The Cyclicality of Real Wage at the Time of Japan's
Ruling Period over the Korean Peninsula

Osaka University of Economics
Makoto KUROSAKA
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Abstract

The study aimed to examine real wage cyclicality during Japan's rule over the Korean Peninsula. The cyclicality of real wages during Japan's ruling period over the Korean Peninsula has not been studied although it has been an important topic of debate among macroeconomists for a long time. The results of the analysis showed that the real wage of skilled workers was counter-cyclical to the real GDP of the secondary industry, using a linear time trend for detrending. The results also showed that the real wage of skilled workers was pro-cyclical to employment in the secondary industry, using a linear time trend for detrending. The choice of measuring the business cycle indicator and detrending method might be of great importance for characterizing the cyclicality of real wage.

Key Words

Real wage, pro-cyclicality, counter-cyclicality, Japan's ruling period over the Korean Peninsula

JEL Classification, E32, O1, O5

[*] Osaka University of Economics, Faculty of Economics. E-mail: makoto@osaka-ue.ac.jp

## 1・Introduction

The purpose of this study is to clarify real wage cyclicality over the Korean Peninsula during Japan's ruling period. Whether real wages show pro-cyclicality has long been an important topic of debate among macroeconomists. Keynesians maintain that an increase in employment and output can lead to a decline in real wage rates. This is known as the counter-cyclicality of real wage. In contrast, real business cycle theorists assume the pro-cyclicality of real wages. Although many macroeconomists have analyzed real wage cyclicality using data from many countries, real wage cyclicality at the time of Japan's rule on the Korean Peninsula has not yet been studied. As far as we know, this paper is the first research. Since the economy during Japan's ruling period over the Korean Peninsula can be considered developing economy, issues related to real wage cyclicality include the following:

The labor market in developing countries is often characterized as the unlimited supply of labor from rural areas, as advocated by Lewis (1954). If the labor supply curve is highly elastic and fixed over time, economic fluctuations in developing countries are mainly attributed to fluctuations in the labor demand curve. In this case, it follows that real wages do not change much despite large fluctuations in production and employment. Thus, the correlation coefficients may have become small, leading to statistical insignificance. If the labor demand curve is stable over time and the labor supply curve fluctuates, economic fluctuations in developing countries are mainly attributed to fluctuations in the labor supply curve. To address these problems, we need to empirically analyze the relationship between real wages, output, and employment during this period.

Section 2 presents a brief review of the preceding results concerning the labor markets in developing countries and the cyclicality of real wages. Section 3 presents the results of the analysis. Section 4 provides the concluding remarks of the paper.

## 2. Preceding Main Results of Research Regarding Labor Market in Developing Countries and Real Wage Cyclicality

(2-1) On the labor markets in developing countries

Bardhan and Udly (1999, Chapter 4) noted that a distinguishing characteristic of the models of less developed economies was the assumption of a horizontal supply curve of labor at an exogenously given wage rate. Gollin (2014) summarized Lewis's main idea as follows: The Lewis model is based on the idea of a dual economy composed of modern capitalist and the subsistence industries. The labor surplus in the subsistence industry determines the wage

rate of the economy in the early stages of development. Regarding the Lewis model, Hansen (1969) maintained that wages appear to be highly flexible and react strongly and rapidly to changes in demand. Hansen (1969) also maintained that the elasticity of labor supply was much different from Lewis's unlimited supplies of labor. Kurosaka (2022) noted that the real wage in the Korean Peninsula at the time of Japan's rule fluctuated significantly by showing high coefficients of variation.

