# The Welfare Costs of the 1997 Asian Crisis

by

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**Abstract**

This paper has measured the welfare cost of the 1997 Asian crisis for each country in Asia, by deploying Miyakoshi and Okubo(2003)'s model. The paper finds that the ratios of welfare cost to the initial level of consumption are large for all countries: 32% for Thailand, 53% for Indonesia, 28% for Korea, 12% for Malaysia and 19% for Hong Kong. The welfare costs imply how much people should pay the costs to prevent the outburst of the crisis. Then, people think that the reforms for all countries are the emergent task and in particular, Indonesia has serious defects, compared with other countries.

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## 1. Introduction

Some Asian currencies in the wake of flotation of the Thai baht in 2 July 1997 collapsed, and the crisis spread to other countries in the Asian region. The currency crisis triggered the financial crisis. Thus, the Asian crisis (currency and financial crises) covered most of the East-Asian countries by the early 1998. The Asian economies have experienced the drastic reduction of the economic growth. In particular, to Thailand, Indonesia and Korea (called as aided countries), the international organization (International Monetary Fund, World Bank, Asian Development Bank) and the G-7 countries provided the assistance together with the program of economic reform.

How much did the Asian countries pay the welfare costs for the 1997 Asian crisis? It is important for their governments to recognize the costs of the crisis. Because the welfare costs will equal to the costs that people allow to pay to prevent the outburst of the crisis. Which country paid the higher costs than other countries? It is also useful to diagnose which country, since the particular country with the higher costs will have serious defects in economic and financial systems, compared with other countries. The costs of the three aided countries should be carefully compared with those of non-aided countries, since the economic situation of the three aided countries have already reflected the results of aids. Nevertheless, measuring the costs provides useful information at least.

The purpose of this paper is to measure the welfare costs of the 1997 Asian crisis for each country in Asia, by deploying Miyakoshi and Okubo (2003)'s model. The paper measures the welfare cost for Thailand, Indonesia, Korea, Malaysia, and Hong Kong. For each country, we calibrate the model by using the estimated parameters, which are supplemented by estimates from Pallage and Robe(2003), and use the quarterly data. Thus, we carry out robustness checks. This paper provides a first trial to measure the welfare

costs of crisis including the 1997 Asian crisis.

The paper finds that the ratios of welfare cost to the initial level of consumption are large for all countries: 32% for Thailand, 53% for Indonesia, 28% for Korea, 12% for Malaysia and 19% for Hong Kong. These welfare costs imply how much we should pay the costs to prevent the outburst of the crisis. The welfare costs that people should pay are large for all countries. Then, people think that the economic reforms for all countries are the emergent task and in particular, Indonesia has serious defects, compared with other countries.

This paper relates to previous researches as follows. The findings of the paper are similar to the previous papers dealing with the 1997 Asian crisis in a sense of qualitative analysis: Corsetti, Pesenti, Roubini (1999,a,b) and others. However, this paper adds the quantitative analysis and moreover a people's welfare point of view, by using the welfare costs. Then, the advantage of this model can assess the welfare costs (that people should pay) to prevent the outburst of the crisis and can compare seriousness of defects among countries.

Lucas (1987, pp. 20–31) had proposed a quantitative analysis of the welfare costs for economic fluctuations. He has measured the compensation that would leave consumers indifferent to a decline in the growth rate of consumption, and the compensation that would leave consumers indifferent between consumption instability and a perfectly smooth consumption path. Lucas calls the former type of compensation "a cost of reduced growth" and the latter type of compensation "a cost of economic instability". Most of the researchers including Obstfeld (1994), Storestetten (2001) and Beaudry and Pages (2001) have developed theoretically the Lucas model focusing on the welfare cost of economic

instability. [1] Pallage and Robe(2003) apply the model to measure the welfare costs of economic instability on the developing countries and find that the cost should not be ignored.

However, no authors have focused on the cost of the crisis.[2] The welfare cost measure for the crisis is necessary. Miyakoshi and Okubo (2003) developed the quantitative analysis for the welfare costs, which include consistently both a cost of reduced growth and a cost of economic instability proposed by Lucas. They derive the welfare costs of crisis, analyze carefully the characters of costs and provide a model for computing the welfare costs of crisis. Thus, they have added the crisis point of view which previous researchers have lost.[3]

Chow and Kwan (1996) and Kwan and Chow (1996) measured the effects of political movements in China (the Great Leap Forward Movement in 1958-1962 and the Cultural revolution in 1966-1969) on the output, consumption and investment. They compare the 'hypothetical' (i.e., without the political movements) time paths of these variables with the actual time paths. Their measurements are not the welfare cost related to preference and not measured in money term as an ordinary cost is. In this sense, this approach is the different stream from Lucas in that they lose a welfare point of view.

