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o. 75 March 1989

The QUEST model (Version 1988)

Peter Bekx, et al Anne Bucher, Alexander Italianer, Matthias Mors*

Internal paper

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1. BACKGROUND

This paper gives an overview of a modelling project in the Directorate-General for Economic and Financial Affairs (DG II) at the Commission of the European Communities. The project aims at the construction of linked quarterly macroeconomic models for the Community countries and their main trading partners. The new model is called QUEST (Quarterly European Simulation Tool) and may be considered as 1) a substitute for the COMET model, as 2) a disaggregation of the COMPACT model, going from an aggregate European model to individual EC country models, and 3) in common with EUROLINK being quarterly and based on national data sources.

The need for such a project has also been emphasized by an outside consultant, Mr. C. Wymer, in his Report on the Use of Macroeconomic Models in DG II (1982). In this report, after a review of the then existing models in DG II (COMET and EUROLINK) and their advantages and disadvantages, Mr. Wymer presented, amongst others, the following proposals for the development of a new system of linked macroeconomic models in DG II:

- the model should be developed specifically for the purposes of DG II;

- the model should be developed to fulfill the forecasting, policy analysis and pedagogical requirements of DG II: it should be small enough to provide a framework for thought and discussion within DG II and serve its pedagogical and research purpose, whilst being suitable for medium-term projections and sufficiently disaggregated in time to be used for short-term forecasts;

- the model should be developed within DG II (pedagogical purpose, interaction modelbuilders-users);

- there could be an exchange of ideas with universities and other organisations; a prototype model for only a few EC countries and the United States could already be used to test the major feedbacks in the system;

- the model should be relatively small in the first instance, paying particular attention to the interactions among the EC countries and between the Community and the rest of the world (United States and Japan, several zones for the rest of the world).

The QUEST project has been designed on this basis, taking into account past modelling experience. The previously existing models, COMET and EUROLINK, which were constructed outside, used to be operated by the Commission's services without major modifications. COMET was more specifically used for medium term projections and policy evaluation. Continued use of COMET would have required updates, reestimations and extensive revisions (such as the production and financial blocks). EUROLINK, although oversized and only covering four Member countries, was an attempt to set up models more adapted to the requirements and the tools of the country experts of DG II in the framework of the forecasting rounds. In the meantime, a new annual

model was constructed by A. Dramais (1986), in which the Community is treated as an aggregate, linked to compacted models for the US and Japan, and a rest of the world zone. This model is called COMPACT, and is used to provide medium-term projections and policy analysis for the Community (EUR12) as a whole. It was requested both by model-users within the Commission services and by member countries that this model be disaggregated both geographically and in time in order to meet the specific purposes of DG II in terms of detail for forecasting and medium-term analysis. Some of its essential characteristics can, however, not easily be maintained at this level of aggregation.

The following sections describe how the objectives defined by Mr. Wymer can concretely be achieved and report on the work in progress. In section 2, an overview of the project, its architecture and purposes, are presented. A more detailed presentation of the equations is given in section 3, with the estimation results obtained. Following Mr. Wymer's proposal of testing the system on a sub-group of countries, the empirical investigation focused up to now on those countries for which a complete set of sufficiently long time series of quarterly national accounts is available, namely Germany, France, the UK and the US. Section 4 illustrates the simulation properties of the four country modules in linked and unlinked mode for a set of standard simulation exercises. In section 5, finally, some conclusions are drawn and subjects for further research are set out.

Two separate volumes (which can be obtained from the authors upon request) contain full listings of the national modules and the trade linkage as well as detailed simulation results.

2. OVERVIEW

2.1. General philosophy

The development of the QUEST model aims at contributing to economic analysis inside DG II. It would be unrealistic to envisage setting up a tool able to answer all the questions raised by the implementation of Community policies. These are anyway often microeconomic or sectoral. The intention is more specifically to build a consistent framework providing a quick evaluation of the main aggregates of the European economies. As recommended by Mr. Wymer, three main working areas of DG II should be concerned: medium term projections, policy analysis, short term forecasts (particularly in view of evaluating quickly alternative scenarios around the central projection elaborated by the country experts of DG II).

These objectives have clear implications for the priorities to be given to the modelling work:

- the model must cover all the Member States and incorporate their interdependencies in a way allowing evaluations of the repercussions at the Community level of national policies;
- the model should endogenise the main determinants of the extra-Community environment, taking into account the interactions of world trade flows; moreover the model should rapidly provide answers to questions on the impact of changes in the world economy. This implies, in particular, a fairly detailed description of the US and Japanese economies;
- to remain manageable, the model must be small: no sectoral disaggregation is envisaged. This should be compatible with the need for a flexible system. Flexibility means partly adaptation to different policy regimes, implying a fairly great disaggregation of policy instruments and the possibility of running the model under different policy constraints (external or budgetary constraints, exchange rate or monetary targets). It is not excluded that for some specific issues, which are not covered by the basic structure, the model may be extended with satellite modules to integrate new international linkages or specific national features.
- as the model will be used for policy evaluation, its specification and simulation properties should be consistent with current mainstream thinking.

The feasibility of achieving these aims is considered below.

2.2. Model architecture

2.2.1. Geographical coverage

The QUEST model is a multinational model, i.e. consisting of national models which are linked. The major linkage mechanisms which could be envisaged are trade and capital flows and exchange rates. In a first instance, only trade linkages are modelled exhaustively. Although the country models contain the balance of payments in consolidated form, bilateral capital flows will not be introduced. This does not exclude the transmission of international monetary effects, such as mutually dependent interest rates or inflationary dynamics through price linkages.

The model consists of individual models for the 12 EC Member States, US and Japan, and integration of six other OECD countries and five zones to cover world trade (for a more detailed overview of the geographical disaggregation see Appendix 1). Introduction of the country models will proceed as follows:

- Group 1: Germany, France, United Kingdom, United States;
- Group 2: Italy, Spain, Belgium/Luxembourg, Netherlands;
- Group 3: Ireland, Greece, Denmark, Portugal, Japan.

For the other six OECD countries, there are no elaborate models in principle. Like the zones covering the rest of the world, these are represented by trade-feedback mechanisms, in which imports are linked to export receipts and relative prices through a partially reduced form, and in which the export price is linked to import prices and the world oil price.

The model contains 25 countries or zones (see Appendix 1) corresponding to the classification which is used for the DG II consistency and forecasting exercise and according to the geographical breakdown of the trade matrices which are used to calculate competitiveness indicators.

2.2.2. Periodicity

The main purposes of the QUEST model, apart from its pedagogical function, reside in forecasting and economic policy analysis. Forecasting rounds in DG II provide forecasts with semi-annual periodicity, whereas medium-term forecasts for five years are also required. A quarterly model is fit for both purposes, as long as it contains satisfactory medium-term properties. The fact that a model is quarterly should not be confused with the forecasting range: whether a model is suited for short term, medium term or even long term forecasting depends essentially on its economic properties, not on its periodicity.

An advantage of a quarterly model over an annual model is that, over the same time period, one has in principle four times as many observations for estimating equations, which does not, however, imply four times as much information. Since the post 1973 world is often regarded as being structurally different from the one before 1973, quarterly data present the advantage of permitting the estimation of economic relationships for the single period after 1973 with a reasonable number of degrees of freedom, which would hardly be possible with annual data.

For the countries of Group 1 (see § 2.2.1.), which are being modelled at this stage of the project, a full system of quarterly national accounts exists; this is however not the case for most countries of Groups 2 and 3.

Whereas a clear preference exists for official national data sources, exploiting other sources cannot however be excluded to obtain quarterly series for those countries. In the worst possible case, where no quarterly data are available at all, these either will have to be constructed through interpolation of annual series or annual modules will have to be integrated into the QUEST model.

2.2.3. Scale and specification

The country modules of the QUEST model are macroeconomically oriented with similar structures among countries. The size of each country module is comparable to that of the aggregate EC model in COMPACT, i.e. 120 to 140 equations, of which some 25 are behavioural. The trade linkage module comprises 605 stochastic equations for bilateral trade which follow a similar specification. The whole QUEST model will therefore eventually consist of a few thousand equations. To maintain intellectual command over such a large and complex system, the similarity of specifications of the national country modules is a necessary condition. Similarity does not imply, however, that the size of the reactions of economic agents in the different models is the same. Because the coefficients of the model are not the same among countries, each model is specific enough to cover a country's own peculiarities. At the same time, the similar specification of equations across countries allows one to make interesting inter-country comparisons of the estimation results and simulation properties.

2.3. Scope for policy evaluation

The QUEST model will be used to reproduce short-term forecasts in line with the DG II Economic Forecasts from the forecasting round. These short-term forecasts (up to six or eight quarters) will then be used as a point of departure for medium-term forecasts (up to 20 quarters). Once a baseline forecast is established, policy scenarios of different kinds and the sensitivity to changes in the international environment may be analysed.

Policy scenarios may be executed through changes in the exogenous policy variables or through the adjustment factors in behavioural equations. The exogenous policy variables comprise the following:

Government spending:

- public consumption and employment;
- public fixed capital formation;
- subsidies.

Policy instruments can be fixed in real or in nominal terms. In the first case, the direct impact on the real variables of the economy is assessed, whereas the nominal effects are the result of an autonomous real effect and an induced price effect.

The use of the instruments in nominal terms allows for the direct assessment of the impact on the government budget, which is determined in nominal terms. The real trajectory will then also depend on the induced inflationary effects.

