EMPIRICAL REGULARITIES IN OECD CONSUMPTION

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Abstract

This paper uses time-series data for 10 commodities in 18 OECD countries to establish the following empirical regularities: (i) Consumers tend to move away from those goods having above-average price increases. (ii) The variability of prices is less than the variability of quantities. (iii) Food and housing are necessities; durables are a luxury. (iv) Price elasticities tend to be less than one in absolute value. (v) Those commodities which are more price elastic also tend to be more luxurious and vice versa.

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TABLE OF CONTENTS

1.	Introduction	1
2.	The Database	2
3.	Budget Shares and Price and Quantity Log-changes	3
4.	Divisia Moments	10
5.	Relative Prices and Consumption	15
6.	Double-Log Demand Equations	26
7.	A Bird's Eye View of the Elasticities	30
8.	Is there a Relationship Between Price and Income Elasticities?	34
9.	The Relationship Between the Autonomous Trends and Income and Price Elasticities	37
10.	A Nonparametric Picture of Prices and Quantities	40
11.	More on the Nonparametric Picture	48
APPENDICES		54
A1.	Summary Statistics for the Demand Equations	54
A2.	Estimates of the Demand Equations with the Autonomous Trends Suppressed	54
REFERENCES		61

LIST OF TABLES

2.1	Characteristics of the Database	4
3.1	Budget Shares of 10 Commodities for 18 Countries	6
3.2	Prices of 10 Commodities and Divisia Price Index for 18 Countries	8
3.3	Per capita Quantities Consumed of 10 Commodities and Divisia Volume Index for 18 Countries	9
4.1	Divisia Price Indexes in 18 Countries	11
4.2	Divisia Volume Indexes in 18 Countries	12
4.3	Divisia Price Variances in 18 Countries	13
4.4	Divisia Quantity Variances in 18 Countries	14
4.5	Divisia Price-Quantity Correlations in 18 Countries	16
5.1	Kolmogorov-Smirnov Test Statistics for Normality of Relative Price and Quantity Log-changes for 10 Commodities in 18 Countries	24
5.2	Frequency Distributions of Relative Price and Quantity Log- changes for 10 Commodities in 18 Countries	25
6.1	Estimates of the Autonomous Trends for 10 Commodities in 18 Countries	27
6.2	Estimates of the Income Elasticities for 10 Commodities in 18 Countries	28
6.3	Estimates of the Price Elasticities for 10 Commodities in 18 Countries	29
7.1	Frequency Distributions of Autonomous Trends and Income and Price Elasticities for 10 Commodities in 18 Countries	31
7.2	Frequency Distributions of $ t $ -values of Autonomous Trends and Income and Price Elasticities for 10 Commodities in 18 Countries	33
8.1	Cross-Commodity Regression Results for Price and Income Elasticities	36
9.1	Divisia Trend-Elasticity Correlations in 18 Countries	39
10.1	Frequencies of Joint Signs of Relative Consumption and Relative Prices of 10 Goods in 18 Countries	43
10.2	Frequency Distributions of Joint Signs of Relative Consumption and Relative Prices for 10 Goods in 18 Countries	45

10.3	Frequency Distributions of 10 Goods in 18 Countries By Joint Signs of Relative Consumption and Relative Prices	47
10.4	Summary of Frequencies of Joint Signs of Relative Consumption and Relative Prices of 10 Goods in 18 Countries	49
10.5	Summary of Frequency Distributions of Joint Signs of Relative Consumption and Relative Prices of 10 Goods in 18 Countries .	50
11.1	Frequencies of Joint Signs of Relative Consumption and Relative Prices of 10 Goods in 18 Countries: Non-Unitary Income Elasticities	52
11.2	Frequency Distributions of Joint Signs of Relative Consumption and Relative Prices of 10 Goods in 18 Countries: Non-Unitary Income Elasticities	53
A1.1	Summary Statistics for the Demand Equations with Autonomous Trends for 10 Commodities in 18 Countries	55
A2.1	Estimates of Income Elasticities for 10 Commodities in 18 Countries: Autonomous Trends Suppressed	56
A2.2	Estimates of Price Elasticities for 10 Commodities in 18 Countries: Autonomous Trends Suppressed	57
A2.3	Summary Statistics for the Demand Equations for 10 Commodities in 18 Countries: Autonomous Trends Suppressed	58
A2.4	Frequency Distributions of Income and Price Elasticities for 10 Commodities in 18 Countries: Autonomous Trends Suppressed .	59
A2.5	Frequency Distributions of $ t $ -values of Income and Price Elasticities for 10 Commodities in 18 Countries: Autonomous Trends Suppressed	60

LIST OF FIGURES

5.1	Relative Price of 10 Commodities in 18 Countries	17
5.2	Relative Consumption of 10 Commodities in 18 Countries	17
5.3	Relative Price of Food in 18 Countries	19
5.4	Relative Consumption of Food in 18 Countries	19
5.5	Relative Price of Beverages in 18 Countries	19
5.6	Relative Consumption of Beverages in 18 Countries	19
5.7	Relative Price of Clothing in 18 Countries	20
5.8	Relative Consumption of Clothing in 18 Countries	20
5.9	Relative Price of Housing in 18 Countries	20
5.10	Relative Consumption of Housing in 18 Countries	20
5.11	Relative Price of Durables in 18 Countries	21
5.12	Relative Consumption of Durables in 18 Countries	21
5.13	Relative Price of Medical Care in 18 Countries	21
5.14	Relative Consumption of Medical Care in 18 Countries	21
5.15	Relative Price of Transport in 18 Countries	22
5.16	Relative Consumption of Transport in 18 Countries	22
5.17	Relative Price of Recreation in 18 Countries	22
5.18	Relative Consumption of Recreation in 18 Countries	22
5.19	Relative Price of Education in 18 Countries	23
5.20	Relative Consumption of Education in 18 Countries	23
5.21	Relative Price of Miscellaneous Goods in 18 Countries	23
5.22	Relative Consumption of Miscellaneous Goods in 18 Countries ..	23
8.1	Price Elasticities Against Income Elasticities for 10 Commodities	35

1. INTRODUCTION

The textbook exposition of the theory of consumer demand typically emphasises two major results. First, that the demand curve slopes down so that a rise in the relative price of a good causes its consumption to fall, other factors remaining unchanged. Second, when discussing income elasticities and the luxury/necessity distinction, almost invariably food is mentioned as the leading example of a necessity. At the risk of oversimplification, these are the only two aspects highlighted.

One of the primary objectives of this paper is to present evidence on these two 'stylized facts'. We do this by estimating demand equations for 10 broad commodity groups, not just for a single country but for 18 countries individually and combined. Such a large body of data should provide convincing evidence (one way or the other) about the validity of the two stylized facts of textbook consumption economics. In addition, we present summary measures of the data in each country in the form of Divisia index numbers.

In this paper we also present new evidence regarding the interrelationship between income and price elasticities. In particular, we find that, on average, luxuries tend to be more price elastic than necessities. In addition, we introduce new nonparametric methods for describing the dependence of quantities on prices.

Our overall findings from the 18 countries can be summarized in the form of the following five empirical regularities:

- (i) Consumers tend to move away from those goods having above-average price increases. In other words, demand curves do indeed slope down.
- (ii) The variability of prices is less than the variability of quantities.

- (iii) Food and housing are necessities; durables are a luxury.
- (iv) Price elasticities tend to be less than one in absolute value.
- (v) Those commodities which are more price elastic also tend to be more luxurious and vice versa.

The use of cross-country data to study regularities in consumption patterns has a fairly extensive history. More recent contributions include Gamaletsos (1973), Goldberger and Gamaletsos (1970), Lluch and Powell (1975), Lluch et al. (1977), Lluch and Williams (1975), Theil (1987) and Theil and Suhm (1981).

The structure of this paper is as follows. In Section 2 we describe the database pertaining to 10 commodities in 18 OECD countries. Sections 3-5 present summary measures of the data in the form of budget shares, price and quantity log-changes, Divisia moments and a graphical representation of the relative price and quantity log-changes. In Sections 6 and 7 we estimate double-log demand equations for each country and for all countries combined; and provide an analysis of the elasticity estimates. Sections 8 and 9 explore the interrelationships between the elasticities. Finally, in Sections 10 and 11 we present a nonparametric picture of the pattern of prices and quantities. This methodology allows the dependence of quantities on prices to be analysed from a new perspective.

2. THE DATABASE

The basic data, consisting of annual consumption expenditures (in current and constant prices) and mid-year population for 18 OECD countries, are from Stening (1985). There are 25 OECD countries of

which we omit 7 due to the unavailability of data. For most countries, goods and services are classified into 10 commodity groups, namely food, beverages, clothing, housing, durables, medical care, transport, recreation, education and miscellaneous.

Table 2.1 summarizes the general characteristics of the database. Column 2 presents the sample period for each country and column 3 gives the sample size (less 1 lag). In column 4 we present per capita gross domestic product (GDP) expressed in 1975 international dollars (from Data Table, Summers and Heston, 1984). Column 5 gives per capita GDP in index form with U.S.= 100. The 18 countries are listed in the order of declining per capita GDP. As can be seen, the U.S. has the highest GDP per capita while Italy has the lowest, it being 54 percent of the U.S. value. Column 6 gives the number of commodity groups considered in each country. All except three of the countries have 10 commodity groups. Germany and Japan have 8, as beverages are included in food and education is included in recreation. Switzerland has 9 groups as education is included in recreation.

3. BUDGET SHARES AND PRICE AND QUANTITY LOG-CHANGES

Let p_{it} be the price and q_{it} the per capita quantity consumed of good i during year t ($t=1, \dots, T$, the sample size). Let there be n goods. Total expenditure is then $M_t = \sum_{i=1}^n p_{it} q_{it}$ and the proportion of total expenditure devoted to commodity i is $w_{it} = p_{it} q_{it} / M_t$. This w_{it} is called the budget share of good i .

TABLE 2.1
CHARACTERISTICS OF THE DATABASE

Country	Sample period	Sample size	Per capita GDP in 1975		Number of commodity groups
			International dollars	(4) with U.S.=100	
(1)	(2)	(3)	(4)	(5)	(6)
1. U.S.	1960-1981	21	7132	100	10
2. Canada	1960-1981	21	6788	95	10
3. Sweden	1964-1981	17	6749	95	10
4. Switzerland	1960-1981	21	6082	85	9
5. Denmark	1966-1981	15	5969	84	10
6. Australia	1960-1981	21	5919	83	10
7. France	1964-1981	17	5864	82	10
8. Germany	1960-1981	21	5758	81	8
9. Belgium	1960-1981	21	5554	78	10
10. Norway	1964-1981	17	5419	76	10
11. Netherlands	1952-1977	25	5321	75	10
12. Iceland	1960-1973	13	5201	73	10
13. Finland	1960-1977	17	5192	73	10
14. Austria	1964-1981	17	4994	70	10
15. Japan	1970-1981	11	4905	69	8
16. U.K.	1964-1981	17	4601	65	10
17. Spain	1964-1977	13	4032	57	10
18. Italy	1964-1981	17	3870	54	10

Note: Sample size is after lagging.

Table 3.1 presents the budget shares at sample means.

$$\bar{w}_i = \frac{1}{T} \sum_{t=1}^T w_{it}$$

for each commodity in the 18 countries. For example, looking at the sixth row we see that, on average, Australians spend 19 percent of their total expenditure on food, 9 percent on beverages, 9 percent on clothing, 16 percent on housing and so on. The last row of the table presents the budget share of each commodity averaged over the 18 countries. As can be seen, the average OECD consumer spends 24 percent of his total expenditure on food. Food, housing and transport in total occupy about 50 percent of the total in most countries.

The log-change in the price of i is defined as $Dp_{it} = \log p_{it} - \log p_{i,t-1}$. Similarly, $Dq_{it} = \log q_{it} - \log q_{i,t-1}$ is the quantity log-change. When multiplied by 100, these can be interpreted as percentage changes or percentage growth rates from year $t-1$ to t . The Divisia price index is a budget-share-weighted average of the price log-changes,

$$(3.1) \quad DP_t = \sum_{i=1}^n \bar{w}_{it} Dp_{it},$$

where $\bar{w}_{it} = \frac{1}{2}(w_{it} + w_{i,t-1})$ is the arithmetic average of the budget share of commodity i in years $t-1$ and t . The arithmetic average is the obvious choice for the weight as it is the budget share mid-way between the $t-1$ and t . The index (3.1) measures the overall growth in prices. The analogous Divisia volume index is defined as

$$(3.2) \quad DQ_t = \sum_{i=1}^n \bar{w}_{it} Dq_{it}.$$

TABLE 3.1
BUDGET SHARES OF 10 COMMODITIES FOR 18 COUNTRIES
(Means $\times$ 100)

Country (1)	Food (2)	Beverages (3)	Clothing (4)	Housing (5)	Durables (6)	Medical care (7)	Transport (8)	Recreation (9)	Education (10)	Miscellaneous (11)
1. U.S.	14.38	4.24	8.03	19.29	7.28	9.46	15.93	6.25	1.81	13.33
2. Canada	16.42	6.21	8.41	18.85	8.73	3.84	15.02	5.96	2.33	14.22
3. Sweden	20.72	7.96	8.41	22.79	7.66	2.27	13.65	9.18	.18	7.18
4. Switzerland	22.73	9.42	6.77	18.06	7.80	6.52	10.99	9.36		8.35
5. Denmark	19.18	9.09	6.97	20.92	8.98	1.92	15.04	7.88	.83	9.19
6. Australia	19.48	8.96	9.13	15.77	8.19	6.04	15.13	5.71	.69	10.89
7. France	21.20	4.69	8.22	14.41	10.23	10.50	11.99	6.05	.29	12.42
8. Germany	30.38		10.36	15.79	12.04	2.68	13.06	7.44		8.55
9. Belgium	23.11	6.95	7.53	15.72	14.14	6.74	10.67	3.98	.23	10.93
10. Norway	23.45	7.56	9.97	14.54	8.86	4.20	13.31	7.68	.54	9.89
11. Netherlands	26.20	6.38	14.78	10.81	12.48	6.67	6.67	3.41	3.10	9.50
12. Iceland	23.50	7.86	10.66	19.06	10.00	6.07	12.13	5.24	.44	5.05
13. Finland	28.24	8.62	8.26	14.36	7.51	2.54	13.60	5.92	1.44	9.49
14. Austria	22.06	7.29	11.37	11.99	8.89	3.49	13.36	5.67	.35	15.54
15. Japan	27.45		7.76	16.78	6.76	8.92	8.97	9.05		14.32
16. U.K.	18.92	6.26	8.40	18.20	7.78	.85	13.13	7.88	1.98	16.50
17. Spain	38.53	3.51	10.58	13.99	8.55	4.62	9.50	4.28	2.02	8.87
18. Italy	30.85	5.69	9.41	12.94	6.79	3.73	10.48	7.05	.43	12.62
Mean	23.71	6.92	9.16	16.35	9.04	5.05	12.37	6.56	1.11	10.94

This measures the overall growth in per capita consumption or the growth in real income.

Table 3.2 contains the mean price log-changes,

$$\bar{Dp}_i = \frac{1}{T} \sum_{t=1}^T Dp_{it}$$

of each commodity. The last column of that table presents the mean of the Divisia price index

$$D\bar{P} = \frac{1}{T} \sum_{t=1}^T DP_t$$

for each country. On average, the annual growth rates in all prices lie between 6 and 9 percent and their weighted average is 7 percent.