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[1] A useful survey of this field is Lucas (2003). He understated the cost of the business cycle. Much subsequent research has debated whether the cost of the business cycle is low.

[2] Since the crisis incorporates reduced growth and economic instability, the cost of crisis should include the costs of both. Lucas defines both costs independently each other. Then, it is difficult to combine them to define the cost of crisis.

[3] Obstfeld (1994) derived the cost of crisis, while he did not define it to be the cost of the crisis. His concern is only to the cost of the economic instability and then provides no more analysis for the cost of the crisis.

This paper is organized as follows. In Section 2, we review the Miyakoshi and Okubo model and define the welfare costs of the 1997 Asian crisis by using the parameters in the consumption and utility functions. In Section 3, we describe the data set. In Section 4, we estimate the costs, discuss the estimates and check the robustness of the results by calibrating the model. Section 5 concludes the paper.

## 2. Economic Model

We sketch the Miyakoshi and Okubo (2003)'s model. Consider a pure exchange economy with no production, no storable goods and no borrowing. Then, optimal consumption $C_t$ for an agent is subject to exogenous income $I_t$ in each period: $C_t = I_t$ for all t. The representative agent lives infinitely and maximizes an expected utility function V by choosing real consumption at time t, and has preferences specified by:

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

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 exogenous income and hence consumption streams $C_t$ with trend and cycle components, given by:

$$C_t = \lambda (1+\mu)^t e^{-\frac{1}{2}\sigma^2} z_t, \tag{2}$$

where $\mu$ is the growth rate of consumption and $\ln z_t$ is assumed to be a stationary stochastic process distributed as $N(0, \sigma^2)$. Due to the property of the log-normal distribution, $E(z_t.\exp(-\sigma^2/2)) = 1$, mean consumption is $\lambda(1+\mu)^t$. Hence, mean consumption at $t = 0$ is $\lambda$. We use $\lambda$ subsequently to measure 'compensation' for variations in the parameters $\mu$ and $\sigma^2$.

We now define the welfare cost of crisis. Given any choice of $(\lambda, \mu, \sigma^2 | \gamma, \beta)$ we can calculate the value of (1) given the consumption process described by (2) and denote the resulting indirect utility function by $V(\lambda, \mu, \sigma^2 | \gamma, \beta)$. This is derived as follows:

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

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

Details of the derivation are given in Miyakoshi and Okubo(2003).

We define that the period of Asian crisis outburst is the next period to the peak period for consumption series after the third quarter of 1997 for all Asian countries, considering the Asian currency crisis on July 2 1997. We partition the whole sample (1990:Q1 to 2002:Q1) into two sub-samples by the outburst of the Asian crisis: the after-crisis periods including the crisis period and the before-crisis periods excluding the crisis period.

We compare two indirect utilities. One is $V(\lambda_A, \mu_A, \sigma_A^2 | \gamma, \beta)$, which is based on actual consumption growth $\mu_A$, its variance $\sigma_A^2$ and mean consumption at $t = 0$ (in the crisis period), $\lambda_A$, in the after-crisis periods (called *the after- crisis paradigm of consumption*). The other is $V(\lambda_B, \mu_B, \sigma_B^2 | \gamma, \beta)$, which is based on expected consumption (called *the before-crisis paradigm of consumption*) under the assumption that the growth rate and variance of the before-crisis periods persists indefinitely (with the mean consumption at t=0 expected under the growth rate and variance in the before-crisis

periods) from the beginning of the after-crisis periods, as shown in Figure 1. However, in actual, the consumption drops gradually during several periods, as denoted by dot line. We replace the dot line by a solid line for analytical convenience. Thus, we compare both paradigms of consumption depicted by the solid lines in the after-crisis period. Although γ and β differ between both paradigms, we assume that they are the same and remain constant over time at $(\gamma, \beta)$.

**[INSERT Figure 1]**

We define the cost of crisis as follows.

