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Measuring the Cost of the Japanese Financial Recession

by

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ABSTRACT

This paper provides a measure for cost of recession and estimates the cost of Japanese economic recession starting from 1990:M1. The cost of recession is defined to be compensation on the consumption during a recession period, required to leave the consumers preference indifferent between a base period and a recession period. The cost of recession per month is ¥74,393.05 yen at 2000:M1, which amounts 79% compared with the actual consumption at that month.

Keywords: cost of recession; compensation; Japanese recession
JEL Classification Number: E32; E60;E20

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1. Introduction

The Japanese stagnation continues for a long time and seems to worsen recently. The real GDP growth in 2001 is -1.2% (3.2% in 1982) and the unemployment rates hits 5.2% (2.5% in 1982). In particular, the annual average GDP are 10.4% in 1960s, 5.0% in 1970s, 4.2% in 1980s,1.6% in 1990s and 0.7% in 2000s (2000- 2001). These numbers suggest that the recession starting from 1990s is a longest and deepest recession in the post World War II.[1]

However, the GDP growth rate does not reflect directly the situation of each individual person and even the unemployment rates do not if they and their relatives are not unemployed. These measures for the recession seem not to be true to nature. Moreover, all banks and large companies in each industry do not go bankrupt even though they failed, since they are rescued by the monetary authority providing tax money: Risona Holdings, Inc. is a just recent failed company. Then, the Japanese cannot feel the recession actually. Alternative measures for recession with actual feeling are expected. They expect that the immediate and decisive policy decision is implemented based on actual feeling of recession.

Lucas (1987, pp. 20-31) computes the compensation which leave the consumer preference-indifferent from the decrease of the consumption growth rate, and leave the consumer preference-indifferent between consumption instability and a perfectly smooth consumption path. Lucas calls the former compensation "a cost of reduced growth" and the latter "a cost of economic instability". These measures of compensation are the alternatives for GDP or unemployment rate, which are aided to all

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[1] See Annual Report on National Accounts of 2003, Cabinet Office, Government of Japan.

people and then a matter of big concern to all persons. However, both measures are defined based on different assumptions which are inconsistent each other. So far, focusing on a cost of economic instability, Imrohoroglu (1989), Atkeson and Phelan (1994) and Beaudry and Pages (2001) developed and applied his methodology to several fields.

However, the recession has the two aspects of reduced growth and economic instability, and then the cost of recession includes consistently both costs proposed by Lucas. The inconsistency between both costs should be resolved and then a new cost concept for recession is expected to appear.

The purpose of this paper is to provide a measure of the cost for recession by applying the Lucas model and to estimate the cost of the Japanese economic recession in 1990-2000. This investigation will show serious degree of recession to the monetary authority with actual feeling and then force the authority to do immediate policy decisions.

This paper is organized as follows. In Section 2 we sketch a Lucas model, define a cost of recession by using the parameters on consumption and utility functions. In Section 3, we describe the data set and provide the statistical methodology for estimating parameters. In Section 4 we estimate the costs of recession and discuss them. Section 5 concludes.

2. Economic Models and Statistical Methodology

Model 1

We sketch the Lucas model. There is a pure exchange economy with no production, no storable goods and no borrowing. Then, the optimal consumption C_t for an agent is subjected to an exogenous income I_t in each period: $C_t=I_t$ for all t. The representative agent lives infinitely and maximizes the expected utility function V with real consumption at date t, and specifies preferences to:

$$V = E\left[\sum_{t=0}^{\infty} \beta^{t} \frac{1}{1-\gamma} c_t^{1-\gamma}\right] \tag{1}$$

where $\beta \in (0,1)$ is a constant discount factor and $\gamma > 0$ is the constant coefficient of relative risk-aversion. We assume a class of consumption streams C_t with trend and cycle components, such as:

$$C_t = \lambda(1+\mu)^t e^{-\frac{1}{2}\sigma_Z^2} z_t, \quad \ln(z_t) \sim N(0, \sigma_Z^2) \tag{2}$$

where μ is a growth rate of consumption. Due to the property of log-normal distribution, $E(z_t. \exp(-\sigma_z^2/2))=1$, so that mean consumption is $\lambda(1+\mu)^t$. Then, a mean consumption at t=0 is λ: we will use λ later on to provide 'compensation' for variation in the parameters μ and σ_z^2. The $\ln(z_t)$ is a stationary stochastic process.