Columns 2-11 of Table 3.3 present the mean log-changes in per capita consumption,

$$\bar{Dq}_i = \frac{1}{T} \sum_{t=1}^T Dq_{it}$$

of each commodity. Column 12 presents the mean Divisia volume index,

$$D\bar{Q} = \frac{1}{T} \sum_{t=1}^T DQ_t$$

for each country. Looking at column 2 of Table 3.3 we see that per capita food consumption grows by .15 percent per annum in the UK while in Spain its growth rate is almost 20 times larger (2.8 percent per annum). The last row of the table presents the mean quantity

TABLE 3.2

PRICES OF 10 COMMODITIES AND DIVISIA PRICE INDEX FOR 18 COUNTRIES

(Mean Log-changes $\times 100$)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	Divisia price index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. U.S.	5.00	4.85	3.29	4.67	4.25	5.81	4.87	3.56	5.91	5.37	4.78
2. Canada	6.15	4.71	3.87	5.18	4.49	4.96	4.72	3.89	8.43	6.73	5.27
3. Sweden	7.17	7.27	4.82	8.50	7.30	6.14	7.66	6.57	9.13	9.10	7.43
4. Switzerland	4.00	4.06	3.39	5.43	3.86	6.49	4.55	4.10		5.47	4.55
5. Denmark	8.69	6.68	6.57	11.43	8.55	8.91	8.79	7.62	9.54	9.30	8.90
6. Australia	6.05	6.58	6.12	7.43	4.33	8.42	6.31	6.97	8.38	7.53	6.58
7. France	7.30	6.47	6.74	8.80	6.76	6.99	8.13	6.13	9.02	8.28	7.48
8. Germany	3.23		3.67	5.57	3.04	5.58	4.13	3.74		4.61	3.96
9. Belgium	4.56	4.61	3.89	5.76	4.36	6.02	5.28	5.00	4.54	6.88	5.13
10. Norway	6.96	6.99	6.74	7.20	7.02	8.25	7.32	5.36	7.85	7.91	7.05
11. Netherlands	3.71	2.91	3.48	5.08	2.29	7.73	3.38	5.51	5.91	4.80	4.07
12. Iceland	13.74	11.25	9.69	11.66	10.13	14.10	11.25	12.66	12.78	11.48	11.79
13. Finland	7.75	6.87	6.09	5.90	6.25	6.22	7.16	6.32	9.44	8.17	7.02
14. Austria	4.57	2.93	3.67	7.49	3.59	8.94	6.12	4.21	4.20	6.53	5.28
15. Japan	7.61		7.99	7.58	6.71	7.36	8.70	7.35		8.88	7.85
16. U.K.	9.00	8.49	6.88	11.28	8.68	9.36	10.25	8.85	10.73	9.99	9.56
17. Spain	9.79	7.57	11.24	8.58	11.07	11.69	7.89	12.54	12.82	10.87	10.06
18. Italy	9.67	7.07	10.37	10.89	10.37	8.72	10.83	9.25	10.03	11.65	10.13
Mean	6.94	6.21	6.03	7.69	6.28	7.87	7.08	6.64	8.58	7.98	7.05

TABLE 3.3
PER CAPITA QUANTITIES CONSUMED OF 10 COMMODITIES
AND DIVISIA VOLUME INDEX FOR 18 COUNTRIES
(Mean Log-changes $\times$ 100)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	Divisia volume index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. U.S.	.60	1.41	2.33	2.97	1.64	4.49	2.80	4.10	3.33	1.77	2.43
2. Canada	.91	2.57	3.12	3.17	3.02	.22	4.17	6.27	4.20	2.79	2.87
3. Sweden	.50	.80	2.66	2.35	1.18	3.02	2.06	4.53	3.17	-.95	1.71
4. Switzerland	1.72	1.57	.75	2.08	.62	2.85	3.63	2.98		2.79	2.13
5. Denmark	.17	1.43	.59	3.23	-1.01	1.50	1.49	3.34	8.53	.75	1.42
6. Australia	1.35	1.03	.71	3.54	4.45	1.23	3.49	4.33	-2.40	1.95	2.37
7. France	1.62	1.37	1.71	4.89	3.31	6.68	4.65	5.37	2.43	3.20	3.57
8. Germany	2.02		2.36	3.24	3.51	1.45	5.69	3.90		3.77	3.15
9. Belgium	1.53	2.58	2.76	2.80	4.20	5.13	4.52	4.04	1.98	2.98	3.11
10. Norway	1.35	2.08	1.40	3.43	3.21	2.14	4.06	5.56	1.26	2.17	2.68
11. Netherlands	2.22	4.39	3.19	3.93	6.91	5.53	7.52	4.07	5.15	5.20	4.34
12. Iceland	1.64	5.11	5.65	2.54	8.12	7.20	8.58	5.92	4.54	8.56	5.07
13. Finland	1.77	4.89	1.62	3.60	5.41	6.43	6.48	6.18	-1.60	5.58	3.86
14. Austria	1.90	2.34	4.26	4.29	3.61	2.62	5.58	4.35	1.94	1.98	3.27
15. Japan	1.50		1.47	4.93	1.58	6.07	4.10	3.26		3.40	3.13
16. U.K.	.15	1.48	2.52	1.87	1.58	.90	2.81	3.65	2.10	1.70	1.76
17. Spain	2.82	4.01	3.00	3.79	3.44	9.24	10.66	5.31	4.24	5.72	4.40
18. Italy	2.20	3.15	2.81	2.80	3.90	6.82	5.71	3.98	1.61	3.65	3.33
Mean	1.44	2.51	2.39	3.30	3.26	4.08	4.89	4.51	2.70	3.17	3.04

log-changes and Divisia volume indexes averaged over all countries. As can be seen, transport and recreation have the highest average growth rates of 4.9 and 4.5 percent per annum, respectively, while food has the lowest growth rate of 1.4 percent per annum. Per capita consumption as a whole, as measured by the Divisia volume index, on average increases by 3.0 percent per annum.

4. DIVISIA MOMENTS

Tables 4.1 and 4.2 present the Divisia price and volume indexes for each year for the 18 countries. The means of these indexes given in the last rows of the tables are identical to those presented in column 12 of Tables 3.2 and 3.3.

The Divisia variances of the price and quantity log-changes are

$$\Pi_t = \sum_{i=1}^n \bar{w}_{it} (Dp_{it} - DP_t)^2$$

and

$$K_t = \sum_{i=1}^n \bar{w}_{it} (Dq_{it} - DQ_t)^2.$$

These variances measure the degree to which the quantities and prices of the individual goods change disproportionately. When all the quantities and prices change proportionately, these two variances vanish. For brevity, we shall refer to Π_t and K_t as the Divisia price and quantity variances. Tables 4.3 and 4.4 present these variances. Comparing these two tables, we see that the Divisia quantity variances systematically exceed the corresponding price variances. This pattern agrees with the

TABLE 4.1
DIVISIA PRICE INDEXES IN 18 COUNTRIES

Year	U.S.	Canada	Sweden	Switzerland	Denmark	Australia	France	Germany	Belgium	Norway	Netherlands	Iceland	Finland	Austria	Japan	U.K.	Spain	Italy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1953	-	-	-	-	-	-	-	-	-	-	-62	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	3.43	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	1.10	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	.88	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	5.54	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	1.28	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	.61	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	1.24	-	-	-	-	-	-	-
1961	1.19	.65	-	2.69	-	.39	-	3.32	2.77	-	1.40	8.99	1.66	-	-	-	-	-
1962	1.48	1.21	-	4.92	-	1.77	-	3.14	1.03	-	1.52	10.25	3.07	-	-	-	-	-
1963	1.47	1.52	-	3.51	-	.50	-	2.92	3.61	-	2.07	9.22	5.24	-	-	-	-	-
1964	1.45	1.27	-	4.04	-	3.13	-	2.37	3.99	-	6.10	14.98	7.94	-	-	-	-	-
1965	1.67	1.96	5.38	3.91	-	3.29	2.44	3.12	4.44	4.13	3.31	9.32	3.48	4.37	-	4.82	9.18	3.51
1966	2.70	3.32	6.31	4.65	-	2.96	3.17	3.58	4.12	3.33	5.57	10.28	2.75	2.44	-	3.92	6.97	2.82
1967	2.41	3.48	5.11	4.36	6.55	3.48	3.10	1.62	2.45	4.44	3.21	4.10	4.80	3.88	-	2.61	5.61	3.00
1968	3.95	4.00	1.51	2.57	7.54	3.19	4.94	1.62	2.70	3.01	3.02	11.93	9.68	2.48	-	4.39	5.03	1.42
1969	4.38	3.77	3.21	2.69	4.60	3.13	6.85	2.09	2.97	3.43	6.43	18.89	2.04	3.33	-	5.43	3.34	2.82
1970	4.45	3.44	4.91	3.86	6.93	5.80	4.85	3.73	2.48	9.50	2.92	10.86	2.19	3.71	-	5.79	6.37	4.88
1971	4.34	2.47	7.77	6.84	7.74	6.57	5.37	5.46	4.93	6.23	7.22	8.32	5.65	4.98	6.17	8.26	7.71	5.33
1972	3.51	4.08	6.48	7.43	7.89	6.12	5.71	5.40	5.27	6.49	6.86	13.28	6.69	6.28	5.28	6.42	7.99	6.21
1973	5.47	7.12	7.05	8.96	10.32	11.75	6.61	7.15	5.91	7.43	7.74	22.82	9.72	7.03	10.00	8.33	10.87	11.77
1974	9.55	10.86	8.71	9.65	13.65	15.95	12.44	6.69	11.54	8.86	8.72	-	14.91	9.88	19.60	15.94	16.11	19.05
1975	7.36	10.13	10.29	6.37	9.57	14.01	10.83	5.65	11.97	11.26	8.66	-	15.48	7.82	10.98	21.11	14.52	16.32
1976	5.36	7.19	10.17	2.40	9.39	10.97	9.38	4.27	7.60	8.48	8.13	-	12.69	6.56	8.47	14.45	15.51	16.60
1977	5.82	7.26	9.92	1.11	9.23	9.01	8.65	3.56	6.76	8.28	5.47	-	11.41	5.60	6.91	14.18	21.55	16.75
1978	6.73	7.14	10.31	1.16	8.72	8.50	8.46	2.59	4.06	7.68	-	-	-	4.08	4.73	8.68	-	12.07
1979	8.62	8.89	7.07	4.18	9.69	9.72	9.90	4.06	3.66	4.59	-	-	-	4.19	3.32	12.39	-	13.91
1980	9.99	10.12	11.08	4.09	10.55	9.10	12.37	5.21	6.74	9.50	-	-	-	6.46	6.36	15.32	-	18.36
1981	8.57	10.84	10.97	6.13	11.19	8.88	11.83	5.56	8.77	13.18	-	-	-	6.71	4.47	10.51	-	17.47
Mean	4.78	5.27	7.43	4.55	8.90	6.58	7.48	3.96	5.13	7.05	4.07	11.79	7.02	5.28	7.85	9.56	10.06	10.13

All entries are to be divided by 100.

TABLE 4.2
DIVISIA VOLUME INDEXES IN 18 COUNTRIES

Year	U.S.	Canada	Sweden	Switzerland	Denmark	Australia	France	Germany	Belgium	Norway	Netherlands	Iceland	Finland	Austria	Japan	U.K.	Spain	Italy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1953	-	-	-	-	-	-	-	-	-	-	6.46	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	7.11	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	5.00	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	7.62	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-1.27	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-2.14	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	4.54	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	5.98	-	-	-	-	-	-	-
1961	.37	-71	-	5.22	-	.66	-	4.03	1.24	-	5.09	-1.60	6.93	-	-	-	-	-
1962	2.96	3.08	-	3.47	-	2.99	-	3.59	3.37	-	5.26	7.10	5.19	-	-	-	-	-
1963	2.36	3.11	-	2.52	-	5.22	-	1.35	3.48	-	7.77	7.78	2.86	-	-	-	-	-
1964	3.97	3.77	-	2.93	-	2.79	-	4.33	1.67	-	3.74	4.63	4.38	-	-	-	-	-
1965	4.27	4.05	2.92	2.15	-	.95	3.12	5.22	3.23	1.54	6.11	3.50	4.69	4.06	-	.79	5.73	2.95
1966	3.91	3.10	.87	1.84	-	2.97	3.92	1.94	2.52	2.96	1.29	10.06	2.33	2.77	-	1.40	5.72	6.42
1967	1.77	3.92	1.41	1.68	2.35	4.18	3.69	.96	2.28	2.64	2.92	.59	1.85	1.82	-	1.83	4.80	6.16
1968	4.43	2.06	3.47	2.52	.75	4.18	2.79	4.12	5.07	2.69	4.66	-4.24	.41	3.59	-	2.95	4.72	4.28
1969	2.65	2.83	3.64	4.10	5.56	4.35	5.84	6.17	4.69	6.88	5.88	-4.45	9.77	2.86	-	.26	5.64	5.71
1970	1.14	1.00	1.99	2.95	2.05	2.32	3.65	6.93	4.39	-50	6.86	14.16	7.43	5.79	-	2.95	3.05	6.39
1971	2.74	6.36	-86	3.43	-61	.43	5.14	3.72	4.19	3.80	3.08	14.00	3.00	6.89	4.46	2.81	3.80	2.24
1972	4.91	5.97	2.80	4.29	1.16	3.35	5.02	3.73	5.60	2.03	3.81	7.43	7.97	5.86	7.64	5.36	6.83	2.60
1973	2.89	5.36	2.89	1.70	4.47	2.43	4.58	1.15	7.05	2.05	4.21	6.96	5.67	3.75	7.58	4.49	6.62	4.63
1974	-1.48	3.52	4.52	-68	-2.77	1.55	2.43	.51	2.95	2.80	2.54	-	3.10	.31	-1.91	-1.55	4.07	1.60
1975	1.18	2.99	2.57	-2.29	2.91	2.39	2.73	3.73	.10	3.85	3.64	-	2.82	3.41	2.86	-44	1.31	-2.20
1976	4.49	4.59	3.48	1.72	7.03	1.58	5.01	4.27	4.78	5.13	4.56	-	-26	3.49	2.26	.69	3.50	2.83
1977	3.64	1.47	-1.37	3.15	1.52	.27	2.73	3.66	2.31	5.73	3.75	-	-2.48	4.05	2.59	.19	1.43	1.73
1978	3.11	1.78	-.93	1.16	.21	2.11	4.21	3.73	2.30	-2.10	-	-	-	-38	3.43	4.97	-	2.56
1979	1.54	1.77	2.46	.80	.76	.89	3.02	2.66	4.37	3.64	-	-	-	4.41	4.87	4.24	-	4.87
1980	-.81	.04	-.10	2.00	-3.55	2.06	1.20	1.25	1.02	1.96	-	-	-	1.89	.69	-1.00	-	4.03
1981	.94	.28	-.77	.12	-.50	2.08	1.70	-.93	-1.34	.42	-	-	-	1.06	-.03	.04	-	-.11
Mean	2.43	2.87	1.71	2.13	1.42	2.37	3.57	3.15	3.11	2.68	4.34	5.07	3.86	3.27	3.13	1.76	4.40	3.33

All entries are to be divided by 100.

TABLE 4.3
DIVISIA PRICE VARIANCES IN 18 COUNTRIES

Year	U.S.	Canada	Sweden	Switzerland	Denmark	Australia	France	Germany	Belgium	Norway	Netherlands	Iceland	Finland	Austria	Japan	U.K.	Spain	Italy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1953	-	-	-	-	-	-	-	-	-	-	.34	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	1.18	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	.21	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	.93	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	.49	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	.84	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	.09	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	.86	-	-	-	-	-	-	-
1961	.03	.08	-	.25	-	.72	-	.45	1.82	-	.10	1.39	.28	-	-	-	-	-
1962	.07	.07	-	.12	-	.95	-	.17	.59	-	.08	3.56	.38	-	-	-	-	-
1963	.03	.15	-	.24	-	.89	-	.18	.96	-	.18	3.18	.47	-	-	-	-	-
1964	.82	.17	-	.26	-	.27	-	.21	.18	-	.67	2.29	1.39	-	-	-	-	-
1965	.04	.19	.17	.32	-	.47	.17	.18	1.53	.19	.37	1.00	.87	.35	-	.38	.97	.15
1966	.22	.35	.32	.15	-	.13	.18	.23	.65	.20	.64	2.03	.39	.24	-	.13	.20	.08
1967	.26	.34	.32	.50	1.15	.19	.32	.41	.22	.37	.95	.26	.56	.50	-	.11	.72	.18
1968	.11	.31	.15	.46	.64	.22	.38	.90	.15	.12	.45	.92	3.36	.58	-	.20	.91	.19
1969	.12	.22	.51	.29	.38	.63	.15	.29	.14	.16	.57	6.08	.05	.19	-	.08	.72	.05
1970	.07	.40	.19	.25	.62	.52	.11	.09	.49	.32	.79	2.45	.22	3.16	-	.17	.88	.13
1971	.16	.34	.21	.22	.68	.56	.10	.19	.36	.22	.97	2.16	.17	.51	.39	.29	.37	.23
1972	.15	.35	.42	.41	.50	.16	.14	.08	.45	.08	.67	3.79	.33	.34	.41	.47	.84	.34
1973	1.48	1.71	.39	.59	1.25	.96	.28	.04	.51	.09	.49	2.69	.25	.69	1.68	.99	.59	.52
1974	.62	1.07	2.19	.23	1.09	1.54	.74	.43	.76	.45	1.02	-	1.84	1.04	2.82	.46	.88	1.77
1975	.33	.47	.34	.25	.24	1.65	.20	.05	.88	.90	.90	-	1.87	.37	.75	1.01	.54	.91
1976	.44	.95	.27	.72	.79	.66	.25	.06	.54	.07	.55	-	.91	.52	.47	.36	1.11	1.13
1977	.30	.83	.42	.02	.34	.44	.28	.11	.51	.07	.64	-	1.45	.35	.40	.18	1.56	.67
1978	.40	.98	.62	.41	.30	.77	.06	.08	.27	.32	-	-	-	.45	.81	.40	-	.43
1979	.47	.27	.64	.85	1.83	.42	.24	.43	.76	.25	-	-	-	.40	.24	.54	-	.46
1980	.96	.18	.47	.25	.79	.35	1.01	.16	1.76	.55	-	-	-	.51	.42	1.17	-	1.00
1981	.40	.53	.42	.28	.43	.29	.20	.23	3.45	1.10	-	-	-	.69	.03	2.20	-	.16
Mean	.36	.47	.47	.34	.73	.61	.28	.24	.81	.32	.60	2.45	.87	.64	.77	.54	.79	.49

All entries are to be divided by 1000.

TABLE 4.4
DIVISIA QUANTITY VARIANCES IN 18 COUNTRIES

Year	U.S.	Canada	Sweden	Switzerland	Denmark	Australia	France	Germany	Belgium	Norway	Netherlands	Iceland	Finland	Austria	Japan	U.K.	Spain	Italy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1953	-	-	-	-	-	-	-	-	-	-	2.10	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	1.94	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	2.21	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	1.86	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	1.16	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	2.35	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	1.23	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	1.42	-	-	-	-	-	-	-
1961	.63	8.64	-	.87	-	.55	-	.62	1.45	-	.60	2.67	2.07	-	-	-	-	-
1962	.72	.57	-	.65	-	2.35	-	.81	.25	-	.68	7.51	1.29	-	-	-	-	-
1963	.44	.63	-	.28	-	3.22	-	.51	.52	-	.48	11.38	1.74	-	-	-	-	-
1964	.34	.47	-	.66	-	.48	-	.56	1.23	-	3.35	5.52	3.86	-	-	-	-	-
1965	.30	.63	.83	.30	-	.19	.52	.81	.50	.54	2.18	1.41	4.49	.84	-	.66	1.72	.50
1966	.46	.87	.71	.30	-	.57	.41	.18	.31	.28	1.98	4.23	.76	.90	-	.16	4.23	.52
1967	.15	.50	.49	.21	.42	.65	.33	.34	.42	.52	1.71	2.67	.93	.30	-	.32	.70	1.06
1968	.59	.61	1.31	.15	.54	.85	.29	.64	.78	.52	1.33	8.39	.75	.31	-	.30	1.75	.10
1969	.55	.35	.76	.21	1.19	1.10	.50	1.91	.52	2.32	2.41	3.33	3.80	.56	-	.24	.97	.73
1970	.67	1.82	.53	.11	.94	.28	.57	1.10	.24	2.61	1.88	19.19	.95	1.60	-	.43	.40	.59
1971	.92	2.51	1.38	.22	1.09	.37	.63	.28	.74	1.02	1.06	8.40	1.06	2.36	.66	.98	.88	.40
1972	.65	1.51	.83	.17	.86	.38	.55	.26	.99	.94	2.86	4.32	1.79	2.39	.49	1.94	2.67	.60
1973	1.31	2.35	1.06	.73	1.17	2.52	.75	.95	2.10	.43	1.61	1.80	2.43	.60	1.29	1.02	1.11	1.03
1974	1.55	1.96	1.45	.93	3.82	1.49	1.19	.62	1.81	.51	1.74	-	2.52	1.16	3.31	1.11	.89	.77
1975	.68	.23	.32	1.78	2.08	1.54	.75	1.21	2.04	.73	4.38	-	2.95	.45	1.59	.21	.48	.97
1976	.54	.35	.40	.47	1.64	.58	.99	.67	.75	1.39	.52	-	3.15	.61	1.06	.16	.28	.32
1977	.31	.67	.73	.35	.55	.56	.44	.88	1.07	1.30	1.49	-	2.04	2.32	.63	.44	.39	.56
1978	.54	.61	.59	.46	.88	.99	.67	.18	.57	2.85	-	-	-	2.21	.97	.71	-	.15
1979	.36	.27	.13	.21	.33	.25	.32	.16	.88	.72	-	-	-	.82	.87	.32	-	.66
1980	1.21	.38	.46	.13	1.96	.44	.55	.26	1.75	.68	-	-	-	.50	1.41	.41	-	.31
1981	.26	.23	.61	.34	.44	.16	.41	.43	.75	1.21	-	-	-	.45	1.07	.52	-	.69
Mean	.63	1.25	.74	.45	1.19	.93	.58	.64	.94	1.09	1.78	6.22	2.15	1.08	1.21	.58	1.27	.59

All entries are to be divided by 1000.

results of Clements (1982,1983), Meisner (1979), Selvanathan (1987) and Theil and Suhm (1979).

