FURTHER EVIDENCE ON THE FRISCH CONJECTURE

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1. INTRODUCTION

Frisch's (1959) famous conjecture states that the income elasticity of the marginal utility of income decreases in absolute value as the consumer (or country) becomes more affluent. Frisch (1959, p.189) provides some numerical conjectures for the dependence of the elasticity (which he calls the 'money flexibility') on the level of real income, which we quote below:

"We may, perhaps, assume that in most cases the money flexibility has values of the order of magnitude given below.

- 10 for an extremely poor and apathetic part of the population.
- 4 for the slightly better off but still poor part of the population with a fairly pronounced desire to become better off.
- 2 for the middle income bracket, 'the median part' of the population.
- .7 for the better off part of the population.
- .1 for the rich part of the population with ambitions towards 'conspicuous consumption.'

It would be a very promising research project to determine the money flexibility for different countries and for different types of populations. A universal 'atlas' should be constructed. It would serve an extremely useful purpose in demand analysis."

In this paper we verify whether or not Frisch's conjecture is supported by data from 18 OECD countries.

2. BUDGET SHARES, MARGINAL SHARES, DIVISIA AND FRISCH MOMENTS

Let the consumer purchase n goods and let p_i and q_i be the price and quantity demanded of good i . Then

$$M = \sum_{i=1}^n p_i q_i$$

is total expenditure ('income' for short) and

$$w_i = \frac{p_i q_i}{M}$$

is the budget share of i . We define the marginal share of commodity i as

$$\theta_i = \frac{\partial(p_i q_i)}{\partial M}.$$

This share answers the question, if income rises by \$1 how much of this increment is spent on good i ? It can be easily shown that the budget shares and the marginal shares add up to one.

The Divisia volume index measures the change in the consumer's real income. This index is a budget-share-weighted average of the n logarithmic quantity changes, $d(\log q_1), \dots, d(\log q_n)$.

$$(2.1) \quad d(\log Q) = \sum_{i=1}^n w_i d(\log q_i).$$

The analogous Divisia price index is defined as

$$(2.2) \quad d(\log P) = \sum_{i=1}^n w_i d(\log p_i).$$

Equations (2.1) and (2.2) can be considered as first-order

weighted moments of

$$d(\log q_1), \dots, d(\log q_n)$$

and

$$d(\log p_1), \dots, d(\log p_n).$$

The corresponding second-order moments, or variances, are

$$(2.3) \quad K = \sum_{i=1}^n w_i [d(\log q_i) - d(\log Q)]^2 = \sum_{i=1}^n w_i \left[d \left[\log \frac{q_i}{Q} \right] \right]^2$$

and

$$(2.4) \quad \Pi = \sum_{i=1}^n w_i [d(\log p_i) - d(\log P)]^2 = \sum_{i=1}^n w_i \left[d \left[\log \frac{p_i}{P} \right] \right]^2.$$

These 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. These measures are known as the Divisia variances of the logarithmic quantity and price changes. For brevity, we shall refer to K and Π as the Divisia quantity and price variances.

The associated Divisia quantity-price covariance, which measures the co-movement of quantities and prices, is

$$(2.5) \quad \begin{aligned} \Gamma &= \sum_{i=1}^n w_i [d(\log q_i) - d(\log Q)][d(\log p_i) - d(\log P)] \\ &= \sum_{i=1}^n w_i d \left[\log \frac{q_i}{Q} \right] d \left[\log \frac{p_i}{P} \right]. \end{aligned}$$

One would expect Γ to be negative, reflecting the tendency of the consumer to move away from those goods having above-average price increases.

The analogous Frisch indexes use as weights marginal shares rather than budget shares. The Frisch quantity and price indexes are defined as

$$d(\log Q') = \sum_{i=1}^n \theta_i d(\log q_i)$$

and

$$(2.6) \quad d(\log P') = \sum_{i=1}^n \theta_i d(\log p_i).$$

The Frisch variances are

$$(2.7) \quad K' = \sum_{i=1}^n \theta_i [d(\log q_i) - d(\log Q')]^2 = \sum_{i=1}^n \theta_i \left[d \left[\log \frac{q_i}{Q'} \right] \right]^2$$

and

$$(2.8) \quad \Pi' = \sum_{i=1}^n \theta_i [d(\log p_i) - d(\log P')]^2 = \sum_{i=1}^n \theta_i \left[d \left[\log \frac{p_i}{P'} \right] \right]^2.$$

3. ESTIMATING THE MONEY FLEXIBILITY

We estimate the money flexibility in reciprocal form which we call the 'income flexibility', to be denoted by ϕ . We start with the differential demand equation for good i (see Clements, 1987),

$$(3.1) \quad w_i d(\log q_i) = \theta_i d(\log Q) + \sum_{j=1}^n \pi_{ij} d(\log p_j),$$

where π_{ij} is the $(i,j)^{th}$ Slutsky coefficient which measures the effect of a change in the price of good j on the demand for i under the condition that real income remains constant [i.e., $d(\log Q) = 0$].

When the consumer's utility function is of the additive (or preference independent) form it is the sum of n sub-utility functions, one for each good,

$$(3.2) \quad u(q_1, \dots, q_n) = \sum_{i=1}^n u_i(q_i).$$

Under preference independence the marginal utility of good i depends only on the consumption of i . Under (3.2) the Slutsky coefficients in (3.1) take the form (see Clements, 1987)

$$(3.3) \quad \pi_{ij} = \phi \theta_i (\delta_{ij} - \theta_j), \quad i, j=1, \dots, n,$$

where δ_{ij} is the Kronecker delta. Substituting (3.3) in (3.1) and using (2.6) we obtain

$$(3.4) \quad w_i d(\log q_i) = \theta_i d(\log Q) + \phi \theta_i d \left[\log \frac{p_i}{P} \right] + \epsilon_i,$$

where we have added a disturbance term ϵ_i . This equation makes clear the importance of the value of ϕ in determining the price responses. We use (3.4) for $i=1, \dots, n$ to obtain estimates of the income flexibility by treating the marginal shares as known.

Theil (1975/76) shows that under (3.2) and rational random behaviour, the variances and covariances of the ϵ_i 's of (3.4) take the following form

$$(3.5) \quad \text{cov}[\epsilon_i, \epsilon_j] = \sigma^2 \theta_i (\delta_{ij} - \theta_j),$$

where σ^2 is an unknown parameter independent of i and j . Theil also shows that under (3.5) the weighted least squares estimator of the income flexibility, ϕ , in (3.4) is given by

$$(3.6) \quad \hat{\phi} = \frac{C}{H},$$

where

$$(3.7) \quad C = \Gamma + d(\log Q) d \left[\log \frac{P}{P} \right].$$

The sampling variance of $\hat{\phi}$ is

$$(3.8) \quad \text{var } \hat{\phi} = \frac{\sigma^2}{\Pi'}$$

and an unbiased estimator of σ^2 is given by

$$(3.9) \quad \hat{\sigma}^2 = \frac{1}{n-2} [V - \hat{\phi}C].$$

where

$$(3.10) \quad V = \sum_{i=1}^n \frac{1}{\theta_i} \left[w_i d(\log q_i) - \theta_i d(\log Q) \right]^2.$$

In Appendix A1 we present an alternative derivation of expression (3.6) which does not require rational random behaviour.

4. THE DATA

We use data from 18 OECD countries. For 15 countries, goods and services are classified into 10 commodity groups, namely food, beverages, clothing, housing, durables, medical care, transport, recreation, education and miscellaneous. Two of the remaining 3 countries, Germany and Japan, have 8 commodities, as beverages are included in food and education is included in recreation. Switzerland has 9 commodities as education is included in recreation. See Selvanathan (1987a) for details of the data source.

Table 4.1 summarizes the general characteristics of the database. Column 2 presents the sample period for each country and column 3 gives the sample size. In column 4 we present per capita gross domestic product (GDP) expressed in 1975 international dollars. The 18 countries are listed in the order of declining per capita GDP. As can be seen, the U.S. has the highest per capita GDP, while Italy has the lowest.

