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Period over the Korean Peninsula

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Abstract

This study examines the stationarity of real wages during Japan's rule over the Korean Peninsula. Nelson and Plosser (1982) found that they could not reject the hypothesis that the U. S. macroeconomic time series were non-stationary stochastic processes with no tendency to return to a trend line. Based on this idea, I investigate the stationarity of real wages over the Korean Peninsula during Japan's ruling period. The analysis suggests that the real wage of skilled workers was difference stationary, while the real wage of unskilled workers was stationary across the entire Korean peninsula, particularly in the northern region.

Key Words

Real wage, Difference stationary, Random walk, Korean Peninsula during Japan's Rule

JEL Classification, E31, E32

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1. Introduction

This study examined the stationarity of real wages during Japan's rule over the Korean Peninsula. Nelson and Plosser (1982) found that they could not reject the hypothesis that the U. S. macroeconomic time series were non-stationary stochastic processes with no tendency to return to a trend line. They concluded that stochastic variation due to real factors is an essential element of any model of macroeconomic fluctuations. If this were true for the macroeconomic model of developing countries, there would be no tendency for main macroeconomic variables such as output and real wage to return to a trend line. Consequently, fiscal and monetary policy that aimed at returning the economy to the trend line in developing countries could be ineffective.

The remainder of paper is organized as the follows. Section 2 summarizes previous research on fluctuation of real wages in developing countries and the stationarities of macroeconomic variables. Section 3 provides descriptive statistics on the real wages in the Korean Peninsula during Japan's rule. Section 4 provides an analysis of the real wage time series during Japan's rule over the Korean Peninsula. Section 4-1 analyzes the autocorrelation function, while Section 4-2 presents Augmented Dickey-Fuller tests and investigates whether real wages on the Korean Peninsula during Japan's rule were difference stationary. The main results are summarized in Section 5.

2. Literature Review

Many economists have interpreted the economies of developing countries as those of the unlimited labor supply model proposed by Lewis (1954). Real wages have been interpreted as constant because of the unlimited supply of labor from rural areas. Hansen (1969) investigated the rural labor market in Egypt and concluded that wages appear to be highly flexible and react strongly and rapidly to changes in demand. Hansen (1969) also noted that there was nothing to indicate that wage levels should be governed by subsistence minimum or institutional factors. Gollin (2014) noted that wages and living standards are not constant at an absolute level of subsistence in most developing countries. Gollin (2014) notes that Lewis's insistence on subsistence wages was largely discarded. Kurosaka (2022) noted that real wage on the Korean Peninsula during Japan's rule fluctuated significantly, showing a high coefficient of variation.

Kurosaka (2023) 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 but pro-cyclical to employment.

Although the real wages in the Korean Peninsula during Japan's rule fluctuated so

greatly, it is questionable whether real wages at that time tended to return to a long-term trend. Blanchard and Fisher (1989, Chapter 1, pp. 7-8) noted that many economists believed that behind short-run fluctuations, the economy evolved along an underlying growth path, which could be considered a trend. Campbell and Mankiw (1987, p. 876) note that many traditional business cycle theories maintain the following two fundamental premises: First, fluctuations in output are assumed to be driven primarily by shocks to aggregate demand. Second, shocks to aggregate demand are assumed to have only a temporary effect on output, and in the long run, the economy returns to its natural rate. Nelson and Plosser (1982) found that they could not reject the idea that the macroeconomic time series for the United States were non-stationary stochastic processes with no tendency to return to a trend line. If so, at least one of the two premises mentioned by Campbell and Mankiw (1987) might be abandoned, and traditional theories need to be corrected. Following Nelson and Plosser's (1982) method, this study examines whether real wages on the Korean Peninsula during Japan's rule were stationary or non-stationary.

3. Descriptive statistics of Real Wage during Japan's Rule over Korean Peninsula
All the data used in this paper are obtained from Odaka, Saito, Fukao, Mizoguchi, Byou, and Mun (2019, pp. 352-353). We collected descriptive statistics of the real wages of both skilled and unskilled workers on the Korean Peninsula during Japan's rule, as shown in Table 1. The data are annual, covering the period from 1909 to 1942, with a sample size of 34 observations. All series were transformed into natural logarithms.

