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Specification and estimation of an allocation system for private consumption in Europe



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SPECIFICATION AND ESTIMATION OF AN ALLOCATION SYSTEM FOR PRIVATE CONSUMPTION IN EUROPE



by Ingrid Bracke and Eric Meyermans



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Specification and estimation of an allocation system for private consumption in Europe

Abstract

This paper presents an empirical analysis of household consumption in 11 European countries. The starting point of our modelling strategy is the assumption that there exists a long run equilibrium between quantities, prices and income, but that rigidities prevent immediate adjustment to this long run equilibrium. The outline of the paper is as follows. First, making use of the theory of rational consumer behaviour, a long run equilibrium and the short run adjustment scheme are specified. Next, some econometric issues are discussed, i.e., imposing the negativity condition, the Two-Step Engle-Granger estimator, and groupwise separability. Finally, some empirical results, including short and long run compensated and uncompensated price effects, are discussed.



Introduction

Under the Non-Nuclear Energy Programme Joule III of the DGXII of the European Commission, 4 European teams¹ are collaborating on the construction of an Energy-Environment-Economy Model for Europe (E3ME). E3ME is a multi-sector, multi-country (region) model which provides a framework for the evaluation of policies promoting sustainable energy use. One of the main features of the model is that it deals with the economy, energy, and the environment in one modelling framework, whereby measures of economic activity are translated into emissions of the main air pollutants which are used to calculate damages to the environment. The model itself consists of behavioural relationships in the form of time series econometric equations, environmental emission flows, and accounting balances. The interactions are structured at three spatial levels: the interactions between the European Union (EU) and the rest of the world, the interactions at the EU level between countries, and the interactions at the level of each country (or region). E3ME is constructed to have a complete specification of the long run equilibrium in the form of estimated behavioural equations which allow for long term restrictions between the coefficients, and dynamic relationships in terms of error correction models which guarantee convergence to the long run equilibrium. This approach allows to generate short and medium term forecasts, and to analyse long term structural changes in the economy.

In the E3ME project the Belgian Federal Planning Bureau (FPB) is in charge of the construction of the allocation modules for regional household consumption. This Working Paper reports a part of the work conducted at the FPB. Due to the technical nature of this paper the reader with a rather limited knowledge of econometrics is advised to skip the following three sections of the paper.

This paper presents an econometric model which describes how for each region total aggregate consumption is allocated over its different components as a function of relative prices, total income, and demographic changes². The starting point of our modelling strategy is the assumption that there exists a long run equilibrium, but that rigidities prevent immediate adjustment to this long run equilibrium. In section II a specification of the long run equilibrium is presented. Here we introduce the CBS version of an econometric allocation system, which explains quantities in terms of a scale effect and relative prices, and which allows us to impose the various restrictions derived from the theory of rational consumer behaviour in a rather flexible way. In section III an error correction mechanism for our allocation problem is derived, while in section IV some econometric issues estimating this error correction mechanism are discussed, i.e., the Two-Step Eng-

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1. The teams collaborating within the E3ME network are: Cambridge Econometrics, Chambre de Commerce et d'Industrie de Paris, Belgian Federal Planning Office and ERECO.
 2. In E3ME the aggregate consumption is related to personal disposable income, a measure of wealth, inflation and interest rates.

le-Granger estimator, imposing the negativity condition, and groupwise separability. Finally, the analytical framework is applied to a dataset consisting of disaggregated household consumption in 11 European countries¹. The estimation results, in the form of overall short and long run income elasticities and overall compensated and uncompensated own price elasticities, together with some simulation results are presented in section V².

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1. These countries are: Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, United Kingdom.
 2. Additional empirical results are provided in a supplement, which is available upon request.



The specification of an econometric allocation system

A. An econometric allocation system

Consider for each country a representative economic agent who allocates his total available means between n commodities, and assume that the preference ordering of this agent satisfies the regular assumptions so that a set of differentiable demand functions exists¹.

A particular set of demand equations reads as follows

$$\ln q_i = \alpha_i + \eta_i \ln Q + \sum_{j=1}^n \varepsilon_{ij} \ln p_j \quad \text{for } i = 1, \dots, n \quad (1)$$

with

q_i : quantity of commodity i ,
 Q : real income,
 p_j : price of commodity j ,
 n : number of commodities,

and with

η_i : income elasticity,
 ε_{ij} : compensated price elasticity.

In other words, system (1) represents a set of log linear demand equations which explains the demand for good i as a function of total available means and prices.

Note that the compensated price elasticity is related to the uncompensated elasticity, θ_{ij} , by

$$\theta_{ij} = \varepsilon_{ij} - w_j \eta_i,$$

with w_i the budget share of commodity i . The compensated price elasticities describe the responses of the quantities to changes in the predetermined prices as we move along the indifference curve, while the uncompensated price elasticities also take into account the budgetary effects of a change in the predetermined

1. The set of axioms of choice includes reflexivity, completeness, transitivity, continuity, non-satiation, and convexity. See for example Barten and Bohm (1982) or Deaton and Muellbauer (1987).

prices. See, for example, Barten and Bohm (1982) or Deaton and Muellbauer (1987).

The theory of rational consumer behaviour imposes the following restrictions on the elasticities of system (1)

$$\sum_{i=1}^n w_i \eta_i = 1 \quad \text{(Engle aggregation)} \quad (2.a)$$

$$\sum_{i=1}^n w_i \theta_{ij} = -w_j \quad \text{(Cournot aggregation)} \quad (2.b)$$

$$\sum_{j=1}^n \theta_{ij} + \eta_i = 0 \quad \text{(Homogeneity)} \quad (2.c)$$

$$w_i \theta_{ij} + w_i w_j \eta_i = w_j \theta_{ji} + w_j w_i \eta_j \quad \text{(Slutsky symmetry)} \quad (2.d)$$

$$\sum_{i=1}^n \sum_{j=1}^n x_i (w_i \theta_{ij} + w_i w_j \eta_i) x_j < 0 \quad \text{(Negativity)} \quad (2.e)$$

with not all x_i having the same value,

or in terms of the compensated elasticities

$$\sum_{i=1}^n w_i \eta_i = 1 \quad \text{(Engle aggregation)} \quad (3.a)$$

$$\sum_{i=1}^n w_i \varepsilon_{ij} = 0 \quad \text{(Cournot aggregation)} \quad (3.b)$$

$$\sum_{j=1}^n w_j \varepsilon_{ij} = 0 \quad \text{(Homogeneity)} \quad (3.c)$$

$$w_i \varepsilon_{ij} = w_j \varepsilon_{ji} \quad \text{(Slutsky symmetry)} \quad (3.d)$$

$$\sum_{i=1}^n \sum_{j=1}^n x_i w_i \varepsilon_{ij} x_j < 0 \quad \text{(Negativity)} \quad (3.e)$$

The adding up and homogeneity condition are a direct consequence of the linear budget constraint. The adding up conditions indicate that the aggregate is divided into its different components, while the homogeneity condition states that it is relative prices which matter. The symmetry and negativity conditions reflect the properties of the underlying preference ordering. Symmetry is a guarantee for consumer's consistency of choice, while the negativity condition emphasizes, for example, that the own compensated price effect should be negative. See for example Barten (1977), Deaton and Muellbauer (1987) or Barten and Bohm (1982) for more details on these restrictions.

Premultiplying both sides of the equations in system (1) with w_i , summing over i , and using the adding up conditions (2.a) and (2.b), yields

$$\sum_{i=1}^n w_i \ln q_i = \sum_{i=1}^n c_i + \ln Q$$

with $c_i = w_i \alpha_i$.

Without loss of generality one can impose as an additional restriction that

$$\sum_{i=1}^n c_i = 0,$$

so that the scale effect, $\ln Q$, is defined as

$$\ln Q = \sum_{i=1}^n w_i \ln q_i,$$

see also Barten (1989).

Although system (1) has some interesting properties it does not yield a parametrization which is easy to estimate under the restrictions (3.a) - (3.e). Therefore a modified parametrization will be used in the empirical section.

B. Alternative parametrizations

Alternative parametrizations of an econometric allocation system have been proposed in the literature, e.g. Barten (1966), Deaton and Muellbauer (1980), and Keller and van Driel (1984). Our choice of a parametrization is a pragmatic one: we do not want to ignore cross price effects and we want a parametrization which allows us to impose the various restrictions in a flexible way.

1. The Rotterdam version

Multiplying both sides of equation (1) by w_i , and defining

$$\begin{aligned} m_i &= w_i \eta_i \\ s_{ij} &= w_i \varepsilon_{ij} \\ c_i &= w_i \alpha_i \end{aligned}$$

as constants, the Rotterdam version in levels of an econometric allocation system is obtained, i.e.,

$$w_i \ln q_i = c_i + m_i \ln Q + \sum_{j=1}^n s_{ij} \ln p_j \quad \text{for } i = 1, \dots, n \quad (4)$$

see Barten (1989).

In view of the restrictions (3.a) - (3.e), the following restrictions hold for the parameters of system (4),

$$\sum_{i=1}^n c_i = 0, \quad \sum_{i=1}^n m_i = 1, \quad \sum_{i=1}^n s_{ij} = 0 \quad (5.a)$$

$$\sum_{j=1}^n s_{ij} = 0 \quad (5.b)$$

$$s_{ij} = s_{ji} \quad \forall i,j \quad (5.c)$$

$$\sum_{i=1}^n \sum_{j=1}^n a_i s_{ij} a_j < 0 \quad \text{with not all } a_i \text{ having the same value.} \quad (5.d)$$

2. The CBS version

The CBS version in levels of an econometric allocation system is an other parametrization and is obtained by subtracting $w_{it} \ln Q_t$ from both sides of equation (4), i.e.,¹

$$\ln y_{it} = c_i + b_i \ln Q_t + \sum_{j=1}^n s_{ij} \ln p_{jt} + v_{it}, \quad \text{for } i = 1, \dots, n \quad (6)$$

with

$$\ln y_{it} = w_{it} (\ln q_{it} - \ln Q_t) \quad (7)$$

and where the parameter b_i is a constant defined by

$$b_i = m_i - w_{it} \quad (8)$$

Note that a subscript t has been added to indicate the observation unit, and that in order to capture randomness in human behaviour a random component v_{it} has been added to each equation. It is assumed that the covariance matrix of this random component is independent of t and that there is no intertemporal correlation of the disturbance terms.

1. The original CBS parametrization was derived in the context of a system in first differences, see Keller and Van Driel (1985). The levels version has been proposed by Barten (1989).

In view of restrictions (3.a)-(3.e), the following set of restrictions can be imposed on the parameters of system (6)

$$\sum_{i=1}^n c_i = 0, \quad \sum_{i=1}^n b_i = 0, \quad \sum_{i=1}^n s_{ij} = 0 \quad (9.a)$$

$$\sum_{j=1}^n s_{ij} = 0 \quad (9.b)$$

$$s_{ij} = s_{ji} \quad \forall i,j \quad (9.c)$$

$$\sum_{i=1}^n \sum_{j=1}^n a_i s_{ij} a_j < 0 \quad \text{with not all } a_i \text{ having the same value.} \quad (9.d)$$

Note that the random components satisfy the condition

$$\sum_{i=1}^n v_{it} = 0 \quad (10)$$

Comparing system (4) with system (6) it becomes clear that the Rotterdam version represents a parametrization for which the marginal propensity to consume is constant over time, while the CBS parametrization implies a marginal propensity to consume which varies over time¹. There is no clear-cut criterion which allows us to select one of these parametrizations a priori. However, since the CBS version provided the best fit for our data, the following discussion will concentrate on the CBS specification.

1. Indeed, in the Rotterdam version m_i is treated as constant, while in the CBS version b_i is constant. But $b_i = m_i - w_i$, implying that when b_i is constant, as it is the case in the CBS version, and w_i varies over time, the previous identity can only hold when m_i also varies over time.



An error correction mechanism

In the previous section a long run equilibrium between quantities, prices and income has been specified. However, such equilibrium is not attained immediately. In other words, the contemporaneous quantities of the commodity vector are assumed to be determined by the following autoregressive distributed lag system

$$\begin{aligned} \ln y_{it} = & c_{1i} + b_{1i} \ln Q_t + b_{2i} \ln Q_{t-1} \\ & + \sum_{j=1}^n s_{1ij} \ln p_{jt} + \sum_{j=1}^n s_{2ij} \ln p_{jt-1} + \sum_{j=1}^n a_{ij} \ln y_{jt-1} + u_{it} \end{aligned} \quad (11)$$

for $i=1, \dots, n$, and where u_{it} is a random component with a covariance matrix independent of t and no intertemporal correlation¹.

