

## **Inflation Rate Variations across Household: Empirical Evidence from Taiwan**

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### **ABSTRACT**

The variability in the rates of inflation across household groups is an important public policy issue. In this empirical study using Taiwan's household expenditure data for the period 1991-1996, we found statistically significant evidence to support the claim that different household groups face differential price changes, and that these variations are persistent over time. We also found an inverse relationship between the inflation rates faced by each household group and the household income level; in particular, the poorest group faced an inflation rate that was significantly higher than the general population by 0.15 percentage point annually. In light of the results of this study, and taking into consideration the intrinsic value of the group-specific price indexes, we recommend the current welfare programs be linked to these indexes.

*JEL: D12, J10*

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## I. INTRODUCTION

The possibility of variability of the inflation rates faced by different household units and household groups has long been an important public policy issue in the literature. It is essential to clarify such an issue, for it has important normative implications for public policies. In order to take into consideration the impact of price changes on the cost of living, numerous public policies in the United States (especially those related to social welfare spending) have included the escalator clauses, which would automatically call for cost-of-living adjustments, normally using the aggregated Consumer Price Index (CPI) as the basis for adjustment.<sup>1</sup>

Different public policies would, however, affect different household groups. Both conceptually and theoretically, different household groups will face different rates of inflation because of the differentials in their expenditure patterns.<sup>2</sup> On the one hand, the CPI as a fixed-weight Laspeyres index has a number of inherent shortcomings that reduce its usefulness as a cost-of-living index (Boskin, Dulberger, Gordon, Griliches, and Jorgenson, 1998; Deaton, 1998). On the other, the CPI cannot correctly reflect the movements in the cost of living faced by different household groups, either overstating or understating their inflation experience relative to the other groups (Idson and Miller, 1997; Idson and Miller, 1998).

Failure to adjust correctly the changes in the cost of living across household would not only distort the distribution of income and consequently aggravate economic inequality, but also have serious fiscal implications for government budget.<sup>3</sup> This is why the merit of such cost-of-living-indexing method based only on the CPI has been questioned and criticized. This is also why researchers have increasingly stepped up the urge for the government to construct group-specific price indexes as a remedy.

As an on-going effort, a number of studies have been devoted in recent years to addressing this index number problem empirically. Generally, these studies have indeed found that there were variations in the rates of inflation faced by different household types in the United States. For example, Michael (1998) and Hagemann (1982) both find statistically significant, but not persistent, differences in measured price indexes across different household groups. For studies that are more restricted in scope, the empirical results are somewhat mixed, but still support the general preposition that there are variations in the inflation experience across household groups. Amble and Stewart (1994) focus on an experimental price index for the elderly in the period 1987-1993, and finds the elderly face relatively higher inflation rates, which are in large part due to relatively faster price increases in medical care that in turn represents a relatively larger share of the elderly household group's expenditure over the period studied. Moulton and Stewart (1999) give an overview of the experimental price indexes and come to the same conclusion with regards to the inflation rates faced by the elderly group. Jorgenson and Slesnick (1999), using an econometric method to measure the group cost-of-living index over the period 1947-1995, report a similar finding for the elderly households since 1980. Boskin and Hurd (1985), however, do not find the elderly as a group experiences higher inflation rates than the general population over the period 1961-1981.

As for household groups with different income levels, Garner, Johnson and Kokoski (1996) investigate the inflation rates faced by the poor relative to that of the general population, and concludes that the poor and the general population face similar price trends over the period 1984-1994. Moulton and Stewart (1999) reiterate the findings of Garner, et al. Idson and Miller (1997) investigate the inflation rates faced by different household types with different educational level for the head of the household. They find that households with lower educational level for the household head normally face higher inflation rates than those households where the household head are relatively more educated. Idson and Miller (1999) investigate the inflation rates faced by household types with children and those without children and find that households with children generally faced relatively lower rates of inflation.

In recognition to the possibility of different inflation experience across household groups and in light of the empirical findings by the above-cited studies, the Bureau of Labor Statistics (BLS) of the U. S. Department of Labor has since 1988 begun to develop an experimental CPI for the elderly, but had no plans to update the experimental price index for the poor (Amble and Stewart, 1994, p. 11; Moulton and Stewart, 1999, p. 149).<sup>4</sup> In Taiwan, calls to improve economic justice and equality has risen rapidly in recent years as a result of successful economic development. An increasing number of public programs, in emulating the practices in the developed countries, have also begun to be indexed with a view to reflecting better the impact of inflation on living costs. To name just a few of such public policies: income tax exemptions and tax bracket adjustments; inheritance and gift tax exemptions and tax bracket adjustments; land price adjustments for land value increment tax; and adjustments of the minimum wage.<sup>5</sup>

The principal objective of this paper is to investigate empirically the appropriateness of using the CPI as the basis for the cost-of-living adjustments in various entitlement programs in Taiwan. Our analysis is undertaken in two steps. The first investigates whether or not there are statistically significant differentials in the rates of inflation across household groups in Taiwan. Since the first step yields positive results, we then move on to the logical second step to calculate relevant inflation rates for demographic-specific household groups differentiated by income and age of the household head, respectively. We concentrate our effort on these two demographic variables not on any *a priori* theoretical ground, but solely because there have been growing concerns for these two socially disadvantaged groups in public debate. We then proceed to evaluate the rates of inflation faced by the poorest group and by the elderly group. Our results show that, first, there are indeed statistically significant and persistent variations in the rates of inflation for some household groups in Taiwan, and second, the poorest (i.e., the first) income group does face higher than average inflation rates. The elderly household group (i.e., those 65 and over), however, does not.

This paper is organized as follows: Section II lays out the relevant equations to test the relations of household characteristics to the inflation rates, and analyzes the empirical results. The sources of data are also briefly discussed. Section III investigates possible variations in the rates of inflation for household groups characterized by such demographic factors as income and age, respectively. Section IV concludes this study.