We will provide a definition of cost for recession, which will be a first trial. Given any choice of $(\lambda, \mu, \sigma_z^2, \gamma, \beta)$ we can simply calculate the value of (1) under the consumption of (2) and call the indirect utility function so defined $V(\lambda, \mu, \sigma_z^2, \gamma, \beta)$. This is derived as follows:

$$V(\lambda,\mu,\sigma_Z^2,\gamma,\beta)=\frac{1}{(1-\gamma)(1-\phi)}\exp\left\{(1-\gamma)(\log\lambda-\frac{\gamma}{2}\sigma_Z^2)\right\}:$$

$$\phi=\exp\{\ln\beta+(1-\gamma)\ln(1+\mu)\} \tag{3}$$

The derivation is given in the Appendix. We compare the indirect utility $V(\lambda,\mu,\sigma_Z^2,\gamma,\beta)$ computed during the present period with $\hat{V}(\hat{\lambda},\hat{\mu},\hat{\sigma}_Z^2,\hat{\gamma},\hat{\beta})$ during the base period, and then define the cost of recession as follows:

Definition 1. The cost of recession is a λ_C which satisfies the following equation:

$$V(\lambda+\lambda_C,\mu,\gamma,\beta,\sigma_Z^2)=\hat{V}(\hat{\lambda},\hat{\mu},\hat{\gamma},\hat{\beta},\hat{\sigma}_Z^2) \tag{4}$$

The cost of recession λ_C is compensation on the present consumption, uniform across all dates and values of the shocks, required to leave the consumer preference-indifferent between the parameters in both periods.[2] In the framework of this consumption, the cost is a

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[2] Lucas defines a cost of reduced growth by λ_C: $V(\lambda_C,\mu,\gamma_0,\beta_0,\sigma_Z^2)=U(0,\mu_0,\gamma_0,\beta_0,\sigma_Z^2)$, so that λ_C is the compensation, required to leave the consumer indifferent between the growth rates μ and the growth rates μ_0 during the base period. The other parameters are assumed to be the same in both indirect utility. He also defines the function $g(\sigma_z^2)$ as the cost of consumption instability by $V(g(\sigma_Z^2),\mu_0,\gamma_0,\beta_0,\sigma_Z^2)=U(0,\mu_0,\gamma_0,\beta_0,0)$. It is the compensation, required to leave the consumer indifferent between the instability of σ_z^2 and a perfectly smooth consumption path. Both assumptions are not consistent each other when we add both costs.

compensation for initial consumption at t=0.[3]

The key concept for cost of recession is that the cost of recession should be calculated as the difference between the present period and the base period utility which depends on the reduced growth and the increased instability. However, the difference between the utilities does not have actual feelings, though the compensation is aided to all persons and must have actual feeling. We select the compensation which equals both utilities. In this calculation, the parameters of utility which evaluate consumption are needed. We assume that consumption attitudes (i.e., a standard of evaluating consumption) are not changeable even though the exogenous consumption reduces and fluctuates greatly between both periods.

A calculation for λ_C gives:

$$\begin{aligned}
&\lambda_C = \exp\{\Psi\} - \lambda \\
&\Psi = \frac{1}{1-\gamma}\left\{\ln\left(\frac{\widehat{A}}{A}\right) + (1-\widehat{\gamma})(\ln\widehat{\lambda} - \widehat{\gamma}\widehat{\sigma}_Z^2/2)\right\} + \gamma\sigma_Z^2/2: \\
&\mathrm{A} = \frac{1}{(1-\gamma)(1-\phi)},\ \widehat{A} = \frac{1}{(1-\widehat{\gamma})(1-\widehat{\phi})}
\end{aligned} \tag{5}$$

The derivation is given in the Appendix.