The associated Divisia price-quantity covariance is

$$\Gamma_t = \sum_{i=1}^n \bar{w}_{it} (Dp_{it} - DP_t)(Dq_{it} - DQ_t).$$

This measures the co-movement of the prices and quantities. The corresponding correlation is defined as

$$\rho_t = \frac{\Gamma_t}{\sqrt{H_t K_t}}.$$

This is known as the Divisia price-quantity correlation.

Table 4.5 presents the Divisia price-quantity correlations. As can be seen, 241 of the 322 correlations are negative which is about 75 percent. The last row of the table shows that, on average, the correlations are all negative for each country. This reflects the tendency of the consumer to move away from those commodities having above-average price increases.

5. RELATIVE PRICES AND CONSUMPTION

The relative price log-change of commodity i from year $t-1$ to t is defined as $D(p_{it}/P_t) = Dp_{it} - DP_t$. The corresponding relative quantity log-change is $D(q_{it}/Q_t) = Dq_{it} - DQ_t$. In this section we present the distributions of the relative price and quantity log-changes.

Figures 5.1 and 5.2 present the relative price and quantity log-changes for all commodities in all years in 18 countries. The total number of observations plotted in each figure is $\sum_{c=1}^{18} n^c T^c = 3135$; where n^c is the number of commodities in country c and T^c is the sample size

TABLE 4.5
DIVISIA PRICE-QUANTITY CORRELATIONS IN 18 COUNTRIES

Year	U.S.	Canada	Sweden	Switzerland	Denmark	Australia	France	Germany	Belgium	Norway	Netherlands	Iceland	Finland	Austria	Japan	U.K.	Spain	Italy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1953	-	-	-	-	-	-	-	-	-	-	-.45	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-.88	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	.21	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-.95	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	.33	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	.13	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-.64	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-.33	-	-	-	-	-	-	-
1961	.45	.01	-	-.32	-	-.11	-	-.40	-.97	-	-.67	-.27	-.57	-	-	-	-	-
1962	.33	-.69	-	-.61	-	.06	-	-.69	-.38	-	-.01	-.65	-.06	-	-	-	-	-
1963	.10	-.69	-	-.55	-	-.22	-	.74	.59	-	-.82	-.70	.30	-	-	-	-	-
1964	-.08	-.45	-	-.39	-	-.87	-	-.71	.31	-	-.57	-.49	-.72	-	-	-	-	-
1965	.10	-.31	-.38	-.59	-	-.01	.42	-.73	-.04	.05	-.38	-.35	-.57	-.78	-	-.21	-.58	.08
1966	-.30	-.57	.15	.13	-	.61	.15	.10	-.31	-.16	-.43	-.62	.22	.54	-	.15	-.58	-.15
1967	-.06	.22	-.23	.19	-.12	-.29	.63	.12	-.21	-.36	-.14	.17	.50	.11	-	.27	-.08	-.13
1968	-.18	-.37	-.19	.61	.69	.05	.20	.11	.29	-.87	-.25	-.46	-.53	.15	-	.41	-.78	.01
1969	-.22	.07	-.47	-.07	-.52	-.74	.44	-.62	-.58	-.67	-.02	-.80	-.25	-.20	-	-.01	.34	-.66
1970	.45	-.06	-.36	-.47	-.10	-.26	.43	-.10	-.25	-.26	-.51	-.16	-.07	-.36	-	-.02	-.30	-.36
1971	.67	.17	-.66	-.06	.19	-.48	-.09	-.07	.27	-.23	-.44	.30	.05	-.42	-.04	.23	.24	.34
1972	-.82	-.65	-.70	-.08	-.71	-.50	-.87	-.89	-.48	-.28	.16	-.61	-.25	-.39	-.27	-.60	-.61	-.60
1973	-.97	-.78	-.64	.37	-.75	-.65	-.77	-.57	-.56	-.45	-.66	-.55	-.43	-.34	-.34	-.90	-.69	-.58
1974	-.59	-.77	-.20	-.26	-.35	-.53	-.62	-.20	-.46	-.08	-.37	-	-.46	-.10	-.75	-.76	-.54	-.63
1975	-.59	-.62	-.56	-.09	-.13	-.67	.04	-.06	.02	-.87	-.49	-	-.32	.38	.34	-.05	-.19	-.52
1976	.08	-.55	-.43	.29	-.59	-.31	-.11	.14	-.38	-.32	-.21	-	-.65	.27	-.74	-.28	.57	.23
1977	.04	-.76	-.61	-.41	-.46	.34	-.58	-.77	.65	.45	-.80	-	-.37	-.55	.29	-.29	-.01	-.31
1978	-.88	-.88	-.16	-.72	-.53	-.58	-.05	-.22	-.11	-.23	-	-	-	.03	-.19	-.36	-	-.30
1979	-.79	-.69	-.44	-.59	.28	.00	-.22	-.10	-.31	-.04	-	-	-	.25	.07	.06	-	-.04
1980	-.70	-.46	-.56	-.42	-.07	-.77	-.48	-.69	-.82	-.49	-	-	-	.00	-.67	-.26	-	.42
1981	-.19	-.67	-.14	-.77	-.28	.04	-.60	-.35	-.70	-.85	-	-	-	-.83	.22	-.26	-	-.03
Mean	-.19	-.45	-.39	-.23	-.23	-.28	-.12	-.28	-.21	-.33	-.37	-.40	-.25	-.13	-.19	-.17	-.25	-.19

RELATIVE PRICE OF 10 COMMODITIES IN 18 COUNTRIES

(Log-changes $\times 100$)

Figure 5.1

RELATIVE CONSUMPTION OF 10 COMMODITIES IN 18 COUNTRIES

(Log-changes $\times 100$)

Figure 5.2

of country c . Figures 5.3-5.22 present the relative price and quantity log-changes for each of the 10 commodities individually in all years in 18 countries. Here there are 322 observations in each figure except for beverages and education; beverages has 290 observations while education has 269. We also present their means and standard deviations. These means differ from those which can be derived from the entries in the last rows of Tables 3.2 and 3.3 since for a certain commodity, the former is averaged over time and countries concurrently while the latter is first averaged over time in each country and then averaged over countries. These values are not equal since the sample size T^c of country c varies for each country, so that

$$\frac{1}{18} \sum_{c=1}^{18} \sum_{t=1}^{T^c} (Dq_{it}^c - DQ_t^c) \neq \frac{1}{18} \sum_{c=1}^{18} \frac{1}{T^c} \sum_{t=1}^{T^c} (Dq_{it}^c - DQ_t^c),$$

where the superscript c denotes country c .

Table 5.1 present the Kolmogorov-Smirnov test statistics for normality of the relative price and quantity log-changes and their critical values. As can be seen from the table, normality is not generally acceptable.

Table 5.2 presents the frequency distributions of the relative price and quantity log-changes (again, for all years and all countries). Columns 2-11 give the distributions for the 10 commodities individually and column 12 presents the figures for all goods. As can be seen from column 12, for an average OECD country, for all goods relative prices increased $31 + 11 + 7 = 49$ percent of the time while relative consumption decreased $10 + 13 + 25 = 48$ percent of the time.

Figure 5.3

Figure 5.4

Figure 5.5

Figure 5.6

RELATIVE PRICE OF CLOTHING IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.7

RELATIVE CONSUMPTION OF CLOTHING IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.8

RELATIVE PRICE OF HOUSING IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.9

RELATIVE CONSUMPTION OF HOUSING IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.10

RELATIVE PRICE OF TRANSPORT IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.15

RELATIVE CONSUMPTION OF TRANSPORT IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.16

RELATIVE PRICE OF RECREATION IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.17

RELATIVE CONSUMPTION OF RECREATION IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.18

Figure 5.11

Figure 5.12

Figure 5.13

Figure 5.14

RELATIVE PRICE OF EDUCATION IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.19

RELATIVE CONSUMPTION OF EDUCATION IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.20

RELATIVE PRICE OF MISCELLANEOUS GOODS IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.21

RELATIVE CONSUMPTION OF MISCELLANEOUS GOODS IN 18 COUNTRIES
(Log-changes $\times 100$)

Figure 5.22

TABLE 5.1
KOLMOGOROV-SMIRNOV TEST STATISTICS FOR NORMALITY OF RELATIVE PRICE
AND QUANTITY LOG-CHANGES FOR 10 COMMODITIES IN 18 COUNTRIES

Commodity (1)	Relative Price Log-change (2)	Relative Quantity Log-change (3)	Critical values	
			5 percent (4)	1 percent (5)
1. Food	.077*	.054	.076	.091
2. Beverages	.083*	.059	.080	.096
3. Clothing	.101**	.055	.076	.091
4. Housing	.080*	.079*	.076	.091
5. Durables	.067	.068	.076	.091
6. Medical care	.074	.077*	.076	.091
7. Transport	.076*	.076	.076	.091
8. Recreation	.093**	.097**	.076	.091
9. Education	.116**	.070	.082	.099
10. Miscellaneous	.151**	.118**	.076	.091

The Kolmogorov-Smirnov test statistic is based on a comparison of the observed sample cumulative relative frequency distribution (S) with the hypothetical population cumulative distribution function specified by the null hypothesis (F_0). The Kolmogorov-Smirnov test statistic is given by $D = \sup_x |F_0(x) - S(x)|$. The test statistic D is normally distributed. A '*' denotes significant at the 5 percent level; and a '**' denotes significant at the 1 percent level.

TABLE 5.2

FREQUENCY DISTRIBUTIONS OF RELATIVE PRICE AND QUANTITY LOG-CHANGES

FOR 10 COMMODITIES IN 18 COUNTRIES

(Percentages)

Range	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<u>Relative Prices</u>											
$(-\infty, -4]$	2	12	9	3	4	6	4	4	8	2	5
$(-4, -2]$	14	20	16	6	23	8	7	17	7	3	12
$(-2, 0]$	41	34	46	29	44	23	39	41	16	20	34
$(0, 2]$	29	22	22	36	22	32	36	28	34	51	31
$(2, 4]$	10	6	5	20	4	15	8	7	19	18	11
$(4, \infty)$	4	5	1	7	3	16	5	4	17	5	7
<u>Relative Quantities</u>											
$(-\infty, -4]$	11	10	13	5	9	10	10	4	24	4	10
$(-4, -2]$	27	17	15	11	16	11	7	6	12	11	13
$(-2, 0]$	39	36	29	25	22	15	15	16	12	38	25
$(0, 2]$	19	20	24	38	25	23	21	37	16	29	26
$(2, 4]$	3	13	13	15	13	20	19	20	16	13	14
$(4, \infty)$	0	5	5	6	13	21	28	17	20	5	12

The ranges in column 1 are to be divided by 100.

6. DOUBLE-LOG DEMAND EQUATIONS

Consider a double-log demand equation for commodity i in year t

$$(6.1) \quad Dq_{it} = \alpha_i + \eta_i DQ_t + \gamma_i Dp_{it}^* + \epsilon_{it},$$

where α_i is an autonomous trend term; η_i is the income elasticity; γ_i is the Slutsky own-price price elasticity; $Dp_{it}^* = Dp_{it} - DP_t$ is the log-change in the relative price of good i ; and ϵ_{it} is a disturbance term. Note that (6.1) includes only the own price and not other prices.

We add a country superscript to everything in (6.1),

$$(6.2) \quad Dq_{it}^c = \alpha_i^c + \eta_i^c DQ_t^c + \gamma_i^c Dp_{it}^{*c} + \epsilon_{it}^c, \quad c=1, \dots, 18.$$

We estimate equation (6.2) by least squares (LS) for $i=1, \dots, n^c$ goods in each country. Tables 6.1-6.3 present the results. The first 18 rows present the estimates for the 18 countries and the second last row (labelled 'Mean') presents the means over the 18 countries. Table 6.1 presents the estimates of the autonomous trend terms (α_i^c) for the 10 commodities in 18 countries.

Table 6.2 presents the estimates of the income coefficients in (6.2). Looking at the table, we see that all except 6 of the income elasticities are positive. However, the negative elasticities are all insignificant. As can be seen from columns 2 and 5 of Table 6.1, all income elasticities are less than one, implying that food and housing are necessities in all countries. Looking at column 6 we see that all elasticities are greater than unity. Hence, durables are a luxury in all countries. The second last row presents the mean over countries of the elasticities and its standard error for each commodity. As can be

TABLE 6.1

ESTIMATES OF THE AUTONOMOUS TRENDS FOR 10 COMMODITIES IN 18 COUNTRIES

(Standard errors are in parentheses)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)	α_1^c	α_2^c	α_3^c	α_4^c	α_5^c	α_6^c	α_7^c	α_8^c	α_9^c	α_{10}^c
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
U.S.	.02 (.59)	.40 (.52)	-2.09 (.76)	1.95 (.21)	-2.90 (.63)	3.84 (.65)	-3.96 (.92)	.39 (.82)	.39 (1.80)	.50 (.45)
Canada	-.80 (.49)	1.19 (.64)	-.11 (1.19)	3.20 (.49)	-2.79 (.83)	-6.76 (3.74)	-.76 (.91)	-.02 (1.16)	4.32 (3.07)	.89 (.62)
Sweden	-.29 (.32)	-2.12 (.89)	-3.32 (1.41)	2.31 (.30)	-2.23 (.64)	2.10 (1.00)	-1.14 (.84)	1.07 (.85)	2.31 (1.53)	-2.66 (.81)
Switzerland	-.34 (.35)	-1.71 (.61)	-4.18 (.89)	1.53 (.59)	-4.56 (.57)	1.93 (.84)	.10 (.93)	.64 (.55)		1.11 (.40)
Denmark	-.43 (.52)	-.37 (.50)	-3.57 (1.21)	3.35 (.81)	-3.36 (.65)	1.24 (1.16)	-1.88 (.80)	.81 (1.00)	8.49 (1.30)	-.65 (.56)
Australia	1.32 (.34)	-1.00 (.44)	-2.65 (.81)	2.51 (.69)	-1.86 (2.34)	.38 (1.77)	-.92 (1.08)	-2.15 (2.32)	-5.04 (3.35)	-.19 (.59)
France	.07 (.43)	-1.54 (.88)	-2.70 (1.01)	1.36 (.88)	-2.85 (1.73)	4.92 (1.62)	-1.55 (1.37)	1.67 (1.03)	3.27 (5.08)	.68 (.48)
Germany	-.33 (.43)		-2.46 (.60)	2.79 (.80)	-1.56 (.67)	1.01 (.97)	-1.28 (1.41)	.70 (.71)		1.71 (.44)
Belgium	-.59 (.75)	-.57 (1.04)	-3.49 (1.46)	1.12 (.92)	-.73 (1.84)	2.78 (1.29)	1.97 (.97)	.21 (1.17)	1.87 (.32)	-5.82 (2.62)
Norway	.62 (.27)	.33 (1.02)	-1.81 (.67)	3.20 (.60)	-.45 (.82)	2.01 (1.43)	-4.66 (1.05)	1.77 (.95)	-.54 (2.03)	-1.08 (.63)
Netherlands	-.50 (.87)	.74 (1.65)	-5.93 (1.36)	2.82 (1.15)	-.09 (2.23)	6.93 (1.70)	2.71 (1.63)	-.34 (1.75)	3.03 (2.05)	2.83 (1.16)
Iceland	-.26 (1.09)	.46 (1.67)	-2.30 (2.01)	2.91 (.67)	-2.59 (1.89)	6.43 (1.83)	-3.88 (3.36)	-.06 (2.37)	6.58 (1.76)	-.27 (2.41)
Finland	.42 (.54)	.05 (1.34)	-4.84 (2.57)	3.05 (.43)	-1.15 (1.51)	4.36 (1.41)	-.88 (2.28)	-1.59 (1.58)	-8.36 (4.04)	2.95 (.83)
Austria	.82 (.93)	.42 (1.46)	-2.63 (1.26)	4.19 (1.41)	-4.17 (2.56)	5.41 (1.54)	-5.74 (1.67)	1.48 (1.12)	2.53 (2.25)	.60 (.62)
Japan	-.81 (.64)		-3.94 (1.36)	4.10 (.31)	-6.22 (2.51)	4.43 (.96)	1.55 (1.57)	-.75 (1.26)		-.30 (1.36)
U.K.	-.43 (.35)	-.46 (.81)	-.43 (.73)	1.49 (.43)	-3.18 (.53)	-1.20 (1.56)	-.33 (.97)	.97 (.62)	2.07 (1.00)	.05 (.43)
Spain	-.93 (1.54)	-1.09 (2.23)	-1.75 (1.68)	3.16 (.95)	-.75 (1.99)	4.33 (4.41)	-1.70 (3.54)	1.65 (2.51)	4.99 (3.30)	2.69 (1.87)
Italy	-.73 (.40)	-.34 (1.09)	-3.29 (.85)	1.34 (.31)	-1.62 (1.55)	2.86 (1.58)	.44 (1.45)	1.34 (.81)	-.42 (2.15)	1.33 (.71)
Mean	-.18 (.16)	-.35 (.29)	-2.86 (.31)	2.58 (.17)	-2.39 (.37)	2.61 (.44)	-1.22 (.40)	.43 (.33)	1.70 (.68)	.24 (.27)
All countries	-.22 (.12)	-.67 (.23)	-2.67 (.26)	2.66 (.16)	-2.45 (.27)	1.92 (.40)	-1.24 (.33)	.47 (.28)	1.48 (.48)	-.15 (.24)

All entries are to be divided by 100.