## II. HOUSEHOLD DEMOGRAPHIC CHARACTERISTICS AND THE RATES OF INFLATION

### A. Household-specific Consumer Price Index and Sources of Data

The *Laspeyres* formula for the household price index,  $PI_t^h$ , for the  $h$ th household in time  $t$  can be expressed either as:

$$PI_t^h = \sum_i \frac{Q_{i0}^h P_{it}}{\sum_{i=1}^n Q_{i0}^h P_{i0}} \times 100 \quad (1)$$

or alternatively as:

$$PI_t^h = \sum_i w_{i0}^h \cdot \left( \frac{P_{it}}{P_{i0}} \right) \times 100 \quad (2)$$

where

$$w_{i0}^h = \frac{Q_{i0}^h P_{i0}}{\sum_{i=1}^n Q_{i0}^h P_{i0}} \quad (3)$$

In the specification above,  $w_{i0}^h$  is the weight of spending of the  $h$ th household on the  $i$ th commodity in the base year;  $\left( \frac{P_{it}}{P_{i0}} \right)$ , the price ratio of the  $i$ th commodity in year  $t$  to the base year, year  $0$ ; and  $Q_{i0}^h$ , the quantity consumed by the  $h$ th household on the  $i$ th commodity in year  $0$ .

To calculate  $PI_t^h$  in equation (1), data on both price and quantity are necessary. However, data on quantity are normally lacking. To get around this problem, we use equation (2), in which data on both itemized household expenditure and prices are needed. The itemized household expenditure data in the base year are taken from *The Survey of Family Income and Expenditure in Taiwan Area of the Republic of China*. The survey data are on magnetic tape available from the Directorate-General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, the Republic of China. This survey contains data on 14,830 non-agricultural household units and their spendings on 382 items of goods and services in 53 categories. Data for  $P_{it}$  are from the *Price Statistics Monthly in Taiwan Area of the Republic of China, 1991 through 1996*, which includes price data for 42 categories of commodities. The bulletin is also published by the DGBAS. Because of the somewhat different classifications of commodity categories in these two separate sets of data, we have to reclassify the data into 38

expenditure categories in order to come up with corresponding match for expenditures and commodity prices. Appendix A provides a list of these 38 commodity categories.

We use the expenditure data on the 38 commodity categories by the 14,830 household units to computer for each household the expenditure share on each category of commodities. We then take these shares as weights to calculate the year-to-year price index for each household. The results are then utilized as input to provide data for the dependent variable in the multiple regression model to be discussed next.

### B. Specifications of the Multiple Regression Model

Operationally, Equation (2) is used to calculate the household price index. As mentioned earlier, consumption patterns and spending structure will both be affected not only by commodity prices and household income, but also by other household demographic characteristics. For the purpose of establishing the relations of household demographic characteristics to the variations in the rates of inflation across household types, we use the regression equation<sup>6</sup>:

$$Y_t^h = \alpha_{t0} + \sum \alpha_{t1i} \cdot x_{1i}^h + \dots + \sum \alpha_{t5i} \cdot x_{5i}^h + \varepsilon_t^h$$

$$t = 1992, \dots, 1996; h = 1, \dots, 14,806 \quad (4)$$

where  $Y_t^h$  is the price index of the  $h$ th household in time  $t$  to time  $t-1$ ; that

is  $\frac{PI_t^h}{PI_{t-1}^h} \times 100$ .  $x_{ji}^h$  are dummy variables for the  $i$ th household group with the  $j$ th

household demographic characteristics,  $j = 1, \dots, 5$ . The five household demographic characteristics variables included in this study are: (1) income level of the household; (2) the age of the household head; (3) the educational level of the household head; (4) types of family members with or without children in the household; and (5) areas of residence of the household. For a more detailed classification of the household demographic characteristics, please see Appendix B.

$\alpha_{t0}$  represents the average price index ratio of the reference household in year  $t$  to year  $t-1$ . For this study, the reference household is chosen for those with the minimum variations in the rates of inflation compared with the overall inflation rates. Such reference household is the household with the sixth income level, where the head of the household is 35 to 49 years of age; the head of the reference household is high school graduate, without children, and lives in suburban areas. The regression coefficients,  $\alpha_{tji}$ , represent the average variation in the rates of inflation for the  $i$ th household group with the  $j$ th demographic characteristics in year  $t$ . Finally,  $\varepsilon_t$  is the disturbance term.

### C. Empirical Results

Table 1 reports regression results for the year-to-year and the pooled (1991-1996) data set. For each of the regression models, the goodness of fit,  $R^2$ , is between 0.10 (for year

1994-1995) and 0.21 (for year 1995-1996). Our  $R^2$ , though not large in absolute terms, are in line with the results of Michael (1979) and Hagemann (1982). The  $F$  values are between 73.865 and 175.285, all are significantly larger than the critical value of  $F_{0,01}(23, 14,806) = 1.81$ , strongly indicating that there are variations in the rates of inflation across household types with different demographic characteristics.