(2-2) On the cyclicality of real wages

  As is well known, Keynesian economics assumes that real wage shows a negative correlation with output and employment. Otani (1978) presented empirical evidence supporting a negative correlation between real wages and output from 14 industrialized countries for a period of approximately 25 years. According to Otani (1978, p. 303), there was a negative correlation between the rate of change in real wages and industrial output in 11 of the 14 industrial countries. Six 6 of these results were considered statistically significant. Bils (1985, p. 667) stated that employment was much more variable among those with less education and those with less work experience. This causes a countercyclical bias, because, in times of high employment, real wages are averaged over a group with lower earning potential, which is averaged in low employment times. Bils (1985) found real wages to be very pro-cyclical, using panel data from the National Longitudinal Survey which extended from 1966 to 1980. The results showed that a percentage point-rise in the unemployment rate was associated with a decrease in real wages between 1.5 and 2 percent. Greenwald and Stiglitz (1988, pp. 223-224) stated that variations in wages were weakly pro-cyclical. If real wages are defined relative to producer's prices, there is some slight indication that real wages are weakly counter-cyclical in the United Staes and Australia. Hall (1988) noted that the important empirical regularities cited by Greenwald and Stiglitz (1988), significant output and employment fluctuations and small real wage fluctuations, could be derived from a simple labor market diagram. Suppose that the horizontal axis represents employment and the vertical axis denotes the real wage. The labor supply curve is highly elastic and the labor supply schedule is stable. If shifts in labor demand are the driving