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**A Microeconometric Analysis on the Impact of  
the 1997 Economic Crisis of Korea on Labour Market,  
Household Economy, and Social Welfare**

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**Thesis submitted for the degree of Doctor of Philosophy of the  
University of London**

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## **Abstract**

An economic crisis broke out in Asian region in 1997. Korea severely suffered from the economic crisis. This thesis examined the impact of the 1997 economic crisis on the Korean economy. The analysis focused on the impact of economic crisis on labour market, household economy, and social welfare. The analysis on labour market impact focused on both female labour force participation and male unemployment duration. The analysis on household economy impact focused on both household income and consumer behaviour. The analysis on social welfare impact focused on both inequality and social welfare.

The analysis is an empirical research using econometric methods based on two micro level datasets: the 1998 Korean Labor and Income Panel Study (KLIPS) and the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999. The probit model, the cox proportional hazard model, the cohort analysis and its decomposition method, the nonparametric kernel regression method, the Quadratic Almost Ideal Demand System (QAIDS), the second order approximation of welfare measure, and the input-output methodology were employed to estimate the impact of economic crisis.

Major findings are as follows. The predicted probability of female labour force participation decreased by 12.8 percent. The conditional probability of being employed decreased by 36.6 percent for male unemployed. Younger generation was more severely affected in the labour market. Household median income in 1998 decreased by 15.9 percent to that in 1994. Income of younger cohorts, households in Seoul, and wage earners group were more heavily affected. The Korean consumers increased food, fuel, and transport expenditure shares and decreased clothing and service shares in the face of economic hardship. Income inequality and poverty severely worsened. Inequality differences among age cohorts, regional, and occupational groups dramatically increased. The social welfare based on indirect utility level decreased by 11.3 percent at  $-1.5$  inequality aversion parameter after the economic crisis.

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## Chapter I Introduction

This thesis examines the impact of the economic crisis in 1997 on the Korean economy. What happened to the Korean economy after the economic crisis is the main question to answer in the analysis. The study focuses on the impact of economic crisis on labour market, household economy, and social welfare. Two micro level datasets are used: the Korean Labor and Income Panel Study (KLIPS) and the Family Income and Expenditure Survey (FIES) of Korea. The analysis is an empirical research that is analytical rather than descriptive, using econometric methods.

### **The 1997 economic crisis of Korea**

In November 1997 Korea requested bailout loans from the International Monetary Fund (IMF) to help resolve its foreign currency crisis. It was perceived as a declaration of the economic crisis of Korea<sup>1</sup>. The crisis was regarded as the largest economic crisis of

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<sup>1</sup> There are some names in calling the economic crisis in 1997: the financial crisis, the currency crisis, and the IMF crisis. I will use the term of “the 1997 economic crisis of Korea” in the thesis.



Korea since Korean War from 1950 to 1953. The 1997 economic crisis hit the country as a whole, causing severe damage to the economy and panic among the population. Every aspect of lives of the Korean people was affected after the economic crisis. Since the economy has grown fast for three decades, the economic crisis was a real shock to the Korean people.

There had been some warning signals to suggest that the economic crisis was likely to happen in Korea. The warning signals initially came from the inside of the country. In early 1997 a number of large conglomerates were facing bankruptcy due to excessive debts. The national credit rating on Korea was degraded to the rating of the undesirable for investment. Foreign financial institutions refused additional financing to the Korean companies and started to withdraw investment from Korea. The stock price indices dramatically fell. The Korean currency, won, started to be massively devaluated from October 1997.

The warning signals also came from the outside of the country. From July 1997 the currencies of some Asian countries were dramatically devaluated. Those Asian countries include Thailand, Malaysia, Indonesia, and the Philippines. The currencies for the four

countries were devaluated, on average, by about 40 percent at the end of 1997 relative to those of 1996. The stock exchange indices of the Asian countries also massively fell. The average decrease rate of stock exchange indices for the four countries at the end of 1997 relative to those of 1996 accounted for about 45 percent. In October 1997 the Hong Kong stock exchange index sharply fell, causing the stock exchange indices of the world financial markets to drop together.

This thesis is not so much about why the economic crisis happened as what happened in Korea after the economic crisis. Regarding the 1997 economic crisis, there would be a number of questions in need of attention. Some of them might be as follows. How and why did the Asian financial crisis happen? Why did the crisis happen to Korea whose GDP was twice as large as that of Indonesia, three times as large as that of Thailand? Why did the crisis happen in 1997? How can small countries protect their economies from international speculation in the future? What should Korea do to prevent from another or further economic crisis? Although all these questions are very valuable topics to study, they are not examined in the thesis. What happened after the 1997 economic crisis to employment, the standard of living, and social welfare of Korea is the main questions to try to answer in the thesis.

### **Looking at main economic indicators**

It might be useful to look at some economic indicators to see broadly what happened to the Korean economy after the 1997 economic crisis at the outset of the analysis. The average growth rate of GDP from 1991 to 1997 was 7.0 percent, and then it fell down to -6.7 percent in 1998 after the economic crisis. From 1971 to 1997 the average growth rate of GDP accounted for 7.8 percent. Since 1970 there was one year with negative growth rate of GDP. In 1980 the growth rate was -2.1 percent due to political crisis. It might be clear that the 1997 economic crisis caused severe impact on the Korean economy.

The unemployment rate sharply increased to 6.8 percent in 1998 and 6.3 percent in 1999, while the average unemployment rate from 1991 to 1997 was 2.4 percent. The number of unemployed persons accounted for 556 thousand in 1997 and increased to 1,461 thousands in 1998 and 1,353 thousands in 1999. The labour force participation rate was 62.2 percent in 1997 and decreased to 60.7 percent in 1998 and 60.5 percent in 1999. Since 1970 unemployment has never been a critical issue on the Korean economy.

After the 1997 economic crisis unemployment would become one of the main economic

concerns. The analysis on the labour market impact of the economic crisis focuses on unemployment and labour force participation.

**Table 1 Main economic indicators of Korea from 1996 to 1999**

<i>Indicators</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>
GDP growth rate (%)	6.8	5.0	<b>-6.7</b>	10.9
Unemployment rate (%)	2.0	2.6	<b>6.8</b>	6.3
Number of unemployed person (thousand)	426	556	<b>1,461</b>	1,353
Labour force participation (%)	62.0	62.2	<b>60.7</b>	60.5
Per capita GNI (US dollar)	11,380	10,307	<b>6,723</b>	8,551
Growth rate of household consumption expenditure (%)	7.1	3.5	<b>-11.9</b>	11.2
Consumer price index (1995 = 100)	104.9	109.6	<b>117.8</b>	118.8
Exchange rate of won to US dollar	844.2	<b>1,415.2</b>	1,207.8	1,145.4

Source: Korean Statistical Information System ([www.nso.go.kr/kosisdb/](http://www.nso.go.kr/kosisdb/))

Exchange rate to US dollar is the average market rate based on end of period.

The per capita gross national income decreased from 10,307 US dollar in 1997 to 6,723

US dollar in 1998 after the economic crisis and increased to 8,551 US dollar in 1999.

The negative growth rate of GDP combined with currency devaluation dramatically

decreased per capita gross national income in 1998. The household consumption expenditure decreased by 11.9 percent from 1997 to 1998 and increased by 11.2 percent in 1999. The 1997 economic crisis might heavily affect household economy. The levels of household income and consumption expenditure sharply decreased. Consumer behaviour might change in the face of economic hardship. The analysis on the household economy focuses on the impact of economic crisis on household income and consumer behaviour.

The consumer price index (1995 = 100) accounted for 109.6 in 1997 and increased by 7.5 percent to 117.8 in 1998. The exchange rate of Korean currency, won, to US dollar was 844.2 at the end of 1996 and was massively devaluated by 67.6 percent to 1,415.2 at the end of 1997. It decreased to 1,207.8 at the end of 1998 and 1,145.4 at the end of 1999. Massive currency devaluation not only triggered the 1997 economic crisis but also changed relative prices of goods. Social welfare level would change by relative price changes resulting from massive currency devaluation. Social welfare might also concern income inequality. The analysis on the social welfare impact of the 1997 economic crisis focuses on both income inequality and welfare change from currency

devaluation. Table 1 presents some main economic indicators of Korea from 1996 to 1999.

### **Microeconometric approach**

Micro level datasets are used for the analyses. For the analysis of the impact on unemployment and labour force participation, the 1998 Korean Labor and Income Panel Study (KLIPS) dataset is used. The KLIPS is a panel dataset based on survey conducted by the Korea Labor Institute. As the KLIPS is generated since 1998, the 1998 KLIPS is the only available KLIPS as of November 2000. There is another dataset based on a survey conducted by The Korea Economic Research Institute in 1998<sup>2</sup>. This dataset contains 700 individuals. Since this dataset is not a panel dataset and contains less sufficient samples and information, the 1998 KLIPS is used for the analysis in the thesis.

The sample size of the 1998 KLIPS is 5,000 households in urban area. The data

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<sup>2</sup> Park (1999) investigates the impact of economic crisis on the unemployment duration and the hazard rate that is divided into the acceptance rate and the arrival rate using this dataset.

contains 13,738 individuals who are equal to or more than 15 years of age. The 1998 survey was carried out through interview method in the period between 2 June and 13 October 1998. The survey collects information on household structure, on household expenditure and income, and on characteristic variables related with work (such as employment status, work history, occupation and industry). A number of papers were produced using the KLIPS dataset. However, regarding the economic crisis of Korea, this thesis would be the first one to examine the impact of the 1997 economic crisis on the Korean labour market using the KLIPS by comparing before and after the economic crisis based on microeconomic approach.

For the analysis of the impact on household economy and social welfare, the Family Income and Expenditure Survey (FIES) of Korea is used. The National Statistical Office of Korea has conducted the survey for the FIES since 1963. The FIES contains 565 items in total (33 for receipts, 529 for disbursement, and 3 items for rental values). The survey collects information on household structure, on socioeconomic characteristics (such as occupation, industry, and region), on household expenditures in some detail, and on incomes by source. For the survey design, data are collected monthly from

diaries that are distributed prior to the month. The overall response rate is 79.7 percent in 1997.

The sample periods used in the thesis are from 1991 to 1999. The sample sizes are over 10,000 households in each year survey and 101,454 households in total. The dataset only includes salary and wage earners in urban area, because the income data of self-employed households are not available. 77.4 percent of the whole household population resides in urban area in 1995. 88.6 percent of the whole 'economically active' population belongs to the salary and wage earners category in 1995. Therefore 68.6 percent of the population would be approximately represented by the dataset used in the analysis.

The methods used for the analysis are as follows. The probit model is used for the study of female participation and the impact of economic crisis on it. The Cox proportional hazard model is employed for the study of male unemployment duration and the impact of economic crisis on it. The cohort analysis and its decomposition method are used for the study of the impact of economic crisis on both household income and consumer behaviour. The nonparametric kernel regression method is employed for the estimation



of the Engel curve for expenditure shares and the economic crisis impact on it. For measuring income inequality, the Gini coefficient, the Atkinson index, and the Mean Log Deviation index and its decomposition method are employed. For estimation of demand system the Quadratic Almost Ideal Demand System (QAIDS) is used. Finally the second order approximation of welfare measure is employed to estimate the impact of economic crisis on social welfare. Those methods are briefly reviewed in the corresponding sections.

This thesis presents as follows. Chapter II presents the analysis of the economic impact on both female labour force participation and male unemployment duration. This chapter concerns the short-term effect of the economic crisis on the labour market of Korea. Chapter III presents the analysis of the economic impact on household income and consumer behaviour. This chapter concerns the short-term effect of the economic crisis on household economy. Chapter IV presents the analysis of the economic impact on income inequality and social welfare. This chapter concerns the short-term effect of the economic crisis on the social welfare of Korea. Chapter V presents summary and conclusion.

## Chapter II Impact on labour market:

### Female labour force participation and male unemployment duration

#### *1. Introduction*

The 1997 economic crisis considerably affected the Korean labour market. The unemployment rate increased by 4.2 percent from 2.6 percent in 1997 to 6.8 percent in 1998. Hundreds of thousands of workers were unemployed and even withdrew their participation in the labour force. The labour force participation rate was 62.2 percent in 1997 and decreased to 60.7 percent in 1998. Since unemployment has never been a critical economic issue since 1970s in Korea, the sharp increase in unemployment caused economic as well as social problems throughout the country.

This chapter examines the macroeconomic impact on the Korean labour market using micro level dataset. The analysis focuses on the effects on both female participation and male unemployment duration. The probit model is employed for the analysis on female labour force participation. The Cox proportional hazard model is employed for the analysis on male unemployment duration. After estimating the models, the changes

caused by the economic crisis were examined using predicted values for both model estimations. The dataset used in the analysis is the 1998 KLIPS (Korean Labor and Income Panel Study). Based on information in the 1998 KLIPS, additional datasets required for the analysis were constructed: (i) the 1997 dataset for female participation, (ii) the male unemployment duration dataset for both the employed and the self-employed who are classified in the 1998 KLIPS. The ways of generating the datasets are described in the corresponding sections.

Although the 1998 KLIPS provides information on hours of work, wages, and the financial circumstances of the household for the year 1998, this information is not available for the year 1997, before the economic crisis. This lack of information restricts the analysis to the impact on participation decision and unemployment duration without analysis on labour supply, hours of work. The appropriateness of the analysis might be subject to the datasets used as well as the methods employed. Despite of the imperfect datasets this analysis can be defensible on the ground that the impact of the 1997 economic crisis on the Korean labour market deserves to be examined and there are few studies in this particular area in Korea as of November 2000. In the future the models

can be improved using successive KLIPS datasets and by the analysis of appropriate structural models.

This chapter is presented as follows: Section 2 reviews the models used for the analysis.

In Section 3 the data and empirical results for the macroeconomic impact on female labour force participation are discussed. Then the data and empirical results for the impact on male unemployment duration are presented in Section 4. Finally summary and conclusion remarks are presented in Section 5.

## *2. Estimation models*

### 2.1 The probit model for labour force participation

The probit model is used for the analysis on female labour force participation and the impact of economic crisis on it. The probit model is a binary choice model with discrete dependent variables. Considering a model of labour force participation, the respondent either works or seeks work ( $Y=1$ ) or does not ( $Y=0$ ) in the period in which the survey is

taken<sup>3</sup>. A set of variables, such as age, education, marital status, in a vector  $x$  are assumed to explain the participation decision. Thus

$$\text{Prob}(Y = 1) = F(\beta' x)$$

$$\text{Prob}(Y = 0) = 1 - F(\beta' x)$$

where  $F(\cdot)$  is a cumulative distribution function. The set of parameters  $\beta$  reflects the impact of changes in  $x$  on the participation probability. The probit model uses the normal distribution for the cumulative distribution,  $F(\cdot)$ :

$$\text{Prob}(Y = 1) = \int_{-\infty}^{\beta' x} \phi(s) ds = \Phi(\beta' x)$$

where  $\phi$  is the normal density function and  $\Phi$  is the cumulative normal distribution function. The probability model is a regression:

$$E[y | x] = 0 \cdot [1 - \Phi(\beta' x)] + 1 \cdot [\Phi(\beta' x)] = \Phi(\beta' x).$$

The marginal effects of the explanatory variables are sometimes more accustomed to analyzing than the estimated parameters like those of any nonlinear regression model:

$$\frac{\partial E[y | x]}{\partial x} = \phi(\beta' x) \beta$$

The log-likelihood function for probit is

$$\ln L = \sum_{j \in S} w_j \ln \Phi(x_j b) + \sum_{j \notin S} w_j \ln(1 - \Phi(x_j b))$$

---

<sup>3</sup> The brief review of the probit model in this section is based on Greene (1997).

where  $w_j$  denotes the optional weights. To obtain the estimated coefficients,  $\ln L$  is maximized based on the method of maximum likelihood.

## 2.2 The Cox proportional hazard model for unemployment duration

The Cox proportional hazard model is employed for the analysis of male short-term unemployment duration and the impact of economic crisis on it. Cox (1972) introduced the continuous proportional hazard model by specifying:

$$\lambda(t | X) = \lambda_0(t) \exp(X\beta)$$

where  $\lambda_0(t)$  is the baseline hazard rate<sup>4</sup>. The interaction of  $t$  and  $X$  is restricted to be multiplicative through the baseline hazard and the regressors embodied in the link function,  $\exp(X\beta)$ . It was shown that the parameter  $\beta$  could be estimated without specifying the form for the baseline hazard rate.

The proportional hazard estimation obtains parameter estimates  $\hat{\beta}$  by maximizing the

---

<sup>4</sup> The brief review of the Cox proportional hazard model in this section is based on Neumann (1997).

partial log-likelihood function:

$$\ln L = \sum_{j=1}^D \left\{ \sum_{k \in D_j} x_k \beta - d_j \ln \left[ \sum_{i \in R_j} \exp(x_i \beta) \right] \right\}$$

where  $j$  indexes the ordered failure times  $t_{(j)}$  ( $j=1, \dots, D$ ),  $D_j$  is the set of  $d_j$  observations that fail at time  $t_{(j)}$ ,  $d_j$  is the number of failures at  $t_{(j)}$ , and  $R_j$  is the set of observations  $k$  that are at risk at time  $t_{(j)}$ .<sup>5</sup>

To assess overall model fit and accuracy, there are some suggested measures including the martingale residuals, the Schoenfeld and score residuals, the deviance residuals, and the Cox-Snell residuals. Among them the Cox-Snell residuals are used for overall model goodness of fit<sup>6</sup>. If the Cox regression fits the data, the Cox-Snell residuals should have a standard censored exponential distribution with hazard rate 1, and thus the plot of the cumulative hazard,  $-\ln(\text{Kaplan-Meier survival estimates})$ , versus the cox-snell residuals should have a straight line with slope 1.

---

<sup>5</sup> Kalbfleisch and Prentice (1980), pp. 74.

<sup>6</sup> Assessing both model goodness of fit and proportional hazard assumption is based on STATA 6 reference manual (1999).

The most important assumption of the Cox's proportional hazard estimation might be that the hazard rate is proportional over time. There are both statistical and graphical methods to evaluate the proportional hazard assumptions. The statistical method used in the paper tests the null hypothesis of zero slopes for individual covariates and globally in the appropriate regression, based on the generalization by Grambsch and Therneau (1994). The graphical assessment used plots  $-\ln(\ln(\text{survival probabilities}))$  curves for each category of covariate versus  $\ln(\text{analysis time})$ . These are often referred to as "log-log" plots. The proportional hazards assumption is not violated when the curves are parallel.

### *3. Data and results for female participation*

#### **3.1 Dataset**

The 1998 KLIPS dataset basically contains information based on the date of survey interview (June ~ October 1998). This information constitutes a dataset after the 1997 economic crisis. Thus there is no available data for analysing labour force participation before the 1997 economic crisis. Fortunately, however, the 1998 KLIPS also contains



every individual's work history that provides information on whether an individual worked or not at a particular period. Based on this information, a dataset that provides the participation status of the sample individuals before the economic crisis can be constructed. The standard date of the constructed dataset before the economic crisis is the June of 1997, when is a year before the starting date of survey interview. Thus there are two datasets used for the analysis on female participation: the 1997 dataset (before the economic crisis) that is additionally constructed and the 1998 dataset (after the economic crisis) that is directly obtained from the 1998 KLIPS.

In generating the 1997 dataset an obstacle is that one cannot know whether she is in the position of unemployment (thus participation) or non-participation in case that she did not work in June 1997. The reason is that one can only know whether she worked or not from the information in the 1998 KLIPS. Dropping these observations would cause significant loss of observations as well as potential selection bias. A selection bias might arise because, in the original 1998 dataset, the sample size of the female non-participation group is as over five times as that of the female unemployed group.

As a second best to deal with this problem, those observations that did not work in June 1997 are classified into either participation or non-participation by estimating the 1998 dataset using the probit estimation. Observations that reveal high-predicted probability of participation, greater than 75 percent, are considered as participation samples in 1997 dataset, while observations that reveal low-predicted probability of participation, less than 25 percent, are regarded as non-participation samples in 1997 dataset. The sample size of the constructed 1997 dataset increases from 1,976 to 2,831 by additional 855 observations using this way. The sample size of the 1998 dataset accounts for 3,964 observations<sup>7</sup>.

Table 2 presents descriptive data statistics for the analysis. Comparing the two datasets, the mean values of the variables in the 1997 dataset would be comparable to those in the 1998 dataset except the participation probabilities. The decrease in participation probability between the two periods accounts for 12.9 percent in mean value. Such variables as age, education, married, and the number of kids are slightly greater in the

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<sup>7</sup> These sample sizes are different from those in the actual model estimation because there is some loss of observations in estimation process.

1998 dataset than in the 1997 dataset. Seoul and home ownership dummies have the same mean value for both datasets. Finally the age band of females in the dataset is from 25 to 54 in order to make sample observations closer to be homogeneous.

**Table 2 Datasets for female participation analysis: the constructed 1997 dataset and the 1998 dataset**

<i>Mean</i>	<i>1997 dataset</i>	<i>1998 dataset</i>
Sample size	2,831	3,964
Participation probability	0.671 (0.47)	0.542 (0.50)
Age	37.97 (8.01)	38.14 (8.07)
Education, year	11.53 (3.75)	11.63 (3.68)
College (#)	0.19 (0.39)	0.20 (0.40)
Married (#)	0.87 (0.33)	0.91 (0.29)
Kid, age<11	0.47 (0.74)	0.57 (0.82)
Seoul (#)	0.29 (0.45)	0.29 (0.45)
Home ownership (#)	0.57 (0.50)	0.57 (0.50)

- (#) indicates dummy variables.

- Standard deviations are in parenthesis.

### 3.2. Estimation of female participation

The estimated parameters and corresponding hypothesis test statistics are presented in Table 3. The main explanatory variables used in the estimations are age, education, marital status, kids, address, and some transformed variables. All occupational characteristics are excluded because they are only observed for working women. Since such economic variables as wage, income, and debt are not available for the year 1997, demographic and characteristic variables are mainly included in the estimation. Age, marital status, and kids related variables are re-calculated for the 1997 dataset while education, address, and home ownership variables are assumed to be unchanged over a year between the standard dates of the two datasets.

There are three parts in the table. The top part reports the probit estimation results. The middle part reports the hypothesis test for model goodness of fit. The bottom part of the table reports the hypothesis test for homoscedasticity. In the top part, there are two panels: estimation results of both the 1997 dataset and the 1998 dataset.

**Table 3 Probit estimation results for female participation before and after the economic crisis: Estimation results, model goodness of fit, and test for homoscedasticity**

	<i>Before crisis</i>			<i>After crisis</i>			<i>Changes</i> (2) – (1)
	Coef.	dF/dX (1)	P> z	Coef.	dF/dX (2)	P> z	
Age	0.019	0.007	(0.173)	0.269	0.107	(0.000)	0.100
Age*Age	-0.000	-0.000	(0.000)	-0.003	-0.001	(0.000)	-0.001
Education, year	-0.229	-0.079	(0.000)	-0.105	-0.042	(0.000)	0.037
Edu*Edu	0.006	0.002	(0.000)	0.003	0.001	(0.000)	-0.001
College (#)	2.978	0.505	(0.000)	1.436	0.463	(0.000)	-0.042
Age*College	-0.067	-0.023	(0.000)	-0.036	-0.014	(0.000)	0.009
Married (#)	-0.228	-0.075	(0.017)	-1.061	-0.352	(0.000)	-0.277
No. of Kids, age<11	-0.385	-0.133	(0.000)	-0.225	-0.089	(0.000)	0.044
Kid (#)	-0.346	-0.123	(0.008)	-0.122	-0.048	(0.245)	0.075
Children, all	0.209	0.072	(0.000)	0.132	0.052	(0.000)	-0.020
Seoul (#)	-0.374	-0.133	(0.000)	-0.072	-0.028	(0.134)	0.105
Home owner (#)	-0.578	-0.192	(0.000)	-0.210	-0.083	(0.000)	0.109
Constant	2.777		(0.000)	-3.115		(0.000)	
Number of obs.		2,731			3,777		
Log likelihood		-1419.7			-2402.3		
Obs. Probability		0.6693			0.5409		
Pred. Probability		0.7057			0.5451		
<i>Model goodness of fit</i>							
LR $\chi^2$ (12)		626.93			406.04		
Prob.> $\chi^2$		0.0000			0.0000		
LRI		0.1809			0.0779		
<i>Test for homoscedasticity</i>							
LR $\chi^2$ (6)		20.35			7.78		
Prob > $\chi^2$		0.024			0.255		

- (#) indicates dummy variables.

- LR indicates the likelihood ratio test and LRI indicates the likelihood ratio index.

Each panel contains three columns presenting estimated coefficients, estimated changes in the participation probability ( $dF/dX$ ) for a one-unit change in explanatory variables<sup>8</sup>, and the probability of mistakenly rejecting the null hypothesis when it is correct ( $P>|z|$ ) at 95 percent confidence level. The interpretation of changes in the participation probability ( $dF/dX$ ) might be more natural to understand because the estimated probit coefficients are in the normal quantile metric.

Among explanatory variables, college dummy indicating whether she graduated from college or higher level of educational institution or not might play a critical role in female labour force participation both before and after the economic crisis. The effects of age and married dummy variables on female participation increased after the economic crisis relative to before it although the directions of effect are different. The

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<sup>8</sup> This calculation is somewhat different from that of the marginal effect. The marginal effect is for an infinitesimal change while this is for a one-unit increase in explanatory variables.

effects of Seoul and home ownership dummies relatively decreased after the economic crisis.

The last column of the top part in the table presents the changes in the participation probability change ( $dF/dX$ ) between before and after the economic crisis. This might provide a useful interpretation on the economic impact on female participation. For example, the participation probability of females in Seoul is less than that of females in the other part of the country by 13.3 percent before the economic crisis and by 2.8 percent after the crisis as in the 11th row of the table. One can interpret this as the 1997 economic crisis decreased the difference in the participation probability of females between in Seoul and in the other part by 10.5 percent. After the economic crisis those females in the other part might face more difficulties in participating labour force relative to those in Seoul.

All the values in the last column, however, do not necessarily provide intuitive interpretation like this because there are transformed variables to improve estimation results: age-squared, education-squared, age-by-college dummy. To facilitate interpretation on the results, the predicted probability of participation are calculated for

each individual after estimation and used for the analysis of the macroeconomic impact on female participation in the next section.

Most estimated coefficients of both model estimations appear to be statistically significant at 95 percent confidence level. Exceptions are for kid and Seoul dummies in the 1998 model estimation and for age variable in the 1997 estimation as shown in the third column of each panel of the top part. For measuring model goodness of fit, both the likelihood ratio test and the likelihood ratio index are presented in the bottom part of the table. The likelihood ratio index is also called as 'pseudo R<sup>2</sup>'. Based on the likelihood ratio  $\chi^2$  model test, the null hypothesis that all the slopes in the model are zero can be rejected for both datasets. The likelihood ratio index (LRI), however, indicates that both model estimations appear not to be very good fit because LRI increases close to one as the fit of the model improves.

The test for homoscedasticity as reported in the bottom part of the table is also based on the likelihood ratio test. The restricted model for the test assumes that there are some variables with heteroscedasticity: age, education, kids, children, Seoul, and home ownership variables. The null hypothesis is that all the variables are jointly



homoscedastic. For the 1998 model estimation the null hypothesis cannot be rejected, while the null can be rejected for the 1997 model estimation at 95 percent confidence level as in the table. The test for each variable's heteroscedasticity cannot reject the null hypothesis of homoscedasticity except age variable for the 1997 model estimation although this is not reported in the paper.

### 3. 3 Impact on female participation

The predicted value of each individual's participation probability using estimation results provides useful information on the effect of economic crisis on female labour force participation. The predicted value is the probability rather than the linear index of the probit estimation. After calculating each individual's predicted probability of labour force participation the values are compared between before and after the economic crisis. In total the predicted participation probability decreased by 12.8 percent after the economic crisis<sup>9</sup>. The changes in participation probability obtained are arranged for further investigation on the macroeconomic impact by two ways: (i) The differences in

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<sup>9</sup> In the dataset, the corresponding value is 12.9 percent as in Table 2.

the changed probabilities are calculated using dummy variables, between dummy 1 and 0. (ii) The changed probabilities are arranged by age, by previous occupation, and by previous industry.

### **Changes in participation using ‘difference in the differences’ method**

This method calculates the coefficients presenting the impact of economic crisis on female participation as follows. For instance, let  $P_{a1}$ ,  $P_{a0}$ ,  $P_{b1}$ , and  $P_{b0}$  be the predicted probabilities with subscripts indicating after crisis (a), before crisis (b), dummy one and zero. Then the coefficient is obtained from calculating the formula:

$$C = (P_{a1} - P_{a0}) - (P_{b1} - P_{b0}).$$

The main idea of this method is that where the estimated coefficients are far from zero, this can be interpreted as the economic impact significantly affected the participation decision through that dummy variable. For example, if the coefficient using college dummy is far from zero and negative, one can interpret this as after economic crisis females with college or more education (college dummy=1) might face relatively more difficulties in labour force participation than females with less education (college dummy=0).

Table 4 presents the estimated difference-in-differences coefficients using five dummy variables. The coefficients are also calculated according to age bands because there are significant differences in the effects of the economic crisis among age bands for some dummy variables. All dummy variables shown in the table are also included in the model estimation except 'professional' dummy. The professional dummy indicates whether the previous occupation of the individual is professional one or not. This variable is not included in the model estimation because the inclusion of professional dummy turns out to cause significant loss of observations used in the estimation.

**Table 4 Changes in the probability of female labour force participation between before and after the economic crisis using 'difference in differences' method**

<i>Age</i>	<i>College</i>	<i>Married</i>	<i>Home own</i>	<i>Seoul</i>	<i>Professional</i>
25~34	-0.078	-0.179	0.179	0.066	-0.015
35~44	0.046	-0.234	0.110	0.12	0.054
45~54	0.101	-0.226	0.120	0.111	0.100
Total	-0.046	-0.136	0.161	0.099	-0.005

- All variables are dummy variables.

The total coefficients in the last row of the table show that who faces more difficulties in participating labour force after the economic crisis. The negative value of the coefficient can be interpreted as the participation of females with the dummy of one was more heavily affected by the economic crisis. The coefficient, however, needs to be interpreted more carefully because the disintegrated coefficients by age band are uneven for some variables.

As shown in the table, females with the characteristics of college graduation, marriage, and professional previous occupation might confront more problems in participating labour force after the economic crisis. The participation decision of females who belong to household without home ownership and live in the area outside Seoul might be more distorted by the economic crisis. Looking at the individual variables, college graduates might confront more difficulties in participating after the economic crisis. However, the coefficients by age band reveal that the effect of economic crisis is not even-handed. The coefficient in the youngest group is negative while the others are positive. It indicates that college graduates in the youngest group are the main group distorted by the economic crisis. The difference in the participation probabilities between married and unmarried females decreased by 13.6 percent after the economic crisis. This can be

interpreted as the decrease in unmarried females' participation rather than the increase in married females' participation. The differences among age groups are limited relative to those of college dummy<sup>10</sup>.

Home ownership dummy represents each individual's economic circumstances in the analysis even if it is a variable that belongs to household rather than to individual member. This dummy has a negative effect on labour force participation as in the model estimation results in the previous subsection. The positive value of the coefficient (0.161) in the table might imply that females in household without home ownership faced more difficulties in participation after the economic crisis. The differences in the coefficients among age groups are limited. The positive coefficient (0.099) of Seoul dummy implies that the economic situation in the area outside Seoul is more heavily hit

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<sup>10</sup> It is seemingly absurd that the total average (-0.136) is less than the coefficients of all the three age group in absolute value. However it is reasonable because the total is the difference value of differences on average probability rather than the average value of the differences of differences in probability.

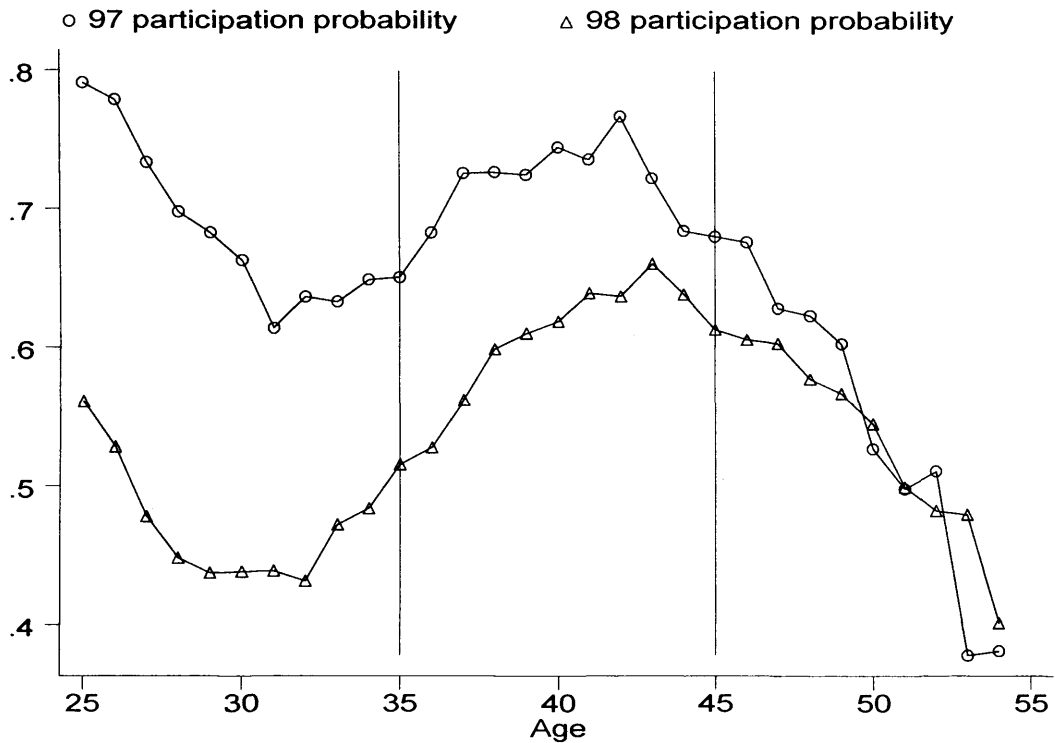
by the economic crisis from the female participation point of view. The differences in the coefficients among age groups are also limited.