Model 2

The logarithm for consumption in (2) is assumed to follows a trend stationary process, but there is empirical evidence against this assumption. Though Lucas (1987,pp.22) considers that the importance of the random walk component is overstated, given vast research on

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[3] Actually, at t+j,the compensation of $\widehat{\lambda}(1+\mu)^j$ is needed.

macro time series data, it is natural to consider the random walk process of consumption. Using a similar model, Saito (1996,pp.228-229) defines the cost of business cycles by assuming the following consumption process:

$$\ln(C_{t+1})-\ln(C_t)\sim N(m,\sigma^2),\quad t=0,1,2\ldots, \tag{6}$$

The first difference of consumption in logs follows a normal distribution, which means that consumption grows with mean m and variance σ^2. This setup is attributed to the critique against the trend stationary in (2). Following Saito (1996,pp.228-229), we can derive the indirect utility function:

$$V(\gamma,\beta,m,\sigma^2)=\frac{1}{(1-\gamma)(1-\phi^*)}C_0{}^{1-\gamma}\quad \text{if } \phi<1:$$

$$\phi^*=\exp\left\{\ln\beta+(1-\gamma)m+\frac{1}{2}(1-\gamma)^2\sigma^2\right\} \tag{7}$$

where C_0 is the consumption level at time 0. Based on his model, we compare the indirect utility $V(m,\ \sigma^2,\gamma,\beta)$ computed during the present period with $\hat{V}(\hat{m},\hat{\sigma}^2,\hat{\gamma},\hat{\beta})$ during the based period. We define the cost of recession:

Definition 2.The cost of recession is a m_c which satisfies the following equation:

$$V(\gamma,\beta,\mathrm{m}+\mathrm{m}_C,\sigma^2)=\hat{V}(\hat{\gamma},\hat{\beta},\hat{\mathrm{m}},\hat{\sigma}^2) \tag{8}$$

The cost of recession m_c is a compensation rate on the present consumption growth, symmetrical to *Definition 1*. A direct calculation for m_c gives:

$$m_C=\frac{1}{1-\gamma}\left\{(\frac{B}{\hat{B}})(\hat{\phi}*-1)-(\phi*-1)\right\}:\ \hat{B}=\frac{1}{1-\hat{\gamma}}\hat{C}_0^{1-\hat{\gamma}}\ ,\ B=\frac{1}{1-\gamma}C_0^{1-\gamma} \tag{9}$$

One of the actual methods to attain the compensation rate is to aid the amount of compensation at period t in the second period: $C_t - C_t^* = C_t^*(\exp(t \cdot m_C)-1)$, where C_t and C^*_t are consumption with and without compensation rate, respectively.[4]

To clarify the exposition in the following section, we describe the investigation strategy used. First, we conduct the unit root test for consumption in log, thereby identifying whether the consumption in log follows (2) or (6) during each period. The null hypothesis is difference stationary with a drift and the alternative hypothesis is trend stationary. If we reject the null hypothesis of difference stationarity, we will use the consumption in log at (2) and estimate the cost of recession by using (4) and (5). If not so, we will use (8) and (9). Second, we estimate the parameters for the reduced growth and instability of consumption, and, to evaluate them, estimate the parameters on the utility function, which will be shown in Table 2. Third, the cost of recession will be given in Table 3.

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[4] $C^*_t=(m+m_c+1)^t\, C_0$ and $C^*_t=(m+1)^t\, C_0$. By using $\log(x+1)÷ x$ because of $x÷ 0$, $C_t= C^*_t\exp(t\cdot m_c)$.

3. Data and Summary Statistics

The data used in this paper are monthly, which cover from 1975:M1 to 2002:M8 (332 observations). To estimate the parameters for consumption in the model, we use total consumption expenditures in the *Monthly Report on Family Income and Expenditures Survey* (FIES). Since the FIES reports the non-seasonally adjusted data, we apply the census X-11 method in order to obtain the seasonally adjusted series. The per capita series is constructed by dividing by the number of family members in the household, and converted into real series using consumer price index (general index, 2000 price) in the *Monthly Report of Consumer Price Index.* All data are taken from the NIKKEI NEEDS database.

To compute the preference parameters, we require asset returns data in addition. We use the stock price index obtained from *Rates of Stock Returns CD-ROM 2002* of the Japanese Securities Research Institute (JSRI) as stock returns and the call money market rate as risk free returns.[5] These nominal returns are converted into real returns by the consumer price index.