force of employment, the aforementioned empirical regularities could be accounted for. Mankiw (1989, p. 82) noted that a crucial implication of the real business cycle theory was that the real wages were pro-cyclical. Real business cycle theorists interpret the real wages as the price of leisure relative to goods. During a recession, households increase leisure (decrease working hours) and decrease consumption because real wages, as the price of leisure, decrease. Because real business cycle theorists assume that the economy always finds itself on the labor supply curve, a decrease in working hour leads to a decrease in output. Blanchard and Fisher (1989, p. 19) stated that the
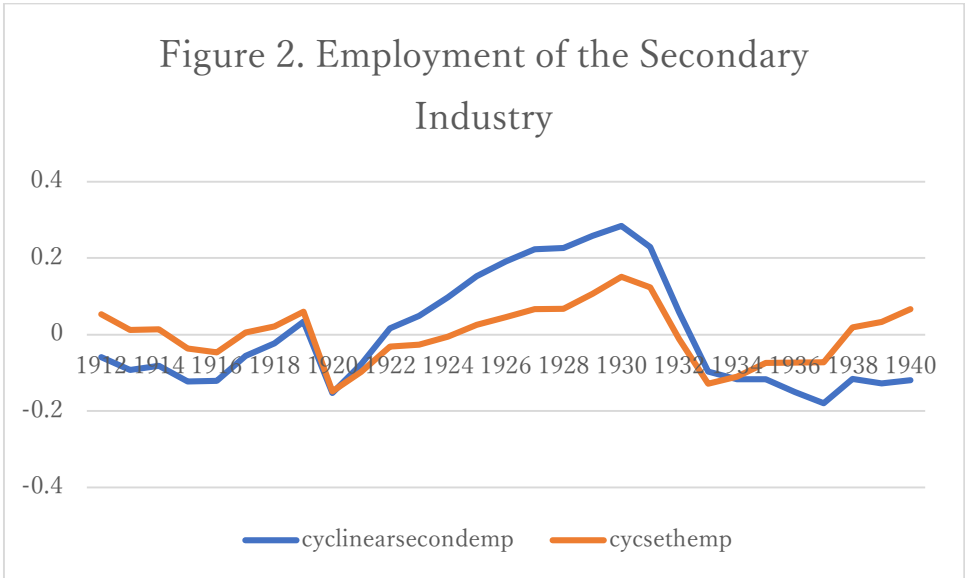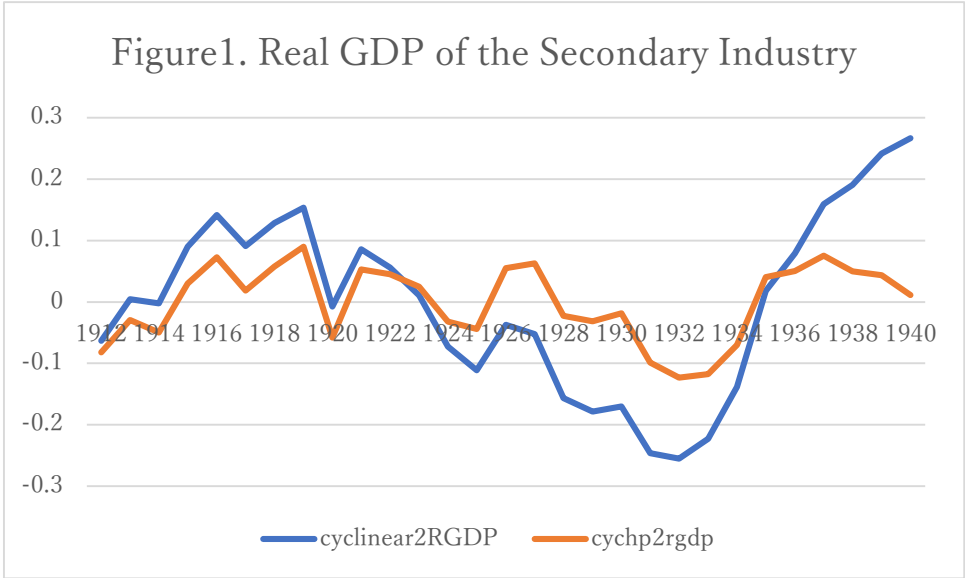
correlation between changes in real wages and changes in output or employment was usually slightly positive but often statistically insignificant. Mocan and Baytas (1991) used vector autoregression to analyze the cyclicality of real wages. They demonstrated that a supply shock generated pro-cyclical real wages, and a demand shock yielded counter-cyclicality. Solon, Barsky, and Parker (1994) maintained that the apparent weakness of real wage cyclicality in the United States was substantially exaggerated by a statistical illusion. They found that aggregate statistics were constructed to give more weight to low-skilled workers during expansions than during recessions. They called this the composition effect, which biases the aggregate statistics in a countercyclical direction and obscures the real wage pro-cyclicality. Abraham and Haltiwanger (1995, pp. 1221) stated that there were four important points regarding the number of measurement and specification choices.
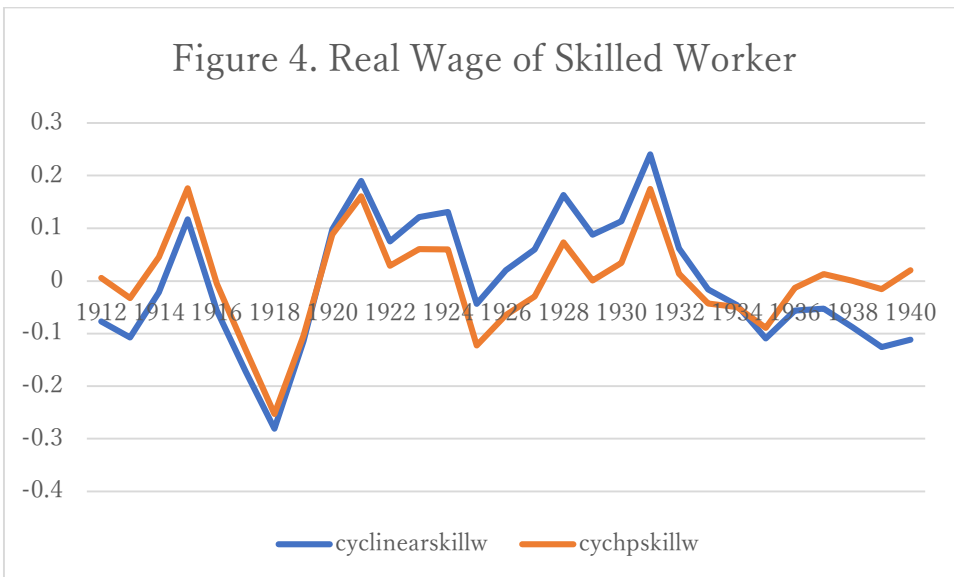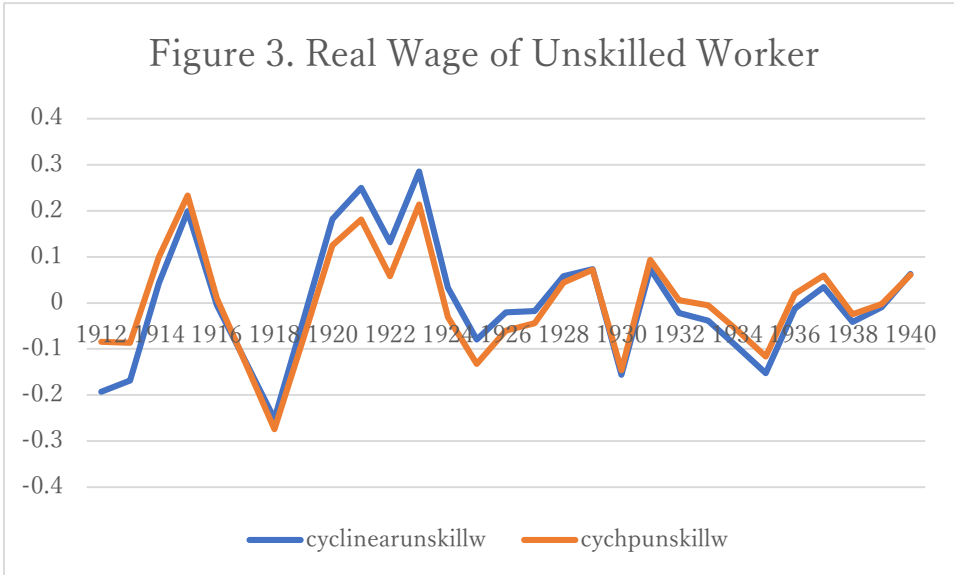
(1) How to measure the nominal wage and price series used to construct the real wage