The coefficients of professional dummy are comparable to those of college dummy in that the negative total value is attributed to that of the youngest group. The youth with previous professional occupation faced more problems in participating after the economic crisis. Regarding the differences in the coefficients among age bands, it might be obvious that there was uneven effect on the different age groups although the extent of it is not uniform for all dummy variables. Particularly the youngest age group might be distinct from the other two groups. Therefore it might be informative to examine the effect of the economic crisis on female participation according to ages and age bands.

### **Changes in labour force participation by age**

Figure 1 and Table 5 present the impact of economic crisis on female participation based on females' age. Figure 1 illustrates two main features of female participation by ages: the pattern of female labour force participation with age in Korea and the changes in participation probability after the economic crisis. The overall patterns of female

**Figure 1 Changes in female participation probability, by age**



participation appear to be similar between before and after the economic crisis although the levels of participation probability are different.

There seem to be three distinct phases in the pattern. The participation probability decreases from the age of 25 to the age of early 30s. This might be related with marriage and childbirth. Then the participation increases up to the age of early 40s. After stabilizing newly married life they appear to try to participate in the labour force for

various motives such as earning a living, improving career, and so on. After the age of early 40s female participation probability falls. One possible explanation is that married females might give more weight to caring their children for their education. Another possible explanation is that, due to social and business culture in Korea, female participants might face difficulties in maintaining their jobs. It might be true that several reasons act together.

Figure 1 also shows the changes in female participation after the economic crisis. The differences of the two participation probability lines are wider in the young age bands and become steadily narrower as age becomes older. It might be clear that the economic crisis impacted young females' participation in the labour force more heavily as can be expected in the previous analysis.

The changes in participation probability after the economic crisis are presented in Table 5. In total the participation probability decreased by 12.8 percent after the economic crisis. As expected, the decrease in participation probability of the youngest age group is over five times as large as that of the oldest group.



**Table 5 Changes in the probability of female labour force participation between before and after the economic crisis, by age band**

<i>Age band</i>	<i>25~34</i>	<i>35~44</i>	<i>45~54</i>	<i>Total</i>
Before crisis	0.677	0.709	0.589	0.669
After crisis	0.472	0.597	0.552	0.541
Total	-0.205	-0.112	-0.037	-0.128

Why the participation of the youngest female group was most heavily affected by the economic crisis? One reason from the demand side of labour might be that most firms in Korea suspended recruiting young workers after the economic crisis in 1997. Also it is well known that the young are one of the workers at most risk of becoming unemployed in the period of economic recession. Although the young unemployed are still in participation, they might be easily discouraged from participating under economic crisis. Another possible reason from the supply side of labour is that the youth might delay participating in the labour force in order to prepare for acquiring some qualifications to get a job in the future.

### **Changes in participation by previous occupation**

Table 6 presents the decreases in participation probabilities after the economic crisis according to previous occupation. Occupations are categorized into five job areas: professionals, salary earners, workers in service industry, skilled workers in agriculture and fishery, and unskilled workers<sup>11</sup>. Each total coefficient is again disintegrated according to age bands in order to examine differences among age groups. There are three age bands in the table: 25~34, 35~44, and 45~54.

Looking at the total value of the participation probability in the last column of the table, the largest decrease in participation probability belongs to those females with unskilled previous jobs, 15.5 percent. Then the decreases in participation probability of female workers with previous jobs of service industry and professional occupation come next, 14.0 percent. Females who were salary earners have the smallest decrease in probability.

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<sup>11</sup> The categorizations of occupations in this table and industries in the next table follow the way of the Korean Labour Institute. ‘Military personnel’ is dropped because there is no observation in the dataset.

**Table 6 Changes in the probability of female labour force participation between before and after the economic crisis, by previous occupation**

<i>Occupation</i>	<i>Age band</i>			<i>Total</i>
	<i>25~34</i>	<i>35~44</i>	<i>45~54</i>	
Professionals	-0.218	-0.060	0.056	-0.132
Salary earners	-0.178	-0.027	0.068	-0.107
Workers in service industry	-0.217	-0.130	-0.063	-0.140
Skilled workers in agriculture and fishery	-0.203	-0.182	-0.066	-0.122
Unskilled workers	-0.235	-0.156	-0.074	-0.155

This result has similar feature to what is frequently observed in the unemployment analysis<sup>12</sup>. The unemployed might be vulnerable to withdrawal of participation because it was in the period of economic crisis. The estimates by age bands again show that the youngest age group withdrew their participation most largely after the economic crisis.

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<sup>12</sup> For instance, “The people at most risk of becoming unemployed are the young and those employed in unskilled manual or personal service jobs.” in Layard, R. et al. (1991) p.269.

Particularly for professional and salaried previous job, the fall of participation mainly concentrates on the youngest group. Those occupations are a type of job that requires advanced education or training relative to the other occupations in the category. This result is consistent with that of the previous analysis using “difference in the differences” method in that the coefficients of college and professional dummies are mainly attributed to the youngest group.

#### **Changes in participation by previous industry**

The changes in participation probabilities after the economic crisis are rearranged by previous industries in Table 7. Among 16 industry categories, four industries are dropped due to lack of observations: electric, gas, and water supply industry, domestic services, international and foreign agencies, and Mining industry. The estimated changes are listed in order of the amount decreased. Construction and manufacturing industries are those two industries in which female participation decreased most after the economic crisis. The next two industries are social and other services industry and eating and drinking places, and hotels industry. This result is consistent with the previous analysis using previous occupations in Table 6. The first two industries are

related with occupations of unskilled workers. The next two industries are related with occupation of workers in service industry.

**Table 7 Changes in the probability of female labour force participation between before and after the economic crisis, by previous industry**

Industry	Change	Industry	Change
Construction	-0.156	Wholesale and retail trade	-0.123
Manufacturing	-0.151	Agriculture, forestry, and fisheries	-0.122
Social and other services	-0.147	Real estate and business services	-0.122
Eating and drinking places, and hotels	-0.146	Finance and insurance	-0.097
Medical, health, and social welfare services	-0.134	Transportation, warehousing, and communications	-0.067
Educational services	-0.128	Public administration and defense	0.007

Looking at the least affected industries, female participation slightly increased by 0.7 percent in public administration and defense sector even after the economic crisis. This might reflect both a trend of increasing female participation in public sector in Korea and a feature of job stability in public sector. Transportation, warehousing, and

communications industry is the next least affected one. The reason might be connected with the characteristics of the component parts of the industry. This industry includes some sectors closely related to public sector such as railway and underground systems. What is more, communication sector includes newly emerging industries such as information and communications technology (ICT) business<sup>13</sup>.

#### *4. Data and results for male unemployment duration*

##### **4.1 Dataset**

The 1998 KLIPS dataset basically contains information on unemployment duration for the unemployed as of the date of survey interview. There is no explicit information on unemployment duration for the people who are classified as the employed or the self-employed as of the date of survey interview. However the 1998 KLIPS data also contains every individual's work history that provides the end dates of the previous job

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<sup>13</sup> This industry was the fastest grown industry even after the 1997 economic crisis in Korea although it faces difficulties after early 2000.

and the start date of the current job. Based on this information, unemployment durations for both the employed and the self-employed are constructed.

Those observations with which the reasons for ending the previous job are military service, retirement, and health problem are excluded from the sample. The reason is that their unemployment spells might not rely on economic conditions. The observations with unemployment duration longer than 24 months are excluded because including the long-term unemployment observations might distort the analysis of the impact of the 1997 economic crisis on unemployment duration.

The dataset to be estimated for the analysis contains two different sub-samples with different unemployment experiences: (i) a group of the male unemployed who were re-employed before the end of 1997, (ii) a group of the male unemployed who were either re-employed in 1998 or still unemployed as of the date of survey interview. The former group represents unemployment experience before the economic crisis, while the latter group represents unemployment experience after the economic crisis.

**Table 8 Dataset for male unemployment duration analysis**

	<i>Before crisis</i>		<i>After crisis</i>		<i>Total</i>	
Sample size	330		610		940	
Age/5	7.214	(1.761)	7.975	(2.146)	7.708	(2.051)
College (#)	0.303	(0.460)	0.241	(0.428)	0.263	(0.440)
Couple (#)	0.739	(0.440)	0.743	(0.438)	0.741	(0.438)
Kids, age<11	0.555	(0.779)	0.492	(0.778)	0.514	(0.778)
Home own (#)	0.479	(0.500)	0.493	(0.500)	0.488	(0.500)
No of previous jobs	3.545	(1.573)	3.241	(1.698)	3.348	(1.661)
Professional (#)	0.139	(0.347)	0.146	(0.353)	0.144	(0.351)
Seoul (#)	0.261	(0.440)	0.285	(0.452)	0.277	(0.448)
Urban (#)	0.291	(0.455)	0.341	(0.474)	0.323	(0.468)
Regional unemployment rate	2.766	(0.880)	8.135	(1.461)	6.250	(2.869)
<i>Unemployment duration band, month</i>						
Months	3	6	12	18	24	Total
Before crisis	209	40	45	24	12	330
After crisis	245	145	160	44	16	610
Total	454	185	205	68	28	940

- 'Before crisis' stands for the group re-employed before crisis and 'After crisis' stands for the group either still unemployed or re-employed after the 1997 economic crisis.

- (#) indicates dummy variable.

- Standard deviations are in parenthesis.



Table 8 presents a descriptive dataset statistics. There are two panels in the table. The first panel shows average values of the variables used in estimation. The two groups are comparable except regional unemployment rates. The average rate was 2.77 percent in the second quarter of 1997 and increased up to 8.14 percent after the economic crisis in the second quarter of 1998. The age band of males for the analysis is from 25 to 65 in order to make samples closer to be homogeneous.

The second panel represents the number of observations according to unemployment duration bands. The number of samples sharply decreases after 3 months of unemployment duration for 'before crisis' group. The number of samples sharply decreases after 12 months for 'after crisis' group. It also sharply decreases after 12 months for total sample observations. The unemployment duration in the table does not necessarily mean that the unemployed are re-employed after that duration because there are many samples whose unemployment spells are censored at the time of survey interview. The duration spells of the samples classifieds as the employed or the self-employed in the 1998 KLIPS are complete, whereas the duration spells of the unemployed are incomplete, thus censored, from the point of survival time analysis.

## 4.2 Estimation of male unemployment duration

### **Estimation results**

Table 9 presents the results of the Cox proportional hazard estimation for male unemployment duration. The hazard rates reported in the table correspond to a one-unit change in the corresponding variables. Standard errors and the probabilities of mistakenly rejecting the null hypothesis when it is correct ( $P > |z|$ ) at 95 percent confidence level are also reported. Ten explanatory variables are used for the estimation including six dummy variables.

'Age/5' variable indicates 5-year changes in age. Couple dummy indicates current marital status rather than marriage experience. Regional unemployment rates are the unemployment rates of the region in which the unemployed in the sample reside. The rate is the second quarter one in 1997 for 'before' and in 1998 for 'after'. College and home ownership dummies are assumed to be unchanged over time in the analysis. The sample size is 940. The number of failures indicates the number of samples who completed unemployment duration, thus re-employed. Then some diagnostic test statistics are presented.

**Table 9 Cox proportional hazard estimation results for male unemployment duration**

<i>Variables</i>	<i>Hazard rate</i>	<i>Std. Err.</i>	<i>Z</i>	<i>P&gt; z </i>
Age/5	0.867	0.024	-5.164	0.000
College (#)	1.062	0.102	0.620	0.535
Couple (#)	1.386	0.170	2.674	0.008
Kids, age<11	1.022	0.062	0.354	0.723
Home ownership (#)	1.258	0.109	2.658	0.008
No. of previous jobs	1.127	0.028	4.860	0.000
Professional (#)	1.335	0.163	2.367	0.018
Seoul (#)	1.454	0.151	3.607	0.000
Urban (#)	1.227	0.127	1.977	0.048
Regional Unemployment rate	0.870	0.013	-9.088	0.000
Sample size		940		
Number of failures		606		
Log likelihood		-3602.80		
LR $\chi^2$ (10)		174.46		
Prob. > $\chi^2$		0.0000		

(#) indicates dummy variable.

As in the table the 5-year change in age results in a lower hazard rate and therefore a longer survival time controlling for the other explanatory variables. As males are older, the unemployment durations become longer, thus the chances to be employed are smaller. The regional unemployment rate causes also a lower chance of being employed. The other variables result in higher hazard rates. Among those variables, couple, professional, and Seoul dummy variables cause higher hazard rates than the other variables do. The reason why coupled males' hazard rate is higher might be related with responsibility for supporting family. Males with professional previous job have higher chance of being employed. Seoul might provide more opportunities for the unemployed to have a new job.

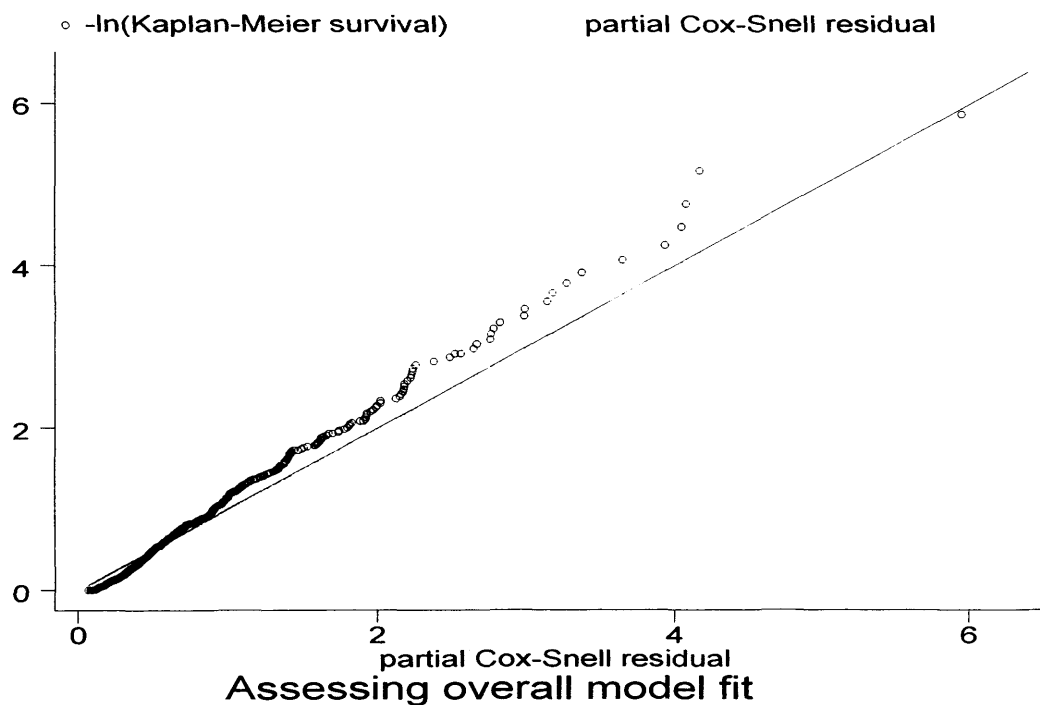
#### **Assessing model goodness of fit**

As presented in the forth and the fifth columns in the table, all the variables except college and kids variables appear to be significant at 95 percent confidence level. Recollecting that college dummy and kids variable play critical role in female participation, this might imply that there must be crucial difference in labour supply

between female and male in Korea although this topic is not dealt with in this analysis<sup>14</sup>.

For overall model goodness of fit, both statistical and graphical tests are presented. For statistical test, the likelihood ratio  $\chi^2$  model test is used. As in the bottom of the table, the null hypothesis that all the slopes in the model are zero can be rejected.

**Figure 2 Graphical assessment of overall model goodness of fit: Cumulative hazards,  $-\ln(\text{Kaplan-Meier survival estimates})$ , versus Cox-Snell residuals**



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<sup>14</sup> This is also related with the reason why the labour force participation analysis focuses on female and the unemployment duration analysis on male in this section.

Regarding graphical test for overall model goodness of fit, Figure 2 illustrates a plot of the cumulative hazard,  $-\ln$  (Kaplan-Meier survival estimates), versus the cox-snell residuals. If the Cox proportional hazard estimation fits the data, the plot should have a straight line with slope 1. As shown in the figure, the model estimation appears to fit most data except for some outliers. The overall model goodness of fit seems to be acceptable.

### **Testing the proportional hazards assumption**

The most important assumption of the Cox proportional hazard estimation might be that the hazard rate is proportional over time. The statistical method used in the analysis tests the null hypothesis of zero slopes for individual covariates and overall in the appropriate regression. The test of zero slopes is equivalent to testing that the log hazard function is constant over time<sup>15</sup>. The rejection of the null hypothesis of a zero slope

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<sup>15</sup> Grambsch and Therneau (1994) showed that many of the tests for proportional hazard assumption are a test of zero slopes in a generalized linear regression of the scaled Schoenfeld residuals on functions of time.

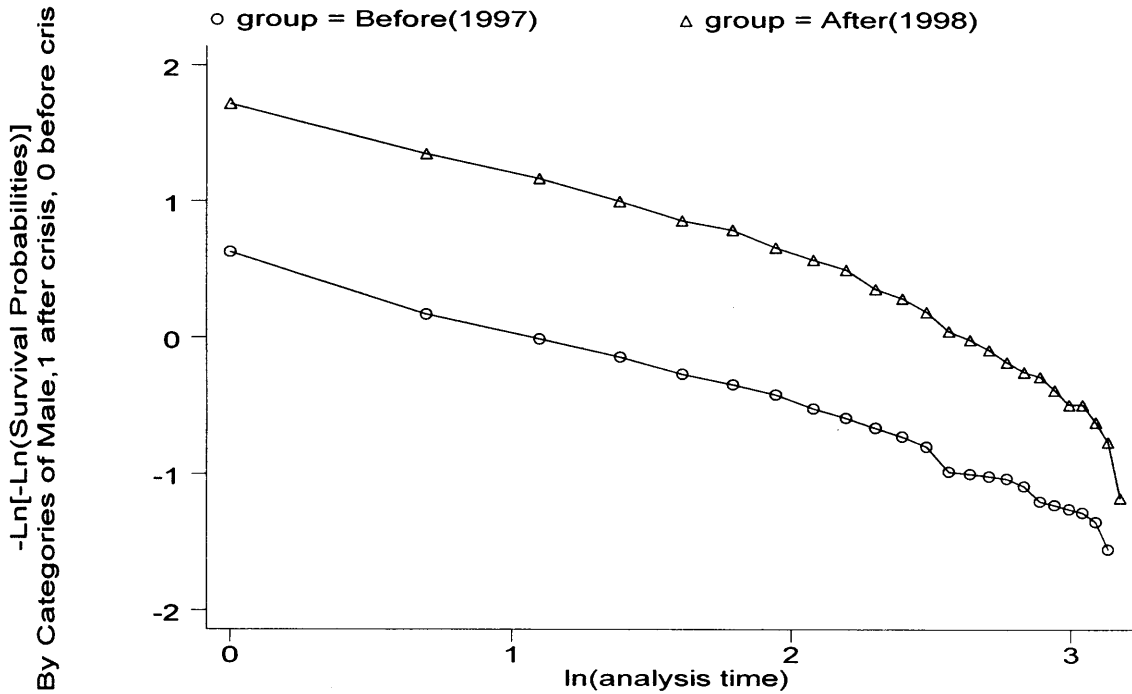
indicates deviation from the proportional hazard assumption. As in Table 10, there is no evidence that the proportional hazards assumption has been violated for 10 individual variables as well as overall.

**Table 10 Statistical test for the proportional hazards assumption**

<i>Variable</i>	<i>Age/5</i>	<i>College</i>	<i>Couple</i>	<i>Kids,</i>	<i>Home own</i>	<i>No. of job</i>
Prob> $\chi^2$	0.2897	0.8390	0.3263	0.7916	0.0855	0.3289
<i>Variable</i>	<i>Professional</i>	<i>Seoul</i>	<i>Urban</i>	<i>Unemp. rate</i>	<i>Overall</i>	
Prob> $\chi^2$	0.5913	0.4724	0.2062	0.3728	0.4731	

Figure 3 presents the graphical assessment that is often referred to as “log-log” plot. The graphical test for the Cox proportional hazard assumption plots  $-\ln(\ln(\text{survival probabilities}))$  curves versus  $\ln(\text{analysis time})$ . The term ‘survival probability’ indicates the probability that the analysis time, the unemployment spell, is of length at least duration  $t$ . The proportional hazards assumption is not violated when the curves are parallel. As shown in the figure, the curve of those in position of being still unemployed after the economic crisis places above the curve of those re-employed before the crisis.

**Figure 3 Graphical assessment of the Cox proportional hazards assumption**



The proportional hazards assumption appears not to be violated because the two curves are likely to be parallel except for those in the range of the longest unemployment duration.

#### 4.3 Impact on male unemployment duration

The predicted value of each individual's relative hazard rate provides useful information on the effect of economic crisis upon male unemployment duration. The predicted



hazard rates present the rates at which unemployment spells are completed after duration  $t$ , given that they last at least until  $t$ . After calculating each individual's predicted hazard rate the values are compared between two sub-groups, before and after crisis. In total the conditional probabilities, hazard rates, of being employed decreased by 36.6 percent after the economic crisis. The changes in relative hazard rates are arranged for further investigation on the macroeconomic impact by two ways as in the analysis of female participation: (i) The differences in the changed hazard rates are calculated using dummy variables between dummy 1 and 0. (ii) The changed hazard rates are arranged by age, by previous occupation, and by previous industry.

### **Changes in hazard rates using 'difference in the differences' method**

Table 11 presents the coefficients obtained from 'difference in the differences' method. The main idea of this analysis is that where the estimated coefficients are far from zero, this can be interpreted as the economic impact significantly affected the conditional probability of being employed through that dummy variable. For instance, looking at the columns of professional dummy, before the economic crisis the hazard rate for males with previous professional job is larger by 28 percent (0.94 minus 0.66) than that for males without previous professional job. After the economic crisis, however, the

difference accounts for only 10 percent (0.39 minus 0.29). It implies that by the economic crisis the conditional probability of being employed for males with previous professional job decreased by 18 percent relative to that for males without previous professional job.

There are six dummy variables used in the table. All the dummies are also included in the model estimation. For all the six dummy variables the hazard rates of males with positive dummies decreased after the 1997 economic crisis. Among them, males with positive professional and Seoul dummies are affected most, whereas those with positive home ownership and college dummies are affected least by the economic crisis.

**Table 11 Changes in the hazard rates of being employed between before and after the economic crisis using ‘difference in differences’ method**

Dummy	<i>College</i>		<i>Couple</i>		<i>Kid</i>		<i>Home own</i>		<i>Seoul</i>		<i>Professional</i>	
	0	1	0	1	0	1	0	1	0	1	0	1
Before crisis	0.66	0.80	0.62	0.73	0.64	0.79	0.68	0.73	0.65	0.85	0.66	0.94
After crisis	0.28	0.38	0.28	0.31	0.27	0.36	0.29	0.32	0.28	0.35	0.29	0.39
Difference in differences	-0.04		-0.08		-0.06		-0.02		-0.13		-0.18	

- All variables are dummy variables.

### **Changes in hazard rates by age band**

Table 12 presents the changes in the hazard rates between before and after the economic crisis according to age bands. In total the hazard rates of being employed decreased, on average, by 36.6 percent after the economic crisis. Four age bands are categorized. There is a strong tendency that the hazard rates become smaller as age bands are greater both before and after the economic crisis as in the second to forth columns in the table. This is consistent with the estimation results in that the 'age/5' variable results in a lower hazard rate and thus a longer survival time. Older groups might face more difficulties in being re-employed than younger groups do.

The extent to which hazard rates decrease after the economic crisis, however, is greater as age group is younger as in the last column in the table. The hazard rate of the youngest group decreased by 40.3 percent, while that of the oldest group by 22.3 percent after economic crisis. Although the youngest group still has, on average, the highest hazard rate after the economic crisis, it might be the most affected group by the economic crisis.

**Table 12 Changes in the hazard rates of being employed between before and after the economic crisis, by age bands**

<i>Age category</i>	<i>Before (b)</i>	<i>After (a)</i>	<i>Total</i>	<i>Change, (a)-(b)</i>
25~34	0.761	0.358	0.534	-0.403
35~44	0.688	0.307	0.431	-0.381
45~54	0.573	0.251	0.351	-0.323
55~65	0.412	0.189	0.221	-0.223
Total	0.699	0.301	0.441	-0.366

#### **Changes in hazard rates by previous occupation**

According to previous occupations the changes in the hazard rates are arranged as presented in Table 13. Five occupational categories are used<sup>16</sup>. The ranks of hazard rates among occupational categories are unchanged between before and after the economic

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<sup>16</sup> The categorizations of occupations in this table and industries in the next table follow the way of the Korean Labour Institute as in the analysis of female participation. ‘Military personnel’ is dropped because there is no observation.

crisis as in the second to fourth columns in the table. Males with previous professional job have the highest hazard rates. Then workers in service industry, salary earners, and unskilled workers show the hazard rates in descending order. Skilled workers in agriculture and fishery have the lowest hazard rates.

**Table 13 Changes in the hazard rates of being employed between before and after the economic crisis, by previous occupation**

<i>Occupation</i>	<i>Before (b)</i>	<i>After (a)</i>	<i>Total</i>	<i>Change, (a)-(b)</i>
Professional	0.936 (1)	0.394 (1)	0.578 (1)	-0.542 (1)
Salary earners	0.665 (3)	0.293 (3)	0.452 (3)	-0.372 (4)
Workers in service industry	0.691 (2)	0.308 (2)	0.464 (2)	-0.383 (3)
Skilled workers in agriculture and fishery	0.506 (5)	0.182 (5)	0.380 (5)	-0.324 (5)
Unskilled workers	0.655 (4)	0.271 (4)	0.382 (4)	-0.384 (2)

- Corresponding ranks are in parenthesis.

The ranks of the extent to which hazard rates decrease after the economic crisis are slightly different as shown in the last column of the table. Males with previous professional occupation are the most affected group and the extent of it is far greater than those of the other four groups. Unskilled workers are the second affected group by

the economic crisis. Skilled workers in agriculture and fishery are the least affected group by economic crisis.

### **Changes in hazard rates by previous industry**

The changes in hazard rates after the economic crisis are rearranged by previous industries in Table 14. Among 16 industry categories, five industries are dropped for lack of observations: electric, gas, and water supply industry, domestic services, international and foreign agencies, medical, health, and social welfare services, and mining industry. The estimated changes are listed in order of the amount decreased.

The male unemployed previously in finance and insurance industry and educational services face more difficulties in being re-employed after the economic crisis than those in any other industries do. Finance and insurance industry is the industry in which the liquidity crisis was initiated in late 1997 in Korea. Most financial institutions were in feeble condition and some of them were bankrupted. Among educational service industries it might be private educational service sector that the decrease in hazard rates is most attributed to. These two industries, finance and insurance industry and educational service industry, might be connected with professional occupation in the

previous table. Eating and drinking places, and hotels industry is the next one and related with workers in service industry from the point of occupational category.

**Table 14 Changes in the hazard rates of being employed between before and after the economic crisis, by previous industry**

<i>Industry</i>	<i>Change</i>	<i>Industry</i>	<i>Change</i>
Finance and insurance	-0.563	Public administration and defense	-0.375
Educational services	-0.542	Manufacturing	-0.373
Eating and drinking places, and hotels	-0.430	Agriculture, forestry, and fisheries	-0.331
Construction	-0.428	Transportation, warehousing, and communications	-0.306
Real estate and business services	-0.427	Social and other services	-0.273
Wholesale and retail trade	-0.411		

Looking at the bottom-right of the table, social and other service industry and transportation, warehousing, and communications industry are the least affected industries, although the extents of the decrease in the hazard rates of being employed are high enough, 27.3 and 30.6 percent, respectively.

## *5. Conclusion*

The 1997 economic crisis of Korea heavily affected labour market. This chapter examined the macroeconomic impact on labour market using a micro level dataset. The analysis focuses on both female participation and male unemployment duration. The basic dataset used in the analysis is the 1998 KLIPS (Korean Labor and Income Panel Survey) data.

For the analysis of female participation, the probit estimation was implemented on both the constructed 1997 dataset and the 1998 dataset. Whether females are college graduates or not turned out to play the most critical role in female labour force participation both before and after the economic crisis. The predicted participation probabilities are calculated and used for the analysis of the impact of economic crisis on female participation. In total the predicted participation probability decreased, on average, by 12.8 percent after the economic crisis. Females with the characteristics of college graduation, marriage, and professional previous occupation confronted more difficulties in participating in the labour force after the economic crisis. The economic



crisis impacted young females' participation more heavily. The participation probabilities of younger female groups decreased more after the economic crisis than those of older groups. The participation probabilities of females with previous job in unskilled part and in service part decreased most after the economic crisis. The participation probability of females who previously participated in construction, manufacturing, social and other services industries decreased most after the economic crisis.

For the analysis of male unemployment duration, the dataset is estimated using the Cox proportional hazard model. The increases in age and regional unemployment rate turned out to cause lower chances of being employed. Couple, professional, and Seoul dummy variables resulted in higher hazard rates than other variables did. The predicted hazard rates are calculated and used for the analysis of the impact of economic crisis on male unemployment duration. In total the conditional probabilities, hazard rates, of being employed decreased, on average, by 36.6 percent after the economic crisis. Males with positive value of college, couple, kid, home ownership, Seoul, and professional dummies faced more decreases in hazard rates after the economic crisis. The economic crisis impacted young males' unemployment durations more heavily. The hazard rates

of young males decreased more relative to those of experienced males after the economic crisis. The hazard rates of the unemployed with previous job in professional, unskilled part, and service sectors decreased most largely after the economic crisis. The hazard rates of the unemployed who previously worked in finance and insurance, educational services, and eating and drinking places and hotel industries decreased most largely after the economic crisis.

## Chapter III Impact on household economy: Household income and consumer behaviour

### *1. Introduction*

This chapter examines the impact of the 1997 economic crisis on the household economy of Korea. The economic crisis of Korea in 1997 heavily impacted labour market as examined in the previous chapter. In 1998 the number of business establishment decreased by 2.4 percent and the number of workers decreased by 7.8 percent relative to those in 1997. The unemployment rate accounted for 6.8 percent in 1998 and 6.3 percent in 1999, while the average unemployment rate from 1991 to 1997 was 2.4 percent. Consequently the household economy might be severely affected by the economic crisis. Household income and consumption expenditure sharply decreased after the economic crisis.

Table 15 presents the evolution of real median income and expenditure in the 1990s. Household real income increased rapidly from 1991 to 1996 and slightly in 1997. In 1998 after the economic crisis the household income sharply decreased by 15.9 percent

down to the level in 1994. It improved in 1999, but still remained below the level of 1995. Household consumption expenditure followed the similar path to the income evolution. It increased until 1997 and sharply decreased by 15.9 percent in 1998. There was some improvement in consumption expenditure in 1999. Household economy was heavily affected by the 1997 economic crisis at least from the income and consumption expenditure points of view.

**Table 15 Evolution of median household real income and consumption expenditure, and their growth rates from 1991 to 1999**

(Unit: million won)

<i>Year</i>	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>
Income	1.23	1.37	1.43	1.53	1.65	1.77	1.82	1.53	1.58
Growth rate	-	11.4	4.4	7.0	7.8	7.3	2.8	-15.9	3.3
Expenditure	0.57	0.62	0.65	0.69	0.74	0.79	0.82	0.69	0.77
Growth rate	-	8.8	4.8	6.2	7.2	6.8	3.8	-15.9	11.6

- Price index: 1995=100

The extents of the impact on household income would not be evenly distributed over the individual households. A certain household group might suffer from economic hardship

more heavily than others by the economic crisis. A certain household group might find itself to recover from the economic hardship more quickly than others with some economic recovery in 1999. The analysis focuses on the impact on household income by examining the differences in the extent of it across individual households. Individual households are categorized into age cohort, regional, and occupational groups. The cohort analysis and its decomposition method is the main method for the analysis.

How the Korean consumers responded the 1997 economic crisis is the next topic in this chapter. Consumers might modify their consumption schedules in the face of economic crisis. They might reduce or postpone expenditure on some goods such as luxuries and durables. The analysis on consumer behaviour focuses on the change in household expenditure shares between before and after the economic crisis. The nonparametric kernel regression and the cohort analysis are used for the analysis. The Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999 is the dataset used in this chapter.

