



Working Papers in
AGRICULTURAL ECONOMICS

JULY 1993

93-10

**ESTIMATING CONSUMER ENERGY DEMAND
USING INTERNATIONAL DATA: THEORETICAL
AND POLICY IMPLICATIONS**

DALE S. ROTHMAN

JONG HO HONG

and

TIMOTHY D. MOUNT

Department of Agricultural Economics
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York, 14853-7801

It is the policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

**ESTIMATING CONSUMER ENERGY DEMAND
USING INTERNATIONAL DATA: THEORETICAL
AND POLICY IMPLICATIONS**

Dale R. Rothman, Jong Ho Hong, and Timothy D. Mount*

ABSTRACT

Energy use has important implications for many economic and environmental issues. Traditionally, the demand for energy has been analyzed independently of demands for other economic goods. In this paper, consumer energy demand, including price and income elasticities, is estimated as part of a complete demand system using a consistent set of international data on prices and expenditures for 53 countries ranging from the poorest to the wealthiest.

Two models, the Deaton-Muellbauer Almost Ideal Demand System (D-M) and the Generalized Logit (Logit), and two levels of commodity aggregation, 6-good and 9-good, are compared. The estimation results indicate that model specification and aggregation are important. The Logit model performs superior to the D-M, which provides illogical estimates for many countries. The 9-good model provides slightly more elastic price and income elasticities for energy and shows that the demand for electricity is significantly more price and income elastic than demand for primary energy sources. The demands for all commodities vary substantially across countries and are strongly influenced by differences in relative prices and per capita income levels. Increasing demands for energy induced by rising levels of income and population, implied by the Logit model, will have a severe impact on the economies and environment of many countries in the future.

The Appendix provides a detailed description of the United Nations International Comparison Project and the data used in this analysis.

* Department of Agricultural, Resource, and Managerial Economics, Cornell University, Ithaca, NY 14853. An earlier version of this paper has been published as Rothman, D. S., J. H. Hong, and T. D. Mount (1992) "Price and Income Elasticities for Consumer Energy Demand: The Importance of Model Forms and Income Changes," *Proceedings of the North American Conference of the International Association for Energy Economics*.

ESTIMATING CONSUMER ENERGY DEMAND USING INTERNATIONAL DATA: THEORETICAL AND POLICY IMPLICATIONS

D. S. ROTHMAN, J. H. HONG, AND T. D. MOUNT

I. INTRODUCTION

Energy demand is at the very heart of many economic and environmental issues. Energy has always played a key role in driving the economy, and it is increasingly becoming recognized that many of the environmental problems facing the world are a direct result of the use of fuels. These include not only those problems associated with the production and combustion of fossil fuels, but also issues such as desertification and increased erosion on hillsides resulting from the increasing demand for fuelwood. More and more, calls to change human relationships to the environment revolve around changes in the way that energy is used.

Understanding the demand for energy is essential for projecting energy needs in the future, for recognizing its influence on the economy as a whole, and for gauging the implications of policies that aim to change how energy is used. Income levels and the prices of fuels are major influencing factors on the demand for energy, so it is important to understand how the demand for energy responds to changes in these factors, and how these responses differ across countries and across groups and sectors within countries.

This paper explores the estimation of price and income elasticities for consumer energy demand as part of a complete demand system. Data from 53 countries for the year 1985, collected as part of Phase V of the United Nations International Comparison Project (ICP) are

used to fit the different models examined. Fiebig, et.al. (1987) and Seale, et.al. (1991) have performed similar analyses using data from earlier phases of the ICP. Dumagan (1991) has also done so using data from New York State.

From a technical perspective, we are interested in comparing the results of different model formulations while using the same data. Two model specifications, the Deaton-Muellbauer Almost Ideal Demand System (D-M) and the Generalized Logit (Logit) are analyzed; the D-M model has gained wide popularity in estimating demand systems, whereas the Logit model has had more limited use (see Dumagan 1991 and Elkhafif 1992 for studies which use the Logit specification). Also, two different levels of aggregation are compared: a 9-good model including Electricity and Other Energy as separate commodities, and a 6-good model including Total Energy as a single good. The behavior of these models are compared, both in terms of empirical results and from the standpoint of their relationship to economic theory.

From a more policy oriented perspective, we are interested in how the demand elasticities for different energy sources change with income levels. Most models of energy use assume either the same price and income elasticities for all countries, or different, but unchanging elasticities for different regions of the world. When one considers that many of these models look 50-100 years in the future, a time period over which significant development and income growth are expected to occur, it is important to recognize that there is a possibility of substantial change in the demand elasticities during the time period.

Sections II and III of this paper describe the data and models used in this study. Section IV provides the basic results of the analyses. The final section reflects on the results of this analysis and presents some of the authors' conclusions concerning their implications.

II. THE DATA

The data used in the analysis have been taken from the United Nations International Comparison Project (ICP). The ICP was initiated to "compare the purchasing power of

currencies and the real gross domestic product (GDP) per capita of different countries." (Kravis, et.al. 1978) The desire was to move beyond comparisons based solely upon the prevailing exchange rates; these are considered misleading because they do not reflect differences in the prices of goods and services between countries. Ang (1987) has explored how using nominal exchange rates can bias estimates of the correlation between energy use and GDP.

The ICP has proceeded through 5 phases to date. Phase I covered 10 countries, with 1970 as a reference date, while also gathering data on 6 of these countries for 1967. Phase II covered 16 countries, using 1970 and 1973 as reference dates. Phase III, using 1975 as the reference date, covered 34 countries. Phase IV saw the coverage expand to 60 countries and used 1980 as the reference date. 64 countries participated in Phase V, with 1985 being the reference date. This analysis uses data from Phase V of the ICP. A complete set of the data for Phase V is not available in a single place, but it was possible to obtain separate data series for Asian, African, and OECD countries

The ICP provides detailed price and expenditure data for a large number of commodities. For 1985, the data on consumer expenditures is reported for 129 goods in the Asian data series, 126 in the African data series, and 154 in the OECD data series. For the purposes of this analysis, these have been aggregated to 9 composite goods: 1)Electricity, 2)Other Energy, 3)Grains & Starches, 4)Animal Products, 5)Other Food, 6)Clothing and Household Goods, 7)Health, 8)Education, and 9)Other Consumer Goods. Other Energy includes fuels used for heating, cooking, lighting, and transportation (purchased firewood is included explicitly in Africa and implicitly in the other two data series). For the 6-good model three pairs of these goods, Electricity and Other Energy, Animal Products and Other Food, and Health and Education, have been further aggregated to single commodities.¹

¹ The prices are aggregated using a weighted geometric average, equivalent to a Stone Price Index. The aggregation procedures, and the techniques used to combine the data from the three different data series are described in more detail in an Appendix.

A price index is also calculated for consumer goods as a whole for each country. Real per capita expenditures are determined as the total per capita expenditures (nominal) divided by this price index. This is used as a proxy for real income, and the two phrases will be used interchangeably in this paper.

The expenditure data have been translated into \$1985 U.S. for all countries. The prices reflect both prevailing exchange rates and purchasing power. They are given in \$U.S. per unit, where a unit is the quantity of the commodity which can be purchased for 1 \$U.S. in the "average" country. A value greater (less) than 1 implies that the good is relatively more (less) expensive in the given country compared to the "average" country. A price ratio different than 1 between two goods within a single country signifies that the relative price between these goods differs from what it is in the "average" country.

III. THE MODELS

This section describes the two demand systems models used in this analysis: the linear approximation to the Deaton-Muellbauer Almost Ideal Demand System (D-M) and the Generalized Logit (Logit) are analyzed. Given the restrictions described below, both satisfy additivity, zero degree homogeneity in prices and income, and symmetry of the Hicksian cross-price effects. Neither guarantees global negative semi-definiteness (GNSD) of the Hicks-Slutsky substitution matrix (HSSM), however.² More details on the D-M model can be found in Deaton and Muellbauer's original papers (1980a,b); the Logit model is described further in Tyrrell and Mount (1982), Considine and Mount (1984) and Dumagan and Mount (1991).

² Additivity implies that the budget shares sum to 1. Homogeneity in prices and income means that if all prices and income are multiplied by the same factor, the consumer's demands, i.e. budget shares, do not change. Symmetry and global negative semi-definiteness of the Hicks-Slutsky Substitution Matrix are necessary conditions for relating the demand functions to underlying, well-behaved utility and expenditure functions for the consumer (Varian, 1984).

A. The Deaton-Muellbauer Almost Ideal Demand System (D-M)

The D-M model is estimated as a system of equations with the budget shares as the dependent variables. These are given as:

$$w_i = \alpha_i + \sum_{j=1}^{n-1} \left(\beta_{ij} \ln \frac{P_j}{P_n} \right) + \gamma_i \ln \frac{I}{PI} \quad i = 1, 2, \dots, n-1 \quad (1)$$

where P_i is the price of the i th good, I is the total nominal per capita expenditures and PI is Stone's geometric price index:

$$PI = \prod_{j=1}^n P_j^{w_j} \quad (2)$$

and the following restrictions are placed upon the parameters:

$$\sum_{j=1}^n \alpha_j = 0; \sum_{j=1}^n \beta_{ij} = 0; \sum_{j=1}^n \gamma_j = 0; \beta_{ij} = \beta_{ji} \quad (3)$$

The value I/PI is the real per capita expenditures described in the previous section. The use of Stone's geometric price index rather than Deaton and Muellbauer's original specification of the price index provides the linear approximation. The expressions given by Green and Alston (1990) for the special case of constant expenditure shares in the short run are used to calculate the Marshallian elasticities.

B. The Generalized Logit Demand System (Logit)

For the generalized version of the Logit model, the equations estimated are the logarithms of the ratio of budget shares, which are expressed as:

$$\ln \frac{w_i}{w_n} = f_i - f_n \quad i = 1, 2, \dots, n-1 \quad (4)$$

where f_i is defined as:

$$f_i = \alpha_i + \sum_{j=1, j \neq i}^n \left(\beta_{ij} \theta_{ij} \frac{P_j}{P_i} \right) + \gamma_i \ln \frac{I}{PI} \quad (5)$$

and the following parameter restrictions and condition on the cross-price weight are made:

$$\beta_{ij} = \beta_{ji}; w_i \theta_{ij} = w_j \theta_{ji} \quad (6)$$

The cross-price weight θ_{ij} is specified here as:

$$\theta_{ij} = w_i^{\delta-1} w_j^{\delta} (1 - w_i - w_j) \quad (7)$$

where $\delta \geq 1$ is a parameter which has been fixed at 2 for this analysis. Defining the price index as Stone's geometric price index, rather than as an arithmetic price index, along with the assumption of constant expenditure shares in the short run, are necessary conditions for the symmetry of the Hicksian cross-price effects in this model. The derivations of the elasticities and cross-price effects for this model are given in Hong, Mount and Rothman (1993).

By defining the Logit specification as a ratio of exponential functions, the model cannot predict negative shares or shares greater than 1. The model does not estimate the budget shares directly, however, and since the shares appear on both sides of the fitted equations, it is necessary to iterate this system of non-linear equations in order to calculate predicted budget shares. This can lead to problems in that there is nothing that guarantees that the set of fitted equations will converge for a given set of prices and income.

IV. RESULTS

In this section, the demand system models described in the previous section are estimated using a sample of 53 countries from the 1985 ICP data. The first results compare the different model formulations and levels of aggregation. The second sets of results focus on the energy related elasticities for one of the models. Finally, the results are presented for a simulation where the relative prices are fixed across countries, but the level of per capita real income varies.

A. Comparison of Models

The two models can be compared in several different dimensions. Firstly, the models are evaluated with respect to the reasonableness of their general results, i.e. can budget shares be calculated for any given set of prices and incomes, are the predicted budget shares within the range 0 to 1, and is the estimated Hicks-Slutsky matrix negative semi-definite. Secondly, the accuracy of predictions of the actual budget shares is determined. Finally, the ranges of the own-price and income elasticities estimated by each of the models are compared.

Table 1 summarizes the number of convergence, budget share violations, and Hicks-Slutsky Substitution Matrix (HSSM) violations for each of the models estimated. As the table shows, the 9-good Logit model is unable to converge for one country. This country, Ethiopia, happens to be the country with the lowest per capita real income (\$178). The 9-good D-M models predicts negative budget shares for two goods in one country, Electricity and Education in Tanzania. The Logit models perform much better with respect to the negative semi-definiteness of the HSSM than the AIDS models. Only a single country in the 9-good Logit model violates this condition, whereas 33 countries in the 6-good D-M model and 51 countries in the 9-good D-M model do. Since there are only 53 countries in the sample, the performance of the D-M model is very poor in terms of the properties of the HSSM.

Turning to the predictive abilities of the different models, Table 2 summarizes how well the 9-good models predict actual budget shares. The coefficient of inequality shown is simply

the root mean squared error scaled to be between 0 and 1, with a value of 0 implying a perfect prediction (Theil 1965). This can be decomposed into three parts: the bias, variance, and covariance. The first two can be considered systematic errors, in that they are related to the mean and systematic fluctuations for the variable of interest, whereas the latter is unsystematic, since it is related to unsystematic variation. Therefore, in addition to a low value of the coefficient of inequality, it is desirable to have most of this value associated with the covariance (Theil 1965).