On rearranging terms, equation (11) can be rewritten as

$$\begin{aligned} \ln y_{it} - \ln y_{it-1} = & c_{1i} + b_{1i} (\ln Q_t - \ln Q_{t-1}) + (b_{2i} + b_{1i}) \ln Q_{t-1} \\ & + \sum_{j=1}^n s_{1ij} (\ln p_{jt} - \ln p_{jt-1}) + \sum_{j=1}^n (s_{2ij} + s_{1ij}) \ln p_{jt-1} \\ & + \sum_{j=1}^n (a_{ij} - \delta_{ij}) \ln y_{jt-1} + u_{it} \end{aligned} \quad (12)$$

with

$$\begin{aligned} \delta_{ij} &= 0 \text{ for } i \neq j \\ &= 1 \text{ for } i=j. \end{aligned}$$

1. For the sake of argument we restricted the number of lags to one, longer lags can also be considered.

In order that relation (6) holds in the long run, i.e., when $\ln y_{it} = \ln y_{it-1}$, $\ln p_{it} = \ln p_{it-1}$, and $\ln Q_t = \ln Q_{t-1}$ the following restrictions have to be imposed on the parameters of equation (12)

$$c_{1i} = - \sum_{j=1}^n (a_{ij} - \delta_{ij}) c_j \quad (13.a)$$

$$(b_{1i} + b_{2i}) = - \sum_{j=1}^n (a_{ij} - \delta_{ij}) b_j \quad (13.b)$$

$$(s_{1ij} + s_{2ij}) = - \sum_{k=1}^n (a_{ik} - \delta_{ik}) s_{jk} \quad (13.c)$$

for $i=1, \dots, n$.

Inserting restrictions (13.a) - (13.c) into equation (12), yields

$$\begin{aligned} \ln y_{it} - \ln y_{it-1} = & b_{1i} (\ln Q_t - \ln Q_{t-1}) + \sum_{j=1}^n s_{1ij} (\ln p_{jt} - \ln p_{jt-1}) \quad (14) \\ & + \sum_{j=1}^n (a_{ij} - \delta_{ij}) \left(\ln y_{jt-1} - c_j - b_j \ln Q_{t-1} - \sum_{k=1}^n s_{jk} \ln p_{kt-1} \right) + u_{it} \end{aligned}$$

for $i=1, \dots, n$,

i.e., an error correction mechanism which explains contemporaneous changes in the quantities by changes in the scale and prices and by past deviations of the quantities from their long run equilibrium value¹.

1. Note that the following adding up conditions hold $\sum_{i=1}^n b_{1i} = 0$, $\sum_{i=1}^n s_{1ij} = 0$, $\sum_{i=1}^n (a_{ij} - \delta_{ij}) = 0$.



IV Some econometric issues

Three features estimating the error correction mechanism (14) will be highlighted in this section, i.e., the Two-Step Engle-Granger estimation procedure, the negativity condition and groupwise separability.

A. The Engle-Granger Two-Step estimator

The econometric technique used to estimate the error correction mechanism (14) is the Two-Step Engle-Granger estimator as promoted by Engle and Granger (1987). The Two-Step Engle-Granger estimator consists of two steps. In a first step the cointegration vector between the quantities, the scale effect and the relative prices, i.e. equation (6), is estimated with ordinary least squares, and the error correction term v_i is calculated. At this stage it should either be tested whether the variables are cointegrated, i.e. whether the residuals of the levels equation are stationary, or a priori be assumed that cointegration holds. In a second step, the short run adjustment scheme - including the error correction term - is estimated. Applied to our model the Two-Step Engle-Granger estimator runs as follows.

1. The first step: estimating the long run equilibrium

In the first step, we estimate the long run equilibrium, i.e. system (6), and calculate the error correction terms

$$v_{it} = \ln y_{it} - \left(\widehat{c}_i + \widehat{b}_i \ln Q_t + \sum_{j=1}^n \widehat{s}_{ij} \ln p_{jt} \right) \text{ for } i = 1, \dots, n \quad (15)$$

with $\widehat{}$ indicating the point estimate of the corresponding parameter.

2. The second step: estimating the short run adjustment mechanism

In the second step, we insert the error correction term (15) into equation (14) yielding

$$\begin{aligned} \ln y_{it} - \ln y_{it-1} = & b_{1i}(\ln Q_t - \ln Q_{t-1}) + \sum_{j=1}^n s_{1ij}(\ln p_{jt} - \ln p_{jt-1}) \\ & + \sum_{j=1}^n (a_{ij} - \delta_{ij})v_{jt-1} + u_{it} \end{aligned} \quad (16)$$

for $i=1, \dots, n$,

and we proceed by estimating system (16). However, note that in view of condition (10), the second last term in (16) is collinear. Therefore, we proceed by noting that

$$v_{nt} = - \sum_{j=1}^{n-1} v_{jt} \quad (17)$$

Inserting (17) into (16) yields

$$\begin{aligned} \ln y_{it} - \ln y_{it-1} = & b_{1i}(\ln Q_t - \ln Q_{t-1}) + \sum_{j=1}^n s_{1ij}(\ln p_{jt} - \ln p_{jt-1}) \\ & + \sum_{j=1}^{n-1} f_{ij}v_{jt-1} + u_{it} \end{aligned} \quad (18)$$

with $f_{ij} = a_{ij} - \delta_{ij} - a_{in} + \delta_{in}$.

Hence, equation (18) will be estimated in the second step.

B. Imposing the restrictions of rational consumer behaviour

Imposing the linear restrictions summability¹, homogeneity and symmetry² is straightforward. However, imposing the negativity condition is a little bit more complicated. See Barten and Geyskens (1975).

In order to impose the negativity condition, we proceed by noting that for any negative semi-definite matrix, like S^3 , there exists a Cholesky decomposition such that

$$S = - F H F' \quad (19)$$

where F is a lower triangular matrix with ones on its diagonal and where H is a diagonal matrix with positive numbers on its diagonal. Hence the negativity condition can be imposed by estimating the F and H matrices separately subject to the restriction that the diagonal elements of the matrix H are positive.

C. Groupwise separability

In this paper we analyse a dataset consisting of 27 commodities for the period ranging from 1970 until 1993. This implies that under the most restrictive variant, i.e. the negativity variant, 15.5 parameters per equation have to be estimated for the long run equation⁴, and 40.5 parameters per equation for the short run adjustment process⁵. It is clear that without further restrictions on the parameters the degrees of freedom will be small. Therefore we will make in the next section the additional assumption of weak separability of the underlying preference ordering⁶. But first we will summarize some of the results of groupwise separability which are of direct interest for the further analysis. See Barten and Bohm (1982) and Deaton and Muellbauer (1987) for a rigorous treatment of the issue.

Under groupwise separability the consumer faces a decision problem in two stages. In a first stage the consumer decides how much he will spend on a particular group of commodities, e.g. durable goods, while in a second stage he decides how to spend the money allocated in the first stage within the group, e.g. furniture or cars within the group of durable goods. Using a similar notation as in section 2, we will now describe the interactions between different commodities in a group, between different groups of commodities and between commodities of different groups.

-
1. As a result of the adding up condition, one equation can be deleted during the estimation of an econometric allocation system, and the obtained results are invariant with respect to which equation has been deleted. See Barten (1969).
 2. I.e. conditions (9.a),(9.b) and (9.c).
 3. Here the matrix S is a $n \times n$ matrix, consisting of the compensated price effects s_{ij} . The element s_{ij} is located at the row i and column j of matrix S .
 4. I.e., for the whole system: 351 price effects, 26 scale effects and 26 constant terms.
 5. I.e., for the whole system: 351 price effects, 26 scale effects and 676 error correction terms.
 6. Consider the continuous, differentiable direct utility function $U(q_1, q_2, \dots, q_n)$ (20) Under the assumption of (weak) separability of the underlying preference ordering the utility function (20) can be written as $U(U_1(q_1, \dots, q_j), \dots, U_I(q_k, \dots, q_m), \dots, U_J(q_{m+1}, \dots, q_n))$, i.e., the sub-utility of a convex combination of commodities of group I does not depend on the consumed amount of commodities of group J .

1. The interactions within a group of commodities

Within a group I the long run equilibrium can be written as

$$\ln y_{it}^I = c_i^I + b_i^I \ln Q_{It} + \sum_{j \in I} s_{ij}^I \ln p_{jt} + v_{it}^I \quad \text{for } i \in I$$

with

$$\ln y_{it}^I = w_{it}^I (\ln q_{it} - \ln Q_{It})$$

and with

b_i^I : the income coefficient of commodity i in group I,

s_{ij}^I : compensated price effect of commodity j on i, both elements of I,

w_{it}^I : the budget share of commodity i in group I,

and where the scale effect of group I is defined by

$$\ln Q_{It} = \sum_{i \in I} w_{it}^I \ln q_{it} \quad (21)$$

Similar to equation (18), the short run adjustment scheme within group I can be written as

$$\begin{aligned} \ln y_{it}^I - \ln y_{it-1}^I &= b_{1i}^I (\ln Q_{It} - \ln Q_{It-1}) + \sum_{j=1}^n s_{1ij}^I (\ln p_{jt} - \ln p_{jt-1}) \\ &\quad + \sum_{j=1}^{n-1} f_{ij}^I v_{jt-1}^I + u_{it}^I \end{aligned} \quad (22)$$

for $i \in I$.

2. The interactions between groups of commodities

Defining the quantity and price aggregates of group I as

$$\ln Q_{It} = \sum_{i \in I} w_{it}^I \ln q_{it},$$

and

$$\ln P_{It} = \sum_{i \in I} w_{it}^I \ln p_{it}, \quad (23)$$

we obtain analogous results for the interactions between groups of commodities. For the long run equilibrium we have that

$$\ln y_{It} = c_I + b_I \ln Q_t + \sum_{J=1}^k S_{IJ} \ln P_{Jt} + v_{It} \quad \text{for } I=1, \dots, k \quad (24)$$

with k the number of groups and where

$$\ln y_{It} = w_{It} (\ln Q_{It} - \ln Q_t).$$

For the short run adjustment scheme we have

$$\begin{aligned} \ln y_{It} - \ln y_{It-1} = & b_{1I} (\ln Q_t - \ln Q_{t-1}) + \sum_{j=1}^n S_{1IJ} (\ln P_{Jt} - \ln P_{Jt-1}) \\ & + \sum_{J=1}^{k-1} f_{IJ} v_{Jt-1} + u_{It} \end{aligned} \quad (25)$$

for $I=1, \dots, k$.

3. The overall interactions

The overall price responses measure the interactions between commodities of different groups. The overall long run interaction coefficients are defined in terms of the long run intra- and inter-group interactions as

$$m_i = m_I m_i^I \quad \forall i, I \quad (26.a)$$

and

$$s_{ij} = s_{ij}^I w_I \delta_{ij} + m_i^I S_{IJ} m_j^J \quad \forall i, j, I, J \quad (26.b)$$

with

$$\delta_{ij} = \begin{cases} 1 & \text{only if } i, j \in I \\ 0 & \text{elsewhere} \end{cases}$$

and where

- m_i^I the marginal propensity to spend on commodity i in group I ,
- m_I the marginal propensity to spend on group I ,
- m_i the overall marginal propensity to spend on commodity i ,
- s_{ij}^I compensated price effect of commodity j on i in group I ,
non-zero only if $i, j \in I$,
- S_{IJ} compensated price effect of group J on group I ,
- s_{ij} overall compensated price effect of j on i ,

and

w_I : budget share of group I .

Note that in the case of the CBS parametrization the marginal propensity to consume is defined as

$$m_i = b_i + w_i. \quad (27)$$

Mutatis mutandis, equations (26.a) and (26.b) can also be used to calculate the short run interaction coefficients.



The empirical results

A. The data

A dataset with annual observations on household expenditures in constant and current prices for different commodities in 11 countries is available¹. See Table 1.A and Table 1.B for a summary of the available data.

TABLE 1.A - Description of the Data: Sample Size

COUNTRY	SAMPLE SIZE
Belgium	1970-1993
Denmark	1966-1993
France	1970-1993
Germany	1970-1993
Ireland	1970-1993
Italy	1970-1993
Luxembourg	1970-1993
The Netherlands	1970-1993
Portugal	1978-1993
Spain	1970-1993
United Kingdom	1960-1993

For most countries, except the United Kingdom and Denmark, the sample size ranges from 1970 until 1993. For the United Kingdom and Denmark the sample starts in 1960 and 1966, respectively, and ends in 1993. There are 27 expenditure items available for the United Kingdom. See Table 1.B for a list of the available commodities. For Belgium, Ireland, Italy, the Netherlands, Portugal, and Spain there are observations for 21 commodities available. For these countries expenditures on electricity, gas, petroleum products, and coal are aggregated to "fuel and power", and expenditures on transport by rail, bus, air, and other public transportation are aggregated to "public transportation". For France expenditures on electricity, gas, petroleum products, and coal are aggregated to "fuel and power", while for Denmark expenditures for transport by rail, bus, air, and other public transportation are aggregated to "public transportation". For Germany and Luxembourg only a few aggregates are available.