TABLE 6.2

ESTIMATES OF INCOME ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES

(Standard errors are in parentheses)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)	η_1^c	η_2^c	η_3^c	η_4^c	η_5^c	η_6^c	η_7^c	η_8^c	η_9^c	η_{10}^c
U.S.	.29 (.20)	.41 (.18)	1.41 (.22)	.41 (.07)	1.55 (.21)	.52 (.22)	2.78 (.32)	1.27 (.23)	.98 (.33)	.70 (.14)
Canada	.79 (.14)	.36 (.19)	.75 (.32)	-.02 (.14)	1.59 (.21)	2.60 (1.11)	1.54 (.29)	1.94 (.30)	.94 (.74)	1.05 (.19)
Sweden	.37 (.13)	1.69 (.39)	1.40 (.32)	.24 (.12)	1.96 (.26)	.54 (.43)	2.04 (.34)	1.50 (.31)	.77 (.62)	1.13 (.27)
Switzerland	.82 (.13)	1.41 (.23)	1.96 (.28)	.27 (.21)	2.09 (.20)	.48 (.25)	1.65 (.34)	.97 (.19)		.60 (.17)
Denmark	.38 (.20)	.65 (.12)	1.55 (.29)	.41 (.17)	1.43 (.23)	.19 (.38)	2.33 (.30)	1.16 (.27)	.04 (.41)	.99 (.17)
Australia	-.06 (.12)	.86 (.16)	1.25 (.30)	.59 (.24)	2.44 (.69)	.57 (.63)	1.80 (.40)	2.87 (.86)	2.46 (1.40)	.94 (.21)
France	.42 (.11)	.74 (.22)	1.02 (.26)	.86 (.21)	1.68 (.51)	.55 (.41)	1.92 (.34)	.87 (.25)	.11 (1.30)	.92 (.12)
Germany	.61 (.10)		1.49 (.16)	.16 (.19)	1.39 (.17)	.52 (.27)	2.29 (.39)	.96 (.19)		.74 (.11)
Belgium	.63 (.20)	.96 (.28)	1.59 (.34)	.56 (.25)	1.49 (.47)	.75 (.36)	.86 (.27)	1.20 (.33)	.04 (.09)	2.85 (.69)
Norway	.26 (.08)	.63 (.30)	1.07 (.19)	.08 (.17)	1.36 (.24)	.46 (.43)	3.29 (.30)	1.09 (.18)	.71 (.66)	.96 (.17)
Netherlands	.59 (.17)	.70 (.37)	1.93 (.28)	.40 (.23)	1.55 (.36)	.22 (.29)	.78 (.34)	1.11 (.38)	.76 (.34)	.65 (.22)
Iceland	.46 (.13)	.89 (.21)	1.39 (.26)	-.07 (.09)	1.79 (.27)	.43 (.25)	2.28 (.54)	1.39 (.34)	-.34 (.28)	1.70 (.31)
Finland	.44 (.10)	1.23 (.27)	1.71 (.48)	.09 (.08)	1.84 (.30)	.62 (.26)	1.92 (.47)	1.71 (.31)	1.94 (.81)	.78 (.17)
Austria	.27 (.23)	.40 (.38)	1.75 (.24)	.23 (.26)	1.93 (.50)	-.60 (.39)	3.40 (.41)	.69 (.30)	-.14 (.60)	.69 (.18)
Japan	.74 (.17)		1.74 (.34)	.25 (.08)	2.38 (.63)	.43 (.23)	1.13 (.35)	1.10 (.30)		1.55 (.29)
U.K.	.30 (.12)	.74 (.39)	1.21 (.20)	.38 (.12)	2.12 (.17)	1.30 (.58)	1.85 (.33)	1.31 (.21)	.79 (.38)	1.11 (.15)
Spain	.84 (.32)	1.12 (.43)	1.17 (.35)	.25 (.18)	1.10 (.41)	1.32 (.96)	2.52 (.82)	1.13 (.46)	.03 (.60)	.70 (.38)
Italy	.86 (.10)	.80 (.21)	1.83 (.21)	.43 (.09)	1.66 (.40)	.95 (.38)	1.60 (.35)	.49 (.20)	.60 (.53)	.91 (.14)
Mean	.50 (.04)	.85 (.07)	1.46 (.07)	.31 (.04)	1.74 (.09)	.66 (.12)	2.00 (.10)	1.27 (.08)	.65 (.18)	1.05 (.06)
All Countries	.53 (.03)	.85 (.06)	1.46 (.06)	.23 (.04)	1.76 (.07)	.75 (.10)	2.02 (.09)	1.22 (.07)	.32 (.12)	1.23 (.06)

TABLE 6.3
ESTIMATES OF PRICE ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES

(Standard errors are in parentheses)

Country	Food γ_1^C	Beverages γ_2^C	Clothing γ_3^C	Housing γ_4^C	Durables γ_5^C	Medical care γ_6^C	Transport γ_7^C	Recreation γ_8^C	Education γ_9^C	Miscellaneous γ_{10}^C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
U.S.	-.54 (.11)	-.08 (.11)	-.67 (.16)	-.22 (.16)	-1.46 (.28)	-.59 (.28)	.00 (.31)	-.51 (.24)	.51 (1.21)	-.73 (.33)
Canada	-.63 (.09)	-.62 (.18)	-.77 (.32)	-.28 (.17)	-1.58 (.47)	1.59 (1.46)	-.91 (.36)	-.52 (.32)	-.89 (.56)	-.76 (.22)
Sweden	-.61 (.14)	-.20 (.29)	-1.38 (.40)	-.35 (.14)	-.54 (.25)	.00 (.13)	-1.22 (.51)	-1.04 (.48)	-.27 (.13)	-.13 (.37)
Switzerland	-.59 (.13)	-.56 (.23)	-.65 (.43)	-.03 (.17)	-1.05 (.20)	-.05 (.24)	-.70 (.47)	-.61 (.26)		.44 (.26)
Denmark	-.25 (.19)	-.39 (.15)	-.83 (.34)	-.27 (.22)	-.90 (.27)	-.58 (.32)	-.47 (.45)	-.69 (.43)	-.02 (.50)	-.04 (.31)
Australia	-.33 (.06)	-.52 (.07)	-.85 (.23)	-.43 (.16)	-.24 (.73)	-.28 (.33)	-.54 (.34)	-.83 (.41)	-1.77 (.78)	-.09 (.10)
France	-.31 (.09)	-.26 (.11)	-1.03 (.27)	.36 (.18)	-.23 (.60)	.43 (.41)	-1.04 (.28)	-.44 (.19)	-.79 (.75)	-.95 (.10)
Germany	-.60 (.19)		-.47 (.37)	-.04 (.22)	-.76 (.24)	-.74 (.21)	-1.30 (.57)	-.75 (.27)		-.40 (.18)
Belgium	-.31 (.19)	-.34 (.30)	-1.06 (.35)	-.09 (.19)	-.37 (.47)	.01 (.22)	-.74 (.31)	-.70 (.34)	.04 (.06)	-.04 (.23)
Norway	-.29 (.12)	-1.05 (.19)	-1.13 (.31)	.12 (.32)	-.49 (.39)	-.92 (.32)	-.35 (.40)	-.51 (.26)	-.14 (.67)	.77 (.35)
Netherlands	-.40 (.28)	-.52 (.33)	-1.25 (.37)	-.63 (.19)	-.17 (.59)	-.64 (.22)	-2.03 (.29)	-.28 (.44)	-.65 (.48)	-.64 (.51)
Iceland	-.21 (.21)	-.28 (.33)	-.42 (.30)	.02 (.08)	-.98 (.40)	-.61 (.29)	-1.67 (1.29)	-1.20 (.34)	-.31 (.21)	-.75 (.29)
Finland	-.48 (.17)	-.69 (.20)	.14 (.71)	-.17 (.08)	.69 (.49)	.42 (.44)	-.48 (.32)	-1.65 (.33)	-.31 (.54)	-.35 (.34)
Austria	-.26 (.22)	-.26 (.19)	-.72 (.49)	-.30 (.38)	-.86 (.85)	-.23 (.28)	.23 (.38)	-.56 (.32)	.10 (.15)	-.69 (.24)
Japan	-.02 (.32)		-.26 (.29)	-.17 (.06)	-.31 (.45)	-.64 (.15)	-1.14 (.45)	-1.12 (.56)		-1.12 (.80)
U.K.	-.08 (.15)	-.59 (.22)	-.31 (.14)	-.16 (.15)	-1.15 (.24)	.90 (.57)	-.17 (.38)	-.54 (.24)	-1.17 (.30)	-.72 (.24)
Spain	-.23 (.31)	-.06 (.18)	-.34 (.34)	.32 (.15)	-.64 (.26)	-.54 (.41)	-.59 (.38)	-.54 (.29)	-.32 (.30)	-.05 (.26)
Italy	-.11 (.19)	-.27 (.15)	-.07 (.32)	.05 (.09)	-.09 (.31)	-.56 (.26)	-.07 (.35)	-1.14 (.28)	-.18 (.35)	-.48 (.25)
Mean	-.35 (.04)	-.42 (.05)	-.67 (.09)	-.13 (.04)	-.62 (.11)	-.17 (.11)	-.73 (.12)	-.76 (.08)	-.41 (.14)	-.37 (.08)
All Countries	-.40 (.04)	-.42 (.05)	-.63 (.07)	-.14 (.04)	-.60 (.08)	-.31 (.08)	-.80 (.10)	-.83 (.07)	-.24 (.08)	-.48 (.06)

seen, on average, food, beverages, housing, medical care and education are necessities while the other five goods are luxuries. We shall come back to the last row of the table (labelled 'All countries') later in this section.

All except 19 of the price elasticities presented in Table 6.3 are negative. However, among the 19 positive price elasticities only 2 are significant. With only a few exceptions, the price elasticities are all less than one in absolute value.

Next, we re-estimate model (6.2) under the assumption that the autonomous trends and the income and price elasticities are the same across countries. Thus, the model becomes

$$(6.3) \quad Dq_{it}^c = \alpha_i + \eta_i DQ_t^c + \gamma_i Dp_{it}^{*c} + \epsilon_{it}^c.$$

Estimation of this model involves pooling the data across countries. The LS estimates are presented in the last rows of Tables 6.1-6.3. Comparing these estimates with the means presented in the second last rows of the tables, we see that they are similar. In Appendix A1 we present the summary statistics for the estimated demand equations.

In Appendix A2 we present the estimates and the summary statistics of model (6.2) with autonomous trend terms suppressed.

7. A BIRD'S EYE VIEW OF THE ELASTICITIES

In Table 7.1 we summarize the autonomous trend and elasticity values in the form of cross-country frequency distributions. Columns 2-11 of Table 7.1 present the percentages of the estimates lying in certain ranges for the 10 commodities individually. Column 12 presents these percentages for all goods. The first part of the table presents the frequencies of the autonomous trends. Looking at the

TABLE 7.1
FREQUENCY DISTRIBUTIONS OF AUTONOMOUS TRENDS AND
INCOME AND PRICE ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES

(Percentages)											
Range	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<u>Autonomous Trends ($\alpha_i^c \times 100$)</u>											
$(-\infty, -1]$	0	25	89	0	78	11	50	11	13	17	30
$(-1, 0]$	67	31	11	0	22	0	22	22	13	22	21
$(0, 1]$	28	38	0	0	0	6	11	33	7	28	15
$(1, \infty)$	6	6	0	100	0	83	17	33	67	33	34
<u>Income Elasticities (η_i^c)</u>											
$(-\infty, -1]$	0	0	0	0	0	0	0	0	0	0	0
$(-1, 0]$	6	0	0	11	0	6	0	0	13	0	3
$(0, 1]$	94	75	6	89	0	78	11	28	73	67	52
$(1, \infty)$	0	25	94	0	100	17	89	72	13	33	45
<u>Price Elasticities (γ_i^c)</u>											
$(-\infty, -1]$	0	6	28	0	22	0	33	28	13	6	14
$(-1, 0]$	100	94	67	72	72	66	62	72	67	83	75
$(0, 1]$	0	0	5	28	6	28	5	0	20	11	10
$(1, \infty)$	0	0	0	0	0	6	0	0	0	0	1

values for clothing and durables we see that the trend is always negative while for housing it is positive for all countries. The trends of other goods do not seem to have any particular sign.

The middle part of Table 7.1 presents the frequency distributions of the income elasticities. As can be seen from column 2 for food, 94 percent of the income elasticities lie between 0 and 1. This strongly supports the Engel's (1857) law that the expenditure share for food falls with the increase in income. Looking at column 12, we see that 52 percent of the goods are necessities and 45 percent are luxuries. (The remaining 3 percent have negative income elasticities.) The lower part of the table gives the results for the price elasticities. As can be seen from column 12, $14 + 75 = 89$ percent of all the price elasticities are negative. This shows very clearly the tendency of the consumer to move away from those goods having above-average price increases. It can also be seen that $75 + 10 = 85$ percent of the price elasticities are less than one in absolute value.

Table 7.2 presents the distributions of the absolute t-values of the three sets of parameter estimates. As can be seen from column 12 of the table, 35 percent of the intercept terms are highly insignificant ($|t| < 1$); 25 percent are insignificant ($1 \leq |t| < 2$); 16 percent are significant ($2 \leq |t| < 3$); and 23 percent are highly significant ($3 \leq |t|$). Among the income elasticities 76 percent have $|t|$ -values greater than or equal to 2; while for the price elasticities 46 percent have $|t|$ -values greater than or equal to 2. Consequently, the income elasticities tend to be estimated with greater precision than the autonomous trends and the price elasticities.

In Appendix A2 we present cross-country frequency distributions of the estimates when the autonomous trends are suppressed. In Sections 8 and 9 we consider the interrelationships between the elasticities and the autonomous trend terms.

TABLE 7.2

FREQUENCY DISTRIBUTIONS OF $|t|$ -VALUES OF AUTONOMOUS TRENDS AND
INCOME AND PRICE ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES

(Percentages)

Range	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<u>Autonomous Trends ($\alpha_i^c \times 100$)</u>											
[0 , 1)	67	69	11	0	33	17	50	56	27	28	35
[1 , 2)	22	12	17	11	22	28	22	39	40	39	25
[2 , 3)	6	19	44	17	11	17	11	6	13	17	16
[3 , ∞)	6	0	28	72	33	39	7	0	20	17	23
<u>Income Elasticities (η_i^c)</u>											
[0 , 1)	6	0	0	28	0	17	0	0	33	0	8
[1 , 2)	17	25	0	28	0	50	0	0	40	6	16
[2 , 3)	17	19	6	17	6	33	6	22	27	6	15
[3 , ∞)	61	56	94	28	94	0	94	78	0	89	61
<u>Price Elasticities (γ_i^c)</u>											
[0 , 1)	22	25	17	39	33	33	28	6	47	28	27
[1 , 2)	28	25	28	28	17	28	33	28	33	28	27
[2 , 3)	11	25	17	28	17	28	28	50	13	28	25
[3 , ∞)	39	25	39	6	33	11	11	17	7	17	21

8. IS THERE A RELATIONSHIP BETWEEN THE PRICE AND INCOME ELASTICITIES?

The size of the own-price elasticity reflects the availability of substitutes while the income elasticity indicates the luxuriousness of the good. As these refer to two distinct aspects of the good we would not expect there to be any particular relationship between the two sets of elasticities. However, the income and price elasticities in Tables 6.2 and 6.3 for a given country tend to be negatively correlated. This is illustrated in Figure 8.1 which gives a scatter of the mean income and price elasticities for the 10 commodities. (These elasticities are given in the second last rows of Tables 6.2 and 6.3.) This figure also contains the LS regression line. As can be seen, most of the points are not too far away from the regression line. The result is that those commodities which are more price elastic also tend to be more luxurious and vice versa.

The relationship between price and income elasticities was first considered by Pigou (1910) and is associated with preference independence. Under preference independence, the consumer's tastes can be described by a utility function which is the sum of n sub-utility functions, one for each good. Deaton (1974) shows that under preference independence, the own-price elasticities are approximately proportional to the income elasticities,

$$(8.1) \quad \gamma_i \simeq \phi \eta_i, \quad i=1, \dots, n.$$

where ϕ is a proportionality constant interpreted as the reciprocal of the income elasticity of the marginal utility of income, or the income flexibility for short. Deaton (1974) failed to find any evidence for (8.1) using double-log demand equations for the U.K. On the other hand, Clements et al. (1984) find support for (8.1) using four sets of

elasticities. They find that ϕ in (8.1) generally lies between $-.5$ and $-.6$, a range consistent with estimates of the income flexibility obtained using other methods (Theil, 1980). Are Deaton's results specific to his sample? In this section we shed some light on this issue by using the OECD elasticities to test hypothesis (8.1).