TABLE 4.1
CHARACTERISTICS OF THE DATABASE

Country	Sample period	Sample size	Per capita GDP in 1975 international dollars
(1)	(2)	(3)	(4)
1. United States	1960-1981	21	7132
2. Canada	1960-1981	21	6788
3. Sweden	1964-1981	17	6749
4. Switzerland	1960-1981	21	6082
5. Denmark	1966-1981	15	5969
5. Australia	1960-1981	21	5919
6. France	1964-1981	17	5864
8. Germany	1960-1981	21	5758
9. Belgium	1960-1981	21	5554
10. Norway	1964-1981	17	5419
11. Netherlands	1952-1977	25	5321
12. Iceland	1960-1973	13	5201
13. Finland	1960-1977	17	5192
14. Austria	1964-1981	17	4994
15. Japan	1970-1981	11	4905
16. United Kingdom	1964-1981	17	4601
17. Spain	1964-1977	13	4032
18. Italy	1964-1981	17	3870

Note: Sample size is after lagging.

5. 322 ESTIMATES OF THE INCOME FLEXIBILITY

The differential demand equation under preference independence, (3.4), is in infinitesimal changes. To apply it to finite-change data obviously requires some adjustments. We denote countries by the superscript $c=1, \dots, 18$; years by the subscript $t=1, \dots, T^c$; and goods by the subscript $i=1, \dots, n^c$. We replace w_i in (3.4) with $\bar{w}_{it}^c = \frac{1}{2}(w_{it}^c + w_{i,t-1}^c)$; $d(\log q_i)$ with $Dq_{it}^c = \log q_{it}^c - \log q_{i,t-1}^c$; θ_i with θ_{it}^c ; $d(\log Q)$ with $DQ_t^c = \sum_{i=1}^{n^c} \bar{w}_{it}^c Dq_{it}^c$; ϕ with ϕ^c ; $d[\log (p_i/P')]$ with $Dp_{it}^c - DP_t^c = [\log p_{it}^c - \log p_{i,t-1}^c] - \sum_{j=1}^{n^c} \theta_{jt}^c Dp_{jt}^c$; and ϵ_i with ϵ_{it}^c .

With these adjustments the demand equation for good i in country c at time t is

$$(5.1) \quad \bar{w}_{it}^c Dq_{it}^c = \theta_{it}^c DQ_t^c + \phi^c \theta_{it}^c [Dp_{it}^c - DP_t^c] + \epsilon_{it}^c.$$

We use Working's (1943) model for the specification of the marginal shares, whereby θ_i and w_i differ by a constant. That is,

$$(5.2) \quad \theta_{it}^c = \bar{w}_{it}^c + \beta_i^c, \quad i=1, \dots, n^c,$$

where β_i^c is a coefficient satisfying $\sum_{i=1}^{n^c} \beta_i^c = 0$.

Selvanathan (1987a) estimates by maximum likelihood (ML) model (5.1) with (5.2) for $i=1, \dots, n^c$ goods for the 18 OECD countries. To allow for trend-like changes in taste etc., Selvanathan adds an intercept term to each equation, which we denote by α_i^c . We present the ML estimates of the intercept terms and the income coefficients of (5.1) in Appendix A2. In Appendix A2 we also present the marginal shares implied by the estimates.

We use these estimates of the marginal shares to obtain one-period estimates of the income flexibility. With intercept terms added to the model, the one-period estimator of the income flexibility and its variance are still given by (3.6) and (3.8) with the addition of a time subscript (t) and a country superscript (c). However, the term C in (3.6) becomes C_t^c which is defined by (3.7) plus $\sum_{i=1}^n \alpha_i^c D_{it}^c$; and V in (3.9) becomes V_t^c defined by (3.10) with minus the intercept ($-\alpha_i^c$) added to the term in the square bracket.

Table 5.1 presents the 322 one-period estimates of the income flexibilities for the 18 countries. We shall come back to the last row in the next section. Figure 5.1 presents the histogram of the 322 income flexibilities. As can be seen, most of the estimates are clustered around -.5.

6. A CONSTANT INCOME FLEXIBILITY FOR EACH COUNTRY

Assuming that the disturbances are uncorrelated over time, it can be easily shown that a common estimator of ϕ^c for all T^c years in country c is given by a weighted average of $\hat{\phi}_t^c$, $t=1, \dots, T^c$, the weights being inversely proportional to their variances (see Theil, 1975/76). That is,

$$(6.1) \quad \hat{\phi}^c = \sum_{t=1}^{T^c} \omega_t^c \hat{\phi}_t^c,$$

where $\omega_t^c = \Pi_t^c / \Pi^c$, with $\Pi^c = \sum_{t=1}^{T^c} \Pi_t^c$. Also we have

$$\text{var } \hat{\phi}^c = \frac{\sigma^{c^2}}{\Pi^c}.$$

TABLE 5.1
INCOME FLEXIBILITIES IN 18 COUNTRIES
(Standard errors are in parentheses)

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	-	-	-	-	-	-	-	-	-	-	-2.63	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-1.22	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	.27	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-.83	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-.62	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-.72	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-1.95	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-1.21	-	-	-	-	-	-	-
1961	-1.42	-.24	-	-.55	-	-.47	-	-1.12	-.31	-	-1.99	-.29	-.66	-	-	-	-	-
1962	.43	-1.85	-	-.72	-	.07	-	-.76	-.01	-	.06	-.87	-.40	-	-	-	-	-
1963	.04	-1.53	-	-.69	-	-.37	-	4.23	.14	-	.33	-.84	.40	-	-	-	-	-
1964	-.17	-.97	-	-.71	-	-.70	-	-1.54	.61	-	-1.59	-.80	-.69	-	-	-	-	-
1965	.56	-.77	-.56	-.96	-	-.08	-.02	-.42	-.05	.26	-.89	-.89	-.64	-.76	-	-.54	-.06	.10
1966	.31	-.93	-.32	-.50	-	.42	-.33	-.54	-.23	-.56	-1.31	-.27	-.06	.95	-	-.26	-1.01	-.17
1967	-.76	-.19	-.79	-.58	-.56	-.35	.00	-.78	-.48	-.46	-.56	.48	.51	-.03	-	-.08	-.27	-.02
1968	-.26	-.90	-.01	.21	-.04	-.27	-.42	-.09	-.09	-1.24	-.73	-.83	-.15	.08	-	-.18	-.37	-.14
1969	-.29	-.28	-.69	.16	-.33	-1.20	-.28	-1.07	-.63	-.15	-.12	-.67	-1.67	-.25	-	-.21	.01	-.27
1970	1.13	-.87	-.67	-.90	-.06	-.32	.69	-.19	.02	-1.68	-1.24	-.93	-1.21	-.37	-	-.43	-.35	-.57
1971	.87	.86	-.80	.18	-.45	-.40	-1.24	-.79	-.17	-.43	-1.03	-.69	-.32	-1.33	-.10	.48	.30	.49
1972	-.52	-.91	-.69	-.51	-.69	-.51	-.51	-1.52	-.29	-.62	-.01	-.51	-.95	-1.10	-1.08	-.92	-.57	-.65
1973	-1.00	-.67	-.86	.45	-.79	-.89	-.43	-2.43	-.25	-1.00	-1.23	.06	-.82	-.17	-.28	-.64	-.14	-.61
1974	-.48	-1.02	-.66	-.54	-.79	-1.07	-.62	-.69	-.90	-.42	-.48	-	-.52	-.08	-.50	-1.09	-.72	-.43
1975	-.78	-.47	-.66	-1.58	-.54	-.66	.10	-1.20	.12	-.31	-1.06	-	-.87	.24	.13	-.09	.06	-.25
1976	-.56	-.59	-.30	-.07	-.35	-.37	-.34	1.50	.09	-2.07	-.13	-	-1.07	.27	-1.25	-.34	-.01	.04
1977	-.49	-.86	-.75	-1.23	-.47	.05	-.42	-1.09	.59	.35	-.83	-	-.62	-1.54	-.29	-.21	.00	-.09
1978	-.88	-.53	-.49	-.77	-.97	-.60	-.82	-1.24	-.83	-.55	-	-	-	-.35	-.67	-.79	-	-.03
1979	-.41	-.35	-.57	-1.09	-.29	-.28	-.48	-.94	-.51	-.48	-	-	-	-.31	-.73	-.36	-	-.08
1980	-.42	-.32	-.80	-.35	-.72	-1.14	-.56	-1.06	-.67	-.61	-	-	-	-.29	-1.10	-.39	-	-.09
1981	-.56	-.43	-.48	-.79	-.72	-.35	-.79	-.13	-.07	-.80	-	-	-	-.45	-.82	-.34	-	-.48
Weighted mean	-.49 (.07)	-.64 (.14)	-.63 (.16)	-.50 (.14)	-.51 (.09)	-.53 (.07)	-.46 (.07)	-.65 (.14)	-.15 (.05)	-.58 (.17)	-.84 (.09)	-.64 (.11)	-.40 (.13)	-.30 (.16)	-.46 (.09)	-.40 (.06)	-.26 (.07)	-.22 (.06)

