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VARIATION ACROSS HOUSEHOLDS IN THE RATE OF INFLATION

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> A perfectly exact measure of purchasing power is not only unattainable, but even unthinkable. The same change of prices affects the purchasing power of money to different persons in different ways. For to him who can seldom afford to have meat, a fall of one-fourth in the price of meat accompanied by a rise of one-fourth in that of bread means a fall in the purchasing power of money; his wages will not go so far as before. While to his richer neighbour, who spends twice as much on meat as on bread, the change acts the other way.
>
> --A. Marshall (1886)

I. Introduction and Summary

This paper reports on an empirical investigation of the distribution of inflation rates across households. The study uses a large cross-sectional survey of households to obtain information on the composition of the market bundles of goods and services purchased by each of several thousand households in the U.S. It also uses published data for the U.S. on monthly changes in the separate indices of prices of some fifty expenditure items which comprise consumers' market bundles. With information on price changes for these fifty items and the composition of households' consumption bundles, a price index is computed for each of some 11,000 households separately for several recent periods of time. The distributions of these price indices are studied and the relationships between household characteristics and these price indices are investigated.

The empirical estimates indicate the magnitude of the effect of recent periods of inflation on the relative prices of various households' market bundles. The study also investigates which types of households have experienced the largest price increases. The findings should be of interest in light of the frequent discussion of the distributional

impact of inflation. The study also provides information relevant to the public discussion of the usefulness of income group specific consumer price indices.

As with every study, there are important limitations to be noted. The price indices computed here are Laspeyres indices with fixed weights, hence we observe how the price of a fixed bundle of goods changes for each household, but we do not observe how the composition of the bundles themselves change in response to the relative price changes in the market place. Furthermore, since prices actually paid for specific goods and services are not observed for each household separately each month, it is assumed here that the same observed average price change for a specific item is experienced by all consumers. Hence only the differences in the composition of consumption bundles can generate dispersion in the calculated price indices.

There is another limitation, perhaps of greater importance. Inflation may affect real income not only by a differential impact on consumers' price indices but also by affecting, say, money earnings and the value of financial assets. But this study does not investigate these influences. Said differently, the study reported here yields answers to such questions as, "have the consumption bundles typically purchased by the elderly risen in price more rapidly in recent years than the bundles typically purchased by middle-aged couples?"; but the study does not address such questions as, "has the inflation in recent years affected the money incomes of the elderly differently than the money incomes of prime-working aged couples?" Without answers to both these (and additional) questions one cannot conclude anything about the net impact of

inflation on the relative position of one group or another in the distribution of real income. In this important sense, the study reported here is a partial analysis.

By way of summary, the study finds the following:

(1) There is considerable dispersion among households in the computed price indices. For the first six months of 1974, for example, the average price index for the more than 11,000 households rose by 6.0 percent, but one in ten households experienced a price increase of less than 4.6 percent in that six-month period, while another one in ten households experienced a price rise greater than 7.4 percent. These household-specific price indices for this period ranged from a low of 2.0 percent to over 13.0 percent, and the standard deviation across households was 1.2.

(2) There is an observed tendency for the relative dispersion in the price indices across households to be smaller when calculated over longer time periods.

(3) In several particular time periods there are sizable and statistically significant relationships between the increase in the household's price index and certain demographic and economic characteristics of the household. For example, over the year 1973 or the month of January 1974, the price index rose relatively rapidly for households with low after-tax family income, or low levels of schooling of the household head, or older aged household heads. However, the importance of these, and other, observed relationships between the price changes and the household characteristics is diminished by two other findings:

(4) When the households are combined into relatively homogeneous groups defined by income, education, age, city size, marital status, race, etc., the within-group dispersion in price indices is still very substantial. The dispersion within groups tends to dominate the differences in group means.

(5) While sizable and significant relationships between the price change and household characteristics are observed in specific time periods, none of these relationships appears to be stable over time. None of the household characteristics studied exhibits a consistently positive or negative simple or partial relationship with the price changes over the several time periods investigated. One of the relationships which did exhibit some stability, qualitatively, is with the schooling level of the household head. On average, and holding marital status, city size, race, family size, and age constant, the market bundles characteristic of households with college educated heads rose in price in the first six months of 1974 (in which the average rise was 6.0) by about one-half a percentage point less than the market bundles of the households with grade school educated heads. A roughly comparable result is observed for the year 1973 in which the group's mean price rise was 9.8 percent and in which the market bundle of the college educated rose by about 1.2 percentage points less than the bundle of the less educated. But this consistency is not observed in an earlier five-year period from 1967 through 1972, in which the education level is positively related to the rate of price change. Nor is the relationship negative in each of the first six months of 1974. In April and June, the schooling level is positively, and statistically significantly, related to the rate of

price increase while for the other four months, and the six months as a whole, the relationship is negative.

(6) There is, however, evidence of a positive covariation over time in the rates of price change across households. That is, the correlations across households between the rates of price increase from one time period to the next are positive. For example, among the nearly 9,000 married couples in the study, the simple correlation between the household's price change in the year 1972 and its price change in the year 1973 was +0.63. Those couples that experienced higher than average increases in the price of their market bundle in 1972 tended to have the same experience in 1973. Of course, evidence from successive months or even years does not necessarily constitute independent evidence if one considers an episode of price adjustments as a single, relevant "observation." That is, the recent rises over several months in the prices of oil products and perhaps food might constitute one observation or one degree of freedom in considering serial correlations or time-dependent covariation in price rises. Thus the month-to-month, and recent year-to-year, positive covariation over time should be interpreted with caution. It would be inappropriate to generalize to covariation over long time periods from the results presented in this paper.

(7) It is not the case that the mean price indices for specific types of households are consistently more highly correlated over time than the within-group deviations from the groups' mean price indices. Indeed, as with the dispersion at any point in time, standardizing for household characteristics does not appreciably affect the dispersion or the covariation over time in the household-specific rates of change of prices.

II. Dispersion in Consumers' Price Indices

Price changes are pervasive in a dynamic economy. An observed change in the nominal market price of a good reflects either (or both) a change in the rate of exchange among marketed goods and services--a relative price change--or a change in the rate of exchange between goods and services on the one hand and the medium of exchange on the other hand--a price level change. Since one cannot identify what portion of an observed price change is attributable to a change in the price level, one typically computes some weighted average of many observed nominal price changes and uses that average price change as an index of the change in the price level. Commonly used weights for this computation are the relative proportions of various market goods and services in the consumer's market basket; thus the calculated change in the average market price reflects the change in the price of that bundle of market goods and services.

For the U.S. economy, the Bureau of Labor Statistics of the U.S. Department of Labor publishes monthly an index of the price of a fixed-quantity bundle of market goods and services. The official name of the index is the "Consumer Price Index for Urban Wage Earners and Clerical Workers," but the index is generally referred to as the Consumer Price Index. One of the principal focuses of this paper is to assess how adequately "the CPI" reflects the price changes experienced in the marketplace by different consumers.[1]

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[1] This issue is underscored and the limitations of the index are emphasized frequently by the BLS itself. For detailed statements about the nature and definition of the CPI, as well as of the BLS's assessment of its uses and limitations, see The Consumer Price Index: History and Techniques, BLS Bulletin 1517, 1966; also see the BLS Handbook of Methods, BLS Bulletin 1711, 1971, and Julius Shiskin, "Updating the Consumer Price Index--An Overview," Monthly Labor Review, July 1974, pp. 3-20.

Consider how two consumers who shop in the same economic market may, in a given time period, experience different changes in the price of their market bundles. Suppose the market in which they shop is characterized at one point in time by a large array of specific items each offered for sale at some distribution of prices varying from vendor to vendor. At a subsequent time period, the market might be characterized by a somewhat different set of marketed items, each offered at a somewhat different distribution of prices. Were we to compute a separate "price index" for two different consumers, these two price indices might differ for at least three reasons.

(1) If we computed a fixed-weight price index, the appropriate weights might differ for the two consumers. That is, if we use, say, the consumers' expenditure shares for various market goods and services--food, clothing, medical care, etc.--as weights, the weighted average for one consumer might differ from the weighted average for the other consumer.

(2) The market prices at which the two consumers purchase goods and services may differ, and the changes from period to period in the relevant prices may also differ. There are at least two reasons for this. If the economic market in which the consumers shop is not characterized by perfect and costless information about the nature and price of each marketed item, some dispersion may exist in the price at which any particular item is sold. If the distribution of market prices for a particular item does not change from one time period to the next, the price used in constructing the individual consumer's price index may, nevertheless, reflect a change if the index is based on the price at which the consumer actually purchased the item. That is, if the

consumers independently sample prices from a stable distribution of prices for a specific item, the prices paid will in general vary from time period to time period, and may vary differently for different consumers. If the consumer samples randomly from the distribution of prices for each particular item, it may be more appropriate to use the change from period to period in some measure of that price distribution --e.g., its mean, its median, etc.--as the market price which each consumer faces. However, if a consumer routinely purchases the item at a price which is located at some particular position in the distribution of prices for that item--e.g., if he or she always purchases the item at a price at the lowest ten percentile--then the movement through time in the central tendency of the price distribution may not accurately reflect the movement of the relevant price for that consumer.

Alternatively, if we disregard the price dispersion for a particular item in a given market, at any practical level of disaggregation of items, differences may exist between the two consumers in the nature and the price of the item purchased. No matter how detailed the expenditure categories used in constructing the price indices, e.g., whether "food" or "vegetables" or "brussel sprouts", the freshness, size or other characteristics of the item may differ from consumer to consumer. These differences are typically referred to as the "quality" of the item. If prices change differentially from period to period for these various items within an expenditure category, the relevant price change for that expenditure category may differ from one consumer to another.

(3) In general, the consumer's price index need not be a fixed-weighted index. As relative prices of market goods and services

change, the consumer adjusts his relative demands for various goods. If consumers differ in their demand elasticities, then any fixed-weighted price index may inadequately reflect the price change for the relevant, shifting bundle of market goods, and it may do so differently for different consumers. When we introduce changes over time in the composition of the consumption bundle which result from the changes in relative prices (or, by extension, the introduction of new products or the changes in product quality), we approach the concept of an index of the cost of living rather than an index of the cost of a fixed bundle of market goods and services. Estimates of systems of demand equations can be used to perform the compensations necessary to estimate, for a given change in market prices, the change in the outlay required to keep the consumer at the same level of utility. If one had data on the shifts in the individual consumer's consumption bundle which resulted from observed changes in the relative prices he or she faced, or if one had the consumer's utility function explicitly, then the consumers' cost of living indices could be computed.

I have suggested three reasons why the price indices for two consumers shopping in the same economic market might differ--because of differences in the proportions spent on various goods and services, differences in the rates of change of the prices paid for the goods and services purchased, and differences in substitution elasticities.[1] In

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[1]There are, of course, other reasons why the relevant price index may differ from consumer unit to consumer unit. The addition and deletion of items sold in the marketplace, differences in the substitution elasticities of consumption between time periods, differences in the ability or willingness to substitute nonmarket effort for intermediate or final production of certain items are but a few complications ignored here with respect to an index of the price changes of consumer goods and services.

the empirical work which is reported below, only the first of these three is investigated. Specifically, a base-period fixed-weighted price index (a Laspeyres price index) is computed for each consumer unit for several successive time periods. Since the expenditure weights are estimated only once for each consumer unit and are constant thereafter, this study does not investigate differences among consumers in their responsiveness to changes in relative prices. Since I have used the same estimate of the price change for a particular good over a particular period of time for all consumer units, differences among consumers in the rates of change of particular market prices are also ignored. The observed differences in computed price indices among consumers, then, result solely from the differences in the composition of their consumption bundles, or more precisely from the correlation between these differences and the observed price changes.

A Laspeyres price index is defined as

$$ {}_0L_1^0 = \frac{\sum_i p_{i1}\, q_{i0}}{\sum_i p_{i0}\, q_{i0}} \qquad (1) $$

for price changes between period zero and period 1 for the consumption items indexed over i for the reference base period zero. Equivalently,

$$ {}_0L_1^0 = \frac{\sum_i (p_{i0}\, q_{i0})\dot{p}_{i1,0}}{\sum_i (p_{i0}\, q_{i0})} \qquad (2) $$

where $\dot{p}_{i1,0} = p_{i1}/p_{i0}$, the ratio of p_i in period 1 to p_i in period zero. Define $w_{i0}^0 = p_{i0}q_{i0}/\sum_i p_{i0}q_{i0}$, the base period expenditure weight for

item i. Then

$$ {}_0L_j^0 = \sum_i w_{i0}^0 \dot{p}_{ij,0} = \sum_i w_{i0}^0 \dot{p}_{ij-1,0} \dot{p}_{ij,j-1} \quad (3) $$

and the index of price changes from period j-k to j for the reference base period zero is

$$ {}_{j-k}L_j^0 = \frac{{}_0L_j^0}{{}_0L_{j-k}^0} = \sum_i w_{ij-k}^0 \dot{p}_{ij,j-k} \quad (4) $$

where $w_{ij-k}^0 = q_{i0}p_{ij-k}/\sum_i q_{i0}p_{ij-k}$. These latter weights use reference base period quantities and j-k period prices. Of course, $\sum_i w_{i0}^0 = \sum_i w_{ij-k}^0 = 1$.

Notice that if one starts with a set of known or directly estimated expenditure weights w_{i0}^0, i=1,...,n, in successive periods the weights can be modified to keep the quantities but not the expenditure shares constant over time. Given the expenditure share from an expenditure survey in period zero, $x_{i0} = p_{i0}q_{i0}$, the expenditure weight in period zero is $w_{i0} = x_{i0}/\sum_i x_{i0}$. With an independently estimated price change from period zero to period j-k, $\dot{p}_{ij-k,0}$, one can estimate the fixed-quantity expenditure on item i at price p_{ij-k} by

$$ p_{ij-k}\, q_{i0} = x_{i0}\, \dot{p}_{ij-k,0}. \quad (5) $$

Thus, the base-period, fixed-quantity weight using j-k prices is estimated by

$$ w_{ij-k}^0 = x_{i0}\, \dot{p}_{ij-k,0}/\sum_i x_{i0}\, \dot{p}_{ij-k,0}. \quad (6) $$

Even though the cross section survey of spending patterns may not yield information on the q_{i0} and p_{i0} separately, by using equation (5) one can construct a fixed-quantity price index. Its construction requires the assumption that the independently observed price change in item i from period zero to another period, j-k, reflects the appropriate price change for that item. Its use implicitly assumes a zero price elasticity of demand.

The fixed-quantity weights used by the BLS in computing the published monthly CPI were most recently revised in December 1963 on the basis of information obtained from the 1960-1961 Consumer Expenditure Survey (CES) of the spending patterns of some 13,700 consumer units.[1] From this survey the BLS calculated an average set of expenditure weights for the subset of consumer units which qualified as "urban wage earners and clerical workers."[2] Since December 1963 the weights for the monthly CPI have been adjusted each year by the method outlined in equations (5) and (6), but the weights have not been re-estimated since the 1960-61 expenditure survey.[3]

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[1]For a description of the 1960-1961 Consumer Expenditure Survey, see the BLS Handbook of Methods for Surveys and Studies (BLS Bulletin 1711), Chapter 8, written by Kathryn R. Murphy, 1971.

[2]This subset of about 4,900 families and single persons included consumer units living in urban places of populations of 2,500 or above with (a) at least one family member earning wages and salary from the occupations of clerical or sales workers; craftsmen, operatives or kindred workers; services workers or laborers; or enlisted personnel in the Armed Forces; (b) the total income from the above occupations equaled at least one-half of the total family income before taxes; and (c) at least one family member was employed a total of 37 weeks or more in the survey year (1960 or 1961), regardless of occupation. The publicly available data tape of the CES does not permit one to identify this subset of 4860 "CPI households" from the 13,728 households in the complete survey.