Government receipts:

- average employers' social contribution rate;
- average employees' social contribution rate;
- income taxes (lump sum);
- average corporate tax rate;
- indirect tax rate (VAT rates and others).

The model endogenises money demand and interest rates. It is however possible to simulate the model in a mode in which short term interest rates are used as an instrument to target the money supply (see § 4.4.1).

In a multinational model, the external constraints are to a large extent endogenised. The inclusion of complete US and Japanese models in particular offers a wide range of possible simulations of international adjustment. Furthermore, the simulation of shocks in the international environment is of primary importance in the context in which the model will be used. Variables representing such international shocks comprise:

- exchange rates (ECU and US-dollar rates);
- foreign interest rates;
- oil prices;
- world demand (imports of various non-EC zones);
- world prices (export prices of various non-EC zones).

2.4. Data characteristics*

a) Basic principles

In the light of the basic features of the QUEST model, as they have been described in the previous paragraphs, two fundamental characterictics emerge covering the data base:

- the model structure for each country and therefore the corresponding set of statistical data should be coherent and internally consistent;

- variables and results for different countries should refer to the same concept and therefore be directly comparable. Such compatibility is also indispensible with a view to calculating EC aggregates. A detailed, harmonised system of European quarterly accounts would do the job ideally; such a system is however not available. Therefore, data coming from national statistical sources are the second best solution. The use of these data necessitates finding an acceptable compromise between the need for consistency and for comparability. It was therefore decided to introduce some adjustments in order to harmonise to a certain extent the different country modules of the model, but at the same time to retain official statistics as much as possible. In each individual case, the choice has been made on economic relevance grounds and by evaluating the effects on the future model behaviour in simulation mode. As a general rule, the limited harmonisation that has been retained for the QUEST data base was designed to be consistent with the European System of Integrated Accounts (ESA), following DG II statistics for short-term forecasts.

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* See Appendix 2 for the list of variables used in the model

More specifically, the following rules for harmonisation and adjustment have been applied:

1. The three major equilibria within each system of national accounts have to be respected. This concerns

   - the equilibrium between the income and the expenditure side of the national accounts;

   - the modelling of profit income by different economic agents through an appropriate distribution of the gross operating surplus of the economy (GOS);

   - the direct connection between the different policy instruments and the corresponding general government income flows which are affected.

2. Only a limited number of variables of central importance are treated in an explicit and harmonised way. Other variables are dealt with implicitly in the form of adjustment factors (e.g. capital transfers).

3. Harmonisation has only been attempted where this does not endanger the consistency of the whole system. For example, while some countries base their national acounts on the concept of gross national product (GNP), others use gross domestic product (GDP) instead. No attempt was made to transform a country's national accounts from one system to the other.

4. Harmonisation was only carried out in cases where the necessary statistical information for the transformation is published in official documents by national statistical sources.

b) Seasonal adjustment

The fact that for some countries (e.g. France and the United States) national accounts data are only available in seasonally adjusted form necessitated the use of seasonally adjusted data for all countries, even if this might imply certain econometric disadvantages.

Unadjusted data have been adjusted by the DAINTIES method of the Statistical Office of the EC.

c) Interpolation

As some of the series needed for the model do not exist in quarterly form, quarterly data had to be obtained by interpolating yearly series. In principle, two different sets of methods are available for this task - purely mathematical methods and methods using related series. Extensive empirical comparisons between the different available methods have shown, related series methods do not necessarily perform better, while involving a considerable amount of additional work. Where necessary, yearly series have therefore been interpolated by a purely mathematical method (a numerical analysis of polynomial approximation).

Box 1: Data sources

The quarterly national accounts data have been taken from the following national sources:

France : Institut National de la Statistique et des Etudes Economiques (INSEE), Paris
Système élargi de comptabilité nationale

Germany : Deutsches Institut für Wirtschaftsforschung (DIW), Berlin
Vierteljährliche Volkswirtschaftliche Gesamtrechnung

United Kingdom : Central Statistical Office (CSO), London
National Income and Expenditure

United States : Bureau of Economic Analysis (BEA), Washington
National Income and Product Accounts (NIPA)

The full set of data is available for the following periods, respectively:

France : 1963, 1st quarter to 1985, 2nd quarter (old base year 1970)
Germany : 1960, 1st quarter to 1984, 4th quarter
UK : 1966, 1st quarter to 1984, 4th quarter (old base year 1980)
US : 1970, 1st quarter to 1985, 2nd quarter (old base year 1972)

Labour market data

Employment data have been chosen to be consistent with national accounts. The unemployment measure corresponds to the number of registered unemployed, retaining EUROSTAT classifications. The block had to be completed with demographic series.

The quarterly balance of payments data have been taken from the following national sources:

France : Banque de France (BdF), Paris, La balance des paiements de la France, Rapports annuels

Germany : Deutsche Bundesbank (DBB), Statistische Beihefte zu den Monatsberichten der Deutschen Bundesbank, Reihe 3, Zahlungsbilanzstatistik

UK : Central Statistical Office (CSO), London. Financial Statistics

US : Bureau of Economic Analysis, Washington, Survey of Current Business (SCB)

Box 1: Data sources (cont.)

The data for the monetary sector have been taken from the following national and international sources:

France : Banque de France (BdF), Bulletin trimestriel

Germany : Deutsche Bundesbank (DBB), Monatsberichte and Statistische Beihefte zu den Monatsberichten der Deutschen Bundesbank, Reihe 2, Wertpapierstatistik

UK : Central Statistical Office (CSO), London. Financial Statistics

US : Bureau of Economic Analysis, Washington, Survey of Current Business (SCB)

Committee of Governors of Central Banks of the Member States of the EEC, Monthly Statistical Series

OECD, Financial Statistics part 2, Monthly Financial Statistics.

The data for the trade linkage module have been obtained from the Direction of Trade Data of the IMF, supplemented with information from the United Nations Yearbook of International Trade Statistics. Quarterly total trade data for the 25 countries/zones from appendix 1 cover the period 1960-1984, while the bilateral trade flow data only start in 1965, and end in 1984.

3. MODEL SPECIFICATION AND ESTIMATION RESULTS

3.1. Guidelines

In the construction of a multinational model, the requirements on the size of the model and the data are the major limiting factors concerning the incorporation of different theoretical approaches in the model and their empirical testing. In particular, the double requirements of availability and comparability of the data constrains the number of variables that may be part of the data set, and consequently the number of testable specifications. The modelling work should then aim at exploiting the wide range of interactions, in particular those offered by the multinational dimension of the model. While thus maintaining the objective of manageability, this strategy is still compatible with the aim of obtaining rich simulation properties. Before presenting the equations in more detail, the achievement of these objectives is further discussed below.

At least in some cases, the quality of the data rules out a high degree of econometric sophistication. For example, the treatment of the data (harmonisation, interpolation, seasonal adjustment) may impede a rigorous investigation of short term dynamic properties or a sophistication in the specification of expectations. This does not exclude a careful examination of long run properties of the equations and even makes robustness tests more necessary (such as parameter stability tests).

Other severe limitations that can be ascribed to the data relate to the treatment of the supply side. The model cannot pretend to combine, in a theoretically consistent manner, aspects such as the treatment of uncertainty, imperfect competition, disequilibrium on the goods market. In the context of these theoretical developments, potential output and its link with investment and employment, together with profitability, are considered as highly relevant determinants of the supply side. But their incorporation had to cope with unsatisfactory measurement of variables. For robust estimation, it was decided to include such effects within a simplified production block, based on a production function with two factors of production.

Clearly the problems concerning the data and the objectives of small scale similar country models play a major role in the design of financial feedbacks which are considered an important issue in recent modelling developments. The QUEST model must compensate for the difficulty of modelling international capital flows or the non-application of a stock-flow approach or a portfolio approach in the national models. In this respect, the linkages through endogenous interest rates and exchange rates in a multinational system go some way towards integrating recent theoretical aspects of monetary and financial analysis.

Although sometimes neglected by economic theory, there can be no doubt that expectations are of major importance in economics. One could even go so far as to say that most behaviour is, implicitly or explicitly, based on expectations. The treatment of expectations in an econometric model is, therefore, of interest.

Theory and empirical analysis of expectations has been heavily influenced by Muth's article on rational expectations and its discovery in the recent years. Rational expectations are by now an integral component of many theoretical models.

However, in the QUEST model expectations are not rational in the sense of Muth. Both theoretical and practical reasons can be given for this fact. Firstly, although theoretically appealing, rational expectations rely on informational assumptions that can hardly be called realistic. Not surprisingly, therefore, the rational expectations hypothesis has been rejected in most empirical studies. Secondly, the implementation of rational expectations in econometric models is normally extremely burdensome computationally .

For these reasons, in the first version of the QUEST model expectations are of the more traditional type (i.e. extrapolative/regressive or adaptive), implemented by using distributed lag structures. Future work might then concentrate on introducing selectively a forward-looking aspect as well as on extending economic agents' information set. The explicit modelling of expectations in this semi-rational way will, however, have to use either survey results (with the need to introduce an equation to explain these data), or to rely on a priori choices of determinants and use joint tests of the respective equation and the assumed expectations formation process.