**Table 1**  
Regression results for year-to-year and "total period" price changes on household characteristics

Variables	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1991-1996
Constant	104.716** (0.041)	102.792** (0.023)	103.985** (0.027)	103.553** (0.016)	102.796** (0.020)	119.176** (0.119)
The Lowest Income Level	0.507** (0.042)	0.042 (0.024)	0.317** (0.027)	0.005 (0.017)	0.029 (0.021)	1.030** (0.122)
The Second Lowest Level	0.406** (0.039)	0.065** (0.022)	0.260** (0.025)	0.037* (0.016)	0.053** (0.019)	0.945** (0.113)
The Third Income Level	0.251** (0.039)	0.007 (0.022)	0.157** (0.025)	-0.002 (0.016)	0.023 (0.019)	0.502** (0.113)
The Fourth Income Level	0.169** (0.038)	0.042 (0.022)	0.136** (0.025)	0.013 (0.015)	0.025 (0.019)	0.443** (0.112)
The Fifth Income Level	0.106** (0.038)	0.016 (0.022)	0.064* (0.025)	-0.006 (0.015)	0.018 (0.019)	0.226* (0.112)
The Seventh Income Level	-0.005 (0.038)	0.031 (0.022)	0.010 (0.025)	0.018 (0.015)	0.005 (0.019)	0.066 (0.112)
The Eighth Income Level	-0.087* (0.039)	-0.008 (0.022)	-0.063* (0.025)	0.009 (0.016)	-0.027 (0.019)	-0.204 (0.112)
The Ninth Income Level	-0.234** (0.039)	-0.032 (0.022)	-0.130** (0.025)	-0.002 (0.016)	-0.056** (0.019)	-0.524** (0.113)
The Highest Income Level	-0.571** (0.039)	-0.147** (0.022)	-0.336** (0.026)	-0.061** (0.016)	-0.189** (0.020)	-1.499** (0.115)
65 and Over	0.229** (0.042)	0.048* (0.024)	0.100** (0.027)	-0.198** (0.017)	-0.156** (0.021)	0.019 (0.122)
50 to 64 Years Old	-0.008 (0.026)	0.040** (0.015)	0.006 (0.017)	-0.054** (0.011)	0.006 (0.013)	-0.012 (0.077)
20 to 34 Years Old	-0.167** (0.022)	-0.165** (0.013)	-0.170** (0.015)	-0.07** (0.009)	-0.224** (0.011)	-0.927** (0.065)
Under 20	0.362** (0.122)	0.180** (0.069)	0.189* (0.080)	0.114* (0.049)	0.283** (0.060)	1.309** (0.356)
6 or less Years of Schooling	0.270** (0.025)	0.006 (0.014)	0.172** (0.016)	0.035** (0.010)	0.047** (0.012)	0.609** (0.072)
9 Years of Schooling	0.161** (0.027)	-0.004 (0.015)	0.103** (0.017)	0.014 (0.011)	0.017 (0.013)	0.332** (0.077)

**Table 1 (continued)**

Variables	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1991-1996
More than 12 Years of Schooling	-0.158** (0.026)	0.080** (0.014)	-0.055** (0.017)	0.016 (0.010)	-0.020 (0.013)	-0.155* (0.075)
Single Parent w/ 1 to 2 Children	0.099 (0.052)	0.394** (0.030)	0.201** (0.034)	0.206** (0.021)	0.435** (0.026)	1.556** (0.152)
Single Parent w/ 3 or More Children	0.458** (0.096)	0.451** (0.055)	0.438** (0.063)	0.309** (0.039)	0.645** (0.048)	2.681** (0.281)
Both Parents w/ 1 to 2 Children	0.196** (0.023)	0.230** (0.013)	0.158** (0.015)	0.181** (0.009)	0.313** (0.011)	1.251** (0.066)
Both Parents w/ 3 or More Children	0.442** (0.028)	0.362** (0.016)	0.357** (0.018)	0.265** (0.011)	0.560** (0.014)	2.310** (0.081)
Urban Areas	0.118** (0.020)	0.159** (0.011)	0.093** (0.013)	0.067** (0.008)	0.049** (0.010)	0.561** (0.059)
Rural Areas	0.042 (0.030)	-0.101** (0.017)	-0.038 (0.020)	-0.041** (0.012)	-0.038* (0.015)	-0.207* (0.088)
F-Value	113.621**	75.277**	109.926**	73.865**	175.285**	118.889**
Standard error of estimate	1.093	0.352	0.470	0.177	0.268	9.317
R_square	0.1444	0.1006	0.1404	0.0989	0.2066	0.1501

( ): Standard errors in parentheses

\*: Statistically significant at 95 percent

\*\*: Statistically significant at 99 percent

For the year-to-year data, the regression results show that households with certain demographic characteristics *persistently* face higher rates of inflation than the reference group. These household groups are (1) those that have the second lowest household income; (2) those where the age of the household head is fewer than 20; (3) those with children; and (4) those that reside in urban areas. Conversely, the household groups that have the highest income level or those where the age of the household head is between 20 and 34 have lower inflation rates compared with those of the reference group.

For the pooled data set, the regression results (the last column of Table 1) shows the following: First, there exists a statistically significant inverse relationship for the income level and the rates of inflation; particularly, it is shown that the household groups with the lowest (i.e., the first), when compared with the reference household group (i.e., the sixth income level), faces a higher rate of inflation that is 1.03 percentage points higher over the period studied. In addition, it is also shown that the wealthiest (i.e., the tenth) household group faces the rate of inflation that is significantly lower than that of the reference household. The wealthiest group faces an inflation rate that is 1.50 percentage points lower than those of the reference group.

Second, there also exists an inverse relationship between the educational level of the household head and the rates of inflation. For the household group where the head

of the household has nine years of schooling, and the group where the household head has six or less years of schooling, the rates of inflation are significantly higher than those of the reference group (i.e., those with high school education) by 0.61 and 0.33 percentage point, respectively. For the household group where the head of the household has college level education or beyond, the rates of inflation are lower than those of the reference group by 0.16 percentage point.

Third, the household groups with children are shown to face higher rates of inflation than the childless reference household group. The household groups with children face an inflation rate that is between 1.25 percentage points (for those with two parents and 1 to 2 children) and 2.68 percentage points (for the household group with single parent and 3 or more children) higher than that of the reference group. It also appears that the more children the group has, the higher inflation rate they will face, and that one-parent group faces higher inflation rates than two-parents group.

Fourth, there is an inverse relationship between urbanization and the rates of inflation. The households residing in urban areas as a group faces higher rates of inflation than those in suburban areas (i.e. the reference group) by 0.56 percentage point. Conversely, the household group in rural areas faces lower inflation rates than those in suburban areas by 0.21 percentage point.

Our results differ somewhat with the findings by Michael (1979) and Hagemann (1982). Although they find statistically significant variations in the rates of inflation for some specific household types, the variations are not persistent; that is, the variations oscillate over time (Hagemann, 1982, p. 500). Our findings also show similar inflation experience across household groups with respect to the demographic characteristics, the differentials (either higher or lower than those of the reference group) are, however, *persistent* throughout the period covered in this study.

### III. THE GROUP-SPECIFIC PRICE INDEXES

Because of the potential policy implications of group-specific cost-of-living adjustments, there have been in the past two decades a number of studies on the inflation experience of different household groups in the United States, especially of the elderly and the poor group. These two groups are often seen to be the most under-privileged in any socio-economic ladder, thus becoming the specific target of some welfare programs.