[3]A large resurvey of consumer spending patterns was undertaken in 1972-73 and will be incorporated in an updated set of expenditure

In the empirical work reported below, I have estimated a price index for each separate household using the expenditure weights observed for that household in the BLS's 1960-61 Consumer Expenditure Survey. Since the expenditure data used here are based on the same survey used by the BLS in its most recent (1963) revision of the definitions of expenditure items, the conformity between the available information on the expenditure weights (from the CES data) and on the price changes from month to month (as published routinely by the BLS) is quite good. I was able to decompose the consumer's total consumption expenditure into fifty-two categories of expenditure for which separate price series were available. Thus for each consumer unit, an index is computed which estimates the change in the price of that consumer unit's fifty-two item consumption bundle over some particular period of time. That price index is computed for 11,761 separate consumer units. In the tables and figures which follow, the distributions of these indices across households for several specific time periods are featured.[1]

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definitions and weights scheduled for implementation in the CPI computations in April 1977. See Shiskin, Monthly Labor Review, for a discussion of the revisions underway.

[1]The appendix includes information on the definitions of the fifty-two expenditure categories (Tables A-1 and A-2), and on the expenditure weights for these fifty-two categories in the official BLS CPI in 1963 and their relative importance or fixed-quantity weights in the CPI by December 1973, as well as their average weights for the 11,761 consumer units based on the 1960-61 expenditure patterns (Table A-2). The CPI weights indicated in Table A-2, part A, have been adjusted to sum to unity while excluding the items in the CPI which are not included in my estimates of individual consumer's bundles. The items included in the official CPI but excluded from my estimates of the consumption bundles are itemized in part B of Table A-2; their relative weights in the official CPI are also indicated in part B of Table A-2.

The price indices computed in this paper for separate consumer units or households are not defined in precisely the same manner as the BLS's CPI. The major difference in the definition of the consumption bundle involves the owner-occupied housing expenditures. While the BLS's CPI includes the purchase price of a house in the series, and assigns it the observed average expenditure share across the urban wage and clerical workers (a share of 5.9 percent of the consumption bundle in the 1973 weights), the price indices computed here for separate consumer units exclude that item from the consumption bundle.[1] Another difference between the price indices estimated here and the CPI is that the former use fixed expenditure weights (i.e. constant 1960-61 expenditure shares) while the CPI adjusts these shares annually to

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[1]The most convincing rationale for excluding that item from the definition of the individual consumer unit's price index is that its weight in the consumption bundle for most consumers would be zero while for those consumers who purchased a house during the survey year the weight would have been extremely large. These differences in the relative weights between home-purchasers and all other consumer units might well have dominated all other observed differences. Of course, it may be that the composition of the remainder of the consumption bundle is also affected during the year in which a house is (first?) purchased, and these differences may affect the observed distributions of price indices. Likewise, the expenditures related to the acquisition of any relatively expensive and durable item--e.g. an automobile, a wedding, a child, a funeral, etc.--may affect the consumer's spending pattern. One might amortize the expenditures of durables over the expected life of the item and use the amortized value to calculate the appropriate expenditure share in the yearly consumption bundle, but that was not done for each of the 11,761 consumer units and for each of the durable goods. Instead, the home purchase was excluded from the definition of the bundle and all other durables were included. The expenditures on housing-related items such as rental expenditures, mortgage interest payments, property insurance, and taxes and repairs were included in the definition of the bundle.

estimate fixed quantity weights.[1] To emphasize that there are definitional differences between the official CPI and the price indices estimated here, in this paper the latter will be referred to as "expenditure price indices" (EPI's).

Expenditure price indices have been computed for each consumer unit for ten separate recent time periods. These time periods vary in length from a five-year period to a one-month period; they span the time from 1967 through June 1974 inclusively.[2] The EPI for each period for each household is the percentage change in the price of that household's bundle of goods over the time period covered. The ten time periods are:

1967-1972 (defined as the percentage change in prices from the year-average 1967 prices to the year-average 1972 prices --a 5-year price change).

1972 (defined as the percentage change in prices from December 1971 through December 1972--a 12-month price change);

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[1]The price indices computed in this paper have also been computed using the fixed-quantity weights for several of the specific time intervals. The observed differences between the fixed quantity and fixed expenditure weighted price indices are discussed briefly below.

[2]While the price changes studied pertain to recent periods of time, the expenditure shares are computed from a cross-section survey in 1960-61. So the implicit assumption is made that the differences in the composition of consumption bundles in 1960 or 1961 adequately reflect the differences which exist in the later period covering 1967 through 1974. The discussion in Section III of the relationship between household characteristics and observed differences in household's price indices also assumes that the differences in the composition of market bundles among various types of households observed in 1960 and 1961 adequately reflect the differences which exist in the later period. Differences in the composition of consumption bundles between 1960 and 1970 surely exist, but these are ignored here.

1973 (defined as the percentage change in prices from December 1972 through December 1973--a 12-month price change);

January 1974 (defined as the percentage change in prices from December 1973 through January 1974--a one-month price change);

February 1974 (defined as the percentage change in prices from January 1974 through February 1974--a one-month price change);

March 1974 through June 1974 separately (defined analogously to January or February 1974);

January-June 1974 (defined as the percentage change in prices from December 1973 through June 1974--a six-month price change).

The expenditure price index was calculated for each of the 11,761 nonfarm consumer units for each of these ten time periods. The distributions of the EPI's are summarized in Table 1 (part A), and are shown in Figures 1-7.

The most significant fact to note about these distributions is the magnitude of the dispersion. Consider the distribution of EPI's for 1973 (Figure 3). The estimated average percentage increase in the price of the bundle of goods purchased was 9.8 percent, but the standard deviation across households in the percentage increase in the price was 2.3 percent. The price of the bundle of goods purchased by about 10 percent of the households rose by less than 7 percent, while about 10 percent of the households experienced a price rise in excess of 13 percent. Said differently, only 32 percent of the households are estimated to have experienced a rise in the price of their bundle of market goods which was within 10 percent of the mean price rise of 9.8 percent (i.e.

Table 1. Percentage change in the expenditure price index for 11,761 nonfarm consumer units and in the consumer price index for several time periods.

(A)

Percentage change in the expenditure price index

Time period	Mean	Standard deviation	Coefficient of variation
1967-1972	22.54	2.92	0.13
1972	3.14	0.58	0.18
1973	9.82	2.33	0.24
January 1974	1.09	0.49	0.45
February 1974	1.43	0.36	0.25
March 1974	1.08	0.30	0.28
April 1974	0.47	0.20	0.43
May 1974	0.95	0.15	0.16
June 1974	0.78	0.16	0.21
January-June 1974	6.03	1.19	0.20

(B)

CPI percentage change

Time period	Actual	(Annualized)
1967-1972	25.3	4.6
1972	3.4	3.4
1973	8.8	8.8
January 1974	0.9	11.4
February 1974	1.3	16.8
March 1974	1.1	14.0
April 1974	0.6	7.4
May 1974	1.1	14.0
June 1974	1.0	12.7
January-June 1974	6.1	12.6

Figure 1. Frequency Distribution of Five-year (1967-1972) Expenditure Price Index (by tenths).

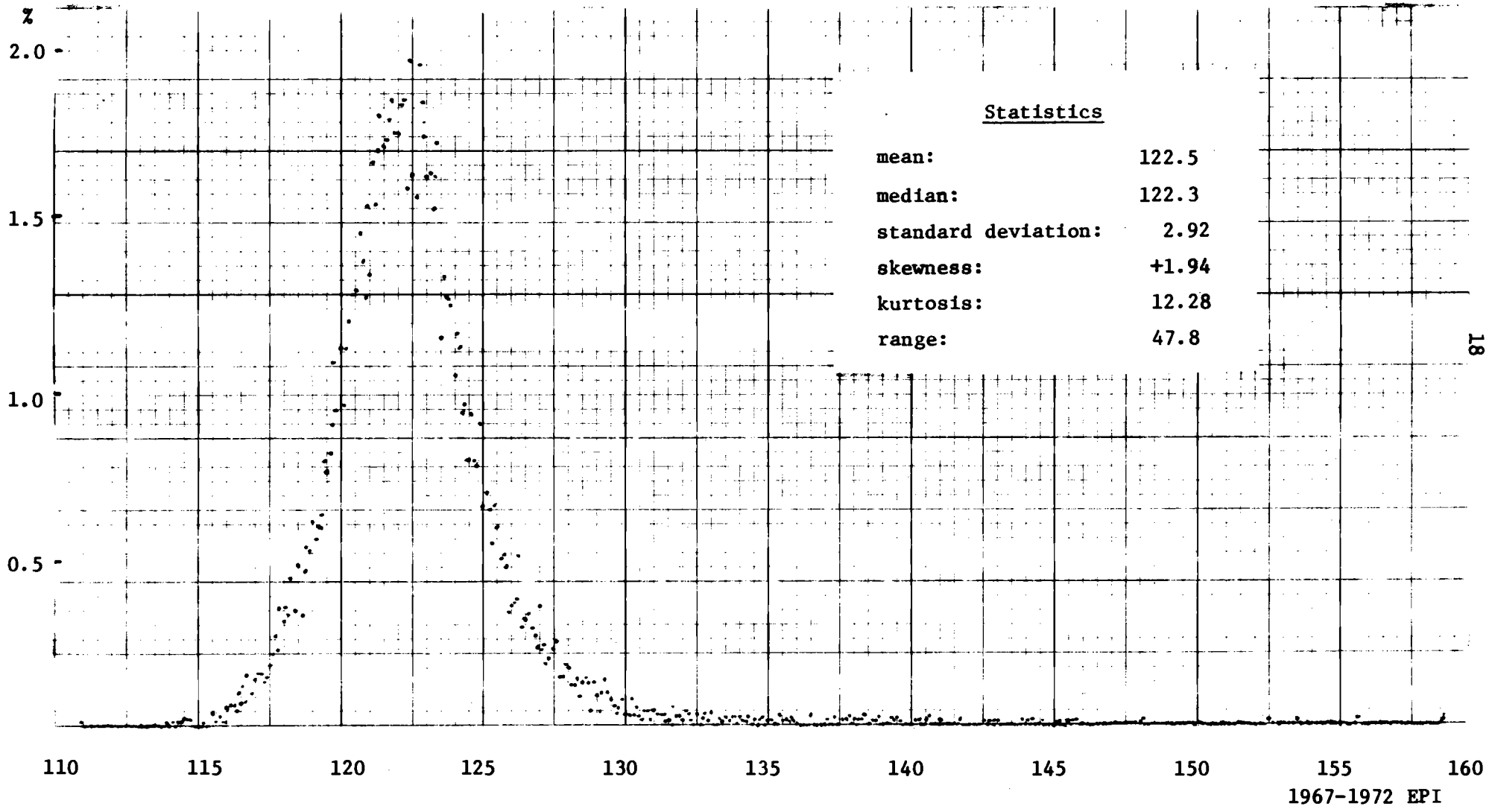


Figure 2. Frequency Distribution of 1972 Expenditure Price Index (by tenths).

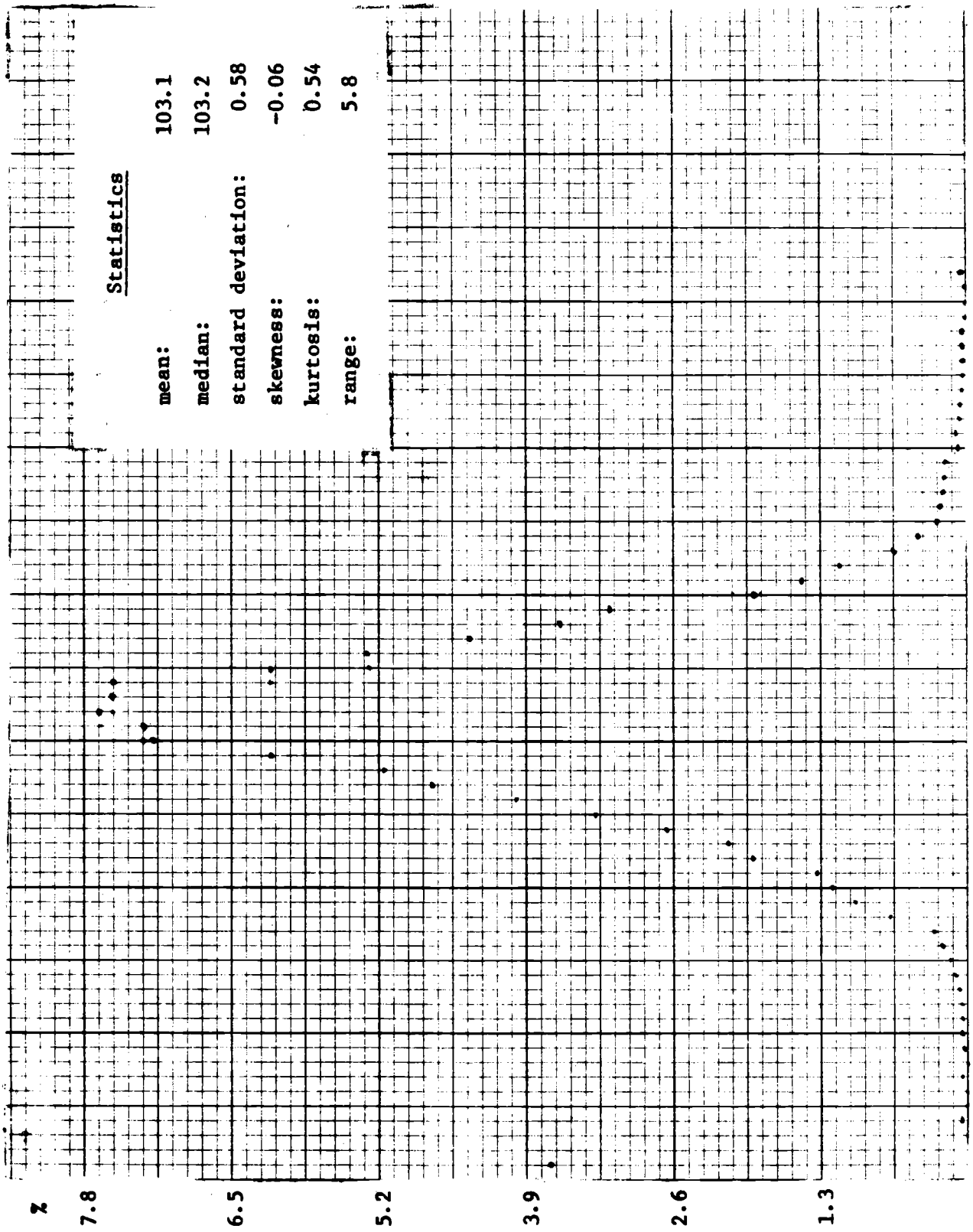


Figure 3. Frequency Distribution of 1973 Expenditure Price Index (by tenths).