The table shows that the coefficients of inequality, and the decomposition by source of error are comparable between the two models. The D-M model, by its linear nature, has no bias, and the Logit model has very little. In addition, the largest portion of the error is related to the unsystematic variation of the budget shares in both models.

The mean values, and ranges of the own-price and income elasticities in the sample estimated by each of the models are presented in Tables 3 and 4. The mean values do differ between the two model formulations, but the most striking differences appear in the ranges of the elasticities. For example, the two models agree closely for the mean values of elasticities for Total Energy (6-good model) and Other Energy (9-good model), whereas the Logit model predicts higher price and income elasticities for Electricity (9-good model). It is the ranges, however, that reveal the more significant differences. The D-M model predicts almost no differences across countries in the income elasticities for Total Energy and Other Energy, but the income elasticity for Electricity ranges from -2.43 to 2.73. The price elasticity for Electricity ranges from -4.28 to + 5.50. (If the corresponding Hicksian price elasticity is positive, it is one example of a violation of the HSSM condition.) Several other commodities also exhibit positive own-price elasticities and/or negative income elasticities in a number countries. Although the existence of such Giffen and inferior goods, respectively, is not ruled out by economic theory, it is generally assumed that they are not prevalent. In the 9-good Logit model, only for a single country and a single good, Grains & Starches in the USA, is a

negative income elasticity predicted. The USA happens to be the country with the largest per capita real income (\$11,798) and has a very small budget share for Grains & Starches (1.8%).

Comparing the results between the 6- and 9-good models for both the D-M and Logit specifications, there are important similarities and differences to note. For the four goods which appear in both models, there is consistency seen in the estimated elasticities. Looking at those goods which are disaggregated further in the 9-good model, there continues to be general consistency with the 6-good model in that the ranges of values, and generally the mean values, for the disaggregated goods bracket those of the aggregated commodity. Differences do appear, though, both between the aggregate and the disaggregated goods, and between the disaggregated goods themselves. In particular, splitting Total Energy into Electricity and Other Energy results in higher estimates of both the average own-price and income elasticities, with striking differences for Electricity. This is explored further in the next part of this section.

B. Energy Elasticities in the 9-Good Logit Model

Since the Logit models perform as well as the D-M models on all of the criteria considered, and much better with respect to the negative semi-definiteness of the HSSM and the reasonableness of the ranges of elasticities in the sample, the remainder of the results will focus on the Logit model. The own-price, and income elasticities for Electricity and Other Energy from the 9-good Logit model are repeated in Table 5. Splitting Energy into Electricity and Other Energy results in much larger own-price and income elasticities for Electricity than Other Energy. This becomes significant when one recalls that the production and transmission of Electricity for consumer use implies the use of energy sources, and that the overall efficiency of electricity production from fossil fuels is often only 30%.

The ranges of elasticities show that all countries are both own-price and income elastic for Electricity, whereas for Other Energy there are examples of elastic and inelastic values for own-price and for income. Wealthier countries are income inelastic with respect to Other Energy, whereas poorer nations are income elastic; the pattern is less clear for the own-price

elasticities, because price levels are different in different countries³. How elasticities change with income levels will be explored further in the last part of this section.

Table 5 also presents the cross-price elasticities for Electricity and Other Energy for the 9-good Logit model. Consumers are not as responsive to the prices of other goods as they are own-prices or income, but some interesting relationships do appear. Positive values imply substitutes as an increase in the price of the other commodity leads to an increase in the quantity purchased of the commodity of interest; similarly, negative values suggest complements. In general, there is consistency across countries in whether particular sets of goods act as substitutes or complements. Electricity and Other Energy are substitutes for each other in all countries. Neither is very responsive to changes in the prices of Grains & Starches or Health related items. Both show complementary relationships with Animal Products and Education, but they differ with respect to other commodities. Electricity behaves as a complement with Other Foods and Other Goods, and as a substitute for Clothing & Household goods; Other Energy has just the opposite behavior.

C. Price Influences

The model can be used to show how differences in relative prices across countries can influence the amount of energy consumed. The actual values for the relative prices of a unit of electricity and other energy in the United States are relatively cheap at 0.88 and 0.73, leading to predicted values of demand of 333 and 654 units, respectively.⁴ When these relative prices are set to the international averages, which are closer to those for the advanced OECD countries, there is only a slight decrease in the amount of electricity demanded to 326 units, but a sharp

³ The dividing line used between poorer and wealthier nations is a real per capita income of 3,000 \$US. The poorer nations all have income elasticities above 1, with an average value of 1.12; the wealthier nations all have income elasticities below 1, with an average value of 0.93. The average own-price elasticities are -0.98 and -1.07 for the poorer and the wealthier nations, respectively, but the ranges for both groups of nations are very similar.

⁴ Recall that 1 unit of any good corresponds to the amount that can be purchased with \$1 U.S. at average international prices. So, for example, the predicted per capita amount of electricity demanded in the United States is the budget share (2.5%) times the per capita nominal income (\$11,798) divided by the price in the United States relative to the international average (0.88).

drop-off in the amount of other energy demanded to 486 units.⁵ This result may appear a little surprising in terms of the energy mix since Table 5 indicated that other energy has a lower own-price elasticity than electricity. However, note that the change in price of other energy is larger than that for electricity, and the cross-price elasticities in Table 5 imply that if prices of both electricity and other energy rise, there will be a shift toward more electricity in total energy demand. Thus, it is important to consider not just overall energy demand, but also its components when thinking about policies such as a carbon tax that affect all energy prices.

D. A Nine-Good Income Simulation

Spurred by concerns over long-term resource depletion and environmental impacts, there has been great interest recently in forecasting energy demand over long time periods. A major question that arises is how these demands change as countries develop. This issue is addressed by predicting budget shares and elasticities for the countries in the data set using the 9-good Logit model with the actual values for real income, but the same relative prices across countries. Some results from this experiment are shown Figures 1-3.

Looking first at the budget shares, it is seen that at low income levels, most expenditures are on food, primarily Grains & Starches. As wealth increases, other items make up a larger share of the budget. Expenditure shares for energy rise slowly, with Electricity starting to approach the level of Other Energy at higher income levels. In fact, the budget share, but not necessarily actual expenditures, for Other Energy begin to fall for income levels above \$3,000.

This changing pattern of expenditures is reflected in the income elasticities for the different goods. The income elasticities for all commodities fall with rising income. (The parallel nature of the income elasticities is a result of fixing the relative prices.) Other Energy moves from being income elastic to income inelastic over the range of real incomes shown here, whereas Electricity remains strongly income elastic.

⁵ All other prices and per capital real income levels were kept at their actual values for this example.

The own-price elasticities show a much less uniform pattern, with some goods becoming more price elastic with rising income and others less. Electricity becomes more price elastic with rising income, whereas Other Energy becomes less so. (In a similar exercise with the 6-good model, the own-price elasticity for Total Energy first declines in absolute terms, then increases with rising per capita real income.)

To make these results more concrete, Table 6 shows the budget shares, consumption units, own-price elasticities, and income elasticities for electricity and other energy for 4 hypothetical countries with average relative prices and real incomes of \$500, \$1,000, \$5,000, and \$10,000.⁶ The trends in the budget shares and elasticities seen in Figures 1-3 are clear in this table, including the rise and then fall in the budget share for other energy. What is striking in the table, and is lost in just looking at the budget shares is the increase in the actual amount of energy used. A rise in per capita real income from \$1,000 to \$10,000 increases demand for other energy 10-fold, and increases demand for electricity more than 30-fold. Whether such increases from current levels of consumption are feasible is very questionable, especially considering the associated increases of population in many developing countries. Whether the environment can handle the implied levels of pollution is doubtful unless there is a major shift away from present technologies in the provision of energy.

Using the projected levels of population and recent trends in per capita income growth for India further illustrates this point, and also shows the interplay between these two factors and changing demand patterns. The World Development Report 1992 shows an average growth rate of per capita income for India of 1.9%/year for the period 1965-1990 (Table 1, p.218). Projecting a more conservative estimate of 1.5%/year, implies an increase in per capita income of 68% over the period 1990 to 2025. Since demand shifts as income rises towards energy and away from other commodities like grains and starches, the increase in the per capita demands for electricity and other energy are more than proportional, 157% and 103%,

⁶ \$500 roughly corresponds to per capita real income levels for Madagascar and Zambia, \$1,000 to the Ivory Coast and the Philippines, \$5,000 to Greece and Spain, and \$10,000 to the United States and Canada.

respectively (relative prices are held constant). The World Development Report 1992 also projects India's population to grow from 850 million in 1990 to 1,348 million in 2025, a total increase of 59% (Table 26, p.268). This implies total increases in consumer demand for electricity and other energy of 308% and 223%, respectively. Even starting at a low base of energy consumption in developing countries, such levels of increase will be difficult to achieve from conventional sources of energy.

V. CONCLUSIONS

The results in this paper show that the choices of model specification and level of aggregation are far from innocuous in estimating price and income elasticities for energy and other commodities using cross-country data. The D-M and Logit models provide significantly different estimates of elasticities, but from a theoretical perspective, the estimates provided by the D-M model are highly suspect for most countries in the sample.

Disaggregating commodities, such as separating Total Energy into Electricity and Other Energy, also shows important differences in estimated elasticities. The estimated own-price elasticities for Total Energy from the Logit model range from -0.60 to -1.04, with a mean value of -0.78 and no clear relationship to real income; the estimated income elasticities range from 0.91 to 1.31, with a mean value of 1.05, and a clear trend of falling elasticities with rising income. These are similar to the estimates presented in Seale et.al. (1991) and Dahl (1991) for own-price elasticities, but significantly lower for income elasticities.⁷ The results show that Electricity is a much more elastic good than Other Energy, both with respect to their own-prices and income. There are also differences in how they respond to changes in prices of other commodities.

⁷ These differences may be partially due to using different data sets. Seale, et.al. (1991) use earlier data from the ICP, and estimate ranges of -0.87 to -1.04 for own-price and 1.17 to 1.42 for income elasticities. Our results using the same data gives ranges of -0.83 to -1.40 for own-price and 1.04 to 1.34 for income elasticities. The mean values presented by Dahl (1991) for comparable energy use elasticities are -0.80 and -0.59 for own-price in developing and industrialized countries, respectively, and 1.45 and 1.49 for income elasticities in developing and industrialized countries, respectively.

Further analysis shows that an increase in the prices of energy in countries with relatively cheap energy, like the United States, to international averages can sharply curtail consumer demand for Other Energy but not for Electricity. At the same time, increases in per capita income levels and population, especially in poorer countries such as India, can be expected to dramatically increase consumer energy demand on a global basis.

In conclusion, when building models of the global economy and energy use, with long time horizons, it is desirable to have a model that is well behaved over a wide range of price and income levels and not just at the point of means. In addition, the values of price and income elasticities vary substantially among countries. Finally, separate treatment of individual energy sources in demand models should improve the analysis of policies directed at influencing energy demand because the characteristics of the demand for electricity are quite different from the characteristics for other sources of energy.

VI. REFERENCES

- Ang, B.W. (1987). "A Cross-Sectional Analysis of Energy-Output Correlation." *Energy Economics* 9(4): 274-286.
- Considine, T. and T.D. Mount (1984). "The Use of Linear Logit Models for Dynamic Input Demand Systems." *The Review of Economics and Statistics* 66(3): 434-444.
- Dahl, C. (1991). "Survey of Energy Demand Elasticities in Developing Countries." Technical Report for Energy Modeling Forum 11.
- Deaton, A. and J. Muellbauer (1980a). "An Almost Ideal Demand System." *American Economic Review* 70(3): 312-326.
- Deaton, A. and J. Muellbauer (1980b). *Economics and Consumer Behavior*, Cambridge: Cambridge University Press.
- Dumagan, J. C. (1991). "Measuring Welfare Changes and Modeling Demand Systems: Theory and Applications to Energy Efficiency and Environmental Externalities in New York State Residential Energy Demand." Ph.D. Dissertation, Cornell University.
- Dumagan, J.C. and T.D. Mount (1991). "Global Properties of Well-Behaved Demand Systems: A Generalized Logit Model Specification." Working Paper 91-6, Cornell University, Ithaca, NY.
- Elkhafif, M.A.T. (1992). "Estimating Disaggregated Price Elasticities in Industrial Energy Demand." *The Energy Journal* 13(4): 209-217.
- Eurostat (1991). "Comparison of Price Levels and Economic Aggregates 1985: The Results for 22 African Countries."
- Fiebig, D.G., J. Seale, and H. Theil (1987). "The demand for energy: evidence from a cross-country demand system." *Energy Economics* 9(3): 149-153.
- Green, R. and J. Alston (1990). "Elasticities in AIDS Models." *American Journal of Agricultural Economics* 72(2): 442-445.
- Hong, J-H., T.D. Mount and D.S. Rothman (1993). "Performance of Alternative Flexible Functional Forms for Modeling Demand System." Working Paper, Cornell University, Ithaca, NY (In Progress).
- Kravis, Heston, and Summers (1978). *International Comparisons of Real Product and Purchasing Power*. The Statistical Office of The United Nations and The World Bank, Baltimore: Johns Hopkins University Press.
- Kravis, Heston, and Summers (1982). *World Product and Income: International Comparisons of Real Gross Product..* The Statistical Office of The United Nations and The World Bank, Baltimore: Johns Hopkins University Press.