As cited previously, some studies pay special attention to the elderly group (Amble and Stewart, 1994; Boskin and Hurd, 1985; Jorgenson and Slesnick, 1999; and Moulton and Stewart, 1999), while some others focus on the poor (Garner, Johnson, and Kokoski, 1996; and Moulton and Stewart, 1999). What follows is the computation of the demographic-specific prices indexes for different income levels and for household heads of different ages for the case of Taiwan. The main purpose of these exercises is to find out how the inflation experience of Taiwan's elderly and poor household groups might be different from the general population. In the meantime, we hope to gain some insight with respect to specific household's inflation experience by contrasting our results with those of the above-cited studies.

### A. The Income-Specific Group Price Indexes

The group-specific price indexes for different income levels for the 1991-1996 period can be calculated using a modified formula similar to equation (2) as follows:

$$PI_t^y = \sum_i w_{i0}^y \cdot \left( \frac{P_{it}}{P_{i0}} \right) \times 100, y = 1, \dots, 10 \quad (5)$$

where  $PI_t^y$  is the price index for income group  $y$  at year  $t$ ;  $W_{i0}^y$ , the aggregate expenditure weights on the 38 categories of commodities by household group  $y$  in the base year. The results are reported in Table 2.

**Table 2**

The group-specific price index for household with different income levels, 1991=100

	1992	1993	1994	1995	1996	Average Growth Rate (1991-1996) <sup>a</sup>
All Household Units	104.83	108.03	112.51	116.68	120.19	3.75
The Lowest (First) Income Level	105.50	108.67	113.57	117.66	121.11	3.90
The Second Income Level	105.38	108.63	113.46	117.70	121.32	3.94
The Third Income Level	105.25	108.43	113.17	117.38	121.00	3.89
The Fourth Income Level	105.13	108.39	113.10	117.34	120.98	3.88
The Fifth Income Level	105.07	108.30	112.92	117.13	120.76	3.84
The Sixth Income Level	104.95	108.17	112.73	116.93	120.53	3.81
The Seventh Income Level	104.89	108.14	112.66	116.88	120.45	3.79
The Eighth Income Level	104.82	108.05	112.50	116.71	120.27	3.76
The Ninth Income Level	104.60	107.79	112.11	116.27	119.71	3.66
The Highest (Tenth) Income Level	104.16	107.24	111.29	115.35	118.59	3.47

<sup>a</sup>: These growth rates are annual compound rates.

We see from Table 2 that during the six years from 1991 to 1996 the CPI for all household units was up by 20.19%, which is equivalent to a compound annual growth rate of 3.75%. In general, the CPI decreases with the income level. To put it differently, the higher is the household income level, the lower is the inflation rate faced by the corresponding household group. On the one hand, the inflation rates faced by the poorest and the second poorest household groups over the period studied were 21.11% and 21.32%, respectively. The inflation rates of these two groups were about one percentage point more than that of all household units (i.e., 0.92 and 1.13 percentage points higher, respectively). The compound annual growth rate was 3.9% and 3.94%, respectively, which was in turn higher by 0.15 and 0.19 percentage point than the overall figure for all household units.

On the other hand, the inflation rates faced by the second wealthiest and the wealthiest household groups were 19.71% and 18.59%, respectively. The inflation rates of these two groups were lower by 0.48 and 1.60 percentage points, respectively, than that of all household units. The compound annual growth rate was 3.66% and 3.47%, respectively, which was in turn lower by 0.09 and 0.28 percentage points than the overall figure for all household units. Moreover, a comparison of the rates of inflation faced by the wealthiest and the poorest household groups over the period 1991-1996 indicates that the difference margin can be as large as 2.52 percentage points against the latter group. As for the annual increase of the inflation rate, that of the former group is lower by 0.43 percentage point than that of the latter. It is evident from the Taiwan data that there is a difference in the rates of inflation across household groups distinguished by the income level.

Why does the relatively low (high) income household group face relatively high (low) rates of inflation? The price changes of each of the 38 categories of commodities included in this study together with the expenditure patterns of the household groups with different income levels may give us a clue. Table 3 reports relative current-to-base-year price ratios for each category of commodities. Table 4 shows base year expenditure patterns by households with different income levels on these 38 categories of commodities. First, from the last column of Table 3, we find four categories of commodities (i.e., fruits and processed fruit products; vegetables and processed vegetable products; fish and shellfish; and educational expenses) whose prices have increased over the period 1991-1996 by more than 40% cumulatively. From Table 4, we find the lower is the household income, the higher share of it is spent on fruits, vegetables, fish and their related processed products, all are in the category of Food and Beverages, which accounts for the largest chunk (35%) of the poorest group's expenditure. Particularly, it is shown that the poorest household group spent some 14.3% of their income on these three commodities together, whereas the wealthiest household group spent a relatively low 8.4% of their income on them.

Second, we find the lower is the household income, the higher is the share of it that is spent on Medicines and Medical Care. The costs of these types of commodities, however, did not show significant increases during the period 1991-1996. For example, the cost of medical care services has increased by 15% over the entire period, that of plant drugs by 8%, and that of medicines by 12.3%, all are lower than the overall average of 20.2 % as indicated by the CPI for all commodities.