Given these compromises on possible specifications, empirical investigation has been pursued following two principles:

- a focus on <u>medium-term properties</u>: as embodied in the estimation of key parameters, such as the propensities to consume or to import, the accelerator effect, the Phillips curve, the productivity-wage-price nexus, competitiveness constraints in prices and external trade, output-employment elasticity, interest rate feedbacks, etc.... The acceptability criteria are a compromise between theoretical requirements (homogeneity with respect to prices, for example), compatibility with other estimations (notably with existing national models) and statistical robustness over the sample period;

- with a view to obtaining an appropriate evaluation of the multipliers, the advantages of a sample period including the first half of the 80's have been exploited to investigate recent theoretical developments in the explanation of behavioural trends (saving behaviour in the labour market context, profitability effect on investment, wage bargaining models, exchange rate and interest rate adjustments).

3.2. Real demand [1]

The real demand block of the model determines gross national product or, depending on the country, gross domestic product at constant prices and its major components endogenously. Real GDP/GNP (YQ) is determined as the sum of:

- private consumption (CPQ)
- general government consumption (CGQ)
- total fixed investment (ITQ)
- total inventory investment (IITQ)
- total exports (XTQ)
- minus total imports (MTQ)

Total imports (MTQ) are the sum of non-energy imports of goods, energy imports of goods and imports of services. Exports (XTQ) are only disaggregated into goods and services. All these flows are treated in the section on international trade (3.8).

3.2.1 Consumption

The specification of the household consumption function (see Table 1) follows a traditional approach. Per capita real consumption (durables plus non-durables) is a function of per capita real income, the inflation rate, the real long-term interest rate and the unemployment rate. The inflation rate enters the equation with a negative coefficient: this serves as a proxy for the real wealth effect. Also the real long term interest rate coefficient is negative, which is the result of two effects: (i) higher interest rates have a positive influence on savings, and (ii) higher interest rates affect purchases of durables to the extent that consumption credit becomes more expensive. The negative influence of the unemployment rate can be explained by the increased uncertainty when unemployment rises, which leads to increased precautionary saving. The estimations yielded a wrong-signed (but insignificant) inflation coefficient for the French equation. As a consequence, the inflation term was dropped in this case. This creates however some problems in simulation; in a later version of the model the inflation term will therefore have to be reintroduced into the French equation. As an alternative for the partial adjustment mechanism which relates actual to desired consumption, an error-correction model was tested, but the latter could not be distinguished significantly from the former in all cases. Finally it should be noted that no wealth variable was directly introduced in the equation at this stage of the project due to data constraints.

Government consumption is exogenous either in real or in nominal terms, depending on the simulation mode (see section 4.1).

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[1] Appendix 3 provides a list of the equations

3.2.2 Investment

Gross fixed capital formation in the QUEST model is treated in a fairly detailed manner. The choice has been made mainly for the following reasons:

Firstly, from a behavioural and simulation point of view, the distinction between private and public investment is quite important. In the QUEST model, public investment is defined as general government investment and treated as an exogenous policy instrument. Private investment, on the other hand, is endogenous and modelled by behavioural equations.

Secondly, it seemed to be desirable to distinguish between investment in equipment and construction investment. This distinction is not only made in the Commission's short-term economic forecasts, it is also justified for behavioural and modelling reasons. Investment in equipment can much easier be aggregated to a stock of equipment, which in turn should be more appropriate to approximate productive capacity than the total capital stock. In addition, equipment has a much shorter life span than structures.

Thirdly, it seemed to be desirable to distinguish between private investment in structures and investment in private dwellings. This decision is based on the assumption that companies' investment decisions are guided by different criteria than households' investment decisions. For the reasons outlined, the following classification has been retained. Total gross fixed capital formation at constant prices (ITQ) is split into private (IPQ) and general government (IGQ) fixed investment. Private fixed investment for its part is the sum of private investment in equipment (IEPQ, discussed in the section describing the supply block), private investment in non-residential construction (= structures, ISPQ) and private residential construction (IHPQ). Government fixed investment is composed of investment in equipment (IEGQ) and investment in construction (ICGQ). It is exogenous either in nominal or in real terms (see section 4.1).

Admittedly, such a detailed classification will not be possible for all Member countries. Where lack of data, even of annual periodicity, does not allow such detail, a higher aggregation level will have to be retained.

A "traditional" way of modelling housing investment decisions adopts a two-step approach, according to which an optimal stock of dwellings is determined by long-term factors, such as population growth and wealth, whereas current housing investment is a function of this optimal stock of dwellings and some short-term determinants, such as interest rates, inflation rates, the level of unemployment, etc.

This approach is however not followed in QUEST, because data series on stocks of dwellings are difficult to construct and not always very reliable. Therefore, it is preferred to specify an equation in which both long-term and short-term determinants appear.

Furthermore, the QUEST data series on residential investment (IHPQ) make no distinction between residential investment by households and residential investment by enterprises.

Table 1: Household consumption

$\log(CPQ/EX.POPT) = a + b.\log(CPQ(-1)/EX.POPT(-1)) + c.\log(YDHQ/EX.POPT) + d.\dot{PCP} + e.DEL^{1}(LUR) + f.(RL/400-\dot{PCP})$

Country/ sample	estimated coefficients[2,3] a	b	c	d	e	f	long-term coefficients c'	d'	e'	f'	ρ	SER	$\bar{R}^2$	DW
DE	0,00	0,59	0,40	-1,12	-0,006	-0,90	0,98	-2,76	-0,01	-2,21	-	0,75	0,999	2,28
1965.I-1984.IV	(0,04)	(0,05)	(0,05)	(0,31)	(0,004)	(0,34)								
FR	-0,00	0,74	0,25	-	-0,01	-	0,96	-	-0,04	-	-0,25	0,76	0,999	2,04
1965.I-1984.IV	(0,03)	(0,03)	(0,04)		(0,005)						(0,11)			
UK	0,17	0,66	0,31	-0,34	-0,01	-0,02	0,91	-0,99	-0,03	-0,05	-	1,09	0,989	2,25
1965.I-1984.IV	(0,10)	(0,07)	(0,06)	(0,12)	(0,004)	(0,16)								
US	-0,09	0,79	0,22	-0,47	-0,01	-	1,05	-2,22	-0,04	-	-	0,62	0,997	2,02
1965.I-1984.IV	(0,05)	(0,05)	(0,06)	(0,13)	(0,001)									

Notes: [1] $DEL(X) = X - X_{-1}$
[2] Standard errors in brackets and SER in percentage points
[3] Estimation method: OLS
FR: OLS with Cochrane-Orcutt correction for autocorrelation

Table 2: Residential investment[1]

$\log(IHPQ) = a + b.\log(IHPQ(-1)) + c.\log(EX.POPT) + d(L).\dot{PIT} + e(L).(RL/100-\dot{PY}) + f(L).\dot{YQ} + g(L).\log(YDHQ-CPQ) + h.LUR$

Country/ sample	estimated coefficients[2,3] a	b	c	d	e	f	g	h	ρ	SER	$\bar{R}^2$	DW
DE	-4,23	0,80	0,44	-0,27	-0,77	0,32	-	-	-	4,03	0,758	2,10
1965.II-1984.IV	(4,19)	(0,07)	(0,39)	(0,18)	(0,40)	(0,19)						
FR[4]	-26,57	0,63	2,52	-0,18	-0,50	-	0,10	-0,03	-	2,02	0,987	2,53
1965.II-1984.IV	(6,89)	(0,09)	(0,65)	(0,12)	(0,25)		(0,04)	(0,01)				
UK	-82,14	0,29	8,00	-0,99	-1,13	1,78	-	-	-	5,03	0,744	1,80
1966.II-1984.IV	(14,58)	(0,10)	(1,39)	(0,21)	(0,27)	(0,39)						
US[5]	-9,43	0,40	0,89	-0,33	-0,26	1,71	-	-	0,86	4,88	0,935	1,76
1965.II-1984.IV	(9,25)	(0,11)	(0,76)	(0,36)	(1,09)	(0,50)			(0,06)			

Notes: [1] With $\dot{X} = X/X_{-4}-1$
[2] Standard errors in brackets and SER in percentage points
[3] Estimation method: OLS with Almon lags (DE: e with 8 lags, degree 2, constraint head
FR: d with 4 lags, degree 1, constraint tail
e with 4 lags, degree 1, constraint tail
g with 4 lags, degree 1, constraint tail
UK: d with 6 lags, degree 2, constraint tail
e with 4 lags, degree 1, constraint tail
f with 4 lags, degree 1, constraint tail
US: e with 4 lags)
[4] With real long-term interest rate defined as $(RL/100-\dot{PCP})$
[5] $d(L)\Delta\dot{PIT}$ in the US equation

Whereas in the latter case construction activities may be considered as an investment, depending on factors like expected returns, economic growth, etc., this is much less the case for the households sector, where residential investment presents more similarities to the purchase of consumer durables, thus depending on factors like disposable income, inflation expectations, wealth, etc.

In the preferred specification (see Table 2), the variables entering the equation are population, the growth of the investment price index as a proxy for construction prices (the first difference of this growth rate in the US equation), the real long-term interest rate and the growth of national income. Only in the French case did the latter variable have to be replaced by households' savings and by the unemployment rate to represent uncertainty about future incomes.

Private investment in structures (ISPQ) is treated in the real demand block instead of the supply block mainly for two reasons. Firstly, the relationship between buildings and production capacity is theoretically less stringent than the one between equipment and capacity. Secondly, empirical investigations have shown that the respective QUEST investment series are in some cases quite different from the series implicit in the EUROSTAT capital stock data referring to structures. The problem arises mainly from the fact that in some countries it is impossible to distinguish precisely between dwellings and other buildings.