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

$$V(\lambda_A + \lambda^*, \mu_A, \sigma_A^2 \mid \bar{\gamma}, \bar{\beta}) = V(\lambda_B, \mu_B, \sigma_B^2 \mid \bar{\gamma}, \bar{\beta}), \quad (4)$$

where the subscripts A and B denote the after- and before-crisis paradigms, respectively.

The key concept relating to the cost of crisis is the following. The consumption parameters are different between the after-crisis paradigm (A-PARA) and before-crisis paradigm (B-PARA) of consumption. Consumer preferences, given by $(\gamma, \beta)$, transform the difference in consumption parameters into a difference in utility levels. The cost of crisis is measured by the compensation, uniform across all periods, required to leave consumers' utility indifferent between the consumption paradigms.

The calculation of the cost λ* is given by:

$$\lambda^* = \exp\{\Psi\} - \lambda_A ,$$

$$\Psi = \frac{1}{1-\bar{\gamma}} \left\{ \ln\left(\frac{1-\phi_A}{1-\phi_B}\right) + (1-\bar{\gamma})(\ln\lambda_B - \bar{\gamma}\sigma_B^2/2) \right\} + \bar{\gamma}\sigma_B^2/2 \ , \qquad (5)$$

where

$$\phi_A = \exp\left\{\ln\bar{\beta} + (1-\bar{\gamma})\ln(1+\mu_A)\right\} \text{ and } \phi_B = \exp\left\{\ln\bar{\beta} + (1-\bar{\gamma})\ln(1+\mu_B)\right\}.$$

The derivation is given in Miyakoshi and Okubo (2003).

To calculate the welfare costs of crisis, we proceed as follows. First, by using data for each sub-sample (the before-crisis or the after-crisis period), we estimate the parameters ($\lambda$,$\mu$, $\sigma^2$) for each consumption paradigm and then use the preference parameters ($\gamma$,$\beta$) employed by Pallage and Robe(2003). These parameter estimates are reported in Table 1. Second, we measure the costs of crisis, which are reported in Table 2. Third, we calculate these costs for varying values of the parameters ($\gamma$,$\beta$). These results are reported in Table 3.

## 3. Data and the 1997 Asian Crisis

The data used in this paper are quarterly data mostly from the first quarter 1990 to the first quarter 2002 (i.e., 1990:Q1 to 2002:Q1), which gives 49 observations but changes depending on the data availability for each country: Thailand, Indonesia, Korea, Malaysia, and Hong Kong. To estimate the parameters ($\lambda$, $\mu$, $\sigma^2$) for consumption in the model, we use total consumption expenditure for households (line 96f, measured in national currency)

from the *International Financial Statistics* (IFS).[4] The per capita series is constructed by dividing consumption expenditure by the number of population (line 99z).[5] These data are converted to real values by using the consumer price index (line 64, for general prices in 1995). For the preference parameters ($\gamma$,$\beta$) employed by Pallage and Robe(2003), we calibrate the model.

Figure 2 plots consumption in logs for each country, which suggests a drop in the log of consumption (which reduces consumption growth) around 1997:Q3. The crisis period is 1997:Q3 for Thailand, 1998:Q1 for Indonesia, 1997:Q4 for Korea, 1998:Q1 for Malaysia and 1998:Q1 for Hong Kong. Our objective is to estimate the cost of the Asian crisis during the after-crisis period by comparing with the before-crisis and the after-crisis paradigms of consumption. The specification of the crisis period seems appropriate, and consistent with previous research including Corsetti, Pesenti and Roubini (1999a,b). Therefore, we do not implement a formal test for structural change between sub-periods.

**[INSERT Figure 2]**

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[4] The consumption series is non-seasonally adjusted except for Korea. It is important to delete the seasonal effects, while the sample size is small for all countries and then the seasonal adjustment reduce the sample size. In addition, the seasonal adjustment is different depending on the country. On the other hand, for each country, we compare the non-seasonal adjusted data between both consumption paradigms. Then, the seasonal adjustment or non-adjustment seems not so important.

[5] The data for population is on annual base, and then we assign the increase of the annual data to the quarterly data one-fourth by one-fourth.