INCOME FLEXIBILITIES IN 18 COUNTRIES

FIGURE 5.1

An unbiased estimator of σ^2 is given by

$$\hat{\sigma}^2 = \frac{1}{(n^c - 1)T^c - 1} \sum_{t=1}^{T^c} [V_t^c - \hat{\phi}^c C_t^c].$$

Using the same procedure we obtain a weighted mean of the income flexibilities over the 18 countries, the weights being inversely proportional to their variances:

$$(6.2) \quad \hat{\phi} = \frac{18}{\sum_{c=1}^{18} \omega^c} \hat{\phi}^c,$$

where $\omega^c = \Pi^c / \Pi'$ with $\Pi' = \sum_{c=1}^{18} \Pi^c$. The variance of $\hat{\phi}$ is given by

$$\text{var } \hat{\phi} = \frac{\sigma^2}{\Pi'} ,$$

where

$$\hat{\sigma}^2 = \frac{1}{\frac{18}{\sum_{d=1}^{18} (n^d - 1)T^d - 1}} \sum_{c=1}^{18} \sum_{t=1}^{T^c} [V_t^c - \hat{\phi}^c C_t^c]$$

is an unbiased estimator of σ^2 .

The last row of Table 5.1 presents the weighted mean of the income flexibilities given by (6.1) and the standard error for each country. Using (6.2) yields an estimate of ϕ for all countries,

$$\hat{\phi} = -.46 (.03).$$

As can be seen from the histogram of the one-period income flexibilities presented in Figure 5.1, $-.46$ lies in the vicinity of the interval where the frequency attains its maximum.

7. TESTING FRISCH'S CONJECTURE

As indicated in Section 1, Frisch conjectures that the money flexibility should decrease in absolute value as the consumer (or country) becomes more affluent. As ϕ is the reciprocal of the money flexibility, the conjecture is that ϕ should increase in absolute value with increasing real income. In this section we use Theil's (1975/76, Ch.15) methodology to test whether the income flexibilities presented in Table 5.1 vary in this manner.

To analyse the effect of income on the income flexibility in country c over time, we regress the ϕ_t^c -estimates presented in Table 5.1 on the logarithm of real income (y_t^c).

$$(7.1) \quad \phi_t^c = \eta_0^c + \eta_1^c y_t^c + \xi_t^c, \quad t=1, \dots, T^c.$$

where η_0^c and η_1^c are parameters to be estimated; and ξ_t^c is an independent disturbance term with mean zero. The logarithm of real income is given by the accumulated value of the Divisia volume index,

$$y_t^c = y_{t-1}^c + DQ_t^c,$$

with initial value $y_0^c = 0$. Frisch would expect η_1^c to be negative (as $\phi^c < 0$) and significant, indicating that ϕ^c declines algebraically with increasing income.

We use weighted least squares to estimate (7.1), where the weights are inversely proportional to the standard errors of the income flexibilities. The first 18 rows of column 2 of Table 7.1 present the t -statistics for the null hypothesis that $\eta_1^c = 0$ against the alternative $\eta_1^c < 0$ for each country. As can be seen, for all countries except France and Finland, the t -statistics are not significant at the

TABLE 7.1
t-STATISTICS AND RESTRICTED WEIGHTED LEAST SQUARES ESTIMATES
OF INCOME FLEXIBILITY IN 18 COUNTRIES
(Standard errors are in parentheses)

Country	t-statistics	Restricted estimates	Weighted means
(1)	(2)	(3)	(4)
1. U.S.	t(19) = -.57	-.556 (.071)	-.487 (.064)
2. Canada	t(19) = 2.45	-.681 (.077)	-.642 (.132)
3. Sweden	t(15) = -1.15	-.661 (.044)	-.626 (.155)
4. Switzerland	t(19) = -1.01	-.660 (.111)	-.501 (.130)
5. Denmark	t(13) = -1.22	-.592 (.062)	-.513 (.083)
6. Australia	t(19) = -1.61	-.426 (.082)	-.527 (.064)
7. France	t(15) = -2.41*	-.488 (.055)	-.462 (.068)
8. Germany	t(19) = .25	-.627 (.132)	-.646 (.133)
9. Belgium	t(19) = -.40	-.211 (.064)	-.152 (.049)
10. Norway	t(15) = -1.45	-.663 (.068)	-.583 (.162)
11. Netherlands	t(23) = .68	-.915 (.094)	-.838 (.087)
12. Iceland	t(11) = .71	-.620 (.094)	-.642 (.108)
13. Finland	t(15) = -1.87*	-.223 (.076)	-.404 (.126)
14. Austria	t(15) = -.94	-.361 (.083)	-.297 (.150)
15. Japan	t(9) = -1.62	-.581 (.132)	-.459 (.081)
16. U.K.	t(15) = -.78	-.378 (.078)	-.396 (.057)
17. Spain	t(11) = .65	-.206 (.076)	-.255 (.067)
18. Italy	t(15) = .38	-.137 (.056)	-.218 (.059)
19. All countries	t(16) = -2.06*	-.410 (.043)	-.462 (.023)

A '*' denotes significant at the 5 percent level (but insignificant at the 1 percent level) using a one-tailed test.

5 percent level. For France and Finland, the t-values are insignificant at the 1 percent level. That is, we are unable to reject the null hypothesis at the 5 percent level for 16 countries and at the 1 percent level for all countries. Although the η_1 -estimates for 12 of the 18 countries are negative (as expected by Frisch), 10 of them are insignificant at the 5 percent level and all are insignificant at the 1 percent level. Thus we conclude that the income flexibility is unrelated to real income in most countries. In other words, we reject Frisch within countries.

The first 18 rows of column 3 Table 7.1 present the weighted least squares estimates of η_0^c in (7.1) under the restriction $\eta_1^c = 0$. These η_0^c estimates are interpreted as ϕ^c -estimates also. For comparison, in column 4 we reproduce the weighted means of the ϕ_t^c 's presented in the last row of Table 5.1. In most cases, the two sets of estimates agree fairly well.

Next, we analyse the effect of real income on the value of the income flexibility across countries by estimating

$$(7.2) \quad \phi^c = \eta_0 + \eta_1 y^c + \zeta^c, \quad c=1, \dots, 18,$$

where η_0 and η_1 are parameters to be estimated; y^c is the logarithm of the per capita GDP in 1975; and ζ^c is an independent disturbance term with mean zero. We use the income flexibilities presented in the last row of Table 5.1 and the per capita GDP's given in column 4 of Table 4.1 to estimate (7.2) by weighted least squares. The last row of column 2 of Table 7.1 presents the t-value for the null hypothesis that $\eta_1 = 0$ against the alternative $\eta_1 < 0$. As the one-tailed critical values of $t(16)$ are -1.75 and -2.58 at the 5 percent and 1 percent levels, respectively, the observed t-value is significant at the 5 percent

level, but insignificant at the 1 percent level. The fact that η_1 is negative and significant at the 5 percent level gives some support for Frisch's conjecture across countries. To pursue this matter further, in Figure 7.1 we plot the absolute value of the weighted income flexibility against the weighted logarithm of GDP for the 18 countries. As can be seen, these data do not reveal any clear cut visual evidence in support of Frisch.

8. COMPARISON WITH OTHER STUDIES

The above findings are not strongly in agreement with the Frisch conjecture. Our conclusion is that the income flexibility seems to be more or less invariant in a wide variety of economic circumstances. How does this result agree with previous studies? Also, is our ϕ -value of $-.46$ for all countries consistent with previous estimates?

Brown and Deaton (1972) report the estimates of the income flexibility from various studies obtained under different demand models (the linear expenditure system, Rotterdam and constant elasticity models). They conclude that the results show no evidence of a relationship between the value of the income flexibility and real income. Also, Brown and Deaton suggest that it would be fair to use a value of $-.5$ for the income flexibility.

DeJanvry et al. (1972) collect estimates of the income flexibility from several studies and, in essence, estimate equation (7.2). They find a statistically significant relationship and hence confirm Frisch. As noted by Theil (1980), however, the validity of their conclusion is based on the uncritical acceptance of the previous estimates.