The chapter is presented as follows: Section 2 presents data and methods used in the analysis. Section 3 presents the economic impact on household income. Section 4

presents the impact on consumer behaviour. The last section concludes.

## *2. Data and methods*

### **2.1 Data**

The data used in the analysis is the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999. The sample sizes are over 10,000 households in each year survey and 101,454 households in total<sup>17</sup>. The dataset include only salary and wage earners in urban area, because the information on income for the self-employed households is not available. 77.4 percent of the whole household population resides in urban area in 1995. 88.6 percent of the whole ‘economically active’ population belongs to the salary and wage earners category in 1995. Despite that the original dataset contains monthly income and expenditure data, quarterly data are used in the analysis because quarters are only indicated in the original dataset.

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<sup>17</sup> The statistical description of the dataset is reported in Appendix III.A.

For the survey design, data are collected monthly from diaries that are distributed prior to the month. The overall response rate is 79.7 percent in 1997. The survey collects information on household structure, socio-economic characteristics (such as occupation, industry, and region), household expenditures in some detail, and incomes by source. All money accounts in the analysis are in real Korean Won, base year = 1995. Household income includes both current and non-current income, but excludes capital gains, imputed rents, and benefits in-kind. Taxes paid are not subtracted from household income.

Consumption expenditure in the FIES has 504 sub-items, but household expenditure data used in the analysis exclude the expenditures on durables, housing, alcohol, tobacco, and miscellaneous. The amount of household expenditure used in the analysis accounts for, on average, 69.98 percent of the whole consumption expenditure in the FIES from 1991 to 1999. The data of alcohol and tobacco are excluded from the dataset used in the analysis because they are severely under-reported to the FIES. Six commodity groups are aggregated: Food and non-alcoholic drink, Fuel, Clothing and footwear, Services, Transport, Other non-durables. 'Meals outside home' item is included not in food group but in service group because the item might be considered as

recreational activity rather than diet. This provides better match of the expenditure shares in the FIES to the private consumption data in the 1995 Input-Output table of Korea.

## 2.2 Methods

The cohort analysis and its decomposition method is the major model in examining the impact of the 1997 economic crisis on household income and consumer behaviour throughout the chapter. The kernel regression is employed to evaluate the movement of Engel curves for expenditure share. Both models are briefly reviewed here. In estimating income elasticity, the Quadratic Almost Ideal Demand System (QAIDS) is used. The demand system is described in the next chapter.

### **Cohort analysis and its decomposition method**

The cohort analysis and its decomposition method<sup>18</sup> is the main method used

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<sup>18</sup> The cohort analysis and its decomposition method follow the way in Deaton (1997) and Deaton and Paxson (1994).



throughout the chapter, where cohorts are defined by date of birth. In examining the evolutions of household income, consumption expenditure, and expenditure shares over the 1990s, the method might provide useful instrument and insightful result. The method is useful in following cohort groups over time because the FIES is not a panel dataset, and thus there is no possibility of tracing individuals over time. The method is informative because its decomposition method identifies individual effects from the evolution of variables of concern by cohort: age, cohort, and year effects.

The use of successive survey data to follow cohorts of individuals over time provides the average values of a variable of concern. These averages have many of the properties of panel data because they are related with the same cohort group of individuals. For example, we can observe the average income of 30-year-olds in the 1991 survey, of 31-year-olds in the 1992 survey, of 38-year-olds in the 1999 survey, and so on. These averages are related to the same cohort group of people, say, 'cohort 30' and provide the evolution of income for the cohort group in the 1990s. Tracking the development of income for 'cohort 30' might provide information on the impact of economic crisis in 1997 on the income for the cohort group. Comparing different income evolutions

among different cohort groups might provide information on the difference in the extents of the impact among cohort groups.

Such variables as household income and consumption expenditure are recognized to have distinct and characteristic life-cycle profiles. The levels of income and expenditure tend to increase to their maximum in the middle years of life. Moreover, younger generations would be better off than older generations with steady economic growth over years. Those variables are also influenced by yearly macroeconomic performance. Household income and expenditure rise with economic expansion and fall with economic contraction. Consequently, the age profile from a single cross section data compound the age profile effect with the generational or cohort effect. The comparison between successive age profiles from successive cross sectional datasets compounds the age profile effect and the cohort effect with the macroeconomic year effect.

The cohort data can be decomposed into the individual effects: age effect, cohort effect, and year effect. Age effect shows the typical age profile. Cohort effect shows the difference in effects among generations or cohorts. Year effect shows yearly macroeconomic effect on the variables of concern, for example, income, by moving all

cohorts off their profiles. The decomposition model can be written as:

$$\ln Y_{ct} = \beta + A\alpha + C\gamma + Y\psi + \varepsilon$$

where  $Y_{ct}$  is average real income (or consumption expenditure) of a cohort ( $c$ ) in a year ( $t$ ),  $A$  is a matrix of age dummies,  $C$  is a matrix of cohort dummies where  $C$  is chosen as the age in year  $t=0$ , and  $Y$  is a matrix of year dummies. Dummy variables are used for the three effects to allow the data to choose any pattern. A basic assumption is that there is no interaction effects between age, cohort, and years, so that the shape of age profile is unaffected by changes in their position.

To avoid the dummy variable trap, a case of perfect collinearity, one column from each of the three matrices should be dropped. Furthermore since there is an additional linear relationship among three dummy matrices,  $\text{Cohort} = \text{Age} - \text{Year} + 91$ , it is necessary to drop one more column from any one of the three matrices to estimate the model. For the normalization of age, cohort, and year effects, a method that is chosen is to attribute growth to age and cohort effects and to use the year effects to capture cyclical fluctuations that average to zero over the long run. This normalization makes the year effects to be orthogonal to a time trend:

$$S_y' \cdot \psi = 0$$

where  $S_y'$  vectors are arithmetic sequences  $\{0,1,2,3,4,\dots,T\}$  of the length of the periods of concern and  $\psi$  is the vector of year effect coefficients.

The simplest way to estimate the model subject to the normalization is to regress log real income on (a) dummies for each age excluding, say, the first, (b) dummies for each cohort excluding, say, the first, and (c) replaced dummies for each trend excluding, say, the first and second. The replaced dummies for the year effects are defined as follows:

from  $t=3,4,\dots,T$ ,

$$d_t^* = d_t - [(t-1)d_2 - (t-2)d_1]$$

where  $d_t$  is the usual year dummy. This procedure enforces the restrictions as well as the year dummies add to zero. Note that the method would be used with any confidence when there are sufficient years for trend and cycle to be separated.

### **Nonparametric Kernel regression**

In examining the changes in consumer behaviour after the economic crisis, the nonparametric kernel regression model is employed to estimate the Engel curve for expenditure shares on logarithmic real income. The nonparametric model provides a

useful method in estimating Engel curves that have a variety of curvatures according to goods, because it avoids the imposition of any parametric assumptions on the conditional mean function. The kernel regression method can be reviewed as follows<sup>19</sup>.

Assume that the model of interest is  $y = g(x) + \varepsilon$  where  $x$  is a univariate of concern and  $\varepsilon$  is defined such that  $E(\varepsilon | x) = 0$ . The kernel regression replaces  $g(x)$  with a local estimator of the conditional mean

$$E(y | x) = \int y f(y | x) dy$$

where  $f(y|x)$  is the conditional density of  $y$ . Since  $f(y|x) = f(x,y)/f(x)$  and  $f(x) = \int f(y,x) dy$ , we can rewrite this as

$$E(y | x) = \frac{\int y f(y, x) dy}{\int f(y, x) dy}.$$

The objective of the kernel regression is to replace the numerator and denominator in the above conditional mean estimator with estimators based on locally weighted averages. Specifically, the Nadaraya-Watson kernel estimator of  $E(y|x)$  can be written as

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<sup>19</sup> The review of the kernel regression is based on Blundell and Duncan (1997)

$$\hat{g}_h(x) = \frac{\sum_{i=1}^n y_i K_h(x_i - x)}{\frac{1}{n} \sum_{i=1}^n K_h(x_i - x)}$$

Or equivalently

$$\hat{g}_h(x) = \sum_{i=1}^n y_i \pi_{ih}(x)$$

where  $h$  is bandwidth,  $K(\cdot)$  is the kernel function, and  $\pi_{ih}(x)$  is a weight function of

the form:

$$\pi_{ih}(x) = \frac{K_h(x_i - x)}{\sum_{j=1}^n K_h(x_j - x)}$$

The choice of the bandwidth  $h$  is crucial to the appearance and properties of the estimation because it determines the degree of smoothing, although the choice can be a subjective one. There are a number of suggestions on the choice of bandwidth. For example, Silverman (1986) sets bandwidths to minimize the Mean Integrated Squared

Error (MISE) of the form

$$MISE(\hat{f}(x)) = \int E \left[ \left\{ \hat{f}(x) - f(x) \right\}^2 \right] w(x) dx$$

where  $f(x)$  denotes the ‘true’ density and  $w(x)$  denotes some trimming function. If the

‘true’ density of  $x$  is normal, then the optimal choice for  $h$  is  $1.06 \sigma_x n^{-1/5}$ .

The kernel function itself is symmetric, integrates to unity, and typically continuously differentiable. Common choices for the univariate kernel function  $K(\cdot)$  include the

Gaussian function of the form  $k(u) = 1/\sqrt{2\pi} \exp(-u^2/2)$  and the Epanechnikov function of the form  $k(u) = 3/4(1-u^2) \cdot 1(|u| \leq 1)$  where  $1(\cdot)$  is the unit indicator function. The Gaussian kernel is employed in the analysis.

### *3. Impact on household income*

The median income of households of Korea decreased by 15.93 percent from 1997 to 1998 after the economic crisis as in Table 15. The level of income in 1998 is nearly equal to that in 1994. The extents of income impact would not be evenly distributed over the individual households. This section focuses the income impact on examining the differences in the extent of the impact among different household groups. Individual households are categorized into age cohorts, regional, and occupational groups.

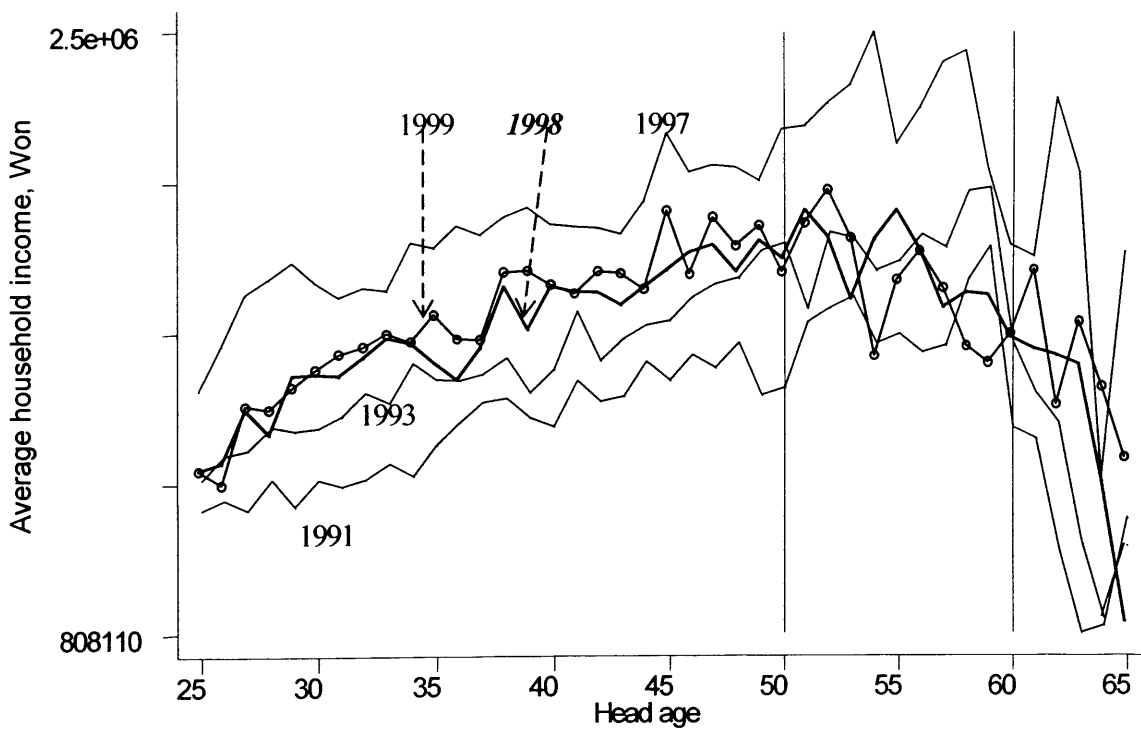
#### **3.1 Income impact by age cohort**

##### **Age profile of income**

The age profiles of income might provide an overall picture on the changes in income profiles over the 1990's. Figure 4 presents the cross sectional age profiles of income for

selected years: 1991, 1993, 1997, 1998, and 1999. Each graph plots against household head's age the average real income of all households with that age. Looking at the individual profiles, there are some common features. Average household income gradually increases until the age of fifty. Then it rises to its maximum in the age band of fifties. After the age of sixty it sharply decreases in general.

**Figure 4 Age profile of average household real income for selected years (1991, 93, 97, 98, and 99)**





Looking at the shifts of the age profiles, the growth of real income raises the graphs until 1997, and then the economic crisis lowers the graphs in 1998 and 1999. The darker line shows the age profile of income in 1998, just after economic crisis. The 1998 profile places much below the 1997 profile. The economic crisis shifted down the age profile across all age bands. The line with small circle symbols indicates the 1999 profile of income, with some economic recovery. The 1999 profile, however, is not far from the 1998 profile. It appears that the 1999 profile places slightly above the 1998 profile in the age band less than fifty. Two lines intersect each other in the age band more than fifty.

However, it might not be easy to identify which age groups are more affected by the 1997 economic crisis and consecutive some economic recovery from this figure of cross-sectional age profiles. Furthermore, comparing age profiles of income from successive cross section data might mislead to inappropriate conclusion because it tends to compound age effects and cohort effects with macroeconomic year effects.

### Income by cohort

To examine the spreading of economic impact over age bands, age cohorts of individuals over time are used. Although the FIES data provide not a panel data but a repeated cross-sectional data, it is possible to follow cohorts of individual over years, where cohorts are defined by the year of birth of household head.

**Table 16 Number of sample observations in selected cohorts by survey year**

<i>Year</i>	<i>Cohort, age in 1991</i>						
	<i>C25</i>	<i>C30</i>	<i>C35</i>	<i>C40</i>	<i>C45</i>	<i>C50</i>	<i>C55</i>
1991	165	553	417	316	231	202	135
1992	235	559	431	249	219	182	134
1993	312	560	409	259	199	171	112
1994	366	546	400	259	209	179	135
1995	401	518	403	248	210	210	137
1996	371	504	373	235	214	197	127
1997	375	465	296	213	201	186	113
1998	408	457	364	217	174	127	76
1999	368	476	368	231	176	110	66

Table 16 presents the number of sample observations in selected cohorts. The year in the table stands for the year of survey. Average income by cohort is the average of each cell. For example, the incomes by cohort of 30-year-olds in 1991 are calculated using 553 observations in 1991, 559 observations in 1992, and so on. The results form a line to show the evolution of income of 'cohort 30' from 1991 to 1999. The average value of observations in the 63 cells accounts for 282 sample observations.

**Figure 5 Evolution of income by cohort for selected cohorts from 1991 to 1999**

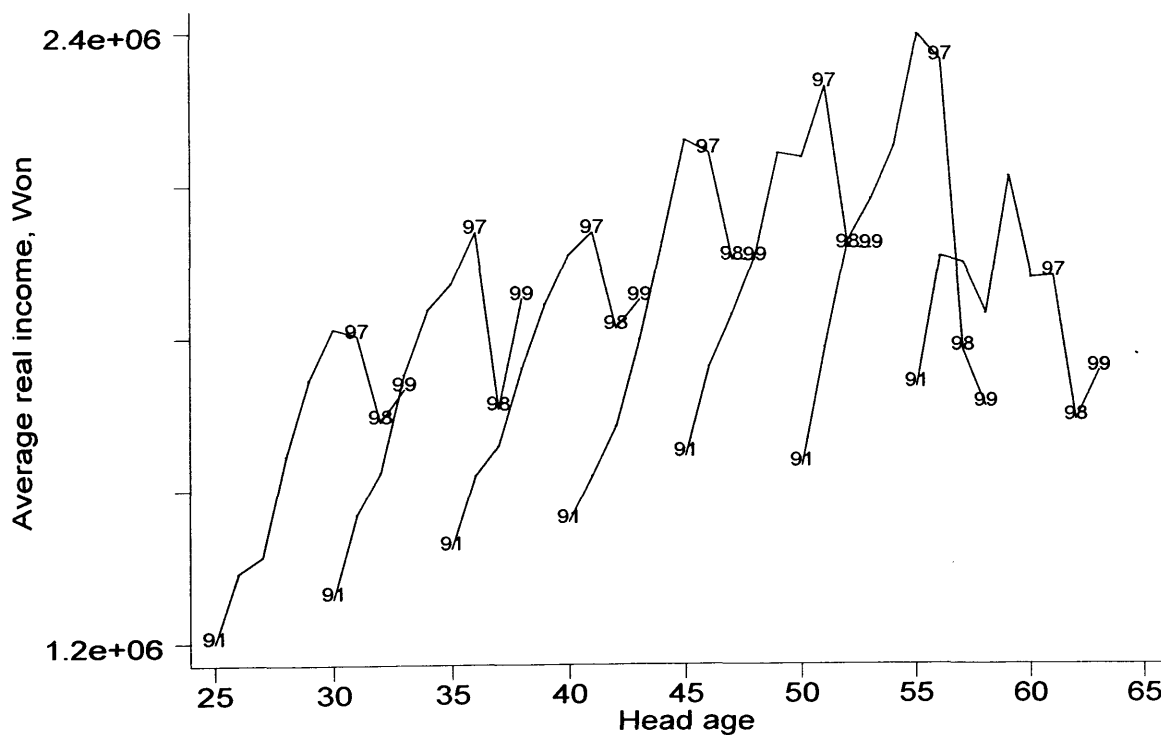


Figure 5 presents the evolution of average incomes by selected cohorts from 1991 to 1999. There are seven cohorts illustrated as in the previous table: cohort 25, 30, 35, 40, 45, 50, and 55. The first line shows the evolution of average income of 'cohort 25'. The second line shows the evolution of average income of 'cohort 30', and so on. With a few exceptions for the older cohorts, the lines for the younger cohorts are above the lines for the older cohorts, even when they are observed at the same age. This might reflect that rapid economic growth in Korea in the 1990s makes younger generations better off. The real income of most cohorts increased from 1991 to 1996 with economic growth. In 1997 such cohorts as 'cohort 25', 'cohort 40', and 'cohort 50' experienced slight decreases in household income.

Every cohort experienced sharp decrease in real income in 1998 after the 1997 economic crisis even if the extent of it is not even-handed across cohorts. The largest real income loss appears to belong to 'cohort 50' that was 57 years of age in 1998. It seems that this cohort is the most vulnerable to macroeconomic impact and economic

restructuring among above seven cohorts<sup>20</sup>. The second largest loss of real income appears to belong to 'cohort30' that was 37 years of age in 1998. This cohort usually takes middle ranking position in firms, which might cause this cohort to be also vulnerable to firm restructuring. Furthermore there would be voluntary unemployment for this age group to find a new job because this cohort is relatively young but some experienced.

In 1999 when there was some economic recovery, the average real income increased for the younger cohorts (cohort 25, 30, and 35). The biggest income increase appears to belong to 'cohort 30'. This might result from their big income loss in 1998 on the one hand. On the other hand it might reflect that this cohort could be easily re-employed relative to the other cohorts when economy gradually recovers from the crisis. The real incomes of the next two cohorts (cohort 40, 45) in 1999 appear to be hardly changed

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<sup>20</sup> This does not contradict with the results of the previous chapter in which one of the conclusions is that younger age groups were more affected than older age groups by the economic crisis. The reason is that the conclusion is related with female participation and male unemployment duration.

from those in 1998. It might be difficult for these cohorts either to have new jobs or to do their own businesses because of both their age and hard economic situation.

The real income of 'cohort 50' decreased dramatically even in 1999. For this cohort, once they are unemployed, it might normally turn out to be permanent retirement.

Another possible explanation of their dramatic income decrease might be that they would face debt repayment due to fall of credit. The last cohort (cohort 55) faced real income increase in 1999. This might result from their gaining of retirement pension as a lump sum. Another possible explanation is the existence of outliers because the number of observations is relatively small comparing with those of the other cohorts as in Table 16. However, since only selected seven cohorts are illustrated in the figure, it is too early to draw a conclusion on the age distribution of the income impact although the figure provides useful information on the analysis.

Table 17 presents the average growth rates of income according to cohort categories.

Since Figure 5 illustrates the income changes of selected cohorts, it might be informative to look at the changes in average income by cohort using the extended number of cohorts from 'cohort 25' to 'cohort 55'. The cohorts are again categorized

into six cohort bands for illustration. The second row of the table shows the ages of the cohorts in 1997, the year when the economic crisis occurred. The third through the sixth rows present the average growth rates of income by each cohort category, in 1991-96, in 1997, in 1998, and in 1999, respectively.

**Table 17 Average growth rate of income by cohort bands using extended 31 cohorts from 1991 to 1999**

(Unit: Percent)

<i>Cohort</i>	<i>C25-C30</i>	<i>C31-C35</i>	<i>C36-C40</i>	<i>C41-C45</i>	<i>C46-C50</i>	<i>C51-C55</i>
Age in 1997	31-36	37-41	42-46	47-51	52-56	57-61
1991-1996	8.7	8.9	6.8	6.4	8.4	4.6
1997	0.9	1.5	3.8	5.2	1.1	2.3
1998	-13.5	-10.8	-10.7	-11.7	-20.3	-21.7
1999	5.6	3.1	3.9	2.1	-6.6	-2.0

As presented in the table, the growth rates of average income decreased in 1997 relative to those in 1991-96 for all cohort bands, although the growth rates are still positive. The extents of decrease in the growth rates are larger for C25-C30, C31-C35, and C46-C50

cohort bands than for the others. In 1998 the levels of the average income sharply decreased for all the cohort bands, negative growth rates. The oldest two cohort bands (C46-C50 and C51-C55) faced the largest fall in income, which is not revealed from the figure. Then the youngest cohort band (C25-C30) experienced larger decrease in average income in 1998 than the others (C31-C35, C36-C40, and C41-C45) did. This result might be consistent with that from the figure. In 1998 those cohorts in their early thirties and over fifties might be most heavily affected by the economic crisis.

In 1999, with some economic recovery, the levels of the average income increased except for the oldest two cohort bands (C46-C50 and C51-C55). The youngest cohort band (C25-C30) in their early thirties in 1999 experienced the largest increase in income growth, while the oldest two groups (C45-C50 and C51-C55) in the fifties still faced the decrease in the level of average income. These results also might be consistent with those from the figure. The economic crisis affected the household income most heavily for both the youth in their early thirties and the old in the fifties in 1998. After some economic recovery in 1999 the former youngest group gradually recovered, whereas the latter oldest group still suffered from economic hardship.

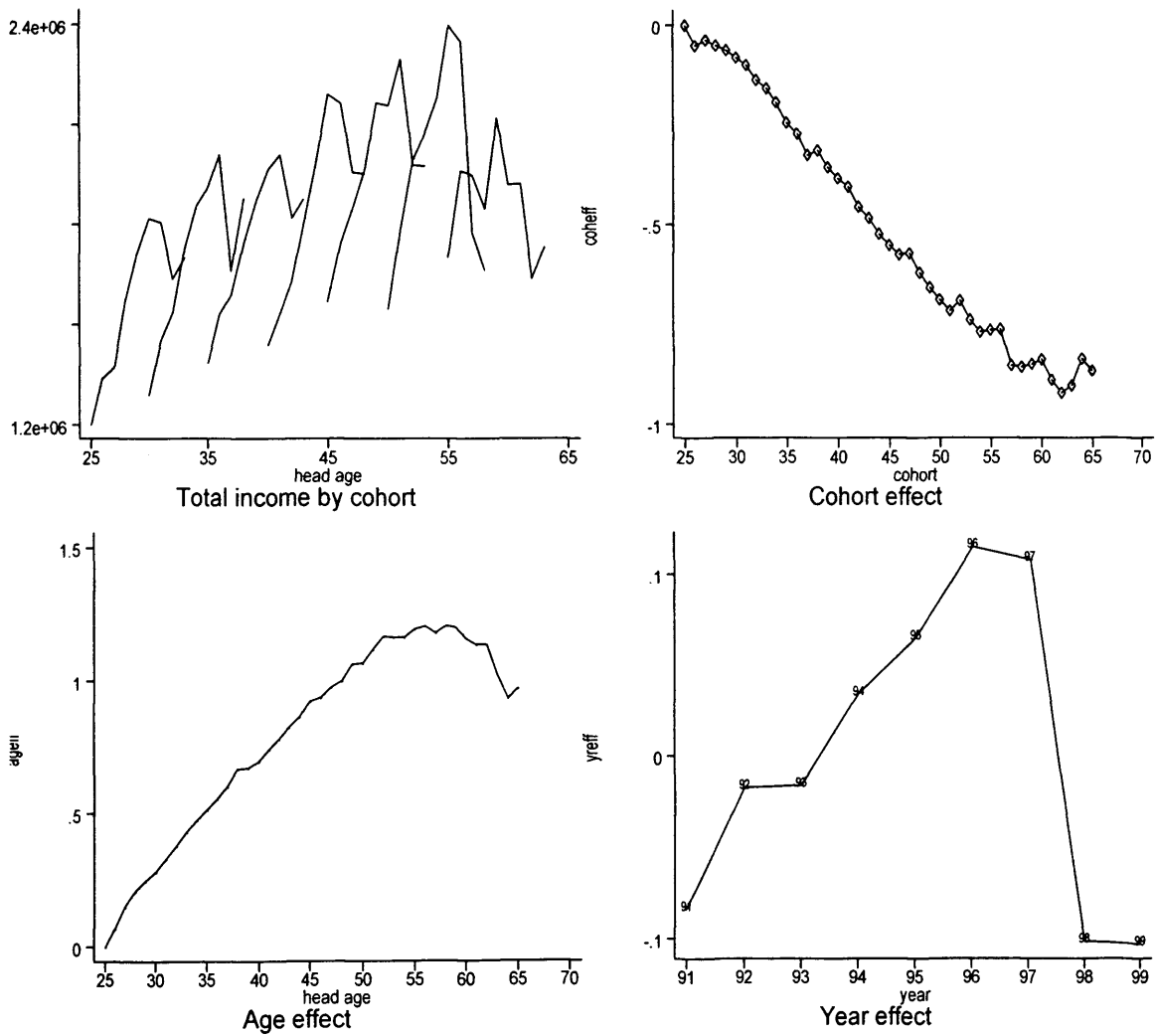


### **Decomposition of income by cohort**

The cohort data can be decomposed into the individual effects: age effect, cohort effect, and year effect. Age effect is related with the typical age profile. Cohort effect is related with the difference in effects among cohorts. Year effect shows yearly macroeconomic effect on income by moving all cohorts off their profiles. Figure 6 shows the graphs of income by cohort and their decomposition. There are four panels in the figure. The top left-hand panel is the same as in Figure 5. The other three panels of the figure present the cohort, age, and year effects that are decomposed from income by cohort.

The top right-hand panel shows the cohort effect of 41 kinds of cohorts from ‘cohort 25’ to ‘cohort 65’. The cohort effect steadily declines from the younger cohorts to the older cohorts except for the oldest age band. This implies that the younger generations are better off than the older generations. Since the Korean economy improved over the years the younger cohorts are better off than their predecessors. The bottom left-hand panel shows a life-cycle profile of real income although it is broken up by the cohort effect. It appears that real income tends to grow steadily until the age of fifty. Then it rises to its maximum at the age of mid-fifties. After the age of sixty, real income tends to decrease sharply.

**Figure 6 Income by cohort and its decomposition from 1991 to 1999: Cohort effect, age effect, and macroeconomic year effect**



The last panel shows the macroeconomic year effect. The year effect sharply increases from 1991 to 1996 and then starts to decrease from 1997. In 1998, after the economic crisis, the year effect dramatically decreases down to that of 1991. The level of year effect of 1999 appears to be slightly below that of 1998 despite of 3.26 percent increase in average household income. This panel of the year effect appears to slightly exaggerate the year effects of both 1998 and 1999. This might be caused by the normalization method that makes the year effects to capture cyclical fluctuations that average to zero over the long run. Nevertheless this analysis clearly shows that the 1997 economic crisis impacted heavily the household income in Korea.

### 3.2 Income impact by region and by occupation

This section focuses on examining the difference in income impact among regional and occupational household groups. Regional difference is compared between Seoul and the other part of the country. Occupational difference is compared between salary and wage earners groups.

#### **Regional difference in income impact**

Seoul is the capital city of Korea. Seoul occupies 6 percent of the whole area in the

country, whereas the economic weight accounts for more or less a quarter of the country in terms of 1995 statistics. 29.2 percent of the urban population resides in Seoul. 24.2 percent of GDP at 1990 constant price is produced in Seoul. 25.6 percent of business establishments are located in Seoul. 24.2 percent of workers work in Seoul. Economic life in Seoul might have some different aspects relative to that in the other part of the country. Therefore the income impact of the 1997 economic crisis might be different between households in Seoul and those in the other part.

**Table 18 Evolution of household income and its regional difference from 1991 to 1999: Seoul and the other part of the country**

(Unit: Million won)

<i>Year</i>	<i>91</i>	<i>92</i>	<i>93</i>	<i>94</i>	<i>95</i>	<i>96</i>	<i>97</i>	<i>98</i>	<i>99</i>
Seoul	1.49	1.64	1.77	1.94	2.05	2.19	2.22	1.83	1.86
Other part	1.35	1.48	1.54	1.65	1.79	1.94	1.97	1.74	1.79
Income difference	0.14	0.16	0.23	0.29	0.26	0.25	0.24	0.09	0.07

Table 18 presents average household incomes both in Seoul and in the other part in the 1990s. The sample size of Seoul accounts for 21.7 percent of the whole sample

households in total. For both regions, the levels of average income steadily increased from 1991 to 1997, and then sharply decreased in 1998 after the economic crisis. The extents of income falls are different: 17.57 percent for Seoul, 11.68 percent for the other part. The last row shows the income difference between Seoul and the other part. Throughout the years the average household incomes in Seoul are greater than those in the other part, thus the income gaps are positive. The income gap became wider until 1994, and then started to become narrower. In 1998 the average income gap sharply decreased from 240 thousand won to 90 thousand won. In 1999 it became narrower, 70 thousand won. From the table it might be suggested that the household income in Seoul was affected more heavily by the economic crisis than that in the other part of the country.

Given that the income difference decreased after the economic crisis, how the economic crisis affected differently between Seoul and the other part might be needed to examine. It would be useful to look at the changes in standard deviation of income as well as the income changes by income groups. Figure 7 presents the evolution of average income and standard deviation (the left-hand panel) and the income evolution by two income

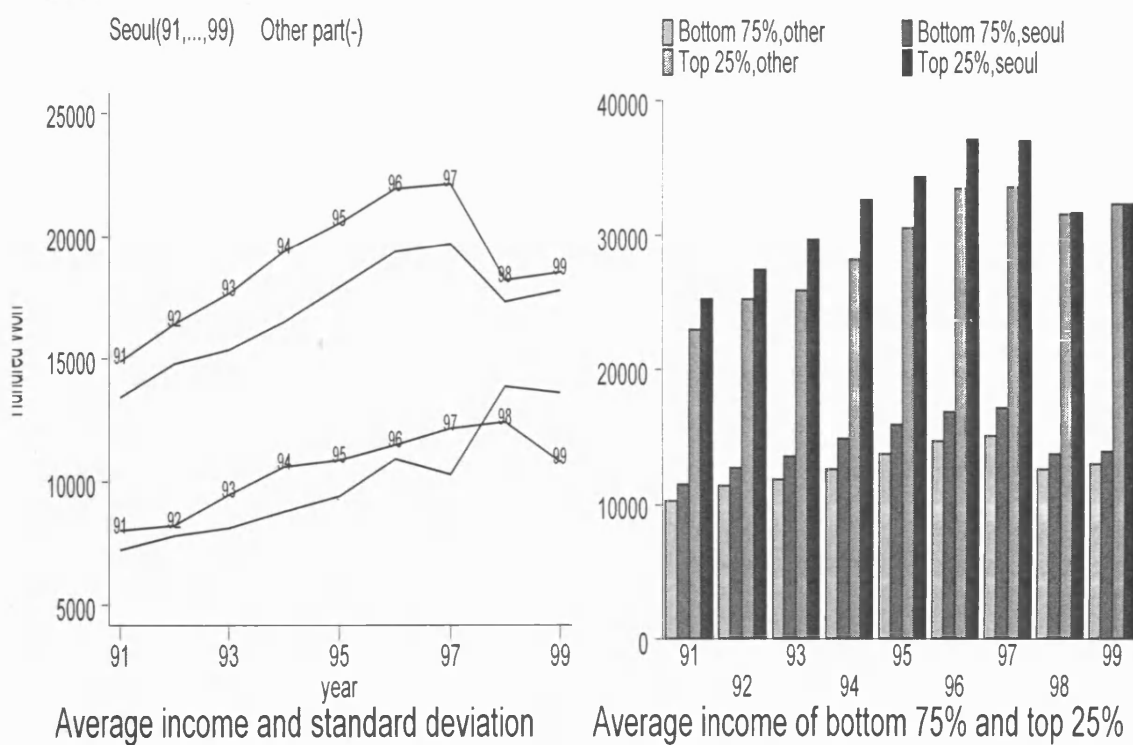
groups, bottom 75 percent and top 25 percent, for both Seoul and the other part (the right-hand panel).