- Seale, J.L. Jr., W.E. Walker and I. Kim (1991). "The Demand for Energy: Cross-country Evidence Using the Florida Model." *Energy Economics* 13(1): 33-40.
- Theil, H. (1965). *Economic Forecasts and Policy*, Amsterdam: North-Holland Publishing Company.
- Theil, H. and K.W. Clements (1987). *Applied Demand Analysis: Results from System-Wide Approaches*, Cambridge, MA: Ballinger Publishing Company.
- Theil, H., C. Chung and J.L. Seale Jr. (1989). *International Evidence on Consumption Patterns*. Greenwich, CT and London: JAI Press.
- Tyrrell, T.J. and T.D. Mount (1982). "A Nonlinear Expenditure System Using a Linear Logit Specification." *American Journal of Agricultural Economics* 64(3): 539-46.
- United Nations Commission of the European Communities and Eurostat (1986). *World Comparisons of Purchasing Power and Real Product for 1980, Phase IV of the International Comparison Project, Part Two: Detailed Results for 60 Countries*. In: United Nations, NY.
- Varian, H.R. (1984). *Microeconomic Analysis*, New York: W.W. Norton & Company.
- World Development Report 1992: Development and the Environment* (1992). Oxford: Oxford University Press.

TABLE 1: MODEL VIOLATIONS				
TYPE	LOGIT		D-M	
	6-GOOD	9-GOOD	6-GOOD	9-GOOD
CONVERGENCE	0	1	0	0
BUDGET SHARE	0	0	0	1
HSSM	0	1	33	51

TABLE 2: PREDICTIVE ABILITY OF MODELS								
GOOD	9-GOOD LOGIT				9-GOOD D-M			
	COEFFICIENT OF INEQUALITY	PROPORTIONS (%)			COEFFICIENT OF INEQUALITY	PROPORTIONS (%)		
		BIAS	VAR	COV		BIAS	VAR	COV
ELECTRICITY	0.25	0.05	2.12	97.83	0.22	0.00	19.59	80.41
OTHER ENERGY	0.17	0.53	38.08	61.39	0.15	0.00	33.00	67.00
GRAINS & STARCHES	0.18	1.38	8.94	89.68	0.16	0.00	11.01	88.99
ANIMAL PRODUCTS	0.13	0.29	26.24	73.47	0.15	0.00	23.54	76.46
OTHER FOODS	0.10	0.40	21.86	77.74	0.11	0.00	36.73	63.27
CLOTHING & HOUSEHOLD	0.09	4.33	27.76	67.91	0.09	0.00	26.49	73.51
HEALTH	0.15	0.02	7.82	92.16	0.16	0.00	15.26	84.74
EDUCATION	0.21	1.11	18.19	80.70	0.21	0.00	14.89	85.11
OTHER GOODS	0.15	0.03	21.35	78.62	0.17	0.00	21.64	78.36

TABLE 3: COMPARISON OF OWN-PRICE AND INCOME ELASTICITIES¹
6-GOOD AND 9-GOOD LOGIT MODELS

GOOD	MARSHALLIAN OWN-PRICE		INCOME	
	6-GOOD MODEL	9-GOOD MODEL	6-GOOD MODEL	9-GOOD MODEL
TOTAL ENERGY	-0.78 [-0.60,-1.04]		1.05 [0.91,1.31]	
ELECTRICITY		-1.42[-1.18,-1.73]		1.54 [1.39,1.77]
OTHER ENERGY		-1.02 [-0.42, 1.47]		1.05 [0.89,1.28]
GRAINS & STARCHES	-0.84 [-0.60,0.98]	-0.91 [-0.57,-1.16]	0.19 [0.06,0.45]	0.14 [-0.01,0.37]
OTHER FOODS	-0.63 [-0.48,-0.87]		0.82 [0.68,1.08]	
ANIMAL PRODUCTS		-0.59 [-0.30,-1.16]		0.75 [0.59,0.98]
OTHER FOODS		-0.92 [-0.77,-1.11]		0.82 [0.66,1.05]
CLOTHING & HOUSEHOLD	-0.87 [-0.47,-1.20]	-0.83 [-0.44,-1.18]	1.13 [0.99,1.39]	1.11 [0.96,1.35]
HEALTH & EDUCATION	-1.29 [-1.12,-1.62]		1.42 [1.29,1.68]	
HEALTH		-1.21 [-0.91,-1.83]		1.58 [1.43,1.82]
EDUCATION		-0.99 [-0.69,-1.21]		1.35 [1.20,1.58]
OTHER GOODS	-1.19 [-0.95,-1.38]	-1.07 [-0.86,-1.27]	1.26 [1.12,1.51]	1.24 [1.09,1.47]

¹Ranges are given in brackets

TABLE 4: COMPARISON OF OWN-PRICE AND INCOME ELASTICITIES¹

6-GOOD AND 9-GOOD D-M MODELS

GOOD	MARSHALLIAN OWN-PRICE		INCOME	
	6-GOOD MODEL	9-GOOD MODEL	6-GOOD MODEL	9-GOOD MODEL
TOTAL ENERGY	-0.70 [-0.39,-0.79]		0.99 [0.99,1.00]	
ELECTRICITY		-1.23 [5.50,-4.28]		1.12 [-2.43,2.73]
OTHER ENERGY		-0.94 [-0.89,-0.96]		1.00 [1.00,1.00]
GRAINS & STARCHES	-0.30 [1.08,-0.81]	-0.32 [2.03,-0.83]	0.21[2.89,0.77]	-0.31[-5.32,0.77]
OTHER FOODS	-0.68 [-0.59,-0.79]		0.93 [0.91,0.95]	
ANIMAL PRODUCTS		-0.81 [-0.68,-0.89]		0.87 [0.78,0.93]
OTHER FOODS		-0.81 [-0.76,-0.86]		0.96 [0.95,0.97]
CLOTHING & HOUSEHOLD	-0.90 [-0.85,-0.92]	-0.90 [-0.85,-0.92]	1.14 [1.12,1.19]	1.16 [1.13,1.22]
HEALTH & EDUCATION	-0.36 [5.17,-0.71]		1.28 [1.13,3.61]	
HEALTH		-0.79 [-0.29,-2.52]		1.28 [-0.84,1.89]
EDUCATION		-0.35 [1.84,-0.67]		1.08 [1.04,1.38]
OTHER GOODS	-1.12 [-1.09,-1.29]	-1.09 [-1.07,-1.21]	1.19 [1.12,1.50]	1.17 [1.11,1.45]

¹Ranges are given in brackets

**TABLE 5: PRICE AND INCOME ELASTICITIES FOR ELECTRICITY
AND OTHER ENERGY, 9-GOOD LOGIT MODEL¹**

	ELECTRICITY	OTHER ENERGY
INCOME ELASTICITY	1.54 [1.39, 1.77]	1.05 [0.89, 1.28]
OWN-PRICE ELASTICITY	-1.42 [-1.73,-1.18]	-1.02 [-1.47,-0.44]
CROSS-PRICE ELASTICITY vs.		
ELECTRICITY	-	0.13 [0.00, 0.48]
OTHER ENERGY	0.33 [0.02, 0.69]	-
GRAINS & STARCHES	0.04 [0.00, 0.13]	0.04 [0.00, 0.15]
ANIMAL PRODUCTS	-0.18 [-0.32,-0.10]	-0.27 [-0.94,-0.06]
OTHER FOODS	-0.25 [-0.38,-0.18]	0.38 [0.18, 0.72]
CLOTHING & HOUSEHOLD	0.42 [-0.06, 1.45]	-0.18 [-0.25,-0.11]
HEALTH	0.00 [-0.03, 0.09]	-0.01 [-0.03, 0.00]
EDUCATION	-0.13 [-0.35,-0.02]	-0.37 [-0.75,-0.05]
OTHER GOODS	-0.36 [-1.00,-0.08]	0.27 [0.04, 0.50]
¹ Ranges are given in brackets		

TABLE 6: EFFECT OF INCOME CHANGES ON ENERGY DEMAND

PER CAPITA REAL INCOME	ELECTRICITY				OTHER ENERGY			
	BUDGET SHARE (%)	UNITS	OWN-PRICE ELASTICITY	INCOME ELASTICITY	BUDGET SHARE (%)	UNITS	OWN-PRICE ELASTICITY	INCOME ELASTICITY
500	0.38	2	-1.26	1.75	3.75	19	-1.30	1.26
1000	0.63	6	-1.26	1.64	4.31	43	-1.21	1.15
5000	1.52	76	-1.47	1.46	4.65	233	-1.02	0.96
10000	2.04	204	-1.57	1.40	4.44	444	-0.96	0.91