Lluch et al. (1977) use time-series data for 14 countries (developed and underdeveloped) at various levels of commodity aggregation to estimate a variant of the linear expenditure system. They find strong evidence in support of Frisch at the four-commodity level of aggregation, but less support at the two- and one-commodity levels.

Selvanathan (1987b) uses time-series data for 15 OECD countries and finds that ϕ is unrelated to real income. Selvanathan recommends a

value of $-.45$ for the income flexibility for all 15 countries (standard error = $.02$). Although the 15 countries considered are a subset of the 18 considered in the present paper, the two studies use different testing procedures.

Theil (1987) tests Frisch's conjecture for 30 countries using a method similar to that presented in Section 7. He compares the estimates for η_0 and η_1 for all 30 countries with those obtained with 29 countries, by leaving out one country at a time. None of the estimates of η_1 are significant and he concludes that the sample cannot support Frisch in spite of the large income variation.

Theil and Brooks (1970/71) use a modified version of the Rotterdam model in which the income flexibility is a function of income. They obtain the result that the income flexibility is unrelated to real income.

This brief review indicates a lack of unanimity in previous studies about the status of Frisch. It seems, however, that the broad thrust of the literature has not been too kind to Frisch's conjecture. Our rejection of Frisch is in agreement with that broad thrust. Moreover, our ϕ -value of $-.46$ for all countries seems to be consistent with previous estimates. This implies a money flexibility of $1/(-.46) \approx -2$. Going back to Frisch's passage quoted in Section 1, this value corresponds to Frisch's 'median' part of the population which seems not unreasonable.

9. CONCLUSION

In this paper we have presented 322 one-period estimates of the income flexibility (the inverse of the income elasticity of the marginal utility of income) for 18 OECD countries. We then obtained a common estimate of the income flexibility for each country by taking a weighted average of the one-period estimates. These values lie between $-.15$ (for Belgium) and $-.84$ (for the Netherlands). Using a similar method we also obtained an estimate of the income flexibility for all 18 countries simultaneously. This value is $-.46$ with standard error $.03$.

We also found that the 322 income flexibilities seem to be more or less unrelated to systematic differences in income. This result means that the data do not support Frisch's famous conjecture about the income dependence of the income flexibility. We then presented a brief review of previous studies which revealed that our results were in broad agreement with those obtained by others.

APPENDICES

A1. ALTERNATIVE DERIVATION OF THE ϕ -ESTIMATOR

Expression (3.6) for the estimator of ϕ was obtained under the theory of rational random behaviour. In this appendix we present an alternative derivation which does not require rational random behaviour.

Consider the demand model (3.4),

$$w_i d(\log q_i) = \theta_i d(\log Q) + \phi \theta_i d\left[\log \frac{p_i}{P'}\right],$$

where we have suppressed the error term. Multiplying both sides of this equation by $d[\log (p_i/P')]$ and summing over $i=1, \dots, n$, we get

$$(A1.1) \quad \sum_{i=1}^n w_i d(\log q_i) d\left[\log \frac{p_i}{P'}\right] = d(\log Q) \sum_{i=1}^n \theta_i d\left[\log \frac{p_i}{P'}\right] + \phi \sum_{i=1}^n \theta_i \left[d\left[\log \frac{p_i}{P'}\right]\right]^2.$$

The left-hand side of (A1.1) can be written as

$$\begin{aligned} & \sum_{i=1}^n w_i d(\log q_i) d\left[\log \frac{p_i}{P'}\right] + \sum_{i=1}^n w_i d(\log q_i) d\left[\log \frac{P}{P'}\right] \\ &= \sum_{i=1}^n w_i d\left[\log \frac{q_i}{Q}\right] d\left[\log \frac{p_i}{P'}\right] + d(\log Q) \sum_{i=1}^n w_i d\left[\log \frac{p_i}{P'}\right] + d(\log Q) d\left[\log \frac{P}{P'}\right] \\ &= \Gamma + d(\log Q) d\left[\log \frac{P}{P'}\right] = C, \end{aligned}$$

where the first step uses (2.1); the second uses (2.2) and (2.5); and

the last step uses (3.7). Therefore, using (2.6) and (2.8), (A1.1) becomes $C = \phi\pi'$, so that

$$\hat{\phi} = \frac{C}{\pi'}.$$

This is (3.6) of the text.

A2. THE ML ESTIMATES OF THE DEMAND MODEL

In this appendix we present the estimates of the demand model (5.1) of the text. Selvanathan (1987a) estimates this model with constant terms added for 18 OECD countries by maximum likelihood (ML). Tables A2.1 and A2.2 give the ML estimates of the constants (α_i^C) and the income coefficients (β_i^C) of the model.

Table A2.3 presents the marginal shares θ_{it}^C implied by the ML estimates of the income coefficients presented in Table A2.2 for the 18 countries. These θ_{it}^C 's are computed according to equation (5.2). As can be seen, all except 23 of the 3135 marginal shares are positive. However, it should be noted that on average all marginal shares are positive. Since preference independence rules out negative marginal shares, we replace the negative θ_{it}^C 's by the sample mean $\bar{\theta}_i^C = (1/T^C) \sum_{t=1}^{T^C} \theta_{it}^C$ and then re-normalize such that $\sum_{i=1}^n \theta_{it}^C = 1$. The resulting values of the marginal shares are used in the computations reported in the text.

TABLE A2.1

CONSTANT TERMS FOR 10 COMMODITIES IN 18 COUNTRIES

(Asymptotic 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)
1. U.S.	-.121 (.060)	.033 (.039)	-.131 (.069)	.384 (.078)	-.203 (.052)	.351 (.053)	-.418 (.074)	.040 (.058)	.028 (.023)	.037 (.063)
2. Canada	-.213 (.124)	.046 (.085)	.014 (.120)	.581 (.144)	-.177 (.125)	-.300 (.073)	-.103 (.133)	-.026 (.109)	.047 (.038)	.136 (.119)
3. Sweden	-.099 (.071)	-.073 (.046)	-.156 (.081)	.507 (.067)	-.142 (.051)	.067 (.024)	-.108 (.065)	.110 (.058)	.004 (.006)	-.110 (.041)
4. Switzerland	-.100 (.071)	-.122 (.050)	-.258 (.050)	.341 (.053)	-.327 (.053)	.169 (.031)	.063 (.054)	.074 (.060)		.159 (.045)
5. Denmark	-.063 (.080)	-.010 (.064)	-.229 (.059)	.650 (.073)	-.285 (.055)	.017 (.025)	-.208 (.071)	.084 (.057)	.066 (.016)	-.021 (.054)
6. Australia	.122 (.112)	-.074 (.074)	-.227 (.087)	.377 (.087)	-.234 (.111)	.017 (.053)	-.015 (.111)	-.031 (.066)	-.041 (.022)	.106 (.071)
7. France	-.011 (.133)	-.027 (.062)	-.280 (.094)	.510 (.080)	-.299 (.093)	.475 (.131)	-.311 (.097)	.060 (.092)	.001 (.011)	-.118 (.087)
8. Germany	-.043 (.120)		-.251 (.074)	.455 (.060)	-.200 (.081)	-.007 (.028)	-.172 (.081)	.055 (.063)		.161 (.055)
9. Belgium	-.008 (.161)	-.036 (.092)	-.073 (.105)	.164 (.121)	-.087 (.146)	.238 (.088)	.179 (.110)	.045 (.074)	.004 (.017)	-.426 (.155)
10. Norway	.160 (.103)	-.073 (.059)	-.204 (.075)	.502 (.083)	-.026 (.070)	.018 (.044)	-.550 (.085)	.148 (.087)	.000 (.018)	.024 (.068)
11. Netherlands	.049 (.197)	.085 (.082)	-.896 (.148)	.228 (.091)	-.129 (.174)	.316 (.057)	-.045 (.089)	.046 (.062)	.095 (.048)	.250 (.106)
12. Iceland	.185 (.183)	.176 (.130)	-.189 (.152)	.296 (.158)	-.286 (.153)	.276 (.110)	-.470 (.160)	-.001 (.112)	.018 (.027)	-.005 (.121)
13. Finland	-.065 (.183)	-.008 (.125)	-.441 (.135)	.419 (.169)	-.077 (.119)	.095 (.077)	-.075 (.148)	-.090 (.109)	-.058 (.045)	.300 (.124)
14. Austria	.266 (.157)	.059 (.095)	-.226 (.128)	.464 (.104)	-.273 (.118)	.067 (.033)	-.532 (.143)	.100 (.084)	.002 (.011)	.074 (.136)
15. Japan	-.140 (.173)		-.335 (.120)	.711 (.160)	-.403 (.099)	.309 (.109)	.015 (.108)	-.052 (.117)		-.106 (.136)
16. U.K.	-.090 (.073)	-.046 (.039)	-.066 (.069)	.280 (.058)	-.216 (.053)	-.002 (.015)	.055 (.059)	.080 (.050)	.015 (.022)	-.010 (.063)
17. Spain	-.349 (.287)	-.016 (.125)	-.235 (.159)	.406 (.229)	-.216 (.137)	.220 (.105)	-.155 (.156)	.009 (.085)	.054 (.050)	.282 (.128)
18. Italy	-.225 (.121)	.023 (.072)	-.301 (.073)	.161 (.089)	-.083 (.062)	.114 (.050)	.109 (.076)	.114 (.066)	-.002 (.017)	.090 (.081)

All entries are to be divided by 100.