(2) How to measure the cyclical indicator

(3) How to detrend the data

(4) The frequency and sample period of the data to be used in the analysis

Miyamoto (2014) found that while real wages constructed using the consumer index and GDP deflator were pro-cyclical, real wages constructed using the producer price index were counter-cyclical by using data from 1994Q1-2014Q2 in Japan. Swanson (2004) found that a vast majority of sectors paid real product wages that varied inversely (counter-cyclically) with the state of the industry by testing with a wage deflated by the firm's own price of output and with respect to the cyclical state of the firm's own industry.

3. The Real Wage Cyclicality at the Time of Japan's Rule over the Korean Peninsula

Figures 1-4 show the cyclical part of the real GDP, amount of employment, real wage of skilled workers, and real wage of unskilled workers, using the HP Filter or a linear time trend for detrending, respectively. We used the real GDP of the secondary industry to denote SGDP. We used employment in secondary industry, denoted as SEMP, as an indicator of business cycle. SKWAGE denotes the real wages of skilled Korean workers. USKWAGE denotes the real wages of unskilled Korean workers.

Figure1. Real GDP of the Secondary Industry

— cyclinear2RGDP    — cychp2rgdp



Figure 2. Employment of the Secondary Industry

— cyclinearsecondemp    — cycsethemp

Figure 3. Real Wage of Unskilled Worker



Figure 4. Real Wage of Skilled Worker

From these Figures, the followings are to be noted.

1. The cyclical part of the real wage of unskilled worker moved in almost the same way in both methods of detrending.

2. The cyclical parts of employment decreased after World War in the first few years.

3. The cyclical parts of the real wage of unskilled workers decreased during the Great depression in 1929. By contrast, the cyclical part of the real wages of skilled workers increased during this period until 1934.

Following Cooley and Prescott (1995), we represented business facts by calculating statistics from the H-P filtered time-series data and linear time detrended series data for the economy at the time of Japan's Ruling Period in the Korean Peninsula. The parameter $\lambda$ of the Hodrick-Prescott filter was set at 100 since there was annual data from 1912-40. We measured the correlation of real wages with real output and employment to capture the extent to which they are pro-cyclical (positively correlated) or counter-cyclical (negatively correlated). We then measured the cross-correlation over time to confirm whether there was evidence of a phase shift. All the data are obtained from Odaka, Saito, Fukao, Mizoguchi, Byou, and Mun (2019). The results are given in the following tables.

Table 1-1 Cross-correlation between real GDP of the secondary industry and real wages at different lags by HP filter

| Variable | 0 | −1 | −2 | −3 | −4 | −5 |
|---|---|---|---|---|---|---|
| SGDP | 1 | 0.53 | 0.23 | 0.07 | −0.17 | −0.29 |
| SKWAGE | −0.22 | −0.28 | −0.22 | −0.18 | −0.09 | −0.03 |
| USKWAGE | −0.04 | −0.03 | −0.02 | −0.02 | 0.03 | −0.10 |

From Table 1-1, we found that the contemporaneous correlation between the real wages of skilled workers and the real GDP of secondary industry was weakly counter-cyclical but statistically insignificant when, using HP Filter for detrending. The same is true of the contemporaneous correlation between the real wages of unskilled workers and the real GDP of the secondary industry. The SGDP line gives its autocorrelation coefficient at different lags when using the HP Filter.