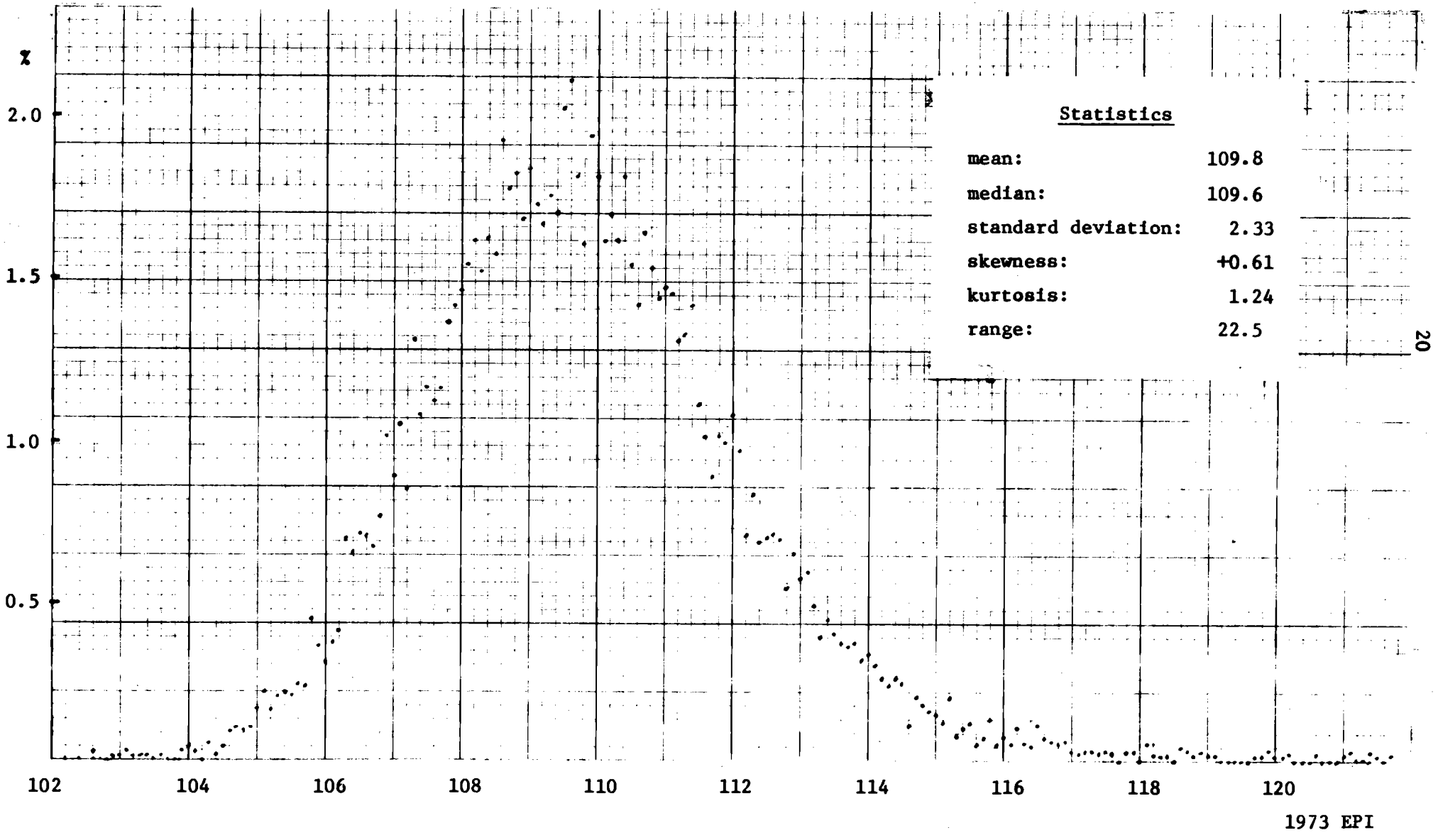


Figure 4. Frequency Distribution of January 1974 Expenditure Price Index (by tenths).

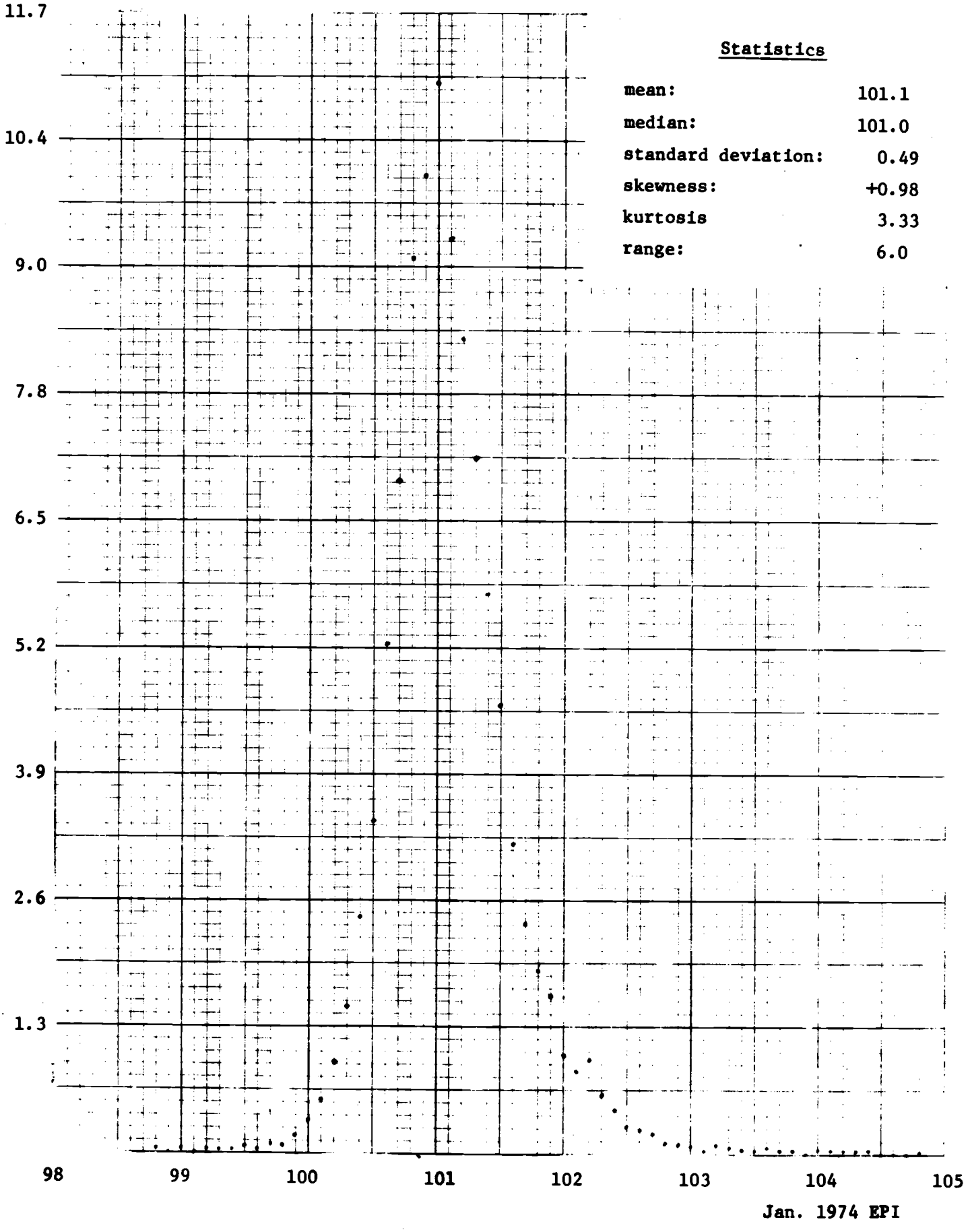


Figure 5. Frequency distributions of February and March 1974 EPI (by tenths).

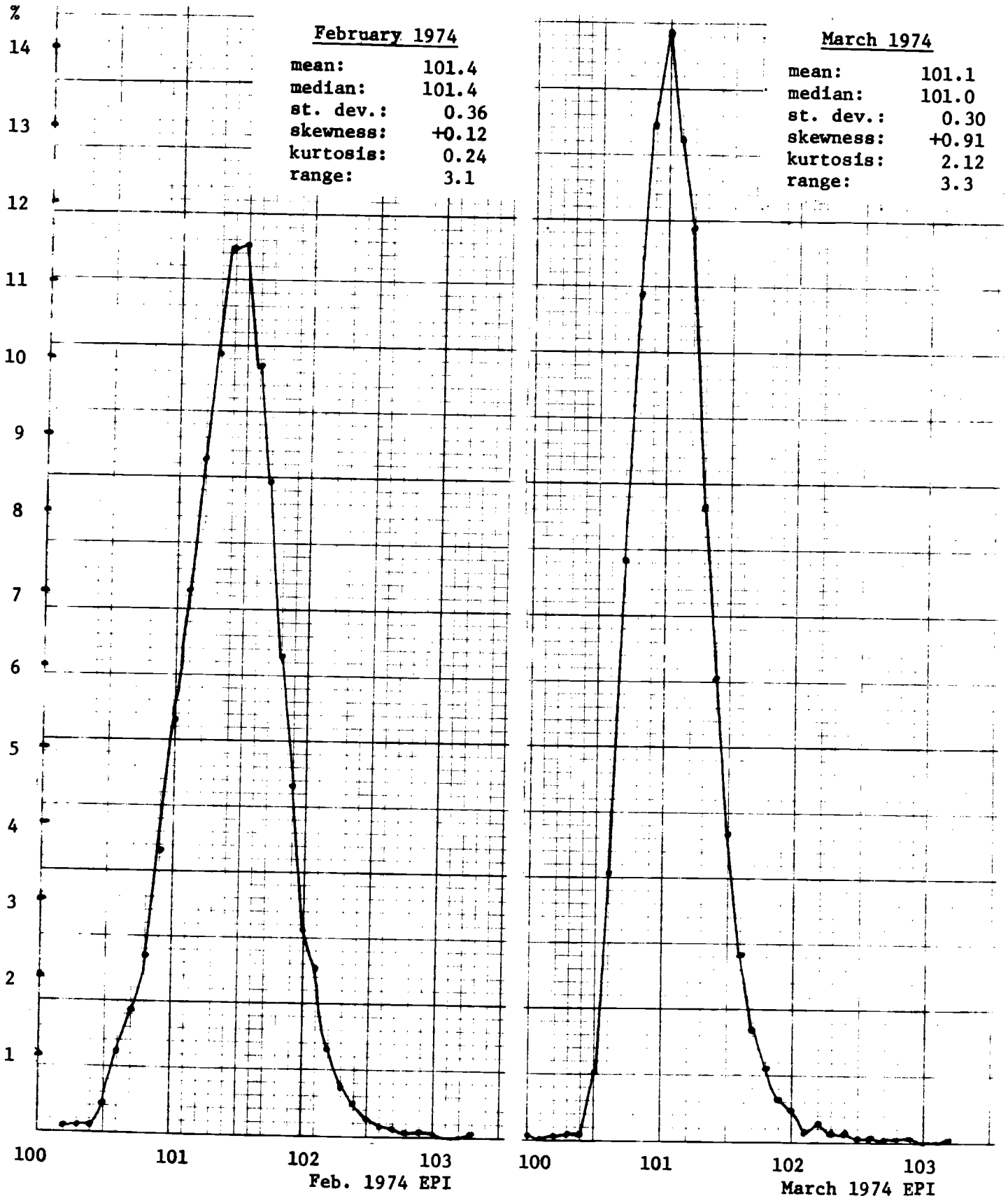
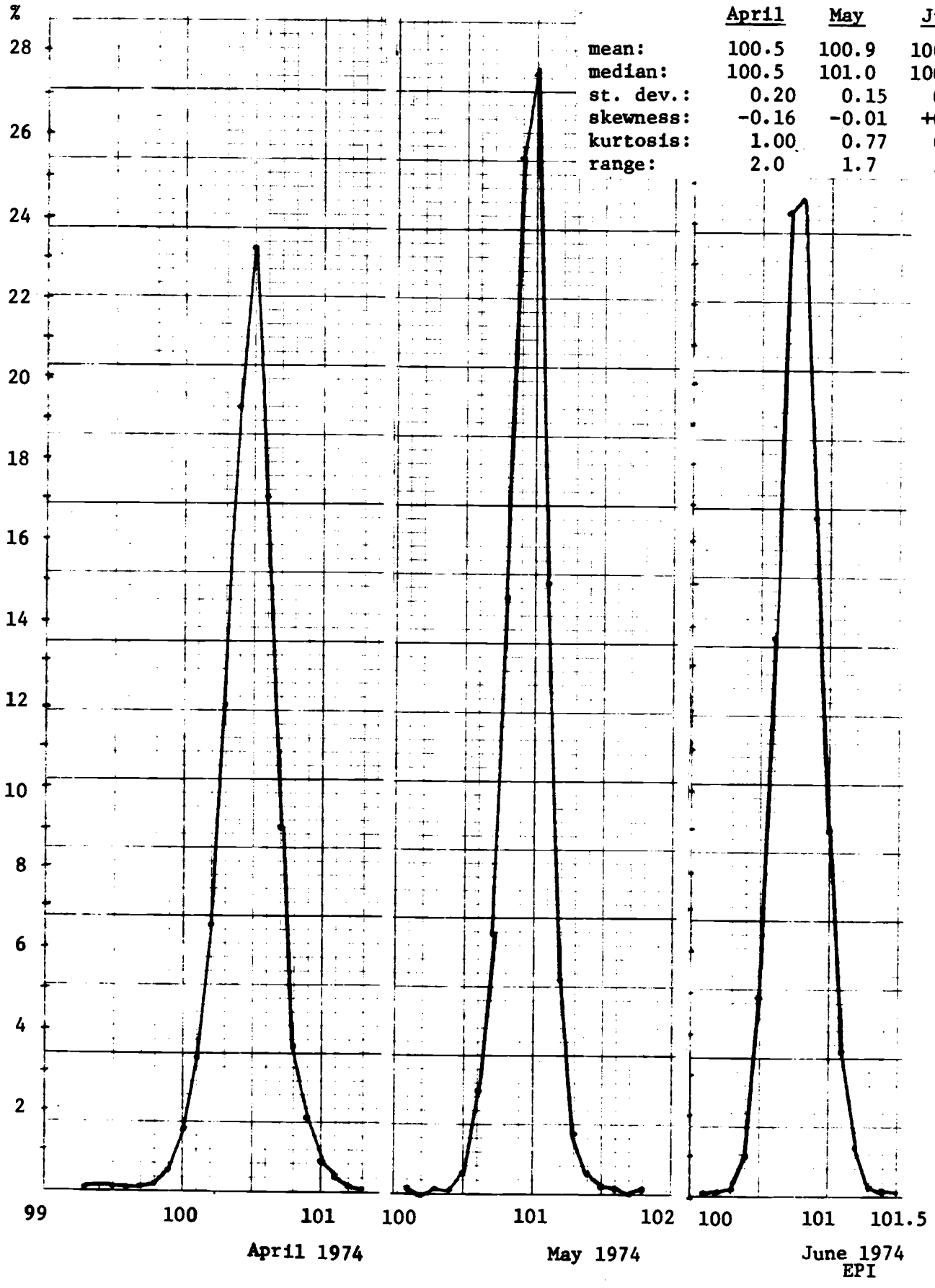


Figure 6. Frequency distributions of April, May, June 1974 EPI (by tenths).



