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A Welfare Cost of the Lost Decade in Japan

by

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Abstract

This paper measures the welfare cost of the Japanese economy in a 'lost decade' from 1990 to 2002, by using panels of different consumer groups. This paper finds that the costs for consumers in the lower and middle income quintiles and in urban districts are much higher, while it is a benefit for consumer in rural districts. This paper suggests that such cost disparities express the defects related to districts and income quintile group with high costs. Also, there exist consumers feeling this stagnation to be costless and the seriousness of stagnation are not recognized unanimously.

Keywords: welfare cost; a lost decade of Japanese economy; Lucas model

JEL Classification Number:E32;E60;E20

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1. Introduction

The Japanese stagnation has continued for a long time and seems to have become worse recently. Average annual real GDP growth rates were 10.4% in the 1960s, 5.0% in the 1970s, 3.8% in the 1980s, but only 1.7% in the 1990s and only 1.8% in the 2000s (2000–2004).[1] These figures suggest that the stagnation of the 1990s and the 2000s is the longest and deepest of the last fifty years.

Such a long stagnation is a big turmoil in academics as a “lost decade” of Japanese economy. In general, the research for the cause of this stagnation has two strands. As a first strand, Kwon (1998), Ogawa and Suzuki (1998),Bayoumi (1999) and Miyakoshi and Tsukuda (2004), while different a little in a methodology, concluded that fluctuations in asset prices affected output through bank lending. Meltzer (2001) argued that a decline in money growth caused the recession in early past of the decade while a decline in exports caused the recession in the later part of the decade. Motonishi and Yoshikawa (1999) found that real factors were principally responsible for sluggish investment in the period 1992-1994, but the credit crunch appeared after then and lowered the growth rate of GDP by 1.6%. As a second strand, Hayashi and Prescott (2002) stressed that the problem is not a breakdown of the financial system, but a low productivity growth rate, and that research efforts should be focused on what policy changes will allow productivity to again grow rapidly. Morana (2004) and Jorgenson and Nomura (2005), while using different analytical frameworks, find that the productivity shock explains the bulk of output fluctuation both in the short- and the long-terms, supporting the Hayashi and Prescott’s hypothesis.

The Japanese economy is still in a long stagnation at around 1% growth rate. It is necessary to add more fact findings on stagnation, in order to analyze the mechanism and to

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[1] See Annual Report on National Accounts of 2005, Cabinet Office, the Government of Japan.

find appropriate policy for stagnation. Until now, the cost of stagnation has typically been measured by reductions in GDP growth and other similar economic indicators. Whereas producers and firm managers have strong concerns about such cost measures, consumers generally do not. Since such measures are not directly related to welfare costs, consumers are not strongly concerned about these costs. It is interesting to use welfare costs measure to do fact findings. Most previous researches use aggregate data, while the disaggregate data such as district and income quintile group show the influence of stagnation on different people. Then, the detail information for stagnation will be obtained. However, to our knowledge, there have been few attempts to calculate the welfare cost of stagnation and to use disaggregate data.

The purpose of this paper is to measure the welfare cost of the Japanese economy in a 'lost decade' from 1990 to 2002, by deploying a Lucas-Obstfeld model with panels of different consumer groups (incorporating five income quintiles and nine districts groups). This paper finds that the costs for consumers in the lower and middle income quintiles and those in urban districts are much higher, while it is a benefit for consumer in Shikoku district. This paper suggests that such cost disparities express the defects related to districts and income quintile group with high costs: Kanto and Kinki districts and the group of about less than 4 millions yen. Also, the paper suggests that there exist consumers feeling this stagnation to be costless and the seriousness of stagnation are not recognized unanimously.

This welfare cost measure was provided by Lucas (1987) and developed by Obstfeld (1994), Saito (1996), Dolmars (1998), Storestetten,et.al. (2001),Beaudry and Pages (2001) and Pallage and Robe(2003) to measure the cost of the economic instability.[2] They measured both compensations that would leave consumers indifferent to a decline in the

[2] A useful survey of this field is Lucas (2003).

economic growth rate and to an increase of economic instability. However, their concern was only with the latter compensation. On the other hand, Miyakoshi, Okubo and Shimada (2006) call both compensation as a 'welfare cost of stagnation' and their model as a 'Lucas-Obstfeld model', and have explored the practical use of meaning this cost. [3]

This paper is organized as follows. In Section 2, we review Lucas- Obstfeld model. In Section 3, we describe the data set and the statistical methodology used for estimating the parameters. In Section 4 and 5, we estimate the costs of stagnation, discuss the estimates and implications of the results. In Section 6, we calibrate the model and check the robustness of the results. Section 7 concludes the paper.

2. Lucas-Obstfeld Model

We sketch the Lucas-Obstfeld model, while details of derivations are given in Miyakoshi, Okubo and Shimada (2006). The representative agent lives infinitely and maximizes an expected utility function V by choosing real consumption C_t at time t . The agent has a preferences specified by:

$$V = E\left[\sum_{t=0}^{\infty} \beta^{t} \frac{1}{1-\gamma} C_t^{1-\gamma}\right], \qquad (1)$$

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[3] Moreover, they propose an alternative measure to the Lucas–Obstfeld model to analyze the welfare costs of stagnation. Compared with the Lucas–Obstfeld model, the alternative model can evaluate: (i) whether the policy was implemented in a timely fashion, (ii) whether the policy cost was expensive compared with the cost of stagnation, and (iii) whether the policy implemented was effective or whether an additional policy is required. These specific exercises cannot be carried out under the existing frameworks, including the

where $\beta \in (0,1)$ is a constant discount factor and $\gamma > 0$ is the constant coefficient of relative risk aversion. Here, we consider a pure exchange economy with no production, no storable goods and no borrowing. Then, the optimal consumption C_t for an agent is subject to exogenous income I_t in each period and hence is equal to income: $C_t = I_t$ for all t.

Lucas and Obstfeld assume a class of exogenous income. Hence, the optimal consumption streams C_t with trend and cycle components, are given by:

$$
\begin{aligned}
&C_t = \lambda (1+\mu)^t e^{-\frac{1}{2}\sigma^2} z_t, \\
&i.\ e.,\ \ln C_t = \ln\lambda - \frac{1}{2}\sigma^2 + \mathrm{t}\cdot\ln(1+\mu) + \ln z_t : \ln z_t \sim N(0,\sigma^2)
\end{aligned} \tag{2}
$$

where μ is the growth rate of consumption and $\ln z_t \sim N(0, \sigma^2)$. In addition, Lucas and Obstfeld assume that an agent has rational expectations, which implies that an agent knows those moments of the consumption distribution, and then maximizes an unconditional expectation of utility (1): the subscript of time t is not attached on V in (1). Owing to the property of the log-normal distribution, $E(z_t \bullet \exp(-\sigma^2/2)) = 1$, the mean consumption is:

$$
E_t(C_t) = \lambda (1+\mu)^t, \tag{3}
$$

where the mean consumption at t = 0 is λ.