In view of the observation that the treatment of investment in structures varies widely between different econometric models, the econometric analysis for the QUEST equation focussed especially on the question of complementarity between equipment and structures. However, the empirical estimations suffered from the fact that the historical evolution of investment in structures has been very different in the four countries under investigation, both in absolute levels and in shares of GDP. The finally retained specification therefore attempts to integrate an aspect of (technical) complementarity by introducing private investment in equipment as an explanatory variable in addition to other variables that are considered to be of specific importance for investment in structure. Two variables are assumed to represent these factors, real interest rates and liquidity, approximated by the profit share. With respect to the estimation results (Table 3) it has to be noted that the equation performs relatively well for Germany, France and the United States. For the UK, however, none of the explanatory variables turns out to be statistically significant. In addition, the liquidity variable had to be dropped for this country, as the coefficient turned out to have the "wrong" sign. The simulation properties of the equation are marked by a very strong sensitivity to interest rate and profit share changes in Germany and France.

As far as inventory investment (IITQ) is concerned, national accounts do not usually distinguish between private and public stocks. Since one would not expect public inventory investment to be of considerable size, this should not be a major disadvantage.

Table 3: Private investment in structures

$$\log(ISPQ) = a + b(L).(RL/4-\dot{P}Y.100) + c.\log(\frac{GOS}{Y}) + d.\log(IEPQ) + e.\log(ISPQ(-1))$$

Country/ sample	estimated coefficients[1,2] a	b	c	d	e	g	long-term coefficients b'	c'	d'	SER	$\bar{R}^2$	DW
DE												
1965.I-1984.IV	0,4335	-3,5285	0,4470	0,2697	0,6996	-0,3238	-11,747	1,488	0,898	3,89	0,906	2,11
	(0,1024)	(1,7404)	(0,1070)	(0,0416)	(0,0563)	(0,1110)						
FR												
1967.I-1984.IV	0,4050	-3,6414	0,3039	0,0648	0,8720	-	-28,461	2,375	0,506	1,82	0,962	2,00
	(0,0910)	(1,0983)	(0,0860)	(0,0297)	(0,0438)							
UK												
1967.I-1984.IV	0,2299	-0,2809	-	0,0626	0,9052	-0,4841	-2,965	-	0,661	7,29	0,730	2,04
	(0,4418)	(0,8253)		(0,0763)	(0,0634)	(0,1052)						
US												
1968.I-1984.IV	0,8810	-0,5718	0,4688	0,3014	0,4666	0,9358	-1,072	0,879	0,565	2,11	0,964	2,11
	(0,4125)	(3,0949)	(0,1964)	(0,0894)	(0,0975)	(0,0420)						

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS (FR) and OLS with Cochrane-Orcutt correction for autocorrelation (DE, UK, US) with Almon lags
(DE: b with 20 lags, degree 2, constraint both
FR: b with 16 lags, degree 2, constraint head
UK: b with 12 lags, degree 2, constraint both
US: b with 12 lags, degree 2, constraint both)

Table 4: Inventory investment

$$IITQ = a + b.(YTTQ(-1)-IITQ(-1)) + c.KAPIQ(-1) + d(L).(RS/4-\dot{P}YTT.100) + e.UCAP + f.IITQ(-1)$$

Country/ sample	estimated coefficients[1] a	b	c	d	e	f	long-term coeff. b'	$\bar{R}^2$	DW	Durbin-h
DE	-42,275	0,105	-0,116	-225,553	0,302	0,269	0,144	0,521	1,96	-
1965.I-1984.IV	(10,387)	(0,035)	(0,040)	(75,326)	(0,101)	(0,124)				
FR	-42,647	0,087	-0,070	-1,417	0,383	0,340	0,132	0,528	2,00	-0,069
1967.I-1984.IV	(9,422)	(0,035)	(0,029)	(29,647)	(0,125)	(0,112)				
UK	-6154,4	0,089	-0,132	-34529,3	51,160	0,281	0,124	0,607	1,64	4,461
1965.I-1984.IV	(1272,1)	(0,019)	(0,027)	(7007,2)	(13,517)	(0,104)				
US	-18,393	0,150	-0,183	-241,850	0,022	0,383	0,244	0,674	1,90	0,702
1965.I-1984.IV	(4,076)	(0,027)	(0,035)	(52,075)	(0,057)	(0,084)				

Notes: [1] Standard errors in brackets
DE: d with 5 lags, degree 2, constraint head
FR: d with 2 lags, degree 1, constraint tail
UK: d with 14 lags, degree 2, constraint head
US: d with 7 lags, degree 2, constraint none

On theoretical grounds, it would be desirable to distinguish between stocks of finished goods, work in progress and stocks of raw materials. Unfortunately national accounts do not permit this distinction, although it might contain useful information for business cycle analysis. For the time being, integration of business survey information referring to stock buildings has not been attempted.

From an econometric point of view, the quality of inventory investment equations is usually inferior to the quality of fixed investment equations, as most national accounts determine the change in stocks as a residual in the final demand breakdown. Statistical measurement errors are, therefore, sometimes quite important. The econometric analysis started from a general model explaining both planned and unplanned inventories. In this framework, planned inventories are mainly due to three motives: the transactions motive in order to cushion the lack of synchronisation between the production or receipt of goods and the delivery or use of goods; the precautionary motive as a reason for holding buffer stock (to smooth or sustain production or to meet demand) and the speculative motive in case of expected price changes. In the empirical estimations, attempts to explain unplanned or speculative inventory changes have met with little success. The finally retained equation therefore focusses on the transactions and precautionary demand for stocks. Derived within a partial adjustment framework, the equation contains as explanatory variables lagged total final demand (excluding inventory investment), the lagged level of stocks, a proxy for the real short term interest rate and the degree of capacity utilization to capture work in progress. As can be seen in Table 4, the equation explains between 50% and 70% of the variation in inventory investment. The estimated coefficients have in all cases the expected sign. However, the influence of the real interest rate in France and of the degree of capacity utilization in the United States is statistically insignificant. In addition, the coefficient of the lagged stock variable (KAPIQ) is relatively low. This phenomenon of the so-called "slow speed of adjustment" is well known in the literature on inventory investment. Although it could be due to missing explanatory variables, attempts to extend the set of explanatory variables did not resolve the problem.

3.3 The supply block

The main purpose of the supply block is to generate the potential output of the economy, with a view of reproducing the medium term potential growth. The approach retained for the QUEST model is a recursive one, separating the decisions on the long-term level of installed productive capacity from those on potential (profitable) output and the capital-labour ratio (production technology). In a first step, decisions on the desired medium-term level of production capacity are considered to be embodied in the determination of investment. This is done through a function for private investment in equipment (IEPQ) which incorporates demand and profitability effects. The thereby determined level of the capital stock (KAPEQ) then forms an input into the second step, the simultaneous determination of potential output (YQPOT) and potential (classical) employment (LEEPPOT). The process operates within the framework of profit maximisation subject to a putty-putty production function and implicitly determines the capital-labour ratio as a function of real wage costs. In specifying the three main equations of this block (IEPQ, YQPOT, LEEPPOT), priority has been given to empirical considerations, in the sense of a systematic investigation of demand and profitability effects and the selection of parameters with acceptable simulation properties, the recursive structure of the block being a guarantee for the consistency of production linkages.

This recursive approach has been preferred to a theoretical model of simultaneous factor demands. Its underlying philosophy is that due to the prevalence of uncertainty, adjustment costs and factor rigidities, asymmetries in factor demand behaviour exist so that investment and employment decisions have to be treated separately. The complexity of production decisions cannot, in fact, be easily formalised as a general problem of optimisation under constraints, the specification of the constraints becoming intractable in that case. Commonly accepted simplifications in such frameworks tend to reduce profitability effects to a relative factor price variable. The resulting models are often rejected by the data, with weak evidence on substitution effects. In addition, specific structural breaks occur in each factor demand equation, which is not easy to reconcile with the assumption of a joint determination of the inputs. All these results have been confirmed by the extensive preliminary tests using the QUEST data.

In the next two sections, the retained equations for investment and potential levels of output and employment are presented.

3.3.1 Investment in equipment and the determination of the capital stock

The starting point for the empirical investigation of private investment in equipment has been the combination of an effective demand model (where firms are rationed in goods markets and therefore the desired capital stock is a function of expected demand and expected relative factor prices) and a profit model (where either firms are constrained on capital markets or where sales are uncertain; see CATINAT/CAWLEY/ILZKOVITZ/ITALIANER/MORS (1987)). However, the econometric estimations did not allow the detection of significant factor substitution effects. This holds true both for a putty-putty and a putty-clay formulation and for alternative specifications of the user cost of capital variable. Instead of imposing a coefficient on a priori grounds, a specification was searched that is not rejected by the data.

The retained equation (Table 5) determines (the logarithm of) private investment in equipment as a function of a putty-clay type accelerator term (change in total final demand), the real long-term interest rate, representing capital cost, and a profitability term (proxied by the profit share in GDP multiplied by the degree of capacity utilization). As investment decisions are largely made on the basis of expectations, all variables enter with distributed lags (i.e. adaptive or extrapolative expectations). In addition, a time trend has been included to represent the influence of technical progress.