TABLE A2.2
INCOME COEFFICIENTS FOR 10 COMMODITIES IN 18 COUNTRIES

(Asymptotic standard errors are in parentheses)

Country (1)	Food β_1^C (2)	Beverages β_2^C (3)	Clothing β_3^C (4)	Housing β_4^C (5)	Durables β_5^C (6)	Medical care β_6^C (7)	Transport β_7^C (8)	Recreation β_8^C (9)	Education β_9^C (10)	Miscellaneous β_{10}^C (11)
1. U.S.	-.055 (.019)	-.031 (.014)	.027 (.021)	-.115 (.026)	.054 (.017)	-.059 (.021)	.209 (.024)	.014 (.018)	-.003 (.009)	-.041 (.023)
2. Canada	-.007 (.037)	-.025 (.022)	-.015 (.029)	-.183 (.041)	.050 (.034)	.055 (.020)	.084 (.036)	.051 (.027)	.001 (.014)	-.011 (.044)
3. Sweden	-.094 (.025)	.008 (.015)	.038 (.022)	-.190 (.032)	.067 (.021)	-.022 (.005)	.138 (.026)	.054 (.021)	-.001 (.001)	.002 (.021)
4. Switzerland	-.007 (.025)	.033 (.017)	.055 (.016)	-.153 (.020)	.086 (.019)	-.046 (.014)	.063 (.021)	.000 (.023)		-.033 (.022)
5. Denmark	-.124 (.032)	-.028 (.018)	.044 (.016)	-.131 (.024)	.053 (.017)	-.010 (.008)	.187 (.023)	.019 (.018)	-.004 (-)	-.005 (.018)
6. Australia	-.144 (.037)	-.015 (.025)	.027 (.030)	-.059 (.033)	.100 (.031)	-.018 (.025)	.074 (.040)	.072 (.024)	.013 (.012)	-.050 (.027)
7. France	-.115 (.034)	-.024 (.014)	.024 (.023)	-.081 (.024)	.059 (.022)	-.047 (.033)	.146 (.025)	.001 (.020)	-.001 (.003)	.039 (.024)
8. Germany	-.113 (.031)		.051 (.020)	-.133 (.020)	.053 (.020)	-.005 (.010)	.171 (.021)	-.000 (.017)		-.025 (.017)
9. Belgium	-.119 (.044)	-.001 (.025)	.011 (.028)	-.066 (.033)	.070 (.039)	-.028 (.025)	-.012 (.030)	-.002 (.021)	-.002 (.005)	.150 (.041)
10. Norway	-.180 (.029)	.010 (.015)	.021 (.021)	-.145 (.024)	.026 (.020)	-.009 (.014)	.293 (.024)	.002 (.022)	-.003 (.006)	-.016 (.022)
11. Netherlands	-.132 (.040)	-.024 (.013)	.157 (.028)	-.046 (.019)	.051 (.029)	-.027 (.014)	.051 (.016)	-.002 (.017)	-.006 (.012)	-.023 (.025)
12. Iceland	-.173 (.018)	-.033 (.014)	.025 (.015)	-.146 (-)	.092 (.017)	-.010 (.017)	.182 (.019)	.028 (.017)	-.004 (-)	.039 (.016)
13. Finland	-.126 (.037)	.024 (.025)	.055 (.027)	-.122 (.032)	.042 (.023)	-.009 (.015)	.109 (.029)	.053 (.021)	.002 (.010)	-.028 (.027)
14. Austria	-.181 (.041)	-.042 (.023)	.088 (.031)	-.100 (.030)	.083 (.029)	-.026 (-)	.271 (.035)	-.014 (.021)	-.002 (-)	-.077 (.036)
15. Japan	-.105 (.039)		.069 (.031)	-.130 (.038)	.073 (.022)	-.020 (.023)	.031 (.026)	.013 (.026)		.070 (.035)
16. U.K.	-.127 (.027)	.002 (.011)	.017 (.020)	-.118 (.023)	.088 (.018)	-.003 (.005)	.087 (.020)	.027 (.018)	.000 (.009)	.027 (.023)
17. Spain	-.049 (.061)	-.003 (.024)	.031 (.036)	-.114 (.045)	.039 (.030)	-.002 (.024)	.130 (.032)	.015 (.020)	-.012 (.012)	-.034 (.028)
18. Italy	-.044 (.029)	-.017 (.016)	.077 (.018)	-.067 (.023)	.036 (.015)	.001 (.012)	.044 (.019)	-.024 (.016)	-.002 (.004)	-.006 (.021)

Income coefficients β_9^C for Denmark, β_4^C and β_9^C for Iceland, and β_6^C and β_9^C for Austria are specified and thus do not have standard errors. See Selvanathan (1987a) for details.