Thus, Lucas and Obstfeld assumed that the stagnation process of exogenous income (consumption) can be expressed by constant moments over time of the distribution of

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Lucas–Obstfeld model.

consumption, λ, μ, and σ^2, and that an agent has rational expectations.

Under the above setup, we can calculate the indirect utility given the consumption process described by (2) and denote it by $V(\lambda, \mu, \sigma^2|\gamma,\beta)$. This is derived as follows:

$$V(\lambda,\mu,\sigma^2 \mid \gamma,\beta) = \frac{1}{(1-\gamma)(1-\phi)} \exp\left\{(1-\gamma)(\ln\lambda - \frac{\gamma}{2}\sigma^2)\right\} \quad if\ \phi < 1,$$

$$\phi = \exp\{\ln\beta + (1-\gamma)\ln(1+\mu)\}. \tag{4}$$

We consider two economies. One is called the *stagnation economy*, in which consumption growth μ_S and its variance σ_S^2 are calculated based on the data in the stagnation period. We denote the resulting indirect utility as $V(\lambda_S, \mu_S, \sigma_S^2 \mid \bar{\gamma}, \bar{\beta})$. The other economy is called the *hypothetical economy* (i.e., the economy without stagnation), which is based on expected consumption under the assumption that the growth rate and the variance in the prestagnation period are maintained during the stagnation period. The resulting indirect utility is $V(\lambda_H, \mu_H, \sigma_H^2 \mid \bar{\gamma}, \bar{\beta})$. The intuition behind this comparison is shown in Figure 1. Owing to (3), the λ_H is mean consumption at the beginning of the stagnation period for the hypothetical economy. Thus, we compare both economies from the beginning of the stagnation period (denoted by t = 0 in Figure 1). Although γ and β may differ between the prestagnation and stagnation periods, we assume that they remain constant over time at $(\bar{\gamma}, \bar{\beta})$.

[INSERT Figure 1]

Based on the indirect utilities under these economies, we define the cost of stagnation as follows.

Definition 1. The cost of stagnation is given by λ^*, which satisfies the following equation:

$$V(\lambda_S+\lambda^*,\mu_S,\sigma_S^2\mid\bar{\gamma},\bar{\beta})=V(\lambda_H,\mu_H,\sigma_H^2\mid\bar{\gamma},\bar{\beta}), \tag{5}$$

where the subscripts S and H denote the stagnation and hypothetical economy, respectively.[4] The cost implies the compensation from the beginning of stagnation to the future.

Then, the cost of stagnation λ^* is given by:

$$\begin{aligned}&\lambda^*=\exp\{\Psi\}-\lambda_S,\\ &\Psi=\frac{1}{1-\bar{\gamma}}\left\{\ln\left(\frac{1\text{-}\phi_S}{1\text{-}\phi_H}\right)+(1-\bar{\gamma})(\ln\lambda_H-\bar{\gamma}\sigma_H^2/2)\right\}+\bar{\gamma}\sigma_S^2/2,\end{aligned} \tag{6}$$

where

$\phi_S=\exp\{\ln\bar{\beta}+(1-\bar{\gamma})\ln(1+\mu_S)\}$ and $\phi_H=\exp\{\ln\bar{\beta}+(1-\bar{\gamma})\ln(1+\mu_H)\}$.

To calculate the costs of stagnation, we proceed as follows. First, we decide the

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[4] The key concept relating to the cost of stagnation is the following. The consumption parameters are different between the stagnation and the hypothetical economies. Consumer preferences, given by $(\bar{\gamma},\bar{\beta})$, transform the difference in consumption parameters into a difference in utility levels. The cost of stagnation is measured by the compensation required to leave consumers indifferent between the two economies.

beginning of the stagnation period and then partition the whole period into two periods: the pre-stagnation and the stagnation periods. Second, the preference parameters (γ,β) of (1) are decided based on the previous researches for the Japanese economy, the parameters (λ,μ,σ^2) of (2) for both economies are estimated by the Maximum Likelihood (ML) and we compute the costs, which are reported in Tables 1 and Table 2. Third, we measure the costs of stagnation in different income quintiles and districts, which are reported in Tables 3 and 4. Fourth, we calculate these costs for varying values of the parameters (γ,β) to check the robustness of the results. These results are reported at the last panels of Table 3 and Table 4.

3. Data and Estimation Methods

Data

The data used in this paper are monthly data from January 1975 to August 2002 (i.e., 1975:M1 to 2002:M8), which gives 332 observations. To estimate the parameters (λ, μ, σ^2) for consumption in the model, we use total consumption expenditure for workers' households from the *Monthly Report on Family Income and Expenditures Survey* (FIES). As the FIES reports nonseasonally adjusted data, we apply the census X-11 method to obtain the seasonally adjusted series. The per capita series is constructed by dividing consumption expenditure by the number of family members in the household. These data are converted to real values by using the consumer price index (for general prices in 2000) from the *Monthly Report of the Consumer Price Index*. All data are taken from the NIKKEI NEEDS CD-ROM.

We partition the whole sample (1975:M1 to 2002:M8) into two subsamples. The first subsample (a pre-stagnation period) is from 1975:M1 to 1989:M12 and the second (the stagnation period) is from 1990:M1 to 2002:M8. Our objective is to estimate the cost of stagnation economy during the stagnation period by comparing it with the hypothetical economy. This partition of periods is supported by Miyakoshi, Okubo and Shimada (2006) where some historical events are shown and a structural break is tested by using Perron (1989,pp.1380).[5] They also reject the null hypothesis of unit root for consumption with a break point, supporting the stationality of data.

Preference Parameters

A large empirical literature has been devoted to estimating the coefficient of relative risk aversion and the discount factor. However, it seems fair to say that there is no complete consensus on their values; in particular, it is difficult to specify what value of the relative aversion coefficient is. (see, e.g., Nakano and Saito (1998) and Hamori (1998)). Following convention, therefore, we adopt a strategy that sets the preference parameters exogenously within some range. In this paper, as a base value, we use 0.996 for $\bar{\beta}$ and 2.5 for $\bar{\gamma}$ as in Miyakoshi, Okubo, and Shimada (2006). To check robustness of the base result, we also try $\bar{\gamma}$ = 0.5, 1.5, 3.5, 5.0, which encompass the range of parameter values used in previous research. Since it is recognized that the estimates of the discount factor are relatively stable, the discount factor is fixed at the base value for ease of comparison.

Estimated Consumption Parameters

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[5] They show that this partition of periods is consistent with previous research including Hayashi and Prescott (2002). They suggest that stagnation began in 1990:M1 because the NIKKEI 225 peaked at a stock price of 38,926 yen in 1989:M12. Since that date, it has fallen gradually, as has the price of land. These events are said to define the collapse of the so-called Japanese bubble economy. In line with previous research, we maintain the importance of these events in defining the starting point of stagnation. Figure 2 plots consumption in logs, which shows the behavior of the data in the model. It suggests a trend break in the log of consumption (which reduces consumption growth) around 1990:M1. These figures suggest an obvious structural change.