All estimated coefficients have the "expected" sign and are statistically significant at the 5% level. With respect to the size of the coefficients, the accelerator seems to be relatively modest at first sight. However, it has to be kept in mind that, in simulation, part of the demand effect is propagated via the degree of capacity utilization in the profitability term. The influence of real interest rates is particularly strong in the German and French equations, while it is only weak for the United Kingdom and the United States. To a lesser extent the same phenomenon can be observed for profitability.

After private investment in equipment has been determined, the capital stock is derived. This is done by adding investment to the capital stock at the end of the previous quarter, after having subtracted depreciation:

$$KAPEQ = (1-DELTA).KAPEQ(-1) + IEPQ$$

The rate of depreciation (DELTA) has been estimated as a function of time on the basis of the available capital stock and investment data series using the equation specified above. The stock of private equipment has been chosen to represent an economy's stock of productive capital as it proved difficult to eliminate "unproductive" buildings from the total stock of private capital.

Table 5: Private investment in equipment

$$\log(IEPQ) = a + b(L).\log(YTTQ-(1-\delta)YTTQ(-1)) + c(L).(RL/4-\dot{PY}.100) + d(L).\log\left(\frac{GOS.UCAP}{Y.100}\right) + e.TIME + f.\log(IEPQ(-1))$$

Country/ sample	estimated coefficients[1,2] a	b	c	d	e	f	long-term coefficients b'	c'	d'	SER[3]	$\bar{R}^2$	DW
DE	1,3300	0,1661	-5,5520	0,4454	0,0041	0,5448	0,3650	-12,1980	0,9785	3,45	0,947	1,81
1968.I-1984.IV	(0,3015)	(0,0783)	(1,7083)	(0,1296)	(0,0009)	(0,0999)						
FR[4]	1,3186	0,1689	-3,6910	0,4575	0,0070	0,4760	0,3224	-7,0445	0,8732	4,02	0,966	2,17
1968.I-1984.IV	(0,4372)	(0,0752)	(1,7401)	(0,1292)	(0,0021)	(0,1170)						
UK	5,2322	0,1922	-1,9147	0,4575	0,0032	0,2441	0,2542	-2,5329	0,6052	3,39	0,885	1,87
1969.I-1984.IV	(1,0398)	(0,0524)	(0,8249)	(0,1196)	(0,0006)	(0,1166)						
US	0,5451	0,1367	-1,0664	0,1252	0,0030	0,7108	0,4727	-3,6872	0,4330	1,84	0,995	1,91
1966.I-1984.IV	(0,2345)	(0,0209)	(0,4765)	(0,0616)	(0,0010)	(0,0778)						

Notes: [1] Standard errors in brackets
[2] Estimation method: OLS with Almon lags:
(DE: b with 6 lags, degree 2, constraint none; c with 5 lags, degree 2, constraint none; d with 8 lags, degree 2, constraint head. FR: b with 7 lags, degree 3, constraint tail; c with 6 lags, degree 2, constraint none; d with 6 lags, degree 2, constraint tail. UK: b with 8 lags, degree 2, constraint head; c with 10 lags, degree 2, constraint head; d with 8 lags, degree 2, constraint head. US: b with 8 lags, degree 2, constraint none; c with 5 lags, degree 1, constraint tail; d with 7 lags, degree 1, constraint tail).
The assumed quarterly depreciation rates are 0,040 for DE and FR, and 0,035 for UK and US
[3] In percentage points
[4] For the second quarter of 1968 the observed value for YTTQ has been replaced by its interpolated value in order to avoid a negative argument for the logarithm

Table 6: Potential employment - basic equations for the estimation of the parameters
(a) $\Delta\log(LEEP) = c + a.time + b.\log(WC/PY) + d.\log(YQ) - e.\log(LEEP(-1))$
(b) $\Delta\log(LEEP/YQPOT) = c + a.time + b.\log(WC/PY) + d.\log(UCAP) - e.\log(LEEP(-1)/YQPOT(-1))$

Country/ sample	estimated coefficients[1,2] c	a	b	d	e	structural parameters elast. to output	elast. of subst.	techn. progr. in % pa	$	SER	$\bar{R}^2$	DW
DE												
1965.I-1984.IV	1,820	-0,0009	-0,098	-	0,218	1*	0,45	3,0	-	0,438	0,494	1,41
(a) with d=e	(0,232)	(0,0001)	(0,016)		(0,025)							
FR												
1965.I-1984.IV	1,732	0,0016	-0,132	0,263	0,419	1*	0,32	2,3	0,540	0,447	0,573	2,11
(b) with CORC	(0,476)	(0,0004)	(0,038)	(0,052)	(0,079)				(0,098)			
UK												
1965.I-1984.IV	0,319	-0,0006	-0,058	0,138	0,139	1	0,42	3,0	0,602	0,418	0,516	2,10
(a) with CORC	(0,505)	(0,0002)	(0,029)	(0,032)	(0,047)				(0,093)			
US												
1965.I-1984.IV	3,606	-0,0003	-0,184	-	0,405	1*	0,45	0,5	-	0,427	0,659	1,23
(a) with d=e	(0,381)	(0,0001)	(0,033)		(0,033)							

Notes: [1] Standard errors in brackets and SER in percentage points.
[2] Estimation method: OLS with Cochrane-Orcutt correction when CORC is specified.

3.3.2 Potential levels of employment and output

The data series for potential output was constructed as (a moving average of) real GDP, divided by the degree of capacity utilisation (in the manufacturing sector). No corresponding measure for potential employment exists. Thus, in this case, the equation had to be specified so as to define potential employment and at the same time to endogenise the adjustment of observed employment to its potential level. Parameters are then directly estimated in the employment function.

The joint determination of potential output and employment follows from:

(max PY.YQPOT - WC.LEEPPOT
) YQPOT = f(KAPEQ, LEEPPOT)

with the standard model mnemonics.

Ideally the system should be fully specified and estimated simultaneously using either the reduced form with the capital stock and the real wage costs as exogenous, or the structural form implying, in particular, a direct estimation of the production function. Unfortunately, these approaches have been unsuccessful and the only alternative left has been a separate treatment of each equation.

a) Potential employment

The employment function relating observed employment to output and the real wage incorporates a partial adjustment dynamic scheme:

$$\Delta\log(LEEP) = c + a.time + b.\log(WC/PY) + d.\log(YQ) - e.\log(LEEP(-1))$$

Its parameters are used to define potential employment as the level required by full use of capacity in the long run:

$$\log(LEEPPOT) = (1/e).(c + a.time + b(L).\log(WC/PY) + d.\log(YQPOT))$$

Four year lags on (WC/PY) are added to keep the feature of delayed effects of factor cost.

Results are presented in Table 6. At this stage, only the structural parameters deserve attention:

- In France and Germany, the long term elasticity of employment to output had to be constrained to one, coming out too low for the former and too high for the latter when unconstrained. In the United States, the constraint plays a minor role: it only mitigates multicolinearity, the technical progress becoming significant with the constraint. In the UK, the elasticity is spontaneously unitary.

- Productivity gains from technical progress range from 2-3% p.a. for the European countries to 0,5% in the United States. These results confirm the contrast observed between Europe and the US when comparing time series of apparent productivity.

- Substitution effects are more homogenous between countries, implying an elasticity of substitution of 0,32 to 0,45 if a CES was used. It was not straightforward to find such a real wage effect in France and the equation had to be rewritten according to the version (b) in Table 6.

Table 7: Potential output - adjustment under the assumption of a COBB-DOUGLAS production function[1]

$$\log(YQPOT) = a.time + b + 0{,}33.P(L).\log(KAPEQ(-1)) + 0{,}67.\log(LEEPPOT)$$

Country/ sample	estimated coefficients[2,3] a	b	ϱ_1	ϱ_2	SER	$\bar{R}^2$	DW
DE	0,0042	-3,370	1,68	-0,71	0,20	0,9996	2,26
1965.I-1984.II	(0,0004)	(0,029)	(0,09)	(0,09)			
FR	0,0027	-3,223	1,57	-0,59	0,15	0,9995	2,19
1967.I-1984.IV	(0,0005)	(0,041)	(0,10)	(0,10)			
UK	0,0033	0,024	1,73	-0,78	0,30	0,9990	2,23
1965.I-1984.IV	(0,0003)	(0,021)	(0,07)	(0,07)			
US[4]	0*	-3,839	1,76	-0,81	0,14	0,9830	1,64
1965.I-1984.IV		(0,003)	(0,06)	(0,06)			

Notes: [1] The capital stock is introduced as a moving average over 4 quarters and potential employment is derived from the estimated employment functions
[2] Standard errors in brackets and SER in percentage points
[3] Estimation method: OLS with Cochrane Orcutt correction of 2nd order autocorrelation of the residuals, the coefficient a has been set to zero
[4] The coefficient a has been set to zero

Table 8: Employment in the private sector - adjustment to potential employment

$$\Delta\log(LEEP) = a(L).[\log(LEEPPOT) - \log(YQPOT/YQ)] + b.\log(LEEP(-1))$$

Country/ sample	estimated coefficients[1,2] a[3]	b	structural parameter: mean adjustment lag[4]		SER	$\bar{R}^2$	DW
DE with CORC	0,256	-0,257	3,9	0,605	0,407	0,576	2,18
1965.I-1984.II	(0,048)	(0,048)		(0,091)			
FR with CORC	0,152	-0,152	6,6	0,822	0,160	0,871	1,23
1968.I-1984.IV	(0,032)	(0,032)		(0,074)			
UK with CORC	0,209	-0,209	4,8	0,720	0,432	0,557	2,17
1965.III-1984.IV	(0,051)	(0,051)		(0,081)			
US with a = -b	0,364	-	1,7	-	0,432	0,789	1,34
with 1965.I-1984.IV	(0,021)						

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS including Cochrane-Orcutt procedure when CORC is specified
[3] Estimated with Almon lags: DE: 4 lags, polynomial of degree 1, constraint: tail
FR: 4 lags, polynomial of degree 1, constraint: tail
UK: 4 lags, polynomial of degree 1, constraint: tail
US: no lag
[4] In quarters; calculated by adding the lag implied by the endogenous variable and the mean lag of the Almon distribution

This preliminary step provides the potential employment (see 3.4.1 for the final employment equation), which can in turn be used as an exogenous variable in the potential output equation.

b) Potential output

At this stage, the putty-putty production function can be directly estimated. To be consistent with the specification of the employment function above, a CES function should be used. However, under this assumption, the estimated elasticity of substitution came out with very high values, between 1,6 (US) and 3,1 (UK), far above the one found with the employment equation. In addition, in simulation, such high values would give too high a weight to potential employment in the determination of potential output.