	April	May	June
mean:	100.5	100.9	100.8
median:	100.5	101.0	100.8
st. dev.:	0.20	0.15	0.16
skewness:	-0.16	-0.01	+0.32
kurtosis:	1.00	0.77	0.39
range:	2.0	1.7	1.4

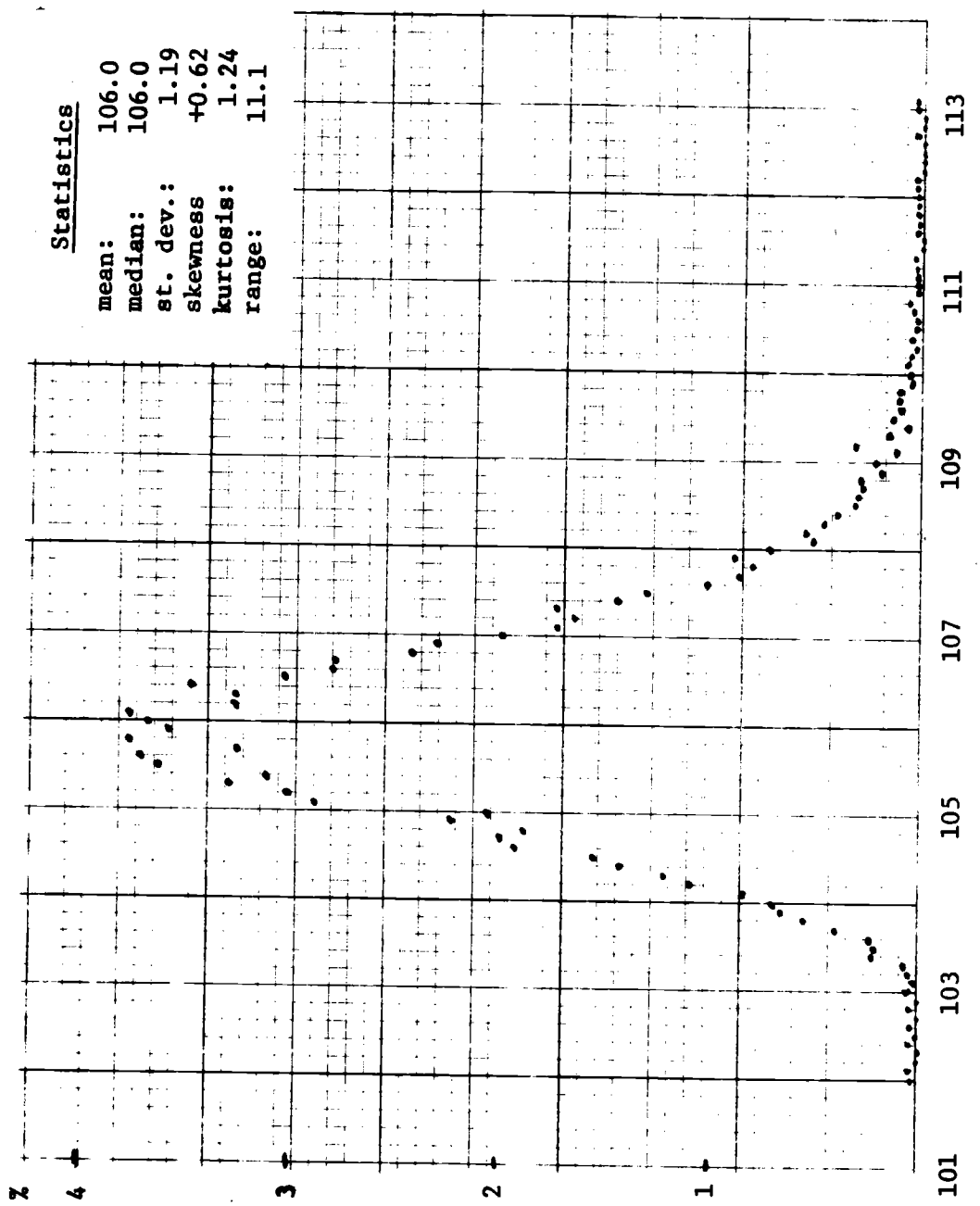


Figure 7. Frequency distribution of six-month (January-June 1974) EPI (by tenths).

within the range 7.84 percent to 11.67 percent). Likewise for the other time periods, the variation across households in the estimated rates of price increase is considerable.

In general, given one set of price changes attributed to all household bundles, the absolute variation in the EPI's across households is greater the larger the variance across households in the share of each item in the consumption bundles, the larger the covariances in the shares between items, the larger the differences across items in the rates of price change, and the greater the correlation between these variances (or covariances) and these differences in the rates of price change.[1]

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[1]The EPI for household j is

$$EPI_j = \sum_{i=1}^{n} w_{ij} \dot{P}_i \qquad (A1)$$

where w_{ij} is the ith good's weight in the jth household's bundle and $\dot{P}_i$ is the ith good's price increase. Imposing the constraint that $\sum_{i=1}^{n} w_{ij} = 1$, with good n as the redundant item we can rewrite equation (A1):

$$EPI_j = \dot{P}_n + \sum_{i=1}^{n-1} w_{ij}(\dot{P}_i - \dot{P}_n) \qquad (A2)$$

and hereafter replace $\dot{P}_i - \dot{P}_n$ by $\dot{P}'_i$. Then the variance across households is

$$\underset{j}{Var}(EPI) = \underset{j}{Var}(\dot{P}_n + \sum_{i=1}^{n-1} w_{ij}(\dot{P}'_i)) \qquad (A3)$$

$$\underset{j}{Var}(EPI) = \sum_{i=1}^{n-1} (\underset{j}{Var}\, w_{ij})\dot{p}_i'^2 + 2\sum_{i=1}^{n-1}\sum_{k=1\ i\neq j}^{n-2} (Cov\, w_{ij}\, w_{kj})\dot{P}'_i\,\dot{P}'_k \qquad (A4)$$

since there is no variation across households in the price change for any item. The term $\underset{j}{Var}(w_{ij})$ is the variation across households in the ith good's share in the consumption bundle. (Appendix Table A-2 shows the standard deviations and the coefficients of variation of these shares for the 52 items across the 11,761 households in the CES data.) The covariance term is the covariation across households in the weights of item i and item k.

The relative variation in the EPI's for these ten time periods ranged between 13 percent and 45 percent. There is a tendency for the relative variation in the estimated EPI's to be smaller over the longer time periods. Of course, the longer time periods considered here happen to be the earlier periods during which the rates of price increase were relatively less. But even within the first half of 1974, while the average coefficient of variation for the six months separately was about 29 percent, the coefficient of variation for the six-month period as a whole was only about two-thirds as large, 20 percent. There is not evidence, judging from the price variations in the first six months of 1974, that the coefficient of variation in the price indices is positively related to the level of the price increase.[1]

The differences reflected in Table 1 between the mean level of the EPI's and the official CPI for the comparable periods deserve comment. These differences are not of much analytical interest, since they result primarily from the differences in the methods of calculation. Most importantly, as discussed above, the EPI's exclude certain consumer items which are included in the CPI, notably house purchases. When comparable sets of items are priced, the mean EPI and the "adjusted" CPI differ very little.[2]

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[1]The most atypical month in this regard appears to be April, which exhibited a considerably lower price rise than the other months and a relatively large coefficient of variation. My casual impression is that the exceptionally large decline in the relative price of food and automobile purchases during that month resulted in the observed level and distribution of EPI's.

[2]For example, for the 1967-72 period the mean EPI was 22.5 and the official CPI was 25.3. During that time period the house purchases item rose in price by 40.1 percent; it is excluded from the EPI's for reasons discussed above. When I recomputed the change in the price index

Another methodological difference between the calculated EPI's and the CPI is the use of fixed expenditure weights in calculating the former and fixed quantity weights in calculating the CPI. This difference appears to have little effect on the indices over the interval of time considered. The EPI's for several of the time periods were recomputed using fixed quantity weights for each household, estimated from equation (6). The means and standard deviations of the EPI's for four time periods for the 11,761 households are shown in Table 2 calculated using the fixed expenditure weights and the fixed quantity weights. Also indicated are the simple correlations across households between these two estimates of the EPI's.

Table 2. Comparison of expenditure price indices with constant expenditure weights and constant quantity weights (n = 11,761).

Time period	Constant expenditure weights		Constant quantity weights		Simple correlation coefficient
	mean	s.d.	mean	s.d.	
1967-72	122.5	2.92	123.2	3.18	.988
1972	103.2	0.57	103.3	0.54	.991
1973	109.8	2.33	109.7	2.21	.990
January 1974	101.1	0.49	101.2	0.53	.992

Figures 1-7 document the considerable dispersion among households in the impact of a given set of observed market price changes on the

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for the 52 items included in the EPI and weighting by the CPI weights (normalized), the "adjusted CPI" was 22.1. Likewise, in the 1973 period in which the mean EPI exceeded the official CPI (9.82 compared to 8.8), the home purchase item which is included in the latter rose in price by only 7.7 percent. When it and the smaller weighted items which have been excluded from the EPI's were deleted from the CPI, the "adjusted CPI" for 1973 rose by 9.8 percent. These calculations were performed not with the intention of suggesting that the "adjusted CPI" is in any way preferable to the official CPI, but only to emphasize that the difference in mean EPI and the CPI simply reflects the difference in the definitions of the bundles of goods priced.

prices of the various households' bundles of purchased goods and services. One question raised by this observed dispersion is: does the dispersion imply that it would be useful to construct a separate price index for several different bundles of goods, or for bundles which characterize the spending patterns of different economic or demographic groups in the economy? Its usefulness would depend, of course, on the purpose for which it is intended. The figures make clear that price indices of different bundles of goods would indeed differ substantially in many specific time periods. If the intention were to describe how a given change in the set of market prices affected the prices of various bundles of goods, several such indexes would be useful. But if the intention were to calculate a price index which more accurately reflects the costs to households within particular economic groups, the issue becomes the dispersion in household-specific price indexes within household-characteristic-specific groups compared to the dispersion between groups. Furthermore, if the underlying concern is to track over time the impact of price changes on the prices of different groups' bundles of goods, even if significant differences exist in the various bundles' price indices for one time period, it may not imply a divergence over time in the price indices for different groups.

The EPI's calculated here can shed some light on these issues. It must be stressed that in calculating the EPI's all households were assumed to confront the same changes in market prices for a particular time period (e.g., the BLS estimated that the price of alcoholic beverages rose 1.8 percent in 1972 and that price rise was then assumed to be the price rise experienced by each of the households in the sample).

The discussion which follows does not address the question of the differences in (or uses of) group-specific price indices when group-specific prices as well as group-specific bundles of goods are estimated.

Table 3 indicates means and standard deviations of EPI's for four time periods for various demographic and economic subgroups in the sample. Part A lists several one-way groupings each of which utilizes all observations while part B cross-classifies a far more demographically homogeneous subgroup. We will consider the results from the classification by 1960-61 after-tax money income. It appears that the mean EPI is negatively related to the level of money income in 1973 and January 1974 and more nearly U-shaped in the earlier periods. Consider in more detail the 1973 EPI's for the two groups with income levels of $1-2,000 and $10-15,000 (the mean EPI's for these two groups, as seen in column 5, are 111.0 and 108.9). If we ask whether these two group means are different from each other, by conventional standards of statistical significance, they are.[1]

But there is considerable dispersion of EPI's within each of the groups. The differences between group means are, in general in Table 3, small relative to the within-group standard deviations. To illustrate the point, suppose we asked what additional information is acquired about the impact of the 1973 price changes on the EPI's of the $10-15,000 income households by using the percentage increase in

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[1]The test of a difference of these two means yields a test statistic equal to 16.6 which is highly significant, statistically. With large enough samples, any observed difference in the means is significant since the standard error of the difference varies inversely with the square root of the sample sizes.

Table 3. Means and standard deviations of EPI's by selected household characteristics.

A. Means and standard deviations of EPI's for four time periods, subgroups of households defined by family income, age of head, number of children under age 18, or region of residence.

Household characteristics	1967-72 EPI		1972 EPI		1973 EPI		1/74 EPI		Cell size
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	
1960 Family income after tax									
< $1,000	123.6	4.5	103.7	0.7	111.6	3.5	101.4	0.7	364
1-2,000	123.0	4.3	103.6	1.7	111.0	3.4	101.2	1.7	1087
2-3,000	123.0	3.7	103.4	1.8	110.3	3.1	101.1	1.7	1203
3-4,000	122.5	3.5	103.2	1.8	109.9	3.0	101.1	1.8	1286
4-5,000	122.2	3.4	103.1	1.9	109.7	2.9	101.1	1.9	1585
5-6,000	122.1	3.1	103.0	1.9	109.7	2.7	101.1	1.9	1520
6-7,500	122.3	2.8	103.0	1.7	109.6	2.4	101.0	1.8	1861
7.5-10,000	122.4	2.8	102.9	1.8	109.3	2.4	101.0	1.8	1707
10-15,000	122.7	3.1	102.9	1.3	108.9	2.2	100.9	1.3	890
15-25,000	123.7	2.9	103.0	0.5	108.3	1.6	100.8	0.4	208
> 25,000	125.1	3.3	103.0	0.6	107.7	1.8	100.6	0.5	50
Total	122.5	2.9	103.1	0.6	109.8	2.3	101.1	0.5	11761
Region of residence									
North East	122.9	3.1	103.2	1.2	110.0	2.5	101.1	1.2	3083
N. Central	122.5	3.1	103.1	1.1	109.8	2.6	101.1	1.0	3350
South	122.2	3.2	103.1	1.1	109.8	2.6	101.1	1.0	3255
West	122.5	3.2	103.0	1.6	109.3	2.5	101.0	1.6	2073
Age of head									
≤ 19	123.0	2.8	103.0	0.6	107.4	2.0	100.4	0.5	32
20-29	121.6	3.0	102.9	1.9	108.8	2.7	101.0	1.9	1536
30-39	122.0	2.6	103.0	1.3	109.7	2.3	101.0	1.3	2637
40-49	122.3	2.6	103.1	1.4	109.7	2.4	101.0	1.3	2462
50-59	122.8	3.0	103.1	1.6	109.7	2.6	101.1	1.6	2088
60-69	123.2	3.8	103.3	1.8	110.2	3.1	101.2	1.9	1711
≥ 70	123.6	4.5	103.5	1.9	110.9	3.5	101.3	1.8	1295

Continued

Table 3 (concluded)

Household characteristics	1967-72 EPI		1972 EPI		1973 EPI		1/74 EPI		Cell size
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	
No. children under age 18									
0	123.0	3.5	103.2	0.4	109.7	2.6	101.1	0.3	5706
1	122.0	2.8	103.0	1.7	109.4	2.5	101.0	1.7	1937
2	122.1	2.8	103.0	1.8	109.7	2.5	101.0	1.7	1831
3	122.1	2.9	103.1	1.7	110.2	2.6	101.1	1.7	1195
4	122.1	2.4	103.1	0.4	110.5	2.0	101.1	0.3	614
5	122.1	2.2	103.2	0.5	110.8	2.0	101.1	0.4	264
≥ 6	122.0	2.3	103.3	0.5	111.3	2.1	101.1	0.4	214

B. Means and standard deviations of 1973 EPI's for married, white, 40-49 year old heads of households living in small (<250,000) cities by education of head and family size.

Family size	Education of head		
	≤ 8 yrs	9-12 yrs	≥ 13 yrs
< 3 persons	110.2 (2.07) [42]	109.6 (2.09) [107]	108.8 (1.64) [26]
3-5 persons	110.1 (2.00) [200]	109.9 (1.89) [432]	109.4 (1.67) [210]
≥ 6 persons	111.7 (2.08) [78]	110.5 (1.89) [104]	110.4 (1.76) [64]

Note: standard deviation in ( ); cell size in [ ].

its own mean EPI (8.9) rather than the percentage increase in the mean EPI for the entire sample or, for that matter, the mean EPI for the low ($1-2000) income group. The group's own EPI is the best estimate of the central tendency of the group's distribution of EPI's, but if we define an interval around that mean of plus or minus 10 percent of the mean, the interval captures only 31 percent of the high income household's EPI's! A comparable interval of plus or minus 10 percent around the entire sample's mean EPI of 9.8 captures 32 percent of the high income household's EPI's and a comparable interval around the low income group's mean EPI of 11.0 captures 25 percent of the high income household's EPI's. An interval defined by the mean plus or minus 30 percent of that mean captures 77 percent of the $10-15,000 income group's EPI's if its own group's mean EPI is used, but again 78 percent (or 70 percent) of that high income group's EPI's are captured by a comparable interval around the entire sample's mean EPI (or around the low income group's mean EPI).[1]

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[1]These calculations assume that the household-specific EPI's within the group are distributed normally around its own group mean. The figures quoted are obtained by calculating the interval ($0.90\mu_i$ to $1.10\mu_i$) using group i's mean EPI (11.0 from the low income group, 9.8 for the entire sample, and 8.9 for the high income group) and then determining from a standard normal table the percentage of observations from the high income group (distributed normally with mean 8.9 and $\sigma = 2.2$) within that interval.