The parameters for consumption in a pre-stagnation period (1975:M1-1989:M12) and a stagnation period (1990:M1-2002:M8) are estimated by applying a ML methodology to the whole sample from 1975:M1 to 2002:M8:

$$\begin{aligned} \ln C_t &= \ln(\lambda_H(1-DU_t)+\lambda_S DU_t)-\frac{1}{2}(\sigma_H^2(1-DU_t)+\sigma_S^2 DU_t) \\ &\quad + t\cdot\ln(1+\mu_H(1-DU_t)+\mu_S DU_t)+\ln z_t : \\ &\qquad \ln z_t \sim N(0,\sigma_H^2(1-DU_t)+\sigma_S^2 DU_t) \end{aligned} \tag{9}$$

where $DU_t=1$ if $t>T_B$ (that is, T_B=1989:M12) and 0 otherwise. All parameters can be identified by being included in the variance of the distribution. Miyakoshi, Okubo and Shimada (2006) have already supported the normality of $\ln z_t$. They have also showed that the parameters in both the prestagnation and the stagnation periods are estimated and denoted as the estimated parameters for the hypothetical economy and the stagnation economy. The exception is an estimate for λ in a hypothetical economy, which is replaced with one for a stagnation economy. The values are shown in Panel (B) of Table 1 in this paper. An agent perceives that the estimated parameters in both periods are the consumption parameters for both economies. All parameter estimates for consumption are statistically significant at the 1% level. The estimated monthly consumption growth rate falls from 0.1059% in the pre-stagnation period to –0.002018%. The variance (which represents instability) of the error term in the log of consumption increases from 2.339E(-4) to 3.927E(-4). The difference in consumption growth and variance between both economies is also statistically significant at 5 % level, as is shown in Panel (C) of Table 1. The λ_H for the hypothetical economy, an estimated consumption for 1990:M1 (out-of-sample) by using the estimated parameters during the pre-stagnation periods, can be available. However, for the sake of simplicity, we reset the λ_H equal to λ_S.

[INSERT Figure 2 and Table 1]

Estimated Cost

What is the estimated cost of stagnation according to this model? As Table 2 shows, by using these parameters in equation (5), we obtain a utility level of -3.813E(-06) for the hypothetical economy and one of -5.362E(-06) for the stagnation economy. This implies that the stagnation reduces utility. Our cost measure λ* enables us to convert the reduction in the utility level into a level of compensation in Japanese yen. The cost of stagnation is 25,390 yen. The cost ratio (cost/λ_H) is the ratio of the cost to the consumption of the hypothetical economy at the starting period. It is 26%, which shows the relative amounts and hence an actual impact.

To check the robustness of the results, we calibrate the preference parameters in (1). Note here that $\gamma>0$ implies risk aversion. The costs and the ratios of costs range from 20,257 yen to 33,180 yen and from 20% to 33% as γ decreases. These findings were already shown theoretically in Miyakoshi, Okubo and Shimada (2006) as follows:

$$\begin{aligned} &\partial\lambda^* / \partial\overline{\beta} > 0,\ \partial\lambda^* / \partial\overline{\gamma} < 0 \quad \mathit{if}\ \ \mu_H > \mu_S, \\ &\partial\lambda^* / \partial\overline{\beta} < 0,\ \partial\lambda^* / \partial\overline{\gamma} > 0 \quad \mathit{if}\ \ \mu_H < \mu_S, \end{aligned} \tag{10}$$

and

$$\partial\lambda^* / \partial\mu_H > 0,\ \partial\lambda^* / \partial\mu_S < 0,\ \partial\lambda^* / \partial\sigma_H < 0,\ \partial\lambda^* / \partial\sigma_S > 0. \tag{11}$$

Thus, the proposed welfare cost measure λ*, which is particularly relevant to consumers, suggests that the cost of stagnation is large for Japanese consumers. As this represents what people are willing to pay to prevent the outbreak of stagnation, it indicates that people were prepared to pay a great deal to avoid the stagnation.

[INSERT Table 2]

4. Welfare costs of workers' households in different categories

Most of investigations for workers' household in Section 3 are already implemented by Miyakoshi, Okubo and Shimada (2006). However, in this section, by using these methods and comparing with these results, we measure and evaluate the welfare costs of workers' households in different categories. Considering the stationarity, the date of structural change, the normality of stochastic term of (9) for workers' household consumption data, we assume that consumption data in different categories satisfy these conditions.

Figure 3 plots the consumption series for workers' households in five income quintile groups. For example, the five income quintiles observed in 2002 are (in millions of yen per year): less than 4.56; from 4.56 to 6.03; from 6.03 to 7.62; from 7.62 to 9.79; and greater than 9.79. The same household will belong to some income quintile in the current year and to another quintile in the subsequent year. We suppose that the household changes the preference and consumption parameters from one year to the next, depending on the different income quintile. We evaluate the changes in these consumption series.

[INSERT Figure 3]

Panels (A) and (B) of Table 3 report the estimated consumption parameters (λ, μ, σ^2) and the base preference parameters (γ, β) for each income quintile. By using these parameters, we evaluate the difference in consumption between the hypothetical and the stagnation economies. The larger the difference in consumption parameters between two economies and the smaller the associated preference parameters γ, the higher the costs of stagnation are, as theoretically suggested by (10) and (11).

There is substantial variation in the differences in (μ, σ^2) between the five income quintile groups. The differences in (μ, σ^2) between the stagnation and the hypothetical economies are (–0.00129, –0.00161) for the first group and (–0.00125, 0.00078) for the fourth group, respectively. The negative difference of μ and the positive difference σ^2 enlarge the costs, as shown in (11). These differences are computed from the figures in Table 3. However, for the same preference parameters (0.996, 2.5) for the first and fifth groups, the differences in consumption parameters are associated with higher costs of stagnation (i.e., 20,637 yen and 28,721 yen). The cost, 20,637 yen, is less than that for consumers in the upper income quintile. However, the costs of 20,637 yen and 28,721 yen are 29% and 22% of the initial levels of consumption λ_H=71,427 yen andλ_H=133,232 yen, prevailing in 1990:M1. Hence, in percentage figures, the cost for the first group is higher than the cost for the fifth group. Thus, there are large differences in the costs of stagnation for consumers in different income quintile groups: the lower and middle group with larger costs; the upper group with smaller costs. The cost 26% for an average worker seen in Table 2 locates between second and third groups in Table 3, irrespective to the values of γ. These findings are supported by Figure 3, which shows that consumption growth increases and decreases more for the first and fifth groups in both sub-periods, respectively.