**PREDICTED BUDGET SHARES
SIMULATION WITH FIXED PRICES**

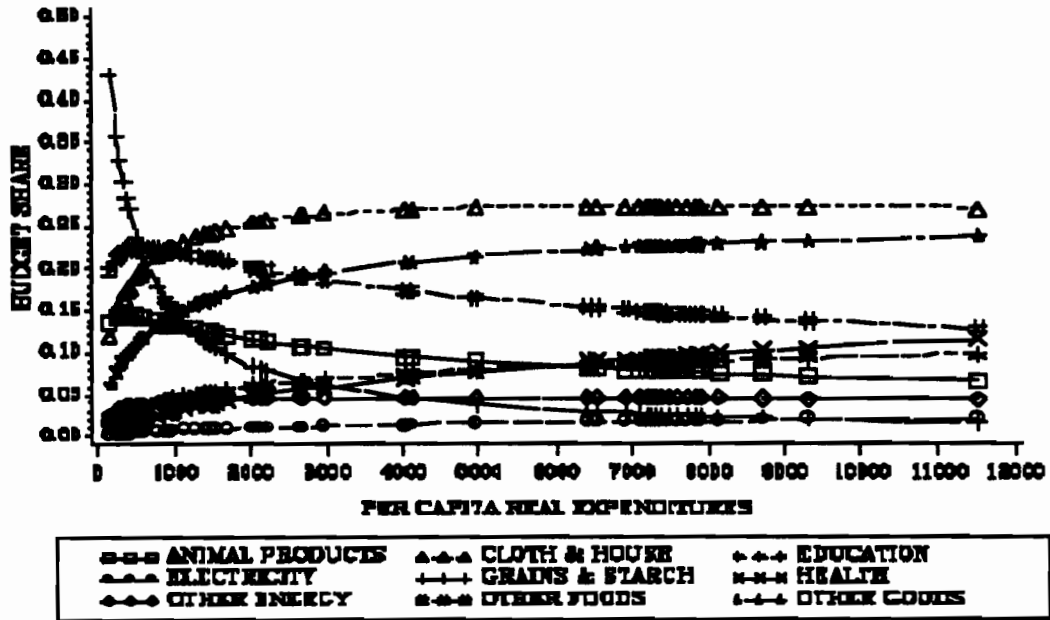


FIGURE 1: PREDICTED BUDGET SHARES

INCOME ELASTICITIES SIMULATION WITH FIXED PRICES

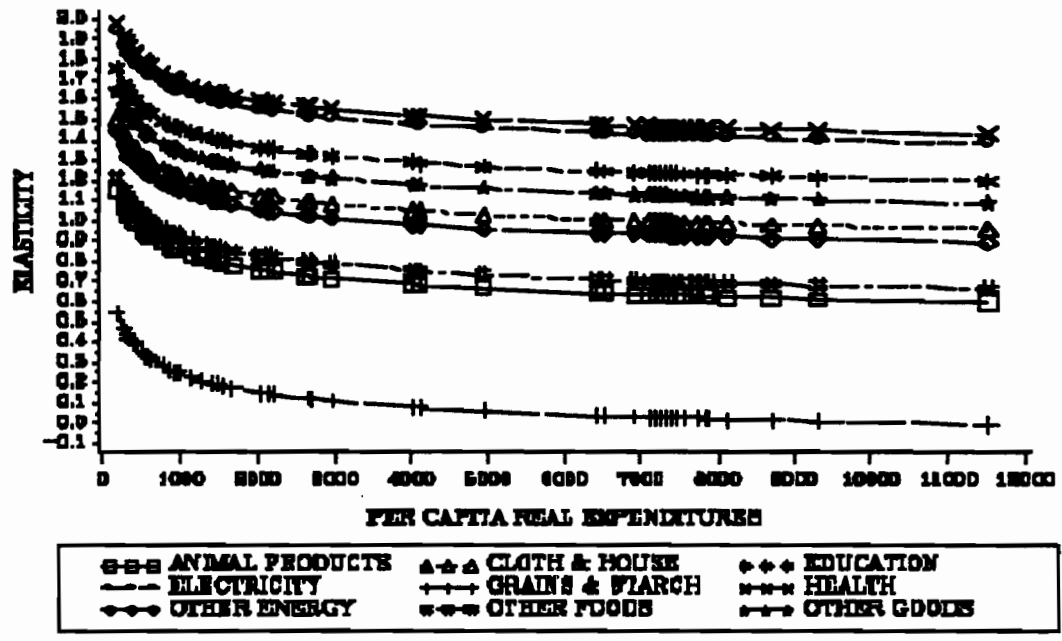


FIGURE 2: INCOME ELASTICITIES

MARSHALLIAN OWN-PRICE ELASTICITIES SIMULATION WITH FIXED PRICES

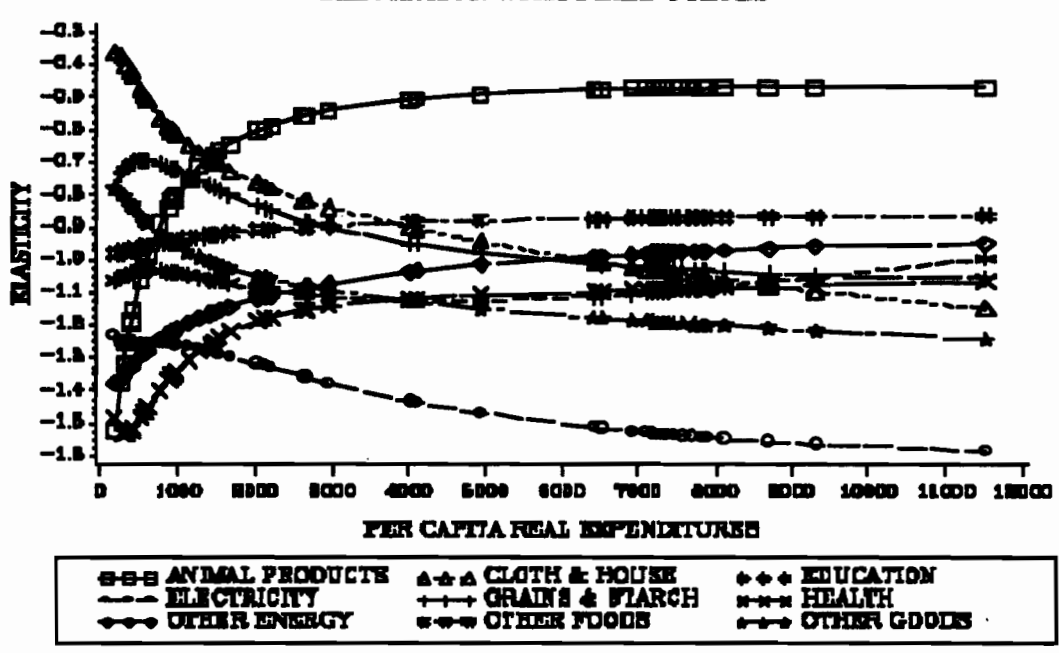


FIGURE 3: MARSHALLIAN OWN-PRICE ELASTICITIES

VII. APPENDIX - DATA SOURCES

A. Introduction - United Nations International Comparison Project

The data used in the analysis have been taken from the United Nations International Comparison Project (ICP). The ICP was initiated to "compare the purchasing power of currencies and the real gross domestic product (GDP) per capita of different countries" (Kravis, et.al. 1978). The desire was to move beyond comparisons based solely upon the prevailing exchange rates; these were considered misleading because they do not reflect differences in the prices of goods and services between countries. The UN, the World Bank, the OECD, EUROSTAT, the EEC, the Economic Commission for Europe (ECE), the Economic Commission for Africa (ECA), the Estudios conjuntos sobre la Integración Económica Latinoamericana (ECIEL), the Inter-American Development Bank, and the Economic Commission for Latin America and the Caribbean (ECLAC) have all participated in the project at various points in the history of the ICP.

The ICP has proceeded through 5 phases to date. Phase I covered 10 countries, with 1970 as a reference date, while also gathering data on 6 of these countries for 1967. Phase II covered 16 countries, using 1970 and 1973 as reference dates. Phase III, using 1975 as the reference date, covered 34 countries. Phase IV saw the coverage expand to 60 countries and used 1980 as the reference date. 64 countries participated in Phase V, with 1985 being the reference date.

This analysis uses data from Phase V of the ICP. A complete set of the data for Phase V is not available in a single place, but it was possible to obtain data series for Asian, African, and OECD countries. The countries included in the data series used in this analysis are shown in Table A.1. Table A.2 provides the complete list of countries from Phase IV (1980) of the ICP. As is seen, the countries covered do change over time.

The ICP provides detailed price and expenditure data for a large number of commodities. Tables A.3 - A.6 show the commodities at the basic heading level for each of the

data series used in the analysis presented here, as well as those for Phase IV of the ICP, grouped into 9 consumer goods and non-consumer goods. The data on consumer expenditures is reported for 125 basic headings in the 1980 data series, 129 in the 1985 Asian data series, 126 in the African data series, and 154 in the 1985 OECD data series. Two items should be noted concerning the treatment of certain consumption items in the ICP. First, all public expenditures on health care, education, and recreation other than those of specifically governmental nature are included in the consumption categories. This was done "to ensure that comparisons for these groupings were independent of the degree to which a country's expenditures for them are made collectively by the society on the one hand and out of household budgets on the other" (Kravis, et.al. 1978). Secondly, rent subsidies provided by the government have also been included in consumption, with corresponding adjustments being made in the prices for rents.

B. Definitions

To understand the data that is provided by the ICP, the following definitions are useful:

P_{ij} : the price of good i in country j ; units are local currency/unit of good j

q_{ij} : the amount of good i purchased in country j ; units are unit of good j (i.e. kilograms of rice, gallons of motor fuel)

PPP_{ij} : purchasing power parity for good i in country j . The units are local currency/\$B, where \$B is a hypothetical currency for the "average" country in the data series, i.e. the "average 1985 OECD country in 1985", the "average African country in 1985", the "average Asian country in 1985", and the "average country in 1980". The value of ppp_{ij} can be interpreted as the amount of local currency that is required to buy a unit of good i in country j where a unit is defined as the amount of good i that can be purchased for 1 \$B in the "average" country. It is important to note that the "average country", and therefore the PPP_{ij} s are a function of the countries involved in the comparisons, and will therefore differ across the different data series.

X_j : the exchange rate for country j against a given country. The U.S. is used as the numeraire country for all of the data series. The 1980 and 1985 data are treated separately.

$V_{ij} = P_{ij}q_{ij}$: per capita expenditures on good i in country j ; units are local currency.

$Q_{ij} = V_{ij}/PPP_{ij}$: the value of expenditures on good i in country j ; units are \$B. This can be viewed equivalently, and perhaps more accurately, as a quantity measure where the units are the number of \$1B sized units of good i that are purchased in country j .

$P_{ij} = PPP_{ij}/X_j$: the relative price of good i in country j ; units are the currency of the numeraire country; this as the amount of \$US that are needed in country j to get the same quantity that 1 \$US will buy in the "average" country.

$R_{ij} = P_{ij}Q_{ij} = V_{ij}/X_j$: per capita expenditures on good i in country j ; units are currency of the numeraire country (\$US).

In this analysis R_{ij} is used for the per capita expenditures and P_{ij} for relative prices. It is important to note that the relative prices, P_{ij} , are dependent upon the set of countries used to define the purchasing power parities, whereas the per capita expenditures are not. Adjustments in the relative prices are necessary to combine the data from the three different 1985 series into a single series. To see why this is the case, recall that the prices given refer to the relative price of good i in country j . The United States is being used as the base country in each case; therefore, the relative prices should be thought of as the amount of money in \$US that is needed in country j to get the same quantity of good i that 1 \$US will buy in the "average" country. Since the "average" country is determined by the countries in the regional data series and these differ between regions, the quantity of any good that 1 \$US will purchase will not be the same in different series. For example, assume that 1 \$US will buy 1 kilogram of rice in the average OECD country, but it will purchase 2 kilograms of rice in the average African country. Therefore, in adjusting the prices for the African countries to match the quantities used in the OECD countries, the relative price of rice must be multiplied by 0.5 since rice is half as expensive on average in the African countries than it is in the OECD countries. Since the per capita expenditures, R_{ij} , are absolute amounts in a common currency, there is no need to adjust these data. The strategies used for making the adjustments in the relative prices are discussed in more detail after the next section, which describes the methods used to aggregate the data from the basic headings to the composite goods used in the analysis. No attempt has been made to combine the 1980 and 1985 data.

C. Aggregation Procedures

For the purposes of the econometric analysis, the data on consumer expenditures and prices are aggregated to 9 composite goods: 1)Electricity, 2)Other Energy, 3)Grains & Starches, 4)Animal Products, 5)Other Food, 6)Clothing and Household Goods, 7)Health, 8)Education, and 9)Other Consumer Goods.

The per capita expenditures are aggregated by adding the values of the sub-aggregates:

$$R_{*j} = \sum_{i \in \epsilon^*} R_{ij}$$

The relative price of a composite good is computed as the weighted geometric average of the relative prices of the sub-aggregates, with the budget shares used as the weighting factors:

$$P_{*j} = \prod_{i \in \epsilon^*} (P_{ij})^{\frac{w_{ij}}{\sum_{i \in \epsilon^*} w_{ij}}}$$

This is the equivalent of using a Stone Price Index. An important property of this index, which is necessary in the formulation of the demand system model as shown later, is that:

$$\frac{\partial \ln(P_{*j})}{\partial \ln(P_{ij})} = \frac{w_{ij}}{\sum_{i \in \epsilon^*} w_{ij}}$$

In contrast, the ICP requires additivity of the value of expenditures, which can be stated as:

$$Q_{*j} \equiv \frac{R_{*j}}{P_{*j}} = \sum_{i \in \epsilon^*} Q_{ij}$$

The Stone Price Index does not exhibit this property. The formula for aggregation of the prices which is used by the UN is a weighted arithmetic average:

$$P_{*j} = \frac{\sum_{i \in *} Q_{ij} P_{ij}}{\sum_{i \in *} Q_{ij}} = \frac{\sum R_{ij}}{\sum_{i \in *} Q_{ij}}$$

This formulation exhibits additivity, but fails the needs of this analysis in that:

$$\frac{\partial \ln(P_{*j})}{\partial \ln(P_{ij})} \neq \frac{w_{ij}}{\sum_{i \in *} w_{ij}}$$

Since the choice of which aggregation method to use is arbitrary, it is proper to choose the one that best serves the purpose at hand. In this case, that is the Stone Price Index.

D. Adjusting the Price Data for Asian and African Countries in 1985

An adjustment to the relative prices is needed when the OECD, Asian, and African data for the year 1985 are combined. The logic behind this was discussed in Section B above. A multiplicative factor is needed to adjust the price of each good in the Asian and African data to make them comparable to the OECD data since the quantity units differ between the "average" countries in each of these data series.

Different strategies are required to calculate the multiplicative factors for the Asian and African data series. Both the OECD and Asian data series include data for Japan; therefore, it is possible to use Japan as a link country. Since the basic headings differ between the two series, though, it is not possible to calculate a factor for each good. The per capita expenditures for each good were compared between the two sets of data for Japan in order to come up with corresponding sets of goods that were the same between the two series. Where a one-to-one match occurs, the factor can be calculated directly; where this does not occur, a geometric

mean price is calculated for each set of goods, which are then used to compute the multiplicative factors. The matching of goods, along with the per capita expenditures for each of the consumer goods in the two series, are shown in Table A.7.

None of the countries included in the African data series appears in either the OECD or Asian series, so it was not possible to link the data as was done for the Asian countries. However, from the Penn World Tables (PWT), it is possible to obtain a consistent set of parity weighted relative prices for consumer goods as a whole in 1985 for all of the countries used in this analysis. Table A.8 compares the relative prices as provided by the PWT with those calculated in this analysis using a geometric mean price. There is generally good agreement between these two estimates, with the average difference being under 5%, and only four of the 31 countries having differences larger than 7%. For the unadjusted African countries, however, the discrepancies are very large.

To calculate the multiplicative factors for the African data series, the budget shares, w_{ij} , and the relative prices, P_{ij} , for individual commodities and PO_j for consumer goods as a whole are taken from the ICP data. Let the relative price of consumer goods as a whole from the PWT for country j be denoted PO_j^* and define d_i as the multiplicative factor for good i . Assuming PO_j^* is a geometric average of the prices, it follows that:

$$PO_j^* = \prod_i (d_i * P_{ij})^{w_{ij}}$$

$$\ln(PO_j^*) = \sum_i (w_{ij} * \ln(d_i)) + \sum_i (w_{ij} * \ln(P_{ij}))$$

$$\ln(PO_j^*) = \sum_i (w_{ij} * \ln(d_i)) + \ln(PO_j)$$

The final form of the equation can be used to run a linear regression to estimate the natural logarithms of the multiplicative factors. It would be desirable to calculate a multiplicative factor for each of the goods at the basic headings level, but this was not possible due to the small number of observations. The estimation is done using six aggregate consumer

goods: 1)Total Energy, 2)Grains & Starches, 3)Other Foods, 4)Clothing & Household, 5)Health & Education, and 6)Other Consumer Goods.⁸

The results of the regression are fairly good. This is best seen by referring to Table A.9, which compares the adjusted calculations of the relative price for all consumer goods with those given by the PWT for 1985. The discrepancies in the values for the African countries are now very much in line with those of the OECD and Asian countries.

E. Summary

This appendix has summarized the data used to perform the analysis in the main body of this paper. With its large degree of commodity disaggregation and attempts at standardization, the United Nations International Comparison Programme is a potentially rich source for doing cross country studies of consumer behavior.