We partition the whole sample (1975:M1-2002:M8) into two sub-samples. The first sub-sample is from 1975:M1-1989:M12 and the second is from 1990:M1-2002:M8. The base period is a first sub-sample and our interest is to estimate the cost of recession during a second period, comparing the base period. This partition of periods seems to be appropriate, following most of previous researches including Hayashi and Prescott (2002). We perceive that the starting point of

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[5] The JSRI index is a value-weighted index constructed from all the brand names traded on the first section of the Tokyo Stock Exchange. An advantage of this index over the frequently used indices such as the TOPIX and NIKKEI 225 is that we can take account of dividend payments.

recession is a 1990:M1, since the NIKKEI 225 hits a peak of stock price (38,926 yen) at 1989:M12 and drop gradually for a long time up to now as well as the price of land. They say that such events show so-called a collapse of the Japanese bubble economy. We insist an importance of events on deciding the starting point of a recession, as the previous researches did.

Table 1 reports selected summary statistics for the data, and Figure 1 plots consumption in log. A visual inspection for Figure 1 supports the trend break of consumption in log (which reduces the consumption growth) around 1990:M1. Also, the observed data in Panel B and C of Table 1 show the reduced mean consumption growth (0.00018) in the second period, compared with (0.00144) in the base period.

These results suggest an obvious structural change. Therefore, we do not implement the test for the structural change between both periods.

[INSERT Table 1]

We need to set the parameters $(\lambda, \mu, \sigma_z^2, \gamma, \beta)$ for model 1 and $(m, \sigma^2, \gamma, \beta)$ for model 2. The first three parameters for model 1 can be estimated by OLS after taking log of (2), and the former two of the parameters for model 2 can exploit the sample mean and variance of consumption growth in Table 1. On the other hand, the latter two parameters represent the preference in (1) and typically estimated by applying GMM (Generalized Method of Moments). However, Table 1 shows that the correlation between consumption growth and the excess return appear to be negative, which make the interpretation of estimation results difficult even if tests of overidentifying restrictions fail to reject the model. In addition, the mean excess return is negative in the second period, which also prevents us from obtaining the theoretically plausible values.

To escape these problems, we use the method by Hansen and Singleton (1983), which is widely applied in more recent literature (see, e.g., Campbell, 1999). First, we assume the perfect correlation between the consumption growth and the excess return, following Campbell (1999).[6] Second, we assume preference parameters to be constant in the whole period. That is, we suppose that even if the consumption growth is reduced and fluctuated greatly, they are not perfectly explained by the change in the consumption attitude.

4. Results of estimation and discussions

The unit root test concludes that log-consumption is trend stationary in the first period and non stationary in the second period.[7] Thus, we use both models, in order to check the robustness of the

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[6] Hansen and Singleton's method is useful for finding the values of the parameters consistent with the observed data. More concretely, the values of γ and β are calculated using the following relations:

$$E_t[\ln(1+r_{i,t+1})-\ln(1+r_{f,t+1})]+\frac{1}{2}\sigma_i^2=\gamma\sigma_{ic} \;\; ; \;\; \frac{1}{\beta}-1=E_t[\ln(1+r_{f,t+1})]-\gamma E_t[\ln(C_{t+1}/C_t)]+\gamma^2\sigma_c^2/2$$

where $\gamma_{i,t+1}$ and $\gamma_{f,t+1}$ are the rate of return on risky and risk free assets between t and t+1, respectively, σ_i^2 is the variance of $\ln(1+\gamma_{i,t+1})$, σ_c^2 is the variance of $\ln(C_{t+1}/C_t)$ and σ_{ic} is the covariance between $\ln(1+\gamma_{i,t+1})$ and $\ln(C_{t+1}/C_t)$. In the practical calculations, the population moments are replaced with the sample moments, reported in Table 1. See Campbell (1999,pp.1249-1250) for more details.

[7] We verify the null hypothesis of difference stationarity against trend stationarity by Said and Dickey's (1984) Augmented Dickey-Fuller test. In the ADF test, the number of lags is determined by the sequential t-test, where an upper bound on the lag length is set at the integer of $12(T/100)^{1/4}$. The optimal lag lengths were two in the base period and seven in the second period. The value of the ADF test was -4.254 for the base period and -2.351 for the second period. Hence, the null hypothesis in the base period is rejected at 1% level, but not rejected in the second period.

results.