In the left-hand panel of the figure, there are two pairs of lines: income evolution (higher pair) and standard deviation (lower pair). The line with year number (91, ... 99) stands for the line of Seoul and the line without it stands for the line of the other part. The patterns of income evolution between two regions appear to be similar although the income gap became narrower as in the previous table. Looking at the changes in standard deviation of income within regional group, the patterns are different. It slightly increased in 1998 and decreased in 1999 for Seoul, whereas it sharply increased after the economic crisis for the other part. This might imply that a certain group in the other part of the country might not be less affected by the economic crisis than the same group in Seoul as well as than the other groups in the same region. The reason is that the income gap between Seoul and the other part decreased after the crisis while the income deviation increased in the other part of the country<sup>21</sup>.

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<sup>21</sup> The change in standard deviation of income is related with the change in income inequality. This inequality issue will be examined in the next chapter.

**Figure 7 Household incomes by region from 1991 to 1999, Seoul and the other part of the country: Evolution of income and standard deviation (left-hand panel) and average regional income by two income groups, bottom 75% and top 25% (right-hand panel)**



The right-hand panel might provide a possible explanation. Each regional group is divided into two groups by income: the bottom 75 percent and the top 25 percent. In the panel there are four bars each year. The first two bars are related with the bottom 75

percent income groups and the next two bars are related with the top 25 percent income groups in order of the other part and Seoul. Looking at the first two bars through the years, the extents of the income decrease after the economic crisis appear to be similar between Seoul and the other part. Looking at the next two bars illustrating the top 25 percent income groups, the levels of average income in 1998 and 1999 became even between Seoul and the other part.

This result might imply, on the one hand, that the extent of income impact on the top 25 percent group in the other part was not so large as that on the same group in Seoul, which resulted in the sharp decrease in income difference between Seoul and the other part after the economic crisis. On the other hand, this result might imply that the extent of income impact on the top 25 percent group in the other part was not so large as that on the other groups in the same region, which resulted in the sharp increase in standard deviation of income for the other part region as in the left-hand panel of the figure.

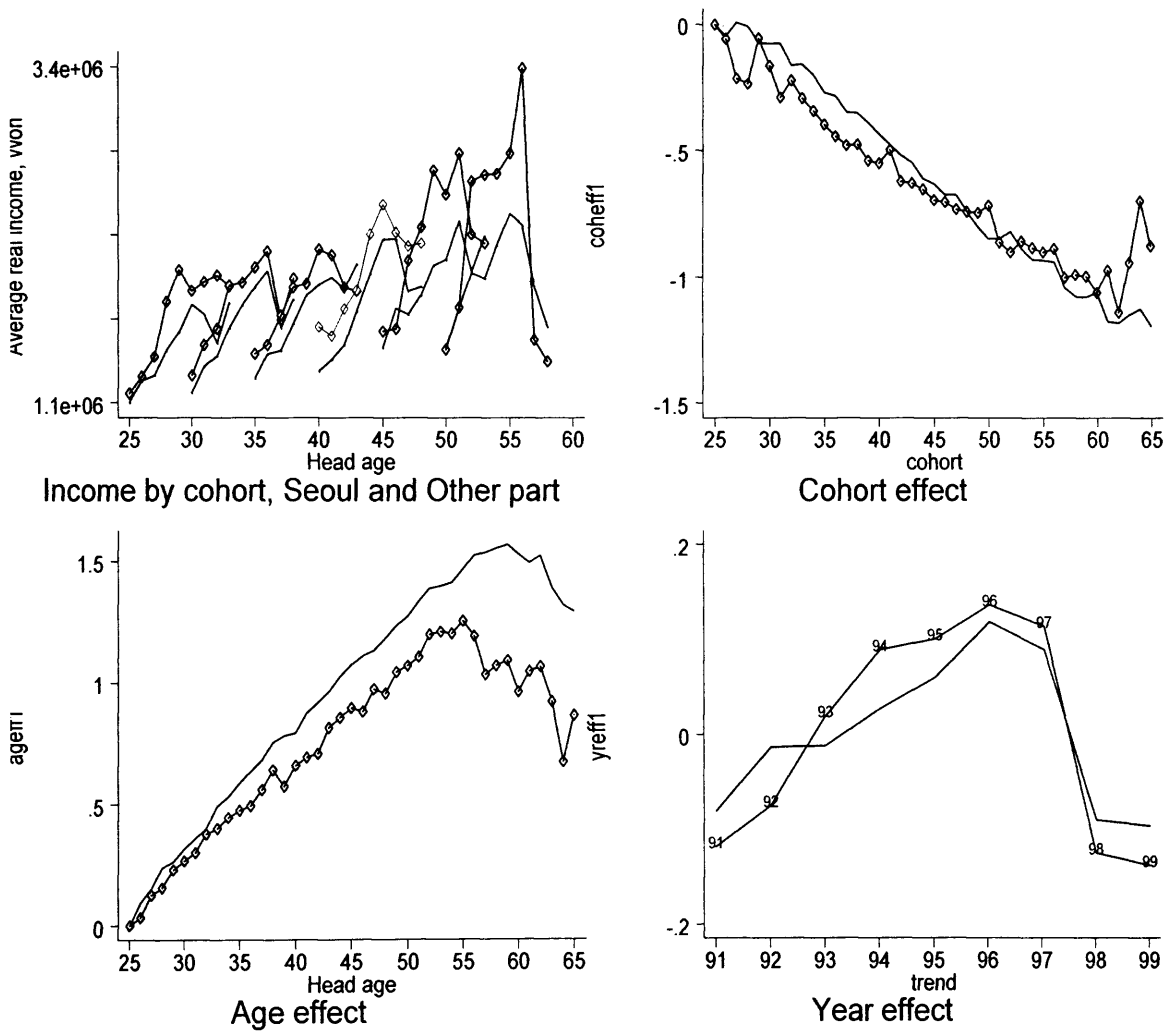
Concerning the reason of this result, there might be two possible explanations. The first one is that, comparing the top 25 percent groups between Seoul and the other part, high-salaried earners in Seoul might be more affected because the economic crisis initially



occurred in Seoul where most business head offices are located. The next one is that, comparing the top 25 percent group and the bottom 75 percent group in the other part, the latter group was more affected by the economic crisis because construction, manufacturing, and service industry might be the most affected industries in the other part after the economic crisis.

It might be informative to look at the differences in income by cohort and its decomposition between Seoul and the other part. Figure 8 contains four panels. The top-left hand panel shows income by selected cohorts for both Seoul and the other part. From 1991 to 1997 the incomes by cohort tend to increase for both regional groups. The income gaps are positive and the lines for Seoul place above those for the other part. In 1998 the incomes decreased for both groups and the income gaps appear to decrease. Looking at the graphs of 'Cohort 50' the level of income for Seoul decreased to the level less than that for the other part. This might imply that older groups in Seoul were more affected by the economic crisis than both the same groups in the other part and younger groups in Seoul. This result appears to be related with the finding that high-salaried earners (top 25 percent) in Seoul were more affected by the economic crisis than both the same group in the other part and low-salaried (or waged) earners in Seoul.

**Figure 8 Regional differences in the income impact, Seoul ( $\diamond$  or 91, ...99) and the other part of the country (-): Income by cohort and its decomposition into cohort, age, and macroeconomic year effects**



The top-right hand panel presents the cohort effects and their difference between Seoul and the other part. As the slopes are negative, younger cohorts appear to be better off than older cohorts for both regional groups. The slope for the other part is likely to be steeper than that for Seoul. This might imply that the degree of which younger generation is better off than older generation is larger in the other part than in Seoul.

The bottom-left hand panel presents the age effects, typical age profile of income for both regional groups. The slope of age effect for the other part is steeper than that for Seoul. This might imply that the degree of which income increases with age is larger in the other part than in Seoul. The age band of the maximum point of age effect is older for the other part than for Seoul. The age bands appear to be the late fifties for the other part and the early fifties for Seoul. This might imply that it is more difficult for older age groups to keep their jobs or positions in Seoul than in the other part.

The last panel shows the macroeconomic year effects for both regional groups. The year effects steadily increased from 1991 to 1996 for both groups and then started to decrease in 1997. In 1998 and 1999 the year effects sharply decreased for both regional groups. The year effect for Seoul fell more sharply than that for the other part. This result might clearly show that the household income of Seoul was more heavily affected

by the 1997 economic crisis than that of the other part, which is consistent with the previous results.

### Occupational difference in income impact

Occupations are categorized into two groups, salary and wage earners groups, because there is no data on the self-employed group as described in the introduction. The two occupational groups might be affected differently by the economic crisis because the properties and industries of the jobs are different. The sample size of salary earners group accounts for 40.3 percent and that of wage earners group accounts for 59.7 percent of the whole sample, 101,454 households, from 1991 to 1999 in total.

**Table 19 Evolution of household income and its occupational difference from 1991 to 1999: salary and wage earners**

(Unit: Million won)

<i>Year</i>	<i>91</i>	<i>92</i>	<i>93</i>	<i>94</i>	<i>95</i>	<i>96</i>	<i>97</i>	<i>98</i>	<i>99</i>
Salary	1.72	1.88	1.91	2.05	2.20	2.42	2.45	2.20	2.25
Wage	1.20	1.30	1.37	1.49	1.60	1.70	1.73	1.43	1.49
Income difference	0.52	0.58	0.54	0.56	0.60	0.72	0.72	0.77	0.76

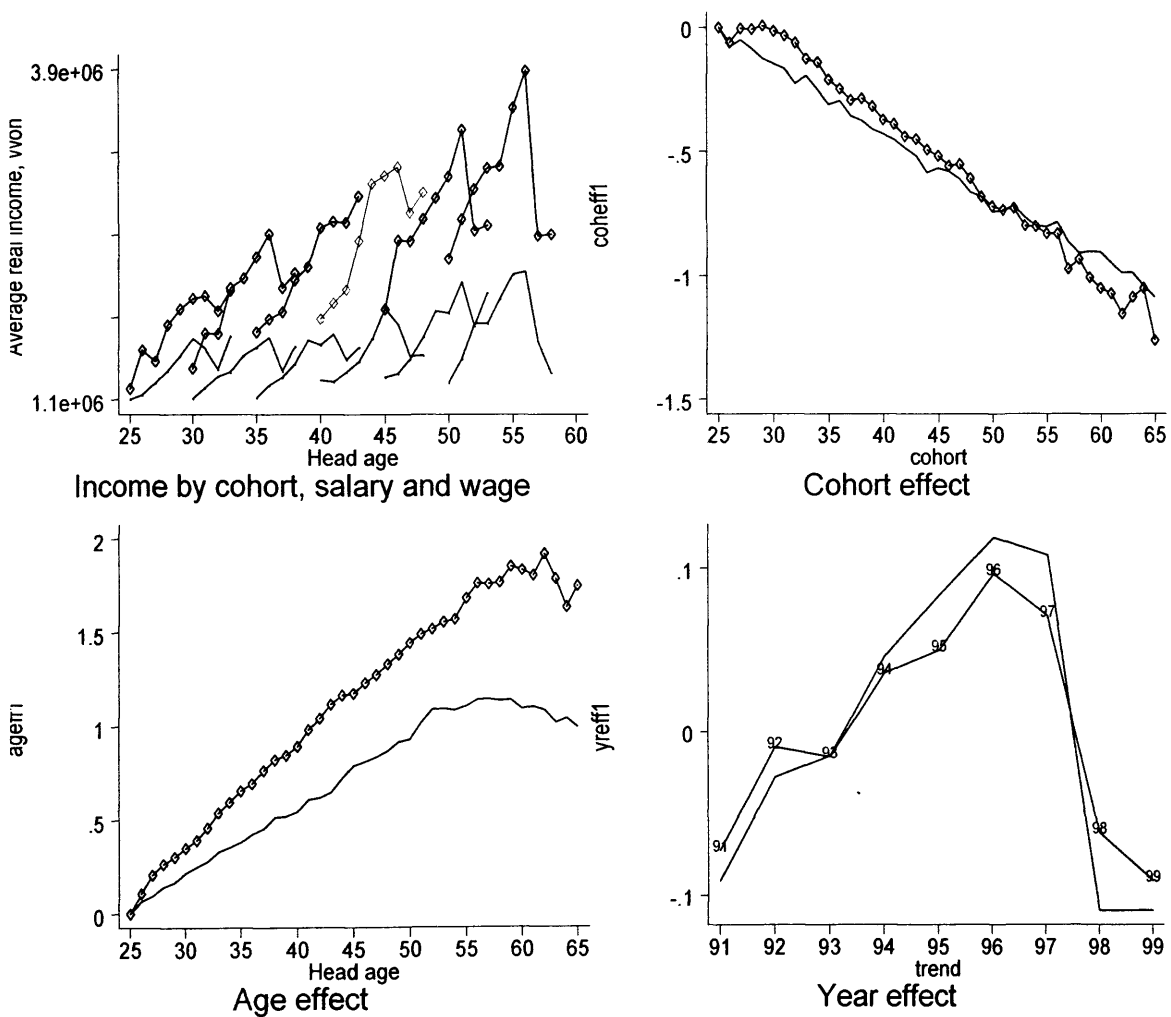
Table 19 presents the evolution of average household incomes of both groups in the 1990s. For both occupational groups, the levels of average income steadily increased from 1991 to 1997, and then sharply decreased in 1998 after the economic crisis. The rates of income falls are different: 10.40 percent for salary earners, 17.25 percent for wage earners. The last row shows the income difference between salary and wage groups. Throughout the years the average incomes of salary earners are greater than those of wage earners, thus the income gaps are positive. The income gap tends to increase over the 1990s. In 1998 the average income gap increased further from 720 thousand won to 770 thousand won. In 1999 it remained around. From the table it might be suggested the household income of wage earners was affected more heavily by the economic crisis than that of salary earners.

It might be informative to look at the differences in income by cohort and its decomposition between salary and wage earners. Figure 9 contains four panels. The top-left hand panel shows income by selected cohorts for both groups. From 1991 to 1997 the incomes by cohort tend to increase for both groups. The income gaps are positive and the lines for salary group place above those for wage group. In 1998 after the economic crisis the incomes decreased for both groups. The income gaps appear to

increase both with cohort age and with age within cohort. From the younger cohorts to the older cohorts, the income gaps tend to increase. This might be related with the economic trend in favour of salaried earners. From younger ages to older ages within each cohort, the income gaps appear to increase. This might be related with the property of occupation. For example, as workers become older, wage earners tend to have fewer opportunities to improve their economic status than salary earners do.

The top-right hand panel presents the cohort effects and their difference between two occupational groups. As the slopes are negative, younger cohorts are better off than older cohorts for both groups. The slope for salary group is likely to be steeper than that for wage group. This might imply that the degree of which younger generation is better off than older generation is larger in salary group than in wage group. The bottom-left hand panel presents the age effects. The slope of age effect for salary group is steeper than that for wage group. This might imply that the degree of which income increases with age is larger in salary than in wage group. The age band of the maximum point of age effect is older for salary than for wage group. The age bands appear to be around sixties for salary group and the mid-fifties for wage group. It might be more difficult for older group of wage earners to keep their jobs than for the same group of salary earners.

**Figure 9 Occupational differences in the income impact, salary earners (◇ or 91, ...99) and wage earners (-): Income by cohort and its decomposition into cohort, age, and macroeconomic year effects**



The last panel shows the macroeconomic year effects for both groups. The year effects tend to increase from 1991 to 1996 for both groups and then started to decrease in 1997. In 1998 and 1999 the year effects sharply decreased for both occupational groups. The year effect for wage earners fell more sharply than that for salary earners. This result also clearly show that the household income of wage earners was more heavily affected by the economic crisis than that of salary earners, which is consistent with the previous result. In addition, unlike the analysis on the regional difference, the income gap between salary earners group and wage earners group increase after the economic crisis. This might suggest some inequality and social welfare concerns caused by the economic crisis in Korea. These topics are examined in the next chapter.

#### *4. Impact on consumer behaviour*

The economic crisis might affect not only the levels of income and consumption expenditure as in the previous section, but also consumer behaviour. This section studies the macroeconomic impact of the 1997 economic crisis on consumer behaviour in Korea. Individual households might change their consumption expenditure schedules in



the face of economic hardship. They might reduce or delay consumption expenditure on such items as, for example, luxurious goods, durable goods, housing, and overseas travel. One useful way to capture overall picture of the changes in consumer behaviour would be to look at the movement in Engel curves between before and after the economic crisis. The nonparametric kernel regression method is used for estimating the Engel curves. To examine how the Korean consumers view each commodity group, income elasticities are calculated using the Quadratic Almost Ideal Demand System (QAIDS).

Although the comparison of the Engel curves provides an overall picture on the changes in consumer behaviour, it might mislead to inappropriate conclusion because there is the time lag between the periods used for before and after the crisis in the analysis. The time lag might cause additional effects on consumer behaviour such as, say, age effect that causes change in consumer behaviour with age profiles besides the macroeconomic year effect and the cohort effects. The cohort analysis including decomposition method is again used for the analysis.

#### 4.1 Change in Engel curves for expenditure share

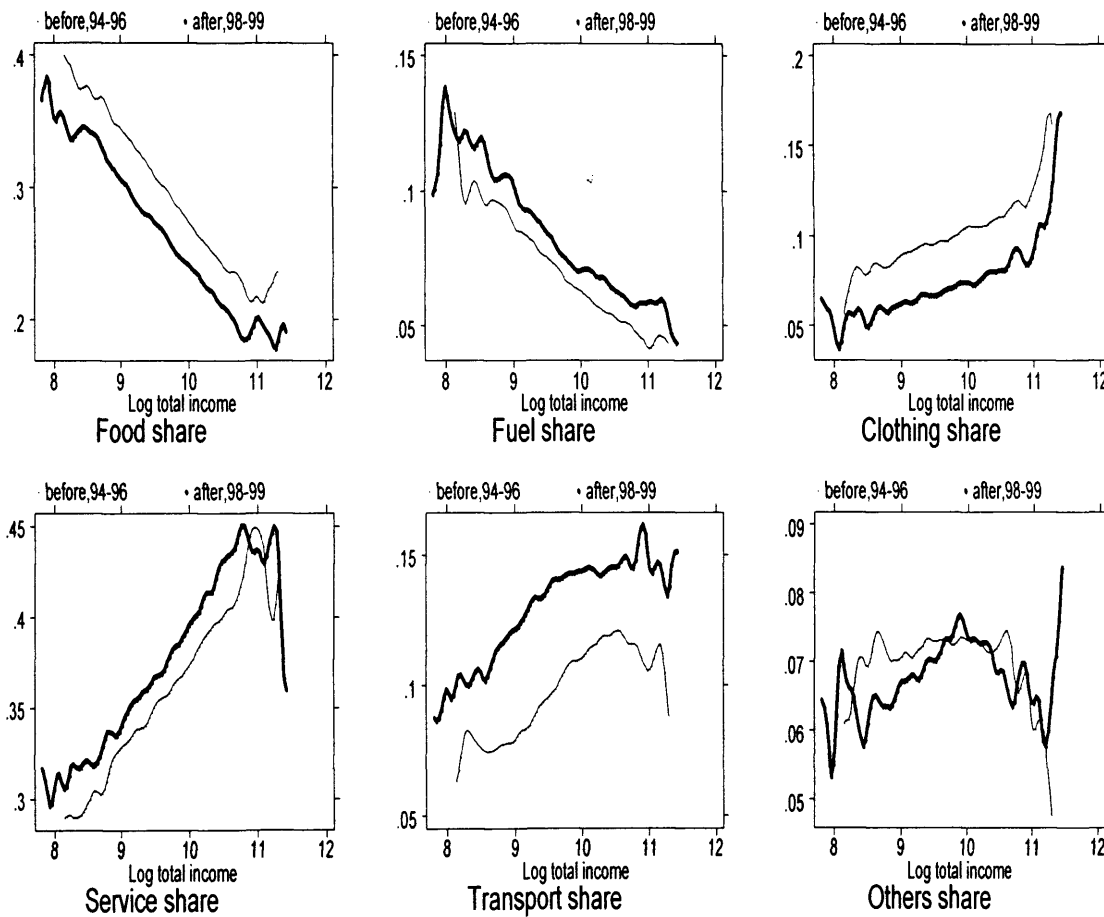
The Engel curve relationship between expenditure shares and log income might be affected by the economic crisis resulting in both sharp decrease in income and changes in relative prices. Figure 10 shows overall shapes and changes of the nonparametric Engel curves for expenditure shares on six commodity groups: food, fuel, clothing, service, transport, and other non-durables<sup>22</sup>. Two periods of before (1994-96) and after (1998-99) the economic crisis are compared.

The Nadaraya-Watson Kernel regression method is used with Gaussian kernel weight function. The choice of bandwidth follows the Haerdle's 'better Gaussian bandwidth'. The outliers outside three standard deviations of the mean of log total income are trimmed. The thin lines show the Engel curves before the crisis and the thick lines show those after the crisis. Therefore the movements of the Engel curves are the changes between the thin lines and the thick lines for six aggregated commodity groups.

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<sup>22</sup> Commodity group aggregation is described in Chapter I Introduction.

**Figure 10 Overall shapes and movements in Engel curves for expenditure share on six commodity groups: Comparing before (1994-96, thin line) and after (1998-99, thick line) the economic crisis**



### **Overall shapes of the Engel curves**

Looking at the overall shapes of the six pairs of Engel curves, the Engel curves for food and fuel shares appear to be linear and to decrease against log total income. These might be consistent with the typical findings on necessities in that the expenditure shares on necessities fall as income rises. The Engel curves for clothing share appear to increase with log total income. The slope of the Engel curve for clothing sharply increases at the range of the highest income level. The Engel curves for service share appear to increase with log total income. The slopes for service share decreased at the range of the highest income level. The Engel curves of transport share appear to increase with decreasing slopes except for the range of the highest income group. The Engel curves for other non-durables shares appear to be quadratic with log total income. In summary the Engel curves for food and fuel shares have negative slopes against log income, whereas those for clothing, service, and transport shares have positive slopes, and those for other non-durables have quadratic slopes in general.

### **Income elasticities of demand**

It might be informative to calculate income elasticity to know the preferences of the Korean consumers on six commodity groups. Most goods are normal goods: higher

income raises quantity demanded. Normal goods have positive income elasticities. Even among normal goods, income elasticities vary substantially in size. Necessities tend to have small income elasticities, whereas luxuries tend to have large income elasticities. To obtain income elasticities, the Quadratic Almost Ideal Demand System (QAIDS) proposed by Banks, Blundell, and Lewbel (1997) is employed. The method is described in the next chapter. The number of observations is 68,832 from 1994 to 1999. Trend variables, ten characteristic variables, total expenditure, total income, and price variables in logarithmic term are included in the estimation<sup>23</sup>. Total income is used as instrumental variable. Using this demand system, income elasticities are obtained for six commodity groups as in the table below.

**Table 20 Income elasticities for six commodity groups using the QAIDS from 1994 to 1999**

<i>Food</i>	<i>Fuel</i>	<i>Clothing</i>	<i>Service</i>	<i>Transport</i>	<i>Others</i>
0.667	0.311	1.501	1.190	0.826	1.025

<sup>23</sup> The QAIDS estimation results are reported in Appendix III.B.

Table 20 presents the income elasticities for six commodity groups from 1994 to 1999.

As in the table the income elasticities for food, fuel, and transport are less than unity, while those for clothing, service, and others are more than unity. It might be clear that the Korean consumers view food and fuel as necessities. The income elasticity for fuel is smaller than that for food. This result might arise from the fact that there are not many available close substitutes in fuel products and consumption on fuel is normally subject to energy supply system of house and social infrastructure. For food consumption consumers have relatively more choices within food commodity group according to change in income level.

The income elasticities for service, transport, and other non-durables are around unity. It appears that the Korean consumers tend to view service as luxuries rather than necessities and transport as necessities rather than luxuries. It might be interesting that the income elasticity for clothing is the largest (1.501). This implies that Korean consumers view clothing as a luxury rather than a necessity. Whereas Economics textbooks used to view clothing as a necessity rather than a luxury<sup>24</sup>.

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<sup>24</sup> For example, Mankiew (2001), p. 94.

There might be some explanations on this result that the income elasticity for clothing is the largest. The first one is related with culture. The Korean culture that gives importance to the outward form might influence the preference on clothing, even if it gradually changes in these days. The second one is related with market. Market opening since 1990s might give the Korean consumers opportunities to buy foreign luxurious clothing and affect the preference on clothing. The last possible answer is that many consumers in these days buy new clothing not because it worn out but because it went out of fashion. These reasons might cause to move the preference on clothing from a necessity to a luxurious one in Korea.

### **Movements in Engel curves**

Comparing the overall shapes of the Engel curves between before and after the economic crisis, all the Engel curves for six commodity groups appear not to change significantly their general shapes although they change their positions. The Engel curves for food, clothing, and others appear to shift downward, while the Engel curves for fuel, service, and transport appear to shift upward. These results might imply that the Korean consumers decreased the shares of food, clothing, and others, and increased the shares

for fuel, service, and transport in the face of economic hardship after the economic crisis.

**Table 21 Price increases for six commodity groups between before (1994-96) and after (1998-99) the economic crisis, 1995 = 100**

<i>Average</i>	<i>Food</i>	<i>Fuel</i>	<i>Clothing</i>	<i>Service</i>	<i>Transport</i>	<i>Others</i>
1994-96	99.98	101.80	99.82	99.34	101.66	99.03
1998-99	117.01	150.16	108.10	117.27	159.58	109.29
% Increase	17.04%	47.50%	8.30%	18.05%	56.98%	10.36%

However careful interpretation would be needed for these results because there are additional effects involved in changes in the Engel curves besides income effect. The first one is the change in relative prices after the economic crisis in 1998-99. This price change would mainly explain the shift-up of the Engel curves for fuel and transport. As in Table 21, the prices of fuel and transport increased by 47.50 percent and 56.98 percent respectively, while those of the other commodity groups increased by between 8.30 percent and 18.05 percent. The devaluation of Korean currency after the economic crisis might cause sharp increases in price of fuel and transport because Korea import



the entire amount of fossil fuels. Sharp increase in relative prices of fuel and transport might cause those Engel curves to shift upward after the economic crisis.

The other additional effect might be 'age effect' because there is the time lag between the periods used for before and after the crisis in the analysis. The time lag might cause change in consumer behaviour as consumers become older besides the income and price effects. In relating to Figure 10, one might put into question the fact that the food Engel curve shifted down and the service Engel curve shifted up after the economic crisis. The reason is related with income elasticities in that the Korean consumers view food as a necessity and service as a luxury. It might be more reasonable that the food Engel curve shifted up and the service Engel curve shifted down in the face of decrease in income after the economic crisis. To answer this question and provide more reasonable interpretation, additional analysis would be required. The cohort analysis including decomposition method used in the previous sections might provide more appropriate interpretation on the macroeconomic impact on the changes in the Engel curves and consumer behaviour.

## 4.2 Looking at changes in each expenditure share

To examine the economic impact on consumer behaviour, cohorts of individuals over time are used, where cohorts are defined by the year of birth of household head. The expenditure shares by cohort are decomposed into the individual effects of age, year, and cohort. This analysis method is described in Section 2.

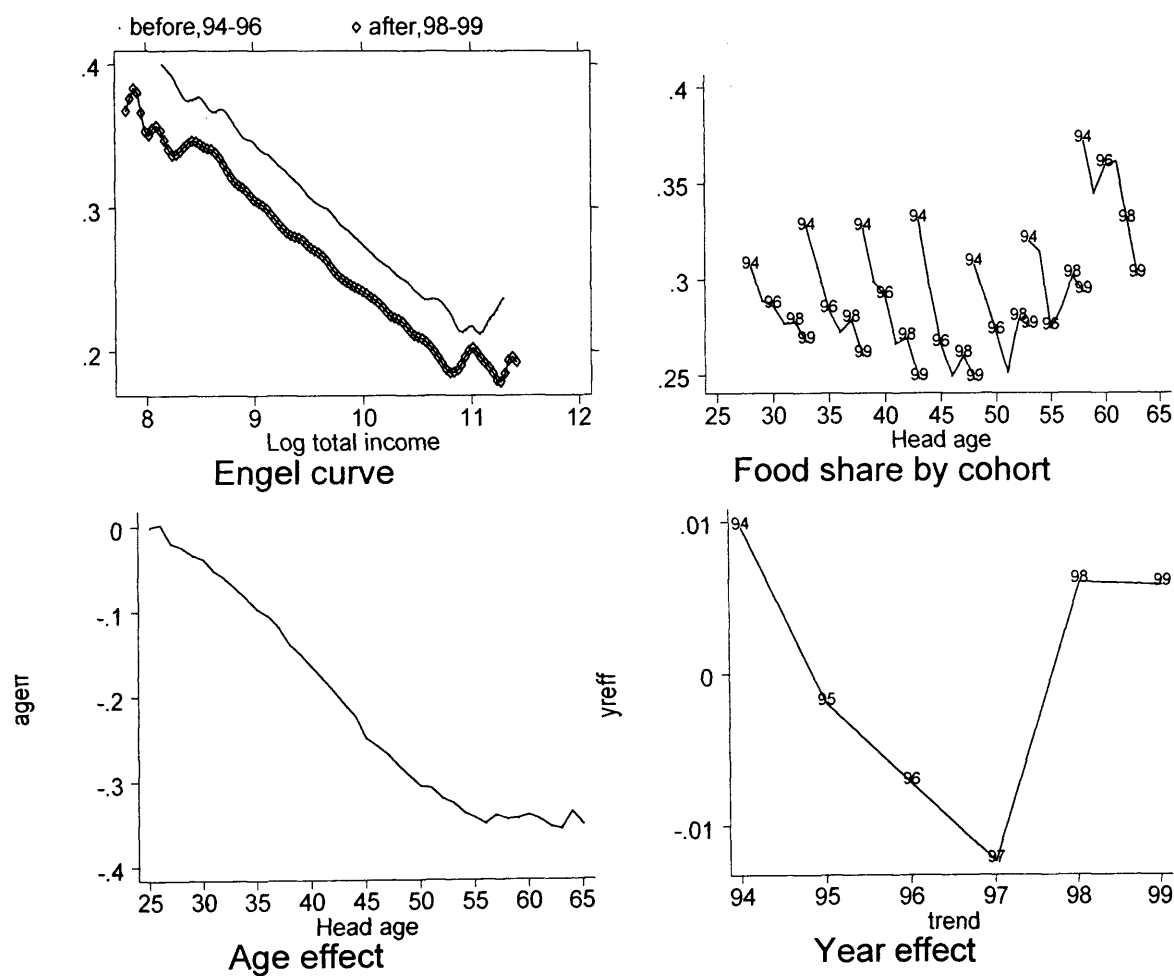
The following each sub-section has a figure that contains four panels. The top-left one is the change in Engel curve for share that is the same as in Figure 10. The top-right panel illustrates the evolution of average shares by selected cohorts from 1994 to 1999. There are seven cohorts illustrated: cohort 25, 30, 35, 40, 45, 50, and 55. The bottom-left panel shows age effect that illustrates the change in expenditure share with age profiles. The last panel presents year effect that illustrates macroeconomic effect on expenditure share. Cohort effect is not presented here because it is not directly related with the subject even if it is included in the analysis. The analysis on the expenditure share for other non-durables is not presented because this commodity group is so heterogeneous that any informative conclusion might not be inferred.

## **Food share**

Figure 11 presents the Engel curves of food share by cohort and its decomposition. The Engel curve shifted downward after the economic crisis (the top-left panel). Does it mean that the Korean consumers decreased food share in the face of economic crisis? Taking into account that food is viewed as a necessity, the shift-up of the Engel curve, thus the increase in food share, seems to be more reasonable. The other three panels might provide the answer.

Food share, in fact, increased for most cohorts in 1998, even if it decreased in 1999 with some economic recovery (the top-right panel). Food share becomes smaller, as individuals are older (the bottom-left panel). This implies that 'age effect' decreased food share in 1998-99 because the individuals in 1998-99 are averagely 3.5 years older than those in 1994-96. Then macroeconomic 'year effect' increased food share (the bottom-right panel) after the economic crisis. In summary, despite of the shift-down of the food Engel curve in 1998-99 the Korean consumers increased food share after the economic crisis, but both the negative 'age effect' and some decrease in food share in 1999 might overwhelm it.