Table 1-2 Cross-correlation between real GDP of the secondary industry of the secondary industry and real wages at different leads by HP filter

| Variable | 1 | 2 | 3 | 4 | 5 |
|----------|------|------|-------|-------|-------|
| SGDP | 0.53 | 0.23 | 0.07 | −0.17 | −0.29 |
| SKWAGE | −0.01 | 0.07 | −0.02 | 0.27 | 0.47 |
| USKWAGE | 0.08 | 0.11 | −0.11 | 0.25 | 0.39 |

The SGDP line indicates its autocorrelation coefficient at different leads using the HP Filter. Depending on table 1-2, we cannot clearly say whether the real wages of both skilled and unskilled workers were pro-cyclical or counter-cyclical because the coefficient of correlation is low.

Table 1-3 Cross-correlation between real GDP of the secondary industry and real wages at different lags by linear time trend

| Variable | 0 | −1 | −2 | −3 | −4 | −5 |
|----------|-------|-------|-------|-------|-------|-------|
| SGDP | 1 | 0.88 | 0.72 | 0.51 | 0.22 | −0.07 |
| SKWAGE | −0.54 | −0.61 | −0.59 | −0.57 | −0.49 | −0.38 |
| USKWAGE | 0.075 | −0.05 | −0.13 | −0.21 | −0.29 | −0.39 |

The SGDP line indicates its autocorrelation coefficient at different lags using a linear time trend. From Table 1-3, we found that the contemporaneous correlations between the real wages of skilled workers and the real GDP of the secondary industry were counter-cyclical and statistically significant, using the linear time trend for detrending.

Table 1-4 Cross-correlation between real GDP of the secondary industry and real wages at different leads by linear time trend

| Variable | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| SGDP | 0.88 | 0.72 | 0.51 | 0.22 | −0.07 |
| SKWAGE | −0.38 | −0.22 | −0.10 | 0.19 | 0.44 |
| USKWAGE | 0.20 | 0.31 | 0.25 | 0.44 | 0.50 |

The SGDP line provides its autocorrelation coefficient at different leads with a linear time trend. From table 1-4, we cannot clearly say whether real wages of skilled and unskilled workers were pro-cyclical or counter-cyclical because the coefficient of correlation was low.

Table 2-1 Cross-correlation between employment of the secondary industry and real wages at different lags by HP Filter

| Variable | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| SEMP | 1 | 0.64 | 0.23 | −0.06 | −0.19 | −0.31 |
| SKWAGE | −0.04 | −0.28 | −0.22 | −0.18 | −0.09 | −0.03 |
| USKWAGE | −0.27 | −0.22 | 0.15 | 0.28 | 0.12 | −0.18 |

The SEMP line indicates its autocorrelation coefficient at different leads using the HP Filter. From Table 2-1, we cannot clearly say whether the real wages of both skilled workers and unskilled workers were pro-cyclical or counter-cyclical because the coefficients of correlation were so low.

Table 2-2 Cross-correlation between employment of the secondary industry and real wages at different lags by HP filter

| Variable | −1 | −2 | −3 | −4 | −5 |
|----------|------|------|-------|-------|-------|
| SEMP | 0.64 | 0.23 | −0.06 | −0.19 | −0.31 |
| SKWAGE | 0.16 | 0.31 | 0.13 | −0.04 | −0.04 |
| USKWAGE | −0.02 | 0.15 | −0.03 | −0.02 | −0.09 |

The SEMP line indicates its autocorrelation coefficient at different lags when using HP Filter. From Table 2-2, we cannot clearly say whether both real wages of skilled worker and of unskilled workers were pro-cyclical or counter-cyclical because coefficients of correlation were so low.

Table 2-3 Cross-correlation between the employment of the secondary industry and real wages at different lags by linear time trend

| Variable | 0 | 1 | 2 | 3 | 4 | 5 |
|----------|-------|------|------|------|------|------|
| SEMP | 1 | 0.89 | 0.71 | 0.52 | 0.31 | 0.06 |
| SKWAGE | 0.51 | 0.47 | 0.49 | 0.42 | 0.27 | 0.03 |
| USKWAGE | −0.01 | 0.11 | 0.34 | 0.44 | 0.42 | 0.30 |