Table 2 presents the results of estimated parameters for consumption and utility. The parameters for model 1 are estimated by OLS and the null hypotheses of zero coefficients are rejected at 1% level. The estimated monthly consumption growth rate reduces from 0.1217% to 0.009%, comparing the base period. Also, the standard deviation (instability) of error term in log-consumption increases from 0.01608 to 0.01839. However, the estimated initial consumption at 1975:M1 in a base period is 74045.13 and 96990.66 in the second period.

On the other hand, in calculating the parameters of model 2, the mean of the observed monthly consumption growth reduces from 0.144% to 0.018% and the standard deviation of consumption growth in (6) increases from 0.01677 to 0.01943. The monthly rates are converted into annual consumption growth rates: $(1.00144)^{12}-1=1.7418\%$ to $(1.00018)^{12}-1=0.2162\%$. Also, the initial consumption C_0 are the original data at 1975:M1 and 1990:M1 consisting of Table 1. The initial consumptions in both models are similar to each other, although those in model 1 are estimated ones.

How much does the additional initial consumption or the additional consumption growth rate in the second period compensate the reduced growth and increased instability? To evaluate these, as described in Section 3, we calculate the preference parameters based on Hansen and Singleton (1983)'s methods. The obtained parameter for γ is 2.65982, while the β is mostly 0.999 in the whole period.

[INSERT Table 2]

As Table 3 shows, by applying these parameters in equation (3) for model 1, we obtain the utility level of -1.81286E(-05) in the base period and -4.67933E(-05) in the second period. This implies that the recession reduces obviously the utility level. The number of reduced utility level does not provide us with actual feeling of recession. However, the use of our measure λ_C makes it possible to convert the reduction of utility into the compensation in Japanese yen. This compensation amount is ¥74,392.05 yen at t=0 in the recession period; thus, it becomes $74{,}392.05(1+0.00009)^{151}=75409.89$ at t=151. Compared with the initial consumption, ¥94762.27, at 2000:M1, it amounts 79%. On the other hand, the result of model 2 shows the same one as the model 1 does. The utility level decreases in the second period. The compensation of mean consumption growth rate is 0.222%. This is 2.6968% in the annual rate, which corresponds to the decreased number of GDP from 1980s to 1990s, as shown in *1.Introduction* of this text. Under this growth, the amount of compensation aided at t=151 is: $(1.00018)^{151}\cdot 94762.27\cdot(\exp(0.00222\cdot 151)-1)= 38778.6$.

[INSERT Table 3]

4. Concluding Remarks

This paper provided a measure for cost of recession and estimated the cost of Japanese economic recession starting from 1990:M1. That cost should be calculated as the difference between the base period and the recession period utilities which depend on the reduced growth and the increased instability. However, the difference between the utilities does not have actual feelings for deepness of recession, so that the cost of recession is compensation on the recession period which equals both utilities.

The cost of recession per month is ¥74,393.05 yen, which is aided to all persons at the beginning data of recession. Compared with the initial consumption, ¥94762.27, at 2000:M1, it amounts 79%. We also calculated the cost of recession in terms of compensation for consumption growth rate. The cost is 0.222%, compared with the rate of consumption growth per month,0.018%, in the recession period. It amounts 11%. They expect that such a big cost of the recession induce the authority to have the actual feeling for serious recession and then force them to do immediate policy decisions.

We encounter some problems in estimating the preference parameters as well as the previous researches dealing with the Japanese data: e.g., the negative excess return rate; the negative coefficients between excess return rate and consumption growth. The preference parameters are sensitive to these problems, which will change the cost of recession. Though this problem annoys the researchers, it will be resolved in future.

We will suggest another problem that the change of assumption from the representative agent to some heterogeneous agents will provide various preference parameters on some agents. This problem expands the analytical scopes. This model will make it possible to estimate the cost of recession depending on the heterogeneous agents: e.g., the cost of lower, middle and upper class households.