Table 1: Descriptive Statistics of Real Wage in the Korean Peninsula during Japan's Rule

Variable (Year:1909-1942)	Average Rate of Change (%)	Standard deviation (%)	Coefficient of variation
toskrw	0.48	10.07	21.11
norskrw	0.003	10.75	3112.19
souskrw	0.40	10.97	27.39
tounskrw	0.22	12.91	68.84
norunskrw	0.48	12.53	25.91
souunskrw	0.17	16.36	97.36

The meanings of symbols are as follows.

toskrw: real wage of skilled worker in the entire Korean Peninsula

norskrw: real wage of skilled worker in the northern part of the Korean Peninsula
souskrw: real wage of skilled worker in the southern part of the Korean Peninsula
tounskrw: real wage of unskilled worker in the entire Korean Peninsula
norunskrw: real wage of unskilled worker in the northern part of the Korean Peninsula
souunskrw: real wage of unskilled worker in the southern part of the Korean Peninsula

To calculate the average rate of change in the real wage of skilled labor in the northern part, I use the arithmetic average because it is obtained as a negative value if one uses the geometric average. In other cases, geometric average was used. Note that the coefficient of variation was very high.

Next, we consider the fluctuation characteristic of real wages by depicting figures for each real wage (natural logarithm value) and the first difference in the natural logarithm value.

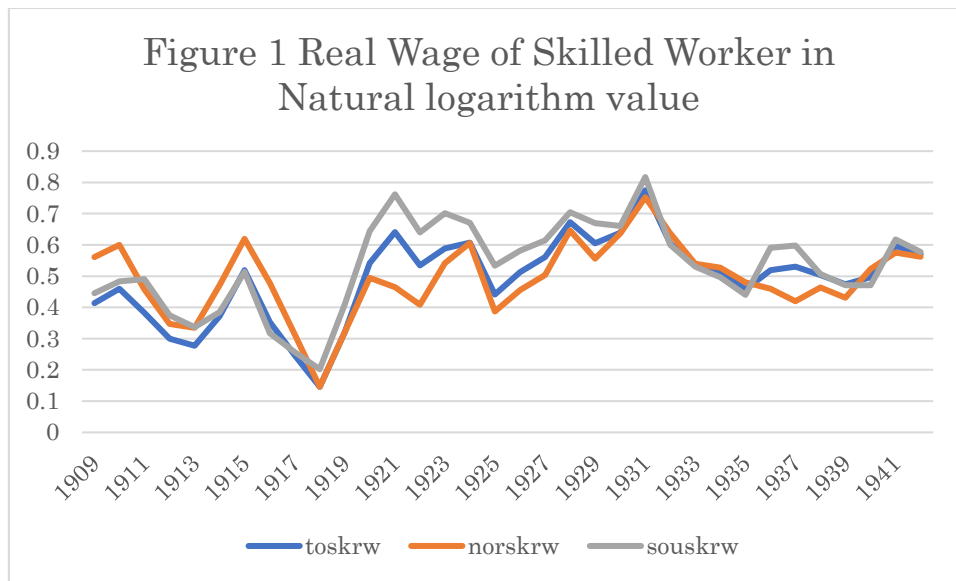


Figure 2 First Difference of Natural Logarithm value of real wage of skilled worker