**Table 3**  
Relative current-to-base-year price ratios for each of the 38 categories of commodities

	1992	1993	1994	1995	1996
<b>All Commodities (CPI)</b>	104.83	108.03	112.51	116.68	120.19
<b>Food and Beverages</b>					
Rice and rice products	101.68	106.16	108.03	114.56	120.49
Flour and bakery products	101.10	101.78	104.44	109.93	117.83
Meat and meat products	104.82	109.63	112.29	117.08	122.77
Eggs	114.02	109.91	116.09	117.71	121.10
Fish and shellfish	112.76	120.82	127.85	133.84	141.62
Vegetables and processed vegetable products	120.74	123.56	150.47	148.85	151.85
Fruits and processed fruit products	126.80	132.30	148.42	167.91	175.89
Dairy products	100.58	102.80	102.90	102.87	104.83
Edible oil	98.75	98.87	101.53	105.98	106.64
Condiments	103.18	101.93	106.57	122.60	110.26
Alcoholic beverages	99.60	98.00	97.23	96.77	104.30
Non-alcoholic beverages	99.39	100.45	101.09	104.07	104.32
Leisure and dissipation	108.30	114.05	113.40	112.27	108.93
Foods away from home	103.12	105.80	108.43	112.88	117.24
Other food (bean and bean products, cooked food)	99.61	102.31	111.30	112.69	112.36
<b>Clothing</b>					
Garments	101.64	97.47	96.24	99.88	102.63
Footwears	100.83	96.90	96.47	99.64	99.98
Cloth, apparel services and other apparel commodities	98.15	102.63	105.60	107.91	111.39
<b>Housing</b>					
Rent, residential	104.30	108.63	113.67	117.59	120.55
Maintenance and repairs	103.67	111.46	117.94	125.45	126.66
Household appliances	100.11	102.31	104.93	107.54	108.48
Household keeping services	104.71	114.93	120.55	129.95	132.05
Water supply, electricity and gas	102.02	101.82	103.55	106.28	107.72
<b>Transportation and Communication</b>					
Private transportation and communication	97.86	96.65	97.79	100.23	100.90
Parts and equipment, oil, and repair charge of transportation	98.20	98.52	95.94	99.80	100.99
Communication fees	100.77	100.84	100.84	99.41	97.08
Transportation fees and other services	101.29	107.58	112.04	115.36	121.32
<b>Medicines and Medical Care</b>					
Medical care services	107.04	108.75	111.41	112.92	114.78
Plant drugs	103.40	103.95	103.09	106.18	107.96
Medicines	102.59	104.36	108.19	109.67	112.29

**Table 3 (continued)**

	1992	1993	1994	1995	1996
Cosmetic items	100.35	99.86	99.69	100.23	100.45
Beauty parlor services	106.52	117.00	125.32	133.16	137.92
Medical Supplies and appliances	98.93	98.95	99.52	102.59	102.65
<b>Education and Entertainment</b>					
Educational expenses	107.13	116.04	124.05	131.25	143.28
Entertainment expenses	101.42	102.93	104.42	106.12	106.77
<b>Miscellaneous</b>					
Tobacco	100.09	100.18	100.98	102.47	104.38
Wedding and funeral expenses	101.23	103.23	107.18	109.77	112.03
Others	102.65	103.79	104.45	107.00	109.31

Third, we find the income share that is spent on Clothing, Transportation and Communication, or Education and Entertainment is higher for the household groups with relatively higher income. The costs of such commodities, except for educational expenses, have remained relatively stable compared with the CPI for all commodities over the period studied.

Fourth, although the share of the category of Education and Entertainment decreases as income rises, each of its component commodities such as education and entertainment is not a negligible item in the poorest group's consumption basket. We have already seen that the cost of educational expenses has risen relatively rapidly than other items. All these together explain why low-income household groups face higher than average rates of inflation, while the relatively well-to-do groups experience the opposite.

The studies cited previously did not show significant differentials in the inflation rates for the poorest group in the United States. Moulton and Stewart (1999, p. 149) show the spending pattern of the poorest group in the United States, which by comparison is approximately similar to that of its counterpart in Taiwan. Although the poorest household group in the United States also spent a relatively large share of their income on Food and Beverages, the prices of these consumer items did not increase faster than the CPI. The relatively larger price increases for Food and Beverages in Taiwan than in the United States causes the poorest household group in Taiwan to suffer more than the rest of the society in terms of price increases.

#### **B. The Age-Specific Group Price Indexes with Different Household Head Ages**

The group-specific price indexes for household heads with different ages can be easily calculated using the spending patterns on the 38 categories of commodities by each age-specific household group and by all household units over the period 1991-1996. The results are reported in Table 5.

**Table 4**  
Expenditure shares by household income<sup>a</sup>

	All House-holds	Lowest	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Highest
All Commodities	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Food and Beverages	29.32	35.04	34.25	33.53	32.39	31.61	30.67	29.55	28.67	27.05	23.29
Rice and rice products	1.79	2.56	2.42	2.20	2.07	2.02	1.89	1.76	1.66	1.55	1.24
Flour and bakery products	1.22	1.33	1.31	1.33	1.32	1.26	1.26	1.25	1.25	1.19	1.02
Meat and meat products	4.45	5.38	5.39	5.26	5.05	4.87	4.72	4.45	4.39	3.98	3.35
Eggs	0.40	0.51	0.50	0.48	0.47	0.44	0.42	0.39	0.38	0.34	0.29
Fish and shellfish	4.24	5.46	5.21	5.03	4.78	4.64	4.49	4.30	4.10	3.79	3.14
Vegetables and processed vegetable products	3.41	4.60	4.27	4.15	3.95	3.75	3.57	3.41	3.24	3.01	2.45
Fruits and processed fruit products	3.59	4.19	4.23	4.13	3.96	3.86	3.73	3.65	3.60	3.30	2.82
Dairy products	1.17	1.09	1.24	1.32	1.28	1.29	1.25	1.17	1.19	1.08	0.99
Edible oil	0.45	0.62	0.56	0.54	0.52	0.50	0.47	0.44	0.43	0.40	0.33
Condiments	0.32	0.45	0.41	0.39	0.37	0.36	0.34	0.31	0.30	0.27	0.22
Alcoholic beverages	0.57	0.81	0.59	0.64	0.56	0.62	0.56	0.56	0.55	0.54	0.53
Non-alcoholic beverages	0.50	0.51	0.52	0.55	0.53	0.55	0.52	0.50	0.49	0.48	0.42
Leisure and dissipation	1.06	1.12	1.06	1.10	1.09	1.16	1.13	1.08	1.10	1.01	0.90
Foods away from home	5.07	5.39	5.50	5.35	5.39	5.27	5.27	5.17	5.00	5.02	4.42
Other food (bean and bean products, cooked food)	1.07	1.02	1.06	1.07	1.07	1.03	1.04	1.08	0.98	1.10	1.17
Clothing	6.86	5.07	5.65	6.02	6.09	6.50	6.56	6.84	7.15	7.30	8.23
Garments	4.69	3.51	3.98	4.26	4.23	4.50	4.54	4.76	4.88	4.93	5.43
Footwears	0.97	0.87	0.93	0.95	0.96	0.98	0.98	0.99	1.00	0.98	0.96
Cloth, apparel services and other apparel commodities	1.20	0.69	0.74	0.82	0.89	1.02	1.03	1.09	1.27	1.40	1.84
Housing	30.08	32.18	30.56	29.34	29.70	29.98	29.62	30.44	30.19	29.89	30.07
Rent, residential	20.36	23.08	21.66	20.56	20.46	21.07	20.45	20.64	20.61	19.71	18.91
Maintenance and repairs	1.33	0.69	0.79	0.64	1.18	0.86	1.07	1.35	1.26	1.44	2.32
Household appliances	3.15	2.68	2.79	2.93	3.00	2.94	3.09	3.20	3.12	3.40	3.50
Household keeping services	1.26	0.29	0.44	0.51	0.68	0.72	0.91	1.28	1.40	1.87	2.22
Water supply, electricity and gas	3.98	5.45	4.88	4.70	4.38	4.39	4.10	3.97	3.80	3.46	3.11