The comparable figures for the estimated proportion of the low income group's EPI's encompassed by an interval defined by plus or minus 10 percent of the group's mean EPI are: 25 percent of the observations if the own group's mean is used, 21 percent if the entire sample's mean is used, and 17 percent if the high income group's mean is used.

Table 3 suggests that the within-group variation in EPI's is substantial, whether grouped by some single demographic or economic variable or by a cross-classification of several variables (see part B of Table 3). There is dispersion in the individual household's price indices, and none of the grouping schemes which I have attempted (and of which Table 3 is representative) appears to reduce substantially that dispersion. A more straightforward approach to the question of the relationship between certain socio-economic characteristics and the variation in the computed EPI's is a regression analysis. The following section presents some results from regressions and also considers briefly evidence on the covariation over time in the individual household's EPI's.

III. Systematic Differences in the EPI's

The preceding section indicates that there is considerable dispersion among households in the impact of a given change in the price vector of market goods on the price of the households' bundles of purchased goods. The evidence of that dispersion gives force to the question of whether there are systematic differences by socio-economic characteristics in the observed dispersion in these price changes. That is, do certain types of households experience systematically larger or smaller changes in their price indices than other types of households?

This question gets to the heart of the recently intensified social concern about the distributional impact of inflation on various groups in the economy--the elderly versus the young, the wealthy versus the poor, etc. While there has been much discussion of this issue, there is, I think, surprisingly little evidence on the nature or magnitude of the effect of changes in the price level on the personal distribution of real income. There have been several studies in the past few years of the impact of inflation on the distribution of wealth among household groups, firms and governments via the nature of the debtor-creditor positions and the fixed and variable priced assets held by these groups.[1] Two other recent studies, one using data for the United

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[1] See G. L. Bach and James B. Stephenson, "Inflation and the Redistribution of Wealth," Rev. Econ. Stat., LVI (February 1974); A. F. Brimmer, "Inflation and Income Distribution in the U.S.," Rev. Econ. Stat., LII (February 1971); E. Budd and D. Seiders, "The Impact of Inflation on the Distribution of Income and Wealth," AER (May 1971); W. Nordhaus, "The Effects of Inflation on the Distribution of Economic Welfare," J. of Money, Credit and Banking (February 1973 Supplement) (NBER U-NB Series, Vol. 25, 1973); and J. Stephenson, "Household Responses to Inflation," Ph.D. dissertation, Stanford University, 1973.

States and the other the United Kingdom, have considered the distributional effects of inflation among specific economic groups via differences in the groups' consumption bundles.

A study by Muellbauer investigates the differential impact of changes in the price structure in the United Kingdom from 1964 to 1972 on the cost of living of consumers.[1] Muellbauer uses an estimated system of linear demand equations (a Stone-Geary system of demand functions) calculated for nine expenditure items with expenditure data from 1954-1970. The system yields estimates of price and time-dependent income (total expenditure) coefficients. Assuming a specific form of the utility function Muellbauer computes a cost of living index which is a function of levels of income (total expenditure), the price vector and the coefficients from the demand equations. He finds that his estimated cost of living index rose more during the 1964-72 period for lower income consumers (for example, the percentage increase over the

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[1] John Muellbauer, "Prices and Inequality: The United Kingdom Experience," The Economic Journal, 84 (March 1974).

Muellbauer's procedure emphasizes the systematic differences in the price index by income level, and incorporates estimated price elasticities. By contrast, the procedure I have followed emphasizes the dispersion--whether systematic or not--in the price indices. Said differently, if we consider nine expenditure items and, say, 20 "representative" consumer units and one period of price change, Muellbauer's method involves 45 "degrees of freedom" (= 9 price changes + 8 price coefficients + 8 expenditure coefficients + 20 expenditure levels) while the procedure I have followed involves 169 "degrees of freedom" (= 9 price changes + 20 [8 expenditure shares]). In fact, Muellbauer employs 9 priced items and 9 expenditure levels while the data here utilize 52 priced items and about 11,000 consumer units. Despite the differences in methods the qualitative systematic differences in price indices do appear to be rather comparable. In both studies the recent increases in food and fuel prices appreciably affect--if not dominate--the results.

nine years for the highest income group was 45 percent and for the lowest income group 51 percent).

On the basis of his own study of cost of living indices in the 1960's and other studies of the relative movement of fixed-weighted price indices for groups in the United Kingdom since the late 1940's, Muellbauer concludes that "for more than twenty years relative consumer price changes [in the United Kingdom] have had an inegalitarian bias."

By contrast, the study of the U.S. experience in recent years shows no such consistency over time in the impact of price changes on the relative position of the poor. Hollister and Palmer constructed a 1960-61 fixed-weighted price index for several categories of consumers (e.g. the aged poor, the urban nonaged poor, all poor, all wealthy, and a middle income group) using the same cross-section data set used in my study, the 1960-61 BLS Consumer Expenditure Survey. On the basis of the movement in those price indices for the various groups from 1953 through 1967 estimated annually, Hollister and Palmer concluded that "the expenditure effects of the type of inflation we have experienced since World War II, in general, have not been adverse for the poor. Particularly in the 1960's the expenditure effects of rising price levels have fallen somewhat less heavily on the poor than on other income groups."[1] An extension of these group-specific price indices from 1967 through July 1974, however, showed a relatively higher rate of growth of the "poor person's price index" than of the "high income

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[1]Robinson G. Hollister and John L. Palmer, "The Impact of Inflation on the Poor," in K. Boulding and M. Pfaff, eds., Redistribution to the Rich and Poor: The Grants Economics of Income Distribution, Wadsworth Publishing Co., 1972. The quotation is from page 249.

person's price index," especially in the time period since 1972.[1] For the period from 1967 through 1972 the ratio of the rise in the poor person's price index to the rise in the rich person's price index was 1.03, for the period from 1972 through July 1974 the ratio was about 1.09.

The present study is similar to these U.K. and U.S. studies in several respects. While the Muellbauer procedure estimates the changes in the composition of consumption bundles resulting from relative price changes, it and my study restrict the focus of analysis to the impact of price changes on the households' index of price changes. Neither study considers the relationship between consumer price increases and the value of flows or stocks of income or wealth. Both are partial analyses. While the Hollister/Palmer and Palmer/Barth papers make estimates of the relationships between inflation and earnings and assets, they, and I, use a fixed-weighted (Laspeyres) price index. None of these studies, including mine, use price change data specific either to the household or to the household type. Economy-wide observed price changes for consumption categories are assumed to reflect the changes in prices actually confronted by all households.[2]

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[1] John L. Palmer, Michael C. Barth and co-authors, "The Impact of Inflation and Higher Unemployment: With Emphasis on the Lower Income Population," Technical Analysis Paper #2, Office of Income Security Policy, Office of the Assistant Secretary for Policy and Evaluation, Department of Health, Education, and Welfare, October 1974.

[2] Snyder reports some evidence that within some broad categories of consumption, e.g. food, from the late 1930's through the mid-1950's, items with lower income elasticities rose relatively more in price. (See Eleanor M. Snyder, "Cost of Living Indexes for Special Classes of Consumers," in The Price Statistics of the Federal Government, George J. Stigler, chm., NBER, GS73, 1961).

The nature of the evidence presented below differs substantially from the Muellbauer and Hollister/Palmer and Palmer/Barth evidence in other respects. These studies compute price indices for groups of households directly. Yet the discussion in the preceding section emphasized that within such groups the expenditure bundles and the price indices exhibit considerable dispersion in any particular time period. The within-group variation appears to be large relative to the between-group differences in means of price indices. With indices computed for each individual household we can determine not only what statistically significant relationships exist between the indices and the groups' characteristics, but also how much of the individual variation is systematically related to its groups' characteristics.

In Table 4 the data set is partitioned into three groups defined by marital status. For each of the groups (married spouse present, divorced-widowed-separated, and single (whites only)), the table indicates the means and standard deviations for a set of dummy variables describing the demographic and economic characteristics of the group, for the after tax 1960 family income of the group and for the 10 EPI's for the group. For example, the table indicates that 36.5 percent of the married couples lived in cities larger than 50,000; in 89.4 percent of these households the race of the head was white, their average family income in 1960 was $6,452, etc. Table 5 shows the simple correlation matrix for each of these three groups. The correlations between the price indices themselves will be presented and discussed below (in Table 10). First, consider the relationship between the demographic/economic variables and the expenditure price indices.

Table 4. Means and standard deviations of selected variables, by marital status.

Item	Singles (whites)		Married, spouse present		Divorced, widowed, separated, other	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
City size (1 if ≥ 50,000)	0.537	0.499	0.365	0.482	0.487	0.500
Sex (1 if male)	0.417	0.494	0.995	0.069	0.228	0.420
Race (1 if white)			0.894	0.308	0.811	0.392
High school (1 if ≥ 9)	0.746	0.436	0.686	0.464	0.498	0.500
College (1 if ≥ 13)	0.365	0.482	0.227	0.419	0.123	0.328
Age 40 (1 if ≥ 40)	0.622	0.485	0.591	0.492	0.857	0.350
Age 50 (1 if ≥ 50)	0.490	0.500	0.361	0.480	0.704	0.456
Age 60 (1 if ≥ 60)	0.319	0.467	0.187	0.390	0.514	0.500
Age 70 (1 if ≥ 70)	0.147	0.354	0.067	0.249	0.276	0.447
Family size 3-5 (1 if ≥ 3)			0.671	0.470		
Family size 6+ (1 if ≥ 6)			0.123	0.328		
1960 family income after tax (000)	3.961	2.971	6.452	3.956	3.074	2.787
Percent expenditure omitted*	0.074	0.068	0.069	0.058	0.078	0.089
EPI 1967-1972	123.622	3.261	122.248	3.179	123.179	3.930
EPI 1972	103.289	0.651	103.064	0.533	103.409	0.643
EPI 1973	109.006	2.859	109.838	2.133	109.995	2.782
EPI January 1974	100.895	0.667	101.121	0.428	101.057	0.627
EPI February 1974	101.226	0.441	101.459	0.341	101.402	0.405
EPI March 1974	100.947	0.323	101.125	0.289	100.940	0.290
EPI April 1974	100.537	0.252	100.471	0.176	100.441	0.257
EPI May 1974	100.888	0.163	100.970	0.138	100.871	0.172
EPI June 1974	100.762	0.183	100.796	0.148	100.728	0.186
EPI Jan.-June 1974	105.441	1.427	106.184	1.088	105.634	1.328
Number of Observations	633		8802		2235	

*I was unable to obtain a price change for every item in the consumer's expenditure basket (see Appendix A). The "percent expenditure omitted" indicates the percent of the consumer's total current consumption expenditure for which I had no price information.

Table 5. Simple correlation coefficients, selected variables by marital status.

A. Singles (whites only); n = 633.

Variables*	City size	Sex	High school	College	Age ≥ 40	Age ≥ 50	Age ≥ 60	Age ≥ 70	Family income	% exp. omitted
City size	1.00									
Sex	-.07	1.00								
High school	.15	-.14	1.00							
College	.10	-.13	.44	1.00						
Age ≥ 40	-.22	-.19	-.31	-.19	1.00					
Age ≥ 50	-.21	-.15	-.31	-.14	.76	1.00				
Age ≥ 60	-.17	-.11	-.32	-.15	.53	.70	1.00			
Age ≥ 70	-.13	-.07	-.24	-.09	.32	.42	.61	1.00		
Income	.08	.10	.32	.22	-.07	-.12	-.26	-.26	1.00	
% exp. omitted	.03	-.10	.16	.22	.05	.10	.09	.02	.16	1.00
EPI 67-72	.01	.01	-.08	-.01	.15	.21	.16	.05	-.01	.08
EPI 72	.01	-.11	-.23	-.12	.31	.35	.31	.29	-.31	.07
EPI 73	-.26	.06	-.38	-.28	.38	.36	.33	.27	-.26	.02
EPI 1/74	-.32	.20	-.25	-.18	.30	.29	.29	.21	-.12	-.01
EPI 2/74	-.26	-.03	-.27	-.19	.31	.29	.26	.22	-.15	.05
EPI 3/74	-.13	.11	.10	.04	-.08	-.07	-.09	-.11	.12	.08
EPI 4/74	-.03	.17	.23	.11	-.22	-.20	-.19	-.22	.11	.06
EPI 5/74	-.19	.18	.12	.01	-.12	-.13	-.14	-.14	.14	.09
EPI 6/74	-.12	.20	.05	.03	.02	.01	-.03	-.08	.13	-.05
EPI 1-6/74	-.32	.20	-.12	-.12	.17	.17	.15	.08	-.02	.05

*Variables are defined in more detail in Table 4.

Approximate critical value for rejecting null hypothesis that the population simple correlation is zero: $r_{631}^{.99} \cong .10$.

(Continued)

Table 5 (continued)

B. Married couples, spouse present; n = 8802.

Variables*	City size	Race	High school	College	Age ≥ 40	Age ≥ 50	Age ≥ 60	Age ≥ 70	Family size ≥ 3	Family size ≥ 6	Family income	% exp. omitted
City size	1.00											
Race	-.21	1.00										
High school	.01	.14	1.00									
College	-.00	.11	.37	1.00								
Age ≥ 40	.02	.02	-.28	-.13	1.00							
Age ≥ 50	.05	.00	-.34	-.13	.63	1.00						
Age ≥ 60	.03	.01	-.32	-.12	.40	.64	1.00					
Age ≥ 70	.00	.02	-.21	-.07	.22	.35	.56	1.00				
Family size ≥ 3	-.07	-.00	.17	.07	-.26	-.43	-.45	-.30	1.00			
Family size ≥ 6	-.05	-.07	-.02	-.00	-.09	-.18	-.16	-.10	.26	1.00		
Income	.02	.14	.30	.34	.06	-.09	-.21	-.21	.22	.04	1.00	
% exp. omitted	.02	.05	.14	.23	.08	.06	-.00	-.01	.04	-.03	.32	1.00
EPI 1967-72	.09	.03	-.01	.04	.16	.17	.16	.13	-.10	-.02	.10	.10
EPI 1972	.12	-.06	-.19	-.09	.22	.24	.26	.20	-.10	.06	-.19	.02
EPI 1973	-.11	-.03	-.23	-.17	.13	.13	.16	.15	.03	.14	-.29	-.10
EPI 1/74	-.23	.06	-.20	-.17	.10	.17	.20	.16	-.10	-.01	-.31	-.12
EPI 2/74	-.13	-.03	-.24	-.23	.12	.14	.15	.12	.01	.12	-.32	-.10
EPI 3/74	-.16	.03	-.04	-.12	-.01	-.02	-.07	-.10	.04	.01	-.07	-.01
EPI 4/74	-.09	.03	.15	.07	-.05	-.08	-.15	-.16	.01	-.09	.25	.12
EPI 5/74	-.17	.02	.04	-.06	-.16	-.16	-.19	-.16	.14	.03	.01	-.02
EPI 6/74	-.12	.08	.08	.05	-.07	-.05	-.06	-.05	-.01	-.07	.10	-.02
EPI 1-6/74	-.25	.04	-.13	-.17	.03	.06	.05	.02	-.01	.01	-.20	-.07

*Variables are defined in more detail in Table 4.

Approximate critical value for rejecting null hypothesis that population simple correlation is zero: $r^{.99}_{8800} \cong .02$.