Appendix:

Derivation of equation (3)

Taking a logarithm of consumption in (2) and setting the first three terms as α_t, we obtain the following:

$$\ln C_t = \alpha_t + \ln z_t : \quad \alpha_t = \ln\lambda + \mathrm{t}\cdot\ln(1+\mu) - \frac{1}{2}\sigma_Z^2 \tag{A-1}$$

It is obviously E(lnC$_t$)= α_t and Var(lnC$_t$)= σ^2_z . In addition, due to the property of log-normality, E(C$_t$)=exp{$\alpha_t + \sigma^2_z /2$}. In the utility function in (1), we can obtain the following calculation.

$$\ln E[\beta^t c_t^{1-\gamma}] = \ln E[\beta^t \eta_t^{1-\gamma} z_t^{1-\gamma}] : \eta_t = \lambda(1+\mu)^t e^{-\frac{1}{2}\sigma_Z^2} \tag{A-2}$$

Using the above property of log-normality, we can rewrite the above equation:

$$\ln E[\beta^t \eta_t^{1-\gamma} z_t^{1-\eta}] = E[\ln(\beta^t \eta_t^{1-\gamma} z_t^{1-\eta})] + Var[\ln(\beta^t \eta_t^{1-\gamma} z_t^{1-\eta})]/2 \tag{A-3}$$

The tedious calculation yields the following.

$$\ln E[\beta^t \eta_t^{1-\gamma} z_t^{1-\eta}] = t\ln\beta + (1-\gamma)(\ln\lambda + t\ln(1+\mu) - \sigma_Z^2\gamma/2) \tag{A-4}$$

Then,

$$E[\beta^t \eta_t^{1-\gamma} z_t^{1-\eta}] = [\exp(\ln\beta + (1-\gamma)\ln\lambda]^t \exp\{(1-\gamma)(\ln\lambda - \sigma_Z^2\gamma/2)\} \tag{A-5}$$

Finally, the indirect utility function is as follows:

$$V = \frac{1}{(1-\gamma)}\sum_{t=0}^{\infty} E[\beta^t \eta_t^{1-\gamma} z_t^{1-\eta}] = \frac{1}{(1-\gamma)}\exp\{(1-\gamma)(\log\lambda - \sigma_Z^2\gamma/2)\}\sum_{t=0}^{\infty}\phi^t : \tag{A-6}$$

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

■

Derivation of equation (5)

Due to equation (4),

$$V(\lambda+\lambda_C,\mu,\gamma,\beta,\sigma_Z^2)=V(\hat{\lambda},\hat{\mu},\hat{\gamma},\hat{\beta},\hat{\sigma}_Z^2) \tag{A-7}$$

We set A and $\hat{A}$ as:

$$A=\frac{1}{(1-\gamma)(1-\phi)}\ ,\ \hat{A}=\frac{1}{(1-\hat{\gamma})(1-\hat{\phi})} \tag{A-8}$$

We input the relation (A-8) into (A-7).

$$A\cdot\exp\left\{(1-\gamma)(\ln(\lambda+\lambda_C)-\frac{\gamma}{2}\sigma_Z^2)\right\}=\hat{A}\cdot\exp\left\{(1-\hat{\gamma})(\ln\hat{\lambda}-\frac{\hat{\gamma}}{2}\hat{\sigma}_Z^2)\right\} \tag{A-9}$$

We take a logarithm of (A-9) and calculate:

$$\ln(\lambda+\lambda_C)=\frac{1}{(1-\gamma)}\left\{\ln(\frac{\hat{\mathrm{A}}}{\mathrm{A}})+(1-\hat{\gamma})(\ln\hat{\lambda}-\frac{\hat{\gamma}}{2}\hat{\sigma}_Z^2)\right\}+\frac{\gamma}{2}\sigma_Z^2 \tag{A-10}$$

We replace the right hand side for (A-10) by Ψ and then get equation (5).

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Table1. Summary Statistics for Consumption Growth and Asset Returns

Panel A. 1975:M1-2002:M8 (observations=332)

	Mean	Std.Dev	Max	Min	Correlation
Consumption	0.00086	0.01802	0.07115	-0.06411	1
Stock return	0.00276	0.05131	0.15256	-0.22791	-0.00952
Call return	0.00162	0.00554	0.01589	-0.01969	0.32672
Excess return	0.00114	0.05107	0.15483	-0.22642	-0.04503

Panel B. 1975:M1-1989:M12 (observations=180)

	Mean	Std.Dev	Max	Min	Correlation
Consumption	0.00144	0.01677	0.07115	-0.05624	1
Stock return	0.01116	0.03900	0.15256	-0.11243	0.02301
Call return	0.00202	0.00654	0.01589	-0.01922	0.41034
Excess return	0.00914	0.03803	0.14807	-0.11094	-0.04699