⁸Electricity and Other Energy, Animal Products and Other Foods, and Health and Education were aggregated in going from 9 to 6 goods. The 9-good model resulted in extreme and illogical parameter estimates and an F-test comparing the 6 and 9 good models failed to reject the hypothesis that the parameter estimates related to each of the pairs of goods shown above were the same. Also, Zambia and Ethiopia were dropped from the estimation as outliers after analyzing the standardized residuals and performing a Chow Type II test.

TABLE A.1: COUNTRIES IN PHASE V (1985) ICP

OECD		AFRICA		ASIA	
BEL	BELGIUM	BEN	BENIN	BAN	BANGLADESH
AUS	AUSTRALIA	BOT	BOTSWANA	HNK	HONG KONG
AUT	AUSTRIA	CAM	CAMEROON	IND	INDIA
CAN	CANADA	CON	CONGO	IRA	IRAN
DNK	DENMARK	EGY	EGYPT	JP2	JAPAN
FIN	FINLAND	ETH	ETHIOPIA	KOR	KOREA
FRA	FRANCE	IVO	IVORY COAST	PAK	PAKISTAN
GER	GERMANY	KEN	KENYA	PHI	PHILIPPINES
GRC	GREECE	MAD	MADAGASCAR	SRL	SRI LANKA
IRE	IRELAND	MAL	MALI	THL	THAILAND
ITA	ITALY	MAR	MOROCCO		
JAP	JAPAN	MAU	MAURITIUS		
LUX	LUXEMBOURG	MAW	MALAWI		
NLD	NETHERLANDS	NIG	NIGERIA		
NOR	NORWAY	RWA	RWANDA		
NZL	NEW ZEALAND	SEN	SENEGAL		
PRT	PORTUGAL	SIE	SIERRA LEONE		
SPA	SPAIN	SWA	SWAZILAND		
SWE	SWEDEN	TAN	TANZANIA		
TUR	TURKEY	TUN	TUNISIA		
UK	UK	ZAM	ZAMBIA		
USA	UNITED STATES	ZIM	ZIMBABWE		

TABLE A.2: COUNTRIES IN PHASE IV (1980) ICP

USA	UNITED STATES	CAM	CAMEROON	PAK	PAKISTAN
BEL	BELGIUM	ETH	ETHIOPIA	PHI	PHILIPPINES
DEN	DENMARK	IVO	IVORY COAST	SRI	SRI LANKA
FRA	FRANCE	KEN	KENYA	ARG	ARGENTINA
GER	GERMANY	MAD	MADAGASCAR	BOL	BOLIVIA
GRC	GREECE	MAW	MALAWI	BRA	BRAZIL
IRE	IRELAND	MAL	MALI	CHI	CHILE
ITA	ITALY	MAR	MOROCCO	COL	COLOMBIA
LUX	LUXEMBOURG	NIG	NIGERIA	COS	COSTA RICA
NLD	NETHERLANDS	SEN	SENEGAL	DOM	DOMINICAN REP.
UK	UK	TAN	U.R. TANZANIA	ECU	ECUADOR
AUT	AUSTRIA	TUN	TUNISIA	ELS	EL SALVADOR
FIN	FINLAND	ZAM	ZAMBIA	GUA	GUATEMALA
HUN	HUNGARY	ZIM	ZIMBABWE	HON	HONDURAS
NOR	NORWAY	ISR	ISRAEL	PAN	PANAMA
POL	POLAND	HNK	HONG KONG	PAR	PARAGUAY
PRT	PORTUGAL	IND	INDIA	PER	PERU
SPA	SPAIN	INS	INDONESIA	URU	URUGUAY
YUG	YUGOSLAVIA	JAP	JAPAN	VEN	VENEZUELA
BOT	BOTSWANA	KOR	KOREAN REP.	CAN	CANADA

TABLE A.3: COMMODITIES IN PHASE V (1985) ICP - OECD COUNTRIES

ELECTRICITY

ELECTRICITY

OTHER ENERGY

TOWN GAS AND NATURAL GAS

LIQUEFIED GAS

HEATING AND LIGHTING OILS

COAL, COKE AND OTHER SOLID

FUELS

MOTOR FUELS, OILS AND GREASES

GRAINS & STARCHES

RICE

FLOUR AND OTHER CEREALS

BREAD

OTHER BAKERY PRODUCTS

MACARONI, SPAG., RAVIOLI, ETC

OTHER CEREAL PRODUCTS

FRESH POTATOES & OTHER

TUBERS

POTATO PRODUCTS

MEAT & ANIMAL

PRODUCTS

FRESH AND FROZEN BEEF

FRESH AND FROZEN VEAL

FRESH AND FROZEN PORK

FRESH ETC. MUTTON, LAMB, GOAT

FRESH AND FROZEN POULTRY

DELICATESSEN MEAT

PREPARATIONS, EXTRACTS, ETC.

OFFAL AND OTHER MEAT NEC

FRESH OR FROZEN FISH

DRIED OR SMOKED FISH

FRESH OR FROZEN SEAFOOD

PROCESSED FISH AND SEAFOOD

PASTEURISED AND STERILISED

MILK

CONDENSED AND POWDERED

MILK

CREAM, YOGHURT AND LIKE

PRODUCTS

PROCESSED AND UNPROCESSED

CHEESE

EGGS AND EGG-BASED PRODUCTS

BUTTER AND SALTED BUTTER

OTHER ANIMAL AND VEGETABLE

FATS

OTHER FOODS

MARGARINE AND "DIET"

MARGARINE

EDIBLE OILS

FRESH FRUIT

DRIED FRUITS AND NUTS

FROZEN/PRESERVED

FRUITS/JUICES

FRESH VEGETABLES

DRIED VEGETABLES

FROZEN VEGETABLES

PRESERVED

VEGETABLES, SOUPS, ETC.

RAW AND REFINED SUGAR

COFFEE AND INSTANT COFFEE

TEA AND OTHER INFUSIONS

COCOA & NOT COCOA

PREPARATIONS

JAMS, JELLIES, HONEY & SYRUPS

CHOCOLATE & COCOA

PREPARATIONS

CONFECTIONERY

EDIBLE ICE AND ICE CREAM

SALT, SPICES, SAUCES AND FOOD

NEC

MINERAL WATER

OTHER SOFT DRINKS NEC

SPIRITS AND LIQUERS

WINE NOT FORTIFIED OR

SPARKLING

BEER

OTHER WINES & ALCOHOLIC

DRINKS

CIGARETTES

OTHER TOBACCO PRODUCTS

RESTAURANTS AND TAKE-AWAYS

PUBS, BARS, TEA-ROOMS, CAFES

CANTEENS AT PLACE OF WORK

CLOTHING &

HOUSEHOLD

MEN'S CLOTHING

LADIES' CLOTHING

CHILDREN'S CLOTHING

INFANT'S CLOTHING

CLOTH, YARNS, THREADS, ACCESSO-

RIES

REPAIRS TO CLOTHING

MEN'S FOOTWEAR

LADIES' FOOTWEAR

CHILDREN'S & INFANT'S

FOOTWEAR

REPAIRS TO FOOTWEAR

RENTS OF TENANTS

IMPUTED RENTS OF OWNER-

OCCUPIERS

REPAIR & MAINTENANCE OF

HOUSING

WATER CHARGES

FURNITURE AND FIXTURES

CARPETS & OTHER FLOOR

COVERINGS

REPAIR OF

FURNITURE, CARPETS, ETC.

TEXTILES AND TEXTILE

FURNISHINGS

REPAIR HOUSEHOLD

TEXTILES, ETC.

REFRIGERATORS AND FREEZERS

CLOTHES & DISH

WASHERS, DRIERS

COOKERS, HOBBS AND OVENS

HEATERS AND AIR-CONDITIONERS

VACUUM

CLEANERS, POLISHERS, ETC.

OTHER HOUSEHOLD APPLIANCES

REPAIR OF HOUSEHOLD

APPLIANCES

GLASSWARE AND TABLEWARE

CUTLERY

MOTORLESS DOMESTIC UTENSILS

MOTORLESS GARDEN APPLIANCES

BULBS, WIRES, POINTS, BATTERIES,

ETC

REPAIR

GLASS/TABLEWARE, UTENSILS

CLEANING & MAINTENANCE

PRODUCTS

OTHER NONDURABLE

HOUSEHOLD ITEMS

LAUNDRY AND DRY CLEANING

OTHER HOUSEHOLD SERVICES

DOMESTIC SERVICES

HEALTH

PHARMACEUTICAL PRODUCTS

OTHER MEDICAL SUPPLIES

EYEGASSES

THERAPEUTIC APPLIANCES NEC

GENERAL PRACTITIONERS

SPECIALISTS

DENTISTS

NURSES

OTHER PRACTITIONERS

MEDICAL ANALYSES

HOSPITAL MEDICAL STAFF

HOSPITAL NON-MEDICAL STAFF

HOSPITAL INTERMEDIATE

CONSUMPTN

HOSPITAL CAPITAL

CONSUMPTION

MEDICAL AND HEALTH CARE

SERVICES

EDUCATION

BOOKS, BROCHURES AND THE LIKE

MAGAZINES, NEWSPAPERS, ETC.

EDUCATIONAL FEES

OTHER CONSUMER

GOODS

PASSENGER CARS

OTHER TRANSPORT EQUIPMENT

TYRES, TUBES, PARTS &

ACCESSORIES

REPAIR AND MAINTENANCE

SERVICES

OTHER PERSONAL TRANSPORT

EXPENSE

LOCAL PUBLIC TRANSPORT AND

TAXIS

RAIL AND ROAD TRANSPORT

SERVICES

AIR, SEA, OTHER TRANSPORT

SERVICES

PURCHASED TRANSPORT

SERVICES NEC

POSTAGE FOR

PARCELS, LETTERS, ETC.

TELEPHONE AND TELEGRAPH

SERVICES

RADIO SETS

TELEVISIONS, VIDEO
 RECORDERS, ETC.
 RECORD-PLAYERS, TAPE
 RECORDERS...
 CAMERAS & PHOTOGRAPHIC
 EQUIPMENT
 OTHER DURABLE RECREATIONAL
 GOODS
 RECORDS, TAPES, CASSETTES, ETC.
 SPORTS GOODS & CAMPING
 EQUIPMENT
 GAMES, TOYS AND HOBBIES
 FILMS AND PHOTOGRAPHIC
 SUPPLIES
 FLOWERS, PLANTS, PETS AND PET
 FOOD
 PARTS & REPAIRS RECREATION
 GOODS
 CINEMAS, STADIUMS, ZOOS, ETC.
 SPORTING & RECREATIONAL
 ACTIVITY
 RADIO/TELEVISION
 LICENCE/RENTAL
 FILM DEVELOPING & OTHER
 SERVICES
 SERVICES OF HAIRDRESSERS, ETC.
 DURABLE TOILET ARTICLES &
 REPAIR
 NON-DURABLE TOILET ARTICLES
 JEWELLERY, WATCHES AND
 REPAIR
 TRAVEL GOODS AND BAGGAGE
 ITEMS
 OTHER PERSONAL GOODS AND
 EFFECTS

WRITING EQUIPMENT AND
 SUPPLIES
 HOTELS & OTHER LODGING
 SERVICES
 FINANCIAL SERVICES CHARGES
 NEC
 FEES FOR SERVICES NEC
 NET PURCHASES ABROAD
**NON-CONSUMER
 GOODS**
 PRIVATE NON-PROFIT
 INSTITUTIONS
 GOVT. COMPENSATION OF
 EMPLOYEES
 GOVT. INTERMEDIATE
 CONSUMPTION
 GOVT. CAPITAL CONSUMPTION
 STRUCTURAL METAL
 PRODUCTS, ETC.
 PRODUCTS OF BOILERMAKING
 TOOLS AND FINISHED METAL
 GOODS
 AGRICULTURAL
 MACHINERY, TRACTORS
 MACHINE TOOLS FOR METAL
 WORKING
 MINING, METALLURGY, ETC.
 EQUIPMENT
 TEXTILE MACHINERY
 MACHINERY FOR
 FOOD, CHEMICALS...
 MACHINERY FOR
 WOOD, LEATHER.....