(Continued)

Table 5 (concluded)

C. Divorced, widowed, separated; n = 2235.

Variables*	City size	Sex	Race	High school	College	Age ≥ 40	Age ≥ 50	Age ≥ 60	Age ≥ 70	Family income	% exp. omitted
City size	1.00										
Sex	.02	1.00									
Race	-.17	-.00	1.00								
High school	.06	-.05	.11	1.00							
College	-.03	.01	.07	.38	1.00						
Age ≥ 40	-.08	.05	.21	-.22	-.05	1.00					
Age ≥ 50	-.07	.03	.22	-.26	-.08	.63	1.00				
Age ≥ 60	-.10	.01	.21	-.26	-.09	.42	.67	1.00			
Age ≥ 70	-.07	.02	.18	-.22	-.08	.25	.40	.60	1.00		
Income	.03	.12	.10	.30	.27	-.07	-.18	-.24	-.21	1.00	
% exp. omitted	-.03	.12	.11	.11	.14	-.00	.02	-.01	-.02	.19	1.00
EPI 1967-72	-.04	-.08	.09	-.04	.01	.09	.14	.14	.08	-.00	.13
EPI 1972	.08	-.13	-.03	-.19	-.16	.08	.17	.21	.21	-.32	-.06
EPI 1973	-.12	-.09	-.06	-.25	-.20	.08	.13	.18	.18	-.27	-.14
EPI 1/74	-.24	.05	.08	-.18	-.11	.19	.21	.24	.21	-.16	-.04
EPI 2/74	-.17	-.10	-.03	-.23	-.18	.07	.10	.15	.14	-.23	-.08
EPI 3/74	-.17	.11	.05	.04	-.00	-.03	-.09	-.13	-.15	.16	.08
EPI 4/74	-.11	.15	.03	.15	.10	-.01	-.07	-.13	-.16	.22	.10
EPI 5/74	-.20	.09	.00	.07	.05	-.06	-.11	-.14	-.15	.21	.04
EPI 6/74	-.13	.18	.06	.08	.12	.07	.02	-.01	-.04	.18	.07
EPI 1-6/74	-.29	.09	.06	-.10	-.07	.11	.09	.09	.06	-.01	.01

*Variables are defined in more detail in Table 4.

Approximate critical value for rejecting the null hypothesis that population simple correlation is zero: $r^{.99}_{2233} \cong .05$.

From these three independent simple correlation matrices notice that none of the demographic or economic variables has the same sign for its correlation with the EPI's for all nine of the time periods considered. Schooling level and family income appear to be negatively related to the rate of change of prices in the period from 1972 through early 1974, but less consistently so in the preceding five-year period and rather consistently positively related in the second quarter of 1974.[1] The age of the head of the household appears to exhibit just the opposite pattern. Sex and race of the head of the household generally have weaker correlations with the price indices while households in larger cities appear to have experienced somewhat milder price increases in 1973 and the first half of 1974.[2]

In order to see the partial relationships with the EPI's, ordinary least squares regressions were run for each of these marital status groups separately on each of the EPI's. The linear regressions used individual households as units of observation. Results for the first four time periods--the five-year period 1967-72, the year 1972, the year 1973, and the month January 1974--for each of the marital status groups are shown in Table 6. These regressions generally show

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[1]Palmer and Barth observe the same pattern in comparing their "poor person's price index" and "high income person's price index." The former rose more rapidly than the latter from mid-1973 through February 1974 but rose less rapidly from February through their last observation in July 1974. Of course, this consistency is not surprising since their evidence and mine are not independent.

[2]Recall that the procedure here uses the same price change for all households, so this statement pertains to systematic differences in the composition of the consumption bundle, not to direct evidence on the differential rates of changes in specific market prices in large and small cities.

Table 6. **Regressions on expenditure price indices for four separate time periods,** 1967-72, 1972, 1973, and January 1974, by marital status.

a. **Singles (whites only).**

Independent variable	Expenditure price index for the period:			
	Five years	1972	1973	Jan. 1974
	(1967-1972)	(12/71-12/72)	(12/72-12/73)	(12/73-1/74)
City size (1 if ≥ 50,000)	0.377 (0.264)	0.133** (0.049)	-0.837** (0.203)	-0.302** (0.048)
Sex (1 if male)	0.341 (0.271)	-0.090 (0.050)	0.338 (0.209)	0.297** (0.050)
High School (1 if ed. head ≥ 9)	-0.221 (0.349)	-0.173** (0.065)	-1.230** (0.268)	-0.075 (0.064)
College (1 if ed. head ≥ 13)	0.243 (0.297)	-0.034 (0.055)	-0.659** (0.228)	-0.072 (0.054)
Age 40 (1 if age of head ≥ 40)	0.048 (0.418)	0.114 (0.078)	1.059** (0.321)	0.225** (0.077)
Age 50 (1 if age of head ≥ 50)	1.267** (0.466)	0.230** (0.087)	0.310 (0.358)	0.029 (0.085)
Age 60 (1 if age of head ≥ 60)	0.488 (0.437)	0.029 (0.081)	0.347 (0.336)	0.181* (0.080)
Age 70 (1 if age of head ≥ 70)	-0.598 (0.452)	0.282** (0.084)	0.653 (0.348)	0.083 (0.083)
Intercept	122.634	103.163	109.455	100.791
St. error of est.	3.195	0.595	2.458	0.586
R^2	0.052	0.177	0.271	0.239
F(8,624)	4.282	16.781	28.930	24.485

*Statistically significant at α_1 = 95%.

**Statistically significant at α_2 = 99%.

Table 6 (continued)

b. Married.

Independent variable	Expenditure price index for the period:			
	Five years (1967-1972)	1972 (12/71-12/72)	1973 (12/72-12/73)	Jan. 1974 (12/73-1/74)
City size (1 if ≥ 50,000)	0.485** (0.058)	0.131** (0.011)	-0.465** (0.045)	-0.208** (0.009)
Race (1 if white)	0.264** (0.092)	-0.041* (0.018)	-0.102 (0.072)	0.045** (0.014)
High school (1 if ed. head ≥ 9)	0.239** (0.068)	-0.080** (0.013)	-0.626** (0.053)	-0.090** (0.011)
College (1 if ed. head ≥ 13)	0.369** (0.070)	-0.029* (0.014)	-0.528** (0.055)	-0.120** (0.011)
Family size 3-5 (1 if ≥ 3)	-0.086 (0.068)	0.037** (0.013)	0.526** (0.053)	-0.017 (0.011)
Family size 6+ (1 if ≥ 6)	0.216** (0.087)	0.177** (0.017)	0.880** (0.068)	0.022 (0.014)
Age 40 (1 if age of head ≥ 40)	0.571** (0.071)	0.112** (0.014)	0.223** (0.056)	-0.034** (0.011)
Age 50 (1 if age of head ≥ 50)	0.311** (0.089)	0.068** (0.017)	0.100 (0.070)	0.060** (0.014)
Age 60 (1 if age of head ≥ 60)	0.380** (0.105)	0.186** (0.020)	0.590** (0.082)	0.105** (0.016)
Age 70 (1 if age of head ≥ 70)	0.650** (0.132)	0.187** (0.026)	0.680** (0.103)	0.100** (0.021)
Intercept	121.097	102.929	109.864	101.226
St. error of est.	2.548	0.499	1.997	0.399
R^2	0.056	0.126	0.124	0.133
F(10,8791)	51.669	126.682	124.509	134.841

*Statistically significant at α_1 = 95%.

**Statistically significant at α_2 = 99%.

Table 6 (concluded)

c. Divorced, widowed, separated, and other.

Independent variable	Expenditure price index for the period:			
	Five years (1967-1972)	1972 (12/71-12/72)	1973 (12/72-12/73)	Jan. 1974 (12/73-1/74)
City size (1 if ≥ 50,000)	-0.099 (0.157)	0.125** (0.026)	-0.638** (0.113)	-0.267** (0.025)
Sex (1 if male)	0.651** (0.184)	-0.222** (0.031)	-0.614** (0.132)	0.066* (0.030)
Race (1 if white)	0.539** (0.211)	-0.079* (0.035)	-0.649** (0.151)	-0.003 (0.034)
High school (1 if ≥ 9 yrs)	-0.052 (0.177)	-0.137** (0.029)	-0.820** (0.127)	-0.096** (0.028)
College (1 if ≥ 13 yrs)	0.202 (0.254)	-0.181** (0.042)	-1.041** (0.183)	-0.129** (0.041)
Age 40 (1 if age ≥ 40)	0.034 (0.286)	-0.080 (0.048)	-0.023 (0.206)	0.151** (0.046)
Age 50 (1 if age ≥ 50)	0.533* (0.265)	0.097* (0.044)	0.043 (0.191)	0.012 (0.043)
Age 60 (1 if age ≥ 60)	0.592** (0.238)	0.131** (0.040)	0.430* (0.171)	0.136** (0.038)
Age 70 (1 if age ≥ 70)	-0.033 (0.217)	0.168** (0.036)	0.603** (0.156)	0.109** (0.035)
Intercept	121.967	103.440	111.111	101.000
St. error of est.	3.636	0.605	2.615	0.584
R^2	0.032	0.119	0.120	0.135
F(9,2225)	8.103	33.449	33.708	38.554

*Statistically significant at α_1 = 95%.

**Statistically significant at α_2 = 99%.

statistically significant and quantitatively sizable relationships between the demographic variables and the EPI's. The relationships tend to be relatively weakest (in terms of explained variance) in the five-year period 1967-1972.

Since the units in the regressions in Table 6 differ from five years (in column one) to one month (in column four), it is not useful to compare the magnitudes of the coefficients from period to period without annualizing (or in some other way normalizing) them. To compare the implied relationships between schooling level and EPI's and age of head and EPI's, Table 7 is useful. Here the comparisons for the separate

Table 7. The implied relationships of schooling and age with the rates of price increase, computed from regressions in Table 6.

Time period	Schooling: ≥ 13 years vs. ≤ 8 years			Age: ≥ 70 years vs. 40-49 years		
	Singles	Married	Div.-Widow	Singles	Married	Div.-Widow
	Per annum*					
1967-1972	0.004	0.12	0.03	0.23	0.27	0.22
1972	-0.21	-0.11	-0.32	0.54	0.44	0.40
1973	-1.89	-1.15	-1.86	1.31	1.37	1.08
Jan. 1974	-1.75	-2.49	-2.66	3.58	3.23	3.13
	Per annum as a percent of the group's mean price increase					
1967-1972	0.1	3	1	5	7	5
1972	-6	-4	-9	16	14	18
1973	-21	-12	-19	15	14	11
Jan. 1974	-15	-17	-20	32	22	23

*The five-year and the one-month rates in price change were annualized assuming a constant rate of price change compounded continuously.

marital status groups and separate time periods have been annualized and we compare the estimated EPI's for college graduates versus grade schooled heads and the estimated EPI's for households with the head aged 70 or over versus the head aged 40 to 49. These figures are derived from the slope coefficients in Table 6. The left-hand number in the second row, -0.21, for example, indicates that the annual rate of price increase over the year 1972 was about two-tenths of a percentage point lower for single persons with 13 or more years of schooling than for single persons with 8 or less years of schooling. In all the periods except the first, the better educated experienced a less rapid rate of price increase, holding constant the other household characteristics in the regressions in Table 6. Since the annual rates of price increase varied considerably among these four time periods, the education differentials and age differentials are also expressed in Table 7 as a percentage of the average price rise for that period. I.e. that two-tenths of a percentage point is six percent of the annualized average rate of price increase for singles in 1972. Not only were the absolute differentials by education and by age greater in the 1973 and early 1974 periods, the differentials expressed as percentages of the rates of price rise also were considerably higher in the 1973 and January 1974 periods.

Although the signs of the relationships in Table 7 are rather persistent--the higher educated experienced generally lower rates of price rise and the elderly experienced higher rates of price rise, ceteris paribus, this consistency is unusual. As with the simple correlations, one sees few if any consistently positive or negative slope

coefficients in Table 6. Furthermore, the consistencies which do seem to be exhibited are not in evidence when regressions for the subsequent five months in 1974 are also considered. Table 8 shows these regressions for the married couples only. While many of the household characteristics are significantly and appreciably related to differential rates of price rise in various time periods, these relationships are not stable in sign or magnitude from period to period.

Since these relationships did not appear to be stable, no effort was made to refine the regression equations by introducing interaction terms, other variables, etc. While the education level and age of the household head presumably quite adequately reflect the household's relative, long-run income position, these regressions were reestimated with the 1960 nominal after-tax income of the family included in the regression. Table 9 indicates the results for the three marital groups for the 1973 EPI's; the table also shows the simple regression of the EPI on the family income variable. The inclusion of the income variable in the six separate 1974 monthly EPI regressions for the separate marital status groups yielded the same pattern of relationships as the simple correlations--the partial effect of income was negative in the first two or three months and positive in the final three or four months. In the six-month period as a whole the partial coefficient on income was positive (and statistically insignificant) for the single and divorced/widowed groups but negative and statistically significant for the married couples. Here too, then, the partial (and simple) relationship with the rates of price rise is not a persistent one.

Table 8. Regressions on expenditure price indices for February through June 1974 and for the six-month period January-June 1974, for married couples, spouse present.

Independent variable	Expenditure price index for the period					
	2/74	3/74	4/74	5/74	6/74	1-6/74
City size	-0.089**	-0.096**	-0.037**	-0.048**	-0.035**	-0.556**
	(0.007)	(0.006)	(0.004)	(0.003)	(0.003)	(0.024)
Race	-0.014	0.009	-0.005	-0.001	0.023**	0.060
	(0.011)	(0.010)	(0.006)	(0.005)	(0.005)	(0.037)
High school	-0.100**	-0.013*	0.039**	-0.000	0.013**	-0.155**
	(0.008)	(0.007)	(0.005)	(0.004)	(0.004)	(0.028)
College	-0.128**	-0.089**	0.009*	-0.032**	0.008*	-0.381**
	(0.009)	(0.008)	(0.005)	(0.004)	(0.004)	(0.028)
Family size 3-5	0.065**	0.005	-0.020**	0.014**	-0.015**	0.030
	(0.008)	(0.007)	(0.005)	(0.004)	(0.004)	(0.028)
Family size 6+	0.119**	-0.011	-0.057**	-0.007	-0.031**	0.024
	(0.011)	(0.010)	(0.006)	(0.004)	(0.005)	(0.035)
Age 40	0.016*	-0.007	0.006	-0.029**	-0.018**	-0.074**
	(0.009)	(0.008)	(0.005)	(0.004)	(0.004)	(0.029)
Age 50	0.036**	0.026**	0.010*	0.000	0.003	0.144**
	(0.011)	(0.010)	(0.006)	(0.005)	(0.005)	(0.036)
Age 60	0.074**	-0.047**	-0.055**	-0.033**	-0.012*	0.030
	(0.013)	(0.012)	(0.007)	(0.005)	(0.006)	(0.042)
Age 70	0.066**	-0.101**	-0.073**	-0.043**	-0.020	-0.086
	(0.016)	(0.015)	(0.009)	(0.007)	(0.008)	(0.053)
Intercept	101.504	101.189	100.489	101.013	100.805	106.495
St. error	0.319	0.281	0.170	0.132	0.145	1.034
R^2	0.129	0.056	0.067	0.087	0.035	0.099
F(10, 8791)	129.690	51.793	62.698	83.488	32.037	96.175

*Significant at 95%.

**Significant at 99%.

Table 9. Regressions on the 1973 expenditure price index, by marital status, and including family money income as an independent variable.