**Table 4 (continued)**

	All House-holds	Lowest	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Highest
Transportation and Communication	9.02	6.03	7.29	8.16	8.75	8.39	9.11	8.82	9.01	9.54	10.75
Private transportation and communication	2.47	0.52	1.21	1.96	2.24	1.80	2.51	2.06	2.34	2.83	4.02
Parts and equipment, oil, and repair charge of transportation	3.91	2.49	3.38	3.61	3.86	3.95	3.99	4.02	4.09	4.17	4.14
Communication fees	1.02	1.22	1.14	1.07	1.04	1.03	1.02	1.04	0.97	0.96	0.98
Transportation fees and other services	1.61	1.80	1.56	1.53	1.60	1.61	1.59	1.70	1.61	1.59	1.61
Medicines and Medical Care	8.64	11.22	9.50	9.16	8.59	8.80	8.45	8.30	8.44	8.51	8.05
Medical care services	4.17	6.08	4.69	4.51	4.05	4.15	3.99	3.84	4.06	4.18	3.83
Plant drugs	0.54	0.80	0.65	0.60	0.52	0.60	0.53	0.53	0.50	0.47	0.49
Medicines	0.35	0.67	0.48	0.44	0.40	0.37	0.35	0.33	0.31	0.30	0.27
Cosmetic items	1.60	1.64	1.70	1.69	1.68	1.68	1.63	1.60	1.58	1.54	1.46
Beauty parlor services	1.67	1.75	1.76	1.64	1.68	1.69	1.65	1.67	1.67	1.67	1.63
Medical Supplies and appliances	0.32	0.29	0.22	0.27	0.27	0.32	0.30	0.33	0.32	0.35	0.38
Education and Entertainment	13.05	7.27	9.74	10.78	11.76	11.85	12.71	13.23	13.62	14.61	16.13
Educational expenses	6.45	3.22	5.47	6.05	6.69	6.67	6.92	6.89	6.99	6.77	6.36
Entertainment expenses	6.60	4.04	4.27	4.74	5.07	5.18	5.79	6.34	6.63	7.84	9.78
Miscellaneous	3.03	3.19	3.00	3.00	2.72	2.86	2.89	2.82	2.91	3.10	3.48
Tobacco	1.20	1.87	1.59	1.52	1.33	1.38	1.23	1.19	1.10	1.03	0.85
Wedding and funeral expenses	0.75	0.73	0.70	0.70	0.57	0.57	0.68	0.50	0.67	0.83	1.15
Others	1.08	0.59	0.72	0.77	0.82	0.92	0.98	1.12	1.15	1.24	1.48

<sup>a</sup>: These are base year expenditure shares that we used to calculate the various price indexes.

A few interesting observations can be made from Table 5. First, for household groups where the age of the household head belongs to the 50-64 age group and those belonging to the most elderly group (i.e., 65 and older), the inflation rates were 20.12% and 20.16%, respectively, with the compound annual growth rate of 3.73% and 3.74%, respectively. These figures are very close to that for all household units. Second, for the groups where the age of the household head is below 50, the age-specific price indexes have shown considerable variations across groups. The index for the group where the age of the household head is in the 35-49 range and that for the youngest (i.e., under 20) group have shown an increase of 20.80% and 21.08%, respectively, over the period

studied. These rates of increase are higher by 0.61 and 0.98 percentage point than that for all household units. Third, for the group where the age of the household head is between 20 and 34, the index has shown an increase of 19.23% over the same period. This group appears to be the one with the least increase in the index, being lower by 0.96 percentage point than that for all household units. The annual compound growth rate of the former is smaller by 0.17 percentage point than that of the latter.

**Table 5**  
The group-specific price index for household heads with different ages, 1991=100

	1992	1993	1994	1995	1996	Average Growth Rate (1991-1996) <sup>a</sup>
All Household Units	104.83	108.03	112.51	116.68	120.19	3.75
65 and Older	105.16	108.38	113.02	116.94	120.16	3.74
50 to 64 Years Old	104.79	108.00	112.48	116.61	120.12	3.73
35 to 49 Years Old	104.93	108.24	112.82	117.10	120.80	3.85
20 to 34 Years Old	104.65	107.66	111.94	116.02	119.23	3.58
Under 20	105.36	108.55	113.29	117.44	121.08	3.90

<sup>a</sup>. These growth rates are annual compound rates.

It is of interest to know why the most elderly household group in Taiwan faces the same price changes as the general household population. This result is in line with the finding by Boskin and Hurd (1985), but opposite to that by Amble and Stewart (1994). Closer scrutiny of Tables 3 and 6, again, points to a plausible explanation: while the elderly household group spent relatively more on medical care services and on rent and residential services, the costs of these commodities did not show significantly higher increases than other commodities over the period 1991-1996.