TABLE A2.3
MARGINAL SHARES FOR 10 COMMODITIES IN 18 COUNTRIES

Year	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
(1)	θ_{1t}^c	θ_{2t}^c	θ_{3t}^c	θ_{4t}^c	θ_{5t}^c	θ_{6t}^c	θ_{7t}^c	θ_{8t}^c	θ_{9t}^c	$\theta_{10,t}^c$
<u>U.S.</u>										
1961	.120	.013	.117	.077	.134	.009	.356	.069	.010	.095
1962	.115	.012	.116	.080	.133	.011	.355	.070	.011	.097
1963	.108	.012	.114	.081	.133	.014	.360	.071	.011	.097
1964	.101	.013	.114	.080	.134	.016	.362	.072	.011	.096
1965	.097	.015	.114	.078	.134	.018	.364	.074	.012	.094
1966	.098	.014	.114	.075	.134	.018	.364	.076	.013	.094
1967	.096	.013	.113	.074	.135	.020	.362	.078	.014	.094
1968	.092	.013	.113	.072	.134	.023	.363	.079	.015	.095
1969	.089	.013	.113	.070	.132	.028	.367	.079	.015	.095
1970	.088	.014	.111	.071	.129	.033	.365	.079	.016	.094
1971	.085	.015	.109	.072	.126	.038	.368	.079	.017	.093
1972	.078	.014	.108	.073	.125	.041	.375	.078	.017	.091
1973	.077	.014	.107	.073	.125	.042	.376	.079	.017	.090
1974	.080	.013	.106	.076	.124	.045	.371	.079	.017	.090
1975	.082	.012	.103	.079	.122	.048	.367	.079	.017	.090
1976	.080	.011	.101	.080	.120	.051	.372	.078	.017	.090
1977	.075	.009	.099	.081	.119	.053	.380	.078	.016	.089
1978	.072	.008	.099	.083	.119	.055	.382	.077	.016	.089
1979	.072	.007	.097	.085	.119	.056	.381	.077	.016	.091
1980	.072	.006	.094	.089	.117	.059	.378	.076	.017	.091
1981	.072	.006	.092	.092	.115	.065	.376	.075	.017	.091
Mean	.088	.012	.107	.078	.127	.035	.369	.076	.015	.093
<u>Canada</u>										
1961	.182	.042	.079	.007	.140	.109	.220	.097	.012	.113
1962	.179	.043	.079	.010	.140	.099	.223	.098	.013	.116
1963	.176	.042	.077	.010	.139	.099	.228	.098	.014	.116
1964	.173	.040	.076	.009	.139	.100	.231	.100	.015	.117
1965	.170	.040	.075	.005	.139	.100	.235	.101	.017	.118
1966	.166	.040	.074	.002	.140	.100	.237	.103	.019	.120
1967	.162	.040	.073	.002	.139	.100	.235	.106	.021	.122
1968	.156	.040	.073	.004	.138	.099	.235	.108	.024	.124
1969	.152	.039	.073	.007	.137	.097	.234	.108	.026	.126
1970	.152	.040	.072	.014	.136	.093	.229	.108	.028	.128
1971	.151	.041	.068	.017	.134	.087	.230	.110	.031	.132
1972	.148	.039	.064	.011	.136	.084	.234	.115	.031	.137
1973	.149	.037	.063	.003	.139	.084	.237	.119	.030	.138
1974	.150	.035	.065	-.002	.141	.085	.237	.121	.029	.140
1975	.151	.033	.066	-.005	.140	.085	.238	.122	.029	.140
1976	.149	.032	.065	-.004	.139	.086	.240	.122	.030	.142
1977	.144	.031	.064	.001	.137	.087	.240	.122	.030	.144
1978	.145	.030	.062	.005	.135	.087	.239	.121	.030	.145
1979	.146	.029	.061	.006	.134	.088	.240	.120	.030	.147
1980	.145	.029	.060	.007	.132	.088	.240	.120	.030	.150
1981	.145	.029	.058	.010	.129	.089	.240	.119	.029	.151
Mean	.157	.037	.069	.006	.137	.093	.234	.111	.025	.132
<u>Sweden</u>										
1965	.145	.088	.137	.011	.144	.001	.269	.127	.000	.079
1966	.139	.091	.135	.015	.143	.001	.269	.128	.001	.079
1967	.136	.094	.132	.020	.142	.002	.264	.130	.001	.080
1968	.131	.095	.127	.023	.142	.002	.267	.133	.001	.080
1969	.123	.096	.124	.026	.142	.002	.273	.135	.001	.079
1970	.118	.095	.122	.030	.143	.001	.274	.138	.001	.078
1971	.118	.094	.119	.034	.142	.002	.273	.142	.001	.075
1972	.117	.092	.117	.036	.142	.003	.273	.146	.001	.073
1973	.112	.090	.115	.039	.144	.004	.273	.149	.001	.072
1974	.105	.088	.117	.040	.147	.002	.275	.153	.001	.071
1975	.098	.089	.119	.037	.149	-.001	.279	.157	.001	.072
1976	.097	.087	.119	.037	.149	.000	.282	.158	.001	.071
1977	.099	.085	.119	.041	.148	.000	.281	.158	.001	.070
1978	.099	.083	.118	.049	.146	.000	.278	.156	.001	.070
1979	.095	.080	.117	.059	.144	.000	.279	.156	.001	.070
1980	.093	.078	.116	.066	.142	.000	.278	.156	.001	.070
1981	.094	.075	.115	.074	.139	.001	.278	.156	.001	.068
Mean	.113	.088	.122	.037	.144	.001	.274	.146	.001	.074

(continued)

Table A2.3 (continued)

<u>Switzerland</u>									
1961	.247	.132	.140	.013	.181	.002	.158	.091	.036
1962	.242	.134	.139	.011	.180	.000	.162	.093	.037
1963	.239	.134	.139	.012	.179	.000	.163	.094	.039
1964	.237	.135	.139	.009	.178	.001	.164	.096	.041
1965	.237	.135	.137	.006	.177	.003	.165	.097	.042
1966	.237	.135	.134	.008	.175	.006	.166	.096	.043
1967	.234	.135	.131	.011	.172	.009	.167	.095	.044
1968	.228	.136	.128	.018	.169	.012	.170	.095	.044
1969	.223	.134	.126	.022	.168	.015	.173	.094	.045
1970	.220	.132	.125	.023	.167	.018	.176	.094	.046
1971	.216	.131	.124	.025	.165	.020	.177	.094	.047
1972	.213	.129	.123	.023	.165	.023	.180	.093	.050
1973	.209	.127	.122	.027	.164	.024	.178	.094	.055
1974	.208	.126	.119	.034	.162	.027	.172	.094	.059
1975	.210	.123	.114	.038	.157	.030	.171	.094	.062
1976	.206	.120	.110	.047	.152	.034	.174	.094	.063
1977	.203	.117	.108	.051	.150	.036	.179	.094	.064
1978	.204	.115	.107	.048	.149	.036	.182	.094	.064
1979	.203	.114	.106	.050	.148	.037	.185	.094	.063
1980	.202	.112	.105	.052	.147	.037	.186	.095	.062
1981	.203	.112	.105	.049	.146	.038	.188	.097	.062
Mean	.220	.127	.123	.028	.164	.020	.173	.094	.051
<u>Denmark</u>									
1967	.091	.078	.131	.017	.159	.009	.334	.090	.090
1968	.087	.077	.125	.029	.155	.009	.335	.091	.091
1969	.081	.075	.123	.038	.153	.009	.337	.092	.090
1970	.079	.070	.122	.045	.151	.010	.338	.094	.091
1971	.077	.067	.117	.057	.147	.011	.336	.095	.090
1972	.072	.067	.113	.066	.146	.011	.337	.095	.089
1973	.071	.065	.112	.070	.146	.011	.339	.096	.086
1974	.070	.062	.111	.081	.143	.011	.334	.099	.085
1975	.062	.060	.109	.092	.142	.010	.333	.103	.084
1976	.057	.056	.108	.094	.141	.009	.343	.105	.083
1977	.057	.055	.109	.095	.138	.008	.345	.105	.084
1978	.057	.055	.106	.100	.135	.008	.343	.105	.086
1979	.051	.053	.104	.113	.132	.008	.343	.102	.086
1980	.047	.051	.103	.131	.129	.008	.338	.099	.086
1981	.050	.049	.101	.143	.126	.008	.332	.098	.085
Mean	.067	.063	.113	.078	.143	.009	.338	.098	.087
<u>Australia</u>									
1961	.095	.085	.139	.071	.181	.040	.206	.111	.051
1962	.089	.083	.135	.077	.179	.038	.211	.111	.057
1963	.081	.080	.133	.079	.179	.035	.219	.116	.057
1964	.078	.079	.133	.080	.179	.036	.221	.121	.053
1965	.077	.081	.130	.081	.178	.037	.220	.121	.053
1966	.075	.082	.127	.084	.175	.038	.219	.125	.054
1967	.069	.081	.125	.086	.173	.039	.222	.128	.056
1968	.061	.080	.122	.087	.176	.039	.226	.128	.058
1969	.053	.078	.120	.090	.179	.039	.230	.130	.061
1970	.047	.077	.117	.094	.178	.040	.233	.130	.061
1971	.042	.076	.115	.098	.179	.043	.234	.131	.061
1972	.038	.074	.115	.101	.181	.045	.232	.132	.061
1973	.037	.072	.116	.100	.187	.045	.229	.133	.061
1974	.032	.070	.115	.100	.193	.045	.228	.136	.061
1975	.025	.070	.111	.104	.197	.048	.229	.138	.061
1976	.022	.069	.108	.111	.196	.048	.230	.138	.060
1977	.025	.066	.107	.120	.191	.047	.229	.138	.060
1978	.027	.065	.105	.126	.184	.047	.229	.137	.060
1979	.029	.065	.102	.128	.180	.047	.233	.137	.061
1980	.032	.063	.100	.128	.180	.045	.236	.137	.062
1981	.031	.062	.100	.131	.180	.046	.235	.137	.063
Mean	.051	.074	.118	.099	.182	.042	.226	.129	.059

(continued)

Table A2.3 (continued)