Independent variable	Singles (whites only) (633 observations)		Married (8802 observations)		Divorced, widowed, separated (2235 observations)	
	(1)	(2)	(3)	(4)	(5)	(6)
City size (1 if ≥ 50,000)		-0.804** (0.201)		-0.410** (0.044)		-0.615** (0.112)
Sex of head (1 if male)		0.473* (0.210)				-0.477** (0.132)
Race of head (1 if white)				0.072 (0.070)		-0.506** (0.151)
High school (1 if ed. head ≥ 9)		-0.989** (0.274)		-0.402** (0.053)		-0.672** (0.127)
College (1 if ed. head ≥ 13)		-0.553** (0.228)		-0.168** (0.055)		-0.803** (0.183)
Family income	-0.247** (0.037)	-0.134** (0.036)	-0.154** (0.006)	-0.143** (0.006)	-0.272** (0.020)	-0.161** (0.022)
Family size 3-5 (1 if ≥ 3)				0.727** (0.052)		
Family size 6+ (1 if ≥ 6)				0.896** (0.066)		
Age 40 (1 if age of head ≥ 40)		1.199** (0.320)		0.491** (0.055)		0.053 (0.204)
Age 50 (1 if age of head ≥ 50)		0.364 (0.355)		0.139* (0.067)		-0.015 (0.189)
Age 60 (1 if age of head ≥ 60)		0.194 (0.335)		0.446** (0.080)		0.311* (0.170)
Age 70 (1 if age of head ≥ 70)		0.495 (0.347)		0.420** (0.101)		0.510** (0.154)
Intercept	109.984	109.650	110.834	110.112	110.830	111.407
St. error of est.	2.766	2.433	2.044	1.937	2.677	2.583
R^2	0.066	0.286	0.082	0.177	0.074	0.141
F	44.512	27.746	785.433	171.484	178.549	36.599

*Statistically significant at α_1 = 95%.

**Statistically significant at α_2 = 99%.

The regression analysis has shown that in several recent time periods of varying lengths, there are quantitatively important differences in the rates of price increase experienced by different demographic/economic groups. These differences however are not stable from time period to time period. But the stability of these relationships is obviously very relevant for any generalization about the relative impact of "inflation" on different groups. Consequently, consider the following evidence on this stability over time. The first question to be addressed is whether there is evidence of a positive covariation over time across households in the rates of price increase. The second question which will be considered is whether the observed covariation is systematically related to the demographic/economic variables.

A useful nonparametric test of the strength of the covariation over time in the observed rates of price rise involves a simple contingency table.[1] Suppose we array all households by their percentage price increases in say 1972 and then partition that distribution into quintiles. So quintile #1 contains the 20 percent of the households with the lowest EPI's for 1972, quintile #2 contains the 20 percent with the next lowest EPI's, etc. We could do the same for the 1973 EPI's. Now, if there were perfect stability in the relative impact of inflation on the household's EPI between those two years, we would expect to find that 100 percent of the households in quintile #1 (the lowest EPI's) in 1972 would also be in quintile #1 in the distribution of 1973 EPI's. So a contingency table of the proportions of households in each quintile for 1973

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[1] I want to thank Robert Willis for suggesting this test to me.

conditioned on its quintile in 1972 would contain 100 percent of the 1972 quintile-specific group in the corresponding quintile for 1973, if there were perfect stability. The matrix of transition probabilities would have 1.0 along the principal diagonal and zeros in all other cells. This circumstance will be referred to as "perfect stability." The alternative extreme is the circumstance of "perfect instability" in which the household's quintile for 1973 EPI's is independent of its quintile in the distribution of 1972 EPI's. In this case the expected contingency table would have 20 percent of the households in each of the cells in every row.

Such contingency tables have been computed for several pairs of EPI's. The table for the 1972 and 1973 EPI's for the entire sample of 11,761 households is shown here.

1972 EPI, by quintiles:	1973 EPI, by quintiles				
	1	2	3	4	5
1	.57	.24	.12	.05	.01
2	.23	.29	.23	.17	.07
3	.14	.23	.25	.24	.14
4	.09	.16	.23	.27	.25
5	.04	.10	.16	.26	.45

The table indicates that 57 percent of those households among the lowest 20 percent of the observed 1972 EPI's also had observed 1973 EPI's which were among the lowest 20 percent. Another 24 percent of those households with the lowest 20 percent of the 1972 EPI's had 1973 EPI's in the second lowest quintile, and so forth. Neither the "perfect stability" nor "perfect instability" circumstance adequately characterizes

this transition matrix.[1] There does appear to be considerable consistency in the household's relative position in these two distributions. I will note only one qualification to this table. The relevant consideration might be the transition matrix from one inflationary period to another--from one price-rise episode to the next--and my partitioning by calendar year probably does not accomplish the appropriate comparison. This point might be emphasized with respect to all of the results regarding stability over time in this paper--it is not clear how many degrees of freedom or how many independent periods of price rise these several EPI's represent.[2] So seeing considerable consistency in the transition matrix from 1972 to 1973--or from one month in 1974 to successive months in 1974--does not constitute strong evidence of the stability of relative price increases across households over time.

Another measure of the covariation in EPI's over time is the simple correlation between the EPI's for period t and period t+1. Table 10, panel A, indicates the simple correlations between each pair of EPI's for the 8802 households of married couples. The simple

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[1]Chi-square tests were conducted to test the observed array against each of the two hypothetical arrays consistent with "perfect stability" (an identity matrix) and "perfect instability" (a matrix with each element equal to 0.2). Both null hypotheses were rejected--the test statistic in each case exceeded the critical value of Chi-square by a factor of at least one hundred-fold! With a sample size as large as the one used here, practically any observed difference is a statistically significant difference.

[2]One of the important contributions to the study of business cycles by the NBER research was the emphasis on the reference cycle as the relevant unit of observation rather than the calendar year as the unit of observation. In the study of inflation episodes as well, several successive monthly surveys on the same several-month adjustment in relative prices does not constitute several independent observations on the relationships studied.

Table 10. Simple correlations between expenditure price indices for specific time periods, for married couples, spouse present (n = 8802).

	1972	1973	1/74	2/74	3/74	4/74	5/74	6/74
A. Simple correlation, total: correlation (EPI_{jt}, EPI_{jt+k})								
1972	1.00							
1973	.63	1.00						
1/74	.17	.69	1.00					
2/74	.59	.87	.68	1.00				
3/74	.06	.25	.41	.62	1.00			
4/74	-.38	-.38	-.03	-.26	.38	1.00		
5/74	-.38	-.04	.30	.16	.59	.63	1.00	
6/74	-.54	-.39	.04	-.45	-.08	.44	.41	1.00
B. Simple correlation, regression component: correlation ($\widehat{EPI}_{jt}$, $\widehat{EPI}_{jt+k}$)								
1972	1.00							
1973	.65	1.00						
1/74	.35	.76	1.00					
2/74	.57	.98	.82	1.00				
3/74	-.39	.30	.50	.45	1.00			
4/74	-.84	-.69	-.30	-.59	.40	1.00		
5/74	-.76	-.05	.09	.06	.81	.55	1.00	
6/74	-.81	-.46	.10	-.38	.43	.79	.58	1.00
C. Simple correlation, residuals: correlation (u_{jt}, u_{jt+k})								
1972	1.00							
1973	.63	1.00						
1/74	.14	.67	1.00					
2/74	.60	.85	.66	1.00				
3/74	.11	.24	.41	.64	1.00			
4/74	-.34	-.35	-.00	-.22	.38	1.00		
5/74	-.33	-.03	.33	.17	.57	.63	1.00	
6/74	-.53	-.39	.03	-.46	-.11	.42	.40	1.00

correlation between the 1972 and 1973 EPI's was .63; the correlation between successive months in 1974 ranged between .38 and .68. However, there were pairs of months in the first half of 1974 for which the simple correlation was negative and sizable--e.g. the correlation between the February EPI and the April EPI was -.26, or between February and June the correlation was -.45. So over these six months, and in fact over the two and one-half years from January 1972 through June 1974, households which experienced relatively large increases in the price of their consumption bundle in one subperiod tended to experience relatively large increases in other subperiods as well.

Panel A of Table 10 indicates a positive covariation over time in the households' price indices. Since we observed above that at any one period of time the variation across households in EPI's was related to several demographic and economic variables, we can ask if the components of the EPI's which are related to these demographic and economic variables are more or less highly correlated over time than the components of the EPI's which are unrelated to this set of variables. To explore this issue the regression equations estimated for each time period separately, for the 8802 households of married couples, were used. First a predicted EPI, $\hat{EPI}_{jt}$, for household j in time period t was computed using the regression equation for EPI_t, and the household's observed residual was also computed, $u_{jt} = EPI_{jt} - \hat{EPI}_{jt}$. The correlation between $\hat{EPI}_{jt}$ and $\hat{EPI}_{jt+1}$ is the covariation over time between the component of EPI which is related to the explanatory variables (the systematic components); the correlation between u_{jt} and u_{jt+1} is the covariation over time in the component of EPI's which is not related to the explanatory variables.

Panel B of Table 10 shows the simple correlations of the $\hat{EPI}$'s and Panel C shows the simple correlations of the residuals. From these figures one cannot conclude that the systematic components are consistently more or less highly correlated than the residual components. For example, consider the covariation between two successive pairs of months in early 1974:

Correlation	January-February	February-March
Total	.68	.62
Regression-related	.82	.45
Regression-residual	.66	.64

The simple correlations between the EPI's was of the same order of magnitude in these two periods, .68 and .62. But the portions of those EPI's which were systematically related to the household's age, education, family size, city size, and race were considerably more highly correlated between the months of January and February (.82) but considerably less highly correlated between the second pair of months (.45).[1]

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[1] Of course the overall covariance is a weighted sum of the within-regression covariance and the residual covariance. An analysis of covariance can be performed to test if the within-regression covariance is statistically significant. Computing the sums of squares from the simple correlation matrix, the F-test for the analysis of covariance between the February and March 1974 EPI's is:

	S.S.	D.F.	M.S.	F
regression-related	.003738	20	.000187	29.06
residual	.056458	8780	.000006	
total	.060110	8800		

$F^{.01}_{20,\infty} = 1.88$

Here, too, with so many degrees of freedom any relationship between the regression-related components will exhibit statistical significance since F varies directly with the residual degrees of freedom. In all the pairwise comparisons for which analyses of covariance were performed, the F statistic exceeded the critical value manyfold.

So the covariation over time in the EPI's is not persistently greater for the household-characteristic-adjusted indices than for the residual variation in EPI's.

The decomposition of the covariance over time suggests that the group-specific bundles did change in relative price somewhat persistently, but not more so than the components of the consumption bundles which were not related to the group's characteristics. In Section II the evidence suggested that while group-specific consumption bundles differed in relative price increases, standardizing for household characteristics reduced the dispersion in EPI's among households very little; in Section III a similar finding emerges that while group-specific price indices tended to move with a positive correlation over time, this correlation is, in general, not greater than the positive correlation over time in the within-group residuals.

So is there evidence that "inflation" systematically raises the price index for certain types of households relative to other types? There is evidence here that in particular, recent time intervals, there have been statistically significant and quantitatively large differences among types of households in the average rates of price change. But these effects are not stable over time, and they are not large in comparison with the dispersion among households in the estimated rates of price change. Other recent studies of the distributional impact of inflation have focused on differences in the price changes of household group averages only, and have focused on the cumulative effects of price changes over time. While important, these focuses disregard the considerable dispersion in rates of price change among households of any particular

type, and deemphasize the erratic nature of the relative price changes through time.[1]

To pursue the question of systematic differences one step further, should one expect a persistent, systematic relationship between household characteristics and changes in the relative prices of market bundles? One would exist between income level and inflation, for example, if, say, necessities (items with income elasticities less than unity) invariably experienced relative price increases in periods of inflation.[2]

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[1]In his recent analysis of price changes in the United Kingdom Muellbauer emphasizes the "inegalitarian bias" in consumer price changes in recent years. He deals with the impact of the observed yearly price changes in an eight-year period from 1964 through 1972 during which he estimates that the cost of living for the low income group rose 15 percent more than the cost of living for the high income group (51.4 percent compared to 44.7 percent). However, for two of the eight year-to-year changes in costs of living over this time period the estimated cost of living for the poor rose less rapidly than for the wealthy (in the 1967-1968 period, the former rose 30 percent less than the latter). Likewise in the Palmer/Barth study (op. cit.), the "poor person's price index" and the "high income person's price index" were computed monthly from June 1973 through July 1974 and the former rose by 6 percent more than the latter over that period. However, in six of the 13 monthly price changes the "high income person's price index" rose relative to the "poor person's price index." So there is not evidence from any of these three studies of consistent effects on the price index of any income group.

[2]To investigate this specific question empirically I computed an unweighted Spearman rank correlation coefficient, r, and an unweighted Person correlation coefficient, r^*, between relative price changes over the period 1967 to January 1974 and income elasticities for a set of eleven aggregated expenditure items. (The income elasticities are taken from R. Michael, The Effect of Education on Efficiency in Consumption, NBER, 1972, p. 47.) The rank correlation was $r = -0.28$; the Pearson correlation coefficient was $r^* = -0.31$. A negative correlation implies that necessities rose in relative price. For the same set of items, however, for the observed price change for a preceding period of time from 1958 to 1967, the comparable correlation coefficients were $r = 0.32$ and $r^* = 0.17$. So while the relative prices of necessities rose most rapidly in the past six years, the relative prices of luxuries rose most in the preceding decade. A comparable correlation for the U.K. price changes for 1963-72 from data on income elasticities and price changes in Muellbauer (op. cit.) reflected a stronger negative relationship $r = -0.41$, $r^* = -0.52$.

But aside from built-in short-run lags in price adjustments, I know of no economic reason why certain market goods or services would consistently experience either an increase or a decrease in its relative price as a result of a change in the price level.[1] Over time, persistent relative price changes do occur, of course, as a result of relative changes in production technology or in the costs of factor inputs, and as a result of differences in the organization of product markets and in various elasticities of product demand. But if "inflation" is something different from the aggregate impact of these various influences, its relationship to them is not clear. If inflation is simply the aggregate result of these several factors, then the policy-relevant question is not "does inflation affect the price level for some groups relative to other groups?" but rather, "do 'technology', specific bottlenecks in supply, and specific natural resource scarcities adversely affect the relative price of the market bundles of certain groups?" The thrust of this latter question seems quite different from the former.

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[1] Do the demand or supply schedules of any consumer goods suffer disproportionately from money illusion? Do increases in the money supply tend to have their first-round price effects in certain product markets?

Appendix

1. It was necessary in this study to match information on expenditures for detailed items by individual consumer units from the BLS Consumer Expenditure Survey 1960-1961 General Purpose Tape (CES) with information on price changes for detailed items from monthly BLS Consumer Price Index bulletins. Since the CES data were collected and used by the BLS in selecting the appropriate market items to price routinely, the conformity of definitions and coverage between these two series was quite good. Table A-1 lists the priced items selected to match an expenditure category for those items in which the matchings were not self-evident.

2. Table A-2 indicates the relative weights of the detailed expenditure items in various price indices. Panel A indicates the weights in the official CPI at the time of its most recent revision, December 1963, of the items which are used in the calculation of the EPI's. Column 2 indicates the relative weights in the CPI by December 1973, which are computed by BLS following the procedure outlined in the text in equations (5) and (6). The weights indicated for these two columns have been adjusted to sum to unity. The third column in Panel A indicates the mean weight of each item in the consumption bundles of the 11,761 nonfarm households used in calculating EPI's; the fourth column indicates the standard deviation in each item's weight across the households. Column five shows the standard deviation relative to the mean for each item, while the final column measures the degree of skewness in the distribution of each item's weight among these 11,761 households.

Far and away the largest item in the consumption bundle is food. It would have been far preferable to decompose that item into several types of food expenditures, but the publicly available CES data tape contains no breakdown of that item. The other relatively large items are rent, food away from home, auto purchase, women's clothing, and automobile gasoline and oil. The items displaying the greatest relative variation in weights across households and the largest positive skews tended to be durables or luxuries such as owned vacation homes, medical appliances, music lessons, or other lumpy expenditures such as hospitalized illnesses, and clothing for infants, while necessities such as food, utilities, household supplies and personal care supplies had the smallest coefficients of variation.

Panel B lists the items included in the CPI but excluded from the EPI computations because of lack of price data or the extreme lumpiness of the purchase (in the case of the home purchase item). Panel B also lists a few items not explicitly included as separate items in the CPI but for which expenditure data from the CES exist although no price data are available.