OTHER MACHINERY AND
 EQUIPMENT
 OFFICE/DATA-PROCESSING
 MACHINES
 PRECISION INSTRUMENTS
 OPTICAL/PHOTOGRAPHIC
 EQUIPMENT
 ELECTRICAL EQUIPMENT
 TELECOMMUNICATION
 EQUIPMENT, ETC.
 ELECTRONIC
 EQUIPMENT, RADIO, ETC.
 MOTOR VEHICLES AND ENGINES
 BOATS, STEAMERS, TUGS, RIGS, ETC.
 LOCOMOTIVES, VANS AND
 WAGONS
 AIRCRAFT, HOVERCRAFT, ETC.
 BICYCLES, MOTORCYCLES, ETC.
 SINGLE-FAMILY DWELLINGS
 MULTI-FAMILY DWELLINGS
 AGRICULTURAL BUILDINGS
 INDUSTRIAL BUILDINGS
 BUILDINGS FOR MARKET
 SERVICES
 BUILDINGS NON-MARKET
 SERVICES
 ROADS, BRIDGES AND TUNNELS
 OTHER TRANSPORT ROUTES, ETC.
 OTHER CIVIL ENGINEERING
 WORKS
 OTHER PRODUCTS
 CHANGE IN STOCKS
 NET EXPORTS OF GOODS &
 SERVICES

TABLE A.4: COMMODITIES IN PHASE V (1985) ICP - ASIAN COUNTRIES

ELECTRICITY

ELECTRICITY

OTHER ENERGY

GAS(INCL. LIQUEFIED)

LIQUID FUELS

OTHER FUELS

FUEL & LUBRICANTS

GRAINS & STARCHES

RICE

FLOUR, OTHER CEREALS

BREAD

OTHER BAKERY PRODUCT

CEREAL PREPARATIONS

OTHER CEREAL PRODUCT

POTATOES(ENGLISH)

MANIOC & OTHER TUBER

MEAT & ANIMAL

PRODUCTS

FRESH BEEF & VEAL

FRESH LAMB & MUTTON

FRESH PORK

FRESH POULTRY

OTHER FRESH MEAT

DRIED/PROCESSED MEAT

FRESH/FROZEN FISH

SEAFOOD

SMOKED/PRESERVED F&S

CANNED FISH, SEAFOOD

FRESH MILK

PRESERVED MILK

CHEESE

OTHER MILK PRODUCTS

EGGS

BUTTER

OTHER FOODS

MARGARINE, OTHER FAT

FRESH FRUITS, TROPIC

OTHER FRESH FRUITS

DRIED/FROZEN/PRE FRU

FRESH VEGETABLES

DRIED/FROZEN/PRE VEG

SUGAR

COFFEE

TEA

COCOA

JAM, PRESERVES

SUGAR PROD., CHOCO.

SALT, SPICE & SAUCES

MINERAL WATER

SOFT DRINKS

SPIRITS

WINE & CIDER

BEER

CIGARETTES

OTHER TOBACCO PROD.

RESTAURANTS & CAFES

WORKERS' CAFES

CLOTHING & HOUSEHOLD

CLOTHING MATERIALS

MEN'S CLOTHING

WOMEN'S CLOTHING

CHILDREN'S CLOTHING

CLOTHING ACCESSORIES

CLOTHING RENT,REPAIR

MEN'S FOOTWEAR

WOMEN'S FOOTWEAR

CHILDREN'S FOOTWEAR

REPAIRS TO FOOTWEAR

GROSS RENTS

INDOOR REPAIR, MATER

INDOOR REPAIR, LABOR

SANITARY & WATER

FURNITURE & FIXTURES

FLOOR COVERINGS

REPAIRS TO FURNITURE

HSEHOLD TEXTILES,ETC

REFRIGERATOR,FREEZER

WASHING, CLEANING AP

COOKING APPL., ETC.

AIR-CONDITIONER, ETC

OTHER H'SEHOOLD APPL.

REPAIR TO H'LD APPL.

GLASSWARE, UTENSILS

PAPER PROD. FOR H'LD

HOUSE CLEANING SUPPL

OTHER NON-DURABLES

DOMESTIC SERVICES

HOUSEHOLD SERVICES

HEALTH

DRUG, MEDICAL PREPAR

MEDICAL SUPPLIES

THERAPEUTIC APPLIANC

SVC OF PHYSICIAN G

SVC OF PHYSICIAN P

SVC OF DENTIST G

SVC OF DENTIST P

OTHER MEDICAL SVC.

HOSPITAL SERVICES G

HOSPITAL SERVICES P

EDUCATION

BOOKS, MAGAZINE, ETC

PRIMARY EDUC

SECONDARY EDUC G

SECONDARY EDUC P

TERTIARY EDUC G

TERTIARY EDUC P

OTHER CONSUMER

GOODS

PASSENGER CARS

OTHER TRANS. EQUIP.

TYRES, TUBES, PARTS

REPAIR TO TRANS. EQU

OTHER FOR TRANS. EQU

LOCAL TAXIS

LOCAL BUSES, TRAM

OTHER LOCAL TRANSPOR

RAILWAY TRANSPORT

ROAD TRANS(LONG DIS)

AIR TRANSPORT

OTHER LONG DIST TRAN

POSTAL SERVICES

TELEPHONE CHARGES

TELEGRAPH CHARGES

RADIO, TV SETS, ETC.

PHOTO, CINEMA EQUIP.

OTHER RECR. DURABLES

SEMI-,NON-D'BLE, REC

REPAIRS TO EQUIPMENT

CINEMA,THEATRE,SPORT

OTHER ENT'MENT SVC.

SVC. OF BARBER, ETC.

TOILET ARTICLE, PREP

PERSONAL EFFECTS

STATIONERY

HOTELS & LODGING

FINANCIAL SERVICES

SERVICES N.E.C.

WELFARE SERVICES

RES. PURCHASE ABROAD

NON-RESIDENT PURCHAS

NON-CONSUMER

GOODS

COMPENS. OF EMPLOYEE

PURCHASE OF G & SVC.

CONSUMP. OF FIX. CAP

RESIDENTIAL BUILDING

INDUSTRIAL BUILDINGS

COMMERCIAL BUILDINGS

EDUCATION BUILDINGS

HEALTH BUILDINGS

AGRICULTURAL BUILD.

OTHER BUILDINGS

OTHER CONSTRUCTION,ETC

LAND IMPROVEMENT,ETC

RAILWAY VEHICLES

MOTOR VEHICLES

AIRCRAFT

SHIPS & BOATS

OTHER TRANS. EQUIP.

ENGINES & TURBINES

AGRICULTURAL MACHINE

OFFICE MACHINE, EQUI

METAL, WOODWORK MACH

CONST&MINING EQUIP.

FOOD MACHINERY

TEXTLE, L' THER WORK M

CHEMICAL MACHINERY

GEN. INDUSTRY MACHIN

SVC. INDUSTRY MACHIN

ELECTRIC MOTORS, ETC

RADIO, TV, ETC.

OTHER ELECTRIC APPAR

FURNITURE & FIXTURES

OTHER PRODUCER D'BLE

CHANGE IN STOCKS

NET FOREIGN BALANCE

TABLE A.5 COMMODITIES IN PHASE V (1985) ICP - AFRICAN COUNTRIES

ELECTRICITY

ELECTRICITY

OTHER ENERGY

GAS

LIQUID FUELS

FIREWOOD

OTHER FUELS

FUEL AND LUBRICANTS

GRAINS & STARCHES

RICE

MAIZE, MEAL, WHEAT, BARLEY, OTHER CER.

BREAD

OTHER BAKERY PRODUCTS

CEREAL PREPARATIONS

MACARONI, OTHER CEREAL PRODUCTS

POTATOES (ENGLISH)

MANIOC, OTHER TUBERS

MEAT & ANIMAL PRODUCTS

FRESH BEEF AND VEAL

FRESH LAMB AND MUTTON

FRESH PORK

FRESH POULTRY

OTHER FRESH MEAT

DRIED OR PRESERVED MEAT

FRESH OR FROZEN FISH

SEAFOOD

SMOKED OR PRESERVED

FISH/SEAFOOD

CANNED FISH AND SEAFOOD

FRESH MILK

PRESERVED MILK

CHEESE

OTHER MILK PRODUCTS

EGGS

BUTTER

OTHER FOODS

MARGARINE, LARD, OTHER

EDIBLE OILS

FRESH FRUITS,

TROPICAL/SUBTROPICAL

OTHER FRESH FRUITS

DRIED, FROZEN, PRESERVED

FRUITS

FRESH VEGETABLES

DRIED, FROZEN, PRESERVED

VEGETABLES

RAW AND REFINED SUGAR

COFFEE

TEA

COCOA

JAM, PRESERVES, ETC

SUGAR PRODUCTS AND

CHOCOLATE

SALT, SPICES, AND SAUCES

MINERAL WATER

SOFT DRINKS

SPIRITS

WINE AND CIDER

BEER

CIGARETTES

OTHER TOBACCO PRODUCTS

RESTUARANTS AND CAFES, EXCL.

WORKERS' CAFETERIAS

WORKERS' CAFETERIAS

CLOTHING &

HOUSEHOLD

CLOTHING MATERIALS

MEN'S CLOTHING

WOMEN'S CLOTHING

CHILDREN'S CLOTHING

OTHER CLOTHING ARTICLES

CLOTHING, RENTAL AND REPAIRS

MEN'S FOOTWEAR

WOMEN'S FOOTWEAR

CHILDREN'S FOOTWEAR

REPAIRS TO FOOTWEAR

GROSS RENTS FOR MODERN

DWELLINGS

GROSS RENT, TRAD./SEMI-TRAD.

DWELL.

MATERIALS FOR INDOOR REPAIRS

LABOUR CHARGES FOR INDOOR

REPAIRS

SANITARY SERVICES AND WATER

CHARGES

FURNITURE AND FIXTURES

FLOOR COVERINGS

REPAIRS TO FURNITURE AND

FLOOR COV.

HOUSEHOLD TEXTILES/OTHER

FURNISH-

INGS, INCL. REPAIRS

REFRIGERATORS, FREEZERS,

SIMILAR APPLIANCES

WASHING AND CLEANING

APPLIANCES

COOLING, OTHER FOOD WARMING

APPL.

HOUSEHOLD-TYPE ROOM

CLIMATE CONTROL

EQUIPMENT

OTHER HOUSEHOLD APPLIANCES

REPAIR TO MAJOR HOUSEHOLD

APPL.

GLASSWARE, TABLEWARE, HH

UTENSILS

PAPER PRODUCTS FOR

HOUSEHOLD

HOUSE CLEANING SUPPLIES

OTHER NON-DURABLE

HOUSEHOLD PROD.

DOMESTIC SERVICES

HOUSEHOLD SERVICES (EXCL.

DOMESTIC)

HEALTH

DRUGS AND MEDICAL PREP. (HH

EXP)

MEDICAL SUPPLIES (HH EXP)

THERAPEUTIC APPL AND EQUIP

(HH EXP)

SERVICES OF PHYSICIANS (HH

EXP)

SERVICES OF DENTISTS (HH EXP)

SERVICES OF NURSES (HH EXP)

OTHER MEDICAL SERVICES (HH

EXP)

HOSPITAL SERVICES (HH EXP)

MEDICAL CARE AND HEALTH

SERVICES (COMM. EXP)

EDUCATION

BOOKS, NEWSPAPERS,

MAGAZINES, ETC.

PRIMARY SCHOOLS (HH EXP)

SECONDARY SCHOOLS (HH EXP)

TERTIARY EDUCATION (HH EXP)

OTHER EDUCATIONAL EXP. (HH

EXP)

EDUCATION (COMM. EXP)

OTHER CONSUMER

GOODS

PASSENGER CARS

OTHER TRANSPORT EQUIPMENT

TYRES, TUBES, OTHER PARTS AND

ACC.

MAINT. AND REPAIR OF PERSONAL

TRANSP. EQUIP.

OTHER EXP. FOR PERS. TRANSP.

EQUIP.

LOCAL TAXIS

LOCAL BUSES, TRAMS, ETC.

OTHER LOCAL TRANSPORT

RAIL TRANSPORT

INTER-URBAN ROAD TRANSPORT

AIR TRANSPORT

POSTAL SERVICES

TELEPHONE CHARGES

TELEGRAPH CHARGES

RADIOS, TVS, ETC.

OTHER MAJOR DURABLES FOR

LEISURE

AND ACCESS.

OTHER RECREATIONAL GOODS

REPAIRS TO EQUIP. AND

ACCESSORIES

PUBLIC ENTERTAINMENT

OTHER ENTER., RELIGIOUS, RECR.,

CULT. SERVICES

SERV. OF BARBERS, BEAUTY

SHOPS, ETC

TOILET ARTICLES AND

PREPARATIONS

PERSONAL EFFECTS

STATIONARY, N.E.C.

HOTELS AND LODGING PLACES

FINANCIAL SERVICES

SERVICES N.E.C.

NET EXP. OF RESIDENT HH

ABROAD

NON-CONSUMER

GOODS

GEN. PUB. SERV.: COMP. OF

EMPLOYEES

GEN. PUB. SERV.: NET PUR. OF

GOODS & SERV.

HEALTH: COMP. OF EMPLOYEES

HEALTH: NET PUR. OF GOODS &

SERV.

EDUCATION: COMP. OF

EMPLOYEES

EDUCATION: NET PUR. OF GOODS

& SERV.