<u>France</u>										
1965	.137	.035	.124	.030	.167	.038	.248	.058	.002	.160
1966	.133	.033	.121	.036	.164	.041	.251	.058	.002	.161
1967	.128	.031	.118	.042	.162	.044	.253	.058	.002	.161
1968	.121	.030	.115	.049	.162	.045	.255	.059	.002	.161
1969	.114	.029	.113	.054	.162	.047	.259	.060	.002	.160
1970	.108	.027	.111	.060	.160	.051	.261	.060	.002	.161
1971	.101	.025	.109	.065	.160	.053	.263	.060	.002	.161
1972	.096	.023	.108	.065	.162	.055	.266	.061	.002	.161
1973	.092	.023	.106	.067	.162	.057	.267	.062	.002	.161
1974	.088	.021	.104	.070	.165	.058	.266	.063	.002	.162
1975	.086	.019	.103	.070	.165	.063	.266	.064	.002	.162
1976	.082	.017	.101	.071	.162	.068	.270	.063	.002	.163
1977	.081	.015	.098	.073	.160	.069	.274	.064	.002	.165
1978	.079	.014	.095	.074	.158	.072	.275	.065	.002	.166
1979	.073	.013	.093	.076	.156	.076	.279	.065	.002	.167
1980	.067	.012	.091	.082	.155	.078	.280	.064	.002	.168
1981	.063	.011	.090	.087	.153	.080	.281	.063	.002	.169
Mean	.097	.022	.106	.063	.161	.058	.266	.062	.002	.163
<u>Germany</u>										
1961	.250		.164	-.004	.181	.023	.264	.071		.051
1962	.244		.163	-.001	.181	.023	.269	.070		.051
1963	.239		.161	.005	.179	.022	.274	.069		.051
1964	.234		.159	.008	.178	.022	.278	.069		.053
1965	.229		.160	.005	.178	.022	.282	.070		.055
1966	.223		.160	.007	.176	.022	.285	.070		.056
1967	.219		.158	.015	.174	.022	.284	.070		.057
1968	.211		.157	.024	.171	.022	.286	.071		.058
1969	.198		.156	.029	.170	.021	.295	.071		.059
1970	.187		.157	.027	.172	.021	.304	.072		.059
1971	.177		.158	.026	.174	.021	.310	.074		.060
1972	.172		.159	.025	.176	.021	.311	.075		.062
1973	.169		.157	.029	.176	.021	.309	.077		.062
1974	.164		.154	.036	.175	.022	.305	.079		.065
1975	.158		.154	.039	.172	.023	.308	.080		.067
1976	.154		.151	.040	.169	.023	.318	.079		.066
1977	.149		.149	.039	.170	.022	.326	.078		.066
1978	.144		.149	.038	.170	.022	.331	.079		.067
1979	.139		.147	.041	.169	.022	.333	.080		.069
1980	.137		.146	.045	.169	.023	.331	.080		.070
1981	.136		.144	.047	.168	.023	.330	.079		.072
Mean	.187		.155	.025	.174	.022	.302	.074		.061
<u>Belgium</u>										
1961	.156	.073	.095	.101	.199	.020	.077	.035	.001	.243
1962	.156	.072	.095	.102	.200	.021	.077	.035	.001	.241
1963	.152	.070	.095	.103	.200	.021	.079	.035	.001	.244
1964	.143	.071	.095	.097	.204	.020	.082	.035	.000	.253
1965	.138	.072	.094	.092	.207	.025	.084	.035	.000	.253
1966	.137	.071	.093	.090	.206	.029	.086	.035	.000	.253
1967	.136	.071	.090	.090	.204	.030	.089	.035	.000	.255
1968	.130	.073	.088	.089	.204	.031	.091	.035	.000	.259
1969	.125	.072	.088	.087	.206	.032	.092	.034	.000	.265
1970	.123	.072	.086	.086	.209	.033	.092	.035	.000	.264
1971	.118	.073	.086	.085	.215	.035	.091	.036	.000	.262
1972	.110	.073	.087	.081	.219	.037	.094	.037	.000	.263
1973	.102	.073	.086	.077	.222	.041	.097	.038	.000	.264
1974	.096	.070	.085	.077	.230	.045	.096	.039	.000	.262
1975	.092	.067	.084	.084	.226	.049	.099	.039	.000	.259
1976	.090	.065	.081	.086	.222	.054	.105	.039	.000	.258
1977	.085	.063	.080	.084	.222	.057	.107	.040	.000	.262
1978	.078	.062	.077	.088	.217	.060	.108	.041	.000	.268
1979	.073	.060	.076	.095	.213	.061	.110	.042	.000	.270
1980	.067	.060	.075	.102	.212	.060	.112	.042	.000	.272
1981	.060	.059	.073	.109	.210	.060	.112	.042	.000	.275
Mean	.113	.069	.086	.091	.212	.039	.094	.037	.000	.259

(continued)

Table A2.3 (continued)

<u>Norway</u>										
1965	.086	.087	.133	-.003	.108	.028	.409	.070	.003	.079
1966	.080	.089	.131	-.003	.107	.029	.411	.071	.003	.082
1967	.074	.089	.130	-.005	.108	.029	.414	.072	.004	.084
1968	.071	.090	.130	-.006	.109	.030	.415	.073	.003	.086
1969	.065	.089	.127	-.007	.110	.031	.420	.074	.003	.087
1970	.064	.089	.127	-.005	.111	.031	.418	.075	.003	.086
1971	.065	.090	.126	-.003	.111	.033	.416	.076	.003	.083
1972	.059	.091	.123	-.004	.112	.035	.421	.078	.002	.082
1973	.055	.091	.120	-.004	.115	.037	.423	.080	.002	.082
1974	.051	.089	.116	-.001	.118	.037	.424	.082	.002	.082
1975	.048	.088	.113	-.001	.120	.037	.425	.083	.003	.083
1976	.045	.086	.112	-.002	.121	.037	.430	.085	.003	.084
1977	.037	.083	.112	-.003	.121	.035	.441	.087	.003	.083
1978	.034	.080	.112	.003	.121	.036	.441	.087	.002	.083
1979	.032	.080	.111	.012	.119	.037	.438	.087	.002	.083
1980	.027	.080	.111	.016	.117	.035	.444	.086	.002	.082
1981	.029	.078	.109	.019	.117	.033	.447	.085	.002	.082
Mean	.054	.086	.120	.000	.114	.034	.426	.079	.003	.083
<u>Netherlands</u>										
1953	.202	.043	.330	.060	.155	.009	.101	.029	.015	.056
1954	.196	.041	.335	.058	.160	.011	.102	.028	.015	.055
1955	.186	.040	.335	.057	.168	.012	.104	.028	.016	.056
1956	.177	.038	.336	.056	.174	.013	.104	.028	.017	.056
1957	.176	.041	.333	.057	.176	.017	.103	.027	.017	.055
1958	.178	.045	.318	.061	.173	.021	.104	.026	.017	.057
1959	.177	.045	.311	.063	.172	.023	.106	.026	.019	.058
1960	.167	.044	.314	.061	.178	.024	.107	.026	.020	.059
1961	.159	.042	.317	.062	.180	.023	.108	.027	.020	.061
1962	.156	.042	.316	.062	.180	.024	.108	.027	.022	.062
1963	.151	.043	.313	.063	.183	.026	.108	.027	.023	.062
1964	.143	.043	.315	.061	.185	.027	.112	.028	.024	.063
1965	.135	.045	.310	.056	.185	.029	.118	.030	.025	.066
1966	.132	.046	.306	.056	.181	.033	.119	.032	.026	.069
1967	.128	.046	.301	.058	.176	.039	.119	.034	.027	.073
1968	.120	.044	.295	.059	.175	.044	.123	.035	.028	.076
1969	.108	.040	.294	.060	.176	.049	.127	.037	.028	.081
1970	.095	.037	.292	.059	.180	.053	.130	.040	.028	.086
1971	.086	.034	.293	.060	.184	.056	.130	.042	.030	.086
1972	.080	.034	.290	.064	.179	.064	.130	.041	.032	.088
1973	.074	.035	.284	.066	.177	.072	.131	.038	.033	.091
1974	.066	.032	.280	.067	.182	.077	.132	.038	.033	.094
1975	.056	.030	.275	.071	.182	.082	.138	.038	.033	.093
1976	.052	.030	.271	.077	.175	.085	.143	.039	.035	.093
1977	.051	.029	.269	.079	.172	.085	.143	.039	.036	.096
Mean	.130	.040	.305	.062	.176	.040	.118	.032	.025	.072
<u>Iceland</u>										
1961	.077	.050	.137	.080	.183	.035	.282	.077	.001	.078
1962	.073	.050	.138	.079	.180	.037	.288	.074	.001	.081
1963	.069	.051	.140	.060	.182	.039	.303	.071	.000	.085
1964	.077	.046	.142	.045	.186	.041	.306	.070	.000	.088
1965	.075	.041	.142	.045	.190	.044	.300	.073	.000	.089
1966	.065	.043	.136	.048	.192	.044	.305	.077	.000	.090
1967	.058	.044	.129	.052	.195	.046	.304	.081	.000	.093
1968	.061	.045	.123	.061	.190	.053	.293	.083	.000	.091
1969	.074	.045	.120	.060	.186	.060	.285	.082	.001	.087
1970	.072	.044	.124	.036	.190	.062	.299	.082	.001	.090
1971	.050	.040	.131	.007	.199	.065	.326	.085	.001	.096
1972	.033	.042	.132	.000	.204	.069	.330	.088	.001	.101
1973	.031	.045	.123	.007	.207	.069	.326	.091	.001	.100
Mean	.063	.045	.132	.045	.191	.051	.304	.079	.000	.090