1. This data is based on the national accounts published by Eurostat.

Table 1.C of the text shows the average budget shares of the different commodities. Across countries the pattern of the budget shares is more or less similar. In all the countries the budget shares of food and expenditures on rent and water charges are highest, ranging for food, on average, between 14 percent in Germany and 34 percent in Portugal, and for rent and water charges between 4 percent in Portugal and 18 percent in Denmark.

In Table 1.D the standard deviation of the annual growth rates is shown. This measure indicates, for example, that expenditures on transport equipment grows at a rather volatile rate, especially if compared to expenditures on food and rent..

TABLE 1.B - Description of the Data: List of Available Commodities

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom
Food											
Beverages											
Tobacco											
Clothing and footwear											
Gross rent and water charges											
Power	■		■	■	■	■	■	■	■	■	■
Gas											
Petroleum products	■										
Coal											
Furniture				■			■				
Textiles											
Major appliances				■			■				
Household utensils				■			■				
Household operation				■			■				
Domestic services				■			■				
Medical care and health expenses											
Personal transport equipment							■				
Operation of personal transport equipment											
Transport by rail	■	■		■	■	■	■	■	■	■	■
Transport by bus, coach or tram											
Transport by air	■	■		■	■	■	■	■	■	■	■
Other transport											
Communication											
Equipment and accessories				■			■				
Recreation				■			■				
Expenditures in restaurants, cafes and hotels							■				
Miscellaneous							■				

Note: Shaded areas aggregate to one commodity

TABLE 1.C - Description off the Data: Average Budget Shares

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom
Food	0.18	0.18	0.18	0.14	0.24	0.24	0.17	0.16	0.34	0.22	0.17
Beverages	0.02	0.04	0.03	0.03	0.13	0.02	0.02	0.03	0.02	0.02	0.07
Tobacco	0.02	0.04	0.01	0.02	0.05	0.02	0.05	0.02	0.02	0.02	0.04
Clothing and footwear	0.09	0.06	0.06	0.08	0.08	0.10	0.07	0.08	0.09	0.09	0.08
Gross rent and water charges	0.13	0.18	0.13	0.13	0.06	0.10	0.13	0.13	0.04	0.12	0.13
Power	0.02	0.02	0.04	0.04	0.05	0.04	0.06	0.04	0.02	0.02	0.02
Gas		0.00									0.01
Petroleum products		0.02									0.00
Coal		0.01									0.01
Furniture	0.04	0.03	0.03	0.09	0.02	0.03	0.10	0.04	0.02	0.02	0.02
Textiles	0.01	0.01	0.01		0.01	0.01		0.01	0.02	0.01	0.01
Major appliances	0.02	0.01	0.01		0.01	0.01		0.01	0.01	0.01	0.02
Household utensils	0.02	0.01	0.01		0.01	0.01		0.01	0.01	0.01	0.01
Household operation	0.02	0.02	0.02		0.02	0.02		0.02	0.02	0.02	0.02
Domestic services	0.02	0.01	0.01		0.01	0.01		0.01	0.01	0.01	0.01
Medical care and health expenses	0.10	0.02	0.08	0.13	0.03	0.05	0.07	0.13	0.04	0.04	0.01
Personal transport equipment	0.04	0.05	0.04	0.04	0.04	0.04	0.16	0.03	0.03	0.04	0.04
Operation of personal transport equipment	0.06	0.07	0.09	0.06	0.05	0.05		0.05	0.05	0.07	0.06
Transport by rail	0.01	0.03	0.01	0.02	0.02	0.02		0.02	0.04	0.02	0.01
Transport by bus, coach or tram			0.00								0.01
Transport by air			0.00								0.01
Other transport			0.00								0.01
Communication	0.01	0.01	0.02	0.02	0.01	0.01		0.01	0.01	0.01	0.01
Equipment and accessories	0.03	0.04	0.03	0.09	0.03	0.04	0.04	0.05	0.02	0.03	0.04
Recreation	0.03	0.05	0.04		0.07	0.05		0.05	0.03	0.04	0.05
Expenditures in restaurants, cafes and hotels	0.08	0.05	0.06	0.05	0.02	0.09	0.14	0.05	0.09	0.13	0.07
Miscellaneous	0.06	0.05	0.07	0.05	0.06	0.06		0.08	0.03	0.06	0.07

TABLE 1.D - Description of the Data: Standard Deviation of Annual Growth Rates of Real Expenditure

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom
Food	1.35	1.59	0.58	2.77	3.04	1.24	1.08	1.34	1.37	2.10	1.08
Beverages	5.65	4.16	1.70	1.60	4.21	2.37	4.71	7.98	3.05	3.09	3.25
Tobacco	4.41	3.93	2.21	3.24	4.29	4.23	10.29	4.80	1.84	1.70	5.77
Clothing and footwear	3.52	4.87	10.67	2.81	6.95	5.00	3.18	3.53	2.19	3.69	2.93
Gross rent and water charges	1.31	2.15	0.98	0.88	2.44	2.04	2.71	1.93	1.17	0.10	1.20
Power	4.45	4.61	6.57	4.26	3.58	3.56	2.86	5.52	2.19	3.90	2.91
Gas		19.29									4.38
Petroleum products		12.34									9.81
Coal		8.00									8.88
Furniture	8.29	7.04	5.30	3.64	11.04	7.60	4.26	6.47	18.19	5.29	6.06
Textiles	7.59	5.33	3.34		12.78	5.76		9.19	2.70	5.36	4.93
Major appliances	7.24	8.15	4.30		17.02	5.08		5.48	8.89	9.25	7.97
Household utensils	6.94	6.68	3.00		14.81	4.68		5.23	3.35	5.36	6.18
Household operation	4.67	3.78	1.98		7.86	9.44		5.79	16.33	4.25	3.10
Domestic services	1.32	5.31	3.40		10.40	5.66		4.82	23.81	3.80	7.57
Medical care and health expenses	3.42	4.32	1.76	2.70	7.25	4.36	4.03	1.38	5.22	4.95	4.51
Personal transport equipment	8.34	20.84	8.70	11.15	17.44	9.07	4.39	11.79	8.25	12.44	11.96
Operation of personal transport equipment	2.39	3.81	2.62	3.70	7.27	4.37		5.61	3.56	4.62	4.47
Transport by rail	5.57	3.85	2.18	3.02	6.57	4.41		7.86	5.94	0.00	5.38
Transport by bus, coach or tram			2.28								3.05
Transport by air			4.30								9.28
Other transport			4.76								6.23
Communication	2.79	4.85	5.38	3.37	10.95	8.12		2.96	2.06	5.48	3.55
Equipment and accessories	4.88	6.77	3.48	3.13	17.38	6.63	3.91	4.96	6.29	6.44	4.98
Recreation	3.02	2.15	1.60		6.33	2.61		3.02	1.79	2.97	1.79
Expenditures in restaurants, cafes and hotels	3.15	3.99	1.79	1.74	8.36	2.29	3.44	2.54	0.78	3.20	4.44
Miscellaneous	4.13	4.90	2.60	1.90	7.74	3.92		2.46	2.30	4.39	5.14

Also available are variables which measure the demographic evolution in the countries. The demographic evolution may affect the composition of total household consumption. In order to incorporate these variables, the model is modified as follows. For the long run equilibrium relationship as

$$\ln y_{it} = c_i + b_i \ln Q_t + \sum_{j=1}^n s_{ij} \ln p_{jt} + g_{1i} \ln DEM P_t + g_{2i} \ln DEM W_t + v_{it}$$

for $i=1, \dots, n$

with

DEM W: share of people of working age in the total population,
DEM P: share of old age people in total population,

and for the short run adjustment scheme as

$$\begin{aligned} \ln y_{it} - \ln y_{it-1} = & b_{1i} (\ln Q_t - \ln Q_{t-1}) + \sum_{j=1}^n s_{1ij} (\ln p_{jt} - \ln p_{jt-1}) \quad (28) \\ & + \sum_{j=1}^{n-1} f_{ij} v_{jt-1} + h_{1i} (\ln DEM W_t - \ln DEM W_{t-1}) \\ & + h_{2i} (\ln DEM P_t - \ln DEM P_{t-1}) + u_{it} \end{aligned}$$

for $i=1, \dots, n$.

During estimation all expenditures are converted to expenditures per capita. In order to save on the degrees of freedom during estimation a similar set of assumptions regarding groupwise separability as described in Bracke and Bréchet (1995) has been used. In a first stage the representative economic agent of each country decides how much to spend on "durable and complementary non-durable goods" on the one hand, and "other non-durable goods" on the other hand. In a second stage he decides how much of the amount to be spent on durable goods will be allocated to clothing, household utilities, and transportation. Transportation includes public transportation, equipment, such as cars, and energy, which includes petrol, heavy fuel and oil. The group of non-durable goods has been modified and an additional decision stage has been added. It now consists of "necessities" and "luxuries". "Luxuries" includes communication, tourism and domestic services, while "necessities" includes food, beverages, tobacco, education, rent, health, electricity and other expenditure items. See also Figure 1¹ and Figure 2.

1. This allocation structure has been modified for Germany, Ireland, Italy, the United Kingdom, Belgium and France. For Germany and Ireland the first decision stage in the group of durable and complementary non-durable goods consists of clothing and footwear, furniture and household equipment, personal transport equipment, operation of personal transport equipment, and purchased transport. For Italy and the United Kingdom medical care has been moved from the group of "necessities" to the group of "luxuries". For Belgium and France domestic services has been moved from the group "furniture and household equipment" to the group of "luxuries".

FIGURE 1 -Allocation structure for durable goods and complementary non durables

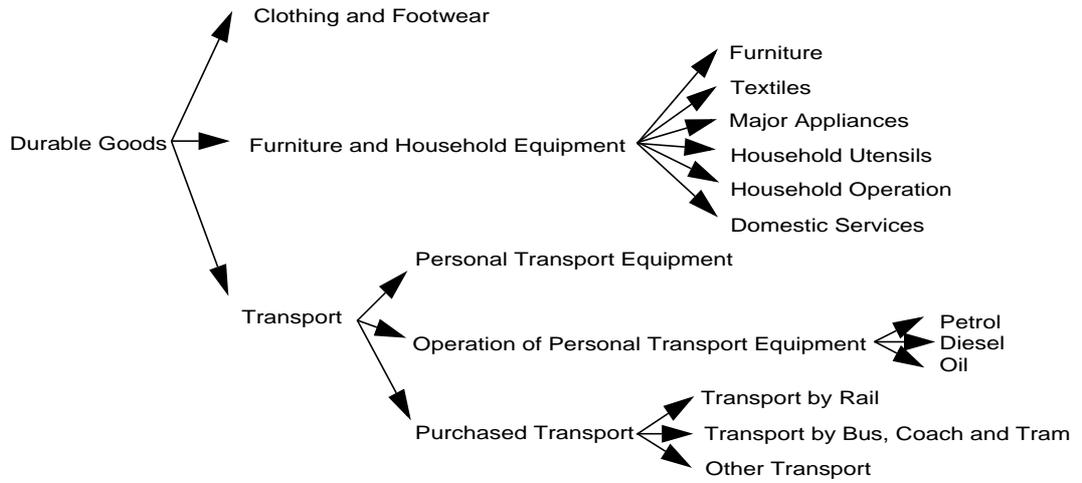
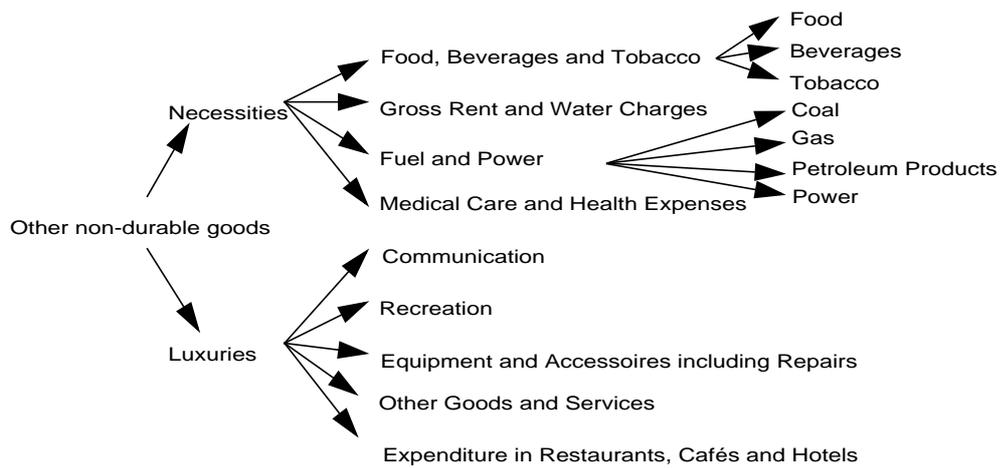


FIGURE 2 -Allocation structure for non-durable goods



B. The estimation results

We estimated for each country a complete system of demand equations subject to the restrictions derived from the theory of rational consumer behaviour¹. In the supplement to this paper all the point estimates of the first and second step of the Two-Step Engle-Granger and some diagnostic statistics are presented. Here we will summarize the major results in the form of the long and short run overall income elasticities, and the compensated and uncompensated overall own price elasticities.