The SEMP line indicates its autocorrelation coefficient at different leads with a linear time trend. From Table 2-3, we found that the contemporaneous correlation between the real wages of skilled workers and employment in the secondary industry was pro-cyclical and statistically significant, using the linear time trend for detrending. In addition, the first-, second, and third-order correlation coefficients had positive signs, and were statistically significant. We cannot clearly say whether real wages of unskilled workers were pro-cyclical or counter-cyclical because the coefficients of correlation were very low.
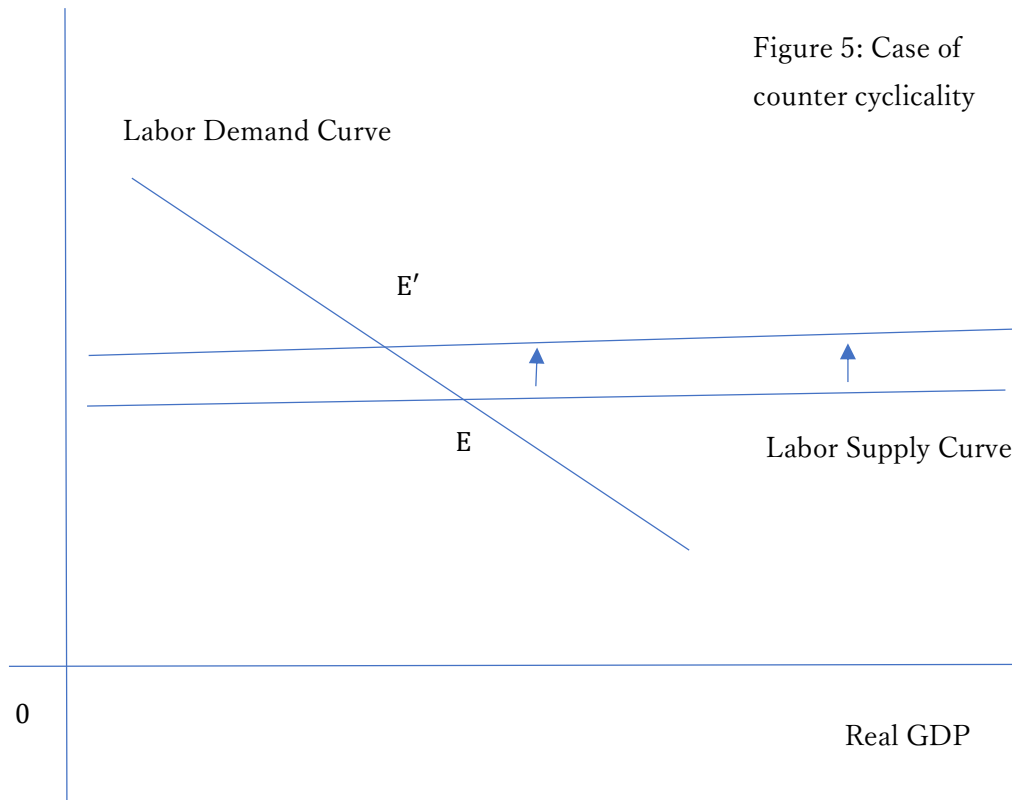
Table 2-4 Cross-correlation between the employment of the secondary industry and real wages at different lags by linear time trend
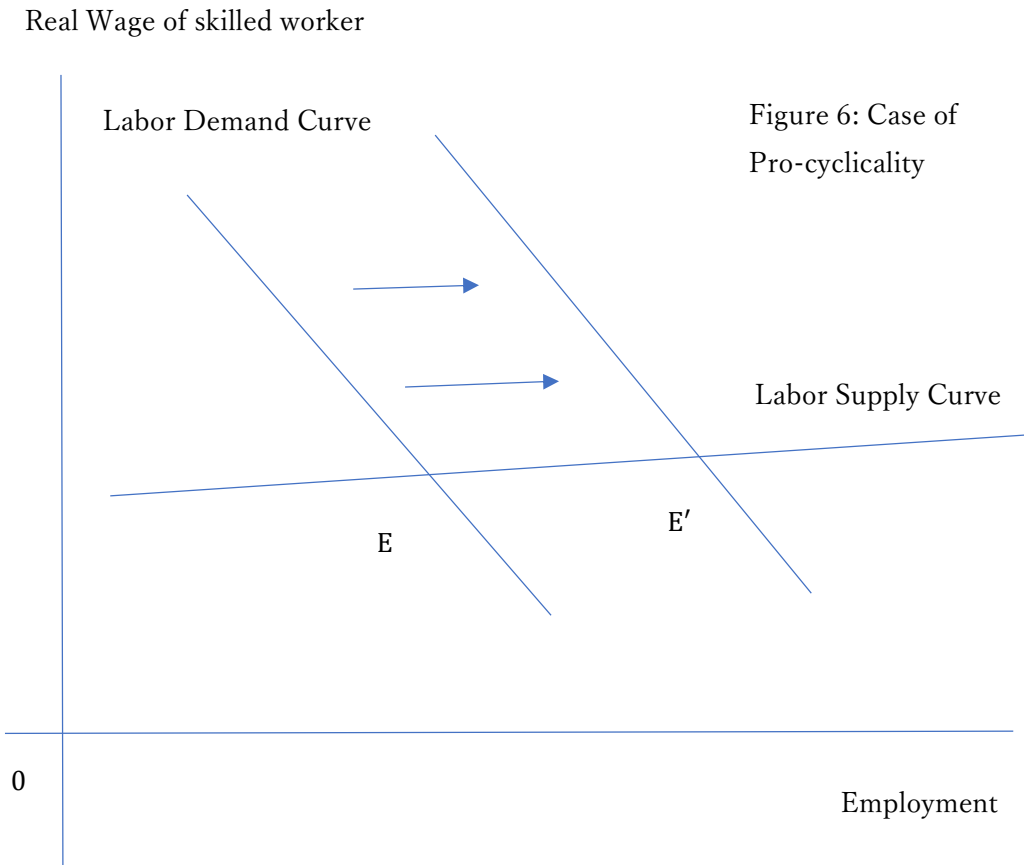
| Variable | −1 | −2 | −3 | −4 | −5 |
|----------|------|-------|-------|-------|-------|
| SEMP | 0.89 | 0.71 | 0.52 | 0.31 | 0.06 |
| SKWAGE | 0.57 | 0.58 | 0.44 | 0.32 | 0.18 |
| USKWAG | 0 | −0.04 | −0.18 | −0.18 | −0.25 |