We need to set the parameters ($\lambda$,$\mu$, $\sigma^2$ |$\gamma$,$\beta$) for each paradigm of consumption . The first three parameters can be estimated by OLS after taking logs of equation (2) with the data in each sub-period as follows:

$$\ln C_t = \ln \lambda - \frac{1}{2}\sigma^2 + t \cdot \ln (1 + \mu) + \ln z_t \qquad (6)$$

In particular, the estimate of $\sigma^2$ is the OLS estimate for variance of ln $z_t$ and then the estimate of $\lambda$ is obtained by using the estimated constant term of (6) and the estimated $\sigma^2$. The other two parameters ($\gamma$ and $\beta$) represent preferences that are typically exogenously given, as the previous researches including Pallage and Robe(2003) did so.

## 4. Estimation Results and Discussion

Table 1 reports the estimated parameters for consumption in each country. All parameter estimates are statistically significant at the 1% level. For example, in Thailand, the estimated quarterly consumption growth rate falls from 1.30% in the before-crisis paradigm to 0.95%. The standard deviation of the error term in the log of consumption decreases from 0.0010 to 0.0002. The estimate of initial consumption at 1997:Q3 is 9.259(in log) baht for the before-crisis paradigm and the one at 1997:Q3 for the after-crisis paradigm is 8.999(in log) baht. The initial consumption of the after-crisis paradigm drastically dropped. These imply $\lambda_B$ and $\lambda_A$ in equations (4) and (5). See Figure 1. The instability of $\sigma^2$ reduces in the after-crisis period except for Korea. This result will be due to the policy effects of each country.

How much is the estimated welfare cost of crisis according to the model ? As

explained in Section 3, to measure these costs, we use the same preference parameters as Pallage and Robe (2003) does. For both paradigms of consumption, we use 0.98 as a base value for β of quarterly data**,** since they use 0.96 as a typical discount factor of annual data for developing countries. We also use the moderate risk-aversion level at $\gamma$ =2.5.

**[INSERT Table 1]**

As Table 2 shows, by using these parameters in equation (3), for Thailand, we obtain a utility level of –1.599E (–05) for the before-crisis paradigm (B-PARA) and one of –2.705E (–05) for the after-crisis paradigm (A-PARA). This implies that crisis reduces utility. Our cost measure λ* enables us to convert the reduction in the utility level into a level of compensation in national currency, which is the same for all periods. The cost of crisis is 3402 baht. In general, it is difficult to identify whether the cost is large or small. However, this amount is 32% of the initial level of consumption $\lambda_B$ (10631baht). This ratio 32% is easy to identify the large. These ratios are large for all countries: 32% for Thailand, 53% for Indonesia, 28% for Korea, 12% for Malaysia and 19% for Hong Kong.

**[INSERT Table 2]**

These welfare costs will imply how much people should pay the costs to prevent the outburst of the crisis. Then, due to the huge costs, people think that the economic reforms for all countries are the emergent task.

Which country paid the higher costs than other countries? It is also useful to diagnose which country, since the particular country with the higher costs will have serious defects, compared with other countries. Considering the ratios of the cost / $\lambda_B$, the aided countries

(Thailand, Indonesia and Korea) burdened larger costs than the others did: in particular, the ratio for Indonesia is the highest,53%. However, the one of Malaysia is the lowest, 12% and the quarter of that of Indonesia. Indonesia has serious defects in economic and financial systems among countries but Malaysia has not. We will have to interpret the causes for Indonesia and Malaysia in future.

These findings are similar to those of the previous papers in a qualitative sense, while our paper is different in that we provide the money measures in a quantitative sense and a people's welfare point of view by using the welfare costs. Then, the advantage of our model can reveal how much people should pay the costs to prevent the outburst of the crisis, which should be equal or less than this welfare cost and can compare seriousness of defects among countries.

To check the robustness of the results, we calibrate the preference parameters in (1). We use $\gamma = 2.0, 2.5, 5.0$ and $\beta = 0.97, 0.98, 0.99$, which encompass the range of parameter values used in previous research (see, e.g., Pallage and Robe, 2003). Note here that $\gamma>0$ implies risk aversion. In Table 3, for Thailand, the ratio of costs / $\lambda_B$ ranges from 29% to 40% at $\beta =0.99$ as $\gamma$ decreases and from 27% to 29% at $\gamma=5$. Varying the parameters, the maximum is 40% and the minimum is 27%. The minimum ratio is still large than 27%, compared with the ratio 32% at $\gamma=2.5$ and $\beta =0.98$ in Table 2. The ratios are robustly larger for the other countries. In particular, the ratios for the aided countries are larger than 21% , while the ratios for non-aided countries are less than 21%, as shown in Table 3. In addition, the minimum ratio 21% of Indonesia is larger than the maximum ratio 16% of Malaysia.