[INSERT Table 3 and Table 4]

Similar investigations are applied to the cost for consumers living in different districts. As Panel (C) (γ=γ*, β=β*) of Table 4 shows, the costs for consumers living in rural districts such as Hokkaido (8,180 yen, or 9% to initial consumption λ_H), Shikoku (–5,000 yen, or

-7%) and Kyusyu (5,586 yen, or 6%) are low. In fact, consumers in the Shikoku district benefited during the stagnation period. By contrast, the costs for consumers in urban districts such as Kanto (47,772 yen, or 42%) and Kinki (28,642 yen, or 28%) are high. Thus, there are large costs differences for consumers living in different districts.

5. Implications of the Results

High costs are attributable to a large decrease in the growth rate μ and the associated small γ and large β preference parameters, as suggested by (10) and (11). Why does the consumption growth rate μ for these groups decrease more than it does for those in the upper income quintile and those in rural districts? This is an interesting question for future research.

However, we briefly consider the implication of the results. (i) The higher cost suggests the serious defect of work situation around these consumers. Miyakoshi and Tsukuda (2004) find that regional disparities in banking performance made a substantial contribution of regional disparities of economic growth: the bad (good) performance in urban (rural) districts caused to its low (high) economic growth. We provide the same results for economic growth, though we did not investigate the causes in this paper. On the other hand, the Gini coefficient provides one of measures for inequality. However, even without any significant Gini change, there is a statistical reason to worry. If individuals are re-binned by income every month, then should not one expect to see people in the lower income quintile to do worse, consumption-wise, than people who are doing relatively better, income-wise? The welfare cost for consumer in lower income quintile express consumer to do worse. In fact, the Japanese Gini coefficient for redistributed income is every three years 0.3455 in 1975, 0.3381 in 1978, (0.3143, 0.3426, 0.3382), 0.3643 in 1990, (0.3645, 0.3606), 0.3814 in 1999, 0.3812 in 2002. The data source is called “Shyotoku Saibunpai Chyosa Houkoku-shyo (in Japanese)”at http://wwwdbtk.mhlw.go.jp/toukei/kouhyo/indexkk_6_3.html., in the Statistical Database, The Ministry of Health, Labor and Welfare of Japan. In particular, the coefficient increases from 1990, while it does not show the great increase. However, the consumers in the lowest income group do worse and pay the cost ratio of 29%, compared with the 22% in the highest income group. (ii) The regional and income quintile disparities for the welfare costs suggest that there exist consumers feeling this stagnation to be costless and the seriousness of stagnation are not recognized unanimously.

6. Robustness of Costs in Different Categories

We calibrate the model by using $\gamma = 0.5, 1.5, 3.5, 5.0$ and the estimates of β for consumers in different categories, as in the previous section. We check the robustness of the effects by using different values of γ. We focus on this cost ratio. The results are shown in Tables 3 and 4. The smaller the value of γ, the larger the cost ratio for the first group (lower income group) is. The cost ratio in the first group account for 29% when $\gamma = 2.5$, while those in the fifth groups account for less than 27% for all γ. Thus, higher cost ratios appear in lower or middle income groups, while lower cost ratios appear in the upper income quintiles, approximately independently of the value of γ.

Similarly, we check the robustness of the costs in different districts when the value of γ is the same for consumers in each district. For almost values of γ, Kanto, Kinki and Hokuriku remain the highest cost districts, while Hokkaido, Kyusyu and Shikoku remain the lowest cost districts, since the order of magnitude for cost does not change for all γ. Moreover, the highest cost -5% (for $\gamma = 5$) of the low-cost districts exceeds the lowest cost 35% (for $\gamma = 5.0$) of the high-cost districts. Hence, costs for consumers living in the urban districts are high, and are low for those in the rural districts, approximately independently of the value of γ.

When the economic prospects of a locality permanently worsen, one expects that at least some people who live there will try to relocate. If so, are those who stay the ones who are at least able to move- and thus are likely to fare the worst? Or, to the contrary, are those who move those who need it the most –in which case, those saving are likely to be left relatively unscathed? Thus, if it turns out that these groups' compositions did not remain constant during or across the sample periods, such an analysis is flawed. The same problem remains for the income quintiles. Due to the data ability, we focus on the regional disparity of welfare costs and have to confirm the population to be low mobile among regions during the pre-stagnation and the stagnation periods. As Figure 5A shows, the ratios of the internal migration for a whole Japan decreases gradually from 1975 when we start to investigate compared with the previous years, suggesting the low mobility of population which support the groups' compositions remain constant. Also, as Figure 5B shows, the net internal migration for Tokyo, Nagoya and Osaka Area which mostly correspond to the Kanto, Tokai and Kink districts, decrease gradually to zero from 1975. Though the numbers of in-migrants and out-migrants are not so small, the net migrant do not increases and then it will not change the composition of people with large costs. As Figure 5C shows, the net internal migration for each prefecture in Shikoku district increases from 1990, while most of the in-migrants from other prefectures and out-migrants to other prefectures indicate the mobile within the Shikoku district. We may consider that the groups' compositions did remain constant during or across the sample periods.

7. Concluding Remarks

This paper has calculated the cost of the Japanese long stagnation (so-called the lost decade of the Japanese economy) beginning in January 1990. We found that the cost of stagnation for consumers is high at 25,390 yen, 26% of the consumption at the starting period of stagnation (99,373 yen), per month. In particular, the cost ratio of stagnation for consumers in lowest and middle income quintiles (Group1,3,4) and for consumers living in urban districts (Kanto) are the highest: in detail, at different district category, Hokkaido (9%);Tohoku(12%);Kanto(42%);Hokuriku(22%); Tokai(18%); Kinki (28%); Chugoku(25%);Shikoku(-7%);Kyushu(6%), at different income category; lowest income(29%);second lower(23%);third (32%);fourth (30%);fifth(22%).

The higher cost suggests the serious defect of work situation around these consumers. The high cost is due to the good economic condition in a pre-stagnation period or the bad economic condition in a stagnation period. In general, the consumers in urban district and low income quintiles are in this case. Also, the regional and income quintile disparities for the welfare costs suggest that there exist consumers feeling this stagnation to be costless and the seriousness of stagnation are not recognized unanimously. As the welfare costs of stagnation equal to the costs that people are willing to pay to prevent the stagnation, the consumers in low income quintiles and in urban district are easier to agree the high policy cost, compared with their own welfare costs.

We did encounter at least one problem. We include the period of the Japanese bubble economy (1985 to 1989) into the pre-stagnation period when we set up the hypothetical economy (without the stagnation) as a base economy. However, the Japanese bubble economy may not be a base economy. The problem is expected to be resolved in the future, but our approach is a first trial for understanding the costs of stagnation.

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Table 1. Estimated Parameters for Consumption.