C. The elasticities

Once the model is estimated the long and short run elasticities can be calculated.

The overall long run elasticities are defined as

$$\text{- income elasticity :} \quad \eta_{it} = \frac{b_i}{w_{it}} + 1$$

$$\text{- compensated price elasticities :} \quad \varepsilon_{ijt} = \frac{s_{ij}}{w_{it}}$$

$$\text{- uncompensated price elasticities :} \quad \theta_{ijt} = \varepsilon_{ijt} - w_{jt} \eta_{it}$$

The overall short run elasticities are defined as

$$\text{- income elasticity :} \quad \eta_{1it} = \frac{b_{1i}}{w_{it}} + 1$$

$$\text{- compensated price elasticity :} \quad \varepsilon_{1ijt} = \frac{s_{1ij}}{w_{it}}$$

$$\text{- uncompensated price elasticities :} \quad \theta_{1ijt} = \varepsilon_{1ijt} - w_{jt} \eta_{1it}$$

where the parameters b_i and s_{ij} are calculated as described in section IV. The previous equations show that the elasticities of the CBS version change together with the budget shares. It should then be noted that the value of the elasticity may change significantly during the course of time, if the budget share changes significantly during the course of time.

Tables 2 until 7 of this paper summarize the main results for the 11 countries as well as the European average² and the coefficient of variation³. The elasticities in the subsequent tables are evaluated for the sample mean, reflecting average responses of demanded quantities to changes in prices and income.

-
1. To estimate the allocation system under the various restrictions, especially the negativity condition, use has been made of a modified version of the DEMMOD software. See Barten et al. (s.a.). In some systems dummy variables have been used and for some countries the restriction of homothetic preferences has been imposed at the level where the allocation between durable and non-durable goods is made. In a few cases the marginal propensity to spend has been fixed to a value equal to the initial point estimate plus (or minus) one or two times the standard error of the unrestricted error.
 2. Unweighted average.
 3. I.e., the standard deviation divided by the mean.

Table 2 shows the overall long run income elasticities. The income elasticities of furniture and transport equipment are highest, i.e., on average, 1.31 and 1.45, respectively. The overall long run income elasticity of recreation is, on average, lowest, i.e. 0.77. The variation coefficient is lowest for transport equipment and highest for tobacco.

The overall long run compensated own price elasticities are presented in Table 3. Most of the overall compensated long run own price elasticities are situated between -0.5 and -1.0. On average, the compensated own price elasticity is the lowest for food, expenditures in restaurants and cafes, clothing, rent and the operation of transport equipment, i.e., -0.39, -0.45, -0.43, -0.43 and -0.36, respectively. Note the rather high own price elasticities of tobacco and beverages, which are on average equal to -1.19 and -1.27, respectively, but note also the rather strong differences between the countries. Table 4 shows the overall long run uncompensated own price elasticities. The uncompensated price elasticities take into account the income effect of a price change. Here we find similar results as in table 3.

Table 5 shows the overall short run income elasticities. Here the short run income elasticity of expenditures on domestic services is on average lowest, i.e., 0.47, while the income elasticity of transport equipment is, on average, fairly high, i.e., 1.81. The variation coefficients of the short run income elasticities are usually higher than the variation coefficients of the long run elasticities.

Table 6 shows the overall short run compensated own price elasticities. Most short run compensated own price elasticities are, in absolute terms, lower than the long run compensated own price elasticities. Here we find the lowest average compensated own price elasticity for food, fuel and power, i.e., -0.19 and -0.17, respectively, and the highest for household appliances, i.e., -0.82. Table 7 shows the overall short run uncompensated own price elasticities, which have a similar structure as the compensated price elasticities.

TABLE 2 - Long Run Overall Income Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	0.56	0.42	0.89	1.09	1.21	1.00	0.24	0.75	1.38	1.03	0.94	0.87	0.40
Beverages	1.10	0.25	1.19	0.93	1.07	1.00	0.36	0.66	1.25	0.82	1.92	0.96	0.47
Tobacco	0.39	0.24	0.76	1.27	1.22	0.42	0.24	0.74	1.63	2.33	1.29	0.96	0.69
Clothing and footwear	0.48	0.77	0.61	0.47	0.67	1.61	0.79	0.59	0.53	1.75	0.70	0.81	0.54
Gross rent and water charges	0.92	2.09	1.06	1.30	0.55	0.78	0.85	1.65	1.28	0.11	0.78	1.03	0.52
Power	0.54	0.32	1.11	0.75	0.37	0.59	0.94	1.41	1.28	1.31	0.62	0.84	0.46
Gas		0.65									1.07	0.91	0.39
Petroleum products		1.01									0.75	0.91	0.37
Coal		0.68									0.20	0.83	0.48
Furniture	1.50	1.59	1.32	0.94	2.09	1.16	1.20	1.44	0.64	1.80	0.76	1.31	0.33
Textiles	1.21	0.95	0.64		0.78	1.03		0.84	0.44	1.62	0.79	0.95	0.34
Major appliances	1.06	1.05	0.74		1.24	1.26		0.60	0.91	1.57	0.75	1.03	0.27
Household utensils	1.30	0.66	0.38		0.75	1.10		0.51	0.38	1.45	1.27	0.90	0.43
Household operations	0.90	0.54	0.44		0.66	1.63		0.34	0.05	1.46	0.54	0.79	0.62
Domestic services	1.61	0.93	0.56		0.96	0.39		0.93	0.37	0.70	0.59	0.83	0.44
Medical care and health expenses	0.96	1.28	1.38	0.27	1.16	0.88	1.55	0.83	1.07	0.68	1.20	1.02	0.35
Personal transport equipment	1.53	1.19	1.22	1.59	2.16	1.14	1.82	1.47	1.03	1.42	1.40	1.45	0.22
Operations of personal transport equipments	1.00	1.19	0.83	1.29	0.36	1.20		0.67	0.49	1.00	0.79	0.97	0.42
Transport by rail	1.14	0.55	1.15	1.24	0.76	1.06		1.00	0.61	0.71	0.65	0.97	0.38
Transport by bus, coach or tram			0.82								0.58	0.94	0.40
Transport by air			1.81								1.62	1.12	0.41
Other transport			1.95								1.14	1.09	0.42
Communication	1.43	1.00	0.54	1.62	1.60	1.55		0.71	0.40	0.62	0.90	1.11	0.46
Equipment and accesories	1.55	1.41	1.58	1.41	1.47	0.86	1.20	1.52	0.34	0.94	0.81	1.19	0.34
Recreation	1.19	0.31	0.70		0.66	0.46		1.07	0.73	0.47	0.31	0.77	0.50
Expenditures in restaurants, cafes and hotels	1.38	1.11	0.85	0.82	0.94	0.94	1.15	0.64	1.00	0.87	1.53	1.02	0.25
Miscellaneous	1.79	0.90	1.36	1.18	0.81	0.81		1.09	0.82	1.28	1.28	1.13	0.26

TABLE 3 - Long Run Compensated Overall Own Price Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	-0.32	-0.42	-0.26	-0.46	-0.57	-0.53	-0.21	-0.34	-0.45	-0.44	-0.26	-0.39	-0.30
Beverages	-1.06	-0.70	-1.00	-0.82	-0.68	-2.08	-1.72	-0.87	-2.49	-2.14	-0.40	-1.27	-0.56
Tobacco	-1.19	-0.87	-1.89	-0.98	-0.89	-1.28	-0.12	-1.12	-2.25	-1.76	-0.77	-1.19	-0.50
Clothing and footwear	-0.91	-0.31	-0.44	-0.62	-0.23	-0.15	-0.54	-0.52	-0.18	-0.74	-0.12	-0.43	-0.60
Gross rent and water charges	-0.19	-0.28	-0.27	-0.85	-0.78	-0.15	-0.53	-0.21	-1.37	-0.00	-0.06	-0.43	-0.98
Power	-1.34	-0.13	-0.35	-0.64	-0.78	-0.94	-0.24	-0.50	-1.06	-0.98	-0.72	-0.70	-0.53
Gas		-1.00									-1.29	-0.83	-0.44
Petroleum products		-1.17									-1.30	-0.85	-0.44
Coal		-0.45									-0.23	-0.68	-0.53
Furniture	-1.17	-1.50	-0.26	-0.79	-0.47	-0.52	-0.45	-0.58	-0.24	-0.37	-0.47	-0.62	-0.63
Textiles	-0.95	-1.00	-0.96		-0.57	-1.19		-0.91	-0.27	-0.35	-0.93	-0.76	-0.40
Major appliances	-0.79	-0.83	-0.33		-1.45	-0.95		-0.66	-0.43	-0.49	-1.30	-0.77	-0.47
Household utensils	-1.14	-1.17	-0.44		-0.96	-0.79		-0.60	-0.57	-0.65	-1.20	-0.80	-0.36
Household operation	-0.51	-0.64	-0.26		-0.11	-1.54		-0.64	-0.06	-0.17	-0.31	-0.50	-0.84
Domestic services	-0.84	-1.58	-1.37		-0.86	-0.68		-1.18	-0.34	-0.22	-0.86	-0.83	-0.50
Medical care and health expenses	-0.66	-1.59	-0.68	-0.30	-1.09	-0.33	-0.81	-0.08	-0.89	-0.98	-1.20	-0.78	-0.56
Personal transport equipment	-0.56	-1.08	-0.10	-0.25	-0.20	-0.37	-0.91	-0.47	-0.61	-0.54	-0.42	-0.50	-0.59
Operation of personal transport equipment	-0.30	-0.91	-0.17	-0.38	-0.07	-0.42		-0.12	-0.03	-0.32	-0.33	-0.36	-0.83
Transport by rail	-1.13	-0.66	-0.43	-1.17	-0.63	-0.79		-0.74	-0.34	-0.87	-0.45	-0.74	-0.37
Transport by bus, coach or tram			-0.60								-0.68	-0.77	-0.31
Transport by air			-0.69								-1.14	-0.82	-0.31
Other transport			-0.57								-0.69	-0.77	-0.31
Communication	-1.30	-1.09	-0.71	-1.02	-0.90	-1.15		-1.17	-1.59	-1.49	-1.14	-1.13	-0.23
Equipment and accessories	-0.28	-0.48	-0.58	-0.75	-1.11	-1.13	-0.88	-0.52	-0.89	-1.06	-0.63	-0.76	-0.37
Recreation	-0.30	-0.46	-0.43		-0.82	-0.86		-0.74	-0.25	-0.20	-0.21	-0.54	-0.52
Expenditures in restaurants, cafes and hotels	-0.29	-1.12	-0.11	-0.31	-0.67	-0.39	-0.63	-0.33	-0.69	-0.16	-0.25	-0.45	-0.66
Miscellaneous	-0.48	-0.41	-0.54	-0.55	-1.22	-0.73		-0.96	-0.20	-0.18	-0.17	-0.55	-0.60