Initial consumption level =71557.59(yen)

Panel C. 1990:M1-2002:M8 (observations=152)

	Mean	Std.Dev	Max	Min	Correlation
Consumption	0.00018	0.01943	0.06020	-0.06411	1
Stock return	-0.00719	0.06151	0.15024	-0.22791	-0.04170
Call return	0.00114	0.00402	0.01086	-0.01969	0.22452
Excess return	-0.00833	0.06193	0.15483	-0.22642	-0.05600

Initial consumption level=94762.27(yen)

Notes: Consumption is the consumption growth, which is calculated as the first difference of log real consumption. Stock return and call return are the log real return: log(1+x), where x is the rate of return. Excess return is defined as stock return minus call return.

Table 2. Estimated Parameters for Utility and Consumption

	Consumption Parameters	
	Base-period	Second period
Model 1		
λ	74045.13	96990.66
μ	0.00127	0.00009
σ_z	0.01608	0.01839
Model 2		
m	0.00144	0.00018
σ	0.01677	0.01943
C_0	71557.59	94762.27
	Utility Parameters(the whole period)	
γ	2.65982	
β	0.99953	

Notes: These parameters are for the monthly consumption and utility. C_0 are consumption in a yen: 1975:M1 and 1990:M1. The λ, μ, and σ_z are the estimated parameters by using OLS on:

$$\ln C_t = \ln \lambda - \frac{1}{2}\sigma_z^2 + t \bullet \ln(1 + \mu) + \ln z_t$$

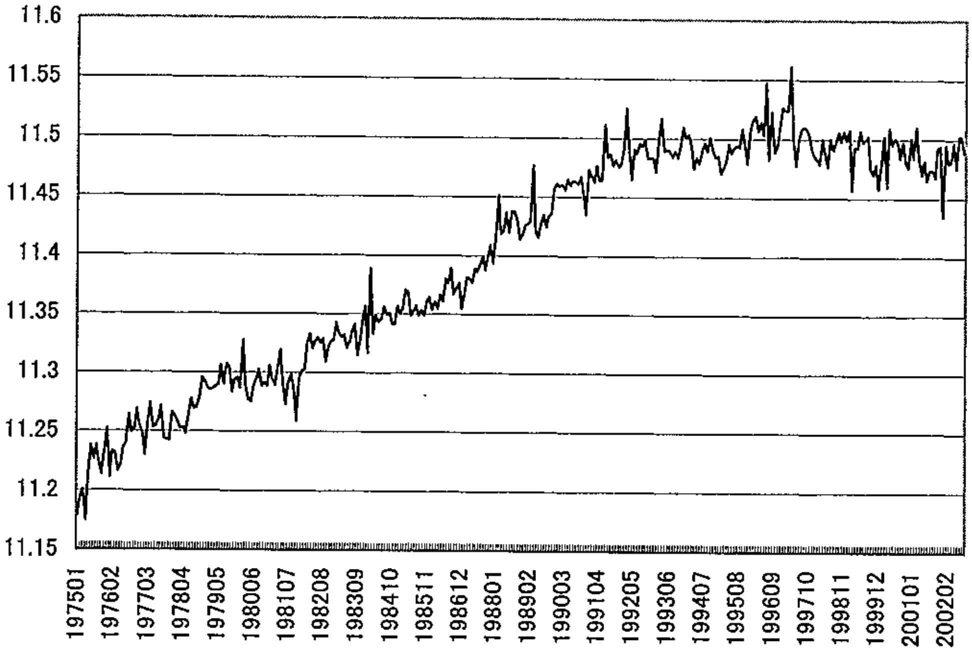
The σ_z is estimated standard error, while λ and μ are derived from estimated coefficients of constant and trend terms. Both coefficients were significant positive.

Table 3. Cost of recession

Models	Indirect Utility		Cost of recession
	Base period	Second period	λc(¥ yen), mc
Model 1	-1.81286E(-05)	-4.67933E(-05)	¥74392.05
Model 2	-2.13684E(-06)	-1.36042E(-05)	0.00222

Notes:E(-x) denote 10^{-x}.

Figure 1
Real per capita total consumption in logarithm



Notes:197501 means 1975:M1.