Results on employment and potential output could not be reconciled and some simplifications had to be introduced. Instead of estimating a production function, it has been retained to impose a simple COBB-DOUGLAS function for the supply determination.

In this case, the only structural parameter that has to be identified is the technical progress and the respective weights of labour and capital inputs are set at the historical average of the wage-profit share. Any attempt to introduce dynamics in this equation has been rejected by the data. The final results are reported in Table 7. They exhibit relatively low standard errors, but they are obtained with substantial corrections for autocorrelation of the residuals. This has to be kept in mind for the use of the equation in projection.

The restrictions and inconsistencies which had to be accepted given the estimation difficulties encountered do not, however, invalidate the approach. The main foundations of the recursive scheme have been kept and ensure consistent linkages with specific features in simulation:

- The channels through which changes in factor costs/profitability affect the different supply components depend on the variable concerned. An increase in the real wage, for example, would tend to affect the capital stock negatively to the extent that it is not compensated by an equivalent increase in productivity, i.e. to the extent that the profit share and therefore productive investment decreases. But it would directly reduce potential output and employment. Changes in the real interest rate, on the other hand, affect all the components of the supply block. Thus, a rise in interest rates has not only a negative influence on investment, but also on potential output and employment. These simulation features are not standard compared to the usual formulation of substitution effects.

- Demand prospects are transmitted to the whole of supply components through the accelerator effect and the elasticity of employment to output. This guarantees market clearing in the medium term. However, in the short run, supply reacts only moderately to demand conditions. The utilisation rate measures the gap between demand and supply on the goods and services market. Its feedback in the inventories, import and price equations implies in the short run a mixed market clearing process with adjustment on prices and effective supply.

3.4 The labour market

For a first version of the model, the labour market block has been limited to two key behavioural equations: the wage rate per head (WR) and the total number of employees in the private sector (LEEP). The labour supply, measured by the active population, is kept exogenous. In simulation, unemployment, which is calculated from an identity equation, consequently only responds to changes in employment. Total employment is calculated by adding to the number of employees in the private sector two exogenous components: the number of self-employed and public sector employment.

3.4.1 Labour demand

The demand for labour is directly derived from the supply block as described in section 3.3. There, a simple employment function was estimated to identify the three key structural parameters of labour demand: elasticity to output, elasticity of substitution and the rate of technical progress. This simple function is used only to define potential employment, but is not incorporated as such in the model. It is more appropriate to relate observed employment (LEEP) to its potential level (LEEPPOT), taking into account the short-term constraint on demand. The adjustment pattern has then to be estimated at this stage. Different specifications relating employment to its potential level, corrected by the utilisation rate of capacity, have been tested. No asymmetries in the adjustment to these two variables could be found. Table 8 presents the final equation based on a partial adjustment model. It has acceptable properties, with a full adjustment of employment to its potential level in the long run. From a statistical point of view, the SER is on the low side, indicating a satisfactory fit.

Greater flexibility of the American labour market is again confirmed with a mean adjustment which is less than two quarters, compared to 4 to 7 quarters in the European countries. But it must also be kept in mind, that with the retained definition of potential employment, employment reacts faster to output changes than to real wage changes in all the countries.

3.4.2 Wage rate per head

The endogenous variable is the growth rate of average earnings per head in the whole economy. The approach follows a standard augmented Phillips curve specification, with additional profitability effects as integrated in wage bargaining models. A pure wage bargaining model determining the wage rate in level has been rejected by the data with the exception of the limit case of the UK. In any event, homogenous specifications have been retained.

The final equations are reported in Table 9 and exhibit strong country specific features:

1) Full indexation has generally been confirmed by the estimation, except in the UK, where the degree of indexation is unstable over the period and full indexation appears only on the 1974-76 period. It has, however, been imposed. This is done through a two step estimation procedure, estimating indexation lags in the first step and reestimating the equation with the

given lags and the long term coefficient of private consumption prices set to one. Full indexation has also been imposed in France and the US, a slight tendency to over-indexation having been observed. But this constraint does not affect the other parameters. Indexation lags are very long in the US, covering a three year period, and short in the European countries with the intermediate case of the UK (a two year period). This is one aspect of the contrast between nominal wage rigidity in the US and real wage rigidity in Europe.

2) The Phillips curve effect is another aspect of this contrast, with a coefficient on the unemployment rate for the United States about three times higher than for the European countries. The similarities between European countries are only superficial: tests on non-linearities of the Phillips curve revealed that the pressure of unemployment on wages has decreased in France since 1970 and increased in Germany; in the UK, the unemployment variable comes out with a significant coefficient only when the wage freeze at the end of the sixties is eliminated through a dummy variable.

3) Employers' pressure on the wage setting process, measured by profitability variables, is another source of inter-country differences. Strong evidence has been found for such effects in Germany, corroborating the efficiency of the industrial relations system in this country. In the final specification, this is represented by the repercussion of productivity changes on wages and the dampening effect of slower growth in the GDP deflator relative to consumer price changes on indexation. In France, only this terms of trade effect plays a role and in the US, only the productivity growth variable has been retained. In the UK, it was impossible to combine simultaneously unemployment and productivity variables. An equation with the unemployment effect has been preferred for reasons of simulation properties and homogeneity of specifications.

4) Other issues such as hysteresis on unemployment and the weight of taxation on wage claims have been examined but are not backed by strong evidence. The treatment of income policies has been simplified by the introduction of dummies.

Table 9: Wage rate per head

$$\dot{WR} = a + b(L).\dot{PCP} + c.(\dot{PCP}-\dot{PY}) + d.LUR + e(L).UPRO$$

Country/ sample	estimated coefficients[1,2] a	b	c	d	e	SER	$\bar{R}^2$	DW
DE[3]	0,498	1,031	-0,806	-0,115	0,644	0,930	0,723	2,24
1965.I-1984.IV	-	(0,176)	(0,133)	(0,046)	(0,149)			
FR[4]	1,063	1*	-0,487	-0,099	-	0,442	0,715	1,19
1965.I-1984.IV	(0,084)		(0,094)	(0,017)				
UK[5]	1,161	1*	-	-0,094	-	1,073	0,494	2,34
1965.I-1984.IV	(0,270)			(0,041)				
US[6]	2,115	1*	-	-0,302	0,327	0,468	0,550	2,12
1965.I-1984.IV	(0,293)			(0,042)	(0,067)			

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS with DE, b: no lag, e: 3 lags; FR, b: 1 lag; UK, Almon lags (b: 8 lags, degree 2); US, b: coefficient set to 1 using for PCP a moving average over 3 years, e: no lag.
[3] With seasonal dummies. The value reported for the constant corresponds to the average estimated seasonal coefficients
[4] With two dummies for the 1968 strike and outcome in 1968.II and 1968.III
[5] With dummies for income policies: D651-694 = 1 from 1965.I to 1969.IV, 0 elsewhere
D743-772 = 1 from 1974.III to 1975.I
-0,5 from 1975.II to 1977.II, 0 elsewhere
[6] with dummies for wage episodes: D651-714 = 1 from 1965.I to 1971.IV, 0 elsewhere
D751-762 = 1 from 1975.I to 1976.II, 0 elsewhere
D754 = 1 in 1975.IV, 0 elsewhere

Table 10: Value-added prices

$$\dot{P} = a(L).\dot{WC} + b.\log(WC(-1)/PY(-1)) + c + d.(UCAP - \overline{UCAP}) + e.(\dot{PMM} - f(L).\dot{PMM})$$

Country/ sample	estimated coefficients[1,2] a[3]	b	c	d[4]	e[5]	ρ	SER	$\bar{R}^2$	DW
DE with CORC	0,641	0,010	-0,046	-	-	-0,303	0,725	0,362	2,15
1965.I-1984.IV	(0,081)	(0,004)	(0,016)			(0,110)			
FR	0,582	0,020	-0,081	0,046	-0,076	-	0,470	0,787	1,57
1965.I-1984.IV	(0,066)	(0,003)	(0,011)	(0,025)	(0,013)				
UK[6]	0,933	0,018	-0,049	0,0010	-0,141	-	0,694	0,814	1,88
1965.I-1984.IV	(0,068)	(0,007)	(0,018)	(0,0033)	(0,028)				
US	0,937	0,033	-0,104	0,035	-0,082	-	0,393	0,610	1,36
1965.I-1984.IV	(0,135)	(0,010)	(0,031)	(0,013)	(0,025)				