The SEMP line indicates its autocorrelation coefficient at different lags by using a linear time trend. From Table 2-4, it was considered that the real wage of skilled worker was pro-cyclical because the correlation coefficients of the first-order, second-order, and third-order had positive signs and they were statistically significant. We cannot clearly state that the real wages of unskilled workers were counter-cyclical because the coefficients of correlation were so low that they were statistically insignificant.

These results are ambivalent regarding real wage cyclicality. Let us now explain these two cases. Consider the following case: the real wage of skilled workers and the real GDP of the secondary industry with a linear time trend. In this case, the results displayed counter-cyclicality. If the labor supply curve is highly elastic and fluctuating and the labor demand curve is stable, economic fluctuations are mainly attributed to fluctuations in the labor supply curve. Then, real wage counter-cyclicality is obtained, as shown in Figure 5. Next, we considered the case of the real wages of skilled workers and employment in the secondary industry by a linear time tend. In this case, the results displayed pro-cyclicality. If the labor supply curve is stable over time, economic fluctuations are mainly attributed to fluctuations in the labor demand curve. Then, the real wage pro-cyclicality is obtained, as shown in Figure 6. Figures 5 and 6 are based on the Figures and explanation proposed by Hall (1988) and Swanson (2004)

Real Wage of Skilled Worker

Figure 5: Case of
counter cyclicality

Labor Demand Curve

E′

E

Labor Supply Curve

0

Real GDP

Real Wage of skilled worker

Labor Demand Curve

Figure 6: Case of
Pro-cyclicality

Labor Supply Curve

E′

E

0

Employment

   Thus far, the analysis has not been able to determine which Figure is more appropriate for describing the economy during this period.


4. Concluding Remarks


      In this study, we investigated real wage cyclicality over the Korean Peninsula during Japan's Ruling Period. Using a linear time trend for detrending, results of our analysis showed that the real wage of skilled workers was counter-cyclical to the real GDP of the secondary industry. Using a linear time trend for detrending, our results also showed that the real wage of skilled workers was pro-cyclical to employment in the secondary industry.
   Taken together, the results are ambiguous. We cannot definitely say whether real wages were pro-cyclical or counter-cyclical because there are both results. The choices of measuring the business cycle indicator and detrending method might be of great importance for the

cyclicality of real wages.

There are several avenues for future research. Our results indicate that the relationship between real wages and the indicators (real GDP and employment) differs between skilled and unskilled workers. Thus, there may be a difference of the labor market between skilled and unskilled workers. Second, the elasticity of the labor supply curve and the labor demand curve in this period needs to be estimated.

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