3. Table A-3 lists the reported changes in the price indices for the 52 items included in the definition of the EPI's. These price data are obtained from the monthly publication The Consumer Price Index, BLS, U.S. Department of Labor (recently renamed CPI Detailed Report).

Table A-1. Priced item (from monthly BLS price bulletin) used to reflect the price change of an expenditure category (selected items).

Consumer expenditure survey item	BLS monthly priced item
Property insurance and other expenses	Property insurance premiums
Owned vacation homes	Homeownership (included all interest, taxes, insurance and maintenance)
Household supplies	Simple average of price change for (1) laundry soaps and detergents, (2) paper napkins, and (3) toilet tissues
Furniture, total	Furniture and bedding
Houseware	Simple average of (1) dinnerware, fine china, and (2) flatware, stainless steel
Insurance on furnishings and equipment	Property insurance premiums
Other house furnishings and equipment	Simple average of the remaining three house furnishings items, (1) table lamps with shades, (2) lawn mowers, (3) electric drills, handheld
Footwear, men (age 16+)	Footwear, men's shoes, street
Footwear, women (age 16+)	Footwear, women's shoes, street, pump
Footwear, children (age 2-15)	Footwear, children's shoes, oxford
Clothing, children under age 2	Diapers, cotton gauze or disposable
Clothing upkeep	Drycleaning, men's suits and women's dresses
Automobile purchase	Transportation, private auto, new
Gasoline, oil, lubrication	Gasoline, regular and premium
Tires, tubes, batteries	Tires, new, tubeless
Public transportation, car pools	Public transportation

Continued

Table A-1 (concluded)

Consumer expenditure survey item	BLS monthly priced item
Hospitalized illness	Hospital service charge
Medical appliances, supplies, other	Adhesive bandages, packages
Personal care supplies	Personal care, toilet goods
Radio, phonographs, etc.	Simple average of (1) radios, (2) tape recorders, portable, (3) phonograph records, stereophonic
Spectator admissions	Indoor movie admissions, adult
Participation sports	Basketballs, rubber or vinyl cover
Club dues, hobbies, pets, toys	Film developing, color
Reading	Magazines, single copy and subscription
Music and other ~~special~~ lessons	Piano lessons, beginner

Table A-2. Relative weights of specific items for the CPI and EPI.

A. Weights of items used in constructing the EPI's. Weights adjusted to sum to 1.0 for items listed.

Item	CPI		EPI 1960-61 expend. weights for 11,761 consumer units			
	1963 base weights	Dec. 1973 weights	Mean	Standard deviation	Coefficient of variation	Skewness
Food prepared at home	.205	.225	.233	.108	0.464	0.605
Food away from home	.051	.060	.053	.071	1.333	3.492
Alcoholic beverages	.030	.026	.016	.033	2.029	4.660
Tobacco	.022	.023	.021	.023	1.112	1.875
Rented dwellings	.063	.056	.078	.115	1.472	1.609
Interest on mortgages	.032	.046	.022	.038	1.760	2.240
Taxes due in survey year	.019	.024	.022	.031	1.382	2.554
Property insurance and other expenses	.005	.007	.009	.022	2.472	8.592
Repairs and replacements	.034	.041	.018	.043	2.374	4.827
Owned vacation homes	n.a.	n.a.	.001	.008	9.804	15.417
Solid and petrol fuel	.008	.010	.015	.028	1.880	3.044
Gas and electricity	.031	.028	.039	.033	0.838	2.535
Water, sewage, garbage	.005	.006	.007	.009	1.336	2.928
Telephone and telegraph	.016	.013	.018	.016	0.869	2.330
Household supplies	.018	.015	.023	.014	0.609	2.194
Household textiles	.007	.006	.006	.008	1.246	3.463
Furniture, total	.016	.015	.014	.029	2.059	3.338
Floor coverings	.006	.005	.005	.016	3.446	7.054
Appliances	.016	.011	.015	.031	2.035	3.316
Houseware	n.a.	n.a.	.003	.009	3.416	9.396
Insurance on furnishings, equipment	n.a.	n.a.	.001	.003	3.480	7.176

Continued

Table A-2 (continued)

Item	CPI		EPI 1960-61 expend. weights for 11,761 consumer units			
	1963 base weights	Dec. 1973 weights	Mean	Standard deviation	Coefficient of variation	Skewness
Other house furnishings and equipment	.009	.007	.006	.010	1.560	4.888
Clothing, men and boys (age 2+)	.033	.031	.029	.026	0.892	1.610
Footwear, men (age 16+)	.003	.003	.004	.005	1.174	1.873
Footwear, children (age 2-15)	.011	.011	.004	.004	1.024	3.238
Clothing, women and girls (age 2+)	.047	.044	.042	.040	0.951	2.099
Footwear, women (age 16+)	.003	.003	.006	.007	1.116	2.823
Clothing, children < 2	n.a.	n.a.	.001	.004	3.241	7.126
Clothing, materials	.008	.007	.003	.006	1.897	8.998
Clothing, upkeep	.017	.016	.010	.011	1.067	3.920
Automobile purchases	.064	.048	.045	.101	2.267	2.475
Gasoline, oil, lubrication	.038	.037	.040	.039	0.982	1.397
Tires, tubes, batteries	.008	.007	.007	.011	1.493	2.921
Repairs and parts, not insured	.011	.011	.008	.016	1.884	3.874
Auto insurance	.016	.018	.015	.015	1.031	1.551
Auto registration and other	.005	.005	.006	.007	1.132	3.183
Public transportation, car pools	.016	.017	.017	.034	1.963	5.606
Hospitalized illness	.005	.007	.010	.037	3.797	7.958
Physicians services outside hospital	.010	.011	.012	.020	1.617	4.978
Dental services	.010	.010	.009	.018	2.035	4.775
Eye care, including glasses	.003	.003	.004	.008	2.258	4.597
Drugs and medicines	.013	.009	.016	.027	1.649	7.102
Medical appliances, supplies, other	n.a.	n.a.	.003	.014	5.051	17.220

Continued

Table A-2 (continued)

Item	CPI		EPI 1960-61 expend. weights for 11,761 consumer units			
	1963 base weights	Dec. 1973 weights	Mean	Standard deviation	Coefficient of variation	Skewness
Personal care services	.014	.015	.014	.012	0.844	2.094
Personal care supplies	.017	.014	.018	.011	0.623	2.214
Television	.007	.005	.009	.020	2.345	4.604
Radio, phonograph, etc.	n.a.	n.a.	.006	.016	2.669	6.304
Spectator admissions	.005	.006	.005	.007	1.524	3.389
Participation sports	.005	.003	.005	.011	2.143	4.414
Club dues, hobbies, pets, toys	.034	.028	.014	.020	1.438	5.789
Reading	.006	.006	.010	.010	0.994	4.168
Music and other special lessons	n.a.	n.a.	.002	.008	4.863	13.235
Totals	1.002	0.999	0.999			

Continued

Table A-2 (concluded)

B. Items included in specific series but excluded from the EPI computations (expressed as a percentage of the own-series totals).

Item	CPI 1963 base weights	CPI Jan. 1973 relative weights	CES total current consumption expenditure
Lodging out of home city	.004	.004	.005
Other real estate	n.a.	n.a.	.001
Ice, water softeners, and freezer rentals	n.a.	n.a.	.000
Other household (housekeeping) services	.016	.018	.018
Home purchase	.063	.059	n.a.
Other auto operating expenses	n.a.	n.a.	.002
Other professional services	.006	.006	.001
Health insurance	.016	.020	.018
Education	.011	.012	.005
Personal expenses (funeral, legal, bank fees)	.004	.004	.019
Miscellaneous	.005	.005	n.a.
Totals	.125	.128	.069

Table A-3. Reported price changes for expenditure items for ten time periods from 1967-1974.

Item	Percentage change in price									
	1967-72	1972	1973	Jan. 1974	Feb. 1974	Mar. 1974	Apr. 1974	May 1974	June 1974	Jan.-June 1974
Food prepared at home	21.6	5.0#	22.1#	1.8	3.0#	1.0	-0.7*	0.6	0.3*	6.2
Food away from home	31.1	4.2	12.7	0.6	0.7	0.7	1.2#	1.0	1.0	5.2
Alcoholic beverages	19.6	1.8	4.0	0.5	0.6	0.4	0.9	0.6	0.7	3.8
Tobacco	33.3#	3.9	3.2	0.1	0.2*	0.3	0.1	0.7	1.6#	3.1
Rented dwellings	19.2	3.5	4.9	0.3	0.6	0.3	0.3	0.4*	0.4	2.3*
Interest on mortgages	17.5	-0.9*	14.7	0.2	-0.2*	-0.5*	0.1	0.6	1.4#	1.5*
Taxes due in survey year	45.7#	9.4#	0.7*	0.2	-0.3*	-0.2*	-0.1	-0.7*	0.0*	-1.1*
Property insurance and other expenses	23.2	2.1	-1.0*	-0.1	0.2*	0.0*	0.2	0.6	-0.1*	0.7*
Repairs and replacements	40.7#	4.9#	8.8	0.9	1.0	1.4	1.7#	1.6#	2.1#	9.1
Owned vacation homes	40.1#	4.1	7.7	0.8	0.6	0.9	0.6	0.8	1.1	4.9
Solid and petrol fuel	18.5	1.1*	44.7#	12.6#	3.8#	-0.2*	2.5#	2.2#	1.5#	24.0#
Gas and electricity	20.5	3.6	6.9	2.5#	2.2	2.0#	1.4#	1.3	0.4	10.3#
Water, sewage, garbage	38.5#	3.9	5.2	0.1	0.9	0.5	2.0#	-0.2*	0.3*	3.6
Telephone and telegraph	13.5*	5.0#	4.5	0.3	0.1*	0.0*	0.1	0.0*	0.0*	0.5*
Household supplies	22.4	2.2	5.2	1.8	1.6	1.9	1.9#	3.8#	2.3#	14.0#
Household textiles	13.6*	2.0	4.1	-0.5*	2.4	2.9#	1.3#	1.3	1.5#	9.2
Furniture, total	21.1	1.7	5.2	0.6	0.3*	1.3	1.1#	1.4#	1.2	6.1
Floor coverings	6.5*	0.0*	2.9	0.6	0.7	1.2	1.3#	1.0	1.7#	6.7
Appliances	9.7*	0.4*	0.2*	0.5	0.1*	0.4	0.5	0.7	1.2	3.3
Houseware	24.4	6.3#	4.6	1.3	1.3	2.0#	1.4#	0.5*	1.4#	8.1
Insurance on furnishings, equipment	23.2	2.1	-1.0*	-0.1	0.2*	0.0*	0.2	0.6	-0.1*	0.7*
Other house furnishings and equipment	16.5	2.0	0.9*	1.1	0.4	2.8#	1.1#	0.6	1.0	6.7

Continued

Table A-3 (continued)

Item	Percentage change in price									
	1967-72	1972	1973	Jan. 1974	Feb. 1974	Mar. 1974	Apr. 1974	May 1974	June 1974	Jan.-June 1974
Clothing, men and boys (age 2+)	21.9	2.6	3.4	-1.1*	1.2	2.0#	1.8#	1.1	1.0	6.1
Footwear, men (age 16+)	23.6	5.4#	6.7	0.0	0.3*	1.1	0.7	1.7#	0.5	4.3
Footwear, children (age 2-15)	26.8	4.8	3.5	0.0	0.6	0.7	0.7	0.4*	0.2*	2.7
Clothing, women and girls (age 2+)	23.0	2.6	4.3	-3.0*	1.2	1.2	1.1#	1.0	-0.1*	1.4*
Footwear, women (age 16+)	26.3	2.6	2.1*	-0.4*	0.0*	1.7	1.7#	0.6	-0.7*	2.9
Clothing, children < 2	15.0	3.2	4.1	0.7	3.2#	3.2#	2.8#	8.6#	3.5#	23.9#
Clothing, materials	19.2	-2.6*	14.2	1.3	2.0	3.4#	1.0	3.6#	3.8#	16.1#
Clothing, upkeep	17.7	1.5*	6.6	0.9	1.2	1.2	0.8	1.4#	1.0	6.7
Automobile purchases	11.0*	0.2*	1.3*	0.8	-0.2*	0.1*	0.4	1.1	1.6#	3.9
Gasoline, oil, lubrication	7.6*	2.7	19.7#	6.2#	5.5#	7.4#	1.7#	2.5#	0.9	26.5#
Tires, tubes, batters	15.9	-3.0*	-3.9*	0.0	0.4	2.1#	1.0	1.9#	2.2#	7.8
Repairs and parts, not insured	35.1#	3.7	6.7	1.0	1.1	0.9	1.0	0.9	0.8	5.8
Auto insurance	40.5#	-1.3*	-1.6*	0.2	0.0*	0.2	0.4	0.0*	-0.3*	0.6*
Auto registration and other	27.4	3.2	-3.1*	4.2#	0.0*	0.0*	0.0	0.0*	0.0*	4.2
Public transportation, car pools	43.4#	3.4	1.4*	-0.3	0.1*	0.3	-0.2*	0.0*	1.6#	1.4*
Hospitalized illness	68.8#	3.2	4.3	0.7	1.1	0.7	0.4	1.2	1.4#	5.6
Physicians services outside hospital	33.8#	2.4	4.0	0.4	0.9	1.7	0.6	1.3	1.8#	6.7
Dental services	32.3#	2.8	3.7	1.2	0.3*	0.6	1.0	0.6	1.3#	5.1
Eye care, including glasses	24.9	2.8	4.6	0.3	0.9	0.4	0.7	2.0#	0.7	5.2
Drugs and medicines	5.6*	0.0*	0.7*	0.4	0.3*	0.3	0.3	0.4*	0.6	2.3*
Medical appliances, supplies, other	24.2	0.9*	2.6*	0.4	0.6	0.6	0.2	1.8#	1.6#	5.3
Personal care services	22.9	3.3	8.1	0.4	0.6	0.6	0.7	1.2	0.6	4.1

Continued

Table A-3 (concluded)

	Percentage change in price									
	1967-72	1972	1973	Jan. 1974	Feb. 1974	Mar. 1974	Apr. 1974	May 1974	June 1974	Jan.-June 1974
Personal care supplies	16.9	2.7	4.6	0.6	1.0	0.9	1.3#	1.6#	1.7#	7.4
Television	-0.5*	-1.3*	-1.2*	0.0	0.1*	0.1*	0.1	0.2*	0.2*	0.7*
Radio, phonograph, etc.	0.1*	1.5	0.4*	0.2	0.4	0.3	0.4	0.1*	0.2*	1.6*
Spectator admissions	41.5#	3.0	4.9	0.5	0.4	0.8	0.5	-1.1#	-3.2*	5.9
Participation sports	26.1	0.2*	1.8*	0.2	0.9	0.7	0.5	0.9	0.6	3.4
Club dues, hobbies, pets, toys	17.0	-1.8*	-0.5*	0.3	-0.1*	0.6	-0.3*	1.0	0.4	1.9*
Reading	31.4#	7.4#	-0.3*	0.0	0.0	0.0	0.0	0.0	5.2	5.2
Music and other special lessons	23.0	2.9	3.9	0.8	0.4	0.2	0.4	0.0*	0.4	2.2

*denotes $< \mu - 3\sigma$.
#denotes $> \mu + 3\sigma$.
These means and standard deviations are computed using the expenditure shares of the sample of 11,761 consumer units (see Table 1).

Notes: (1) In January 1972 the BLS altered the composition of its "hospital daily service charges" item, renaming it "hospital service charges." These two series have been matched in order to obtain the 68.8 percent price rise for 1967-1972.

(2) The BLS does not report a price index change for "women's clothing" in February and March since some of the components of this item are out of season. The price changes listed here are calculated on the assumption of a constant rate of change in the price of that item from January to April.