**Figure 11 Food share by cohort and its decomposition before (1994-96) and after (1998-99) the economic crisis**

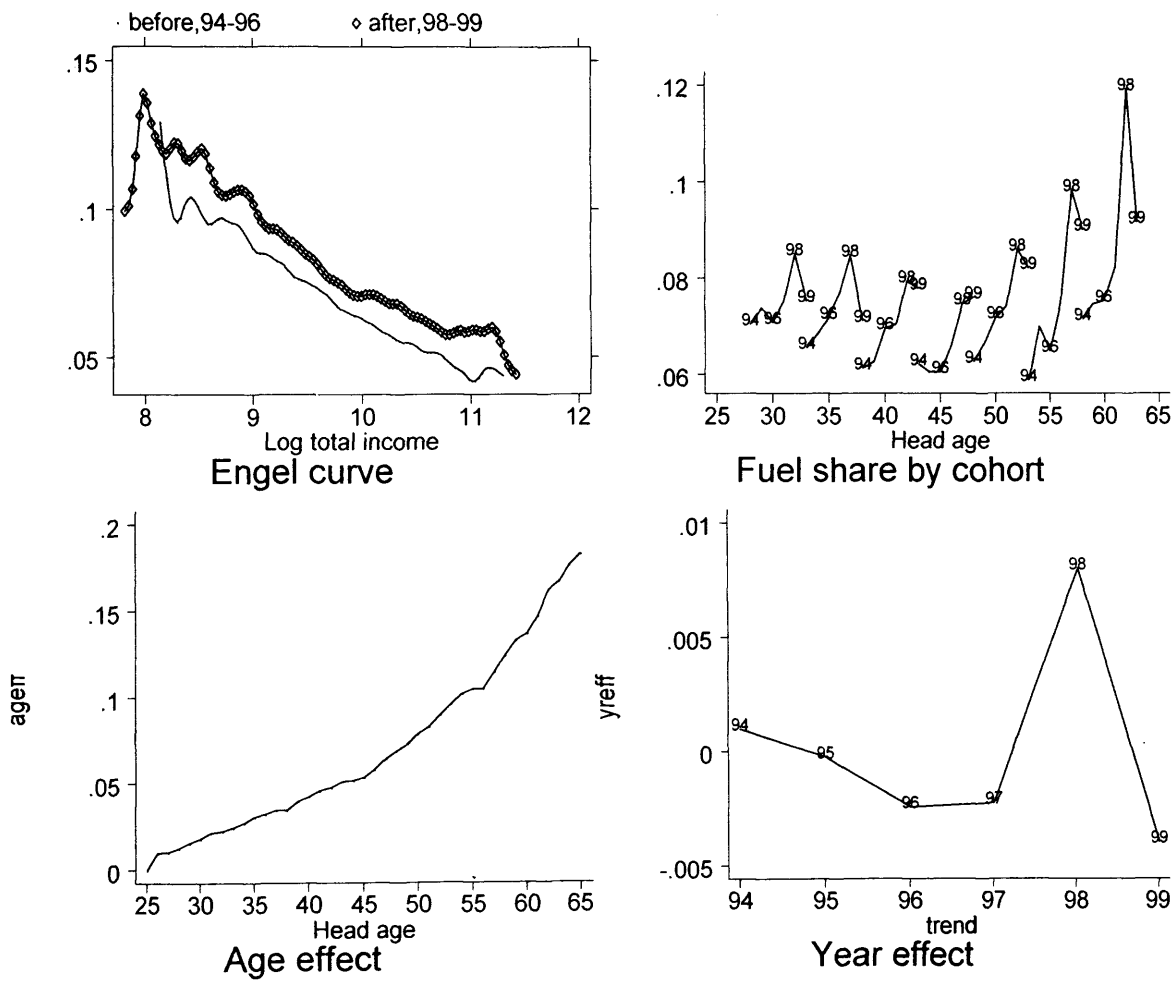


## Fuel share

Figure 12 presents the Engel curves of fuel share by cohort, and its decomposition. The Engel curve shifted upward after the economic crisis (the top-left panel). Does it mean that the Korean consumers increased fuel share in the face of economic crisis? Taking into account both that fuel is view as a necessity and that fuel price sharply increased in 1998-99, it seems to be reasonable. The other three panels might provide the answer. Fuel share increased for all the seven cohorts in 1998, even if it decreased in 1999 with some economic recovery (the top-right panel).

Fuel share becomes larger, as individuals are older (the bottom-left panel). This implies that 'age effect' increased fuel share in 1998-99 because the individuals in 1998-99 are older than those in 1994-96. Then macroeconomic 'year effect' increased fuel share in 1998 (the bottom-right panel). In 1999 the year effect largely decreased. This can be explained by the fact that the income elasticity of fuel is very small (0.311). The Korean consumers sharply decreased fuel share with some income increase in 1999. In summary, as the Engel curve shifted upward in 1998-99 the Korean consumers increased fuel share after the economic crisis, moreover the positive 'age effect' also increased it despite of sharp decrease in fuel share in 1999.

**Figure 12 Fuel share by cohort and its decomposition before (1994-96) and after (1998-99) the economic crisis**



## Clothing share

Figure 13 presents the Engel curves for clothing share by cohort and its decomposition.

The Engel curve shifted downward after the economic crisis (the top-left panel). Does it

mean that Korean consumers decreased clothing share in the face of economic crisis?

Taking into account that Korean consumers view clothing as a luxury, it seems to be

reasonable. The other three panels might provide the answer. Clothing share radically

decreased in 1998 and hardly increased in 1999 for most cohorts (the top-right panel).

Clothing share becomes smaller, as individuals are older (the bottom-left panel). This

implies that 'age effect' decreased clothing share in 1998-99 because the individuals in

1998-99 are older than those in 1994-96. Then macroeconomic 'year effect' decreased

clothing share (the bottom-right panel). In 1999 the year effect largely increased. This

can be explained by the fact that the income elasticity of clothing is very large (1.501).

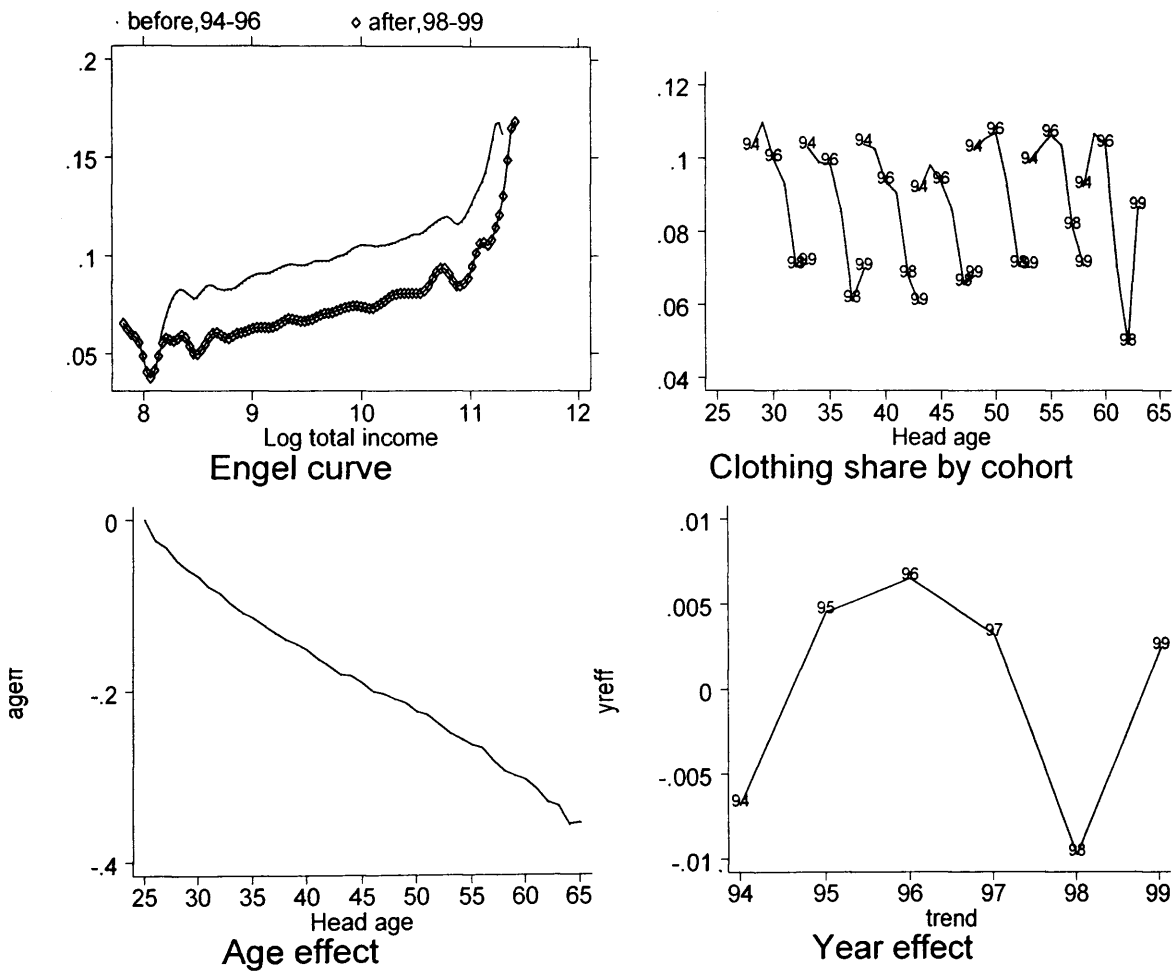
The Korean consumers sharply increased clothing share with some income increase in

1999. In summary, as the Engel curve shifted down in 1998-99 the Korean consumers

decreased clothing share after the economic crisis, moreover the negative 'age effect'

also decreased it despite of sharp increase in clothing share in 1999.

**Figure 13 Clothing share by cohort and its decomposition before (1994-96) and after (1998-99) the economic crisis**





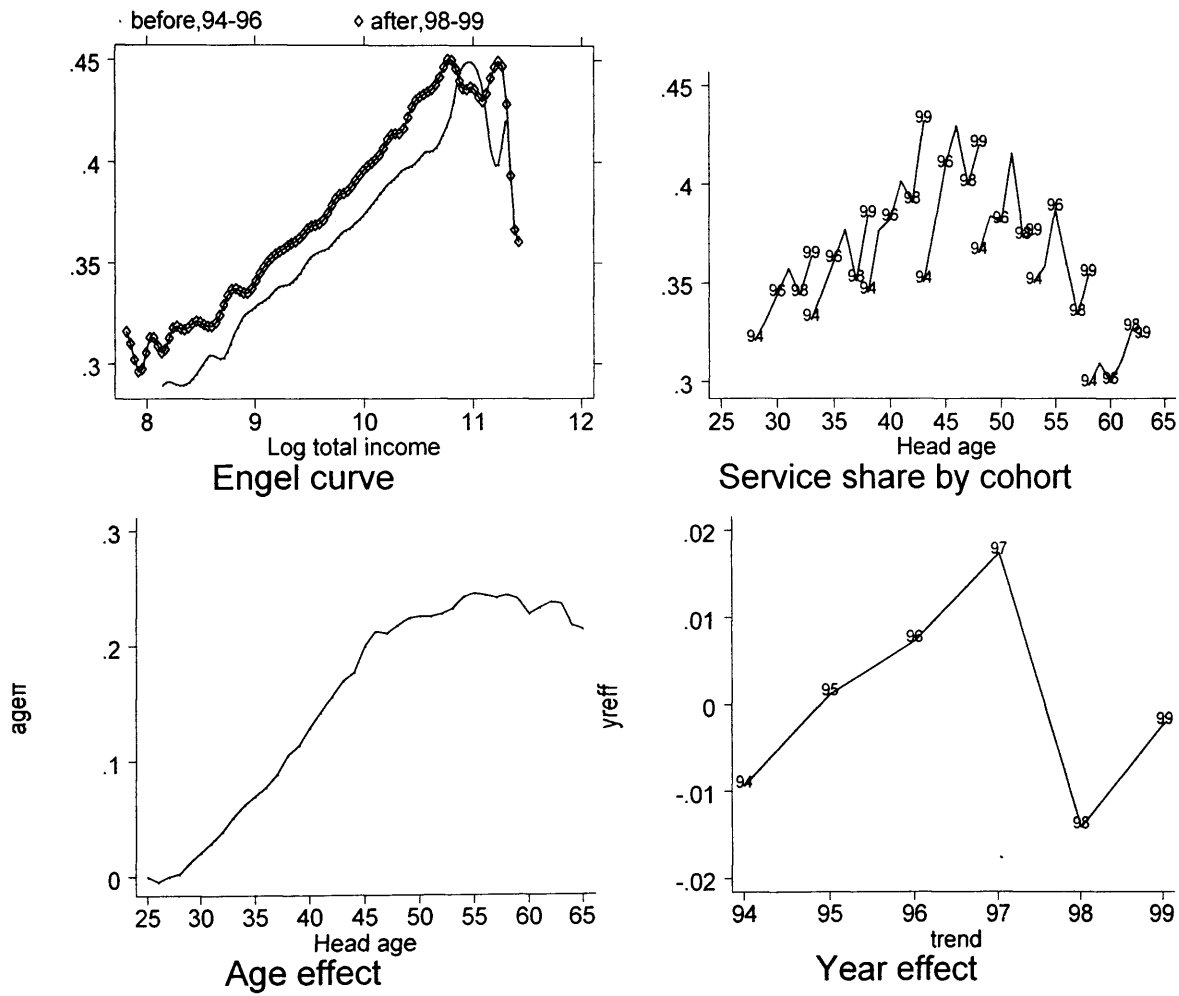
## **Service share**

Figure 14 presents the Engel curves for service share by cohort and its decomposition.

The Engel curve shifted up after the economic crisis (the top-left panel). Does it mean that Korean consumers increased service share in the face of economic crisis? Taking into account that Korean consumers tend to view service as a luxury, it seems to be unreasonable. The other three panels might provide the answer. Service share decreased in 1998 after the economic crisis in fact, but it increased in 1999 with some economic recovery for most cohorts (the top-right panel). Service share becomes larger, as individuals are older (the bottom-left panel).

This implies that 'age effect' increased service share in 1998-99 because the individuals in 1998-99 are older than those in 1994-96. Then macroeconomic 'year effect' decreased service share (the bottom-right panel). In summary, despite that the Engel curve shifted up in 1998-99 the Korean consumers decreased service share after the economic crisis in fact, but both the positive 'age effect' and some increase in service share in 1999 might overwhelm it.

**Figure 14 Service share by cohort and its decomposition before (1994-96) and after (1998-99) the economic crisis**

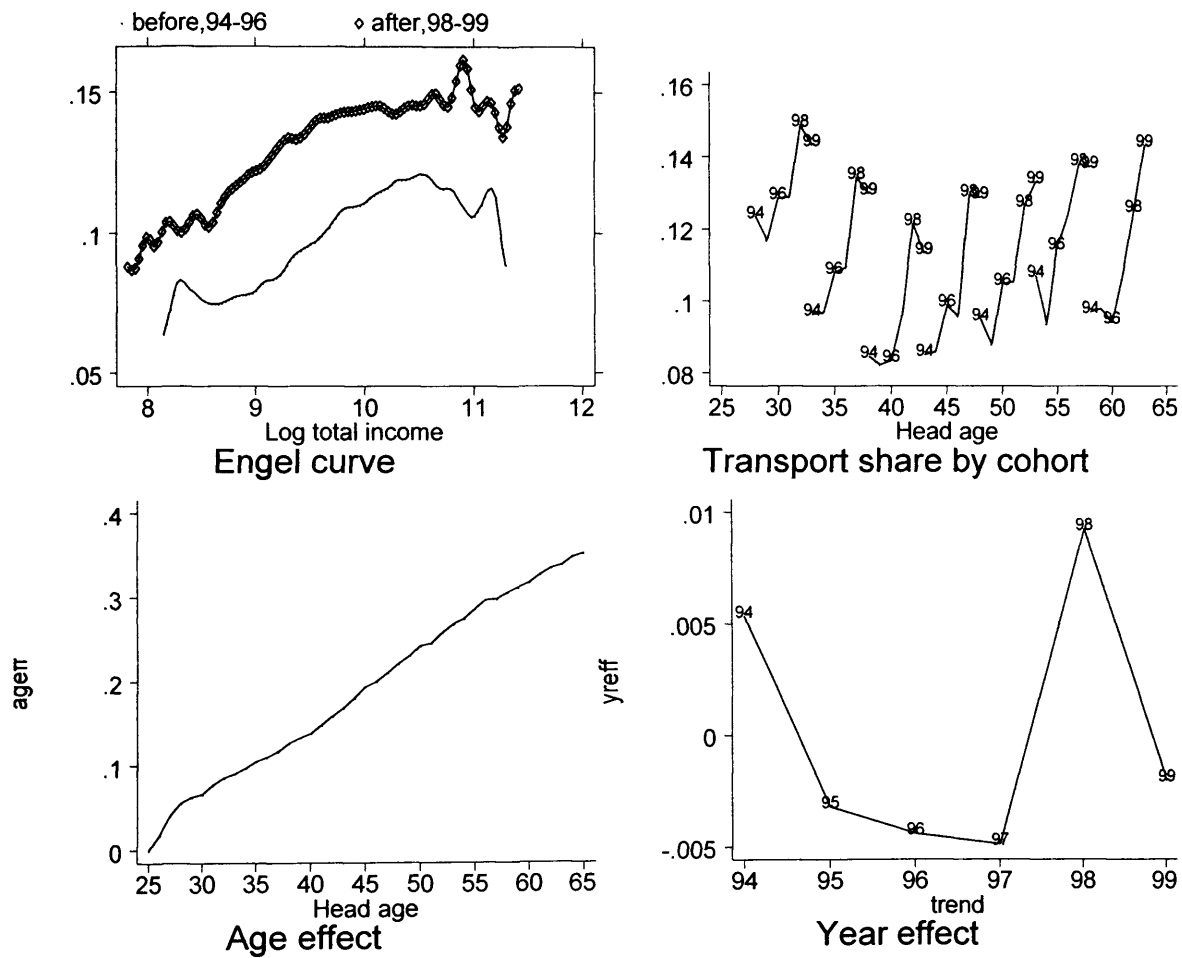


## **Transport share**

Figure 15 presents the Engel curves for transport share by cohort and its decomposition. The Engel curve shifted up after the economic crisis (the top-left panel). Does it mean that Korean consumers increased transport share in the face of economic crisis? Taking into account both that Korean consumers tend to view transport as a necessity and that transport price sharply increased in 1998-99, it seems to be reasonable. The other three panels might provide the answer.

Transport share sharply increased in 1998 after the economic crisis, and it hardly decreased in 1999 for most cohorts (the top-right panel). Transport share becomes larger, as individuals are older (the bottom-left panel). This implies that 'age effect' increased transport share in 1998-99 because the individuals in 1998-99 are older than those in 1994-96. Then macroeconomic 'year effect' increased transport share (the bottom-right panel). In summary, as the Engel curve shifted up in 1998-99 the Korean consumers increased transport share after the economic crisis, moreover the positive 'age effect' also increased it.

**Figure 15 Transport share by cohort and its decomposition before (1994-96) and after (1998-99) the economic crisis**



## *5. Conclusion*

The household economy was severely affected by the economic crisis. In 1998 after the economic crisis, the levels of both household median income and consumption expenditure sharply decreased by 15.9 percent down to the level in 1994. This chapter studied the macroeconomic impact on household economy by examining the impact on both household income and consumer behaviour. Using the micro-level dataset, the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999, the analysis focused on evaluating both the differences in income impact between age cohort, regional, and occupational groups and the changes in consumption expenditure shares.

As results of the analysis on income impact between age cohort groups, the economic crisis more heavily affected the household income for both those in early thirties and in the fifties in 1998. With some economic recovery in 1999, the former younger group gradually recovered whereas the latter older group still suffered from economic hardship. In general the difference in the impact of economic crisis among age groups

would be more distinct in the period of economic recovery than in the period of initial economic crisis. As cohorts are younger they tend to recover more quickly than the older cohorts.

Comparing the income impacts between Seoul and the other part of the country, the household income of Seoul was more heavily affected by the economic crisis than that of the other part. The income gap between two regions decreased after the economic crisis. The standard deviation of income sharply increased in the other part, while it decreased in Seoul after the economic crisis. The reason of these results might arise from the fact that the top 25 percent income group in the other part was less affected by the economic crisis relative both to the same group in Seoul and to the bottom 75 percent group in the same region. Comparing the income impacts between salary and wage earners groups, the household income of wage group was more heavily affected by the economic crisis than that of salary group. Unlike the result on the regional difference, the income gap between salary and wage earners groups increased after the economic crisis. This might suggest some inequality and social welfare issues caused by the economic crisis in Korea. These topics are examined in the next chapter.

In examining the macroeconomic impact on consumer behaviour, the 1994-1996 dataset is used for 'before crisis' and the 1998-1999 dataset was used for 'after crisis'. To capture the change in consumer behaviour, the Engel curves for six expenditure shares were estimated and compared between before and after the economic crisis in the first place. For the overall shapes of the Engel curves, the Engel curves for food and fuel shares have negative slopes against log income, whereas those for clothing, service, and transport shares have positive slopes, and those for other non-durables appear to be quadratic. As a result of calculating income elasticities, the Korean consumers tend to view food, fuel, and transport as necessities, whereas clothing and service as luxuries. This result might suggest that the former shares would increase, while the latter shares would decrease after the economic crisis causing sharp income decrease. Looking at the movement in the Engel curves, the Engel curve for fuel and transport shares shifted up and the Engel curve for clothing share sifted down as expected. However, the Engel curve for food share shifted down and the Engel curve for service shifted up, as opposed to the expectation.

Although the comparison of the Engel curves provides an overall picture on the change in consumer behaviour, it might mislead to inappropriate conclusion because there is the

time lag between the periods used for 'before' and 'after crisis'. The cohort analysis including decomposition method is again employed. As a result of the cohort analysis, the Korean consumers increased food, fuel, and transport shares and decreased clothing and service shares after the economic crisis, as expected from calculating income elasticities. The 'age effect' caused by the time lag of the comparing datasets might offset the macroeconomic impact on expenditure shares for food and service. In conclusion, the Korean consumers increased food, fuel, and transport shares and decreased clothing and service shares in the face of the 1997 economic crisis.



*Appendix III.A Data description of the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999 on selected variables: 101,454 households in total*

Variables	Mean	Standard deviation	Minimum	Maximum
Year trend	95.02	2.54	91	99
Seoul (*)	0.22	0.41	0	1
Salary earners (*)	0.40	0.49	0	1
Smoker (*)	0.53	0.50	0	1
Car owner (*)	0.51	0.50	0	1
Year, 1998-1999 (*)	0.22	0.41	0	1
Household size	3.73	1.13	2	11
No. of kids	1.38	0.99	0	8
No. of employed	1.49	0.66	1	7
Age	39.22	10.16	15	82
Food share	0.31	0.12	0	0.962941
Fuel share	0.07	0.05	0	0.652174
Clothing share	0.10	0.08	0	0.874776
Service share	0.35	0.13	0	0.946171
Transport share	0.10	0.07	0	0.7606
Others share	0.07	0.06	0	0.724371
Food expenditure	223358.60	108990.60	0	2184483
Fuel expenditure	52342.67	37369.27	0	652630
Clothing expenditure	79345.56	99648.57	0	5015000
Service expenditure	307794.00	277459.00	0	6870140
Transport expenditure	85421.22	82816.27	0	3374991
Others expenditure	59624.02	63913.27	0	1806900
Total expenditure	807879.60	466650.70	41800	8204028
Total income	1769143.00	1166176.00	0	4.72E+07

Note: (\*) indicates dummy variables.

Unit of expenditure is won.

Total expenditure is the total sum of expenditures on six commodity groups.

*Appendix III.B Results of estimating demand system using the QAIDS from 1994 to 1999 for calculating income elasticities*

Variable	<i>Dependent variable</i>					
	FOOD	FUEL	CLOTHING	SERVICE	TRANSPORT	OTHERS
CONST	0.889 (10.6)	-0.272 (-7.1)	0.312 (3.7)	-0.813 (-7.4)	0.666 (11.1)	0.218 (3.2)
TREND	-0.009 (-9.7)	0.002 (6.0)	0.000 (0.2)	0.013 (11.6)	-0.006 (-9.6)	-0.001 (-1.7)
QUART1	-0.029 (-26.5)	0.018 (36.2)	-0.015 (-17.0)	0.012 (8.6)	0.006 (7.9)	0.008 (10.8)
QUART2	-0.022 (-20.4)	-0.019 (-37.3)	-0.004 (-4.5)	0.028 (20.1)	0.013 (17.0)	0.003 (4.0)
QUART3	0.004 (3.6)	-0.032 (-65.5)	-0.018 (-20.8)	0.041 (29.5)	0.006 (8.5)	-0.001 (-1.6)
SEOUL	-0.001 (-1.0)	-0.004 (-8.8)	-0.018 (-25.6)	0.032 (27.1)	-0.004 (-6.2)	-0.005 (-9.2)
SALARY	-0.013 (-14.7)	0.002 (5.9)	-0.002 (-2.3)	0.001 (1.1)	0.010 (16.1)	0.001 (1.5)
SMOKER	-0.005 (-6.8)	-0.001 (-2.7)	-0.008 (-15.1)	0.017 (19.0)	0.003 (6.3)	-0.007 (-14.8)
CAR	-0.017 (-19.4)	0.001 (1.7)	-0.012 (-18.4)	-0.028 (-25.5)	0.064 (105.0)	-0.007 (-13.3)
YEAR98	0.016 (6.5)	-0.003 (-2.7)	0.010 (4.6)	-0.043 (-11.4)	0.007 (3.8)	0.014 (6.4)
SIZE	0.025 (43.5)	0.009 (35.0)	-0.009 (-20.6)	-0.017 (-23.9)	-0.005 (-12.8)	-0.002 (-5.5)
KIDS, age < 20	-0.007 (-10.8)	-0.005 (-18.7)	0.000 (0.0)	0.016 (19.9)	-0.011 (-24.9)	0.007 (17.9)
EMPLOYED	-0.026 (-41.2)	-0.004 (-15.1)	0.009 (17.9)	0.019 (23.6)	0.007 (16.2)	-0.005 (-12.4)
AGE	0.002 (5.6)	0.001 (5.4)	-0.004 (-16.9)	0.004 (9.7)	-0.002 (-9.0)	-0.000 (-1.7)
AGE2	0.000 (0.6)	-0.000 (-1.7)	0.000 (13.0)	-0.000 (-11.8)	0.000 (6.6)	0.000 (1.0)
Ln (Exp)	-0.060 (-6.2)	-0.043 (-10.0)	0.056 (7.5)	0.089 (7.2)	-0.038 (-5.6)	-0.004 (-0.6)
[Ln (Exp)] <sup>2</sup>	0.013 (4.1)	0.002 (1.1)	0.004 (1.6)	0.000 (0.0)	-0.013 (-6.2)	-0.005 (-2.4)
Food price	-0.147 (-6.5)	-0.142 (-18.5)	0.041 (2.0)	0.153 (6.9)	0.131 (12.6)	-0.037 (-2.4)
Fuel price	-0.142 (-18.5)	0.075 (14.1)	-0.013 (-1.6)	0.097 (7.8)	0.002 (0.4)	-0.019 (-2.0)
Cloth price	0.041 (2.0)	-0.013 (-1.6)	0.046 (1.8)	0.006 (0.3)	-0.141 (-14.2)	0.061 (3.4)
Service price	0.153 (6.9)	0.097 (7.8)	0.006 (0.3)	-0.341 (-8.1)	-0.036 (-2.6)	0.121 (4.1)
Trans price	0.131 (12.6)	0.002 (0.4)	-0.141 (-14.2)	-0.036 (-2.6)	0.082 (8.0)	-0.037 (-4.4)
Others price	-0.037 (-2.4)	-0.019 (-2.0)	0.061 (3.4)	0.121 (4.1)	-0.037 (-4.4)	-0.090 (-3.3)

Note: Test of homogeneity and symmetry:  $\chi^2(15) = 323.09210$

All prices are logarithmic prices. T-ratios are shown in parenthesis.

## Chapter IV Impact on social welfare: Income inequality, poverty, and social welfare

### *1. Introduction*

This chapter examines the impact of the 1997 economic crisis on inequality and social welfare of Korea. As examined in the previous chapters, the economic crisis severely affected labour market as well as household economy. The female participation probability considerably decreased by 12.8 percent and the male hazard rates of being employed massively decreased by 36.6 percent after the economic crisis. Household income and expenditure decreased by 15.9 percent in 1998. The degree of income impact varied according to household characteristics: age cohorts, region, and occupation. After the economic crisis the Korean consumers increased food, fuel, and transport expenditure shares and decreased clothing and service expenditure shares in the face of economic hardship.

It might be a natural next step to examine how much inequality and social welfare would be affected by the economic crisis. Inequality analysis focuses on income inequality and poverty. Using some inequality measures the trend and change of inequality in the 1990s will be evaluated and compared between before and after the

economic crisis. Cross-country comparison of income inequality will be presented. Within and between group inequalities as well as inequality of each sub-group will be calculated to look at how the inequality impact varies according to characteristic sub-groups.

The analysis on social welfare focuses on the estimation of welfare loss caused by the price changes after the economic crisis. The second order approximation of welfare measure proposed by Banks, Blundell, and Lewbel (1996) will be used to capture the substitution effects of individual households. Welfare loss will be estimated on the whole sample as well as sub-sample groups. The price change used in the analysis is not the actual change between before and after the economic crisis but the estimated price change caused by massive currency devaluation after the economic crisis in 1997. To evaluate price changes resulting from currency devaluation the input-output methodology will be employed. To obtain the substitution effects of individual households caused by considerable relative price changes, demand system will be estimated using the Quadratic Almost Ideal Demand System (QAIDS) proposed by Banks, Blundell, and Lewbel (1997).

The dataset used for the inequality analysis is the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999. The sample sizes are over 10,000

households in each year survey and 101,454 households in total. In social welfare analysis the dataset from 1991 to the third quarter of 1997 will be used to estimate demand system. Since the exchange rate of the Korean currency started to increase sharply from October 1997, the dataset excludes the data after September 1997. The sample size is 76,834 households in total. For the estimation of welfare loss the dataset from 1996 to the third quarter of 1997 is used. The sample size is 20,516 households in total.

This chapter is presented as follows: Section 2 reviewed briefly the methods employed in the analysis. Section 3 examines the macroeconomic impact on income inequality and poverty. Section 4 examines the impact on social welfare caused by the price changes after the economic crisis. The last section summarizes.

## *2. Methods*

### **2.1 Measuring inequality**

To evaluate the effect of the economic crisis on income inequality, three measures are employed: the Gini coefficient, the Atkinson measure, and the Mean Log Deviation (MLD) index.

### **Gini coefficient**

The Gini coefficient is a widely used measure of inequality although it does not have a simple interpretation. The Gini coefficient can be defined as:

$$G = \frac{H+1}{H-1} - \frac{2}{H(H-1)\bar{Y}} \sum_{h=1}^H \delta_h Y_h$$

where  $H$  is the number of households,  $\bar{Y}$  is the mean value of household real income ( $Y_h$ ), and  $\delta_h$  is the rank of household  $h$  in the income distribution counting from the top so that the richest has the rank 1. The Gini coefficient lies between zero and unity. The closer it is to unity, the more highly incomes are concentrated among smaller number of households.

The Gini social welfare measure can be defined as:

$$Wg = \bar{Y} \cdot (1 - G)$$

The Gini social welfare measure depends on both the mean real income and the level of inequality. With the same level of income, the more equally incomes are distributed, the greater this measure is.

### **Atkinson measure**

The Atkinson measure also includes an inequality index and social welfare measure.

The Atkinson inequality index can be defined as:

$$A = 1 - \frac{Yede}{\bar{Y}}$$

where  $Yede = \left[ \frac{1}{H} \sum_{h=1}^H Y_h^{(1+\rho)} \right]^{\left( \frac{1}{1+\rho} \right)}$ ,

$Yede$  is the equally distributed equivalent level of income,  $\rho$  is the inequality aversion parameter and negative for concavity. As the absolute value of  $\rho$  increases the measure places more weight to the lower level of income across income distribution.

The Atkinson index also lies between zero and unity. Where income is completely equally distributed across the households, the Atkinson index is zero. Where total income of a society belongs to one household, the Atkinson index becomes unity.

The Atkinson social welfare measure can be defined as:

$$Wa = \bar{Y} \cdot (1 - A)$$

The Atkinson social welfare measure also depends on both the mean income and the level of inequality. With the same level of income, the more equally incomes are distributed, the greater this measure is.

### **Mean log deviation index and its decomposition**

The mean log deviation is defined as:

$$MLD = \frac{1}{H} \sum_h \ln \left( \frac{\bar{Y}}{Y_h} \right),$$

where  $H$  is the number of individuals,  $\bar{Y}$  is the mean household income, and  $Y_h$  is the income of the individual  $h$ <sup>25</sup>. The MLD is more sensitive to changes at the bottom of the distribution because of its logarithmic formulation.

When there are sub-groups in the population, this index can be additively decomposable as:

$$MLD' = \sum_g w'_g \cdot MLD'_g + \sum_g w'_g \cdot \ln \left( \frac{\bar{Y}}{Y_g} \right),$$

where  $w_g$  is the share of the group  $g$  in the population. The first term of the right-hand side is the weighted sum of the MLD of each group, the ‘within-group component’. The second term of the right-hand side concerns the effect of the difference in relative mean income between groups on the total MLD, the ‘between-group component’.