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS with Cochrane-Orcutt correction when CORC is specified
[3] With Almon lags: DE: 4 lags, polynomial of degree 1, constraint: tail; FR: 3 lags, polynomial of degree 1, no constraint; UK: 5 lags, polynomial of degree 2, no constraint; US: 5 lags, polynomial of degree 3, no constraint.
[4] In FR: UCAP = 83,7%; UK: UCAP = 81,2% and the effect is introduced only in 1974 onwards; US: UCAP = 81,6% and the effect is introduced in 1975 onwards
[5] The lags on f have been imposed: $f(L).\dot{PMM} = 0,44.\dot{PMM}(-1) + 0,31.\dot{PMM}(-2) + 0,25.\dot{PMM}(-3)$
For the US, the effect is only introduced after 1974
[6] The UK equation includes a dummy in 1973. I for the introduction of the VAT system

3.5 The price block

The price block is organised according to a recursive scheme, with a central price equation representing producers' behaviour and specified as a mark-up over costs. The demand deflators are obtained, in a second step, from this domestic price index and from the import prices derived in the linkage block. This step also includes a correction for indirect taxes. Difficulties lie in the choice (a) of a good price indicator for an accurate description of profit margin determination, and (b) for adequate disaggregation of demand deflators to avoid distortions in relative prices and nominal aggregates in simulation.

3.5.1 The value added price

This first point is a delicate one. Different producers' or wholesale price indexes have been examined and finally rejected as they do not cover the whole economy and are not comparable between countries. It has therefore been decided to endogenise the value-added price (P). This is a partly unsatisfactory solution, as this price does not allow a proper treatment of imported intermediate goods, and its use raises also problems of consistency and overdetermination within the price block. It is, however, the only feasible option for a recursive structure. Preliminary investigation of the demand deflator equations have shown that the recursive approach still performs better than a direct approach, relating demand deflators to the corresponding production costs.

Empirical investigation of the value-added price equation on the basis of the mark-up assumption led to retain the following options: 1) exclusion of capital costs which are not observable; the use of proxies based on interest rates would have perverse inflationary effects in the case of a tight monetary policy; 2) long-term homogeneity of prices with respect to labour costs; 3) domestic costs are measured by the wage cost per head instead of by unit labour cost. This follows from econometric tests, where productivity was systematically found with a too high weight, even when lags were introduced and even if the long term coefficient was always smaller than one. This feature implies in simulation that the productivity gains generated by an expansion would have dominated the inflationary effects of the wage/price nexus; 4) the adjustment of prices on wages follow an error correction mechanism, which, in terms of dynamic simulation properties, has been found superior to other dynamic patterns. This insures also a determination of prices in levels; 5) to endogenise the mark-up, the approach focussed on the introduction of demand pressure indicators. Such an effect is represented in the model by the deviation of the utilisation rate from its historical average level. Such an effect could not be found in Germany, and in both the UK and the US it plays a significant role only after the first oil shock. Temporary reductions of the mark-up rate also occur with a shock on external prices. This is taken into account through the deviation of import price growth from its average in the recent past. This effect is particularly important for a value-added price which is, in the very short term, negatively affected by the import price. This method is an indirect way to reintroduce the price of imported inputs in the mark-up behaviour.

Table 11: Energy import deflator

$$\dot{PME} = b_0.\dot{POIL}.\dot{EXCHR} + b_1.(\dot{POIL}.\dot{EXCHR})_{-1}$$

Country/ sample	estimated coefficients[1] b_0	b_1	b_0+b_1	Dummy	ϱ	SER	$\bar{R}^2$	DW
DE[2] 1970.II-1984.IV	0,843 (0,073)	-	0,843 (0,073)	-0,794 (0,132)	-	4,91	0,833	1,85
FR 1974.IV-1984.IV	0,568 (0,083)	0,263 (0,083)	0,832 (0,063)	-	-0,304 (0,160)	3,83	0,738	2,15
UK 1970.III-1984.IV	0,667 (0,030)	0,154 (0,030)	0,821 (0,036)	-	-	5,03	0,918	2,02
US 1967.III-1984.IV	0,712 (0,026)	0,145 (0,026)	0,857 (0,031)	-	-	4,03	0,933	1,88

Notes: [1] Standard errors between brackets and SER in percentage points
[2] Dummy is for 1974.I

Table 12: Private consumption deflator

(a) $\dot{PCP} = [a(L).OPEN.\dot{PMM} + b(L).(1-OPEN)\dot{P}].\dot{VAT}$

(b) $\dot{PCP} = [a(L).(OPEN.\dot{PMM} + (1-OPEN).\dot{P}) + c(OPEN.\dot{PMM} - (1/3).\sum_{-1}^{-3} OPEN(i).\dot{PMM}(i))].\dot{VAT}$

Country/ sample	Type of equation	estimated coefficients[1,2] a	b	c	SER	$\bar{R}^2$	DW
DE[3] 1965.I-1984.IV	(a)	1,000 (0,249)	0,798 (0,093)	-	0,673	0,732	2,31
FR[4] 1965.I-1984.IV	(b)	0,977 (0,034)	-	-0,252 (0,112)	0,661	0,914	2,92
UK[5] 1965.I-1984.IV	(b)	0,934 (0,020)	-	0*	0,497	0,965	1,80
US[6] 1965.1-1984.IV	(a)	1,034 (0,144)	0,934 (0,024)	-	0,260	0,970	1,94

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS
[3] Private consumption deflator and value added price are corrected for remaining seasonal components (X11-method); equation has been estimated with Almon lags for a: 5 lags, degree 1 and b: 2 lags, degree 1
[4] Without any lags
[5] Including a dummy for the introduction of VAT in 1973.I; equation has been estimated with an Almon lag for a: 2 lags, degree 1; the coefficient c has been set to zero
[6] Equation has been estimated with an Almon lag for b: 3 lags, degree 1

The variable $\dot{VAT}$ is defined as (1 + EX.VATR)/(1 + EX.VATR(-1)), where EX.VATR is a proxy for the VAT rate, calculated under the assumption that VAT receipts are entirely raised on private consumption.
The variable OPEN - used as the weight of import cost components - represents the trend of openness of the domestic market. It is calculated as the fitted value of a logistic distribution describing the share of real imports in real total final demand.

The final equation is reported in Table 10. The quality of the fit is acceptable, except maybe for Germany, but the low R^2 for that country is mainly imputable to the unsatisfactory treatment of the seasonal components of the lefthand side variable. Faster price adjustments are observed in the UK and the US, in opposition with the slow wage indexation process characterising these two countries. The coefficient on the mark-up variables do not allow wide fluctuations of the mark-up rate.

3.5.2 Import prices

Import prices (PMT) in the QUEST model are distinguished between non-energy goods (PMN), energy (PME) and non-factor services (PMS). The import price deflator for energy is linked, via exchange rates, in growth rates to the world oil price, in this case defined as the spot price of Saudi light petroleum (Ras Tanura). Estimation results for this equation are presented in Table 11 and show an elasticity of 0,85 of energy import prices with respect to world oil prices converted in local currency. The import price of non-factor services is, for the time being, entirely proportional to the import price deflator of non-energy goods. In the future this variable could be explained by a behavioural equation. The import price deflator of non-energy goods is directly proportional, after conversion into local currency, to a trade-weighted (bilateral import shares) average of non-energy export prices of the other countries and zones in the system (see section 3.8 for a definition of these non-energy export prices). This quasi-identity therefore embodies the hypothesis that there is no export price discrimination. Although, without having to use bilateral export prices, one could introduce this feature by rendering import prices partially dependent on domestic prices to represent geographical differences in mark-up pricing behaviour, it should be stressed that such a specification is, theoretically speaking, not in agreement with the separability hypothesis underlying the bilateral trade flow model.

3.5.3 The domestic final demand deflators

These deflators do not involve any behavioural issues. The main purpose of these equations is to correctly reproduce the adjustment of final demand deflators on domestic and import costs as incorporated in the national accounts. With this view, simple rules can be adopted:

1) The block has been designed to reduce the number of equations. Only the deflators for private consumption and total investment are explicitly treated. The deflator for public consumption is replaced by a combination of the wage rate and the deflator for private consumption. Changes in inventories are calculated in nominal terms, using the deflator for total final demand instead of the deflator for changes in stocks provided by the national accounts.

2) The treatment for VAT has been simplified through the assumption that VAT is only applied to private consumption items.

3) The deflators for private consumption (PCP) and total fixed investment (PIT) are simply adjusted according to a weighted average of the import and value-added prices. The weights are the trend in openness of each country.