Note : unweighted average

TABLE 4 - Long Run Uncompensated Overall Own Price Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	-0.42	-0.49	-0.43	-0.62	-0.86	-0.77	-0.25	-0.45	-0.93	-0.67	-0.43	-0.57	-0.37
Beverages	-1.08	-0.71	-1.04	-0.85	-0.82	-2.10	-1.73	-0.89	-2.52	-2.16	-0.54	-1.31	-0.52
Tobacco	-1.20	-0.88	-1.90	-1.00	-0.94	-1.28	-0.13	-1.13	-2.29	-1.79	-0.82	-1.22	-0.49
Clothing and footwear	-0.96	-0.36	-0.48	-0.65	-0.28	-0.31	-0.60	-0.56	-0.23	-0.90	-0.17	-0.50	-0.52
Gross rent and water charges	-0.30	-0.65	-0.41	-1.02	-0.81	-0.23	-0.64	-0.42	-1.42	-0.01	-0.17	-0.55	-0.74
Power	-1.35	-0.13	-0.40	-0.67	-0.80	-0.96	-0.30	-0.57	-1.10	-1.00	-0.74	-0.73	-0.50
Gas		-1.00									-1.31	-0.86	-0.40
Petroleum products		-1.19									-1.30	-0.88	-0.41
Coal		-0.46									-0.23	-0.71	-0.50
Furniture	-1.23	-1.54	-0.30	-0.87	-0.51	-0.55	-0.56	-0.63	-0.25	-0.41	-0.49	-0.67	-0.60
Textiles	-0.97	-1.01	-0.96		-0.58	-1.20		-0.91	-0.28	-0.37	-0.94	-0.79	-0.37
Major appliances	-0.81	-0.84	-0.34		-1.47	-0.96		-0.67	-0.44	-0.51	-1.32	-0.80	-0.44
Household utensils	-1.17	-1.18	-0.45		-0.97	-0.80		-0.61	-0.58	-0.65	-1.21	-0.82	-0.34
Household operation	-0.53	-0.65	-0.26		-0.12	-1.58		-0.65	-0.06	-0.19	-0.32	-0.53	-0.82
Domestic services	-0.86	-1.59	-1.37		-0.86	-0.68		-1.19	-0.35	-0.22	-0.86	-0.86	-0.48
Medical care and health expenses	-0.76	-1.62	-0.79	-0.34	-1.12	-0.37	-0.91	-0.18	-0.93	-1.01	-1.22	-0.84	-0.50
Personal transport equipment	-0.62	-1.14	-0.15	-0.32	-0.29	-0.41	-1.20	-0.52	-0.65	-0.59	-0.47	-0.58	-0.57
Operation of personal transport equipment	-0.36	-0.99	-0.25	-0.47	-0.08	-0.48		-0.16	-0.05	-0.40	-0.37	-0.44	-0.82
Transport by rail	-1.14	-0.68	-0.44	-1.19	-0.65	-0.80		-0.75	-0.37	-0.88	-0.46	-0.78	-0.38
Transport by bus, coach or tram			-0.60								-0.69	-0.81	-0.33
Transport by air			-0.70								-1.16	-0.87	-0.32
Other transport			-0.58								-0.70	-0.81	-0.33
Communication	-1.31	-1.10	-0.72	-1.05	-0.92	-1.17		-1.18	-1.59	-1.49	-1.15	-1.17	-0.21
Equipment and accessories	-0.34	-0.54	-0.64	-0.88	-1.15	-1.17	-0.93	-0.58	-0.90	-1.09	-0.66	-0.81	-0.34
Recreation	-0.33	-0.48	-0.45		-0.86	-0.88		-0.79	-0.27	-0.22	-0.23	-0.58	-0.51
Expenditures in restaurants, cafes and hotels	-0.40	-1.18	-0.16	-0.35	-0.69	-0.47	-0.79	-0.36	-0.78	-0.28	-0.36	-0.53	-0.56
Miscellaneous	-0.58	-0.46	-0.64	-0.61	-1.26	-0.78		-1.05	-0.22	-0.26	-0.25	-0.63	-0.52

Note : unweighted average

TABLE 5 - Short Run Overall Income Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	0.63	0.81	0.52	0.98	1.30	0.84	0.00	0.47	1.14	1.12	0.59	0.76	0.49
Beverages	1.20	0.51	0.34	0.69	1.27	1.19	0.07	2.01	0.68	1.20	1.85	1.00	0.60
Tobacco	1.33	0.49	0.27	0.41	0.33	0.98	0.27	0.87	0.95	0.22	1.66	0.71	0.68
Clothing and footwear	0.69	0.93	0.68	0.61	0.80	1.34	0.55	0.84	1.26	0.97	0.68	0.85	0.30
Gross rent and water charges	0.79	1.40	1.39	1.02	0.21	0.83	1.00	1.60	0.71	0.09	0.37	0.86	0.58
Power	1.18	0.57	1.19	0.35	0.78	0.98	0.96	1.95	1.02	1.49	0.15	0.97	0.53
Gas		1.86									0.40	1.11	0.47
Petroleum products		1.59									0.66	1.10	0.41
Coal		0.85									0.30	1.00	0.47
Furniture	1.53	1.41	1.52	0.95	1.55	1.20	1.77	1.70	0.54	1.25	0.98	1.31	0.28
Textiles	1.09	0.95	0.47		1.70	1.14		1.04	0.40	1.03	0.67	1.02	0.42
Major appliances	1.01	1.46	0.92		1.51	1.66		1.27	0.97	1.30	1.00	1.26	0.25
Household utensils	1.17	0.39	0.59		1.34	0.66		0.80	0.20	1.26	1.15	0.93	0.49
Household operation	0.97	0.60	0.58		0.28	1.20		0.66	0.03	0.95	0.48	0.77	0.61
Domestic services	0.04	0.15	0.14		-0.41	0.45		0.24	0.69	0.40	0.77	0.47	1.21
Medical care and health expenses	1.80	0.65	1.64	0.83	0.36	1.57	0.76	0.50	0.97	1.03	1.04	1.01	0.47
Personal transport equipment	1.23	2.21	1.74	1.93	2.17	1.68	2.16	1.49	1.74	1.61	1.91	1.81	0.17
Operation of personal transport equipment	1.07	0.67	0.97	1.17	0.30	0.91		0.57	0.73	0.68	1.07	0.94	0.51
Transport by rail	0.27	0.00	0.66	0.09	0.67	0.60		0.95	1.40	0.96	0.84	0.78	0.79
Transport by bus, coach or tram			0.15								0.37	0.69	0.94
Transport by air			1.28								1.13	0.86	0.74
Other transport			1.65								1.21	0.91	0.74
Communication	0.50	0.92	0.76	0.69	0.39	0.75		1.18	-0.29	1.75	0.81	0.87	0.75
Equipment and accessories	1.32	1.63	1.44	1.58	1.96	1.59	1.03	1.38	0.29	1.50	1.68	1.40	0.31
Recreation	0.20	0.59	0.30		0.77	0.14		1.00	1.26	0.58	0.50	0.72	0.63
Expenditures in restaurants, cafes and hotels	0.95	1.22	1.10	1.00	0.53	0.97	1.09	0.93	0.80	1.35	1.53	1.04	0.26
Miscellaneous	1.57	0.74	1.26	1.42	1.03	0.80		0.81	1.26	1.46	2.02	1.22	0.32

Note : unweighted average

TABLE 6 - Short Run Compensated Overall Own Price Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	-0.23	-0.30	-0.15	-0.47	-0.33	-0.17	-0.00	-0.17	-0.09	-0.04	-0.11	-0.19	-0.74
Beverages	-0.29	-0.51	-0.51	-0.38	-0.45	-0.07	-0.00	-0.68	-0.19	-0.02	-0.14	-0.29	-0.77
Tobacco	-0.43	-0.59	-0.24	-0.64	-0.35	-0.61	-0.12	-0.56	-0.14	-0.02	-0.38	-0.37	-0.59
Clothing and footwear	-0.82	-0.45	-0.60	-0.42	-0.48	-0.10	-0.42	-0.67	-0.24	-0.44	-0.15	-0.44	-0.49
Gross rent and water charges	-0.12	-0.20	-0.42	-0.81	-0.13	-0.07	-0.65	-0.27	-0.05	-0.00	-0.04	-0.25	-1.06
Power	-0.04	-0.07	-0.04	-0.10	-0.32	-0.05	-0.32	-0.16	-0.33	-0.30	-0.19	-0.17	-0.71
Gas		-0.28									-0.15	-0.19	-0.65
Petroleum products		-0.47									-0.81	-0.27	-0.87
Coal		-0.26									-0.60	-0.23	-0.76
Furniture	-0.91	-1.22	-0.21	-0.87	-1.41	-0.19	-0.42	-0.43	-0.38	-0.31	-0.26	-0.60	-0.71
Textiles	-1.20	-1.58	-0.64		-0.72	-1.45		-0.40	-0.34	-0.50	-0.61	-0.79	-0.54
Major appliances	-0.65	-0.93	-0.03		-1.80	-1.29		-0.26	-0.67	-0.98	-1.17	-0.82	-0.60
Household utensils	-0.82	-1.40	-0.33		-2.24	-0.17		-0.36	-0.21	-0.15	-0.26	-0.66	-0.99
Household operation	-0.09	-0.70	-0.22		-0.64	-2.25		-0.72	-0.39	-0.32	-0.65	-0.66	-0.87
Domestic services	-0.08	-0.94	-0.66		-0.14	-0.01		-0.22	-0.87	-0.27	-0.97	-0.49	-0.76
Medical care and health expenses	-0.81	-0.02	-0.56	-0.54	-0.37	-0.35	-0.70	-0.04	-0.90	-0.01	-0.45	-0.43	-0.73
Personal transport equipment	-0.28	-1.25	-0.20	-0.46	-0.03	-0.67	-0.43	-0.42	-0.58	-0.30	-0.29	-0.45	-0.72
Operation of personal transport equipment	-0.30	-0.61	-0.07	-0.21	-0.11	-0.53		-0.11	-0.01	-0.11	-0.35	-0.26	-0.78
Transport by rail	-0.00	-0.45	-0.11	-0.88	-0.55	-0.11		-0.54	-0.56	-0.06	-0.73	-0.40	-0.73
Transport by bus, coach or tram			-0.25								-0.64	-0.41	-0.67
Transport by air			-0.38								-0.99	-0.45	-0.69
Other transport			-0.46								-0.55	-0.42	-0.62
Communication	-0.52	-0.45	-0.81	-0.35	-0.61	-0.65		-0.31	-0.42	-0.45	-0.26	-0.48	-0.33
Equipment and accessories	-0.21	-0.41	-0.48	-0.67	-0.58	-0.84	-0.78	-0.35	-1.03	-0.24	-0.28	-0.53	-0.51
Recreation	-0.21	-0.21	-0.12		-0.98	-0.86		-1.00	-0.32	-0.23	-0.28	-0.51	-0.67
Expenditures in restaurants, cafes and hotels	-0.41	-1.06	-0.32	-0.18	-0.68	-0.61	-0.81	-0.49	-0.44	-0.10	-0.11	-0.47	-0.64
Miscellaneous	-0.62	-0.61	-0.64	-0.27	-1.50	-0.38		-0.32	-0.14	-0.21	-0.42	-0.54	-0.70

Note : unweighted average

TABLE 7 - Short Run Uncompensated Overall Own Price Elasticities
(Evaluated for the sample mean)

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom	Average	Variation
Food	-0.35	-0.45	-0.24	-0.61	-0.64	-0.37	-0.00	-0.24	-0.49	-0.29	-0.21	-0.35	-0.53
Beverages	-0.32	-0.53	-0.52	-0.40	-0.61	-0.09	-0.01	-0.74	-0.21	-0.05	-0.28	-0.34	-0.71
Tobacco	-0.46	-0.60	-0.24	-0.65	-0.36	-0.62	-0.14	-0.58	-0.16	-0.02	-0.45	-0.39	-0.57
Clothing and footwear	-0.89	-0.51	-0.64	-0.47	-0.54	-0.24	-0.46	-0.74	-0.36	-0.53	-0.21	-0.51	-0.40
Gross rent and water charges	-0.22	-0.45	-0.60	-0.94	-0.14	-0.16	-0.78	-0.47	-0.07	-0.01	-0.09	-0.36	-0.87
Power	-0.07	-0.08	-0.09	-0.11	-0.36	-0.08	-0.38	-0.24	-0.36	-0.33	-0.19	-0.21	-0.62
Gas		-0.30									-0.15	-0.22	-0.56
Petroleum products		-0.55									-0.81	-0.31	-0.75
Coal		-0.23									-0.60	-0.26	-0.64
Furniture	-0.96	-1.26	-0.25	-0.95	-1.44	-0.22	-0.59	-0.49	-0.39	-0.34	-0.29	-0.65	-0.66
Textiles	-1.21	-1.59	-0.65		-0.73	-1.46		-0.41	-0.35	-0.51	-0.61	-0.83	-0.51
Major appliances	-0.67	-0.95	-0.05		-1.81	-1.31		-0.27	-0.68	-0.99	-1.18	-0.86	-0.57
Household utensils	-0.84	-1.40	-0.34		-2.25	-0.17		-0.37	-0.21	-0.16	-0.27	-0.69	-0.95
Household operation	-0.10	-0.71	-0.24		-0.65	-2.28		-0.73	-0.40	-0.34	-0.65	-0.69	-0.84
Domestic services	-0.08	-0.94	-0.66		-0.14	-0.02		-0.22	-0.88	-0.28	-0.97	-0.52	-0.74
Medical care and health expenses	-0.99	-0.03	-0.69	-0.64	-0.38	-0.43	-0.75	-0.10	-0.94	-0.05	-0.46	-0.50	-0.68
Personal transport equipment	-0.33	-1.40	-0.26	-0.54	-0.12	-0.73	-0.77	-0.47	-0.64	-0.35	-0.37	-0.54	-0.64
Operation of personal transport equipment	-0.37	-0.63	-0.15	-0.29	-0.13	-0.58		-0.14	-0.05	-0.16	-0.41	-0.33	-0.72
Transport by rail	-0.01	-0.45	-0.11	-0.88	-0.56	-0.12		-0.55	-0.62	-0.08	-0.73	-0.44	-0.70
Transport by bus, coach or tram			-0.25								-0.65	-0.45	-0.65
Transport by air			-0.38								-1.00	-0.49	-0.66
Other transport			-0.46								-0.55	-0.46	-0.61
Communication	-0.53	-0.46	-0.82	-0.36	-0.62	-0.65		-0.33	-0.42	-0.46	-0.27	-0.52	-0.34
Equipment and accessories	-0.26	-0.48	-0.53	-0.82	-0.63	-0.89	-0.82	-0.41	-1.04	-0.28	-0.34	-0.59	-0.45
Recreation	-0.21	-0.24	-0.13		-1.03	-0.87		-1.05	-0.36	-0.26	-0.30	-0.55	-0.65
Expenditures in restaurants, cafes and hotels	-0.48	-1.12	-0.39	-0.23	-0.69	-0.69	-0.96	-0.53	-0.51	-0.28	-0.21	-0.55	-0.53
Miscellaneous	-0.71	-0.65	-0.72	-0.34	-1.56	-0.43		-0.39	-0.18	-0.30	-0.55	-0.62	-0.62

Note : unweighted average.