When considering the changes in the MLD over time by groups, the above formula can be decomposable once more by the first difference of the equation:

$$\Delta MLD = MLD' - MLD^0$$

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<sup>25</sup> The review of the mean log deviation index is based on Oxely et al. (1997).



$$= \sum_g \bar{w}_g \Delta MLD_g \quad (1) \quad + \sum_g \bar{w}_g \Delta \left( \ln \left( \frac{\bar{Y}_0}{Y_g} \right) \right) \quad (2)$$

$$+ \sum_g \overline{MLD}_g \cdot \Delta w_g + \sum_g \left( \overline{\ln \left( \frac{\bar{Y}}{Y_g} \right)} \right) \cdot \Delta w_g + \sum_g \bar{w}_g \cdot \Delta \left( \ln \left( \frac{\bar{Y}}{\bar{Y}_0} \right) \right) \quad (3),$$

where  $Y_g$  is the mean income of group  $g$ ,  $\bar{Y}_0 = \sum_g w_g^0 \cdot Y_g'$  is the mean income holding

the population structure constant,  $\bar{Y} = \sum_g w_g' \cdot Y_g'$  is the current mean income, and the

bar over a term refers to the average over the period of concern. The first term (1) is the effect of inequality change within each group holding the population structure constant.

The second term (2) concerns the effect of inequality change between groups holding the population structure constant. The last term (3) concerns the effect of inequality change caused by the change in the population structure.

## 2.2 Estimating demand system

### **Quadratic Almost Ideal Demand System (QAIDS)**

The Quadratic Almost Ideal Demand System (QAIDS) proposed by Banks, Blundell, and Lewbel (1997) is employed to obtain more realistic information on the substitution, own-price, and income effects. This is a budget share system that is quadratic in the logarithm of total expenditure. This system models how individual households allocate

consumption spending over different groups of goods, given total expenditure level, relative prices, and other characteristic variables.

The indirect utility function for this model is of the form

$$\ln V_h = \left[ \left( \frac{\ln x_h - \ln a_h(p)}{b(p)} \right)^{-1} + l(p) \right]^{-1},$$

where  $x_h$  is total expenditure,  $a_h(p)$  has the translog form,  $b(p)$  and  $l(p)$  are differentiable, homogeneous of degree zero functions of prices. Choosing

$$\ln a_h(p) = \alpha_0 + \sum_{i=1}^n \alpha_{ik} z_{hk} \ln p_i + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln p_i \ln p_j,$$

$$b(p) = \prod_{i=1}^n p_i^{\beta_i},$$

$$l(p) = \sum_{i=1}^n \lambda_i \ln p_i,$$

and using Shepard's Lemma construct the budget share equations for households  $h$ , given by:

$$w_{hi} = \sum_{k=1}^n \alpha_{ik} z_{hk} + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln \left[ \frac{x_h}{a_h(p)} \right] + \frac{\lambda_i}{b(p)} \left\{ \ln \left[ \frac{x_h}{a_h(p)} \right] \right\}^2$$

where  $\sum_j \gamma_{ij} = 0$ ,  $\sum_i \alpha_i = 1$ ,  $\sum_i \beta_i = 0$ ,  $\sum_i \lambda_i = 0$  to ensure homogeneity (doubling the budget and all the prices simultaneously does not affect demands), symmetry (price responses in different equations are consistent), and adding-up conditions (the sum of the budget shares must be unity so that all of the available budget is spent).

## 2.3 Measuring social welfare

The second order approximation of welfare measure proposed by Banks, Blundell, and Lewbel (1996) is employed to examine welfare loss affected by the economic crisis.

Using this method would be justified on the ground that the price changes by the economic crisis is far from marginal and obviously involves significant changes in relative prices.

The second order approximation of welfare measure can be defined as:

$$\frac{\Delta U}{\Delta p} \approx -\frac{\Delta \ln p}{\Delta p} \sum_h \mu_h w_h \left[ 1 + \frac{\Delta \ln p}{2} \left( \frac{\partial \ln \mu_h}{\partial \ln p} + \frac{\partial \ln w_h}{\partial \ln p} \right) \right]$$

where,  $P$  is the price of the good,  $\mu_h = \theta_h x_h$  is the utility weight measure,  $x_h$  is total consumption expenditure of household  $h$ ,  $w_h = q_h p / x_h$  is the budget share of the good, and  $q$  is the quantity demanded of the good. Stern weight is used for the calculation of the utility weight measure:

$$\theta_h = \frac{\partial U}{\partial V_h} \frac{\partial V_h}{\partial x_h} = V_h^\rho \frac{\partial V_h}{\partial x_h}$$

The Bergson class social welfare function is employed:

$$U = \sum_h \frac{V_h(x_h, p)^{(1+\rho)}}{1+\rho}$$

where  $\rho$  is the inequality aversion parameter with the range of zero or negative for concavity. The QAIDS indirect utility function is used:

$$\ln V_h = \left[ \left( \frac{\ln x_h - \ln a_h(p)}{b(p)} \right)^{-1} + l(p) \right]^{-1}$$

where  $a_h(p)$ ,  $b(p)$ , and  $l(p)$  present price indices that reflect individual households' substitution possibilities and are obtained from the estimation of demand system using the QAIDS.

To estimate welfare loss as a percentage of indirect utility level, this measure is slightly modified by multiplying the mean value of price change and dividing it by the indirect utility level. Thus the welfare measure used in the analysis is

$$\frac{\left( \frac{\Delta U}{\Delta P} \right) \cdot \Delta \bar{P}}{V_h}$$

This welfare measure tends to estimate welfare loss to be larger with strong inequality aversion parameter and/or with small indirect utility level. The one reason is that the utility weight measure increases with strong inequality aversion parameter as well as small indirect utility level. Another reason is that the measure is itself divided by the indirect utility level. With the same amount of numerator, the household with smaller

indirect utility level might bear more welfare loss<sup>26</sup>.

### *3. Impact on inequality*

The 1997 economic crisis of Korea decreased the level of household median income by 15.9 percent from 1997 to 1998. The income impact was not evenly distributed across the individual households as examined in the previous chapter. This result might suggest that the degree of income inequality be also considerably affected by the economic crisis. This section examines the impact of the economic crisis on household income inequality. Firstly, the changes in income inequality and poverty rate are examined with the whole sample households. Cross-country comparison of inequality is carried out with the results. Then, The whole sample is divided into sub-groups by income deciles, age cohort, region, and occupation. The inequality impact is decomposed into within and between sub-groups.

#### **3.1 Income inequality and poverty**

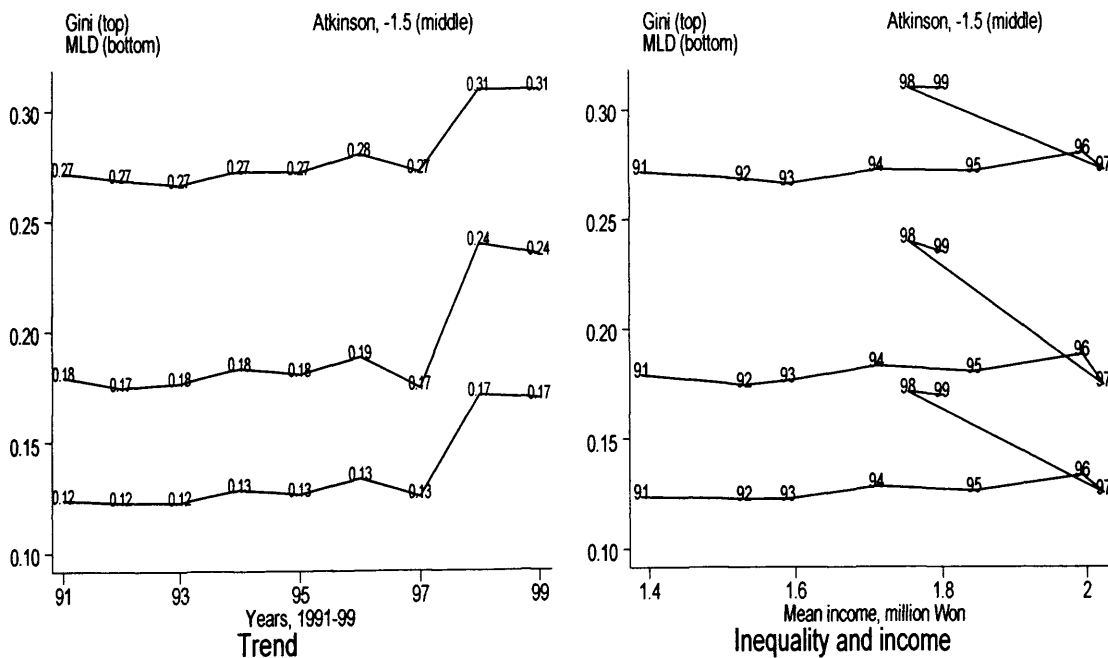
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<sup>26</sup> In this sense, this modified welfare measure might overestimate welfare loss relative to the original welfare measure by Banks, Blundell, and Lewbel (1996).

### Household income inequality and poverty

Figure 16 presents the trends and changes in household income inequality of Korea in the 1990s. Three inequality measures are employed: the Gini coefficient, the Atkinson measure with  $-1.5$  inequality aversion parameter, and the Mean Log Deviation (MLD). The measures are briefly reviewed in the previous section. There are two panels in the figure. The left-hand panel presents the trend of income inequality over the years. The numbers on the lines stand for the calculated inequality indices.

**Figure 16 Trend and change in household income inequality from 1991 to 1999 using Gini coefficient, Atkinson index, and Mean log deviation: Inequality versus year trend (left-hand panel) and inequality versus mean income (right-hand panel)**



Three lines representing inequality trends by three different measures show similar pattern. From 1991 to 1997 the change in inequality level appears to be insignificant although there are some rise and fall. In 1998 after the economic crisis the inequality level sharply increased for all the three measures. The inequality level appears not to change considerably in 1999. The estimated inequality indices are indicated on the lines.

The right-hand panel plots the inequality indices using the three measures against mean household income. The mean household income increased from 1991 to 1997 and then decreased in 1998 and 1999. The 1998 and the 1999 income take positions between the 1994 and the 1995 income in the graph. From 1996 to 1997 the inequality level slightly decreased and the mean income increased. In 1998 the inequality level jumped up and the mean income decreased largely after the economic crisis. In 1999 the inequality level did not improved although the mean income level slightly increased with some economic recovery.

Table 22 summarizes the changes in household income inequality using three inequality measures as employed in the figure and poverty rate. The poverty rate is defined in this analysis as the proportion of individual households falling below one half of median household income. The first row of the table shows the average values of inequality

indices from 1991 to 1996. The next three rows show the estimated inequality indices in 1997 when the economic crisis occurred, in 1998, and in 1999, respectively.

**Table 22 Changes in household income inequality from 1991 to 1999 using Gini, Atkinson, Mean log deviation, and poverty rate**

<i>Year</i>	<i>Gini</i>	<i>Atkinson</i>			<i>MLD</i>	<i>Poverty rate (%)</i>
		<i>-1.0</i>	<i>-1.5</i>	<i>-2.0</i>		
1991-96	0.272	0.123	0.181	0.287	0.126	8.49
1997	0.273	0.125	0.175	0.235	0.125	9.63
1998	0.310	0.167	0.240	0.375	0.172	11.42
1999	0.310	0.168	0.236	0.359	0.170	12.49

Looking at the change in inequality after the 1997 economic crisis as in the first through the forth row of the table, it might be clear that the economic crisis made the income inequality much worse than before. All the inequality indices dramatically increased in 1998 although the extents of change vary according to the measures. Comparing the changes in inequality between different inequality measures, the level of income inequality using the Gini and the Atkinson with low (-1.0) aversion parameter show similar pattern, while the Atkinson with higher (-1.5, -2.0) aversion parameters and the MLD show similar movement in inequality indices.



The former indices keep increasing over the years, while the latter indices slightly decrease in 1997, sharply increase in 1998, and then decrease in 1999. This difference might arise from the difference in the way to give weight to different income levels among the measures. For the Atkinson index, as the absolute value of the inequality aversion parameter increases the index gives more weight to the lower level of income across the distribution. The LMD gives more weight to the lower level of income and is more sensitive to the changes at the bottom of income distribution than the Gini coefficient does.

Looking at the change in poverty rate as in the last column of the table, it kept increasing over the years. The poverty rate sharply increased in 1998 from 9.63 to 11.42 percent. It continued to increase in 1999 to 12.49 percent. Comparing the poverty rates over years would require further consideration because the poverty rate of a certain year is defined according to the median income of its own year. The median income level dramatically decreased by 15.9 percent in 1998 and slightly increased by 3.3 percent in 1999. Therefore it might be informative to use the 1997 median income instead of the own year's median income for the calculation of the poverty rates.

**Table 23 Changes in poverty rates using both own years' median income and the 1997 median income**

(Unit: percent)

	<i>91-96</i>	<i>97</i>	<i>98</i>	<i>99</i>
By own year's income	8.49	9.63	11.42	12.49
By 1997 income	16.41	9.63	18.08	17.61

Table 23 presents the changes in poverty rates calculated by both own years' median income and the 1997 median income. The first row is the same as in the last column of the previous table using the own years' median income. The second row presents the poverty rates obtained from the 1997 median income. In 1997 both poverty rates are naturally equivalent, 9.63 percent. In 1998 the poverty rate using the 1997 median income dramatically increased to 18.08 percent. Almost two households out of ten fell below the poverty line in 1998 on condition that the median income level is the same as that in 1997. It might be proper to say that 8.45 percent of the whole households (18.08 % - 9.63 %) additionally fell below the poverty line by the economic crisis. In 1999 the poverty rate using the 1997 median income decreased with some economic recovery.

### **Cross-country comparison**

Comparing the inequality level with those of other countries might provide useful information on the economic impact on income inequality of Korea. The data on inequality of the 13 OECD countries is obtained from the table in Oxely et al. (1997). This paper uses the 'equivalent disposable income per household member' instead of household income. This income concept is total household disposable income divided by household size with household economies of scale, 0.5. Each individual is attributed the 'adjusted' income of the household. Thus the sample size increases by the average household size.

To improve cross-country comparability this 'adjusted' income is applied to calculate the income inequality of Korea. Three measures are employed: the Gini coefficient, the Mean Log Deviation (MLD), and the poverty rate. One thing different from the 'adjusted' income in Oxely et al. (1997) is that direct tax is included in the household income used for inequality of Korea. It might cause to overestimate slightly the inequality level of Korea relative to those of the 13 OECD countries. For the inequality level before the economic crisis the average value from 1991 to 1996 is used. For the inequality after the economic crisis the value of 1998 is used. For the other countries the inequality values used for the comparison are those from the mid-1990s subject to availability.

**Table 24 Cross-country comparisons in inequality and poverty between Korea and 13 OECD countries using Gini, Mean log deviation, and poverty rate**

<i>Countr</i>								
<i>y</i>	<i>Korea,</i> <i>91-96</i>	<i>Korea</i> <i>,</i> <i>98</i>	<i>Australi</i> <i>a</i> <i>94</i>	<i>Belgium</i> <i>95</i>	<i>Canad</i> <i>a</i> <i>94</i>	<i>Denmar</i> <i>k</i> <i>94</i>	<i>Finlan</i> <i>d</i> <i>95</i>	<i>Franc</i> <i>e</i> <i>90</i>
Gini	0.259	0.298	0.306	0.299	0.284	0.217	0.231	0.291
MLD	0.114	0.158	0.178	0.269	0.143	0.088	0.09	0.295
Poverty rate	0.072	0.102	0.095	0.108	0.089	0.050	0.049	0.068
<i>Countr</i>								
<i>y</i>	<i>German</i> <i>y</i> <i>94</i>	<i>Italy</i> <i>93</i>	<i>Japan</i> <i>94</i>	<i>Netherland</i> <i>s</i> <i>94</i>	<i>Norwa</i> <i>y</i> <i>95</i>	<i>Sweden</i> <i>95</i>	<i>US</i> <i>95</i>	
Gini	0.282	0.345	0.265	0.253	0.256	0.230	0.344	
MLD	0.135	0.240	0.126	0.116	0.131	0.110	0.219	
Poverty rate	0.091	0.142	0.081	0.089	0.080	0.064	0.171	

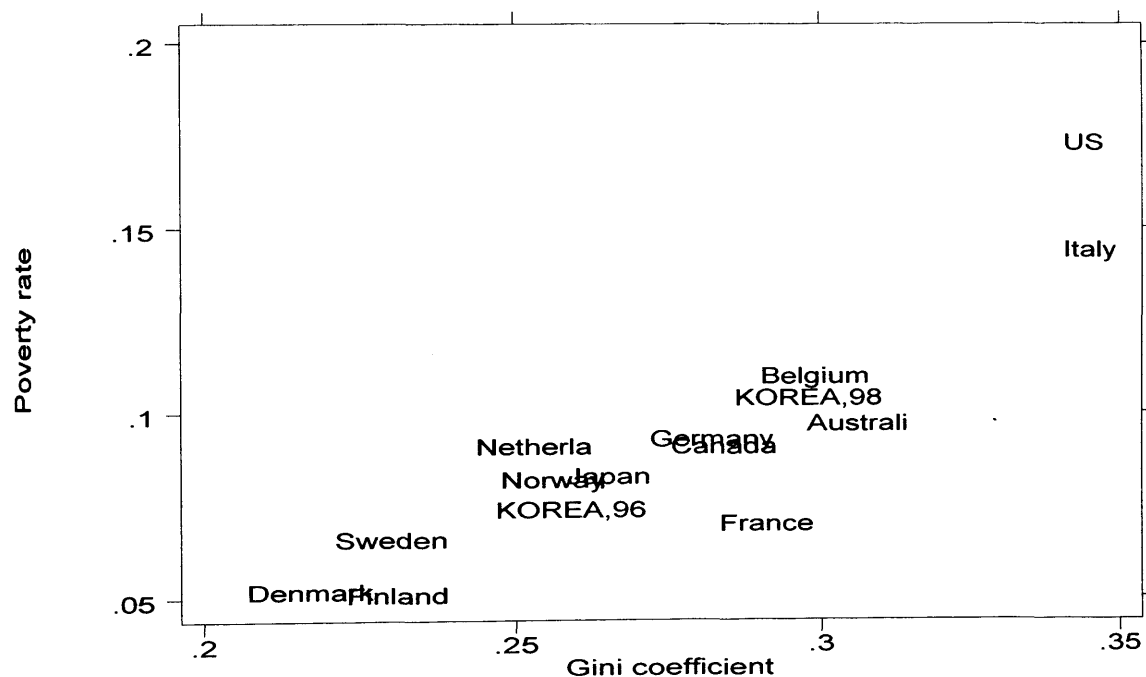
Data source: Oxely et al. (1997)

Table 24 presents cross-country comparisons in inequality level and poverty rate using the three measures. The estimated values of inequality of Korea place in the first and the second column in the table. Then the other 13 countries are arranged in alphabetical order. The table ranks Korea before the economic crisis around 5th out of the 14 countries: 6th for the Gini, 4th for the MLD, and 5th for the poverty rate. After the economic crisis the inequality level increased to around 11th out of the 14 countries:

10th for the Gini, 11th for the MLD, and 11th for the poverty rate.

Figure 17 illustrates cross-country comparisons for both the Gini coefficient and the poverty rate. The figure plots the 13 OECD countries and Korea both before (Korea 96) and after the crisis (Korea 98) on the Gini coefficient-poverty rate dimension. The x-axis is related with the Gini coefficient and the y-axis with the poverty rate.

**Figure 17 Cross-country comparisons in inequality and poverty between Korea and 13 OECD countries using Gini and poverty rate**



As in the figure Denmark, Finland, and Sweden take the lowest positions in income

inequality and poverty rate, while US and Italy take the highest positions among the 14 countries. Korea changed its position from the 6th to the 10th lowest in income inequality and from the 5th to the 11th lowest in poverty rate among the 14 countries after the economic crisis. Before the crisis the levels of inequality and poverty of Korea were similar to those of Norway and Japan. After the economic crisis the levels of inequality and poverty of Korea became similar to those of Belgium and Australia.

### 3.2 Inequality impact by sub-groups

To examine the difference in the impact on income inequality between characteristic sub-groups, the whole sample households are categorized using income deciles, age cohort, region, and occupation. Between sub-groups the income inequalities are estimated and compared. The total inequality is decomposed into within and between group components.

#### **By income deciles**

The 101,454 sample households from 1991 to 1999 are divided into 10 sub-groups each year by income deciles. The 1997 economic crisis sharply increased inequality level as in the previous sub-section. This result might imply that the impact on income affected lower income deciles more than higher income deciles. Table 25 presents the changes in

household income by deciles in the 1990s. There are two panels in the table. The top panel concerns the change and the growth rates of household income by deciles. The bottom panel concerns the proportion of income by deciles to the total sum of household income and its changes.

Looking at the changes in household income by deciles in the top panel of the table, the average income levels of all the deciles decreased in 1998 and slightly increased in 1999.

The income ratio of top two deciles to bottom two deciles would provide some information on inequality and its change. The calculated ratios are 4.06 in 1991-96, 4.14 in 1997, 5.02 in 1998, and 5.07 in 1999. The ratio increased in 1998 and continued to increase in 1999. This ratio also indicates that the economic crisis made inequality level worse.

For the growth rate of income, the mean household income decreased by 16.3 percent from 1997 to 1998. As income groups belong to lower deciles the decrease in income is larger. The 10th deciles experienced the least decrease rate in income (-2.3 %). In 1999 the income increased slightly, on average, by 2.6 percent. The increase rates of the 6th and 7th deciles are the largest (3.7 %), while that of the second deciles is the smallest (1.2 %).

**Table 25 Changes in household income by deciles: Average income by deciles, its growth rate, proportion of each deciles' income, and changes in proportion**

Deciles	1	2	3	4	5	6	7	8	9	10	Mean
<i>Average income by deciles, million Won</i>											
91-96	0.60	0.90	1.08	1.25	1.41	1.59	1.80	2.07	2.47	3.61	1.68
97	0.70	1.06	1.31	1.52	1.72	1.93	2.19	2.52	3.00	4.28	2.02
98	0.51	0.84	1.05	1.24	1.43	1.63	1.87	2.17	2.60	4.18	1.75
99	0.52	0.85	1.07	1.27	1.47	1.69	1.94	2.24	2.69	4.25	1.80
<i>Growth rate of income, %</i>											
97-98	-27.1	-20.8	-19.9	-18.4	-16.9	-15.6	-14.6	-13.9	-13.3	-2.3	-16.3
98-99	2.0	1.2	1.9	2.4	2.8	3.7	3.7	3.2	3.5	1.7	2.6
<i>Proportion of each decile's income to the total sum</i>											
91-96	3.56	5.37	6.46	7.44	8.42	9.48	10.74	12.33	14.70	21.50	
97	3.45	5.24	6.46	7.51	8.50	9.52	10.83	12.47	14.85	21.17	
98	2.9	4.81	5.97	7.08	8.17	9.32	10.66	12.36	14.85	23.88	
99	2.87	4.71	5.97	7.06	8.18	9.40	10.76	12.47	14.95	23.64	
<i>Changes in proportion</i>											
97-98	-0.55	-0.43	-0.49	-0.43	-0.33	-0.20	-0.17	-0.11	0.00	2.71	
98-99	-0.03	-0.10	0.00	-0.02	0.01	0.08	0.10	0.11	0.10	-0.24	
97-99	-0.58	-0.53	-0.49	-0.45	-0.32	-0.12	-0.07	0.00	0.10	2.47	

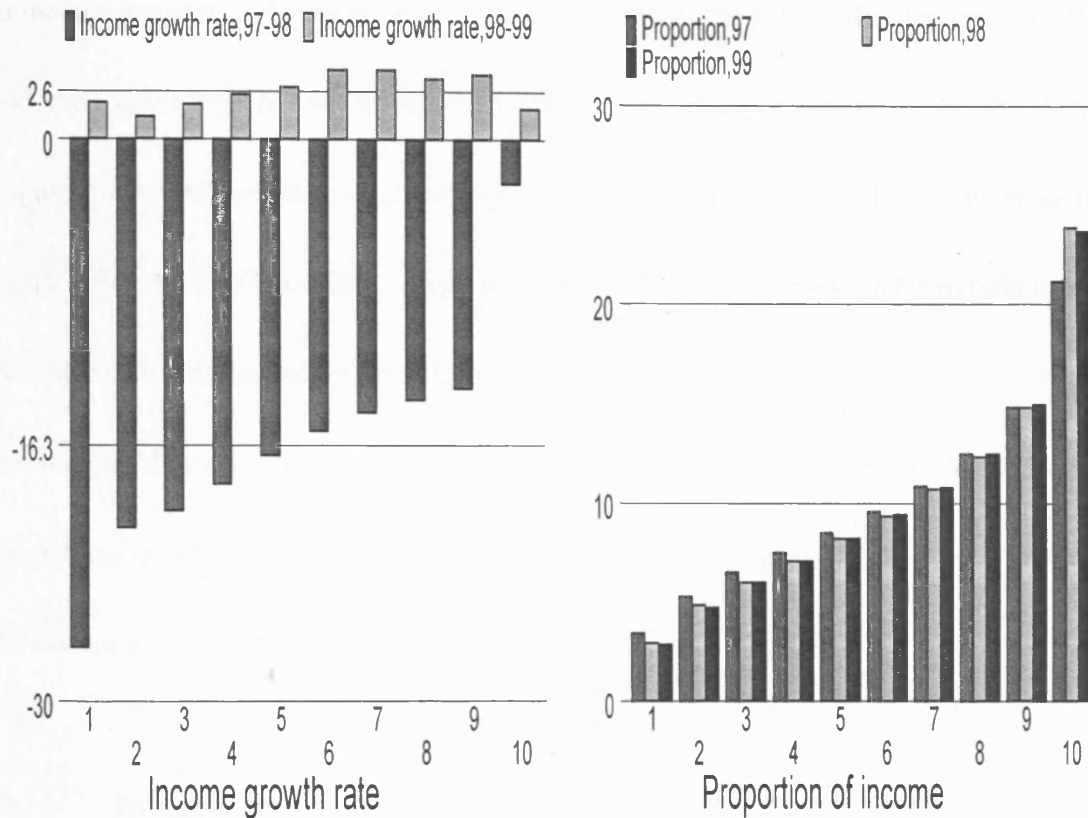


The proportions of income by deciles to the total might provide more information on relative impact among deciles as in the bottom panel of the table. The income proportions from the lowest to the 8th deciles decreased in 1998. The income proportion of the 9th deciles unchanged at 14.85 and that of the highest deciles even increased from 21.17 to 23.88 in 1998. In 1999 the proportions of the first, the second, the fourth, and the highest deciles decreased further. Looking at the last row in the table there is a result of the changes in income proportions from 1997 to 1999 by the economic crisis. The proportions of the highest two deciles increased, while those of the lowest seven deciles decreased. The increase in proportion of the highest deciles (2.47) is much larger than that of the 9th deciles (0.10). As income groups belong to lower deciles the amounts of decrease in income proportion after the economic crisis are larger.

Figure 18 illustrates the income changes by deciles. There are two panels in the figure. The left-hand panel shows the growth rate of income by deciles from 1997 to 1999. The left-hand panel shows the income proportion by deciles from 1997 to 1999. Looking at the income growth rate by deciles, each deciles group has two bars indicating the growth rates in 1998 relative to 1997 and in 1999 to 1998. For all the deciles the income growth rates are negative in 1998. The decrease rate of the highest deciles accounts for

the smallest. The lowest five deciles experienced larger decrease

**Figure 18 Changes in household income by deciles from 1997 to 1999: Growth rate of income by deciles (left-hand panel) and income proportion of deciles (right-hand panel)**



rate than the average (-16.3 %). In 1999 all the income growth rates are positive. The growth rates for the 5th through the 9th deciles are larger than the average (2.6 %).

Looking at the right-hand panel illustrating the income proportion, each deciles group

has three bars indicating the income proportions from 1997 to 1999. The lowest six deciles have the proportions less than 10 percent. The highest deciles group has the proportion more than 20 percent. From 1997 to 1999 the income proportions of the lowest seven deciles decreased. As income groups belong to lower deciles the decreases in income proportion become larger. The proportion of the 8th deciles decreased in 1998 and then recovered to the level of 1997 in 1999. The proportion of the 9th deciles slightly increased, while that of the highest deciles largely increased after the economic crisis. After the 1997 economic crisis of Korea, although the levels of household income decreased for all the income deciles, the highest deciles would be the least loser from the income decrease rate point of view as well as the main gainer from the income proportion point of view. This result might cause the inequality level to be worse after the economic crisis as in the previous sub-section.

### By age cohorts

In relating to the analysis on the income impact by age cohort in Chapter III, the impact on inequality by cohorts is examined where cohorts are defined by the year of birth of household head<sup>27</sup>. Variances of log real income by cohort are employed to show within-

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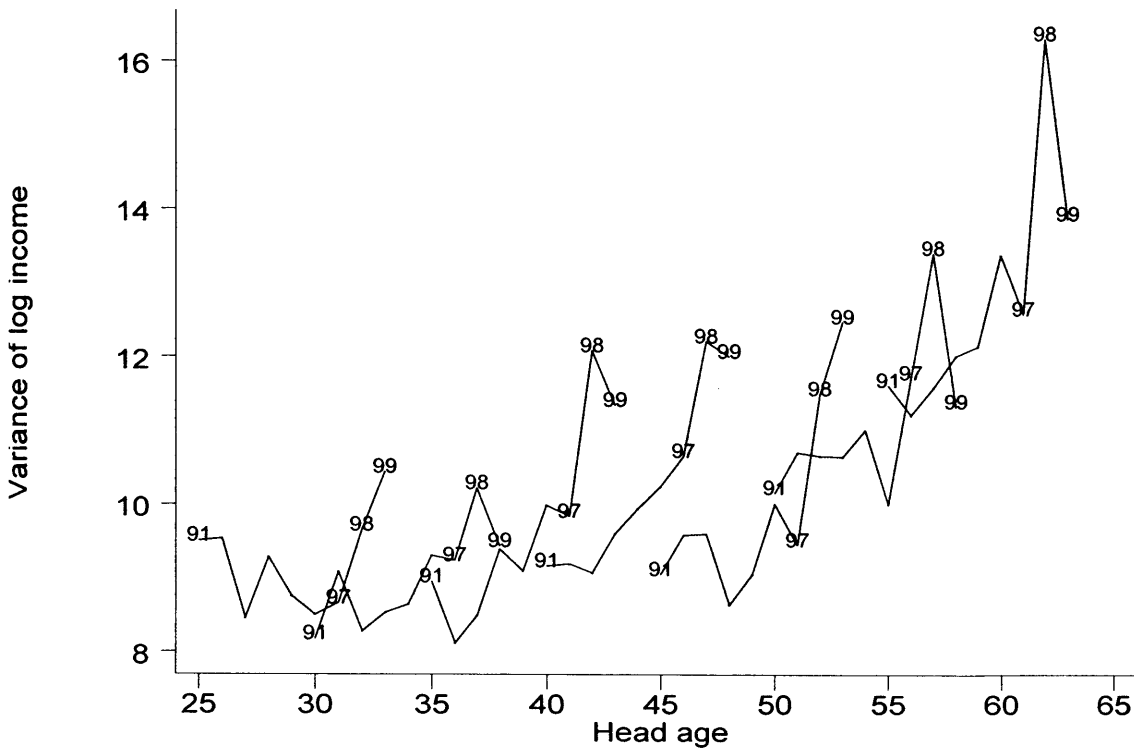
<sup>27</sup> The detailed explanation on cohort and observations used in the analysis are presented in the corresponding section in Chapter III.

cohort and between-cohort inequality. For each cohort the sample variances of log real income are calculated over the years although the whole figures are not presented in this paper. Figure 19 shows variances of seven selected cohorts for illustration: 25, 30, 35, 40, 45, 50, 55cohort.

There seems to be some patterns of the cohort income variances over the whole 9-year period from 1991 to 1999. Looking at the individual lines in the figure, within-cohort inequality appears to increase with age. As in Blundell and Preston (1997), this might be a frequently observed pattern on within-cohort inequality. Then looking at the trend of the lines from younger cohorts to older cohorts, the mean values of within-cohort variances have a tendency to increase from younger cohorts to older cohorts. In other words, between-cohort inequality also appears to increase with cohort age. The within-cohort inequality sharply increased in 1998 after the economic crisis. The within-cohort inequality of older cohorts appears to increase more than that of younger ones in 1998.

Although the figure provides information on inequality for the selected cohorts, the within-cohort inequality did not improve for many cohorts in spite of some economic recovery in 1999. The within-cohort income inequality increased in 1999 for some younger cohorts (25, 26, 27cohort) as well as for many older cohorts (37, 38, 41, 42, 44, 45, 46, 47, 51, 52, 53cohort).

**Figure 19 Income inequality by age cohort using cohort income variance from 1991 to 1999**



Within-cohort and between-cohort inequality can be closely examined using the mean log deviation (MLD) index because this index is additively decomposable due to its logarithmic formula as described in Section 2. The sum of the within and the between-group MLD indices is equal to the total inequality MLD index. Table 26 presents the within and between-group inequality by age cohort using the mean log deviation from 1991 to 1999. The first row of the table presents total MLD indices. The values are the

same as those presented in Table 22. The second row is within-group inequality and the values in parenthesis are the proportion of within-group inequality to the total. The third row is between-group inequality and the values in parenthesis are the proportion of between-group inequality to the total.