As for the inflation experience of other age groups, we know from Table 5 that the youngest household group experienced the highest inflation among all others. The reason is that this group spent relatively more than any other age groups on Food and Beverages. But during the period 1991-1996, the commodities in this category have shown relatively faster than average increases in prices, as have already been shown above. The households in the 20-34 age group experienced the least inflation, because they spent less than all other age groups on the four categories of commodities (i.e., fruits and processed fruit products; vegetables and processed vegetable products; fish and shellfish; and educational expenses) which have experienced the most rapid price increases. In particular, this group spent 14.81% of their income on these four

categories of commodities, compared with the 16.88% for the group under 20, 19.71% for the 35-49 age group, 17.46% for the 50-64 age group, 14.92% for the most elderly group, and the overall average of 17.69% for all household units. In contrast, the 35-49 age group faced above-average inflation, because of its above average expenditure share on these four categories of commodities.

**Table 6**  
Expenditure shares by age of the household head<sup>a</sup>

	All HouseholdUnits	65 and Over	50~64	35~49	20~34	Under 20
All Commodities	100.00	100.00	100.00	100.00	100.00	100.00
Food and Beverages	29.32	27.65	28.68	29.37	29.78	33.54
Rice and rice products	1.79	1.71	1.74	1.83	1.77	2.26
Flour and bakery products	1.22	1.18	1.13	1.26	1.23	1.15
Meat and meat products	4.45	4.42	4.29	4.55	4.40	5.40
Eggs	0.40	0.37	0.37	0.40	0.41	0.44
Fish and shellfish	4.24	4.48	4.10	4.32	4.17	4.94
Vegetables and processed vegetable products	3.41	3.71	3.31	3.46	3.35	4.04
Fruits and processed fruit products	3.59	3.53	3.46	3.67	3.54	4.02
Dairy products	1.17	0.89	0.86	1.06	1.58	0.82
Edible oil	0.45	0.47	0.44	0.45	0.45	0.61
Condiments	0.32	0.34	0.30	0.32	0.32	0.38
Alcoholic beverages	0.57	0.70	0.63	0.53	0.60	0.62
Non-alcoholic beverages	0.50	0.39	0.49	0.51	0.49	0.59
Leisure and dissipation	1.06	1.21	1.07	1.05	1.03	1.00
Foods away from home	5.07	3.40	5.33	4.98	5.24	6.28
Other food (bean and bean products, cooked food)	1.07	0.84	1.15	0.98	1.21	1.00
Clothing	6.86	5.50	6.96	6.82	7.05	6.10
Garments	4.69	3.60	4.62	4.72	4.83	4.18
Footwears	0.97	0.79	0.96	0.99	0.97	1.09
Cloth, apparel services and other apparel commodities	1.20	1.11	1.39	1.11	1.26	0.83
Housing	30.08	34.41	29.55	29.55	30.77	27.41
Rent, residential	20.36	25.21	20.31	20.19	20.08	19.67
Maintenance and repairs	1.33	1.41	1.66	1.23	1.28	0.43
Household appliances	3.15	2.61	2.98	3.08	3.46	2.49
Household keeping services	1.26	0.73	0.74	1.09	1.93	0.23

**Table 6 (continued)**

	All HouseholdUnits	65 and Over	50~64	35~49	20~34	Under 20
Water supply, electricity and gas	3.98	4.44	3.87	3.96	4.02	4.59
Transportation and Communication	9.02	5.44	8.63	9.01	9.74	6.46
Private transportation and communication	2.47	0.57	2.03	2.49	2.96	0.66
Parts and equipment, oil, and repair charge of transportation	3.91	1.58	3.55	3.96	4.37	2.87
Communication fees	1.02	1.14	1.11	0.97	1.04	0.93
Transportation fees and other services	1.61	2.14	1.95	1.59	1.38	2.00
Medicines and Medical Care	8.64	12.16	8.85	7.80	9.41	12.00
Medical care services	4.17	7.35	4.23	3.51	4.79	6.68
Plant drugs	0.54	0.77	0.61	0.49	0.55	0.71
Medicines	0.35	0.70	0.36	0.32	0.36	0.72
Cosmetic items	1.60	1.30	1.53	1.54	1.77	1.79
Beauty parlor services	1.67	1.64	1.76	1.62	1.70	1.80
Medical Supplies and appliances	0.32	0.39	0.36	0.33	0.26	0.30
Education and Entertainment	13.05	12.09	14.05	14.66	9.93	11.69
Educational expenses	6.45	3.20	6.59	8.26	3.81	5.88
Entertainment expenses	6.60	8.88	7.45	6.39	6.12	5.81
Miscellaneous	3.03	2.76	3.28	2.78	3.31	2.79
Tobacco	1.20	1.20	1.23	1.09	1.38	1.27
Wedding and funeral expenses	0.75	0.59	0.88	0.63	0.89	0.93
Others	1.08	0.97	1.18	1.07	1.04	0.59

<sup>a</sup>: These are base year expenditure shares that we used to calculate the various price indexes.

#### IV. CONCLUDING REMARKS

In this empirical study on the variability in the rates of inflation across household groups in Taiwan, we find statistically significant evidence to support the claim that different household groups face differential price changes, and that these variations are persistent. Particularly, four demographic characteristics are found to cause these variations. These four socio-economic household characteristics are households (1) with the second lowest income level; (2) where the household head is under 20 years of age; (3) with children; and (4) residing in urban areas. The household groups with one or more of these four characteristics are found to face higher than average rates of inflation. On the contrary, a couple of other demographic characteristics are also found

to contribute to lower than average inflation rates faced by a specific household group. These characteristics are households (1) with the highest income level; and (2) where the household head is in the 20-34 age group.

We also find an inverse relationship between the absolute level of the inflation rate faced by each household group and the income level of the household. Similarly, the absolute level of the inflation rate faced by each household group is inversely related to the educational level of the household head.