(A) Utility Parameters	(B)Consumption Parameters			(C) Test Hypotheses	
H-ECO & S-ECO		H-ECO	S-ECO	Hypothesis	$\chi^2(1)$
	λ	99373 yen	99373 yen		
		(619.43)	(619.43)		
γ^* 2.5	μ	1.059E(-3)	–2.018E(-5)	H1: $\mu_H=\mu_S$,	8049.48
		(101.91)	(-3.33)		
β^* 0.996	σ^2	2.339E(-4)	3.927E(-4)	H2: $\sigma^2{}_H=\sigma^2{}_S$,	15.54
		(10.95)	(11.50)		

Notes: E(-0X) means 10^{-X} . H-ECO and S-ECO denote the hypothetical and the stagnation economies, respectively. The λ is consumption in yen in 1990:M1 for both economies. The critical value of $\chi^2(1)$ distribution is 3.84 at 5% level. See Miyakoshi, Okubo and Shimada (2006: Table 2B). The numbers in parentheses (..) denotes t-values.

Table 2. Costs of Stagnation (Aggregate) and Ratios of Cost

Models	Indirect Utility		Costs of Stagnation	
	H-ECO	S-ECO		
			λ^* (¥ yen)	λ^*/λ_H (%)
$\gamma=\gamma^*$ $\beta=\beta^*$	–3.813E(–06)	–5.362E(–06)	25,390	26
$\gamma=0.5$ 〃	181,567	157,237	33,180	33
$\gamma=1.5$ 〃	–1.401	–1.590	28,610	29
$\gamma=3.5$ 〃	–1.938E(–11)	–3.256E(–11)	22,968	23
$\gamma=5.0$ 〃	–3.126E(–19)	–6.557E(–19)	20,257	20

Note: λ^*/λ_H denotes the ratio (%) of cost λ^* to consumption λ_H in yen in 1990:M1. See notes of Table 1.

Table 3. Cost of Stagnation (Income Quintile Groups)

	Economy	Group 1	Group 2	Group 3	Group 4	Group 5
(A) Consumption Parameters						
Λ	H-ECO	71,427	80,154	99,059	109,051	133,232
	S-ECO	71,427	80,154	99,059	109,051	133,232
M	H-ECO	0.00137 (24.01)	0.00112 (44.34)	0.00104 (50.95)	0.00119 (72.17)	0.00088 (15.40)
	S-ECO	0.00008 (7.43)	0.00012 (15.84)	–0.00023 (-22.64)	–0.00006 (-5.02)	–0.00003 (-2.70)
σ^2	H-ECO	0.00277 (14.12)	0.00093 (10.08)	0.00074 (10.40)	0.00059 (11.87)	0.00275 (14.33)
	S-ECO	0.00116 (12.19)	0.00069 (8.13)	0.00106 (12.93)	0.00137 (9.17)	0.00120 (10.72)
H1: $\mu_H=\mu_S$	$\chi^2(1)$	496.87	1414.12	3101.67	3848.13	244.28
H2: $\sigma^2_H=\sigma^2_S$	$\chi^2(1)$	54.95	3.90	8.82	24.42	48.59
(B) Preference Parameters						
γ*		2.5	2.5	2.5	2.5	2.5
β*		0.996	0.996	0.996	0.996	0.996
(C) Cost of Stagnation						
$\gamma = \gamma$*	$\beta = \beta$*	20,637 [29]	18,092 [23]	31,904 [32]	32,564 [30]	28,721 [22]
$\gamma = 0.5$	〃	30,319 [42]	24,891 [31]	39,303 [40]	43,554 [40]	36,047 [27]
$\gamma = 1.5$	〃	24,412 [34]	20,867 [26]	34,931 [35]	36,983 [34]	31,871 [24]
$\gamma = 3.5$	〃	17,963 [25]	16,037 [20]	29,689 [30]	29,348 [27]	26,228 [20]
$\gamma = 5.0$	〃	15,102 [21]	13,765 [17]	27,328 [28]	25,852 [24]	23,299 [17]

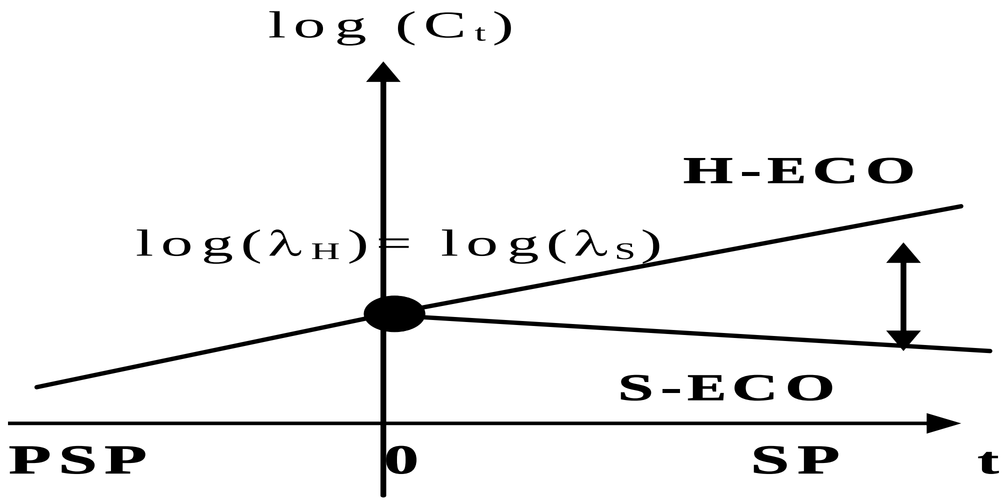
Note: The β* and γ* are the base values of preference parameters for each income quintile group. The numbers in parentheses [..] denote the λ^* / λ_H (%) as seen in Table 2. See notes of Table 1.

Table 4. Cost of Stagnation (Districts)