**Table 26 Decomposition of inequality by age cohort using the mean log deviation (MLD) index from 1991 to 1999**

<i>MLD</i>	<i>91</i>	<i>92</i>	<i>93</i>	<i>94</i>	<i>95</i>	<i>96</i>	<i>97</i>	<i>98</i>	<i>99</i>	<i>Average</i>
Total	0.124	0.123	0.123	0.128	0.126	0.134	0.125	0.172	0.170	0.136
Within-cohort	0.112 (0.91)	0.112 (0.91)	0.111 (0.90)	0.116 (0.91)	0.115 (0.91)	0.121 (0.91)	0.114 (0.91)	0.160 (0.93)	0.160 (0.94)	0.125 (0.92)
Between-cohort	0.011 (0.09)	0.011 (0.09)	0.012 (0.10)	0.012 (0.09)	0.011 (0.09)	0.012 (0.09)	0.012 (0.09)	0.012 (0.07)	0.010 (0.06)	0.011 (0.08)

Note: The proportions are in parenthesis.

The changes in total inequality level appear to be insignificant from 1991 to 1997, although there is some rise and fall. The total value sharply increased in 1998 and 1999 after the economic crisis. On average from 1991 to 1999, 92 percent of total income inequality was caused by within-cohort inequality and 8 percent of it by between-cohort inequality as in the last column of the table. The within-cohort inequality has a similar pattern to that of the total inequality. It also sharply increased after the economic crisis

from 0.114 to 0.160. The proportion of within-cohort inequality to the total also sharply increased in 1998 and continued to increase in 1999. The between-cohort inequality appears not to increase in 1998, and it decreased in 1999. The proportion of between-cohort inequality decreased in 1998 and continued to decrease in 1999. These results might suggest that the dramatic increase in inequality after the economic crisis was mainly caused by within-cohort inequality and the inequality level between age cohorts reduced<sup>28</sup>.

### **By region**

The extents of the impact on inequality would not be even-handed between different regions. Regional difference in inequality impact is compared between Seoul and the other part of the country. Seoul is the capital city of Korea. 21.7 percent of the whole households in the dataset are from Seoul, on average, from 1991 to 1999. Regional difference in inequality impact between Seoul and the other part is examined by focusing on the three points using the mean log deviation (MLD). Firstly, the inequality difference in level and trend is examined between two regional groups. Then, the total inequality is decomposed into within-regional group and between-regional group

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<sup>28</sup> Similar result is also obtained from the analysis using age bands instead of age cohort although the result is not reported in the paper.

inequalities. Lastly, the changes in inequality after the economic crisis are again decomposed into three components: change in within-regional group inequality, change in between-regional group inequality, and changes in inequality caused by the population structure.

**Figure 20 Regional differences in income inequality between Seoul and the other part of the country using the mean log deviation (MLD) index from 1991 to 1999**

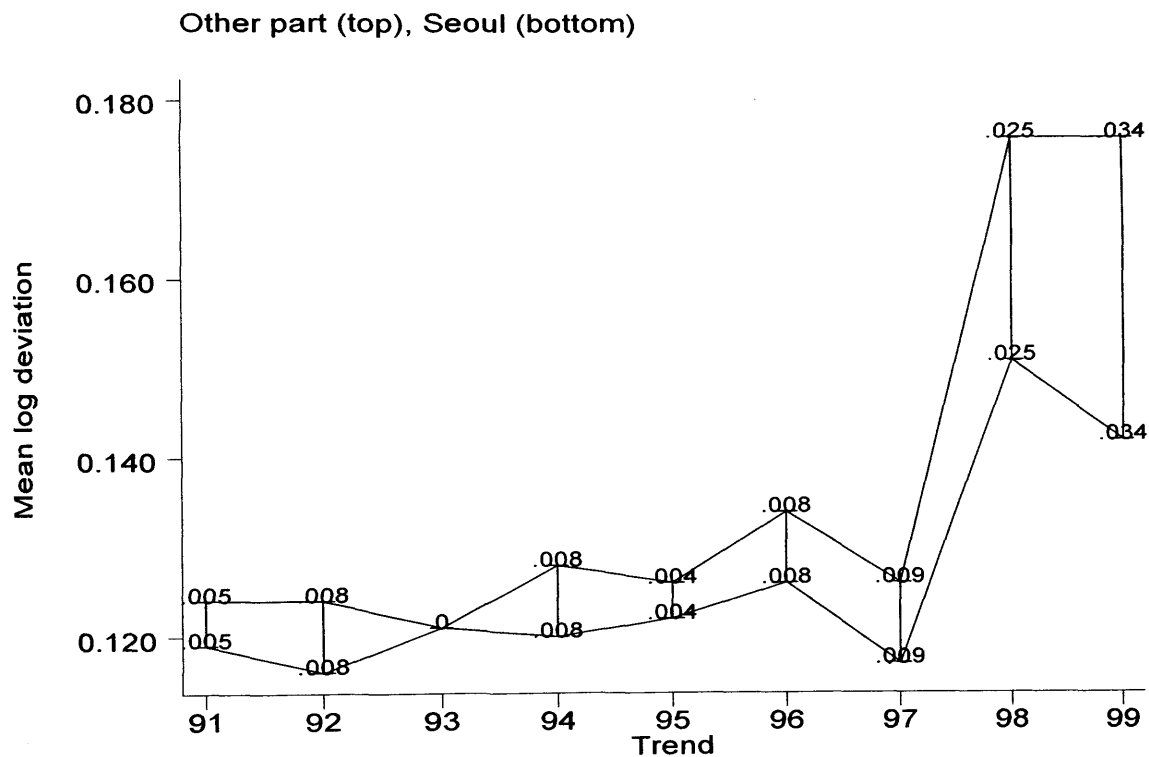


Figure 20 illustrates the inequality trend and its difference between Seoul and the other part. The inequality level of the other part is higher than that of Seoul over the 1990s



except in 1993. Both inequality levels sharply increased in 1998 after the economic crisis. The vertical lines to connect the two graphs indicate the inequality differences between two regions each year. The amounts of difference are shown at each point on the lines. Before 1998 the differences are between zero and 0.009. The inequality difference increased from 0.009 to 0.025 in 1998 because the inequality level increased more in the other part than in Seoul. In 1999 the inequality difference continued to increase to 0.034 because the inequality level of Seoul fell while that of the other part remained unchanged.

The total inequality can be decomposed into within-group and between-group components. Table 27 presents the decomposition of inequality by regional groups using the mean log deviation (MLD). The first through the third row present total, the other part, and Seoul inequality levels, respectively. The fourth row presents within-group inequality component with the proportions of it to the total in parenthesis. The last row presents between-group inequality component with the proportions of it to the total in parenthesis. The sum of within-group and between-group components is equal to the total as in the first row.

**Table 27 Decomposition of inequality by region between Seoul and the other part of the country using the mean log deviation (MLD) index from 1991 to 1999**

<i>MLD</i>	<i>91-96</i>	<i>97</i>	<i>98</i>	<i>99</i>	<i>Average, 91-99</i>
Total	0.126	0.125	0.172	0.170	0.136
Other	0.126	0.126	0.176	0.176	0.137
part					
Seoul	0.121	0.117	0.151	0.142	0.126
Within	0.125 (0.99)	0.124 (0.99)	0.172 (1.00)	0.17 (1.00)	0.135 (0.99)
Between	0.001 (0.01)	0.001 (0.01)	0.000 (0.00)	0.000 (0.00)	0.001 (0.01)

Note: The proportions are in parenthesis.

The total inequality sharply increased in 1998 and the inequality difference between two regions also increased after the economic crisis as in the first three rows in the table as well as in the figure. As a result of decomposition of the total inequality, the total inequality is mainly due to the within-group inequality as in the forth and the last rows of the table. The proportions of within-group component appear to be more than 99 percent of the total inequality by regional groups. After the economic crisis the between-group component and its proportion reduced to zero. From the regional groups point of view, the total inequality was caused not by the inequality between Seoul and the other part, but by the inequality within each group.

For the analysis on the impact of economic crisis on inequality by regional groups, the

changes in the mean log deviation ( $\Delta MLD$ ) can be decomposed into three components: changes in inequality within each group, changes in inequality between groups, and changes in inequality caused by the population structure. The structural changes concern the change of group shares to the total households over the years. The methods are described in Section 2. Table 28 presents the decomposition results. Each row shows the changes in total inequality and its three decomposed components. The proportion of each component to the total change is in parenthesis. The sum of three decomposed components is equal to the total.

**Table 28 Decomposition of the changes in inequality by region between Seoul and the other part of the country using the mean log deviation (MLD) index from 1997 to 1999**

<i>Difference</i>	<i>Total change</i>	<i>Within-group change</i>	<i>Between-group change</i>	<i>Structural change</i>
97-98	0.04655	0.04699 (1.009)	-0.00187 (-0.040)	0.00143 (0.031)
98-99	-0.00181	-0.0017 (0.939)	-0.00008 (0.044)	-0.00003 (0.017)

Note: The proportions are in parenthesis.

Looking at the top row regarding the inequality change from 1997 to 1998, the total amount of inequality increased by 0.04655. The change in within-group inequality exceeds the total change. The change in between-group inequality and its proportion are

negative. The inequality between Seoul and the other part decreased after the economic crisis. This result might reflect the fact that the income difference between two regional groups decreased after the economic crisis as in Chapter III. The effect of structural change on the total change and its proportion are positive. This result might suggest that the total increase in inequality in 1998 was due to both the within group change and the structural change and it was offset by the negative change in between group inequality.

Looking at the bottom row regarding the inequality change from 1998 to 1999, the total inequality decreased by 0.00181 although the amount appears not to be significant. 93.9 percent of the total inequality decrease was caused by the improvement of inequality within each group with some economic recovery. 4.4 percent of it was due to the improvement of inequality between two regional groups, which reflects further decrease in income difference between two groups as in Chapter III. The rest of it was due to the structural change. Both inequality within each group and inequality between two regional groups improved a little in 1999.

### **By occupation**

The extents of the impact on inequality would not be even-handed between different occupational groups. Occupational difference in inequality impact is compared between salary and wage earners groups. 40.3 percent of the whole household heads in the

dataset are salary earners, on average, from 1991 to 1999. Occupational difference in inequality impact between salary earners and wage earners is examined by focusing on three points using the mean log deviation (MLD) as in the previous sub-section. Firstly, the inequality difference in level and trend is examined between two occupational groups. Then, the total inequality is decomposed into within-group and between- group inequalities. Lastly, the changes in inequality after the economic crisis are again decomposed into three components: change in within-group inequality, change in between-group inequality, and changes in inequality caused by the population structure.

**Figure 21 Occupational differences in income inequality between salary and wage earners using the mean log deviation (MLD) index from 1991 to 1999**

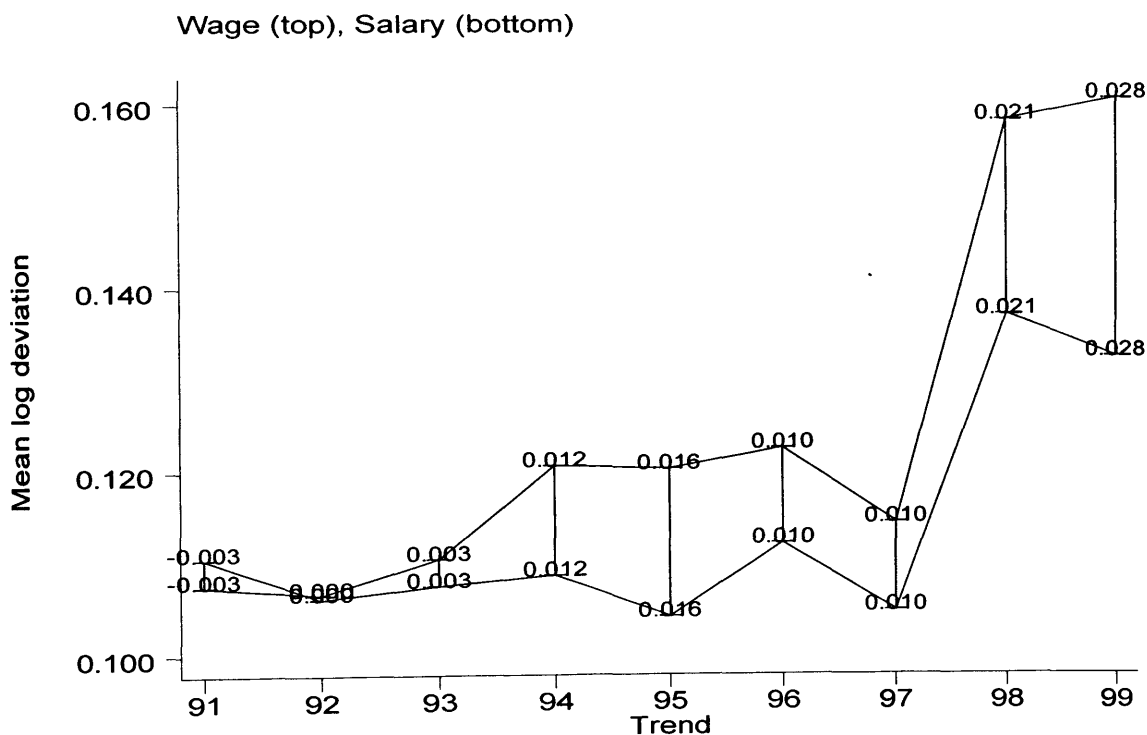


Figure 21 illustrates the inequality trend and its difference between salary and wage earners. The inequality level of wage earners was lower than that of salary earners by  $-0.003$  in 1991, and then both levels became equal in 1992. Since 1992 the inequality level of wage earners was higher than that of salary earners. Both inequality levels sharply increased in 1998 after the economic crisis. The vertical lines to connect the two trend graphs indicate the inequality differences between two occupational groups. The amounts of difference are shown at each point. Before 1998 the differences lie between  $-0.003$  and  $0.016$ . The inequality difference increased from  $0.010$  to  $0.021$  in 1998 because the inequality level increased more for wage earners group than for salary earners group. In 1999 the inequality difference continued to increase to  $0.028$  because the inequality level of salary earners group decreased while that of wage earners group increased.

The total inequality can be decomposed into within-group and between-group components. Table 29 presents the decomposition of inequality by occupational groups using the mean log deviation (MLD). The first through the third rows present total, wage earners group, and salary earners group inequality levels, respectively. The fourth row presents within-group inequality component with the proportions of it to the total in parenthesis. The last row presents between-group inequality component with the

proportions of it to the total in parenthesis. The sum of within-group and between-group components is equal to the total as in the first row.

**Table 29 Decomposition of inequality by occupation between salary and wage earners using the mean log deviation (MLD) index from 1991 to 1999**

<i>MLD</i>	<i>91-96</i>	<i>97</i>	<i>98</i>	<i>99</i>	<i>Average, 91-99</i>
Total	0.126	0.125	0.172	0.170	0.136
Wage	0.115	0.114	0.158	0.161	0.125
Salary	0.108	0.105	0.137	0.132	0.114
Within	0.112 (0.89)	0.111 (0.89)	0.150 (0.87)	0.149 (0.88)	0.120 (0.88)
Between	0.014 (0.11)	0.015 (0.11)	0.022 (0.13)	0.021 (0.12)	0.016 (0.12)

Note: The proportions are in parenthesis.

The total inequality sharply increased in 1998 and the inequality difference between two occupational groups also increased after the economic crisis as in the first three rows of the table as well as in the figure. The total average value (0.136) is greater than both the value of wage earners group (0.125) and the value of salary earners group (0.114). The reason might be that this occupational categorization produces more homogeneous groups than the whole sample households from the income inequality point of view. As a result of decomposition of the total inequality, the total inequality is mainly due to the

within-group inequality as in the forth and the last rows. The proportions of within-group component appear to be around 88 percent of the total inequality by occupational groups. After the economic crisis the proportions of two decomposed components appear not to change considerably. Around 88 percent of the total inequality was caused by within group inequality and the rest of it was caused by the inequality between salary earners group and wage earners group.

For the analysis on the impact of economic crisis on inequality by occupational groups, the changes in the mean log deviation ( $\Delta MLD$ ) are decomposed into three components: changes in inequality within each group, changes in inequality between groups, and changes in inequality caused by the population structure. The structural changes concern the change of group shares to the total households over the years.

**Table 30 Decomposition of the changes in inequality by occupation between salary and wage earners using the mean log deviation (MLD) index from 1997 to 1999**

<i>Difference</i>	<i>Total change</i>	<i>Within-group change</i>	<i>Between-group change</i>	<i>Structural change</i>
97-98	0.0466	0.0392 (0.84)	0.0070 (0.15)	0.0004 (0.01)
98-99	-0.0018	-0.0006 (0.33)	-0.0014 (0.78)	0.0002 (-0.11)

Note: The proportions are in parenthesis.



Table 30 presents the decomposition results. Each row shows the changes in total inequality and its three decomposed components. The proportion of each component to the total change is in parenthesis. The sum of three decomposed components is equal to the total. Looking at the top row regarding the inequality change from 1997 to 1998, the total amount of inequality change accounts for 0.047. 84 percent of the total change in 1998 was due to the inequality change within each occupational group. 15 percent of it was due to the inequality change between two occupational groups. One percent of it was due to the structural change from 1997 to 1998. After the economic crisis the inequality between wage and salary earners increased considerably. This result might reflect the fact that the income difference between two groups increased considerably after the economic crisis as in Chapter III.

Looking at the bottom row regarding the inequality change from 1998 to 1999, the total inequality decreased by 0.00181 although the amount appears not to be significant. 33 percent of the total inequality decrease was caused by the improvement of inequality within each group with some economic recovery. 78 percent of it was due to the improvement of inequality between two occupational groups, which reflects decrease in income difference between two occupational groups as in Chapter III. The rest of it was due to the structural change. Both inequality within each group and inequality between

two occupational groups improved in 1999. The proportion of the inequality change between groups is greater than that of inequality within each group unlike the analysis on regional difference in inequality as in the previous sub-section.

#### *4. Impact on social welfare*

The 1997 economic crisis of Korea might also heavily affect social welfare level as well as income inequality. The measures to estimate social welfare vary. For example, both the Gini coefficient and the Atkinson measure are also used for measuring social welfare as described in Section 2. Apart from those measures, the welfare measure based on price changes will be employed in this section. The price change used in the analysis is not the actual change between before and after the economic crisis, but the estimated price change caused by currency devaluation by the economic crisis. The analysis logic is that the economic crisis in 1997 affected exchange rate of the Korean currency significantly and it caused considerable price changes. The households would respond the price change. The changes in utility level of individual households that respond the changed prices might affect the social welfare.

#### 4.1 Estimating price change by currency devaluation

##### **Massive devaluation of the Korean currency after the economic crisis**

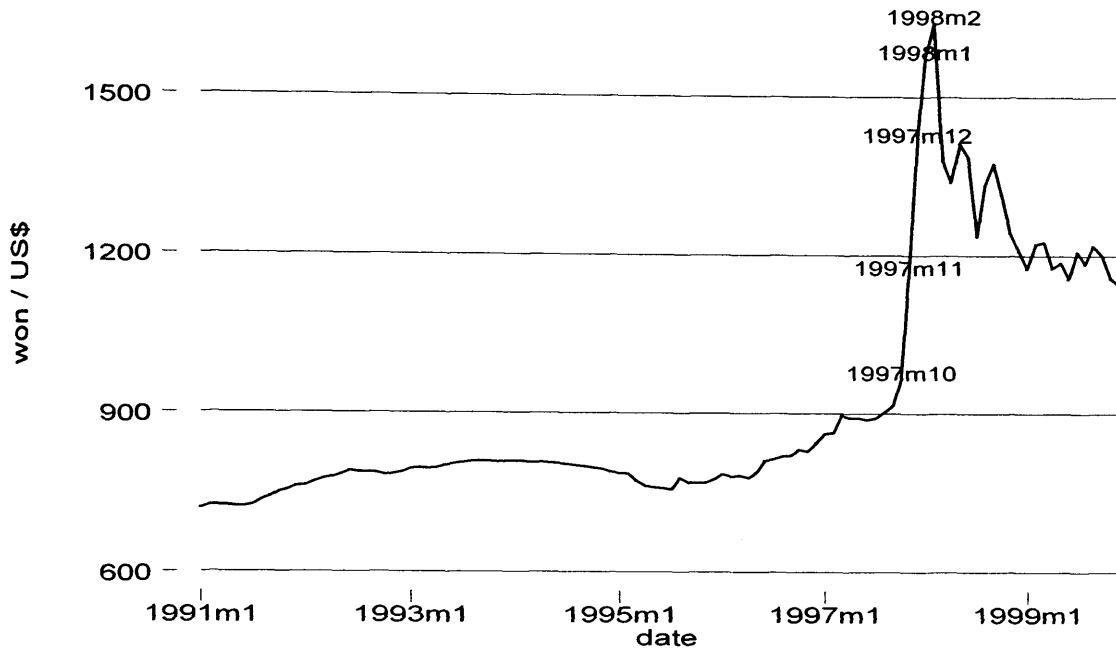
One of the most distinct features in the Korean economy after the 1997 economic crisis is massive devaluation of the Korean currency, won. The Korean currency was massively devaluated with and after the economic crisis<sup>29</sup>. Figure 22 illustrates the trend of monthly exchange rate of the Korean currency to US dollar from 1991 to 1999. As in the figure the Korean currency accounted for around 800 won per US dollar from 1991 to the third quarter of 1997. The economic crisis that occurred in the last quarter of 1997 resulted in sharp devaluation of the Korean currency. In October 1997 the exchange rate started to increase to 965.1 from 914.8 in the previous month. It continued to increase dramatically to its maximum, 1640.1, in February 1998. For the period of five months, from September 1997 to February 1998, the Korean currency was devaluated by 79.3 percent. From March 1998 it tended to decrease but did not recover the levels before the economic crisis<sup>30</sup>.

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<sup>29</sup> In relating to the massive devaluation, some economists in Korea refer to the 1997 economic crisis as ‘the exchange rate crisis’, for example, Kang (1999).

<sup>30</sup> From 2000 to April 2001 the average monthly exchange rate accounts for 1176.04 won per US dollar.

**Figure 22 Trend of monthly exchange rate of the Korean currency, won, to US dollar from 1991 to 1999**



The effect of the economic crisis on exchange rate might be measured by the difference of average exchange rates between before and after the economic crisis. The average exchange rate from 1991 to September 1997 accounts for 794.6 won per US dollar, while that from October 1997 to the end of 1999 accounts for 1627.8. It increased by 59.55 percent between two periods. This sharp devaluation caused price to change considerably in absolute term as well as in relative term among goods<sup>31</sup>.

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<sup>31</sup> This massive devaluation also was a major cause of the bankruptcy of a number of firms that had large foreign debts.

### **Estimating price change using the input-output methodology**

The input-output method is employed to obtain price changes caused by 59.55 percent devaluation of the Korean currency between before and after the economic crisis. A key assumption of input-output method is the full shifting of change in exchange rate to consumer price. It is strong in that it does not allow for general equilibrium effects such as factor substitution from supply side, demand shift from demand side, and change in indirect taxation from the government side. Therefore the results should be considered as a short-term approximation to the impacts of devaluation on prices.

Despite of the limitation, the input-output method would be useful in the context of welfare analysis using price change caused by the economic crisis. One reason might be that it would be difficult for the supply side to adjust swiftly its production process against currency devaluation under economic crisis in 1998 and 1999. Another one is that the change in demand will be reflected in the welfare measure because it is based on demand system estimation as described in the following sub-sections.

The 1995 Input-Output Table published by the bank of Korea is used because it is the latest available one before the economic crisis. The medium-scale table with 77 industry sectors is used for price estimation. The price change rates of 77 sectors by the currency

devaluation can be obtained from the formula<sup>32</sup>:

$$\dot{P}_d = (1 - A'_d)^{-1} \cdot A'_m \cdot \dot{E}$$

where  $\dot{P}_d$  is the vector of price change rates of domestic goods,  $A'_d$  is the transposed vector of input coefficients of domestic goods,  $A'_m$  is the transposed vector of input coefficients of imported goods, and  $\dot{E}$  is the change rate of exchange rate. Since the 1995 input-output table provides the input coefficients of both domestic and imported goods, the price change rates of 77 sectors can be obtained from putting 59.55 percent into  $\dot{E}$ .

Table 31 presents the price increase rates caused by 59.55 percent devaluation of the Korean currency. The large-scale 28 sectors are presented in the table for illustration although the medium-scale 77 sectors are used for the actual estimation. As shown in the table, the price increase of petroleum and coal products accounts for the largest, 33.42 percent. The price increases of primary metal products and wood and paper products come next. The smallest increase in price belongs to finance and insurance sector, 2.67 percent.

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<sup>32</sup> The calculation is, in effect, provided by the built-in function in the 1995 input-output table CD-Rom. The described formula follows the method in the explanation section of the CD-Rom by the bank of Korea.

**Table 31 Price change rate by 59.55 percent currency devaluation with large-scale 28 sectors in the 1995 Input-Output table of Korea**

<i>No</i>	<i>Name</i>	<i>%</i>	<i>No</i>	<i>Name</i>	<i>%</i>	<i>No</i>	<i>Name</i>	<i>%</i>
1	Agriculture, forestry, and fisheries	5.18	11	Fabricated metal products	15.52	21	Transportation and warehousing	16.02
2	Mining and quarrying	4.55	12	General machinery and equipment	16.74	22	Communications and broadcasting	3.87
3	Food, beverages and tobacco	11.29	13	Electronic and other electric equipment	20.69	23	Finance and insurance	2.67
4	Textile products and leather products	19.46	14	Precision instruments	13.47	24	Real estate and business service	2.89
5	Wood and paper products	22.74	15	Transportation equipment	16.60	25	Public administration and defence	8.54
6	Printing, publishing and reproduction of recorded media	11.51	16	Furniture and other manufacturing products	15.65	26	Educational and health service	4.43
7	Petroleum and coal products	33.42	17	Electric, gas, and water services	14.59	27	Social and other services	5.43
8	Chemicals and allied products	20.13	18	Construction	8.95	28	Dummy sector	17.33
9	Non-metallic mineral products	10.77	19	Wholesale and retail trade	3.67			
10	Primary metal products	23.30	20	Eating and drinking places, and hotels and other lodging places	5.70			

To relate the price changes of the medium-scale 77 sectors in the 1995 input-output table with six groups of goods (food, fuel, clothing, service, transport, and others), the 77 industry sectors in the input-output table are matched to the 504 consumption items in the Family Income and Expenditure Survey (FIES) of Korea. In many cases the basic-scale 402 sectors in the input-output table are also examined because the consumption items in the FIES are not necessarily matched with the 77 industry sectors in the input-output table. After matching sectors between the 1995 input-output table and the FIES, the price changes for aggregated groups of goods are obtained from weighting price changes of 77 sectors. The amounts of private consumption of each sector in the 1995 input-output table are used for the weights<sup>33</sup>.

### **Price estimation results and comparison**

Table 32 presents both the estimated price increase rates by 59.55 percent devaluation using the input-output method and the actual price changes from 1996-97 to 1998-99.

The latter values are included in the table for comparison. As in the top row of the table,

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<sup>33</sup> The matching table is reported in Appendix IV. The matching method is described in detail in the unpublished paper by the author, 'Matching sectors between the 1995 Input-Output table and the Family Income and Expenditure Survey of Korea'.



the estimated price increase rates by currency devaluation for fuel, clothing, and transport are higher than those for the other consumption goods. Both relative and absolute price changes appear to be significant. Looking at the bottom row of the table, the actual price increase rates for fuel and transport appear to be much higher than those for the other four goods.

**Table 32 Price changes by 59.55 % devaluation and the actual price changes for six commodity groups**

(Unit: Percent)

	<i>Food</i>	<i>Fuel</i>	<i>Clothing</i>	<i>Service</i>	<i>Transport</i>	<i>Others</i>
Devaluation	9.62	18.53	19.46	4.56	16.98	12.99
Actual	11.46	30.44	6.10	7.48	34.97	4.91

Note: Actual price changes are compared the average price indices between 1996-97 and 1998-99.

In comparing two rows there are some differences between the pairs of price increase rates. In particular the price changes for fuel and transport are much larger in actual than in the estimated price by devaluation. In addition the price change for clothing is much smaller in actual than in the estimated price by devaluation. These differences between the actual and the estimated price change rates might put the price estimation method using the input-output methodology into question. However the input-output method

would be justified if the price differences can be properly explained, because the welfare analysis in this paper concerns the welfare impact of price changes caused by massive devaluation after the economic crisis.

Regarding the price differences in fuel and transport commodity groups, the difference in price increase rates between in actual and in estimation mainly results from the increase in indirect tax rates after 1995. Since the 1995 input-output table does not reflect the tax rate increase after 1995, the estimated price change rates using the input-output table would be less than the actual price change rates. Transportation tax on gasoline increased by 112.3 percent from 195 won per litre in 1995 to 414 won per litre in December 1996<sup>34</sup>. This might result in the difference in price increase rates for transport. Transportation tax on diesel increased by 84.6 percent from 26 won per litre in 1995 to 48 won per litre in January 1997. Special consumption tax on kerosene increased by 150 percent from 10 won per litre in 1995 to 25 won per litre in January 1997. These two changes in tax rates might result in the difference in price increase rates for fuel.

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<sup>34</sup> Since there is 15 percent of Education tax that is levied on Transportation tax, the total increase rate would be 129.1 percent.

Regarding the price difference in clothing goods, the estimated price increase rate is 19.46 percent, while the actual rate is 6.10 percent. Since there was no significant change in indirect tax rate for clothing after 1995, the difference in price increase rate might arise from demand side combined with supply side. With the opening of the Korean market in the 1990s, foreign luxurious clothing was imported largely. The high price level of this luxurious clothing might be reflected in the 1995 input-output table.

Therefore the estimation of price increase caused by currency devaluation using the input-output table would result in the high price increase rate. However the currency devaluation might not affect the price of clothing considerably. The Korean consumers might stop or delay spending on the luxurious clothing after the economic crisis. At the same time the import of foreign luxurious clothing might be stopped or delayed after the economic crisis. In consequence the actual price change rate of clothing (6.10 %) turns out to be much less than the estimated price change rate (19.46 %).

## **4.2 Evaluating welfare loss**

### **Estimating demand system**

Demand system estimation is required to measure welfare costs properly in this analysis. The reason is that the price changes caused by massive devaluation are significant in

relative term as well as in absolute term. Therefore there must be considerable substitution effects by significant price changes for individual households. The Quadratic Almost Ideal Demand System (QAIDS) is employed to estimate demand system of the Korean households. The system is briefly reviewed in Section 2. The data used for estimating demand system is the Family Income and Expenditure Survey (FIES) of Korea from 1991 to the third quarter of 1997. Since the exchange rate of the Korean currency started to increase sharply from October 1997, the dataset excludes the data after September 1997. The sample size is 76,834 households in total.

Table 33 presents the share equation estimation results for six commodity groups. The characteristic variables used in the estimation contain: time variables such as trend, quarter dummies, characteristic dummy variables such as Seoul, salary, smoker, and car, and some demographic variables such as household size, number of kids who are younger than 20 years of age, number of the employed member, household head age, and age-squared. This demand system is quadratic in the logarithm of total expenditure. Total income variable is used as instrumental variable. All prices are logarithmic form. The homogeneity and symmetry constraints are imposed. The values of t-ratio are in parenthesis. As shown in the table, the estimation results appear to be significant from the t-ratios point of view.