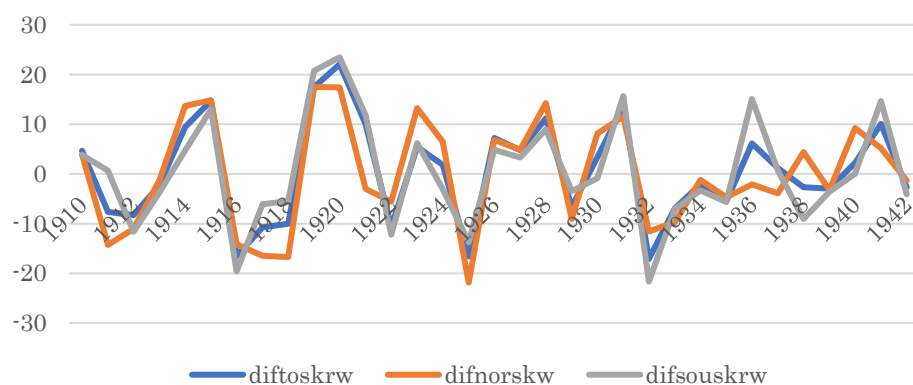
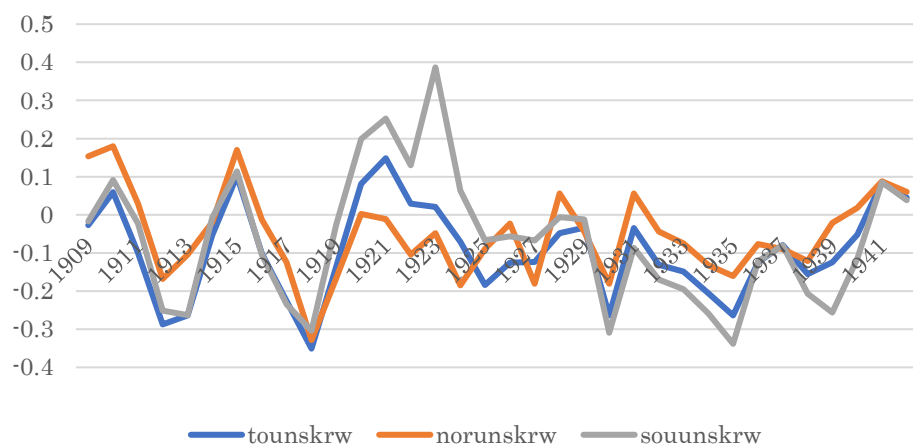
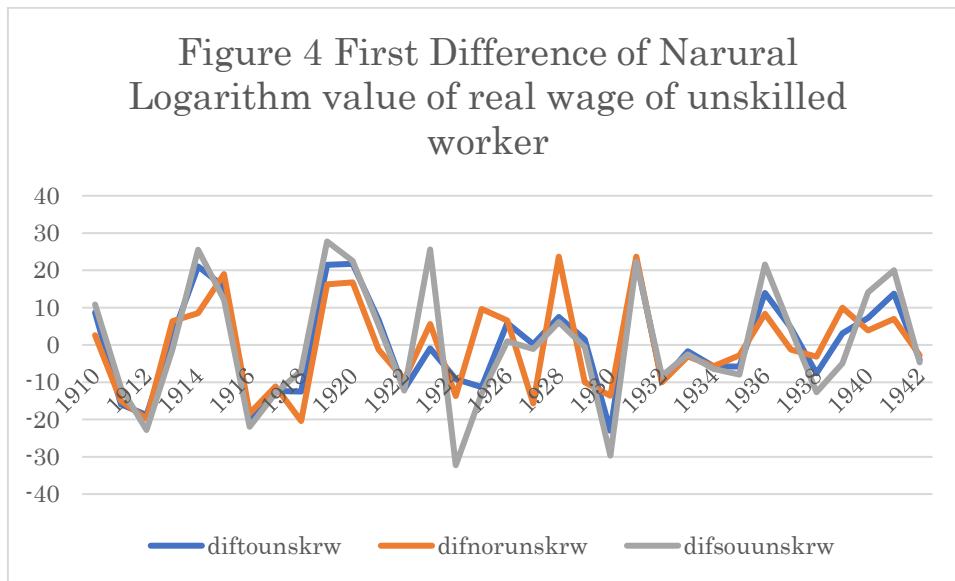


Figure 3 Real wage of unskilled worker in natural logarithm value





As shown in Figures 1 and 3, one can notice that there is no upper trend in both the real wage of skilled labor or the real wage of unskilled labor. Figures 2 and 4 show, that the Figures of the first difference in each real wage are akin to those of the random walk.

4. Analysis of the real wage time series during Japan's Rule over the Korean Peninsula

In this section, I analyze the time series of real wages. The sample autocorrelations of the levels are tabulated in table 2. A logarithmic transformation was applied to the data.

(4-1) Analysis of the sample autocorrelations of real wages

I perform an analysis using autocorrelations for each real wage. Table 2 shows the results of the autocorrelations of the natural logs of each real wage in the annual data.