	Economy	Hokkaido	Tohoku	Kanto	Hokuriku	Tokai	Kinki	Chugoku	Shikoku	Kyusyu
(A) Consumption Parameters										
λ	H-ECO	92,168	90,731	113,904	91,157	86,958	101,421	95,800	72,975	87209
	S-ECO	92,168	90,731	113,904	91,157	86,958	101,421	95,800	72,975	87209
μ	H-ECO	0.00065	0.00054	0.00136	0.00139	0.00121	0.00100	0.00101	0.00064	0.00046
		(21.05)	(15.84)	(71.94)	(30.00)	(45.69)	(59.42)	(30.53)	(14.36)	(14.70)
	S-ECO	0.00026	**0.00003**	-0.00029	0.00035	0.00037	-0.00014	-0.00003	0.00102	0.00018
		(10.57)	(1.62)	(-35.20)	(11.54)	(24.99)	(-11.35)	(-1.91)	(50.13)	(14.47)
σ^2	H-ECO	0.00196	0.00212	0.00071	0.00301	0.00140	0.00068	0.00269	0.00348	0.00209
		(8.27)	(9.15)	(11.13)	(10.22)	(10.92)	(12.13)	(9.40)	(9.01)	(8.72)
	S-ECO	0.00329	0.00268	0.00068	0.00497	0.00235	0.00166	0.00325	0.00416	0.00166
		(9.24)	(9.36)	(9.94)	(9.36)	(9.72)	(8.37)	(9.15)	(9.07)	(9.44)
H1: $\mu_B=\mu_S$	$\chi^2(1)$	79.35	187.46	6402.75	366.74	771.11	2998.40	779.87	59.35	65.61
H2: $\sigma^2_B=\sigma^2_S$	$\chi^2(1)$	9.57	**2.33**	**0.07**	10.28	12.18	22.36	**1.51**	**1.26**	**2.15**
(B) Utility Parameters										
γ*		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
β*		0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996
(C) Cost of Stagnation										
γ = γ*	**β = β***	8,180	11,163	47,772	20,105	15,452	28,642	23,780	-5,000	5,586
		[9]	[12]	[42]	[22]	[18]	[28]	[25]	[-7]	[6]
γ =0.5	〃	10,063	12,821	63,342	30,867	22,786	35,622	30,531	-7,274	6,590
		[11]	[14]	[56]	[34]	[26]	[35]	[32]	[-10]	[8]
γ =1.5	〃	9,003	11,916	53,734	24,200	18,346	31,540	26,593	-5,935	6,047
		[10]	[13]	[47]	[27]	[21]	[31]	[28]	[-8]	[7]
γ =3.5	〃	7,524	10,525	43,726	17,313	13,405	26,467	21,646	-4,307	5,187
		[8]	[12]	[38]	[19]	[15]	[26]	[23]	[-6]	[6]
γ =5.0	〃	6,759	9,729	39,723	14,464	11,248	24,055	19,243	-3,544	4,679
		[7]	[11]	[35]	[16]	[13]	[24]	[20]	[-5]	[5]

Notes: See notes of Table 1 and Table 3.

Figure 1. Hypothetical and Stagnation Economies



Note: PSP (H-ECO) and SP (S-ECO) denote the prestagnation and the stagnation periods (the hypothetical and the stagnation economies), respectively. Parts of the intercept, $-(1/2)\sigma^2_H$ and $-(1/2)\sigma^2_S$, are neglected because they are negligible.

Figure 2. Per capita total consumption in logarithm (Aggregate)