We estimate for each of the 18 countries

$$(8.2) \quad \gamma_i^c = \alpha^c + \phi^c \eta_i^c, \quad i=1, \dots, n^c,$$

where α^c is the intercept term and ϕ^c is the slope. We use the income and price elasticities presented in Tables 6.2 and 6.3 and estimate (8.2) by LS. Table 8.1 presents the results. As can be seen from column 2, the intercepts are insignificant for 15 countries. In column 4 we present F-statistics for testing the null hypothesis that

TABLE 8.1
CROSS-COMMODITY REGRESSION RESULTS FOR PRICE AND INCOME ELASTICITIES

$$\gamma_i^c = \alpha^c + \phi^c \eta_i^c$$

(Standard errors are in parentheses)

Country	Intercept α^c	Slope ϕ^c	F-statistic for $\alpha^c=0, \phi^c=-.5$	t-statistic for $\phi^c=-.5$
(1)	(2)	(3)	(4)	(5)
U.S.	-.423 (.306) -	-.006 (.243) -.281 (.146)*	F(2,8) = 2.19	t(9) = 1.49
Canada	-1.064 (.460)* -	.458 (.336) -.197 (.220)	F(2,8) = 4.08	t(9) = 1.37
Sweden	-.163 (.301) -	-.352 (.228) -.461 (.103)*	F(2,8) = .21	t(9) = .37
Switzerland	.200 (.201) -	-.546 (.154)** -.411 (.074)**	F(2,7) = 1.21	t(8) = 1.19
Denmark	-.246 (.148) -	-.218 (.130) -.391 (.085)**	F(2,8) = 2.36	t(9) = 1.28
Australia	-.232 (.247) -	-.259 (.149) -.375 (.083)**	F(2,8) = 1.57	t(9) = 1.51
France	-.194 (.348) -	-.256 (.333) -.418 (.159)*	F(2,8) = .28	t(9) = .52
Germany	-.205 (.163) -	-.421 (.136)** -.566 (.075)**	F(2,6) = 1.22	t(7) = .89
Belgium	-.266 (.221) -	-.086 (.168) -.254 (.096)*	F(2,8) = 4.20	t(9) = 2.57*
Norway	-.380 (.296) -	-.020 (.226) -.240 (.153)	F(2,8) = 2.38	t(9) = 1.71
Netherlands	-.647 (.368) -	-.084 (.367) -.646 (.202)**	F(2,8) = 1.87	t(9) = .72
Iceland	-.157 (.162) -	-.489 (.126)** -.583 (.080)**	F(2,8) = 1.01	t(9) = 1.04
Finland	-.175 (.459) -	-.092 (.330) -.202 (.148)	F(2,8) = 1.91	t(9) = 2.01
Austria	-.351 (.151)* -	-.005 (.107) -.157 (.103)	F(2,8) = 10.93**	t(9) = 3.33**
Japan	-.530 (.364) -	-.059 (.272) -.402 (.145)*	F(2,6) = 1.33	t(7) = .68
U.K.	-.226 (.444) -	-.155 (.358) -.318 (.153)*	F(2,8) = .78	t(9) = 1.19
Spain	-.028 (.154) -	-.265 (.128)* -.285 (.064)**	F(2,8) = 4.97*	t(9) = 3.33**
Italy	-.578 (.254)* -	.282 (.227) -.184 (.117)	F(2,8) = 7.91*	t(9) = 2.70*
Mean	-.101 (.085) -	-.345 (.072)** -.422 (.033)**	F(2,8) = 3.59	t(9) = 2.35*
All countries	-.145 (.080) -	-.328 (.068)** -.435 (.037)**	F(2,8) = 3.58	t(9) = 1.77

A '*' denotes significant at the 5 percent level; and a '**' denotes significant at the 1 percent level.

$\alpha^c = 0$ and $\phi^c = -.5$. (The value $-.5$ for the income flexibility ϕ^c is in agreement with previous studies.) The conclusion is that we may not reject this hypothesis for all countries except Austria, Spain and Italy at the 5 percent level of significance. That is, the data support the proportionality hypothesis for 15 countries at the 5 percent level and for 17 countries at the 1 percent level. The second last and the last rows of the table present the regression results obtained using the corresponding values of the elasticities given in the second last and the last rows of Tables 6.2 and 6.3.

Column 3 of Table 8.1 also presents the estimates of ϕ^c with the constant α^c suppressed. As can be seen for 13 countries, the estimates are significantly different from zero at the 5 percent level. Column 5 presents the t-values for the null hypothesis that $\phi^c = -.5$ given $\alpha^c = 0$. As can be seen, we cannot reject the null hypothesis for all countries except Belgium, Austria, Spain and Italy at the 5 percent level; and at the 1 percent level, the hypothesis cannot be rejected for all except Austria and Spain. Taken as a whole, the results indicate that there is a distinct tendency for luxuries to be more price elastic than necessities. This finding provides some indirect evidence in favour of preference independence.

9. THE RELATIONSHIP BETWEEN THE AUTONOMOUS TRENDS AND INCOME AND PRICE ELASTICITIES

In this section we use Divisia indexes to analyse the relationships between the autonomous trends and the income and price elasticities. The autonomous trends for country c are α_i^c , $i=1, \dots, n^c$. The budget-share-weighted (or Divisia) mean of these is $\bar{\alpha}^c = \sum_{i=1}^{n^c} \bar{w}_i^c \alpha_i^c$.

where $\bar{w}_i^c = (1/T^c) \sum_{t=1}^{T^c} \bar{w}_{it}^c$ is the sample mean of $\bar{w}_{it}^c$. The Divisia variance of the autonomous trends is

$$V_{\alpha}^c = \sum_{i=1}^{n^c} \bar{w}_i^c (\alpha_i^c - \bar{\alpha}^c)^2.$$

The Divisia variance of the income elasticities is

$$V_{\eta}^c = \sum_{i=1}^{n^c} \bar{w}_i^c (\eta_i^c - \bar{\eta}^c)^2,$$

where $\bar{\eta}^c = \sum_{i=1}^{n^c} \bar{w}_i^c \eta_i^c$ is the Divisia mean of the income elasticities.

Similarly, the Divisia variance of the price elasticities is

$$V_{\gamma}^c = \sum_{i=1}^{n^c} \bar{w}_i^c (\gamma_i^c - \bar{\gamma}^c)^2,$$

where $\bar{\gamma}^c = \sum_{i=1}^{n^c} \bar{w}_i^c \gamma_i^c$ is the Divisia mean of the price elasticities.

We define the correlation between the autonomous trends and the income elasticities for country c as

$$\rho_{\alpha\eta}^c = \frac{V_{\alpha\eta}^c}{\sqrt{V_{\alpha}^c V_{\eta}^c}},$$

where $V_{\alpha\eta}^c = \sum_{i=1}^{n^c} \bar{w}_i^c (\alpha_i^c - \bar{\alpha}^c)(\eta_i^c - \bar{\eta}^c)$ is the Divisia covariance between $(\alpha_1^c, \dots, \alpha_{n^c}^c)$ and $(\eta_1^c, \dots, \eta_{n^c}^c)$. The trend-price elasticity correlation is

$$\rho_{\alpha\gamma}^c = \frac{V_{\alpha\gamma}^c}{\sqrt{V_{\alpha}^c V_{\gamma}^c}},$$

where $V_{\alpha\gamma}^c = \sum_{i=1}^{n^c} \bar{w}_i^c (\alpha_i^c - \bar{\alpha}^c)(\gamma_i^c - \bar{\gamma}^c)$ is the Divisia covariance between $(\alpha_1^c, \dots, \alpha_{n^c}^c)$ and $(\gamma_1^c, \dots, \gamma_{n^c}^c)$.

Column 2 of Table 9.1 presents the trend-income elasticity

TABLE 9.1

DIVISIA TREND-ELASTICITY CORRELATIONS IN 18 COUNTRIES

Country	Trend-income elasticity correlation	Trend-price elasticity correlation
(1)	$\rho_{\alpha\eta}^c$ (2)	$\rho_{\alpha\gamma}^c$ (3)
U.S.	-.850	-.004
Canada	-.811	-.107
Sweden	-.655	.314
Switzerland	-.866	.711
Denmark	-.658	.563
Australia	-.746	.510
France	-.586	.616
Germany	-.741	.653
Belgium	-.850	.022
Norway	-.881	.140
Netherlands	-.805	.166
Iceland	-.810	.610
Finland	-.721	-.002
Austria	-.931	-.132
Japan	-.843	-.084
U.K.	-.565	.368
Spain	-.537	.495
Italy	-.641	-.437

correlations. These are computed with the α_i^c 's and η_i^c 's from Tables 6.1 and 6.2. As can be seen, the autonomous trends and the income elasticities are highly negatively correlated. This indicates that those goods having a higher-than-average trend term have a lower-than-average income elasticity and vice versa. In other words, these two parameters act as substitutes for each other. The statistical explanation for this finding is that real income tends to grow according to a constant trend. Consequently, the income variable in the demand equation (6.2), DQ_t^c , is approximately a constant, which is obviously correlated with the constant term.

Column 3 of Table 9.1 gives the trend-price elasticity correlations. These correlations are mainly positive, but smaller (in absolute value) than most of the $\rho_{\alpha\eta}^c$'s. The conclusion is that there is much less of a relationship between the autonomous trends and the price elasticities.

10. A NONPARAMETRIC PICTURE OF PRICES AND QUANTITIES

The law of demand states that the demand curve slopes down. Thus, an increase in the relative price of a good causes its consumption to fall, other things remaining unchanged. In this section we introduce a new nonparametric way of describing consumption data which provides further evidence on the validity of the law of demand. Existing nonparametric tests in demand analysis are mainly concerned with aspects of revealed preference; for a brief review, see Deaton (1984).

The log-change in the quantity consumed of good i from year $t-1$ to t is $Dq_{it} = \log q_{i,t} - \log q_{i,t-1}$. This Dq_{it} includes the effects of

all the determinants of consumption, the effects of autonomous trends, income and relative prices. We commence by adjusting Dq_{it} to exclude the effects of the non-price determinants. To take account of the autonomous trends we subtract from Dq_{it} the constant term in the demand equation (6.1), α_i . Under the assumption of a unitary income elasticity, we can adjust for income by subtracting from Dq_{it} the log-change in real income, DQ_t . (This assumption will be relaxed in the next section.) Thus, adjusted consumption is

$$(10.1) \quad Dq_{it}^* = Dq_{it} - \alpha_i - DQ_t.$$

This is the log-change in consumption of good i which results from change in relative prices and random factors only. For brevity, we shall refer to Dq_{it}^* as the change in relative consumption of i .

The law of demand predicts that Dq_{it}^* and the relative price change of good i , $Dp_{it}^* = Dp_{it} - DP_t$, would have opposite signs. Consider a 2x2 contingency table based on the signs of the pairs (Dq_{it}^*, Dp_{it}^*) for all goods in all years in all countries:

		Sign of Relative Price, Dp_{it}^*	
		Positive	Negative
Sign of Relative Consumption, Dq_{it}^*	Positive	I	II
	Negative	IV	III

If the law of demand were true, then most of the observations should lie in the off-diagonal cells, i.e. cells II and IV, implying that when the relative price of a good increases (decreases), its consumption grows less (more) rapidly than otherwise.

We implement (10.1) with the OECD data and use the estimates of the coefficients α_1 given in Table 6.1. Table 10.1 presents the frequency distributions of the pairs of relative price and consumption changes. Rather than having four cells like the above 2x2 contingency table, Table 10.1 has four quadrants. The first quadrant presents the number of pairs of relative prices and consumption that both have positive growth, disaggregated by commodity and country. The last row of this quadrant presents the frequency over all countries for each commodity and the last column presents the frequency over all goods for each country. The entries in the other three quadrants have the analogous interpretations.

To illustrate the working of Table 10.1, consider for example the U.S. The sample size for this country is 21 (see Table 2.1). Food consumption in the U.S. (adjusted for the autonomous trend) grows faster than income when its relative price increase only once during the sample period; this is indicated by the entry 1 in the first row of the first column of Table 10.1. Food consumption grows when the price falls in 3 years; consumption and the price both fall in 9 years; and consumption falls when the price increases in 8 years. These four entries in the table completely describe the 21 pairs of signs of the relative consumption and price of food in the U.S.

Next, consider the $21 \times 10 = 210$ pairs of signs of all goods in the U.S. Looking at the row totals in Table 10.1 for the U.S., $38 + 39 = 77$ pairs move in the same directions, while $65 + 68 = 133$ move in opposite directions. Overall, among the $\sum_{c=1}^{18} n^c_T = 3135$ pairs of signs for all 18 countries (where, for country c , n^c is the number of

TABLE 10.1

FREQUENCIES OF JOINT SIGNS OF RELATIVE CONSUMPTION AND

RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
	Positive relative prices											Negative relative prices										
U.S.	1	1	4	2	3	3	7	4	12	1	38	3	4	14	1	15	1	11	15	0	1	65
Canada	1	0	1	1	4	9	1	3	11	2	33	6	3	9	1	17	8	15	16	0	2	77
Sweden	1	5	1	2	3	2	7	3	2	7	33	5	7	15	2	10	3	5	10	5	2	64
Switzerland	2	5	3	2	5	4	8	5	5	5	39	8	9	15	2	15	1	9	8	0	0	67
Denmark	1	0	1	3	2	2	3	2	3	5	22	5	9	12	1	7	6	9	7	3	4	63
Australia	0	2	3	1	1	6	6	9	7	3	38	2	7	14	1	16	2	11	9	5	5	72
France	0	1	1	6	1	1	11	0	2	1	24	1	5	9	1	14	0	4	7	0	2	43
Germany	0	1	6	1	3	3	6	5	1	1	25	6	11	1	1	13	3	9	8	3	3	54
Belgium	1	4	4	3	7	3	3	5	1	8	39	7	9	14	1	8	3	6	10	1	9	68
Norway	0	1	3	2	3	3	11	0	4	10	37	1	6	9	0	9	1	4	12	2	2	45
Netherlands	0	2	5	2	2	3	2	13	7	3	39	4	10	16	3	16	0	13	4	2	3	71
Iceland	2	0	2	1	3	2	1	3	1	3	18	0	5	5	2	7	1	7	5	2	7	41
Finland	1	4	3	0	8	2	4	4	10	2	38	1	6	8	2	6	1	7	9	1	2	43
Austria	0	0	0	1	1	1	9	0	3	2	17	1	5	17	0	12	0	7	5	1	2	50
Japan	2	1	3	1	1	1	1	1	1	4	14	1	5	5	1	7	3	4	6	1	1	28
U.K.	1	0	1	2	3	6	8	3	4	2	30	4	6	11	2	12	2	4	7	3	5	56
Spain	2	2	4	0	4	4	2	4	0	3	25	1	7	2	0	4	4	10	2	0	1	31
Italy	1	0	7	0	6	0	8	0	3	4	29	5	9	8	1	7	9	6	5	5	1	56
All countries	16	27	52	30	60	55	98	64	70	66	538	61	107	194	22	195	48	141	145	30	52	995
U.S.	8	7	1	7	2	15	2	1	9	16	68	9	9	2	11	1	2	1	1	0	3	39
Canada	12	7	4	6	0	0	4	1	9	16	59	2	11	7	13	0	4	1	1	1	1	41
Sweden	7	5	0	10	2	7	4	1	6	8	50	4	0	1	3	2	5	1	3	4	0	23
Switzerland	5	3	1	11	1	13	2	5	5	13	54	6	4	2	6	0	3	2	3	3	3	29
Denmark	7	2	1	11	5	5	3	2	5	4	45	2	4	1	0	1	2	0	4	4	2	20
Australia	9	6	4	14	0	10	2	3	9	11	68	10	6	0	5	4	3	2	0	0	2	32
France	8	5	4	8	1	5	2	3	12	12	60	8	6	3	2	1	11	0	7	3	2	43
Germany	6	6	2	16	3	13	6	4	14	14	64	9	6	2	3	2	2	0	4	3	3	25
Belgium	6	4	1	5	1	9	8	6	5	4	49	7	4	2	12	5	6	4	0	14	0	54
Norway	7	6	5	5	4	9	1	2	6	3	48	9	4	0	10	1	4	1	3	5	2	39
Netherlands	11	2	3	13	1	19	8	6	14	15	92	10	11	1	7	6	3	2	2	2	4	48
Iceland	8	5	3	6	2	9	2	4	6	2	47	3	3	3	4	1	1	3	1	4	1	24
Finland	9	5	0	8	0	4	4	4	4	11	49	6	2	6	7	3	10	2	0	2	2	40
Austria	4	4	0	16	1	14	1	3	6	12	61	12	8	0	0	3	2	0	9	7	1	42
Japan	3	1	7	2	3	6	2	2	6	6	30	5	6	2	2	1	4	0	2	0	0	16
U.K.	4	5	2	12	1	5	2	3	9	9	52	8	6	3	1	1	4	3	4	1	1	32
Spain	4	1	6	4	5	4	1	6	10	5	46	6	3	1	9	0	1	0	1	3	4	28
Italy	4	3	2	12	2	5	2	4	7	12	53	7	5	0	4	2	3	1	8	2	0	32
All countries	122	70	40	171	33	149	60	60	117	173	995	123	86	36	99	34	70	23	53	52	31	607

commodities and T^C the number of observations), 538 of them have positive consumption and price growth; 995 have an increase in consumption and a fall in price; 607 have negative consumption and price growth; and 995 have a fall in consumption and a rise in price. This can be summarized as follows:

		Sign of Relative Price, Dp_{it}^*	
		Positive	Negative
Sign of Relative Consumption, Dq_{it}^*	Positive	538	995
	Negative	995	607

As can be seen, the off-diagonal entries are almost twice as large as the diagonals, so that this 2x2 matrix can be described as 'dominant non-diagonal'. This result gives clear support for the law of demand.