**[INSERT Table 3]**

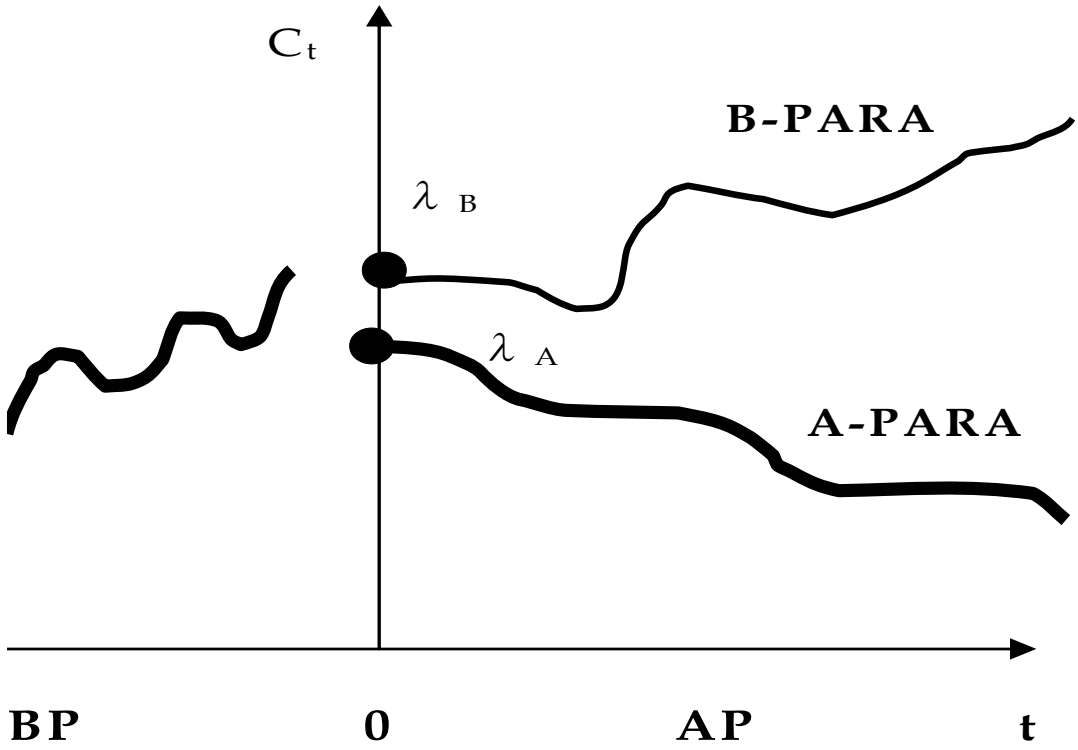
## 5. Concluding Remarks

This paper has measured the welfare cost of the 1997 Asian crisis for Thailand, Indonesia, Korea, Malaysia, and Hong Kong, by deploying Miyakoshi and Okubo(2003)'s model. For each country, we calibrate the model by using the model's parameter estimates, which are supplemented by estimates from Pallage and Robe(2003). Thus, we have carried out robustness checks.

The paper finds that the ratios of cost to the initial level of consumption are large for all countries: 32% for Thailand, 53% for Indonesia, 28% for Korea, 12% for Malaysia and 19% for Hong Kong. These welfare cost will imply how much people should pay the cost to prevent the outburst of the crisis. Then, due to the huge costs, people think that the economic reforms for all countries are the emergent task. We also find that the ratio for Indonesia is the highest,53%. However, the one of Malaysia is the lowest, 12% and the quarter of that of Indonesia. Indonesia with the higher costs will have serious defects, compared with other countries. The two main results are robust independent of the preference parameters.

