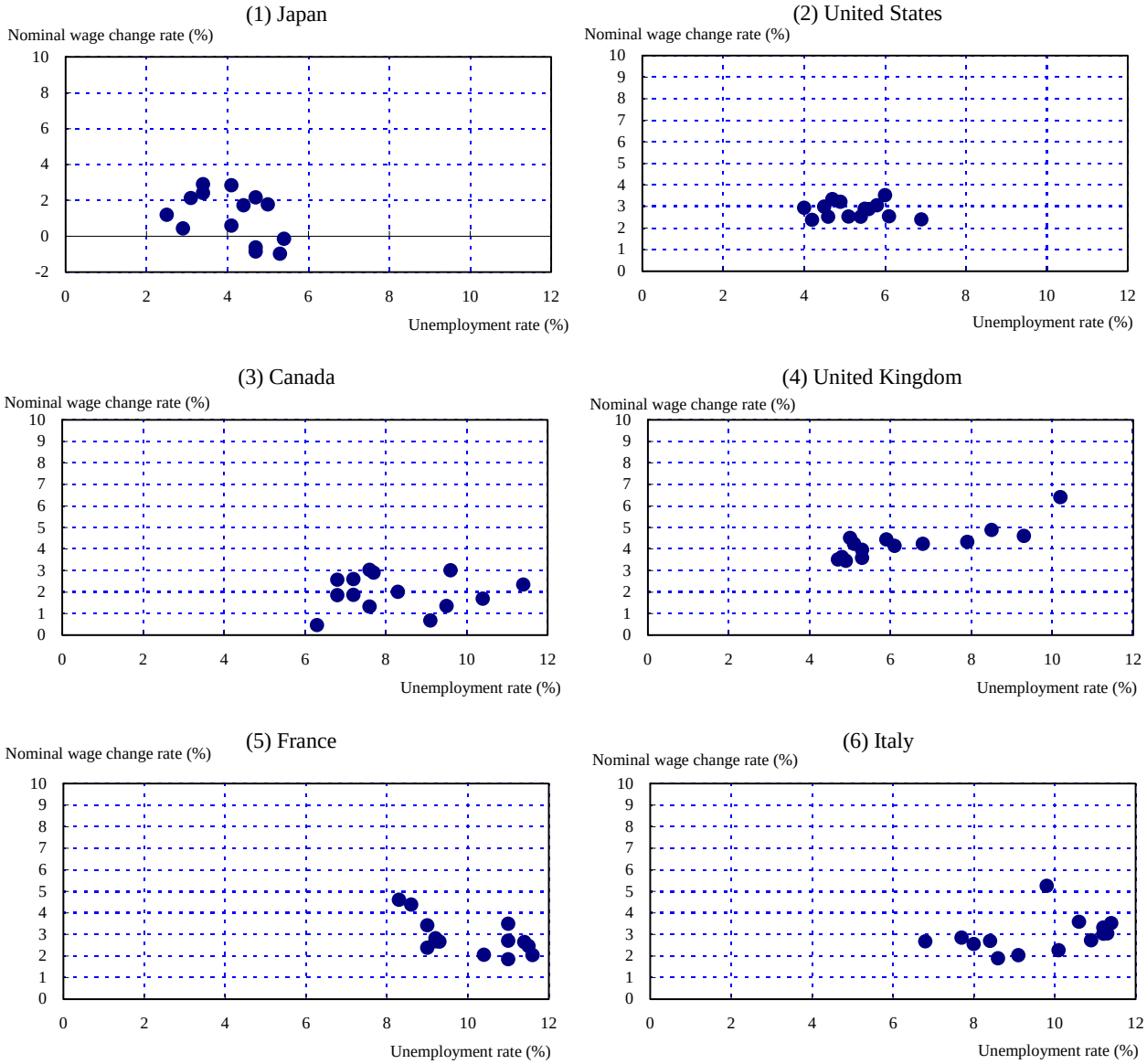
Figure 1. Phillips curves for industrialized countries: 1980-1992



Note) Nominal wage includes regular salaries, overtime payment, and bonus payment.

Source) *Main Economic Indicators* (OECD)

Figure 2. Phillips curves for industrialized countries: 1993-2006



Note) Nominal wage includes regular salaries, overtime payment, and bonus payment.

Source) *Main Economic Indicators* (OECD)