Table 2 Autocorrelations of the natural logs of annual data

Variable	r_1	r_2	r_3	r_4	r_5	r_6
toskrw	0.71	0.38	0.24	0.22	0.25	0.21
norskrw	0.57	0.08	-0.03	0.11	0.11	0.01
souskrw	0.71	0.40	0.22	0.15	0.16	0.08
tounskrw	0.44	-0.18	-0.42	-0.18	0.19	0.11
norunskrw	0.33	-0.14	-0.25	-0.15	0.28	0.27
souunskrw	0.55	0.13	0.01	0.11	0.16	-0.02

Table 3 Autocorrelations of the first difference of the natural logs of annual data

Variable	$r(1)$	$r(2)$	$r(3)$	$r(4)$	$r(5)$	$r(6)$
toskrw	0.08	-0.32	-0.26	-0.08	0.13	-0.02
norskrw	0.07	-0.42	-0.27	0.18	0.08	-0.16
souskrw	0.03	-0.21	-0.22	-0.14	0.14	-0.04
tounskrw	0.03	-0.31	-0.40	-0.11	0.37	0.10
norunskrw	-0.18	-0.22	-0.09	-0.27	0.33	0.24
souunskrw	-0.05	-0.31	-0.21	0.04	0.24	0.03

Table 4 Autocorrelations of the deviations from the time trend

Variable	$d(1)$	$d(2)$	$d(3)$	$d(4)$	$d(5)$	$d(6)$
toskrw	0.61	0.17	-0.03	-0.03	0.05	0.02
norskrw	0.53	-0.01	-0.14	0.02	0.02	-0.09
souskrw	0.66	0.30	0.08	0.00	0.03	-0.0
tounskrw	0.44	-0.18	-0.42	-0.18	0.19	0.11
norunskrw	0.32	-0.15	-0.26	-0.16	0.28	0.26
souunskrw	0.52	0.08	-0.04	0.05	0.11	-0.08

Table 2 shows the autocorrelations of each real wage from the first to sixth lag. The first-order autocorrelations of the real wages of skilled labor are higher, but do not decay slowly with increasing lags. The first-order autocorrelations of the real wages of

unskilled workers are not close to 1. The autocorrelations of the first difference in each real wage are summarized in Table 3. In all series, the first-order autocorrelations were close to 0. As Nelson and Plosser (1982, p. 147) point out, the only positive autocorrelation at lag one is that the series are generated by a difference stationary process. Our results for the first difference in the real wages of skilled labor are indicative of stationary processes. The results of fitting a linear trend to the data and forming sample autocorrelations of the residuals are presented in Table 4. In this case, the autocorrelation coefficients of the real wage of skilled workers are inclined to be higher than those of unskilled workers. In the case of the real wages of unskilled worker in the entire Korean Peninsula and North, detrending them has almost no effect compared to the case in table 2.

In summary, the autocorrelations of the real wages of skilled workers are indicative of difference stationary processes. In the case of real wages of unskilled workers, we cannot definitely say that they are indicative of difference stationary.

(4.2) Analysis by Augmented Dickey-Fuller test

Next, I perform Augmented Dickey and Fuller tests, following Dickey and Fuller (1979), Nelson and Plosser (1982), and Enders (2015, Chapter 4). The real wages shown in Figure 1 and 3 do not increase over time. Consequently, it can be considered that the issue is whether the series is a random walk. I estimated the following equation for each real wage using the ordinary least squares method. The degree of lag in the Augmented Dickey-Fuller test was determined using the Schwartz Bayesian information criterion (SBIC). I estimated the following equation for each real wage:

$$\Delta w_t = a_0 + \gamma w_{t-1} + \sum_{i=2}^p \beta_i \Delta w_{t-i+1} + \varepsilon_t$$

$$\varepsilon_t \sim \text{i. i. d}(0, \sigma_u^2)$$

ε_t is an identically and independently distributed with mean zero and variance σ_u^2 .

The symbols ***, ** and * indicate that the null hypothesis is rejected at the 1 percent (***), 5 percent (**), and 10 percent (*) levels, respectively.

The results are given in the Table 5. The entries in parentheses represent the t-values for the null hypothesis that the coefficient is zero. It is necessary to use the Dickey-Fuller critical values. At the 0.05 significance level, the critical value for the t -statistics is -2.954 .