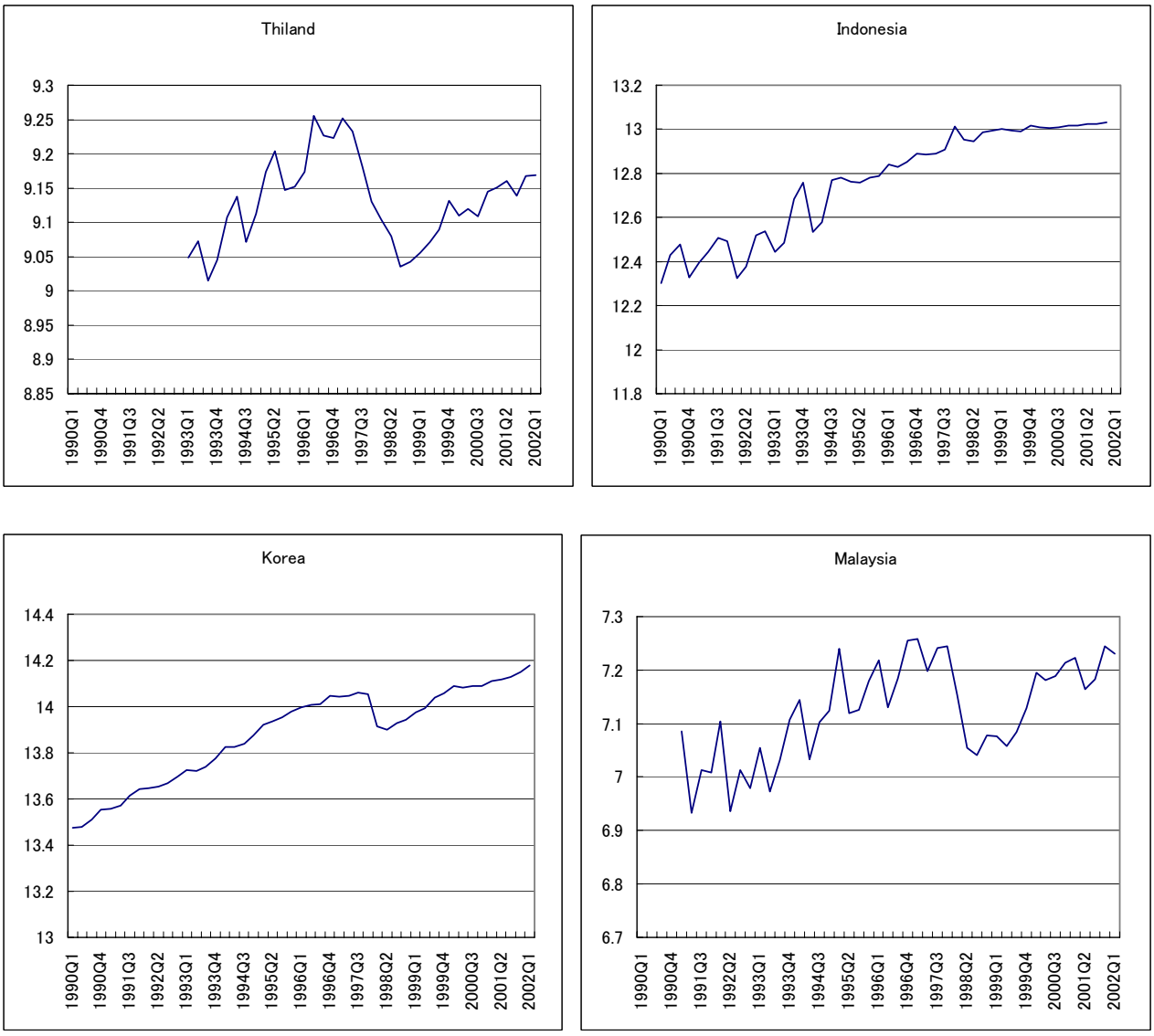
The findings of the paper are similar to the previous papers dealing with the 1997 Asian crisis in a sense of qualitative analysis. This paper is different in that we provide the money measures in a quantitative sense and a people's welfare point of view by using the welfare costs. Then, the advantage of our model can reveal how much people should pay the costs to prevent the outburst of the crisis, which should be equal or less than this welfare cost and can compare seriousness of defects among countries.

**Figure 1. The before-and after-crisis paradigms of consumption**




Note: BP (B-PARA) and AP (A-PARA) denote the before- and after-crisis periods (paradigms of consumption), respectively. The t=0 denotes the crisis period.