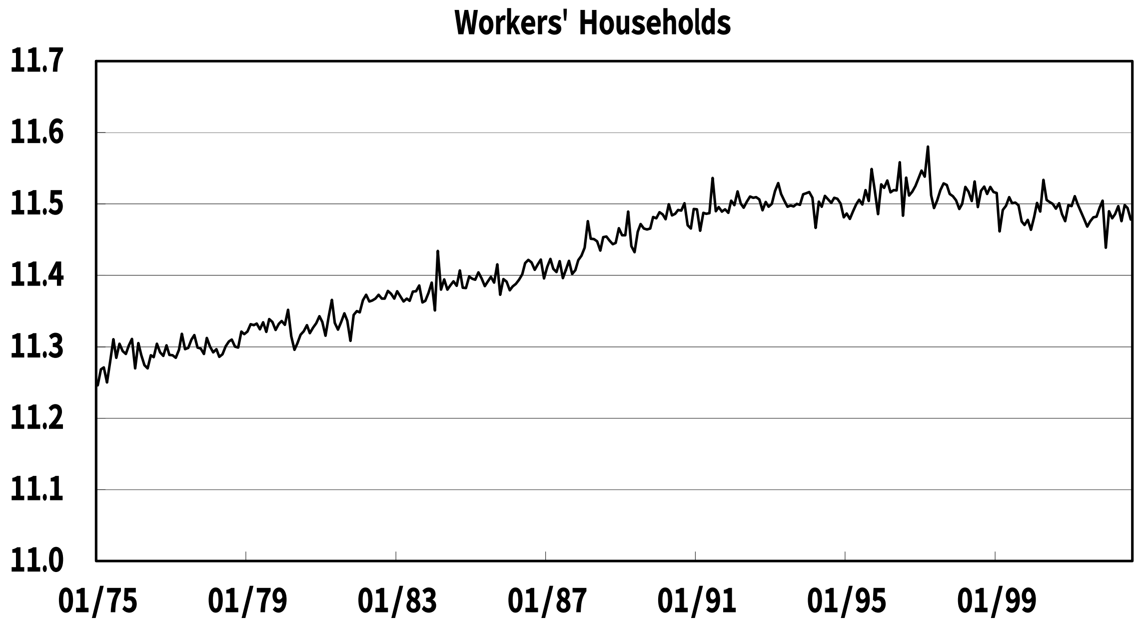
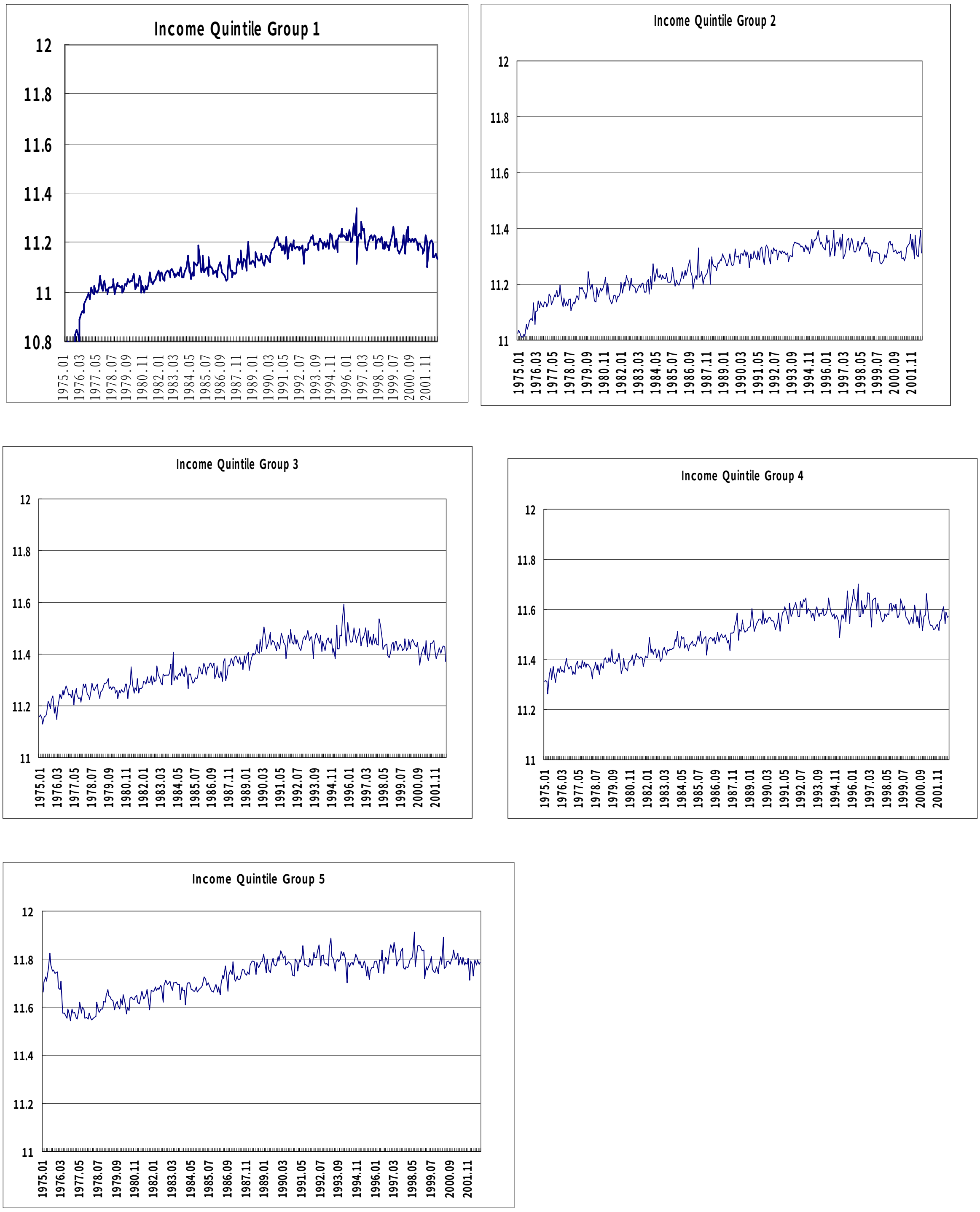
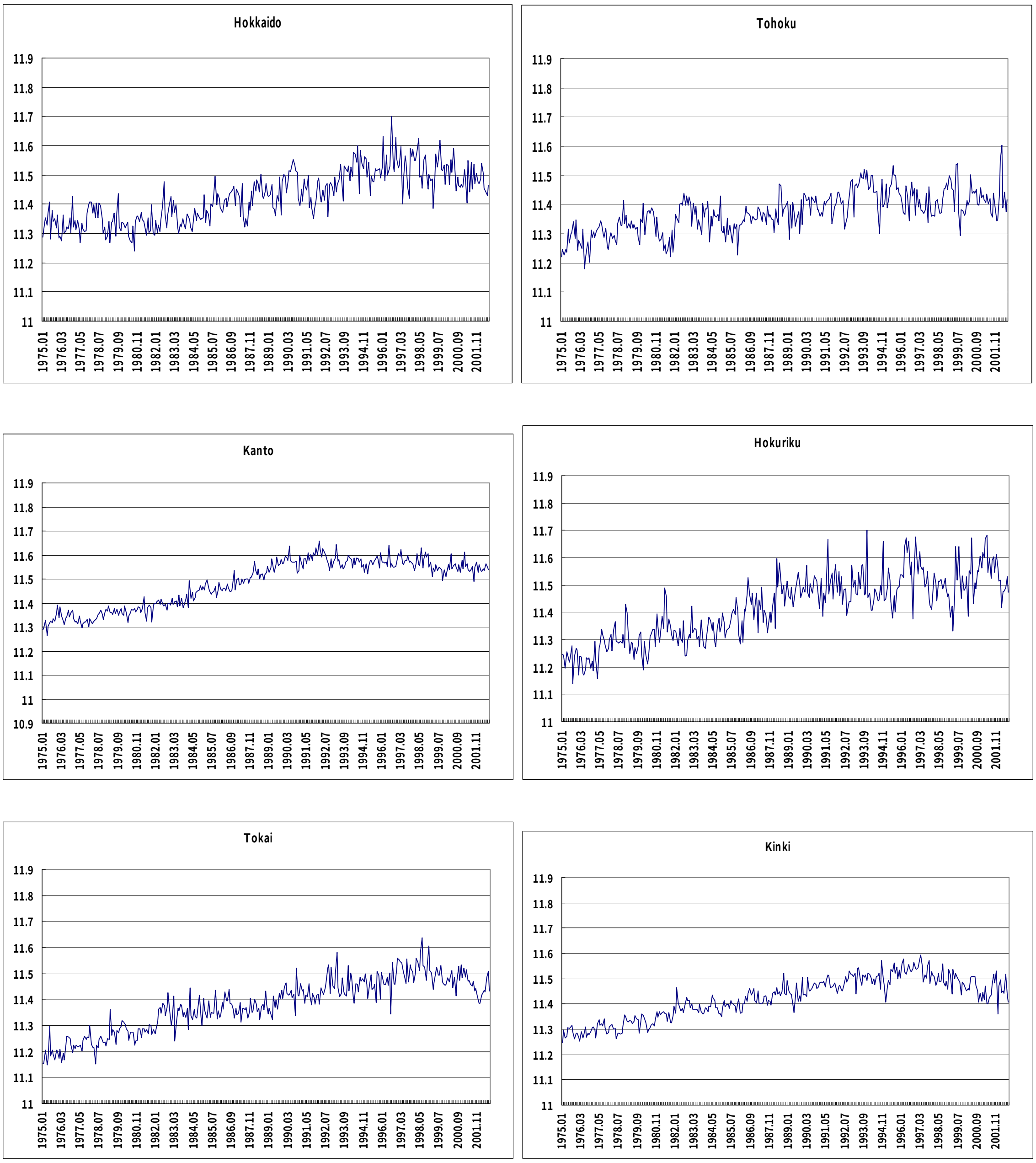


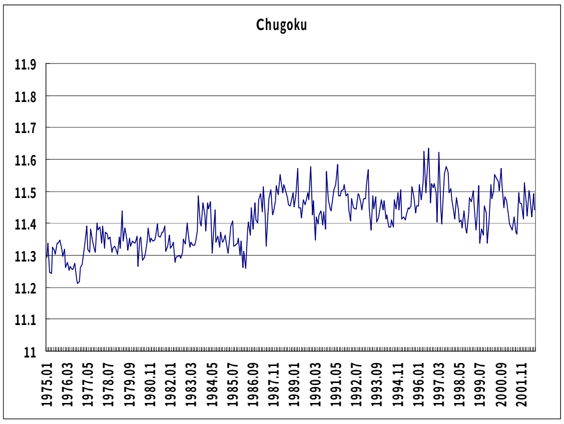
Figure 3. Per capita total consumption in logarithm (Income Quintile Groups, Workers' Households)



Note: For the notation of the period, the 1975.01 means Jan,1975.