ONE/TWO DWELLING BUILDINGS

MULTI DWELLING BUILDINGS
OWN ACCOUNT CONSTRUCTION
INDUSTRIAL BUILDINGS
COMMERCIAL BUILDINGS
EDUCATIONAL BUILDINGS
HEALTH BUILDINGS
AGRICULTURAL BUILDINGS
OTHER BUILDINGS
ROADS, STREETS, MOTORWAYS
TRANSP., UTILITY LINES, OTHER
CONST.
LAND IMPROVEMENT,
PLANTATION
RAILWAY VEHICLES
PASSENGER MOTOR CARS
OTHER MOTOR VEHICLES
AIRCRAFT
SHIPS AND BOATS

OTHER TRANSPORT EQUIPMENT
ENGINES AND TURBINES
AG. MACHINERY AND EQUIPMENT
OFFICE MACHINES AND
EQUIPMENT
METAL AND WOODWORKING
MACHINERY
CONST. AND HEAVY
EARTHMOVING EQUIP.
MINING AND OILFIELD EQUIP.
FOOD MACHINERY
TEXTILE/LEATHERWORKING
MACHINERY
PAPER IND./PRINTING-TRADE
MACHINERY
OTHER SPECIALIZED IND.
MACHINERY
GENERAL IND. MACHINERY

SERVICE IND. MACHINERY AND
EQUIP.
ELECT. GEN., TRANS., DIST., AND
IND. APPARATUS
RADIOS, TVS, AND OTHER COMM.
EQUIP. APPARATUS
INSTR. AND OTHER ELECT.
APPARATUS N.E.C.
FURNITURE AND FIXTURES
OTHER PRODUCER DURABLE
GOODS
BREEDING STOCK AND DAIRY
CATTLE
CHANGES IN STOCKS
NET EXPORTS OF GOODS AND
SERVICES

TABLE A.6: COMMODITIES IN PHASE IV (1980) ICP - ALL COUNTRIES

ELECTRICITY

ELECTRICITY

OTHER ENERGY

TOWN,NATURAL GAS
LIQUEFIED GAS
LIQUID FUELS
OTHER FUELS
MOTOR FUELS
OIL, GREASE

GRAINS & STARCHES

RICE
FLOUR, OTHER CEREALS
BREAD
BISCUITS, CAKES, ETC.
NOODLE, MACARONI, ETC.
OTHER CEREAL PRODUCTS
POTATOES
TUBERS, PROC. POTATOES

MEAT & ANIMAL

PRODUCTS

BEEF & VEAL
PORK
LAMB GOAT MUTTON
POULTRY
DELICATESSEN
MEAT PREPARATION
OTHER MEATS
FISH: FRESH/FROZEN
FISH: DRIED/SMOKED
OTHER SEAFOODS
FISH: PROCESSED, TINNED
MILK: FRESH
MILK: PRESERVED
OTHER MILK PRODUCTS
CHEESE
EGGS
BUTTER

OTHER FOODS

MARGARINE
EDIBLE OILS
OTHER FATS
FRESH FRUITS
DRIED FRUITS, NUTS
FRUITS FROZEN, JUICE
FRESH VEGETABLES
DRIED VEGETABLES
FROZEN PRESERVED
VEGETABLES
SUGAR
COFFEE
TEA
COCOA
JAM, SYRUP, HONEY
CHOCOLATE
CONFECTIONARY
ICE CREAM
CONDIMENTS, SPICES
MINERAL WATER, SOFT DRINKS
OTHER ALCOHOLIC BEVERAGES

WINE

BEER
CIGARETTES
CIGARS, CIGARILLOS
OTHER TOBACCO

CLOTHING & HOUSEHOLD

MEN'S GARMENTS
WOMEN'S GARMENTS
CHILDREN'S CLOTHING
CLOTHING ACCESSORIES
REPAIRS TO CLOTHING
FOOTWEAR: MENS
FOOTWEAR: WOMENS
FOOTWEAR: CHILDREN, INFANTS
REPAIRS TO FOOTWEAR
RENTS OF APARTMENTS
RENTS OF HOUSES
REPAIRS, MAINTENANCE OF
HOUSEHOLD
FURNITURE, FIXTURES
FLOOR COVERINGS
HOUSEHOLD TEXTILES, ETC.
REFRIGERATORS, FREEZERS
COOKING WASHING HEATING
SEWING, KNITTING MACHINES
OTHER H'HOLD APPLIANCES
GLASSWARE, TABLEWARE
CUTLERY
KITCHEN, UTENSILS WITHOUT
MOTORS
CLEANING MAINTENANCE
PRODUCTS
LAUNDRY, DRY CLEANING
DOMESTIC SERVICES & OTHER

HEALTH

PHARMACEUTICAL PRODUCTS
OTHER MEDICAL PRODUCTS
OTHER THERAPEUTIC GOODS
SERVICES OF GENERAL
PRACTITIONERS
SERVICES OF DENTISTS
SERVICES OF OTHER OUTSIDE
MEDICAL ANALYSIS
MEDICAL PERSONNEL
OTHER THAN MEDICAL
PERSONNEL
CURRENT CONSUMPTION OF
GOVT.

EDUCATION

BOOKS, BROCHURES
MAGAZINES, NEWSPAPER,
PERIODICALS
EDUCATION FEES
COMPENSATION FOR EDUCATION
COMMODITIES FOR EDUCATION

OTHER CONSUMER

GOODS
MOTOR CARS

OTHER PERS. TRANSPORT
TIRES, TUBES, ACCESSORIES
REPAIR CHARGES
PARKING, TOLLS, ETC
LOCAL TRANSPORT
RAIL, BUS TRANSPORT
AIR, SEA, OTHER
POSTAL COMMUNICATION
TELEPHONE, TELEGRAPH
RADIO SETS
TV SETS
RECORD, CASSETTE RECODERS
CAMERA, PHONOGRAPH EQ.
MAJOR DURA. RECR. EQ.
SPORTS GOODS, ACCESSORIES
CINEMA, THEATRE, CONCERTS
OTHER (INC. STADIUM, ZOOS)
OTHER RECR. SERVICES
BARBER, BEAUTY SHOPS
TOILET ARTICLES SEMI-DURABLES
NON-DURABLE TOILET ARTICLES
JEWELRY, WATCH (INC. REPAIRS)
OTHER PERSONAL GOODS
WRITING, DRAWING SUPPLIES
RESTAURANT, CATERING
SERVICES
HOTELS, LODGING
FINANCE, OTHER SERVICES

**NON-CONSUMER
GOODS**

PRODUCTS OF PROCESSING
TOOL, FINISHED METAL
AGRICULTURAL MACHINERY
MACHINE TOOLS FOR METAL
MINING EQUIPMENT E.T.C.
MACHINERY FOR VARI.SPEC.
OTHER MACHINERY EQUIPMENT
OFFICE, DATA PROCESSING
PRECISION, OPTICAL
INSTRUMENTS
ELECTRICAL EQUIPMENT (INC
ELECTRICAL EQUIPMENT FOR
MOTOR VEHICLES, ENGINES
OTHER TRANSPORT EQUIPM
FAMILY DWELLINGS
MULTI.FAMILY DWELLINGS
AGRICULTURAL BUILDINGS
INDUSTRIAL BUILDINGS
BUILDINGS FOR MARKET
SERVICES
BUILDINGS FOR NON-MARKET
SERVICES
TRANSPORT ROUTES
OTHER TRANSPORT ROUTES
OTHER CIVIL ENGINEERING
CHANGE IN STOCK
NET FOREIGN BALANCE
COMPENSATION OF EMPLOYEES
GOVERNMENT.COMMODITIES

**TABLE A.7: COMPARISON OF JAPANESE CONSUMER EXPENDITURE DATA -
NOMINAL EXPENDITURES IN \$US**

ASIAN DATA		OECD DATA	
RICE	114.06	RICE	115.44
FLOUR, OTHER CEREALS	3.30	FLOUR AND OTHER CEREALS	3.35
BREAD	31.97	BREAD	32.36
OTHER BAKERY PRODUCT	50.57	OTHER BAKERY PRODUCTS	51.17
CEREAL PREPARATIONS	0.47	MACARONI, SPAGHETTI, RAVIOLI, ETC.	35.88
OTHER CEREAL PRODUCT	35.64	OTHER CEREAL PRODUCTS	0.70
FRESH BEEF & VEAL	44.50	FRESH AND FROZEN BEEF	22.54
		FRESH AND FROZEN VEAL	22.54
FRESH LAMB & MUTTON	0.00	FRESH ETC. MUTTON, LAMB, GOAT	1.58
FRESH PORK	45.34	FRESH AND FROZEN PORK	45.89
FRESH POULTRY	14.39	FRESH AND FROZEN POULTRY	14.58
OTHER FRESH MEAT	3.12	DELICATESSEN	29.33
DRIED/PROCESSED MEAT	39.37	MEAT PREPARATIONS, EXTRACTS, ETC.	10.53
		OFFAL AND OTHER MEAT NEC	1.58
FRESH/FROZEN FISH	78.46	FRESH OR FROZEN FISH	79.41
SEAFOOD	56.09	DRIED OR SMOKED FISH	68.60
SMOKED/PRESERVED F&S	102.19	FRESH OR FROZEN SEAFOOD	60.99
CANNED FISH, SEAFOOD	5.29	PROCESSED FISH AND SEAFOOD	35.99
FRESH MILK	32.88	PASTEURISED AND STERILISED MILK	33.28
PRESERVED MILK	7.45	CONDENSED AND POWDERED MILK	7.54
CHEESE	3.90	PROCESSED AND UNPROCESSED CHEESE	3.94
OTHER MILK PRODUCTS	12.24	CREAM, YOGHURT AND LIKE PRODUCTS	12.40
EGGS	14.18	EGGS AND EGG-BASED PRODUCTS	14.37
BUTTER	2.86	BUTTER AND SALTED BUTTER	2.89
MARGARINE, OTHER FAT	10.85	MARGARINE AND "DIET" MARGARINE	0.53
		EDIBLE OILS	8.03
		OTHER ANIMAL AND VEGETABLE FATS	2.39
FRESH FRUITS, TROPIC	22.93	FRESH FRUIT	61.63
OTHER FRESH FRUITS	37.96		
DRIED/FROZEN/PRE FRU	9.48	DRIED FRUITS AND NUTS	2.47
		FROZEN/PRESERVED FRUITS/JUICES	7.15
FRESH VEGETABLES	83.26	FRESH VEGETABLES	84.27
DRIED/FROZEN/PRE VEG	34.62	DRIED VEGETABLES	3.66
		FROZEN VEGETABLES	1.90
		PRESERVED VEGETABLES, SOUPS, ETC.	29.51
POTATOES(ENGLISH)	4.18	FRESH POTATOES & OTHER TUBERS	4.23
MANIOC & OTHER TUBER	6.38	POTATO PRODUCTS	6.44
SUGAR	6.14	RAW AND REFINED SUGAR	6.23

COFFEE	12.06	COFFEE AND INSTANT COFFEE	12.22
TEA	19.73	TEA AND OTHER INFUSIONS	19.97
COCOA	0.24	COCOA & NOT COCOA PREPARATIONS	6.27
JAM, PRESERVES	4.75	JAMS,JELLIES,HONEY & SYRUPS	4.79
SUGAR PROD., CHOCO.	73.35	CHOCOLATE & COCOA PREPARATIONS	13.45
		CONFECTIONERY	50.08
		EDIBLE ICE AND ICE CREAM	10.71
SALT, SPICE & SAUCES	117.05	SALT,SPICES,SAUCES AND FOOD NEC	112.48
MINERAL WATER	0.00	MINERAL WATER	2.47
SOFT DRINKS	49.03	OTHER SOFT DRINKS NEC	47.15
SPIRITS	47.15	SPIRITS AND LIQUERS	47.72
WINE & CIDER	36.09	WINE NOT FORTIFIED OR SPARKLING	3.91
		OTHER WINES & ALCOHOLIC DRINKS	32.61
BEER	45.94	BEER	46.48
CIGARETTES	100.12	CIGARETTES	91.24
OTHER TOBACCO PROD.	0.04	OTHER TOBACCO PRODUCTS	10.14
CLOTHING MATERIALS	11.41	CLOTH,YARNS,THREADS,ACCESSORIES	32.12
CLOTHING ACCESSORIES	20.42		
MEN'S CLOTHING	105.90	MEN'S CLOTHING	133.22
WOMEN'S CLOTHING	181.53	LADIES'CLOTHING	133.19
CHILDREN'S CLOTHING	42.63	CHILDREN'S CLOTHING	33.31
		INFANT'S CLOTHING	33.31
CLOTHING RENT,REPAIR	1.27	REPAIRS TO CLOTHING	1.30
MEN'S FOOTWEAR	12.38	MEN'S FOOTWEAR	12.47
WOMEN'S FOOTWEAR	17.45	LADIES' FOOTWEAR	16.62
CHILDREN'S FOOTWEAR	11.39	CHILDREN'S & INFANT'S FOOTWEAR	12.47
REPAIRS TO FOOTWEAR	0.49	REPAIRS TO FOOTWEAR	0.49
GROSS RENTS	915.99	RENTS OF TENANTS	268.94
		IMPUTED RENTS OF OWNER- OCCUPIERS	691.11
INDOOR REPAIR, MATER	11.82	REPAIR & MAINTENANCE OF HOUSING	3.84
INDOOR REPAIR, LABOR	38.65	MOTORLESS DOMESTIC UTENSILS	13.84
		MOTORLESS GARDEN APPLIANCES	0.07
		BULBS,WIRES,POINTS,BATTERIES,ETC	21.62
SANITARY & WATER	35.15	WATER CHARGES	35.57
ELECTRICITY	103.89	ELECTRICITY	105.15
GAS(INCL. LIQUEFIED)	69.32	TOWN GAS AND NATURAL GAS	31.34
		LIQUEFIED GAS	38.81
LIQUID FUELS	30.48	HEATING AND LIGHTING OILS	30.85
OTHER FUELS	1.07	COAL,COKE AND OTHER SOLID FUELS	1.09
FURNITURE & FIXTURES	24.73	FURNITURE AND FIXTURES	25.39
FLOOR COVERINGS	6.56	CARPETS & OTHER FLOOR COVERINGS	6.76