Table 10.2 presents the frequencies in Table 10.1 in percentage form. That is, the entries in the first quadrant of Table 10.2 are the percentages of the total number of observations having a simultaneous increase in relative prices and consumption, disaggregated by commodity and country. The entries in the other three quadrants have a similar interpretation. For example, for food in the U.S., relative prices and consumption move in the same directions for $5 + 43 = 48$ percent of the time, while they move in the opposite directions $14 + 38 = 52$ percent of the time. As can be seen from the 'All countries' rows and the 'All goods' columns, overall $32 + 32 = 64$ percent of the pairs of relative

TABLE 10.2

FREQUENCY DISTRIBUTIONS OF JOINT SIGNS OF
RELATIVE CONSUMPTION AND RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES

(Percentages)

Country	Positive relative prices										Negative relative prices											
	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
U.S.	5	5	19	9	14	14	33	19	57	5	18	14	19	67	5	71	5	52	71	0	5	31
Canada	5	0	5	5	19	43	5	14	52	9	16	29	14	43	5	81	38	71	76	0	10	37
Sweden	6	29	6	12	18	12	41	18	12	41	19	29	41	88	12	59	18	29	59	29	12	38
Switzerland	9	24	14	9	24	19	38	24	24	21	21	38	43	71	10	71	5	43	38	0	0	35
Denmark	7	0	7	20	13	13	20	13	20	33	15	33	60	80	7	47	40	60	47	20	27	42
Australia	0	9	14	5	5	29	29	43	33	14	18	10	33	67	5	76	10	52	43	24	24	34
France	0	6	6	35	6	6	65	0	12	6	14	6	29	53	6	82	0	24	41	0	12	25
Germany	0	0	29	5	14	14	29	24	5	5	15	29	52	52	5	62	14	43	38	14	32	32
Belgium	5	19	19	14	33	14	14	24	5	38	19	33	43	67	5	38	14	29	48	5	43	32
Norway	0	6	18	12	18	18	65	0	23	59	22	6	35	53	0	53	6	24	71	12	12	27
Netherlands	0	8	20	8	8	12	8	52	29	12	16	16	40	64	12	64	0	52	16	8	12	28
Iceland	15	0	15	8	23	15	8	23	8	23	14	0	39	39	15	54	8	54	39	15	54	32
Finland	6	23	18	0	47	12	23	23	59	12	22	6	35	47	12	35	6	41	53	6	12	25
Austria	0	0	0	6	6	6	53	0	18	12	10	6	29	100	0	71	0	41	29	6	12	29
Japan	18	0	27	9	9	9	9	9	36	16	16	9	46	9	64	27	36	55	5	9	32	32
U.K.	6	0	6	12	18	35	47	18	23	12	18	24	35	65	12	71	12	24	41	18	29	33
Spain	15	15	31	0	31	31	15	31	0	23	19	8	54	15	0	31	31	77	15	0	8	24
Italy	6	0	41	0	35	0	47	0	18	23	17	29	53	47	6	41	53	35	29	29	6	33
All countries	5	9	16	9	19	17	30	20	26	20	17	19	37	60	7	61	15	44	45	11	16	32
U.S.	38	33	5	33	10	71	10	5	43	76	32	43	43	9	52	5	9	5	5	0	14	19
Canada	57	33	19	29	0	0	19	5	43	76	28	9	52	33	62	0	19	5	5	5	5	19
Sweden	41	29	0	59	12	41	24	6	35	47	29	23	0	6	18	12	29	6	18	23	0	13
Switzerland	24	14	5	52	5	62	10	24	62	29	29	29	19	9	29	0	14	9	14	14	15	15
Denmark	47	13	7	73	33	33	20	13	33	27	30	13	27	7	0	7	13	0	27	27	13	13
Australia	43	29	19	67	0	48	10	14	43	52	32	48	29	0	24	19	14	9	0	0	9	15
France	47	29	24	47	6	29	12	18	71	71	35	47	35	18	12	6	65	0	41	18	12	25
Germany	29	10	76	14	62	29	19	19	67	38	38	43	9	9	14	9	9	0	19	14	15	15
Belgium	29	19	5	24	5	43	38	29	24	19	23	33	19	9	57	24	29	19	0	67	0	26
Norway	41	35	29	29	24	53	6	12	35	18	28	53	23	0	59	6	23	6	18	29	12	23
Netherlands	44	8	12	52	4	76	32	24	56	60	37	40	44	4	28	24	12	8	8	8	16	19
Iceland	62	39	23	46	15	69	15	31	46	15	36	23	23	23	31	8	8	23	8	31	8	18
Finland	53	29	0	47	0	24	24	24	24	65	29	35	12	35	41	18	59	12	0	12	12	23
Austria	24	24	0	94	6	82	6	18	35	71	36	71	47	0	0	18	12	0	53	41	6	25
Japan	27	9	64	18	27	55	18	18	55	34	45	45	18	18	9	36	0	18	18	0	18	18
U.K.	24	29	12	71	6	29	12	18	53	53	31	47	35	18	6	6	23	18	23	6	6	19
Spain	31	8	46	31	39	31	8	46	77	39	35	46	23	8	69	0	8	0	8	23	31	21
Italy	24	18	12	71	12	29	12	24	41	71	31	41	29	0	23	12	18	6	47	12	0	19
All countries	38	24	12	53	10	46	19	19	44	54	32	38	30	11	31	11	22	7	16	19	10	19

prices and consumption have opposite signs, while $17 + 19 = 36$ percent have the same signs.

Quadrants I and III of Table 10.2 refer to the situations where relative prices and consumption move in the same directions. Consequently, the information in these quadrants enables us to identify the major violators (commodities and countries) of the law of demand. If entries in the four quadrants of Table 10.2 occurred with equal probability, then each would be 25 percent. Thus using 30 percent as the cut-off value, the major villains in Table 10.2 are transport (30 percent of the cases are in quadrant I), food (38 percent in quadrant III) and beverages (30 percent in quadrant III). With respect to countries, there are none in quadrants I and III with more than 30 percent in the 'All goods' columns. Consequently, none of the countries individually are major trouble makers for the law of demand.

The entries in Table 10.1 are the number of occurrences of each sign pattern. In Table 10.3 we convert these count data to percentages within each quadrant. Thus, in the first quadrant, among the 538 occurrences of pairs of positive relative price and quantity changes (see Table 10.1), .2 percent of these are for food in the U.S., .2 percent for beverages in the U.S. and so on. If we consider all goods, we see that 7.1 percent of the observations having this sign configuration are from the U.S, 6.1 percent from Canada and so on. Considering the 'All countries' row in the first quadrant, it can be seen that 3.0 percent of this sign configuration are from food, 5.0 percent from beverages etc. The other three quadrants are interpreted in a similar manner.

The row for 'All countries' in the first quadrant of Table 10.3 shows that transport is the main contributor to the violation of the law of demand in so far as this quadrant is concerned. Similarly we see that food, beverages and housing are the main deviates in quadrant III.

TABLE 10.3

FREQUENCY DISTRIBUTIONS OF 10 GOODS IN 18 COUNTRIES
BY JOINT SIGNS OF RELATIVE CONSUMPTION AND RELATIVE PRICES

(Percentages)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
	Positive relative prices											Negative relative prices										
U.S.	.2	.2	.7	.4	.6	.6	1.3	.7	2.2	.2	7.1	.3	.4	1.4	.1	1.5	.1	1.1	1.5	.0	.1	6.5
Canada	.2	.0	.2	.2	.7	1.7	.2	.6	2.0	.4	6.1	.6	.3	.9	.1	1.7	.8	1.5	1.6	.0	.2	7.7
Sweden	.2	.9	.2	.4	.6	.4	1.3	.6	.4	1.3	6.1	.5	.7	1.5	.2	1.0	.3	.5	1.0	.5	.2	6.4
Switzerland	.4	.9	.6	.4	.9	.7	1.5	.9	.9	.9	7.2	.8	.9	1.5	.2	1.5	.1	.9	.8	.0	.0	6.7
Denmark	.2	.0	.2	.6	.4	.4	.6	.4	.6	.9	4.1	.5	.9	1.2	.1	.7	.6	.9	.7	.3	.4	6.3
Australia	.0	.4	.6	.2	.2	1.1	1.1	1.7	1.3	.6	7.1	.2	.7	1.4	.1	1.6	.2	1.1	.9	.5	.5	7.2
France	.0	.2	.2	1.1	.2	.2	2.0	.0	.4	.2	4.5	.1	.5	.9	.1	1.4	.0	.4	.7	.0	.2	4.3
Germany	.0	.0	1.1	.2	.6	.6	1.1	.9	.2	.2	4.6	.6	.0	1.1	.1	1.3	.3	.9	.8	.3	.3	5.4
Belgium	.2	.7	.7	.6	1.3	.6	.6	.9	.2	1.5	7.2	.7	.9	1.4	.1	.8	.3	.6	1.0	.1	.9	6.8
Norway	.0	.2	.6	.4	.6	.6	2.0	.0	.7	1.9	6.9	.1	.6	.9	.0	.9	.1	.4	1.2	.2	.2	4.6
Netherlands	.0	.4	.9	.4	.4	.6	.4	2.4	1.3	.6	7.2	.4	1.0	1.6	.3	1.6	.0	1.3	.4	.2	.3	7.1
Iceland	.4	.0	.4	.2	.6	.4	.2	.6	.2	.6	3.3	.0	.5	.5	.2	.7	.1	.7	.5	.2	.7	4.1
Finland	.2	.7	.6	.0	1.5	.4	.7	.7	1.9	.4	7.1	.1	.6	.8	.2	.6	.1	.7	.9	.1	.2	4.3
Austria	.0	.0	.0	.2	.2	.2	1.7	.0	.6	.4	3.2	.1	.5	1.7	.0	1.2	.0	.7	.5	.1	.2	5.0
Japan	.4	.6	.2	.2	.2	.2	.2	.2	.7	.7	2.6	.1	.0	.5	.1	.7	.3	.4	.6	.1	.1	2.8
U.K.	.2	.0	.2	.4	.6	1.1	1.5	.6	.7	.4	5.6	.4	.6	1.1	.2	1.2	.2	.4	.7	.3	.5	5.6
Spain	.4	.4	.7	.0	.7	.7	.4	.7	.0	.6	4.6	.1	.7	.2	.0	.4	.4	1.0	.2	.0	.1	3.1
Italy	.2	.0	1.3	.0	1.1	.0	1.5	.0	.6	.7	5.4	.5	.9	.8	.1	.7	.9	.6	.5	.5	.1	5.6
All countries	3.0	5.0	9.7	5.6	11.2	10.2	18.2	11.9	13.0	12.3	100.0	6.1	10.8	19.5	2.2	19.6	4.8	14.2	14.6	3.0	5.2	100.0
U.S.	.8	.7	.1	.7	.2	1.5	.2	.1	.9	1.6	6.8	1.5	1.5	.3	1.8	.2	.3	.2	.2	.0	.5	6.4
Canada	1.2	.7	.4	.6	.0	.0	.4	.1	.9	1.6	5.9	.3	1.8	1.2	2.1	.0	.7	.2	.2	.2	.2	6.8
Sweden	.7	.5	.0	1.0	.2	.7	.4	.1	.6	.8	5.0	.7	.0	.2	.5	.3	.8	.2	.5	.7	.0	3.8
Switzerland	.5	.3	.1	1.1	.1	1.3	.2	.5	.0	1.3	5.4	1.0	.7	.3	1.0	.0	.5	.3	.5	.5	.5	4.8
Denmark	.7	.2	.1	1.1	.5	.5	.3	.2	.5	.4	4.5	.3	.7	.2	.0	.2	.3	.0	.7	.7	.3	3.3
Australia	.9	.6	.4	1.4	.0	1.0	.2	.3	.9	1.1	6.8	1.6	1.0	.0	.8	.7	.5	.3	.0	.0	.3	5.3
France	.8	.5	.4	.8	.1	.5	.2	.3	1.2	1.2	6.0	1.3	1.0	.5	.3	.2	1.8	.0	1.2	.5	.3	7.1
Germany	.6	.2	1.6	.3	1.3	.6	.4	.4	1.4	6.4		1.5	.0	.3	.5	.3	.3	.0	.7	.5	.4	4.1
Belgium	.6	.4	.1	.5	.1	.9	.8	.6	.5	.4	4.9	1.2	.7	.3	2.0	.8	1.0	.7	.0	2.3	.0	8.9
Norway	.7	.6	.5	.5	.4	.9	.1	.2	.6	.3	4.8	1.5	.7	.0	1.6	.2	.7	.2	.5	.8	.3	6.4
Netherlands	1.1	.2	.3	1.3	.1	1.9	.8	.6	1.4	1.5	9.2	1.6	1.8	.2	1.2	1.0	.5	.3	.3	.3	.7	7.9
Iceland	.8	.5	.3	.6	.2	.9	.2	.4	.6	.2	4.7	.5	.5	.5	.7	.2	.2	.5	.2	.7	.2	4.0
Finland	.9	.5	.0	.8	.0	.4	.4	.4	.4	1.1	4.9	1.0	.3	1.0	1.2	.5	1.6	.3	.0	.3	.3	6.6
Austria	.4	.4	.0	1.6	.1	1.4	.1	.3	.6	1.2	6.1	2.0	1.3	.0	.0	.5	.3	.0	1.5	1.2	.2	6.9
Japan	.3	.1	.7	.2	.3	.6	.2	.2	.6	.3	3.0	.8	.0	.3	.3	.2	.7	.0	.3	.0	.0	2.6
U.K.	.4	.5	.2	1.2	.1	.5	.2	.3	.9	.9	5.2	1.3	1.0	.5	.2	.2	.7	.5	.7	.2	.2	5.3
Spain	.4	.1	.6	.4	.5	.4	.1	.6	1.0	.5	4.6	1.0	.5	.2	1.5	.0	.2	.0	.2	.5	.7	4.6
Italy	.4	.3	.2	1.2	.2	.5	.2	.4	.7	1.2	5.3	1.2	.8	.0	.7	.3	.5	.2	1.3	.3	.0	5.3
All countries	12.3	7.0	4.0	17.2	3.3	15.0	6.0	6.0	11.8	17.4	100.0	20.3	14.2	5.9	16.3	5.6	11.5	3.8	8.7	8.6	5.1	100.0

However, looking at the 'All goods' columns in quadrants I and III we see that no individual country is a dominant contributor.

Table 10.4 presents a summary picture of Table 10.1. The upper half of Table 10.4 adds the corresponding entries in quadrants I and III of Table 10.1 to give the frequencies of the relative prices and consumption moving in the same directions. The lower half of the table presents the frequencies of those moving in the opposite directions; this lower half is constructed by adding the corresponding entries in quadrants II and IV of Table 10.1. Looking at the entries in column 12 for the U.S., we see that 77 of the pairs of relative prices and consumption move in the same directions, while 133 move in opposite directions. For all commodities and countries, among the 3135 pairs, 1990 pairs move in opposite directions, while the rest move in the same directions. Table 10.5 is the percentage version of Table 10.4. It is to be noted that in all countries prices and consumption move in opposite directions more than 50 percent of the time. Indeed, for most countries the figure is substantially above 50 percent.

11. MORE ON THE NONPARAMETRIC PICTURE

In the last section we defined the change in relative consumption of good i as the deviation of its quantity log-change from its autonomous trend and the Divisia volume index, $Dq_{it} - \alpha_i - DQ_t$. This assumes unitary income elasticities for all goods. In this section we relax this assumption by using our estimates of the income elasticities from the double-log demand equations. Thus we now define relative consumption as $Dq_{it} - \alpha_i - \eta_i DQ_t$, where η_i is the estimate of the income elasticity of good i presented in Table 6.2.

TABLE 10.4

SUMMARY OF FREQUENCIES OF JOINT SIGNS OF RELATIVE CONSUMPTION AND
RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Relative consumption and relative prices move in the same directions											
U.S.	10	10	6	13	4	5	8	5	12	4	77
Canada	3	11	8	14	4	13	2	4	12	3	74
Sweden	5	5	2	5	5	7	8	6	6	7	56
Switzerland	8	9	5	8	5	7	10	8		8	68
Denmark	3	4	2	3	3	4	3	6	7	7	42
Australia	10	8	3	6	5	9	8	9	7	5	70
France	8	7	4	8	2	12	11	7	5	3	67
Germany	9		8	4	5	5	6	9		4	50
Belgium	8	8	6	15	12	9	7	5	15	8	93
Norway	9	5	3	12	4	7	12	3	9	12	76
Netherlands	10	13	6	9	8	6	4	15	9	7	87
Iceland	5	3	5	5	4	3	4	4	5	4	42
Finland	7	6	9	7	11	12	6	4	12	4	78
Austria	12	8	0	1	4	3	9	9	10	3	59
Japan	7		5	3	2	5	1	3		4	30
U.K.	9	6	4	3	4	10	11	7	5	3	62
Spain	8	5	5	9	4	5	2	5	3	7	53
Italy	8	5	7	4	8	3	9	8	5	4	61
All countries	139	113	88	129	94	125	121	117	122	97	1145
Relative consumption and relative prices move in opposite directions											
U.S.	11	11	15	8	17	16	13	16	9	17	133
Canada	18	10	13	7	17	8	19	17	9	18	136
Sweden	12	12	15	12	12	10	9	11	11	10	114
Switzerland	13	12	16	13	16	14	11	13		13	121
Denmark	12	11	13	12	12	11	12	9	8	8	108
Australia	11	13	18	15	16	12	13	12	14	16	140
France	9	10	13	9	15	5	6	10	12	14	103
Germany	12		13	17	16	16	15	12		17	118
Belgium	13	13	15	6	9	12	14	16	6	13	117
Norway	8	12	14	5	13	10	5	14	8	5	94
Netherlands	15	12	19	16	17	19	21	10	16	18	163
Iceland	8	10	8	8	9	10	9	9	8	9	88
Finland	10	11	8	10	6	5	11	13	5	13	92
Austria	5	9	17	16	13	14	8	8	7	14	111
Japan	4		6	8	9	6	10	8		7	58
U.K.	8	11	13	14	13	7	6	10	12	14	108
Spain	5	8	8	4	9	8	11	8	10	6	77
Italy	9	12	10	13	9	14	8	9	12	13	109
All countries	183	177	234	193	228	197	201	205	147	225	1990

TABLE 10.5
SUMMARY OF FREQUENCY DISTRIBUTIONS OF JOINT SIGNS OF
RELATIVE CONSUMPTION AND RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES

(Percentages)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Relative consumption and relative prices move in the same directions											
U.S.	48	48	29	62	19	24	38	24	57	19	37
Canada	14	52	38	67	19	62	9	19	57	14	35
Sweden	29	29	12	29	29	41	47	35	35	41	33
Switzerland	38	43	24	38	24	33	48	38		38	36
Denmark	20	27	13	20	20	27	20	40	47	47	28
Australia	48	38	14	29	24	43	38	43	33	24	33
France	47	41	23	47	12	71	65	41	29	18	39
Germany	43		38	19	24	24	29	43		19	30
Belgium	38	38	29	71	57	43	33	24	71	38	44
Norway	53	29	18	71	23	41	71	18	53	71	45
Netherlands	40	52	24	36	32	24	16	60	36	28	35
Iceland	38	23	38	38	31	23	31	31	38	31	32
Finland	41	35	53	41	65	71	35	23	71	23	46
Austria	71	47	0	6	23	18	53	53	59	18	35
Japan	64		45	27	18	45	9	27		36	34
U.K.	53	35	23	18	23	59	65	41	29	18	36
Spain	61	38	38	69	31	38	15	38	23	54	41
Italy	47	29	41	23	47	18	53	47	29	23	36
All countries	43	39	27	40	29	39	38	36	45	30	36
Relative consumption and relative prices move in opposite directions											
U.S.	52	52	71	38	81	76	62	76	43	81	63
Canada	86	48	62	33	81	38	90	81	43	86	65
Sweden	71	71	88	71	71	59	53	65	65	59	67
Switzerland	62	57	76	62	76	67	52	62		62	64
Denmark	80	73	87	80	80	73	80	60	53	53	72
Australia	52	62	86	71	76	57	62	57	67	76	67
France	53	59	76	53	88	29	35	59	71	82	61
Germany	57		62	81	76	76	71	57		81	70
Belgium	62	62	71	29	43	57	67	76	29	62	56
Norway	47	71	82	29	76	59	29	82	47	29	55
Netherlands	60	48	76	64	68	76	84	40	64	72	65
Iceland	61	77	61	61	69	77	69	69	61	69	68
Finland	59	65	47	59	35	29	65	76	29	76	54
Austria	29	53	100	94	76	82	47	47	41	82	65
Japan	36		54	73	82	54	91	73		64	66
U.K.	47	65	76	82	76	41	35	59	71	82	63
Spain	38	61	61	31	69	61	85	61	77	46	59
Italy	53	71	59	76	53	82	47	53	71	76	64
All countries	57	61	73	60	71	61	62	64	55	70	63

Table 11.1 presents the frequency distributions of the pairs of signs of relative prices and consumption. This table is to be compared with Table 10.1. Table 11.2 is the percentage version of Table 11.1 and is comparable with Table 10.2. As can be seen, overall, $18 + 17 = 35$ percent of the pairs of relative prices and consumption move in the same directions, while $34 + 31 = 65$ percent move in opposite directions. Looking at the 'All countries' rows in quadrants I and III and using 30 percent as the cut-off value (as before), we see that now no individual good has a significant contribution to the violation of the law of demand. Thus, in this sense, the overall results improve slightly when we use non-unitary income elasticities.

TABLE 11.1
FREQUENCIES OF JOINT SIGNS OF RELATIVE CONSUMPTION AND
RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES:
NON-UNITARY INCOME ELASTICITIES

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
	Positive relative prices											Negative relative prices										
U.S.	4	4	2	3	2	6	5	2	12	3	43	7	5	12	7	13	2	6	11	0	4	67
Canada	1	1	2	1	1	8	0	2	10	2	28	7	10	11	8	14	6	12	11	0	2	61
Sweden	1	4	1	3	1	5	2	1	2	7	27	8	5	15	3	8	4	4	9	6	2	64
Switzerland	2	3	1	6	1	8	3	5		11	40	11	7	10	5	12	2	7	8	0	0	62
Denmark	2	0	1	4	2	3	3	0	4	5	24	6	11	11	1	7	6	4	7	4	4	61
Australia	3	3	3	4	1	9	1	4	5	4	37	8	10	10	2	10	2	9	6	4	5	65
France	1	1	1	9	1	5	2	2	4	1	27	8	9	9	2	8	3	3	10	2	3	57
Germany	3	3	4	7	2	6	3	5	5	5	35	12		10	3	12	4	8	8	3	3	60
Belgium	2	4	0	5	3	7	4	3	5	6	39	8	9	13	7	6	4	6	9	11	6	79
Norway	1	1	1	5	3	4	5	0	4	10	34	7	8	9	5	8	2	3	12	3	2	59
Netherlands	7	1	1	6	1	5	2	10	7	7	47	8	12	13	6	12	3	13	3	3	5	78
Iceland	5	0	2	3	2	3	1	3	1	1	21	1	7	4	3	6	1	5	4	4	6	41
Finland	3	3	1	4	3	3	2	2	7	5	33	5	6	7	5	2	5	6	7	1	2	46
Austria	1	2	0	7	1	5	4	0	3	5	28	8	11	11	0	11	1	3	9	2	2	58
Japan	2	0	1	3	2	6	5	2	4	2	27	6	9	10	3	10	1	4	6	3	4	56
U.K.	3	2	4	2	2	2	1	4	3	4	27	4	7	2	2	3	4	7	1	3	2	35
Spain	2	0	3	7	6	0	6	1	4	4	33	7	9	6	1	4	9	3	9	5	1	54
Italy																						
All countries	45	29	29	61	34	66	50	47	75	64	560	123	135	166	66	151	65	106	136	51	54	1053
U.S.	5	4	3	6	3	12	4	3	9	14	63	5	8	4	5	3	1	6	5	0	0	37
Canada	12	6	3	6	3	1	5	2	10	16	64	1	4	5	6	3	6	4	6	1	1	37
Sweden	7	6	0	9	4	4	9	3	6	8	56	1	2	1	2	4	4	2	4	3	0	23
Switzerland	5	5	3	7	5	9	7	5	7	7	53	3	6	7	3	3	2	4	3	3	3	34
Denmark	6	2	1	10	5	4	3	4	4	4	43	1	2	2	0	1	2	5	4	3	2	22
Australia	6	5	4	11	0	7	7	8	11	10	69	4	3	4	4	10	3	5	3	1	2	39
France	7	5	4	5	1	1	11	1	10	12	57	1	2	3	1	7	8	1	4	1	1	29
Germany	3	4	4	10	4	10	9	4		10	54	3		3	1	3	1	1	4	3	19	
Belgium	5	4	5	3	5	5	7	8	1	6	49	6	4	3	6	7	5	4	1	4	3	43
Norway	6	6	7	2	4	8	7	2	6	3	51	3	2	0	5	2	3	2	3	4	2	26
Netherlands	4	3	7	9	2	17	8	9	14	11	84	6	9	4	4	10	0	2	3	1	2	41
Iceland	5	5	3	4	3	8	2	4	6	4	44	2	1	4	3	2	1	5	2	2	2	24
Finland	7	6	2	4	5	3	6	6	7	9	54	2	2	7	4	7	6	3	2	2	2	37
Austria	3	2	0	10	1	10	6	3	6	9	50	5	2	6	0	4	1	4	5	6	1	34
Japan	3	3	3	6	3	3	6	2		8	34	4		4	0	3	1	0	2		0	14
U.K.	3	5	2	11	2	5	5	4	9	9	55	6	3	4	0	3	5	3	5	1	2	32
Spain	3	1	6	2	7	6	2	6	7	4	44	3	3	1	7	1	1	3	2	0	3	24
Italy	3	3	6	5	2	5	4	3	6	12	49	5	5	2	4	5	3	4	4	2	0	34
All countries	93	68	63	120	59	118	109	77	112	155	973	61	59	64	55	78	53	58	62	31	29	549

TABLE 11.2

FREQUENCY DISTRIBUTIONS OF JOINT SIGNS OF RELATIVE CONSUMPTION AND

RELATIVE PRICES OF 10 GOODS IN 18 COUNTRIES:

NON-UNITARY INCOME ELASTICITIES

(Percentages)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
	Positive relative prices											Negative relative prices										
U.S.	19	19	9	14	9	29	24	9	57	14	20	33	24	57	33	62	9	29	52	0	19	32
Canada	5	5	9	5	5	38	0	9	49	9	13	33	48	52	38	67	29	57	52	0	9	39
Sweden	6	23	6	18	6	29	12	6	12	41	16	47	29	88	19	47	23	23	53	35	12	38
Switzerland	9	14	5	29	5	38	14	24		52	21	52	33	48	24	57	9	33	38	0	0	33
Denmark	13	0	7	27	13	20	20	0	27	33	16	40	73	73	7	47	40	27	47	27	27	41
Australia	14	14	14	19	6	43	5	19	24	19	18	38	48	48	9	48	9	38	29	19	24	31
France	6	6	6	53	6	29	12	12	23	6	16	47	53	53	12	47	18	18	59	12	18	33
Germany	14		19	33	9	29	14	24		24	21	57		48	14	57	19	38	38		14	35
Belgium	9	19	0	24	14	33	19	14	24	29	19	38	43	62	33	29	19	29	43	52	29	38
Norway	6	6	6	29	18	23	29	0	23	59	20	41	47	53	29	47	12	18	71	18	12	35
Netherlands	28	4	4	24	4	20	8	40	28	28	19	32	48	52	24	48	12	52	12	12	20	31
Iceland	38	0	15	23	15	23	8	23	8	8	16	8	54	31	23	46	8	38	31	31	45	31
Finland	18	18	6	23	18	19	12	12	41	29	19	29	35	41	29	12	29	35	41	6	12	27
Austria	6	12	0	41	6	29	23	0	18	29	16	47	65	65	0	65	6	18	53	12	12	34
Japan	18		9	18	0	9	9	9		18	11	18		27	27	45	54	35	54		9	34
U.K.	12	0	6	18	12	35	29	12	23	12	15	35	53	59	18	59	6	23	35	18	23	33
Spain	23	15	31	15	15	15	8	31	23	31	21	31	54	15	15	23	31	54	6	23	15	27
Italy	12	0	18	41	35	0	35	6	23	23	19	41	53	35	6	23	53	18	53	29	6	32
All countries	14	10	9	25	11	27	15	15	28	26	18	38	47	52	20	47	20	33	42	19	17	34
U.S.	24	19	14	29	14	57	19	14	43	67	30	24	38	19	24	14	5	29	24	0	0	18
Canada	57	29	14	29	14	5	24	9	48	76	30	5	19	24	29	14	29	19	29	5	5	18
Sweden	41	35	0	53	23	23	53	18	35	47	33	6	12	6	12	23	23	12	23	19	0	13
Switzerland	24	24	14	33	24	43	33	24		33	28	14	29	33	14	14	9	19	14		14	18
Denmark	40	13	7	67	33	27	20	27	27	27	29	7	13	13	0	7	13	33	27	20	13	15
Australia	29	24	19	52	0	33	33	38	52	48	33	19	14	19	19	48	14	24	14	5	9	19
France	41	29	23	29	6	6	65	6	59	71	33	6	12	18	6	41	47	6	23	6	6	17
Germany	14		19	48	19	48	43	19		48	32	14		14	5	14	5	5	19		14	11
Belgium	24	19	24	14	24	24	33	38	5	29	23	29	19	14	29	33	24	19	5	19	14	20
Norway	35	35	41	12	23	47	41	12	35	18	30	18	12	0	29	12	18	12	18	23	12	15
Netherlands	16	12	28	36	8	68	32	36	56	44	34	24	36	16	16	40	0	8	12	4	8	16
Iceland	38	38	23	31	23	61	15	31	46	31	34	15	8	31	23	15	8	38	15	15	15	18
Finland	41	35	12	23	29	18	35	35	41	47	32	12	12	41	23	41	35	18	12	12	12	22
Austria	18	12	0	59	6	59	35	18	35	53	29	29	12	35	0	23	6	23	29	35	6	20
Japan	27		27	54	27	27	54	18		73	39	36		36	0	27	9	0	18		0	15
U.K.	18	29	12	65	12	29	29	23	53	53	32	35	18	23	0	18	29	18		6	12	19
Spain	23	8	46	15	54	46	15	46	54	31	34	23	23	8	54	8	8	23	15	0	23	18
Italy	18	18	35	29	12	29	23	18	35	71	29	29	29	12	23	29	18	23	23	12	0	20
All countries	29	23	20	37	18	37	33	24	42	48	31	19	20	20	17	24	16	18	19	11	9	17

APPENDICES

A1. SUMMARY STATISTICS FOR THE DEMAND EQUATIONS

Table A1.1 presents the values of R^2 , the Durbin-Watson (DW) statistic and the standard error of estimate (SEE) implied by models (6.2) and (6.3) for the 18 countries. The format of this table is exactly the same as Tables 6.1-6.3. For brevity, we shall focus on the values of the summary statistics averaged over all countries; these are contained in the rows labelled 'Mean'. As can be seen, the fit of the model is satisfactory except for housing, medical care and education. The DW statistics indicates no serial correlation except for education. The standard errors of estimate range from 1.3 percent (for food) to 4.8 percent (education).

A2. ESTIMATES OF THE DEMAND EQUATIONS

WITH THE AUTONOMOUS TRENDS SUPPRESSED

In this appendix we present the LS estimates of models (6.2) and (6.3) with the autonomous trend terms suppressed. Table A2.1 presents the estimates of the income elasticities. Again, this table has the same format as before. As can be seen, all elasticities are positive and the pooled estimates are similar to the mean values. Table A2.2 presents the price elasticities. Table A2.3 presents the values of the DW statistics and the SEEs implied by the models when the trend terms are omitted. This table is interpreted in the same way as Table A1.1.

Tables A2.4 and A2.5 present cross-country frequency distributions of the estimates and their $|t|$ -values when the trend terms are omitted. These tables are interpreted in the same way as Tables 7.1 and 7.2.

TABLE A1.1
SUMMARY STATISTICS FOR THE DEMAND EQUATIONS
WITH AUTONOMOUS TRENDS FOR 10 COMMODITIES IN 18 COUNTRIES

Country		Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
U.S.	R ²	.59	.23	.70	.67	.83	.30	.85	.62	.33	.63
	DW	1.42	1.27	2.75	1.64	1.32	1.38	2.14	1.75	.36	1.87
	SEE	1.55	1.33	1.51	.55	1.65	1.69	2.18	1.68	2.51	1.08
Canada	R ²	.82	.54	.38	.14	.78	.25	.76	.70	.18	.65
	DW	1.67	1.44	2.16	1.42	1.21	1.13	1.83	1.88	.35	2.19
	SEE	1.21	1.57	2.70	1.20	1.76	9.23	2.20	2.50	6.19	1.50
Sweden	R ²	.72	.67	.64	.35	.81	.11	.74	.68	.28	.56
	DW	1.93	1.29	1.22	1.98	2.28	1.66	2.34	1.23	1.92	2.51
	SEE	.98	2.57	2.29	.87	1.89	3.02	2.52	2.33	4.61	1.96
Switzerland	R ²	.81	.74	.74	.08	.87	.18	.58	.59		.62
	DW	1.86	1.09	1.19	1.97	1.57	1.06	1.55	1.75		1.72
	SEE	.99	1.72	2.16	1.63	1.47	1.93	2.62	1.27		1.13
Denmark	R ²	.24	.75	.74	.40	.87	.24	.89	.64	.00	.73
	DW	2.65	1.62	2.33	1.09	2.43	1.40	2.81	1.34	2.44	2.79
	SEE	1.64	1.28	3.10	1.84	2.24	3.99	2.70	2.84	4.18	1.85
Australia	R ²	.62	.82	.66	.49	.42	.07	.57	.44	.24	.54
	DW	2.12	1.91	1.65	1.23	1.31	2.44	2.13	2.64	.62	2.24
	SEE	.73	.99	1.83	1.45	4.17	3.82	2.42	5.21	7.52	1.29
France	R ²	.58	.49	.67	.56	.55	.33	.84	.50	.07	.94
	DW	1.36	2.64	2.15	2.40	2.17	2.06	1.69	1.84	2.39	1.73
	SEE	.54	1.09	1.33	1.07	2.22	1.69	1.63	1.19	6.66	.58
Germany	R ²	.68		.83	.04	.81	.43	.84	.61		.74
	DW	2.05		2.34	2.02	1.98	1.98	1.57	1.24		2.52
	SEE	.83		1.36	1.66	1.49	2.28	2.62	1.60		.96
Belgium	R ²	.36	.41	.55	.29	.44	.20	.44	.42	.04	.68
	DW	2.17	2.14	2.52	2.37	2.50	1.80	2.09	2.93	1.08	2.23
	SEE	1.43	2.46	2.30	1.97	2.94	3.08	2.32	2.39	.76	4.18
Norway	R ²	.53	.74	.78	.02	.71	.38	.90	.73	.08	.75
	DW	2.16	1.57	1.51	2.05	1.50	1.10	1.61	1.91	1.16	2.01
	SEE	.70	2.62	1.71	1.50	2.12	3.67	2.65	1.43	5.16	1.45
Netherlands	R ²	.35	.35	.77	.39	.47	.30	.77	.29	.29	.32
	DW	2.07	2.65	3.03	1.73	2.50	1.82	2.20	1.47	2.42	1.60
	SEE	1.80	3.87	3.27	2.73	4.16	3.41	3.87	4.21	3.92	2.65
Iceland	R ²	.63	.64	.78	.07	.89	.37	.83	.67	.52	.76
	DW	2.45	2.56	1.57	1.58	2.59	2.20	1.44	.93	.85	2.74
	SEE	2.59	4.56	5.43	1.80	5.17	4.96	8.65	6.30	4.41	6.49
Finland	R ²	.74	.66	.52	.26	.73	.39	.63	.77	.29	.61
	DW	2.29	1.98	2.56	1.75	1.71	1.88	1.75	2.52	.79	1.91
	SEE	1.20	3.39	5.60	1.00	3.80	3.12	5.69	3.89	10.13	2.05
Austria	R ²	.13	.19	.79	.12	.52	.23	.86	.43	.04	.55
	DW	2.89	2.47	1.47	1.84	2.22	1.64	1.24	1.81	2.84	2.42
	SEE	1.70	2.92	1.88	1.96	3.77	2.89	2.71	2.29	4.62	1.27
Japan	R ²	.77		.78	.63	.70	.74	.71	.72		.78
	DW	2.09		2.23	2.28	2.45	2.28	1.99	2.16		2.12
	SEE	1.32		2.83	.63	5.56	2.14	3.25	2.78		2.68
U.K.	R ²	.32	.71	.73	.46	.92	.31	.72	.74	.53	.83
	DW	2.23	1.65	1.76	1.96	2.84	1.50	1.46	1.60	1.34	2.41
	SEE	.97	2.44	1.48	1.02	1.38	4.91	2.70	1.79	3.12	1.30
Spain	R ²	.41	.44	.55	.53	.63	.22	.68	.62	.17	.33
	DW	1.66	1.94	1.68	2.17	1.50	1.43	1.99	2.34	1.36	1.75
	SEE	1.83	2.33	2.13	1.01	2.43	5.70	4.44	2.52	2.87	2.03
Italy	R ²	.85	.51	.85	.74	.69	.43	.62	.64	.09	.80
	DW	1.61	1.93	2.18	2.29	1.12	1.47	1.78	2.49	1.19	2.54
	SEE	.90	1.72	1.92	.68	2.94	3.56	3.18	1.84	4.97	1.26
Mean	R ²	.56	.55	.69	.35	.70	.30	.73	.60	.21	.66
	DW	2.03	1.88	2.02	1.88	1.96	1.68	1.87	1.88	1.41	2.18
	SEE	1.27	2.30	2.49	1.37	2.84	3.62	3.24	2.67	4.78	1.98
All countries	R ²	.55	.48	.64	.13	.71	.17	.72	.51	.04	.62
	DW	1.98	1.74	2.11	1.28	1.90	1.52	2.00	1.68	.96	1.98
	SEE	1.38	2.62	2.79	1.77	3.08	4.60	3.71	3.08	5.51	2.61

All SEEs are to be divided by 100.