Table 5

Variable	Degree of lag	a_0	γ	$\gamma + 1$
Toskrw	0	0.141 (2.24)	-0.280 (-2.24)	0.72
Norskrw	0	0.204 (2.78)	-0.417 (-2.86)*	0.583
Souskrw	0	0.159 (2.30)	-0.292 (-2.32)	0.708
tounskrw	0	-0.05 (-2.01)	-0.544 (-3.34)**	0.456
norunskrw	0	-0.038 (-1.93)	-0.665 (-4.11)***	0.335
Souunskrw	0	-0.03 (-1.04)	-0.443 (-2.95)*	0.557

In case of real wage of skilled labor, the null hypothesis that signifies γ equals zero cannot be rejected. It is supposed that each real wage series of skilled labor act as difference stationary. In case of real wage of unskilled labor in the entire Korean Peninsula, the null hypothesis that signifies γ equals zero can be rejected at the 5 percent level. In case of real wage of unskilled labor in the northern part, the null hypothesis that signifies γ equals zero can be rejected at the 1 percent level. The real wage series of unskilled labor in both the entire Korean Peninsula and the northern part appears to be stationary in level.

(4-3) Analysis by F-tests

Next, I perform an F-test for each real wage of the skilled labor and the real wage of the unskilled labor in southern part, as proposed by Diskey and Fuller (1981). Because the real wages of unskilled labor in both the entire Korean Peninsula and the northern part appear to be stationary in level, F-test to them were not performed. The following description strongly depends on Enders' description (2015, pp. 207-208). Dickey and Fuller (1981) provide three F-statistics (called Φ_1 , Φ_2 , and Φ_3) to test joint hypothesis on the coefficients. I need to test the null hypothesis $\gamma = a_2 = 0$ on the above equation, using the Φ_1 statistic. The null hypothesis was that the data are generated by the

restricted model. The alternative hypothesis is that the data are generated by an unrestricted model. If the calculated value of Φ_1 is larger than that reported by Dickey and Fuller, you can reject the null hypothesis. The results are summarized in table 6. The calculation results are summarized in the following Table 7. The calculated values of Φ_1 are smaller than that reported by Dickey and Fuller (1981, p. 1063. Sample size =25). Thus, I do not reject the null hypothesis, and, equivalently, accept the restricted model.

Table 6

Null Model (the restricted model)	Alternative Model (the unrestricted model)	Test statistic	Critical Values for 95 percent and 99 percent Confidence Intervals
$\Delta w_t = \varepsilon_t$	$\Delta w_t = a_0 + \gamma w_{t-1} + \varepsilon_t$	Φ_1	5.18 and 7.88

Table 7

Variable	Φ_1
toskrw	2.51
norskrw	3.86
souskrw	2.65
souunskrw	0.54

It can be suggested that the growth rate of the real wage series of skilled labor and the growth rate of the real wage series of unskilled labor in the southern part act as a random walk.

5. Concluding Remarks

This study examined the stationarity of real wages over the Korean Peninsula during Japan's rule. Nelson and Plosser (1982) found that they could not reject the hypothesis that the U. S. macroeconomic time series were non-stationary stochastic processes with no tendency to return to a trend line. Based on this idea, I investigated the stationarity of the real wage during Japan's ruling period over the Korean Peninsula. The analysis by the ADF test showed that the real wages of skilled workers were suggested to be difference stationary, while the real wage of unskilled worker in the entire Korean

peninsula and northern part was suggested to be stationary in level. The analysis using F-test showed that the growth rate of the real wage series of skilled labor and that of the real wage series of unskilled labor in the southern part acted as a random walk. Thus, large fluctuations of real wage can be interpreted as real wages followed by random walks, and it can be interpreted that there was no tendency for real wages to return to their natural rate.

Is this conclusion consistent with the realities in developing economies? Because real wages fluctuate significantly, should the Lewis model, which considers real wages to be constant, be considered entirely unrealistic? In addition to these, as Nelson and Plosser (1982) advocated, could we conclude that macroeconomic models that focus on monetary disturbances as a source of purely transitory fluctuations might never be successful? Next, we could consider these problems.

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