REPAIRS TO FURNITURE	0.58	REPAIR OF FURNITURE,CARPETS,ETC.	0.60
HSEHOLD TEXTILES,ETC	49.31	TEXTILES AND TEXTILE FURNISHINGS	50.57
		REPAIR HOUSEHOLD TEXTILES,ETC.	0.00
REFRIGERATOR,FREEZER	10.51	REFRIGERATORS AND FREEZERS	10.78
WASHING, CLEANING AP	7.47	CLOTHES & DISH WASHERS,DRIERS	3.84
		VACUUM CLEANERS,POLISHERS,ETC.	3.77
COOKING APPL., ETC.	17.01	COOKERS,HOBBS AND OVENS	16.69
AIR-CONDITIONER, ETC	35.03	HEATERS AND AIR-CONDITIONERS	35.92
OTHER H'SEHOLD APPL.	24.23	OTHER HOUSEHOLD APPLIANCES	25.60
REPAIR TO H'LD APPL.	1.10	REPAIR OF HOUSEHOLD APPLIANCES	1.09
GLASSWARE, UTENSILS	46.02	GLASSWARE AND TABLEWARE	10.11
		CUTLERY	1.06
		REPAIR GLASS/TABLEWARE,UTENSILS	0.46
HOUSE CLEANING SUPPL	14.93	CLEANING & MAINTENANCE	15.32
		PRODUCTS	
OTHER NON-DURABLES	52.36	OTHER NONDURABLE HOUSEHOLD	63.28
		ITEMS	
PAPER PROD. FOR H'LD	9.28		
DOMESTIC SERVICES	4.63	DOMESTIC SERVICES	4.75
HOUSEHOLD SERVICES	44.33	LAUNDRY AND DRY CLEANING	42.26
		OTHER HOUSEHOLD SERVICES	3.20
DRUG, MEDICAL PREPAR	33.55	PHARMACEUTICAL PRODUCTS	33.98
MEDICAL SUPPLIES	2.01	OTHER MEDICAL SUPPLIES	2.04
THERAPEUTIC APPLIANC	6.68	EYEGLASSES	4.75
		THERAPEUTIC APPLIANCES NEC	1.97
SVC OF PHYSICIAN G	8.38	GENERAL PRACTITIONERS	132.20
SVC OF PHYSICIAN P	145.69	OTHER PRACTITIONERS	38.07
SVC OF DENTIST G	2.76	DENTISTS	91.49
SVC OF DENTIST P	104.95		
OTHER MEDICAL SVC.	191.98	SPECIALISTS	132.20
		MEDICAL AND HEALTH CARE	44.06
		SERVICES	
		MEDICAL ANALYSES	5.67
HOSPITAL SERVICES G	13.14	HOSPITAL MEDICAL STAFF	76.66
HOSPITAL SERVICES P	189.12	HOSPITAL NON-MEDICAL STAFF	25.57
		HOSPITAL INTERMEDIATE	75.08
		CONSUMPTN	
		HOSPITAL CAPITAL CONSUMPTION	2.32
		NURSES	38.07
PASSENGER CARS	86.94	PASSENGER CARS	88.00
OTHER TRANS. EQUIP.	11.23	OTHER TRANSPORT EQUIPMENT	11.37
TYRES, TUBES, PARTS	5.97	TYRES,TUBES,PARTS & ACCESSORIES	6.02
REPAIR TO TRANS. EQU	56.51	REPAIR AND MAINTENANCE SERVICES	57.19
FUEL & LUBRICANTS	105.27	MOTOR FUELS, OILS AND GREASES	106.56

OTHER FOR TRANS. EQU	35.36	OTHER PERSONAL TRANSPORT EXPENSE	35.78
LOCAL TAXIS	55.44	LOCAL PUBLIC TRANSPORT AND TAXIS	134.74
LOCAL BUSES, TRAM	29.32		
OTHER LOCAL TRANSPOR	50.55		
RAILWAY TRANSPORT	47.86	RAIL AND ROAD TRANSPORT SERVICES	62.40
ROAD TRANS(LONG DIS)	17.00		
AIR TRANSPORT	34.64	AIR,SEA,OTHER TRANSPORT SERVICES	34.44
OTHER LONG DIST TRAN	0.10		
		PURCHASED TRANSPORT SERVICES NEC	6.20
POSTAL SERVICES	9.80	POSTAGE FOR PARCELS,LETTERS,ETC.	9.93
TELEPHONE CHARGES	50.92	TELEPHONE AND TELEGRAPH SERVICES	51.84
TELEGRAPH CHARGES	0.28		
RADIO, TV SETS, ETC.	83.27	RADIO SETS	23.59
		TELEVISIONS, VIDEO RECORDERS,ETC.	40.67
		RECORD-PLAYERS,TAPE RECORDERS...	20.00
PHOTO, CINEMA EQUIP.	16.61	CAMERAS & PHOTOGRAPHIC EQUIPMENT	16.09
OTHER RECR. DURABLES	10.88	OTHER DURABLE RECREATIONAL GOODS	11.73
SEMI-,NON-D'BLE, REC	65.54	RECORDS,TAPES,CASSETTES,ETC.	6.23
		SPORTS GOODS & CAMPING EQUIPMENT	13.98
		GAMES,TOYS AND HOBBIES	21.45
		FILMS AND PHOTOGRAPHIC SUPPLIES	5.85
		FLOWERS,PLANTS,PETS AND PET FOOD	18.88
REPAIRS TO EQUIPMENT	4.04	PARTS & REPAIRS RECREATION GOODS	4.09
CINEMA,THEATRE,SPORT	44.94	CINEMAS,STADIUMS,ZOOS,ETC.	45.22
OTHER ENTMENT SVC.	243.83	SPORTING & RECREATIONAL ACTIVITY	146.89
		RADIO/TELEVISION LICENCE/RENTAL	12.04
		FILM DEVELOPING & OTHER SERVICES	53.70
BOOKS, MAGAZINE, ETC	61.98	BOOKS,BROCHURES AND THE LIKE	16.38
		MAGAZINES,NEWSPAPERS,ETC.	46.38
PRIMARY EDUC	191.20	EDUCATIONAL FEES	508.29
SECONDARY EDUC G	188.72		
SECONDARY EDUC P	36.17		
TERTIARY EDUC G	33.70		
TERTIARY EDUC P	81.86		
SVC. OF BARBER, ETC.	82.31	SERVICES OF HAIRDRESSERS,ETC.	83.00
TOILET ARTICLE, PREP	56.66	DURABLE TOILET ARTICLES & REPAIR	4.30
		NON-DURABLE TOILET ARTICLES	52.86
PERSONAL EFFECTS	63.09	JEWELLERY,WATCHES AND REPAIR	34.30
		TRAVEL GOODS AND BAGGAGE ITEMS	17.75
		OTHER PERSONAL GOODS AND EFFECTS	11.59
STATIONERY	9.64	WRITING EQUIPMENT AND SUPPLIES	9.72

RESTAURANTS & CAFES	377.34	RESTAURANTS AND TAKE-AWAYS	223.52
WORKERS' CAFES	0.00	PUBS,BARS,TEA-ROOMS,CAFES	78.95
		CANTEENS AT PLACE OF WORK	78.81
HOTELS & LODGING	111.21	HOTELS & OTHER LODGING SERVICES	111.42
FINANCIAL SERVICES	162.91	FINANCIAL SERVICES CHARGES NEC	164.32
SERVICES N.E.C..	226.60	FEEES FOR SERVICES NEC	285.80
WELFARE SERVICES	91.67		
RES. PURCHASE ABROAD	41.62	NET PURCHASES ABROAD	31.21
NON-RESIDENT PURCHAS	-10.32		
TOTAL	6949.8	TOTAL	6916.8

TABLE A.8: COMPARISON OF CALCULATED AND PWT REAL PRICE INDICES FOR PHASE V (1985)

	PO PWT	PO Calc.	%Diff. (Calc-PWT)/Calc.
OECD			
BEL	0.843548	0.810107	-4.13%
DNK	1.055202	0.992841	-6.28%
FRA	0.886534	0.855676	-3.61%
GER	0.916214	0.894722	-2.40%
GRC	0.624729	0.603255	-3.56%
IRE	0.816630	0.855528	4.55%
ITA	0.742531	0.716919	-3.57%
LUX	0.775794	0.795424	2.47%
NLD	0.810182	0.786855	-2.96%
PRT	0.567107	0.530915	-6.82%
SPA	0.695656	0.598032	-16.32%
UK	0.791658	0.763894	-3.63%
AUT	0.897280	0.889104	-0.92%
FIN	1.117634	1.081905	-3.30%
NOR	1.163691	1.120706	-3.84%
SWE	1.036780	0.992816	-4.43%
TUR	0.385850	0.391433	1.43%
AUS	0.891753	0.899960	0.91%
NZL	0.695656	0.718265	3.15%
JAP	1.058273	0.961222	-10.10%
CAN	0.945383	0.935101	-1.10%
USA	1.023475	1.023475	0.00%
ASIA			
HNK	0.613982	0.622001	1.29%
KOR	0.612447	0.581813	-5.27%
THL	0.330275	0.343743	3.92%
IND	0.445928	0.453976	1.77%
IRA	0.870874	0.910330	4.33%
SRL	0.311546	0.307439	-1.34%
PAK	0.297012	0.380836	22.01%
PHI	0.404170	0.405910	0.43%
BAN	0.284219	0.237758	-19.54%
JP2	1.058273	0.961960	-10.01%
AFRICA			
BOT	0.352996	0.728275	51.53%
EGY	0.478781	0.877552	45.44%
ETH	0.410516	1.038862	60.48%
KEN	0.358318	0.711819	49.66%
MAW	0.284833	0.617773	53.89%
MAU	0.282581	0.514917	45.12%
NIG	0.936377	1.897430	50.65%
SIE	0.572634	1.167451	50.95%
SWA	0.339589	0.620767	45.30%
TAN	0.991337	1.885973	47.44%
ZAM	0.564753	0.828659	31.85%
ZIM	0.432213	0.790888	45.35%
BEN	0.306326	0.554849	44.79%
CAM	0.467216	0.862938	45.86%
CON	0.572634	1.048143	45.37%
IVO	0.416554	0.874398	52.36%
MAD	0.370600	0.780911	52.54%
MAL	0.398234	0.772083	48.42%
MAR	0.321780	0.547276	41.20%
RWA	0.476734	0.913328	47.80%
SEN	0.411130	0.757830	45.75%
TUN	0.352792	0.756855	53.39%

TABLE A.9: COMPARISON OF ADJUSTED AND PWT REAL PRICE INDICES AFRICAN 1985 DATA

	PO PWT	PO Adj.	%Diff (Adj.-PWT)/Adj.
BOT	0.352996	0.369817	4.55%
EGY	0.478781	0.495146	3.30%
ETH	0.410516	0.493091	16.75%
KEN	0.358318	0.367981	2.63%
MAW	0.284833	0.326809	12.84%
MAU	0.282581	0.275286	-2.65%
NIG	0.936377	0.985634	5.00%
SIE	0.572634	0.582209	1.64%
SWA	0.339589	0.321247	-5.71%
TAN	0.991337	0.903452	-9.73%
ZAM	0.564753	0.450492	-25.36%
ZIM	0.432213	0.428572	-0.85%
BEN	0.306326	0.285133	-7.43%
CAM	0.467216	0.464898	-0.50%
CON	0.572634	0.519808	-10.16%
IVO	0.416554	0.465465	10.51%
MAD	0.370600	0.377398	1.80%
MAL	0.398234	0.376852	-5.67%
MAR	0.321780	0.289776	-11.04%
RWA	0.476734	0.470165	-1.40%
SEN	0.411130	0.398127	-3.27%
TUN	0.352792	0.415607	15.11%

OTHER AGRICULTURAL ECONOMICS WORKING PAPERS

No. 93-01	Empirical Analysis of Agricultural Commodity Prices: A Viewpoint	William G. Tomek Robert J. Myers
No. 93-02	Imperfect Competition Model and Deregulation: U.S. Dairy Policy	Nobuhiro Suzuki Harry M. Kaiser John E. Lenz Olan D. Forker
No. 93-03	A Convolutions Approach to Measuring the Differences in Simulated Distributions: Application to Dichotomous Choice Contingent Valuation	Gregory L. Poe Eric K. Lossin Michael P. Welsh
No. 93-04	Overshooting Agricultural Prices: Evidence from Brazil	Heloisa Burnquist Steven Kyle
No. 93-05	Dynamic Aggregate Milk Supply Response with Biological Constraints on Dairy Herd Size	Chinhwa Sun Olan D. Forker Harry M. Kaiser
No. 93-06	Measurement of Generic Milk Promotion Effectiveness using an Imperfect Competition Model	Nobuhiro Suzuki John E. Lenz Harry M. Kaiser Kohei Kobayashi Olan D. Forker
No. 93-07	A Spatial Model of Forest Conversion Using a Geographic Information System Part I: Conceptual Outline	Steven W. Stone
No. 93-08	Exchange Rate Reform and Its Effects on Ecuador's Traditional Agricultural Export Sector	Xavier Bejarano David R. Lee Duty Greene
No. 93-09	Processed Sweet Potato: Responding to Kenya's Urban Food Needs	Njeri Gakonyo