We find that the poorest household group faced an average inflation rate that is higher by 0.43 percentage point than that of the wealthiest group. We believe the differences in the spending patterns by different household groups contribute to these inflation rate variations. Specifically, the poorest household group spent relatively more on Food and Beverages than other household groups over the period 1991-1996, and the prices of the commodities in this category happened to experience relatively faster than average price increases in the same period. It is therefore not surprising to find that the poorest household group faced higher than average price changes. By way of contrast, although the poorest household group in the United States also spent relatively more on Food and Beverages, this group did not suffer more hardship than other groups in terms of inflation experience, because the costs of those items in the Food and Beverages category did not increase faster than other commodities in the country over the period covered by the above-cited studies.

As for the age factor in this study, we do not find the most elderly group to face higher than average inflation rates over the period 1991-1996. This result differs from that of Amble and Stewart (1994). Both of our studies find that the elderly group spent a relatively larger share of their income on medicines and medical care. But the similarity stops here. While we experienced mild increases in the costs of such commodities in Taiwan during the period under our study, they found that the prices of such commodities had almost doubled during the period included in their study.

In recent years, both the central and various local governments in Taiwan have implemented a social security scheme for low-income groups, and the central government is currently studying an "Annuity" program for the elderly. In light of our findings for the poor, and in spite of our results with respect to the elderly, we believe the group-specific price indexes have intrinsic values: they are not costly to construct, nor are they expensive to implement, but their potentials to achieve greater equality, by mitigating possible distortions in income distribution, are great. We therefore strongly recommend that all welfare and entitlement programs be linked to the group-specific consumer price indexes.

Our current research focuses only on the limitation to using the CPI as a basis for cost-of-living adjustments. Admittedly, we have not tackled the other limitations of the CPI as a true cost-of-living index, such as the substitution bias and quality changes over time, etc. As Jorgenson and Slesnick (1999, p. 180) wrote: "The index-number methodology employed in the construction of the CPI is unsatisfactory as a basis for cost-of-living measure," the multi-faceted problems of the CPI are recognized. In order to fill the gap, the next step of our study will be to measure the true cost of living across households in Taiwan.

### NOTES

1. The now widely used simple CPI is usually constructed using the *Laspeyres Index* formula. In this formula, prices of various commodities are weighted averages. The weight is derived from the percentage of the average expenditure on each commodity in total spendings by all households in the base year.
2. Consumption patterns will be affected not only by household income and commodity prices, but also by socio-economic characteristics of different households. For a more detailed discussion on the differentials in the expenditure structures across household types, see, for example, Barten (1964).
3. On this last point, see, for example, Shapiro and Wilcox (1996, pp. 51-54), and Boskin, et al. (1985, p.3).
4. The 1987 Amendments to the Older Americans Act of 1965 “directed BLS to develop an experimental index” for those 62 years of age and older. The CPI-E has thus come to exist since 1988. See Amble and Stewart (1994, p. 11).
5. For more information, please visit the website:  
[http://www.dgbas.gov.tw/english/dgbas\\_e3.htm#3.4](http://www.dgbas.gov.tw/english/dgbas_e3.htm#3.4).
6. This practice follows Michael (1979) and Hagemann (1982).

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## APPENDIX A

### The 38 categories of commodities

- 1. Food and Beverages**

a. Rice and rice products	i. Edible oil
b. Flour and bakery products	j. Condiments
c. Meat and meat products	k. Alcoholic beverages
d. Eggs	l. Non-alcoholic beverages
e. Fish and shellfish	m. Leisure and dissipation
f. Vegetables and processed vegetable products	n. Foods away from home
g. Fruits and processed fruit products	o. Other food (bean and bean products, cooked food)
h. Dairy products	
- 2. Clothing**

a. Garments	c. Cloth, apparel services and other apparel commodities
b. Footwears	
- 3. Housing**

a. Rent, residential	d. Household keeping services
b. Maintenance and repairs	e. Water supply, electricity and gas
c. Household appliances	
- 4. Transportation and Communication**

a. Private transportation and communication	c. Communication fees
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- b. Parts and equipment, oil, and repair charge of transportation
- d. Transportation fees and other services

**5. Medicines and Medical Care**

- a. Medical care services
- b. Plant drugs
- c. Medicines
- d. Cosmetic items
- e. Beauty parlor services
- f. Medical Supplies and appliances

**6. Education and Entertainment**

- a. Educational expenses
- b. Entertainment expenses

**7. Miscellaneous**

- a. Tobacco
- b. Wedding and funeral expenses
- c. Others

**APPENDIX B**

The five demographic characteristics and their partitions

**1. The Income Levels**

The lowest (first) income level: The lowest 10 percent of household by disposable income

The second income level: The second lowest 10 percent of household by disposable income

The third income level: The third lowest 10 percent of household by disposable income

The fourth income level: The fourth lowest 10 percent of household by disposable income

The fifth income level: The fifth lowest 10 percent of household by disposable income

The sixth income level: The sixth lowest 10 percent of household by disposable income

The seventh income level: The seventh lowest 10 percent of household by disposable income

The eighth income level: The eighth lowest 10 percent of household by disposable income

The ninth income level: The ninth lowest 10 percent of household by disposable income

The highest (tenth) income level: The highest 10 percent of household by disposable income

**2. Age of the Household Head**

Those 65 and over  
Those between 50 and 64  
Those between 35 and 49  
Those between 20 and 34  
Those under 20

**3. Educational Levels of the Household Head**

Elementary level (6 years of schooling or less)  
Junior High level (9 years of schooling)  
Senior High Level (12 years of schooling)  
College level and beyond (more than 12 years of schooling)

**4. Family Structures**

Type 1 Household: Households with no children under 20  
Type 2 Household: Households with single parent and 1 to 2 children  
Type 3 Household: Households with single parent and 3 or more children  
Type 4 Household: Households with both parents and 1 to 2 children  
Type 5 Household: Households with both parents and 3 or more children

**5. Areas of Residence**

Urban (city) Areas: Areas where employment in agriculture, forestry, fishery, animal husbandry and mining together account for less than 25% of total employment, and where employment in service industries accounts for 40% or more of total employment.

Rural (village) Areas: Areas where employment in agriculture, forestry, fishery, animal husbandry and mining together account for more than 40% of total employment.

Suburban (town) Areas: All other Areas that are classified neither as Urban nor as Rural Areas.