(continued)

Table A2.3 (continued)

<u>Finland</u>										
1961	.203	.099	.160	.033	.115	.013	.210	.106	.015	.047
1962	.190	.100	.159	.032	.115	.013	.216	.110	.015	.049
1963	.184	.102	.152	.035	.113	.013	.224	.110	.017	.050
1964	.182	.103	.147	.035	.109	.013	.234	.109	.017	.052
1965	.177	.102	.143	.031	.108	.014	.244	.108	.017	.056
1966	.172	.104	.138	.030	.109	.016	.243	.108	.018	.062
1967	.168	.108	.140	.033	.112	.017	.232	.108	.019	.065
1968	.166	.110	.136	.032	.113	.017	.232	.108	.020	.066
1969	.159	.114	.133	.026	.112	.017	.246	.108	.020	.066
1970	.146	.118	.136	.020	.114	.017	.254	.109	.020	.066
1971	.138	.120	.135	.020	.115	.017	.255	.110	.020	.071
1972	.133	.121	.132	.016	.118	.018	.258	.111	.019	.074
1973	.126	.119	.132	.008	.122	.018	.265	.115	.018	.076
1974	.119	.116	.131	.008	.129	.018	.265	.119	.016	.079
1975	.119	.114	.127	.005	.133	.019	.266	.120	.014	.083
1976	.126	.113	.122	.000	.128	.020	.268	.123	.013	.087
1977	.134	.112	.119	.001	.123	.020	.267	.123	.011	.090
Mean	.155	.110	.138	.022	.117	.016	.246	.112	.017	.067
<u>Austria</u>										
1965	.083	.052	.206	-.007	.173	.000	.369	.042	.002	.080
1966	.077	.050	.206	-.007	.175	.001	.375	.041	.002	.080
1967	.071	.049	.203	-.005	.176	.002	.382	.041	.002	.079
1968	.067	.049	.200	-.001	.174	.004	.386	.042	.002	.077
1969	.060	.048	.200	.002	.175	.007	.385	.043	.002	.076
1970	.059	.042	.202	.005	.175	.008	.387	.043	.002	.077
1971	.053	.035	.205	.006	.176	.008	.397	.042	.001	.077
1972	.042	.031	.209	.006	.179	.008	.408	.042	.001	.076
1973	.035	.029	.210	.011	.179	.008	.411	.042	.000	.076
1974	.031	.026	.208	.019	.178	.010	.408	.043	.000	.077
1975	.025	.021	.205	.027	.177	.013	.410	.044	.000	.079
1976	.021	.019	.202	.034	.173	.013	.416	.043	.000	.078
1977	.015	.019	.198	.038	.171	.013	.426	.044	.000	.076
1978	.012	.018	.196	.043	.168	.015	.426	.046	.001	.077
1979	.012	.017	.195	.048	.162	.016	.426	.045	.001	.079
1980	.008	.014	.195	.052	.158	.016	.434	.043	.001	.079
1981	.005	.012	.194	.058	.155	.017	.436	.042	.001	.080
Mean	.040	.031	.202	.019	.172	.009	.405	.043	.001	.078
<u>Japan</u>										
1971	.193		.147	.034	.148	.059	.110	.106		.203
1972	.182		.149	.036	.147	.059	.112	.108		.207
1973	.174		.153	.033	.150	.059	.114	.108		.210
1974	.174		.155	.027	.150	.061	.119	.104		.210
1975	.178		.151	.025	.143	.067	.124	.102		.211
1976	.179		.150	.028	.137	.070	.125	.102		.210
1977	.175		.148	.033	.136	.071	.124	.102		.210
1978	.164		.144	.039	.134	.075	.125	.102		.216
1979	.151		.142	.043	.135	.078	.126	.102		.223
1980	.145		.140	.048	.135	.079	.126	.103		.224
1981	.143		.136	.057	.132	.082	.126	.103		.222
Mean	.169		.147	.037	.141	.069	.121	.104		.213

(continued)

Table A2.3 (continued)

<u>United Kingdom</u>										
1965	.094	.073	.112	.044	.173	.006	.199	.095	.017	.187
1966	.090	.073	.110	.049	.171	.006	.200	.095	.018	.188
1967	.087	.072	.107	.052	.170	.005	.203	.096	.019	.188
1968	.081	.070	.106	.056	.169	.006	.207	.099	.019	.189
1969	.076	.069	.105	.059	.168	.006	.208	.101	.020	.190
1970	.072	.068	.105	.060	.166	.006	.209	.103	.021	.191
1971	.067	.064	.104	.060	.165	.006	.216	.105	.021	.192
1972	.059	.061	.102	.061	.167	.006	.223	.108	.021	.192
1973	.054	.060	.102	.062	.169	.006	.223	.110	.021	.194
1974	.054	.060	.103	.066	.168	.005	.218	.112	.021	.194
1975	.053	.061	.101	.071	.166	.005	.220	.112	.021	.192
1976	.052	.063	.096	.073	.163	.004	.226	.111	.021	.191
1977	.052	.063	.094	.076	.161	.004	.226	.110	.021	.193
1978	.050	.062	.094	.075	.161	.004	.227	.111	.021	.196
1979	.044	.060	.095	.073	.163	.004	.233	.111	.021	.197
1980	.038	.058	.092	.077	.162	.005	.236	.111	.020	.200
1981	.032	.058	.087	.090	.160	.005	.236	.111	.021	.200
Mean	.062	.064	.101	.065	.166	.005	.218	.106	.020	.192
<u>Spain</u>										
1965	.340	.034	.138	.040	.124	.026	.199	.049	.005	.046
1966	.337	.033	.137	.036	.123	.030	.207	.049	.005	.043
1967	.323	.034	.137	.035	.122	.033	.215	.050	.006	.045
1968	.311	.034	.137	.037	.121	.036	.217	.052	.007	.048
1969	.299	.034	.136	.036	.122	.039	.221	.054	.007	.051
1970	.287	.034	.135	.032	.126	.043	.224	.057	.008	.054
1971	.279	.035	.135	.028	.126	.048	.225	.059	.009	.056
1972	.271	.035	.137	.022	.126	.052	.229	.061	.010	.058
1973	.269	.034	.139	.017	.127	.052	.233	.062	.009	.059
1974	.271	.032	.138	.017	.125	.052	.236	.063	.008	.057
1975	.271	.029	.135	.019	.124	.053	.236	.066	.009	.059
1976	.268	.026	.133	.016	.124	.055	.238	.066	.011	.064
1977	.259	.023	.134	.009	.126	.057	.245	.066	.011	.070
Mean	.291	.032	.136	.026	.124	.044	.225	.058	.008	.054
<u>Italy</u>										
1965	.301	.055	.171	.060	.100	.032	.125	.050	.003	.103
1966	.301	.054	.169	.059	.097	.034	.128	.050	.004	.104
1967	.296	.052	.170	.060	.095	.035	.135	.048	.004	.105
1968	.289	.050	.171	.062	.096	.035	.139	.048	.004	.106
1969	.283	.050	.170	.064	.096	.036	.142	.047	.004	.109
1970	.277	.048	.170	.063	.098	.038	.145	.047	.003	.111
1971	.271	.046	.172	.064	.099	.038	.148	.047	.003	.113
1972	.265	.043	.171	.069	.099	.038	.151	.046	.003	.115
1973	.261	.042	.173	.068	.101	.040	.150	.045	.003	.116
1974	.258	.040	.174	.067	.106	.041	.147	.045	.002	.121
1975	.255	.037	.171	.066	.109	.042	.147	.045	.002	.125
1976	.254	.033	.168	.062	.110	.043	.154	.045	.002	.128
1977	.251	.029	.169	.059	.112	.042	.160	.046	.002	.129
1978	.248	.027	.171	.059	.113	.040	.159	.048	.002	.132
1979	.243	.026	.171	.060	.111	.040	.161	.047	.002	.138
1980	.231	.025	.173	.062	.112	.041	.169	.046	.002	.141
1981	.221	.024	.171	.064	.112	.042	.176	.046	.002	.142
Mean	.265	.040	.171	.063	.104	.039	.149	.047	.003	.120

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