**Figure 2. Per capita consumption in logarithm**



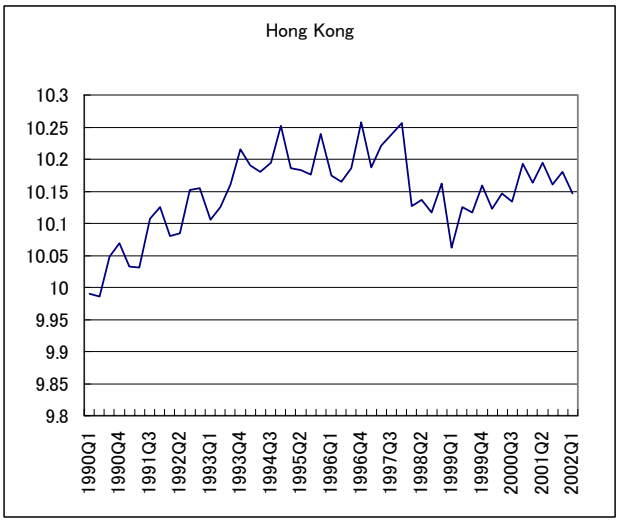

Hong Kong
10.3
10.25
10.2
10.15
10.1
10.05
10
9.95
9.9
9.85
9.8
1990Q1
1990Q4
1991Q3
1992Q2
1993Q1
1993Q4
1994Q3
1995Q2
1996Q1
1996Q4
1997Q3
1998Q2
1999Q1
1999Q4
2000Q3
2001Q2
2002Q1

**Table 1. Estimated Parameters for Consumption**

| Country | Crisis | ln(λ) | $\mu$ | $\sigma^2$ |
|---|---|---|---|---|
| Thailand | | | | |
| B-PARA | 97Q3 | 9.259 | 0.0130 | 0.0010 |
| A-PARA | 97Q3 | 8.999 | 0.0095 | 0.0002 |
| Indonesia | | | | |
| B-PARA | 98Q1 | 12.961 | 0.0208 | 0.0053 |
| A-PARA | 98Q1 | 12.968 | 0.0040 | 0.0001 |
| Korea | | | | |
| B-PARA | 97Q4 | 14.098 | 0.0208 | 0.0003 |
| A-PARA | 97Q4 | 13.877 | 0.0170 | 0.0004 |
| Malaysia | | | | |
| B-PARA | 98Q1 | 7.249 | 0.0103 | 0.0030 |
| A-PARA | 98Q1 | 7.015 | 0.0138 | 0.0010 |
| Hong Kong | | | | |
| B-PARA | 98Q1 | 10.261 | 0.0072 | 0.0014 |
| A-PARA | 98Q1 | 10.074 | 0.0066 | 0.0007 |

Notes: B-PARA and A-PARA denote the before-crisis paradigm and the after-crisis paradigm of consumption. The value of lambda is measured in national currency.

**Table 2. Welfare Costs of the Crisis ( $\gamma$ =2.5, $\beta$ =0.98)**

| Country | Indirect Utility | | Welfare Costs | |
|---|---|---|---|---|
| | B-PARA | A-PARA | Level | Ratio |
| Thailand | -1.599E-05 | -2.705E-05 | 3402 | 0.32 |
| Indonesia | -4.876E-08 | -9.179E-08 | 224999 | 0.53 |
| Korea | -8.764E-09 | -1.370E-08 | 369206 | 0.28 |
| Malaysia | -0.0003638 | -0.000450 | 170 | 0.12 |
| Hong Kong | -4.532E-06 | -6.166E-06 | 5413 | 0.19 |

Notes: The cost is measured in national currency.

**Table 3. Welfare Costs of the Crisis based on Various Preference Parameters**

| Country | | $\beta$ | |
|---|---|---|---|
| $\gamma$ | 0.97 | 0.98 | 0.99 |
| Thailand | | | |
| 2 | 31% | 34% | 40% |
| 2.5 | 30% | 32% | 36% |
| 5 | 27% | 28% | 29% |
| Indonesia | | | |
| 2 | 45% | 61% | 114% |
| 2.5 | 39% | 53% | 83% |
| 5 | 21% | 22% | 34% |
| Korea | | | |
| 2 | 28% | 31% | 34% |
| 2.5 | 26% | 28% | 30% |
| 5 | 23% | 24% | 24% |
| Malaysia | | | |
| 2 | 13% | 11% | 6% |
| 2.5 | 14% | 12% | 9% |
| 5 | 16% | 16% | 15% |
| Hong Kong | | | |
| 2 | 19% | 20% | 21% |
| 2.5 | 18% | 19% | 20% |
| 5 | 18% | 18% | 18% |

Notes: The shaded number is the one at $\gamma$ =2.5 and $\beta$ =0.98 in Table 2.

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