D. The dynamics of the system

The starting point of our modelling strategy was the assumption that there exists a long run equilibrium, but that the adjustment to this equilibrium does not occur immediately¹. The dynamics of the demand for a particular commodity is determined by the initial difference between the demand for the commodity and its new long run equilibrium, and the spill over effects from disequilibria in the demand for the other commodities. The speed of this adjustment process is determined by the values of the coefficients associated with the error correction terms, i.e., f_{ij} .

Tables 8 until 18 show for 11 countries some numerical results for a 1 percent increase in total real income². In period 0 the system is in a steady state, and in period 1 the total real income increases by 1 percent. In the absence of further shocks the error correction mechanism will pull the system to the new steady state.

The numerical results presented in tables 8 until 18 show the adjustment process to the new steady state. These tables show deviations from the baseline. In period 1 the responses can be interpreted as short run income elasticities, while the values in period 10 approximate the long run income elasticities. The elasticities differ from the elasticities shown in tables 2 and 6, to the extent that the average budget share differs from the contemporaneous budget share. Note that here the responses of, for example, personal transport equipment are smaller than reported in tables 2 and 6, reflecting the increasing budget share of this expenditure item. The results in tables 8 until 18 illustrate also that in most countries the system converges to its new equilibrium rather fast: after 5 years the changes are less than 0.1 percent.

Within sample simulations are also made and the root mean squared errors (RMSE) were calculated as

$$RMSE_i = \frac{1}{T} \sqrt{\sum_{t=1}^T \left(\frac{\tilde{q}_{it} - q_{it}}{q_{it}} \right)^2} \quad \text{for } i=1, \dots, n \quad (29)$$

with : \tilde{q}_{it} : simulated value of the endogenous variable,
 q_{it} : actual value of the endogenous variable,

1. See also the appendix for a brief discussion of the dynamics of the allocation system.
2. Inserting the analytical expressions for the error correction terms into equation (28) and rearranging terms, we used for the simulation

$$\begin{aligned} \ln q_{it} = & (w_{1993} \ln q_{it-1} - w_{1993} \ln Q_{t-1} + w_{1993} \ln Q_t + b_{1i} (\ln Q_t - \ln Q_{t-1})) \\ & + \sum_{j=1}^n s_{1ij} (\ln p_{jt} - \ln p_{jt-1}) + \sum_{j=1}^{n-1} f_{ij} \left(\ln y_{jt-1} - c_j - b_i \ln Q_{t-1} - \sum_{k=1}^n s_{jk} \ln p_{kt-1} \right) \\ & + h_{1i} (\ln DEMW_t - \ln DEMW_{t-1}) + h_{2i} (\ln Demp_t - \ln Demp_{t-1}) / w_{1993} \end{aligned}$$

for $i=1, \dots, n$

with w_{1993} the budget shares evaluated for 1993, i.e., the last observed budget share.

T : number of time periods in the simulation.

Table 19 shows the RMSE for the 11 countries. The overall performance of the model seems to be satisfying. Expenditures on transport equipment, domestic services, and medical care seem to perform worst, while the performance of food seems to be best.