TABLE A2.1

ESTIMATES OF INCOME ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES:

AUTONOMOUS TRENDS SUPPRESSED

(Standard errors are in parentheses)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
η_1^c	η_2^c	η_3^c	η_4^c	η_5^c	η_6^c	η_7^c	η_8^c	η_9^c	η_{10}^c	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
U.S.	.29 (.11)	.53 (.10)	.90 (.13)	.94 (.10)	.78 (.19)	1.44 (.26)	1.61 (.23)	1.36 (.13)	1.02 (.26)	.81 (.09)
Canada	.59 (.08)	.66 (.12)	.73 (.19)	.77 (.14)	1.05 (.17)	.93 (.65)	1.34 (.16)	1.93 (.18)	1.64 (.55)	1.24 (.14)
Sweden	.29 (.10)	1.03 (.31)	.96 (.29)	.74 (.23)	1.33 (.24)	1.14 (.35)	1.74 (.26)	1.73 (.26)	1.40 (.48)	.82 (.33)
Switzerland	.72 (.09)	.93 (.17)	1.11 (.31)	.69 (.16)	.84 (.25)	.87 (.21)	1.68 (.20)	1.15 (.10)		.90 (.16)
Denmark	.29 (.16)	.62 (.11)	1.25 (.34)	.70 (.24)	.92 (.35)	.37 (.34)	1.99 (.30)	1.25 (.24)	1.38 (.72)	.90 (.16)
Australia	.36 (.08)	.54 (.09)	.41 (.19)	1.35 (.15)	2.11 (.55)	.68 (.36)	1.51 (.19)	2.18 (.42)	.79 (.89)	.88 (.10)
France	.44 (.03)	.37 (.08)	.38 (.12)	1.16 (.09)	.89 (.20)	1.73 (.14)	1.55 (.11)	1.24 (.09)	.88 (.50)	1.08 (.04)
Germany	.54 (.05)		.94 (.11)	.68 (.15)	1.07 (.11)	.74 (.17)	1.96 (.16)	1.13 (.09)		1.10 (.08)
Belgium	.49 (.09)	.83 (.15)	.85 (.16)	.82 (.12)	1.32 (.17)	1.41 (.22)	1.32 (.15)	1.25 (.14)	.48 (.08)	1.42 (.28)
Norway	.40 (.06)	.71 (.18)	.66 (.15)	.81 (.18)	1.26 (.15)	.91 (.30)	2.24 (.28)	1.38 (.12)	.58 (.42)	.77 (.13)
Netherlands	.50 (.07)	.85 (.19)	.87 (.19)	.89 (.13)	1.53 (.21)	1.13 (.23)	1.28 (.17)	1.05 (.22)	1.18 (.20)	1.11 (.14)
Iceland	.44 (.09)	.93 (.16)	1.22 (.21)	.18 (.11)	1.58 (.23)	.92 (.29)	1.85 (.40)	1.38 (.24)	.39 (.28)	1.67 (.22)
Finland	.51 (.06)	1.23 (.16)	.97 (.30)	.57 (.10)	1.66 (.20)	1.28 (.19)	1.78 (.28)	1.46 (.19)	.72 (.62)	1.17 (.17)
Austria	.45 (.11)	.49 (.21)	1.39 (.19)	.81 (.22)	1.32 (.34)	.25 (.41)	2.12 (.23)	1.02 (.18)	.44 (.31)	.81 (.12)
Japan	.57 (.11)		.96 (.29)	1.04 (.21)	1.26 (.55)	1.20 (.28)	1.39 (.24)	.98 (.20)		1.52 (.23)
U.K.	.20 (.09)	.60 (.29)	1.12 (.13)	.60 (.13)	1.44 (.23)	1.01 (.44)	1.77 (.23)	1.52 (.17)	1.24 (.35)	1.12 (.11)
Spain	.65 (.10)	.93 (.14)	.84 (.15)	.81 (.09)	.96 (.14)	2.19 (.37)	2.16 (.32)	1.41 (.17)	.89 (.19)	1.22 (.13)
Italy	.72 (.06)	.75 (.11)	1.16 (.16)	.74 (.07)	1.29 (.19)	1.50 (.24)	1.68 (.19)	.74 (.13)	.52 (.29)	1.10 (.10)
Mean	.47 (.02)	.75 (.04)	.93 (.05)	.79 (.04)	1.26 (.07)	1.09 (.08)	1.72 (.06)	1.34 (.05)	.90 (.12)	1.09 (.04)
All countries	.49 (.02)	.72 (.04)	.97 (.05)	.74 (.04)	1.30 (.05)	1.12 (.07)	1.76 (.05)	1.32 (.04)	.60 (.08)	1.20 (.04)

TABLE A2.2

ESTIMATES OF PRICE ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES:

AUTONOMOUS TRENDS SUPPRESSED

(Standard errors are in parentheses)

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)	γ_1^C	γ_2^C	γ_3^C	γ_4^C	γ_5^C	γ_6^C	γ_7^C	γ_8^C	γ_9^C	γ_{10}^C
U.S.	-.54 (.11)	-.10 (.11)	-.37 (.14)	-.27 (.37)	-1.27 (.39)	-.22 (.46)	-.59 (.39)	-.59 (.18)	.73 (.63)	-.57 (.30)
Canada	-.65 (.09)	-.59 (.19)	-.75 (.28)	-.32 (.30)	-.76 (.50)	1.54 (1.55)	-.96 (.35)	-.52 (.28)	-.43 (.47)	-.70 (.22)
Sweden	-.62 (.14)	-.41 (.32)	-.58 (.24)	-.04 (.30)	-.36 (.32)	.03 (.14)	-1.26 (.52)	-1.29 (.44)	-.27 (.13)	-.85 (.39)
Switzerland	-.59 (.12)	-.51 (.27)	.39 (.53)	.07 (.19)	-.37 (.39)	.27 (.21)	-.71 (.46)	-.79 (.22)		.50 (.30)
Denmark	-.19 (.17)	-.32 (.11)	-.16 (.32)	.43 (.22)	-.96 (.47)	-.56 (.32)	-.69 (.51)	-.88 (.35)	1.13 (.95)	-.13 (.31)
Australia	-.39 (.08)	-.51 (.08)	-.82 (.28)	-.23 (.18)	.12 (.58)	-.26 (.31)	-.52 (.33)	-.82 (.41)	-1.70 (.80)	-.10 (.10)
France	-.32 (.08)	-.19 (.11)	-.86 (.31)	.49 (.17)	-.54 (.60)	-.36 (.39)	-1.19 (.25)	-.60 (.17)	-.67 (.71)	-.88 (.10)
Germany	-.52 (.16)		-.09 (.49)	.32 (.25)	-.57 (.26)	-.71 (.21)	-1.62 (.45)	-.83 (.26)		-.16 (.22)
Belgium	-.21 (.15)	-.31 (.29)	-.43 (.26)	.01 (.17)	-.23 (.31)	-.02 (.24)	-.78 (.33)	-.74 (.28)	.03 (.10)	-.42 (.17)
Norway	-.31 (.14)	-1.04 (.18)	-1.09 (.36)	.52 (.52)	-.49 (.38)	-.89 (.33)	-.69 (.58)	-.92 (.19)	-.12 (.64)	.51 (.34)
Netherlands	-.32 (.23)	-.48 (.31)	-1.32 (.49)	-.56 (.21)	-.15 (.44)	-.13 (.24)	-1.95 (.29)	-.28 (.43)	-.22 (.39)	-.26 (.53)
Iceland	-.24 (.17)	-.28 (.31)	-.36 (.30)	-.04 (.13)	-.96 (.42)	-.47 (.40)	-2.18 (1.23)	-1.20 (.31)	-.62 (.28)	-.75 (.27)
Finland	-.41 (.15)	-.69 (.20)	.84 (.66)	-.39 (.14)	.76 (.48)	-.27 (.48)	-.51 (.31)	-1.56 (.32)	-.53 (.58)	-.01 (.44)
Austria	-.35 (.20)	-.27 (.18)	-.03 (.39)	.53 (.32)	.11 (.64)	.19 (.34)	-.57 (.40)	-.61 (.33)	.11 (.15)	-.67 (.24)
Japan	-.16 (.30)		.03 (.37)	-.48 (.24)	-.37 (.56)	-.67 (.26)	-.99 (.42)	-1.09 (.53)		-1.20 (.67)
U.K.	.00 (.13)	-.62 (.20)	-.24 (.09)	.18 (.15)	-.35 (.36)	.88 (.56)	-.23 (.33)	-.69 (.24)	-1.08 (.33)	-.71 (.22)
Spain	-.16 (.28)	-.01 (.14)	-.42 (.33)	.04 (.17)	-.68 (.24)	-.57 (.40)	-.63 (.35)	-.41 (.22)	.01 (.21)	.16 (.23)
Italy	-.03 (.20)	-.23 (.10)	-.37 (.44)	-.08 (.13)	-.27 (.25)	-.68 (.26)	-.04 (.32)	-1.24 (.29)	-.17 (.34)	-.16 (.21)
Mean	-.33 (.04)	-.41 (.05)	-.37 (.09)	.01 (.06)	-.41 (.10)	-.16 (.12)	-.89 (.11)	-.84 (.07)	-.25 (.13)	-.36 (.09)
All countries	-.40 (.04)	-.40 (.05)	-.37 (.07)	-.05 (.05)	-.50 (.09)	-.28 (.08)	-.89 (.09)	-.87 (.07)	-.22 (.08)	-.49 (.06)

TABLE A2.3

SUMMARY STATISTICS FOR THE DEMAND EQUATIONS FOR 10 COMMODITIES

IN 18 COUNTRIES: AUTONOMOUS TRENDS SUPPRESSED

Country		Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
U.S.	DW	1.42	1.26	2.26	1.30	1.07	1.00	1.79	1.70	.38	1.78
	SEE	1.50	1.32	1.76	1.30	2.37	2.80	3.02	1.64	2.45	1.08
Canada	DW	1.43	1.56	2.15	1.24	1.14	1.03	1.96	1.88	.37	1.80
	SEE	1.26	1.67	2.63	2.16	2.18	9.77	2.18	2.43	6.34	1.54
Sweden	DW	1.91	.74	1.17	1.00	1.44	1.62	2.27	1.47	1.86	1.99
	SEE	.97	2.94	2.61	1.92	2.49	3.34	2.60	2.38	4.81	2.53
Switzerland	DW	1.92	.58	.65	1.57	1.04	1.23	1.55	1.69		1.28
	SEE	.98	2.01	3.13	1.86	3.05	2.13	2.55	1.28		1.31
Denmark	DW	2.53	1.46	1.91	1.64	1.06	1.23	2.20	1.36	.87	2.47
	SEE	1.62	1.25	3.91	2.76	3.86	4.01	3.13	2.80	8.57	1.88
Australia	DW	1.04	1.51	1.48	1.45	1.41	2.41	2.01	2.57	.51	2.24
	SEE	.97	1.09	2.24	1.85	4.13	3.72	2.40	5.19	7.76	1.26
France	DW	1.40	2.16	1.72	2.77	1.82	1.82	2.08	2.24	2.53	1.53
	SEE	.52	1.16	1.58	1.11	2.35	2.11	1.64	1.26	6.53	.60
Germany	DW	2.12		1.45	1.67	1.67	1.68	1.60	1.37		2.08
	SEE	.82		1.85	2.09	1.65	2.29	2.61	1.60		1.28
Belgium	DW	2.10	2.03	2.62	2.33	2.50	1.87	2.10	2.93	1.16	2.35
	SEE	1.41	2.41	2.57	1.99	2.88	3.36	2.50	2.33	1.27	4.59
Norway	DW	1.99	1.54	1.28	2.33	1.45	1.30	2.32	1.96	1.17	2.06
	SEE	.79	2.54	2.04	2.52	2.07	3.78	3.97	1.58	5.00	1.54
Netherlands	DW	2.16	2.57	1.83	1.31	2.50	1.99	2.10	1.47	2.38	1.64
	SEE	1.77	3.81	4.36	3.01	4.07	4.42	4.01	4.12	4.02	2.93
Iceland	DW	2.48	2.54	1.47	.85	2.18	1.42	1.47	.93	1.04	2.73
	SEE	2.48	4.36	5.50	2.92	5.37	7.06	8.78	6.01	6.51	6.19
Finland	DW	2.13	1.98	1.90	1.49	1.62	1.63	1.76	2.36	.23	1.58
	SEE	1.19	3.28	6.06	2.07	3.74	3.91	5.53	3.89	11.18	2.72
Austria	DW	2.90	2.46	1.13	2.25	2.06	1.35	1.90	1.91	2.23	2.33
	SEE	1.69	2.83	2.08	2.42	3.97	3.83	3.56	2.34	4.66	1.27
Japan	DW	1.82		1.53	.66	1.75	1.25	1.76	1.97		2.15
	SEE	1.36		3.83	2.85	6.97	3.84	3.24	2.68		2.53
U.K.	DW	2.08	1.75	1.71	1.81	1.45	1.36	1.51	1.82	.97	2.43
	SEE	.98	2.39	1.45	1.34	2.53	4.85	2.62	1.88	3.45	1.26
Spain	DW	1.67	1.84	1.82	1.76	1.62	1.48	2.04	2.53	1.75	1.83
	SEE	1.77	2.25	2.13	1.40	2.33	5.69	4.29	2.46	3.03	2.12
Italy	DW	1.49	1.93	1.76	2.19	1.28	1.50	1.84	2.42	1.16	2.69
	SEE	.97	1.67	2.67	1.01	2.95	3.82	3.09	1.95	4.81	1.35
Mean	DW	1.92	1.74	1.66	1.65	1.61	1.51	1.91	1.92	1.24	2.05
	SEE	1.28	2.31	2.91	2.03	3.27	4.15	3.43	2.66	5.36	2.11
All countries	DW	1.97	1.72	1.78	1.16	1.61	1.53	2.01	1.69	.98	1.96
	SEE	1.39	2.65	3.21	2.44	3.45	4.75	3.78	3.09	5.58	2.61

All SEEs are to be divided by 100.

TABLE A2.4

FREQUENCY DISTRIBUTIONS OF INCOME AND PRICE ELASTICITIES
FOR 10 COMMODITIES IN 18 COUNTRIES: AUTONOMOUS TRENDS SUPPRESSED

(Percentages)

Range	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<u>Income Elasticities (η_i^c)</u>											
$(-\infty, -1]$	0	0	0	0	0	0	0	0	0	0	0
$(-1, 0]$	0	0	0	0	0	0	0	0	0	0	0
$(0, 1]$	100	88	67	83	28	44	0	11	60	39	51
$(1, \infty)$	0	12	33	17	72	56	100	89	40	61	49
<u>Price Elasticities (γ_i^c)</u>											
$(-\infty, -1]$	0	6	11	0	6	0	28	28	13	6	10
$(-1, 0]$	94	94	72	50	78	72	72	72	53	78	74
$(0, 1]$	6	0	17	50	17	22	0	0	27	17	15
$(1, \infty)$	0	0	0	0	0	6	0	0	7	0	1

TABLE A2.5

FREQUENCY DISTRIBUTIONS OF $|t|$ -VALUES OF
INCOME AND PRICE ELASTICITIES FOR 10 COMMODITIES IN 18 COUNTRIES:

AUTONOMOUS TRENDS SUPPRESSED

(Percentages)

Range	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous	All goods
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<u>Income Elasticities (η_i^c)</u>											
[0 . 1)	0	0	0	0	0	6	0	0	7	0	1
[1 . 2)	6	0	0	6	0	17	0	0	47	0	7
[2 . 3)	17	12	6	6	11	6	0	0	13	6	7
[3 . ∞)	78	88	94	89	89	72	100	100	33	94	85
<u>Price Elasticities (γ_i^c)</u>											
[0 . 1)	22	19	33	44	44	50	11	6	60	39	32
[1 . 2)	28	38	22	39	28	28	50	17	13	22	29
[2 . 3)	11	12	39	17	22	17	22	33	20	22	22
[3 . ∞)	39	31	6	0	6	6	17	44	7	17	17

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