Figure 4. Per capita total consumption in logarithm (Districts, Workers' Households)




Chugoku
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
1975.01
1976.03
1977.05
1978.07
1979.09
1980.11
1982.01
1983.03
1984.05
1985.07
1986.09
1987.11
1989.01
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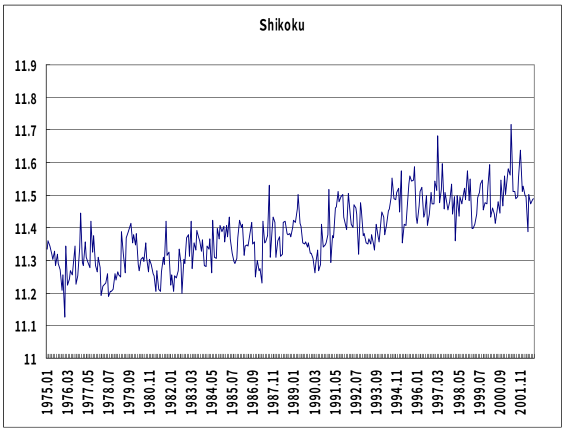
1999.07
2000.09
2001.11


Shikoku
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
1975.01
1976.03
1977.05
1978.07
1979.09
1980.11
1982.01
1983.03
1984.05
1985.07
1986.09
1987.11
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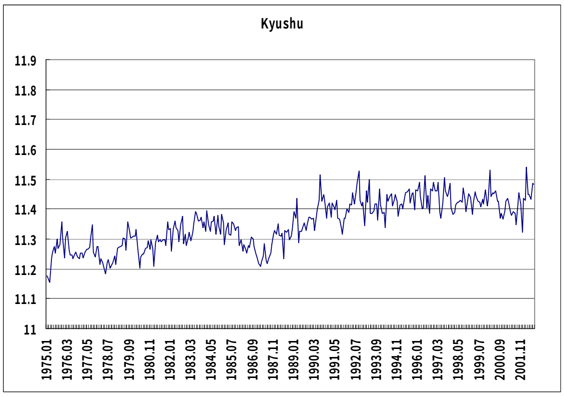
1999.07
2000.09
2001.11


Kyushu
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11
1975.01
1976.03
1977.05
1978.07
1979.09
1980.11
1982.01
1983.03
1984.05
1985.07
1986.09
1987.11
1989.01
1990.03
1991.05
1992.07
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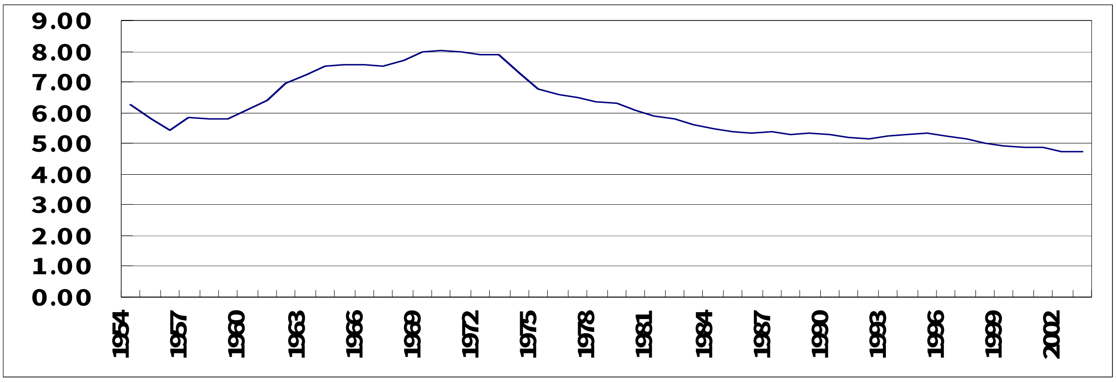
1997.03
1998.05
1999.07
2000.09
2001.11

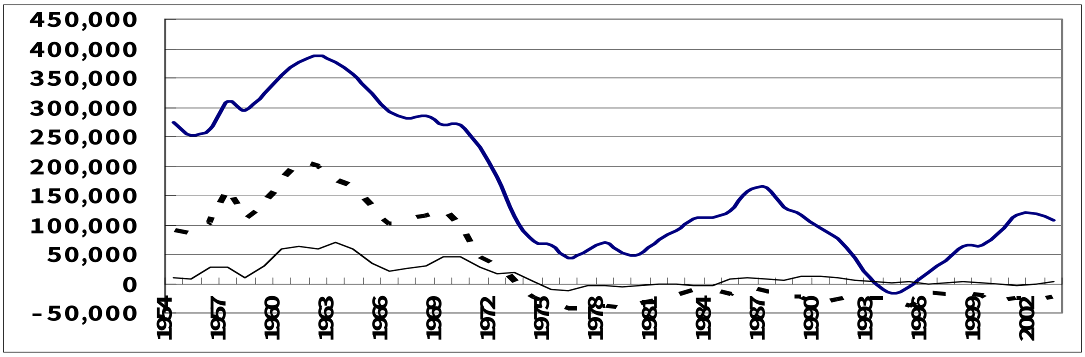
Figure 5A. Rate of internal migration from 1954 to 2003 : (%)



Note: Rate of internal migration for a whole Japan refers to the ratio of the migrants to the Japanese population.

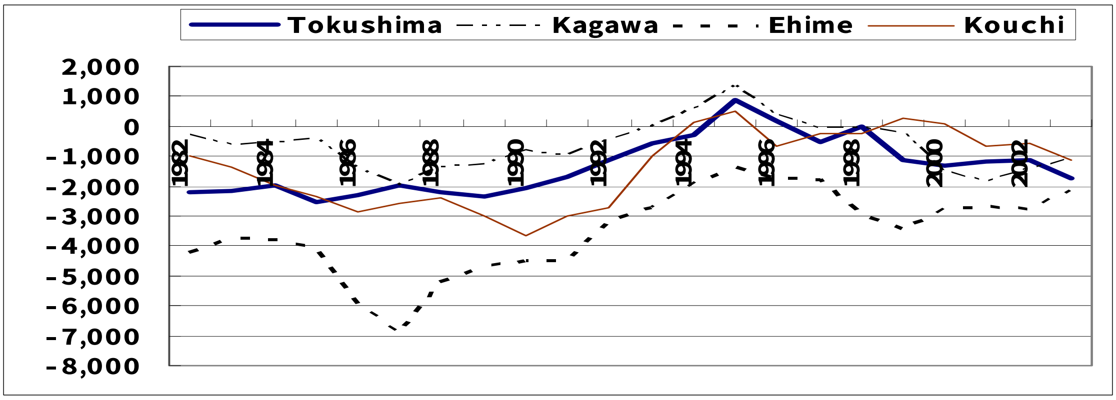
Figure 5B. Net internal migration for Tokyo, Nagoya and Osaka Area: 1954-2003:

(people) — Tokyo, — Nagoya, ----Osaka



Note: The minus means the net loss. Prefectures included each area are as follows. Tokyo area:Tokyo,Saitama,Kanagawa,Chiba; Nagoya area: Aichi, Gifu, Mie; Osaka area:Osaka,Hyogo,Kyoto,Nara.

Figure 5C. Net internal migration for Shikoku district: 1982-2003:(people)



Note: Shikoku district consists of four prefectures: Tokushima, Kagawa, Ehime and Kouchi.

Data source: Statistics Bureau of Japan (http://www.stat.go.jp/data/idou/3.htm)