TABLE 8 - Belgium: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.58	0.57	0.59	0.57	0.55	0.53	0.53	0.52	0.52	0.52
Beverages	0.00	1.09	0.85	0.94	1.02	1.06	1.07	1.05	1.03	1.02	1.01
Tobacco	0.00	1.23	0.92	0.59	0.35	0.26	0.27	0.31	0.34	0.36	0.36
Clothing and footwear	0.00	0.66	0.52	0.47	0.45	0.43	0.43	0.43	0.43	0.43	0.43
Gross rent and water charges	0.00	0.81	0.95	0.90	0.87	0.87	0.87	0.88	0.88	0.88	0.89
Fuel and Power	0.00	1.18	0.09	0.16	0.38	0.47	0.49	0.50	0.51	0.52	0.53
Furniture	0.00	1.56	1.54	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53
Textiles	0.00	1.11	1.15	1.21	1.22	1.22	1.21	1.21	1.22	1.22	1.22
Major appliances	0.00	1.02	1.01	1.06	1.08	1.08	1.07	1.07	1.07	1.07	1.07
Household utensils	0.00	1.18	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.31	1.31
Household operations	0.00	0.96	0.84	0.83	0.86	0.88	0.88	0.88	0.88	0.88	0.88
Domestic services	0.00	-0.38	1.10	1.96	1.86	1.58	1.50	1.55	1.60	1.61	1.60
Medical care and health expenses	0.00	1.64	1.25	1.06	0.99	0.96	0.94	0.93	0.92	0.91	0.91
Personal transport equipment	0.00	1.22	1.40	1.45	1.48	1.49	1.49	1.49	1.49	1.49	1.50
Operations of personal transport equipment	0.00	1.07	1.00	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Purchased transport	0.00	0.08	0.84	1.01	1.06	1.07	1.08	1.08	1.08	1.08	1.08
Communication	0.00	0.54	1.52	1.33	1.21	1.24	1.33	1.38	1.40	1.40	1.40
Equipment and accessories	0.00	1.33	1.13	1.26	1.40	1.49	1.51	1.51	1.51	1.52	1.52
Recreation	0.00	0.14	0.77	0.88	1.03	1.11	1.14	1.14	1.14	1.14	1.14
Expenditures in restaurants, cafes and hotels	0.00	0.95	1.15	1.26	1.35	1.37	1.37	1.36	1.35	1.35	1.36
Miscellaneous	0.00	1.54	1.67	1.69	1.68	1.70	1.73	1.74	1.74	1.74	1.74
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 9 - Denmark: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.71	0.48	0.30	0.20	0.17	0.17	0.18	0.19	0.20	0.20
Beverages	0.00	0.43	0.28	0.17	0.11	0.10	0.10	0.11	0.11	0.11	0.11
Tobacco	0.00	0.42	0.27	0.17	0.11	0.10	0.10	0.10	0.11	0.11	0.11
Clothing and footwear	0.00	0.93	0.80	0.78	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Gross rent and water charges	0.00	1.31	1.60	1.74	1.81	1.84	1.85	1.85	1.85	1.85	1.85
Power	0.00	0.71	0.25	0.24	0.28	0.34	0.37	0.38	0.38	0.37	0.37
Gas	0.00	1.29	0.33	0.40	0.51	0.61	0.66	0.67	0.67	0.66	0.66
Petroleum products	0.00	1.16	1.43	1.00	0.98	1.11	1.25	1.34	1.36	1.36	1.35
Coal	0.00	1.48	0.53	0.40	0.53	0.66	0.73	0.74	0.73	0.71	0.70
Furniture	0.00	1.49	1.64	1.66	1.67	1.69	1.70	1.70	1.69	1.69	1.69
Textiles	0.00	0.95	1.09	1.03	0.92	0.93	0.97	0.98	0.97	0.96	0.96
Major appliances	0.00	1.36	1.00	1.12	1.05	1.03	1.03	1.05	1.05	1.04	1.04
Household utensils	0.00	0.37	0.66	0.70	0.71	0.65	0.64	0.65	0.66	0.66	0.66
Household operations	0.00	0.64	0.69	0.52	0.56	0.61	0.61	0.59	0.59	0.59	0.59
Domestic services	0.00	0.14	0.45	0.90	1.19	1.06	0.92	0.92	0.97	0.99	0.97
Medical care and health expenses	0.00	0.68	1.70	2.22	2.15	1.82	1.50	1.30	1.22	1.22	1.23
Personal transport equipment	0.00	1.62	1.44	1.33	1.27	1.24	1.23	1.22	1.22	1.22	1.22
Operations of personal transport equipment	0.00	1.11	1.05	1.11	1.14	1.16	1.17	1.17	1.17	1.17	1.18
Purchased transport	0.00	0.17	0.62	0.64	0.63	0.62	0.62	0.62	0.62	0.61	0.61
Communication	0.00	0.95	0.93	0.94	0.96	0.97	0.99	0.99	1.00	1.00	1.00
Equipment and accessories	0.00	1.71	1.57	1.53	1.51	1.50	1.49	1.49	1.49	1.49	1.49
Recreation	0.00	0.63	0.43	0.39	0.38	0.37	0.37	0.37	0.37	0.36	0.36
Expenditures in restaurants, cafes and hotels	0.00	1.22	1.10	1.10	1.11	1.12	1.12	1.13	1.13	1.13	1.13
Miscellaneous	0.00	0.73	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.91	0.91
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 10 - France: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.42	0.80	0.92	0.90	0.89	0.89	0.89	0.89	0.89	0.89
Beverages	0.00	0.28	0.52	0.63	0.66	0.69	0.72	0.75	0.78	0.81	0.83
Tobacco	0.00	0.23	0.52	0.66	0.69	0.68	0.69	0.69	0.70	0.70	0.70
Clothing and footwear	0.00	0.39	0.34	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37
Gross rent and water charges	0.00	1.32	1.31	1.09	1.04	1.06	1.06	1.06	1.06	1.06	1.06
Fuel and Power	0.00	1.27	1.86	1.53	1.37	1.35	1.34	1.33	1.31	1.29	1.27
Furniture	0.00	1.56	1.37	1.30	1.29	1.30	1.31	1.31	1.31	1.31	1.31
Textiles	0.00	0.46	0.67	0.71	0.67	0.63	0.60	0.60	0.61	0.62	0.62
Major appliances	0.00	0.92	0.80	0.77	0.74	0.72	0.71	0.72	0.72	0.72	0.72
Household utensils	0.00	0.63	0.47	0.43	0.41	0.41	0.41	0.42	0.42	0.42	0.42
Household operations	0.00	0.56	0.34	0.37	0.42	0.43	0.42	0.41	0.40	0.40	0.40
Domestic services	0.00	-0.27	-0.26	-0.11	-0.04	0.04	0.15	0.26	0.33	0.35	0.35
Medical care and health expenses	0.00	1.55	0.95	1.21	1.34	1.34	1.33	1.33	1.33	1.33	1.33
Personal transport equipment	0.00	1.67	1.24	1.09	1.07	1.10	1.13	1.15	1.15	1.14	1.14
Operations of personal transport equipment	0.00	0.93	0.86	0.82	0.78	0.76	0.75	0.76	0.76	0.77	0.77
Transport by rail	0.00	0.60	0.66	0.81	0.94	0.98	0.98	0.96	0.94	0.94	0.94
Transport by bus, coach or tram	0.00	0.13	0.45	0.64	0.74	0.80	0.79	0.76	0.72	0.70	0.70
Transport by air	0.00	1.25	1.07	1.38	1.57	1.62	1.60	1.58	1.57	1.56	1.56
Other transport	0.00	1.63	1.64	1.87	1.96	1.90	1.77	1.68	1.65	1.66	1.69
Communication	0.00	0.81	1.00	0.82	0.70	0.64	0.63	0.63	0.63	0.63	0.63
Equipment and accessories	0.00	1.51	1.82	1.64	1.62	1.63	1.65	1.66	1.66	1.66	1.66
Recreation	0.00	0.36	0.56	0.77	0.82	0.81	0.77	0.74	0.73	0.72	0.72
Expenditures in restaurants, cafes and hotels	0.00	1.10	1.01	1.01	0.93	0.87	0.83	0.82	0.82	0.83	0.84
Miscellaneous	0.00	1.26	1.17	1.17	1.25	1.31	1.35	1.36	1.36	1.36	1.35
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 11 - Germany: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.98	0.87	1.02	1.09	1.12	1.13	1.13	1.13	1.13	1.13
Beverages	0.00	0.70	0.92	0.92	1.01	1.02	1.02	1.01	1.00	0.99	0.98
Tobacco	0.00	0.39	0.75	0.82	0.98	1.07	1.13	1.18	1.21	1.24	1.25
Clothing and footwear	0.00	0.51	0.42	0.41	0.38	0.36	0.35	0.35	0.35	0.35	0.35
Gross rent and water charges	0.00	1.00	1.25	1.27	1.26	1.25	1.25	1.25	1.25	1.25	1.25
Fuel and Power	0.00	0.23	0.62	0.73	0.73	0.72	0.72	0.72	0.72	0.72	0.72
Furniture	0.00	0.94	0.97	0.94	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Medical care and health expenses	0.00	0.83	0.63	0.46	0.39	0.36	0.35	0.34	0.34	0.34	0.34
Personal transport equipment	0.00	1.78	1.54	1.46	1.45	1.44	1.43	1.43	1.43	1.43	1.43
Operations of personal transport equipment	0.00	1.00	1.23	1.24	1.25	1.26	1.26	1.26	1.26	1.27	1.27
Purchased transport	0.00	0.26	0.36	0.93	1.09	1.18	1.23	1.26	1.28	1.29	1.29
Communication	0.00	0.73	1.47	2.01	1.76	1.42	1.45	1.63	1.66	1.58	1.55
Equipment and accessories	0.00	1.58	1.55	1.42	1.35	1.39	1.44	1.43	1.40	1.40	1.41
Expenditures in restaurants, cafes and hotels	0.00	0.97	1.00	0.78	0.68	0.77	0.83	0.81	0.77	0.77	0.79
Miscellaneous	0.00	1.41	0.83	1.03	1.31	1.28	1.14	1.11	1.18	1.20	1.18
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 12 - Ireland: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	1.33	1.33	1.31	1.29	1.27	1.26	1.25	1.24	1.24	1.24
Beverages	0.00	1.26	1.25	1.21	1.17	1.14	1.13	1.11	1.11	1.10	1.10
Tobacco	0.00	0.24	0.53	0.74	0.89	1.00	1.07	1.12	1.15	1.18	1.20
Clothing and footwear	0.00	0.78	0.71	0.64	0.63	0.63	0.62	0.62	0.62	0.62	0.62
Gross rent and water charges	0.00	0.30	0.27	0.37	0.46	0.52	0.56	0.58	0.59	0.60	0.60
Fuel and Power	0.00	0.74	0.52	0.34	0.29	0.26	0.26	0.26	0.26	0.26	0.26
Furniture	0.00	1.60	2.06	2.13	2.12	2.09	2.08	2.08	2.09	2.09	2.09
Textiles	0.00	1.81	1.20	0.65	0.51	0.52	0.53	0.53	0.53	0.53	0.53
Major appliances	0.00	1.51	1.27	1.31	1.27	1.24	1.23	1.23	1.23	1.23	1.23
Household utensils	0.00	1.36	0.40	0.14	0.33	0.48	0.53	0.53	0.53	0.53	0.53
Household operations	0.00	0.41	0.72	0.74	0.78	0.78	0.77	0.76	0.76	0.76	0.76
Domestic services	0.00	0.12	1.04	1.15	0.99	0.95	0.97	0.98	0.98	0.97	0.97
Medical care and health expenses	0.00	0.58	0.95	1.06	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Personal transport equipment	0.00	1.86	1.77	1.86	1.87	1.87	1.86	1.86	1.86	1.86	1.86
Operations of personal transport equipment	0.00	0.00	-0.07	0.02	0.04	0.06	0.07	0.07	0.08	0.08	0.08
Purchased transport	0.00	0.67	0.85	0.79	0.78	0.77	0.77	0.76	0.76	0.76	0.76
Communication	0.00	0.52	1.61	1.64	1.67	1.62	1.59	1.57	1.57	1.57	1.57
Equipment and accessories	0.00	2.02	1.89	1.67	1.57	1.53	1.53	1.53	1.54	1.54	1.54
Recreation	0.00	0.75	0.82	0.79	0.72	0.67	0.65	0.65	0.65	0.65	0.66
Expenditures in restaurants, cafes and hotels	0.00	0.56	1.14	1.02	1.01	0.98	0.97	0.96	0.96	0.96	0.96
Miscellaneous	0.00	1.07	0.43	0.59	0.71	0.80	0.84	0.84	0.84	0.83	0.83
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 13 - Italy: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.84	0.99	1.06	1.07	1.04	1.02	1.03	1.04	1.04	1.04
Beverages	0.00	1.22	1.15	1.12	1.08	1.03	1.02	1.05	1.06	1.06	1.06
Tobacco	0.00	0.97	0.82	0.71	0.61	0.52	0.48	0.49	0.49	0.48	0.47
Clothing and footwear	0.00	1.35	1.50	1.58	1.62	1.62	1.62	1.62	1.62	1.62	1.62
Gross rent and water charges	0.00	0.82	0.84	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Fuel and Power	0.00	0.93	0.77	0.68	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Furniture	0.00	1.20	1.25	1.24	1.23	1.21	1.20	1.19	1.19	1.19	1.18
Textiles	0.00	1.13	0.80	1.02	1.01	1.01	1.01	1.02	1.03	1.03	1.03
Major appliances	0.00	1.74	1.24	1.28	1.28	1.28	1.27	1.27	1.28	1.27	1.27
Household utensils	0.00	0.42	0.74	0.99	0.95	0.97	0.99	1.00	1.01	1.02	1.02
Household operations	0.00	1.22	1.58	1.57	1.60	1.62	1.64	1.66	1.67	1.68	1.69
Domestic services	0.00	0.53	0.90	0.65	0.59	0.58	0.56	0.54	0.53	0.52	0.51
Medical care and health expenses	0.00	1.50	0.38	0.70	0.86	0.86	0.86	0.86	0.86	0.86	0.87
Personal transport equipment	0.00	1.62	1.32	1.20	1.17	1.16	1.16	1.15	1.15	1.15	1.15
Operations of personal transport equipment	0.00	0.87	1.03	1.10	1.14	1.17	1.18	1.19	1.19	1.19	1.19
Purchased transport	0.00	0.61	0.92	1.01	1.03	1.04	1.05	1.05	1.05	1.05	1.05
Communication	0.00	0.73	1.60	1.20	1.11	1.22	1.30	1.35	1.38	1.41	1.44
Equipment and accessories	0.00	1.61	1.35	0.95	0.89	0.91	0.91	0.90	0.90	0.89	0.89
Recreation	0.00	0.10	0.69	0.72	0.55	0.51	0.50	0.49	0.48	0.48	0.47
Expenditures in restaurants, cafes and hotels	0.00	0.95	0.75	0.78	0.89	0.91	0.92	0.92	0.92	0.93	0.93
Miscellaneous	0.00	0.80	1.18	1.04	0.89	0.86	0.85	0.84	0.84	0.83	0.83
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 14 - Luxembourg: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.00	-0.01	-0.03	-0.02	0.00	0.02	0.04	0.05	0.06	0.07
Beverages	0.00	0.00	0.01	0.02	0.13	0.19	0.22	0.23	0.24	0.24	0.24
Tobacco	0.00	-0.08	-0.13	0.26	0.36	0.36	0.35	0.33	0.31	0.29	0.28
Clothing and footwear	0.00	0.02	0.58	0.65	0.62	0.57	0.54	0.52	0.50	0.49	0.49
Gross rent and water charges	0.00	0.88	0.82	0.74	0.75	0.77	0.79	0.79	0.79	0.80	0.80
Fuel and Power	0.00	0.93	0.73	0.96	0.99	0.97	0.95	0.94	0.93	0.93	0.93
Furniture	0.00	1.71	1.46	1.33	1.26	1.22	1.20	1.19	1.18	1.18	1.17
Medical care and health expenses	0.00	0.69	1.47	1.40	1.36	1.36	1.37	1.37	1.37	1.37	1.38
Personal transport equipment	0.00	2.03	1.77	1.70	1.69	1.70	1.71	1.71	1.72	1.72	1.72
Equipment and accessories	0.00	0.98	1.10	1.13	1.14	1.15	1.15	1.15	1.15	1.15	1.15
Expenditures in restaurants, cafes and hotels	0.00	1.02	1.07	1.09	1.10	1.11	1.11	1.11	1.11	1.11	1.11
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 15 - The Netherlands: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.43	0.70	0.69	0.64	0.61	0.61	0.61	0.61	0.61	0.61
Beverages	0.00	1.86	1.36	0.58	0.46	0.51	0.54	0.54	0.54	0.54	0.54
Tobacco	0.00	0.79	0.56	0.38	0.47	0.56	0.59	0.60	0.60	0.60	0.60
Clothing and footwear	0.00	0.83	0.70	0.61	0.57	0.56	0.56	0.55	0.55	0.55	0.55
Gross rent and water charges	0.00	1.51	1.38	1.43	1.47	1.48	1.48	1.48	1.48	1.48	1.48
Fuel and Power	0.00	1.99	1.39	1.43	1.52	1.54	1.54	1.53	1.53	1.53	1.53
Furniture	0.00	1.95	1.72	1.66	1.66	1.64	1.62	1.61	1.61	1.61	1.61
Textiles	0.00	1.09	1.08	1.06	0.97	0.91	0.88	0.87	0.86	0.86	0.85
Major appliances	0.00	1.33	0.61	0.71	0.60	0.61	0.60	0.60	0.60	0.60	0.59
Household utensils	0.00	0.86	0.49	0.61	0.52	0.52	0.53	0.54	0.54	0.54	0.54
Household operations	0.00	0.77	0.34	0.41	0.41	0.43	0.43	0.44	0.44	0.44	0.44
Domestic services	0.00	0.35	1.51	0.60	0.86	0.90	0.92	0.91	0.91	0.91	0.92
Medical care and health expenses	0.00	0.49	0.76	0.86	0.87	0.86	0.86	0.86	0.86	0.86	0.86
Personal transport equipment	0.00	1.75	1.80	1.74	1.70	1.66	1.64	1.63	1.63	1.62	1.62
Operations of personal transport equipment	0.00	0.62	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Purchased transport	0.00	0.95	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.95
Communication	0.00	1.17	1.12	1.02	0.89	0.83	0.80	0.78	0.77	0.76	0.76
Equipment and accessories	0.00	1.45	1.43	1.49	1.58	1.63	1.66	1.68	1.69	1.69	1.70
Recreation	0.00	1.00	0.94	1.01	1.04	1.05	1.06	1.06	1.06	1.07	1.07
Expenditures in restaurants, cafes and hotels	0.00	0.93	0.82	0.74	0.72	0.70	0.69	0.68	0.68	0.67	0.67
Miscellaneous	0.00	0.85	1.04	1.08	1.08	1.08	1.09	1.09	1.09	1.09	1.09
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 16 - Portugal: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	1.15	1.28	1.35	1.38	1.39	1.40	1.40	1.40	1.40	1.40
Beverages	0.00	0.46	1.12	1.33	1.37	1.34	1.31	1.27	1.25	1.23	1.22
Tobacco	0.00	0.98	1.04	1.17	1.29	1.38	1.45	1.49	1.52	1.53	1.54
Clothing and footwear	0.00	1.24	0.70	0.64	0.59	0.57	0.56	0.55	0.55	0.55	0.55
Gross rent and water charges	0.00	0.11	0.44	0.60	0.76	0.88	0.97	1.05	1.11	1.16	1.20
Fuel and Power	0.00	1.02	1.09	1.18	1.23	1.25	1.27	1.28	1.28	1.29	1.29
Furniture	0.00	0.35	1.03	0.84	0.90	0.70	0.73	0.69	0.68	0.68	0.68
Textiles	0.00	0.24	0.73	0.59	0.44	0.43	0.41	0.40	0.41	0.41	0.41
Major appliances	0.00	0.56	1.60	1.03	0.90	0.91	0.83	0.84	0.83	0.83	0.83
Household utensils	0.00	0.08	0.37	0.53	0.36	0.41	0.38	0.36	0.35	0.34	0.34
Household operations	0.00	0.08	0.23	0.13	0.12	0.10	0.11	0.11	0.11	0.11	0.11
Domestic services	0.00	0.47	1.09	0.25	0.50	0.44	0.47	0.47	0.45	0.45	0.45
Medical care and health expenses	0.00	0.98	1.08	1.12	1.14	1.14	1.14	1.13	1.13	1.13	1.12
Personal transport equipment	0.00	1.73	1.42	1.24	1.12	1.08	1.07	1.06	1.06	1.06	1.06
Operations of personal transport equipment	0.00	0.54	0.55	0.54	0.48	0.45	0.43	0.43	0.43	0.43	0.43
Purchased transport	0.00	1.39	0.74	0.68	0.68	0.69	0.67	0.66	0.66	0.66	0.66
Communication	0.00	0.13	1.03	1.31	0.88	0.45	0.40	0.56	0.68	0.66	0.59
Equipment and accessories	0.00	0.30	-0.05	-0.14	0.31	0.58	0.52	0.35	0.27	0.32	0.38
Recreation	0.00	1.30	0.55	0.61	0.81	0.90	0.84	0.75	0.73	0.76	0.78
Expenditures in restaurants, cafes and hotels	0.00	0.81	0.96	1.16	1.19	1.11	1.05	1.05	1.08	1.09	1.08
Miscellaneous	0.00	1.34	1.61	0.90	0.52	0.64	0.92	1.01	0.93	0.83	0.82
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 17 - Spain: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	1.12	0.98	0.98	0.99	1.00	1.01	1.02	1.02	1.03	1.03
Beverages	0.00	1.19	0.95	0.89	0.86	0.85	0.85	0.85	0.85	0.85	0.85
Tobacco	0.00	0.37	1.40	1.77	1.92	1.99	2.02	2.04	2.05	2.06	2.06
Clothing and footwear	0.00	0.97	1.47	1.64	1.71	1.74	1.76	1.77	1.78	1.78	1.78
Gross rent and water charges	0.00	0.13	0.14	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14
Fuel and Power	0.00	1.22	1.29	1.26	1.27	1.27	1.28	1.28	1.28	1.28	1.27
Furniture	0.00	1.21	1.68	1.79	1.80	1.80	1.80	1.79	1.79	1.78	1.78
Textiles	0.00	1.03	1.62	1.68	1.72	1.70	1.71	1.70	1.70	1.69	1.69
Major appliances	0.00	1.52	1.84	1.83	1.72	1.69	1.66	1.66	1.65	1.66	1.67
Household utensils	0.00	1.28	1.67	1.70	1.68	1.65	1.61	1.58	1.56	1.53	1.52
Household operations	0.00	0.95	1.33	1.41	1.43	1.45	1.46	1.47	1.47	1.48	1.48
Domestic services	0.00	0.38	0.58	0.51	0.55	0.54	0.58	0.59	0.62	0.64	0.65
Medical care and health expenses	0.00	0.99	0.59	0.66	0.68	0.69	0.69	0.70	0.70	0.70	0.70
Personal transport equipment	0.00	1.65	1.97	1.85	1.74	1.67	1.62	1.58	1.56	1.55	1.53
Operations of personal transport equipment	0.00	0.72	0.93	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03
Purchased transport	0.00	0.91	0.97	0.80	0.67	0.58	0.52	0.47	0.44	0.42	0.40
Communication	0.00	1.73	0.90	0.67	0.60	0.57	0.56	0.55	0.56	0.56	0.56
Equipment and accessories	0.00	1.48	1.10	1.09	1.10	1.10	1.09	1.07	1.06	1.04	1.03
Recreation	0.00	0.44	0.33	0.33	0.35	0.36	0.36	0.36	0.37	0.37	0.37
Expenditures in restaurants, cafes and hotels	0.00	1.32	1.08	1.01	0.98	0.96	0.95	0.93	0.93	0.92	0.91
Miscellaneous	0.00	1.41	1.23	1.17	1.14	1.13	1.13	1.14	1.14	1.15	1.16
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 18 - United Kingdom: a 1 percent increase in total real consumption