**Table 33 Results of estimating demand system using the QAIDS from 1991 to the third quarter of 1997**

Test of homogeneity and symmetry:  $\chi^2(15) = 191.70241$

Variable	<i>Dependent variable</i>											
	FOOD		FUEL		CLOTHING		SERVICE		TRANSPORT		OTHERS	
CONST	1.357	(20.9)	0.094	(1.2)	0.166	(0.9)	-0.874	(-3.3)	0.268	(4.2)	-0.011	(-0.1)
TREND	-0.014	(-21.0)	-0.001	(-1.4)	0.002	(1.0)	0.014	(5.1)	-0.002	(-2.4)	0.001	(0.9)
QUART1	-0.028	(-25.6)	0.011	(18.9)	-0.014	(-10.7)	0.018	(8.7)	0.006	(7.8)	0.008	(8.7)
QUART2	-0.017	(-16.1)	-0.024	(-57.4)	-0.002	(-2.6)	0.029	(22.2)	0.010	(15.8)	0.003	(4.2)
QUART3	0.013	(12.3)	-0.037	(-90.2)	-0.016	(-19.6)	0.037	(28.4)	0.006	(8.6)	-0.002	(-2.5)
SEOUL	0.001	(0.6)	-0.003	(-9.9)	-0.020	(-28.7)	0.025	(23.3)	0.001	(1.0)	-0.003	(-5.5)
SALARY	-0.015	(-17.1)	0.002	(5.8)	-0.002	(-2.5)	0.004	(3.4)	0.011	(20.0)	0.000	(0.6)
SMOKER	-0.007	(-10.0)	-0.002	(-6.4)	-0.008	(-14.4)	0.020	(22.6)	0.005	(10.7)	-0.007	(-17.0)
CAR	-0.015	(-17.7)	0.001	(3.5)	-0.012	(-18.6)	-0.023	(-22.2)	0.057	(109.2)	-0.007	(-14.3)
SIZE	0.029	(52.5)	0.008	(38.3)	-0.010	(-23.5)	-0.019	(-28.0)	-0.005	(-15.6)	-0.003	(-7.7)
KIDS, age < 20	-0.011	(-17.7)	-0.005	(-22.5)	0.002	(4.3)	0.016	(21.9)	-0.007	(-19.9)	0.005	(13.4)
EMPLOYED	-0.029	(-46.1)	-0.004	(-18.2)	0.010	(20.1)	0.019	(24.3)	0.009	(22.4)	-0.004	(-10.3)
AGE	0.004	(11.6)	0.000	(2.1)	-0.004	(-17.2)	0.002	(4.9)	-0.002	(-9.5)	0.000	(1.4)
AGE2	-0.000	(-6.4)	0.000	(1.0)	0.000	(13.2)	-0.000	(-6.4)	0.000	(7.4)	-0.000	(-1.6)
Ln (Exp)	-0.072	(-5.6)	-0.036	(-7.5)	0.056	(5.6)	0.081	(5.2)	-0.003	(-0.4)	-0.025	(-3.2)
[Ln (Exp)] <sup>2</sup>	0.009	(2.6)	0.001	(0.5)	0.003	(1.1)	-0.001	(-0.3)	-0.002	(-1.0)	-0.010	(-4.4)
Food price	-0.003	(-0.2)	-0.039	(-6.8)	0.005	(0.4)	0.023	(1.3)	0.011	(1.4)	0.004	(0.5)
Fuel price	-0.039	(-6.8)	0.008	(0.9)	-0.034	(-2.5)	0.074	(3.6)	0.009	(1.4)	-0.018	(-2.3)
Cloth price	0.005	(0.4)	-0.034	(-2.5)	0.072	(2.2)	-0.033	(-0.7)	-0.042	(-3.7)	0.033	(2.0)
Service price	0.023	(1.3)	0.074	(3.6)	-0.033	(-0.7)	-0.105	(-1.3)	0.009	(0.5)	0.033	(1.2)
Trans price	0.011	(1.4)	0.009	(1.4)	-0.042	(-3.7)	0.009	(0.5)	0.047	(5.4)	-0.033	(-4.4)
Others price	0.004	(0.5)	-0.018	(-2.3)	0.033	(2.0)	0.033	(1.2)	-0.033	(-4.4)	-0.019	(-1.5)

Note: All prices are logarithmic prices.

Quart1, Quart2, Quat3, Seoul, Salary, Smoker, Car are dummy variables

T-ratios are shown in parenthesis.

### **Evaluating household welfare loss**

Using the estimated coefficients obtained from the estimation of demand system, the welfare loss caused by price changes from devaluation after the economic crisis is evaluated. The second order approximation of welfare measure proposed by Banks, Blundell, and Lewbel (1996) is employed to measure welfare loss capturing substitution effects by significant price changes. The measure is briefly reviewed in Section 2. As in the previous sub-sections, the 59.55 percent devaluation of the Korean currency is the starting point of evaluation in the welfare impact of the economic crisis in the analysis. The price increase rates for six goods caused by devaluation are used for the estimation of welfare loss by the economic crisis. The data used contains the households from 1996 to the third quarter of 1997. The sample size is 20,516 households in total.

Table 34 presents the estimated welfare loss by the economic crisis. The welfare loss is evaluated as a percentage of the indirect utility value before the economic crisis. The indirect utility levels for individual households are those obtained from estimating demand system using the Quadratic Almost Ideal Demand System (QAIDS) as in the previous sub-section.

**Table 34 Estimated welfare loss as a percentage of the indirect utility level before the economic crisis**

$\rho$	Total	3 bottom deciles		4 middle deciles		3 top deciles	
		Mean	Proportion	Mean	Proportion	Mean	Proportion
-1.7	-16.9	-28.6	50.6	-14.8	35.0	-8.2	14.5
-1.5	-11.3	-18.1	48.0	-10.2	36.0	-6.0	16.0
-1.3	-7.6	-11.5	45.5	-7.0	37.0	-4.4	17.5
-1.0	-4.3	-5.9	41.7	-4.1	38.2	-2.9	20.1

Note:  $\rho$  stands for the inequality aversion parameter.

There are total means of welfare loss in the first column of the table. The estimated welfare loss for each household is aggregated by income deciles. The values of welfare loss by income deciles are arranged by grouped deciles: three bottom deciles, four middle deciles, and three top deciles. Each panel of the grouped deciles has two columns: the mean value of welfare loss and the proportion of welfare loss to the total.

Four inequality aversion parameters,  $\rho$ , are used: -1.7, -1.5, -1.3, and -1.0<sup>35</sup>. As the

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<sup>35</sup> Atkinson (1970) implicitly suggested that the inequality aversion parameter lie between -1.5 and -2.0. However there might be no absolute standard on the degree of the inequality aversion parameter. It might vary according to countries as well as periods of concern. In this paper the parameter between -1 and -1.7 will be used for the analysis.

absolute value of the parameter increases, the welfare measure gives more weight to the lower levels of household income.

As shown in the first column, the total mean welfare loss accounts for from 4.3 percent to 16.9 percent according to inequality aversion parameters. As the inequality aversion parameter is stronger, the evaluated welfare losses become larger. Looking at the mean values in each grouped deciles panel, the welfare loss is also larger at stronger inequality aversion parameter. For each parameter level, as the income deciles are lower level in income distribution the welfare loss become larger.

Looking at the proportions in each grouped deciles panel, the proportion of welfare loss borne by the three bottom income deciles is from 41.7 percent to 50.6 percent to the total welfare loss according to inequality aversion parameters. The proportion of welfare loss borne by the four middle deciles is from 35.0 percent to 38.2 percent to the total welfare loss according to inequality aversion parameters. The proportion of welfare loss borne by the three top deciles is from 14.5 percent to 20.1 percent to the total welfare loss according to inequality aversion parameters.



**Figure 23 Estimated welfare loss as a percentage of the indirect utility level before the economic crisis, arranged by income deciles with four inequality aversion parameters**

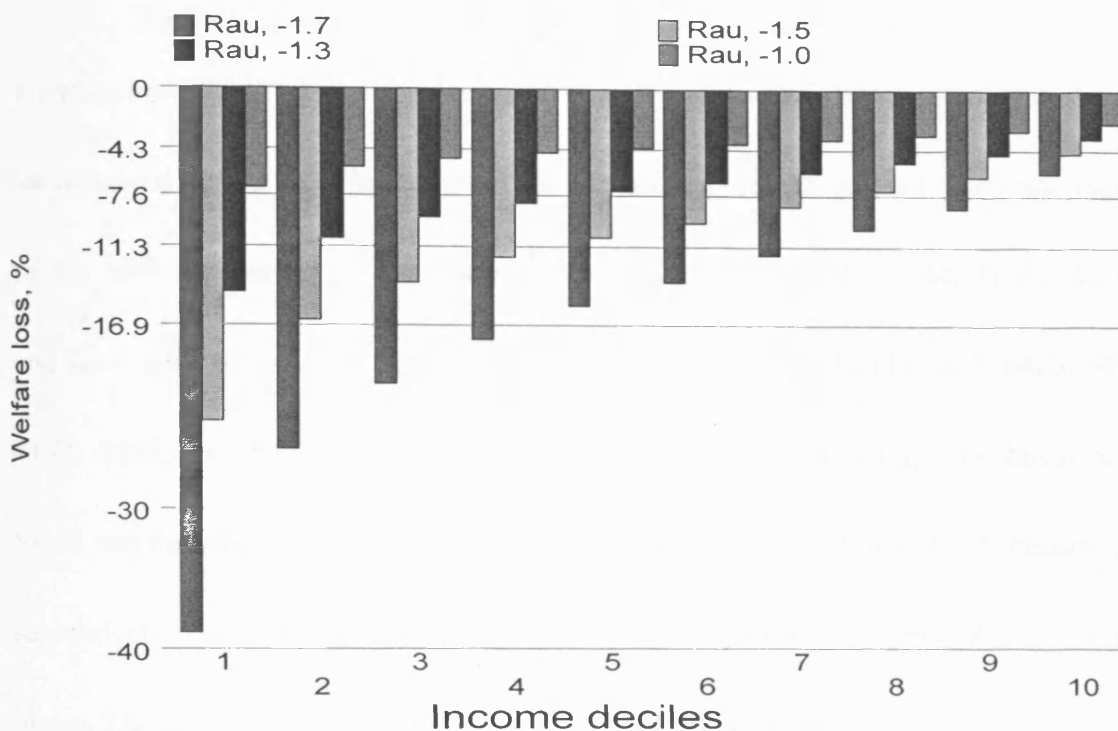


Figure 23 illustrates the estimated welfare loss for each income deciles with four inequality aversion parameters. Four mean values of welfare loss are indicated as the lines of the figure. This figure might present better picture for the pattern of welfare loss according to income deciles. It is clear that as the households belong to lower income deciles, the welfare loss borne by the households are larger. With stronger inequality aversion parameters, the welfare loss is estimated to be larger than with weaker

parameters. The difference of welfare loss among income deciles grows larger as the inequality aversion parameter is stronger.

### **Welfare impact by sub-groups**

To examine the difference in the impact on social welfare between sub-groups, the sample households used in the previous sub-section are categorized using age bands, region, and occupation. Six age bands are used: 15~24, 25~34, 35~44, 45~54, 55~65, and more than 65 years of age. The sample size of each age band is 822, 6423, 6696, 4171, 2093, and 300 households, respectively. Two regional groups are categorized: Seoul and the other part of the country. The sample size is 4,215 and 16,290 households, respectively. Two occupational groups are used: salary earners group and wage earners group. The sample size is 8,376 and 12,129 households, respectively.

Table 35 presents the estimate welfare loss of sub-groups as a percentage of the indirect utility level before the economic crisis. The degree of inequality aversion parameter is – 1.5<sup>36</sup>. The estimated welfare loss for each household is aggregated by income deciles.

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<sup>36</sup> Since the choice of the degree of inequality aversion parameter is subjective within a certain range, the results presented in the table should be considered as relative measurement rather than absolute one. In addition, as a result of using a number of parameter degrees the pattern of welfare loss by sub-groups appears not to change.

The values of welfare loss by income deciles are arranged for illustration by grouped deciles: three bottom deciles, four middle deciles, and three top deciles. There are three parts of the table. The top part concerns welfare loss by age bands. The middle part concerns welfare loss by regional groups. The bottom part concerns welfare loss by occupational groups. Each part has four panels: total mean value, three bottom deciles, four middle deciles, and three top income deciles. Each grouped income deciles has two columns: the mean welfare loss of the grouped deciles and the proportion of welfare loss of the grouped deciles to the total sum of welfare loss.

Looking at the top part of the table concerning welfare loss by age bands, the total mean value of welfare loss appears to be larger in the both ends of age band than in the middle age bands. Age bands '35~44' and '45~54' bear the smallest welfare losses (-8.1 % and -7.1 %, respectively), while age bands '15~24' and '65~' bear the largest welfare losses (-13.9 % and -18.0 %, respectively). This pattern might be consistent with the mean values within each grouped deciles with some exceptions in the three top deciles. In the panel of three top deciles the younger age bands tend to bear more welfare loss than the older ones. This result might suggest that the welfare loss borne by the youngest and the

oldest age bands are larger than that by the middle age bands after the economic crisis causing price changes<sup>37</sup>.

**Table 35 Estimated welfare loss by sub-groups as a percentage of the indirect utility level before the economic crisis: Age band, regional group, and occupational group**

$\rho = -1.5$	<i>Total</i>	<i>3 bottom deciles</i>		<i>4 middle deciles</i>		<i>3 top deciles</i>	
		<i>Mean</i>	Proportion	<i>Mean</i>	Proportion	<i>Mean</i>	Proportion
<i>Age bands</i>							
15 ~ 24	-13.9	-21.1	45.7	-13.0	37.5	-7.7	16.8
25 ~ 34	-10.5	-15.0	43.1	-9.9	37.9	-6.6	19.0
35 ~ 44	-8.1	-12.5	46.5	-7.4	36.4	-4.6	17.1
45 ~ 54	-7.1	-12.0	50.5	-6.0	33.6	-3.8	15.9
55 ~ 64	-9.2	-16.3	53.1	-7.7	33.3	-4.2	13.6
65 ~	-18.0	-31.8	53.0	-16.4	36.5	-6.3	10.5
<i>Regional group</i>							
<b>Seoul</b>	-7.2	-11.6	48.4	-6.4	35.7	-3.8	15.9
<b>Other part</b>	-10.3	-16.4	47.6	-9.3	36.1	-5.6	16.3
<i>Occupational group</i>							
Salary	-7.3	-11.5	47.1	-6.6	36.0	-4.1	17.0
Wage	-11.2	-17.4	46.4	-10.2	36.3	-6.5	17.3

<sup>37</sup> This is also consistent with the result in Chapter III in that the income impact was largely borne by the youngest and oldest age bands.

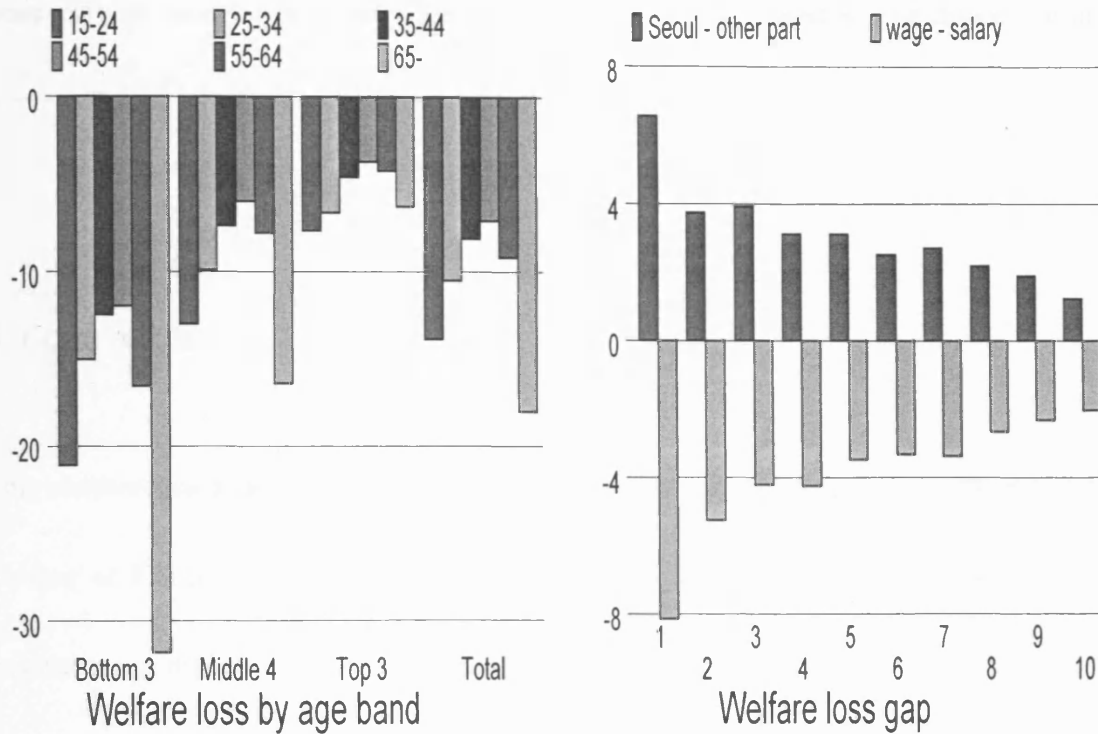
Looking at the proportion columns in the top part of the table, around 48 percent of the total welfare loss within each age band is borne by three bottom deciles while 15 percent of it is borne by three top deciles, although the amounts vary according to age bands. The households in three bottom deciles of the oldest age bands appear to bear larger proportion of welfare loss for each age band than those of the younger age bands do. Within both four middle deciles and three top deciles, the proportion of welfare loss for the younger age bands appears to be larger than that for the older age bands. This result might suggest that around half of welfare loss for each age band is borne by three bottom deciles and the relative proportion within three bottom deciles increases with older age bands.

Looking at the middle part of the table concerning welfare loss by region, the households in the other part of the country bears more welfare loss than those in Seoul by the economic crisis. The difference in welfare loss between the other part and Seoul tends to decrease from 4.8 percent in three bottom deciles to 1.8 percent in three top deciles. Around 48 percent of the total welfare loss for each regional group is borne by three bottom deciles, while around 16 percent of it is borne by three top deciles. The households in three bottom deciles of Seoul appear to bear slightly larger proportion of welfare loss for each group than those of the other part do.

Looking at the bottom part of the table concerning welfare loss by occupation, the households of wage earners group bears more welfare loss than those of salary earners group by the economic crisis. The difference in welfare loss between wage earners group and salary earners group also tends to decrease from 5.9 percent in three bottom deciles to 2.4 percent in three top deciles. Around 47 percent of the total welfare loss for each regional group is borne by three bottom deciles, while around 17 percent of it is borne by three top deciles. The households in three bottom deciles of salary earners group appear to bear slightly larger proportion of welfare loss for each group than those of wage earners group do.

Figure 24 illustrates welfare loss by sub-groups that is related with the previous table. There are two panels of the figure. The left-hand panel presents the estimated welfare losses by six age bands with three grouped income deciles. In the panel there are four parts of graphs: three bottom deciles, four middle deciles, three top deciles, and total. Each part contains six bars that indicate estimated welfare losses of six age bands. The level of welfare loss tends to decrease with higher grouped deciles. The welfare loss borne by the oldest and the youngest age bands is larger than that by the middle age bands as shown in the graphs of each part. The welfare loss borne by three bottom deciles of age band '65~' seems to be much larger than that by the others.

**Figure 24 Estimated welfare loss by sub-groups as a percentage of the indirect utility level before the economic crisis: Welfare loss by age band (left-hand panel) and welfare loss gap by region and by occupation (right-hand panel)**



The right-hand panel presents the differences in welfare loss both between regional groups and between occupational groups according to income deciles. The positive side of the panel shows that the welfare loss differences between Seoul and the other part. Since the welfare loss of the other part is larger than that of Seoul, the height of the bars indicates the amount by which the households in the other part bear more welfare loss than those in Seoul. The difference tends to decrease with higher income deciles. The

negative side of the panel shows that the welfare loss differences between salary earners group and wage earners group. Since the welfare loss of wage earners is larger than that of salary earners, the height of the bars indicates the amount by which the households of wage earners bear more welfare loss than those of salary earners. The difference also tends to decrease with higher income deciles as in the figure.

## *5. Conclusion*

This chapter examined the impact of the 1997 economic crisis on inequality and social welfare of Korea. Inequality analysis focused on income inequality and poverty. The income inequality dramatically increased in 1998 after the economic crisis: from 0.273 to 0.310 for the Gini coefficient, from 0.175 to 0.240 for the Atkinson index at  $-1.5$  inequality aversion parameter, and from 0.125 to 0.172 for the mean log deviation (MLD) index. In 1999 the inequality level appears not to improve despite of some economic recovery. 8.45 percent of the whole households additionally fell below the poverty line by the economic crisis in 1998. As a result of cross-country comparison with the 13 OECD countries, the inequality of Korea changed its position from the 5th rank to the 11th rank after the economic crisis. Before the crisis the levels of inequality and poverty of Korea were similar to those of Norway and Japan, while after the



economic crisis those of Korea became similar to those of Belgium and Australia.

Concerning inequality by income deciles, the highest deciles would be the least loser from the income decrease rate point of view as well as the main gainer from the income proportion point of view.

For inequality by age cohorts both within-cohort and between-cohort inequality increased with age. After the economic crisis the cohort inequality dramatically increased. For inequality by region the inequality difference increased in 1998 because the increase in inequality of the other part was larger than that in Seoul. For inequality by occupation the inequality difference increased in 1998 because the increase in inequality of wage earners group was larger than that of salary earners group. Concerning the decomposition of inequality between sub-groups, the dramatic increase in inequality after the economic crisis was mainly caused by within-group inequality rather than both between-group inequality and structural component.

Social welfare analysis focused on the estimation of welfare loss caused by price changes after the economic crisis. The input-output methodology was employed to obtain price changes caused by currency devaluation. 59.55 percent of currency devaluation was used for the cause of price change after the economic crisis. To aggregate price changes from the input-output method into six groups of goods, the

industry sectors in the input-output table were matched with the consumption items in the Family Income Expenditure of Korea. Demand system was estimated using the Quadratic Almost Ideal Demand System (QAIDS). The second order approximation of welfare measure was employed to estimate welfare loss.

Social welfare level decreased significantly after the economic crisis. 11.3 percent of social welfare decreased with  $-1.5$  inequality aversion parameter. For welfare loss by income deciles as the households belong to lower income deciles, the welfare loss borne by the households become larger. With stronger inequality aversion parameter, the welfare loss is estimated to be larger. For welfare loss by age bands the welfare loss borne by the youngest and the oldest age bands are larger than that by the middle age bands after the economic crisis. For welfare loss by region the households in the other part of the country bears more welfare loss than those in Seoul by the economic crisis. For welfare loss by occupation the households of wage earners group bears more welfare loss than those of salary earners group by the economic crisis. For each subgroup around half of welfare loss is borne by three bottom deciles, while around 15 percent of it is borne by three top deciles. The difference in welfare loss between subgroups tends to decrease with higher income deciles.

*Appendix IV Matching sectors between the Family Income and Expenditure Survey (FIES) and the 1995 input-output table of Korea*

Group	Item in the FIES	Item No. in the FIES <sup>(1)</sup>	Sector No. in the 1995 I-O table
1	Food	Food & beverages, less alcohol and meals outside the home <sup>(2)</sup>	100~359, 370~380 1~4, 9~15, 16(0.437) <sup>(3)</sup>
		Water charges	430-431 60 (0.431)
		Electricity	436 59 + WR <sup>(4)</sup> (0.030)
2	Fuel	Fuel	440~449 27 (Coal), 28(0.390 Petrol) + WR (0.054), 60 (0.569 LPG)
		Heating expenses for apartment	450 --
3	Clothing	For adults less children's items	[580~649], 19, 20, 21, 22, 23
		For children	589,591,592, 605,614,617, 632,642
		Meals outside the home	390~399 64 (0.779)
		Household services	570~579 69 (0.115) + WR (0.112)
		Clothing services	650~659
4	Service	Fee for medical consultation	680~689 72
		Tuition fee	690~698 71
		Supplemental education	706~719 --

Group	Item in the FIES	Item No. in the FIES <sup>(1)</sup>	Sector No. in the 1995 I-O table	
	Culture and recreational services	770~789	64 (0.221), 66 (0.097) + WR (0.149), 69 (0.610) + WR (0.112), 73	
4	Service	Communication	820~829	66 (0.903) + WR (0.149)
		Personal care service	860~869	--
				All services 74 (0.782)
	Public transportation services	800~809	65 + WR (0.070)	
	Parts purchase	813	37	
5	Transport	Petrol	814	28 (0.610) + WR (0.054)
		Repairs	815	--
		Insurance etc.	816 ~ 819	--
	Domestic utensils	526~539	25 (0.592) + WR (0.017)	
	Medicines	660~669	34 (0.526)	
6	Other	Medical appliances	670	53 (0.283)
	non-	Teaching material	700~705	--
	durables	Stationary	720~729	25 (0.408), 58 (0.058)
		Newspaper and books	730~739	26 + WR (0.023)
		Personal care	840~859	34 (0.474)
7	Alcohol	Alcoholic beverages	360~369	16 (0.563)
	Tobacco	Tobacco	830	18
		Rent paid	400	--
8	Housing	House mending	401~415	24, 36 (0.535), 40, 41, 44, 69 (0.013) + WR (0.112)

Group	Item in the FIES	Item No. in the FIES <sup>(1)</sup>	Sector No. in the 1995 I-O table	
	Others	420~429	--	
	Furniture	460~479	57	
	Household appliances	480~499	46, 47, 52	
	Kitchen utensils	500~519	39	
	Domestic utensils	520~ 525	36 (0.465), 45, 48	
9	Furniture	Bedding and cloth	540~559	--
		Decoration in rooms	560~569	38, 58 (0.122)
		Medical appliances	671, 672, 679	53 (0.283)
		Culture and recreation instrument	740~769	33, 35, 49, 50, 51, 53 (0.598), 58 (0.637)
		Car, motor, bicycle	810, 811, 812	54, 56
		Personal effects	870~880	53 (0.119), 58 (0.101)
10	Others	Miscellaneous	890~899	17, 67 (0.356) + WR (0.107), 69 (0.262) + WR (0.112), 74 (0.218)

1. Item classification is based on the 1998 FIES of Korea.

2. 'Meals outside the home' item is included not in food but in service group.

3. Aggregation is carried out using weights obtained from the amount of the private consumption in the 1995 input-output table. The weight is in the parenthesis.

4. 'WR' stands for Sector 63 wholesale and retail trade in the 1995 input-output table. This sector is treated not as a commodity, but as an intermediate stage of industry. Thus even if all 77 sector prices increase by the same rate, the prices of aggregate commodity groups including the wholesale and retail trade sector increase more.

## Chapter V. Conclusions

This thesis examined the impact of the 1997 economic crisis on the Korean economy.

The study concerned what happened to the Korean economy after the economic crisis rather than why and how the economic crisis happened. The analysis focused on the impact of economic crisis on labour market, household economy, and social welfare.

The analysis of labour market impact focused on both female labour force participation and male unemployment duration. The analysis of household economy impact focused on both household income and consumer behaviour. The analysis of social welfare impact focused on both inequality and social welfare. Two micro level datasets are used: the 1998 Korean Labor and Income Panel Study (KLIPS) and the Family Income and Expenditure Survey (FIES) of Korea from 1991 to 1999.

### **Impact on labour market**

The 1997 economic crisis of Korea heavily affected labour market. For the analysis of female participation, the probit estimation was implemented. Whether females are

college graduates or not played the most critical role in female labour force participation both before and after the crisis. In total the predicted participation probability decreased, on average, by 12.8 percent after the economic crisis. Females with the characteristics of college graduation, marriage, and professional previous occupation confronted more difficulties in participating in the labour force after the economic crisis. The economic crisis impacted more heavily on the participation of young females than on that of aged females. The economic crisis impacted more heavily on the participation of females with previous job in unskilled occupation as well as in service part. The economic crisis impacted more heavily on the participation of females who previously participated in construction, manufacturing, and social and other services industries.

For the analysis of male unemployment duration, the dataset is estimated using the Cox proportional hazard model. The increases in age and regional unemployment rate caused the male unemployed to face lower chances of being employed. In total the conditional probabilities, hazard rates, of being employed decreased, on average, by 36.6 percent after the economic crisis. Males with positive value of college, couple, kid, home ownership, Seoul, and professional dummies faced more difficulties in being employed after the economic crisis. The economic crisis impacted more heavily on the chances of

being employed for young males than on those for aged ones. The economic crisis impacted more heavily on the chances of being employed for the male unemployed with previous job in professional, unskilled part, and service sectors. The economic crisis impacted more heavily on the chances of being employed for the male unemployed who previously worked in finance and insurance, educational services, and eating and drinking places and hotel industries.

### **Impact on household economy**

The household economy was also severely affected by the 1997 economic crisis. In 1998 the level of median income of the sample households from the FIES of Korea sharply decreased by 15.9 percent down to the level in 1994. As results of the analysis on income impact among age cohort groups, the economic crisis more heavily affected the household incomes for both those in early thirties and in the fifties in 1998. As cohorts are younger they tended to recover more quickly than the aged cohorts in 1999. In general the difference in the impact of economic crisis among age groups would be more distinct in the period of economic recovery than in the period of initial economic crisis.



Comparing the income impacts between Seoul and the other part of the country, the household income of Seoul was more heavily affected by the economic crisis than that of the other part of the country. The income gap between two regions decreased after the economic crisis. Comparing the income impacts between salary and wage earners groups, the household income of wage group was more heavily affected by the economic crisis than that of salary group. Unlike the result on the regional difference, the income gap between salary and wage earners groups increased after economic crisis. This might suggest some inequality and social welfare concerns caused by the economic crisis in Korea.

To capture the change in consumer behaviour after economic crisis, the Engel curves for six expenditure shares were estimated. The nonparametric Kernel regression is employed. The estimated Engel curves were compared between before and after the economic crisis. The Engel curves for fuel, service, and transport shares shifted up, while those for food and clothing shares sifted down after the economic crisis. Among the Engel curve movements, the movements of food and service curves turned out to be different from the expectation based on the estimation results of income elasticity. Since the elasticity estimation suggested that food share show necessity characteristics and

service share show luxury characteristics, it was expected that the Engel curve for food share shift up and the Engel curve for service share shift down in the face of economic hardship.

To examine these results more closely, the cohort analysis including decomposition method was employed. As a result of decomposition of the effects, the Korean consumers turned out to increase food share and to decrease service share after the economic crisis, as expected from estimating income elasticities. The age effect caused by the time difference between the comparing two datasets might offset the macroeconomic impact on expenditure shares for food and service. To sum up the Korean consumers increased food, fuel, and transport shares and decreased clothing and service shares in the face of economic hardship after the economic crisis.

### **Impact on inequality and social welfare**

The analysis of inequality consists of income inequality and poverty. The income inequality considerably worsened in 1998 after the economic crisis: from 0.273 to 0.310 for the Gini coefficient, from 0.175 to 0.240 for the Atkinson index at  $-1.5$  inequality aversion parameter, and from 0.125 to 0.172 for the mean log deviation (MLD) index..

In 1999 the inequality level appeared not to improve despite of some economic recovery. 8.45 percent of the whole households additionally fell below the poverty line after the economic crisis in 1998. As a result of cross-country comparison with the 13 OECD countries, the inequality of Korea degenerated its position from the 5th rank to the 11th rank after the economic crisis. Concerning inequality by income deciles, the highest deciles would be the least loser from the income decrease rate point of view as well as the main gainer from the income proportion point of view.

For inequality by age cohorts, both within-cohort and between-cohort inequality increased with age. After the economic crisis the cohort inequality dramatically increased. For inequality by region, the income inequality in the other part of the country was larger than that in Seoul throughout the 1990s. The inequality difference between Seoul and the other part increased in 1998 after the economic crisis. For inequality by occupation, the income inequality of wage earners was larger than that of salary earners after 1992. The inequality difference increased in 1998 after the economic crisis. Concerning the decomposition of inequality between sub-groups, the dramatic increase in inequality after the economic crisis was mainly caused by within-group inequality rather than either between-group inequality or structural component.

Social welfare analysis focused on the estimation of welfare loss caused by price changes after the economic crisis. The input-output methodology was employed to obtain price changes caused by currency devaluation. To aggregate price changes using the input-output method from six groups of goods, the 77 industry sectors in the 1995 input-output table were matched with the 504 consumption items in the FIES. Demand system was estimated using the Quadratic Almost Ideal Demand System (QAIDS). The second order approximation of welfare measure was employed to estimate welfare loss.

Social welfare level significantly decreased after the economic crisis. On average, the household indirect utility decreased by 11.3 percent with  $-1.5$  inequality aversion parameter. The households that belong to lower income deciles bore more welfare loss after the economic crisis. The welfare losses borne by the youngest and the oldest age bands were larger than those by the middle age bands after the economic crisis. The households in the other part of the country bore more welfare loss than those in Seoul by the economic crisis. The wage earners group bore more welfare loss than the salary earners group. For each group around half of welfare loss was borne by three bottom deciles, while around 15 percent of it was borne by three top deciles.

### **Did the crisis end?**

Five years have passed since the Korean economic crisis took place as of 2002. After 1999 the Korean economy appeared to recover from the crisis. The GDP growth rate accounted for 9.3 percent in 2000 and 3.1 percent in 2001. The per capita gross national income increased to 9,770 US dollar in 2000 and 8,900 US dollar in 2001. The growth rate of household consumption expenditure was 7.9 percent in 2000 and 4.2 percent in 2001. The unemployment rate decreased to 4.1 percent in 2000 and 3.7 percent in 2001. The average exchange rate to US dollar accounted for 1,259.7 in 2000 and 1,326.1 in 2001. The Korean government paid off all of the loans to the International Monetary Fund as of August 2001. The foreign exchange reserve accounts for over 102 billion US dollar as of December 2001.

Taking a long view of the effect of the 1997 economic crisis, however, the crisis might not end at all. The Korean economy is suffering from a number of problems. The financial sectors are vulnerable in spite of restructuring. The corporate sectors are still in deep trouble. Exports are declining. Price and exchange rate are unstable. More and more parts of the economy become to be controlled by foreign capital. All these

problems are not necessarily the direct effect of the 1997 economic crisis, of course. In the long run it would be much clearer how the economic crisis in 1997 affected the Korean economy as well as Korea as a whole. This thesis might be one starting point of the longer and more thorough understanding of the 1997 economic crisis of Korea. The contribution of the thesis would be that the short-term effect of the 1997 economic crisis was examined using microeconomic approach on labour market, household economy, and social welfare.

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