(deviation from baseline, in percent)

	00	01	02	03	04	05	06	07	08	09	10
Food	0.00	0.54	0.81	0.91	0.94	0.96	0.96	0.96	0.96	0.96	0.96
Beverages	0.00	1.63	1.80	1.84	1.83	1.82	1.81	1.81	1.80	1.80	1.79
Tobacco	0.00	1.74	1.45	1.42	1.40	1.39	1.38	1.38	1.37	1.37	1.37
Clothing and footwear	0.00	0.59	0.56	0.56	0.57	0.58	0.59	0.60	0.60	0.61	0.61
Gross rent and water charges	0.00	0.45	0.63	0.73	0.79	0.82	0.84	0.84	0.85	0.85	0.85
Power	0.00	0.13	0.22	0.28	0.32	0.35	0.38	0.40	0.42	0.43	0.45
Gas	0.00	0.29	0.36	0.42	0.47	0.52	0.56	0.59	0.62	0.65	0.67
Petroleum products	0.00	0.88	1.37	1.51	1.48	1.39	1.29	1.20	1.13	1.08	1.04
Coal	0.00	0.71	0.42	0.19	0.05	-0.03	-0.08	-0.11	-0.13	-0.14	-0.16
Furniture	0.00	0.98	0.81	0.77	0.75	0.74	0.74	0.74	0.74	0.74	0.74
Textiles	0.00	0.65	0.80	0.75	0.75	0.76	0.76	0.77	0.77	0.77	0.77
Major appliances	0.00	0.95	0.78	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Household utensils	0.00	1.15	1.22	1.25	1.27	1.28	1.28	1.28	1.28	1.28	1.28
Household operations	0.00	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.49	0.49	0.49
Domestic services	0.00	0.79	0.66	0.67	0.66	0.66	0.65	0.65	0.65	0.65	0.65
Medical care and health expenses	0.00	1.05	1.37	1.39	1.34	1.28	1.25	1.22	1.21	1.20	1.19
Personal transport equipment	0.00	1.88	1.52	1.45	1.43	1.42	1.41	1.41	1.41	1.40	1.40
Operations of personal transport equipment	0.00	1.07	0.89	0.84	0.83	0.82	0.82	0.81	0.81	0.81	0.81
Transport by rail	0.00	0.71	0.91	0.76	0.67	0.64	0.63	0.62	0.61	0.60	0.60
Transport by bus, coach or tram	0.00	0.02	0.21	0.34	0.36	0.34	0.32	0.31	0.30	0.29	0.29
Transport by air	0.00	0.86	1.28	1.28	1.25	1.25	1.25	1.26	1.26	1.27	1.27
Other transport	0.00	0.93	1.10	1.06	1.09	1.11	1.10	1.08	1.07	1.06	1.06
Communication	0.00	0.81	1.15	1.06	0.99	0.96	0.95	0.94	0.94	0.93	0.93
Equipment and accessories	0.00	1.61	0.95	0.88	0.83	0.81	0.81	0.80	0.80	0.79	0.79
Recreation	0.00	0.33	0.27	0.19	0.17	0.17	0.18	0.18	0.18	0.18	0.18
Expenditures in restaurants, cafes and hotels	0.00	1.44	1.35	1.34	1.35	1.37	1.39	1.41	1.43	1.45	1.46
Miscellaneous	0.00	1.85	1.72	1.58	1.50	1.44	1.40	1.38	1.36	1.34	1.33
Total real consumption	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

TABLE 19 - Root mean squared errors

	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	United Kingdom
Food	0.002	0.006	0.011	0.004	0.005	0.003	0.002	0.002	0.004	0.003	0.003
Beverages	0.014	0.007	0.008	0.004	0.005	0.007	0.011	0.018	0.005	0.009	0.008
Tobacco	0.024	0.012	0.030	0.013	0.016	0.027	0.014	0.035	0.095	0.073	0.009
Clothing and footwear	0.004	0.005	0.006	0.004	0.009	0.005	0.005	0.005	0.005	0.004	0.005
Gross rent and water charges	0.002	0.005	0.018	0.002	0.004	0.007	0.003	0.004	0.007	0.001	0.018
Power	0.006	0.038	0.047	0.007	0.007	0.007	0.004	0.009	0.007	0.010	0.007
Gas		1.046									0.097
Petroleum Products		0.061									2.264
Coal		0.084									0.376
Furniture	0.007	0.006	0.008	0.005	0.016	0.005	0.006	0.009	0.008	0.006	0.008
Textiles	0.004	0.004	0.005		0.020	0.010		0.019	0.005	0.005	0.006
Major appliances	0.006	0.007	0.006		0.017	0.007		0.010	0.015	0.010	0.008
Household utensils	0.006	0.007	0.004		0.020	0.005		0.008	0.003	0.008	0.010
Household operation	0.017	0.004	0.007		0.008	0.006		0.005	0.001	0.005	0.006
Domestic services	0.025	0.035	0.031		0.064	0.014		0.111	0.013	0.023	0.034
Medical care and health expenses	0.005	0.461	0.025	0.005	0.049	0.012	0.006	0.006	0.034	0.018	0.045
Personal transport equipment	0.011	0.024	0.007	0.013	0.013	0.015	0.006	0.018	0.015	0.017	0.012
Operation of personal transport equipment	0.006	0.006	0.005	0.007	0.007	0.005		0.007	0.006	0.004	0.007
Transport by rail	0.085	0.090	0.033	0.077	0.079	0.078		0.080	0.084	0.091	0.013
Transport by bus, coach or tram			0.007								0.006
Transport by air			0.076								0.014
Other transport			0.095								0.021
Communication	0.003	0.008	0.005	0.006	0.023	0.014		0.008	0.010	0.006	0.006
Equipment and accessories	0.007	0.008	0.004	0.005	0.025	0.009	0.009	0.005	0.012	0.009	0.006
Recreation	0.005	0.003	0.002		0.007	0.003		0.004	0.012	0.006	0.005
Expenditures in restaurants, cafes and hotels	0.003	0.005	0.003	0.003	0.008	0.005	0.005	0.005	0.007	0.005	0.007
Miscellaneous	0.005	0.008	0.002	0.006	0.016	0.004		0.004	0.015	0.012	0.007

Note : See equation (29) for definition of root mean squared error.

VI Appendix: the dynamics of the system

In order to facilitate the analysis of the dynamic properties of the model described in section 3, we rewrite model 14 in matrix notation.

$$\text{Let } \ln Y_t = \begin{bmatrix} \ln y_{1t} \\ \cdot \\ \ln y_{n-1t} \end{bmatrix}, \ln P_t = \begin{bmatrix} \ln\left(\frac{p_{1t}}{p_{nt}}\right) \\ \cdot \\ \ln\left(\frac{p_{n-1t}}{p_{nt}}\right) \end{bmatrix},$$

$$C = \begin{bmatrix} c_1 \\ \cdot \\ c_{n-1} \end{bmatrix}, B = \begin{bmatrix} b_1 \\ \cdot \\ b_{n-1} \end{bmatrix}, B_1 = \begin{bmatrix} b_{11} \\ \cdot \\ b_{1n-1} \end{bmatrix}$$

$$\text{and } S = \begin{bmatrix} s_{11} & \cdot & s_{1n-1} \\ \cdot & \cdot & \cdot \\ s_{n-11} & \cdot & s_{n-1n-1} \end{bmatrix}, S_1 = \begin{bmatrix} s_{111} & \cdot & s_{11n-1} \\ \cdot & \cdot & \cdot \\ s_{1n-11} & \cdot & s_{1n-1n-1} \end{bmatrix},$$

$$A = \begin{bmatrix} a_{11} & \cdot & a_{1n-1} \\ \cdot & \cdot & \cdot \\ a_{n-11} & \cdot & a_{n-1n-1} \end{bmatrix} - \begin{bmatrix} 1 & \cdot & 0 \\ \cdot & 1 & \cdot \\ 0 & \cdot & 1 \end{bmatrix}$$

In view of these definitions system (14) can be rewritten as

$$\ln Y_t - \ln Y_{t-1} = (\ln Q_t - \ln Q_{t-1})B_1 + S_1(\ln P_t - \ln P_{t-1}) + A(\ln Y_{t-1} - C - \ln Q_{t-1}B - S \ln P_{t-1}) \quad (1)$$

or on rearranging terms,

$$\ln Y_t = (I + A)\ln Y_{t-1} + (\ln Q_t - \ln Q_{t-1})B_1 + S_1(\ln P_t - \ln P_{t-1}) - A(C + \ln Q_{t-1}B + S \ln P_{t-1}) \quad (2)$$

with I the (n-1) x (n-1) identity matrix.

Repeated backward substitution of (2) yields

$$\begin{aligned} \ln Y_t = & (I + A)^k \ln Y_{t-k} + \sum_{l=1}^k (I + A)^{l-1} (\ln Q_{t+1-l} - \ln Q_{t-l}) B_1 \\ & + \left(\sum_{l=1}^k (I + A)^{l-1} S_1 (\ln P_{t+1-l} - \ln P_{t-l}) \right) \\ & - \sum_{l=1}^k (I + A)^{l-1} A (C + \ln Q_{t-l} B + S \ln P_{t-l}) \end{aligned} \quad (3)$$

System (3) will converge to its steady state if

$$\lim_{k \rightarrow \infty} (I + A)^k = 0 \quad (4)$$

For simulation purposes, the point estimates of the dynamic adjustment coefficients are calibrated as to meet condition (4).

VII References

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