Table 13: Total fixed investment deflator

$\dot{PIT} = a(L).OPEN.\dot{PMM} + b(L).(1-OPEN).\dot{P}$

Country/ sample	estimated coefficients[1,2] a	b	ρ	SER	$\bar{R}^2$	DW
DE[3]	0,808	0,883	0,290	0,874	0,672	1,94
1965.I-1984.IV	(0,347)	(0,146)	(0,111)			
FR[4]	0,827	1,015	-	0,636	0,920	2,19
1965.I-1984.IV	(0,115)	(0,044)				
UK[5]	0,997	1*	-	0,908	0,904	1,50
1965.I-1984.IV	(0,037)					
US[6]	1*	1,036	-	0,539	0,902	1,37
1965.1-1984.IV		(0,038)				

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS
[3] Investment deflator and value added price are corrected for remaining seasonal components (X11-method); equation has been estimated with Almon lags for a: 3 lags, degree 2, constraint tail and for b: 2 lags, degree 1 and Cochrane-Orcutt correction
[4] Without any lags
[5] Equation has been estimated with an Almon lag for a: 2 lags, degree 1; the coefficient b has been set to zero
[6] Equation has been estimated with an Almon lag for b: 2 lags, degree 1; the coefficient a has been set to zero

Table 14: Export prices[1]

$\dot{PXM} - (OPEN.\dot{PMM} + (1-OPEN).\dot{P}) = a(L).[OPEN.\dot{PMM} + (1-OPEN).\dot{P} - \dot{WPXMS} + b(L).\dot{EXCHR}] + c$

Country/ sample	estimated coefficients[2,3] a	b	c	SER	$\bar{R}^2$	DW
DE[3]	-0,207	0,201	-0,195	0,736	0,34	2,12
1965.I-1984.IV	(0,034)	(0,043)	(0,084)			
FR[3]	-0,284	-	-0,423	1,438	0,27	2,64
1965.I-1984.IV	(0,051)		(0,164)			
UK[3]	-0,285	0,280	-0,196	1,082	0,34	1,87
1970.II-1984.IV	(0,064)	(0,056)	(0,157)			
US[3,4]	-0,345	-	-0,104	1,243	0,37	1,48
1965.I-1984.IV	(0,051)		(0,141)			

Notes: [1] The endogenous variable is the deflator for exports of goods (PXM) for DE, FR and the US and for exports of non-energy goods (PXN) for the UK. Correspondingly, the competitors' price index in USD is WPXMS for DE, FR and US and WPXNS (excluding OPEC) for the UK. The variable OPEN used for the weights of domestic cost components is the trend of openness of the domestic market used for the other final demand deflators
[2] Standard errors in brackets and SER in percentage points
[3] Estimation method: OLS with Almon lags; DE: a: no lag; b: 4 lags, polynomial of degree 2; FR: a=b: 2 lags; UK: a: no lag; b: 4 lags, polynomial of degree 2; US: a: 3 lags, polynomial of degree 1.
[4] Competitor's prices being defined in USD, no exchange rate effect is required for the US

The equations are written in growth rates; they allow for some adjustment lag, notably on import prices and they provide coefficients close to the homogeneity constraint of the price block. The results are reported in Tables 12 and 13. The quality of the fit is not always good. Generally, the least satisfactory fit performance is observed for the investment deflator.

3.5.4 Export prices

The treatment of export prices differs from the one applied to the other demand deflators, as it must reproduce the mark-up behaviour on the external markets. In the framework of a recursive price block, based on a key mark-up equation for the value added price and derived demand deflators, it is not easy to isolate the mark-up behaviour on the external markets.

The modelling of the export price behaviour is based on a standard mark-up assumption: export prices adjust to domestic production costs to a lesser or greater extent depending on the competitive pressure on the external markets. This pressure is measured by the ratio of competitors' prices to domestic production costs.

With simple assumptions, this is equivalent to defining the export price as a weighted average of domestic prices and foreign prices.

In the model, the equation endogenises the deflator for exports of goods (PXM), except in the UK where the special treatment for oil led to a distinction between export prices of energy (PXE, treated in Box 2) and export prices of non-energy goods (PXN). The equation applies to the latter. The deflator for exports of services (PXS) is simply related to the GDP deflator.

All prices are expressed in national currency. Competitors' prices are provided by the linkage, calculated as an average of export prices of the competitors, with a double weighting system taking into account the market share of the competitors on the export markets and the relative importance of the export markets. The production cost variables are the same as those used for the domestic final demand deflators (PMM,P).

The estimation results are reported in Table 14. The homogeneity of export prices had to be imposed, notably for France and Germany, where unconstrainted estimation results suggest that domestic costs are not fully repercussed on export prices. Preliminary tests have shown that, in Germany and the UK, fluctuations in exchange rates are not immediately considered as a change in the competitive position. Longer adjustment lags on the exchange rate than on competitors' prices in dollar have been kept in the final version for these two countries.

The country results exhibit rather fast adjustments of export prices to internal as well as to external conditions. In addition, they imply a relatively weak external constraint, with an elasticity to the competitors' prices between 0,2 and 0,3. This feature may be more specifically imputed to the perturbations over the last years. Stability tests have confirmed a tendency to a decreasing sensitivity of export prices to competitiveness for all the countries except the UK. The eighties in particular raise problems in France and Germany.

Table 15: Households' non-wage income

log (YNWH) = c + a.log(EX.LSE.WR) + b.log(GOS+INTG+YX) + d.log(YNWH(-1))

Country/ sample	estimated coefficients[1,2]					SER	$\bar{R}^2$	DW
	a	b[3]	c	d	ρ			
DE	0*	0,489	-0,406	0,547	-	4,1	0,99	2,23
1965.I-1984.IV		(0,094)	(0,096)	(0,086)				
FR with CORC	0,135	0,252	-1,850	0,621	0,520	0,8	0,99	2,24
1965.I-1984.IV	(0,047)	(0,031)	(0,619)	(0,050)	(0,102)			
UK with CORC	0,070	0,258	-0,361	0,648	-0,375	3,8	0,99	2,09
1965.I-1984.IV	(0,043)	(0,060)	(0,199)	(0,070)	(0,108)			
US with CORC	0,111	0,560	-1,865	0,343	0,816	1,4	0,99	2,35
1965.I-1984.IV	(0,088)	(0,069)	(1,176)	(0,072)	(0,068)			

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS with Cochrane-Orcutt correction when CORC is specified
[3] For Germany and the US, where national accounts are based on the GNP aggregate, the variable GOS already includes factor income from abroad; the YX variable is then omitted

Table 16: Implicit interest rate on government debt

RDG = a + b.RDG(-1) + (1-b).RL

Country/ sample	estimated coefficients[1,2]			SER	$\bar{R}^2$	DW
	a	b	ρ			
DE	0,09	0,86	-0,46	0,80	0,748	2,21
1971.I-1984.IV	(0,07)	(0,05)	(0,12)			
FR	0,25	0,93	0,80	0,34	0,990	1,27
1971.I-1984.IV	(0,23)	(0,05)	(0,08)			
UK	0,02	0,95	-0,64	0,61	0,995	1,94
1971.I-1984.IV	(0,06)	(0,02)	(0,11)			
US	-0,15	0,73	-	0,37	0,819	1,88
1971.I-1984.IV	(0,07)	(0,05)				

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: DE, FR, UK: OLS with Cochrane-Orcutt correction for autocorrelation
US: OLS

3.6. Sectoral income, taxes and transfers, savings, government deficit and the balance of payments

This block has been designed to guarantee the consistency of income flows and to be adequate for policy simulations. But given the data availability and comparability, compromises had to be made.

Sectoral income flows in the QUEST model are modelled according to a somewhat simplified scheme. Factor income from (YXX) and to (YXM) the rest of the world is simply determined by total exports or imports by applying exogenous shares. The same approach is applied to the general government trading surplus and profit income (YG), which is proportional to the gross operating surplus of the whole economy (GOS). Only households' non-wage income (YNWH) and interest payments on government debt (INTG) are modelled in a semi-behavioural way, companies' profits (YC) being calculated as a residual item.

As for most of the sectoral income and financial flows, a proper modelling of non-wage income of households would require a disaggregation into the main income sources. Availability and comparability of the data do not, however, allow this approach for the QUEST model. Using national quarterly data, only a proxy for total non-wage income, combining income of self-employed, interest and property receipts can be constructed. These different components are so heterogenous that a simple rule linking the aggregate to the other profit variables of the QUEST model (GOS, INTG) could not be applied without serious distortions in simulation.

One of the major differences in the income structure between countries lies in the weight of self-employed in the economy, the highest being found in France and the lowest in the UK, where non-wage income is to an important extent composed of dividend payments. It seems desirable for the QUEST model to roughly reproduce these country features. In the absence of detailed data on the income components, a simple rule correcting the link of non-wage income to the amount of profit generated in whole economy by the weight of self-employed has to be applied. The retained assumption is that the income of self-employed is partly related to wages. Total non-wage income can then be decomposed into a pure profit component and a wage dependent component, their respective weights being estimated rather than imposed.

The estimation results (Table 15) confirm the high weight of self-employment in France and show that earnings of self-employed are weakly related to wages in the other countries. In Germany, it was even necessary to eliminate this link in order to get acceptable results. The elasticity of households' non-wage income with respect to the amount of profit lies between 0,7 (FR) and 1 (DE). Even if the retained income distribution rule is highly simplistic, it nevertheless reproduces country specificities. In addition, it should attenuate the strong "automatic stabiliser" effect of the non-wage income of households on the disposable income of households which would otherwise occur in simulation.

Table 17: Households' income taxes

$\dot{TYH} = a.(\dot{YWB}+\dot{YNWH}+TPH)$

Country/ sample	estimated coefficient[1,2] a	ϱ	SER	$\bar{R}^2$	DW
DE					
1965.I-1984.IV	1,785	-0,285	5,21	0,534	2,07
	(0,191)	(0,108)			
FR					
1965.I-1984.IV	1,281	-0,346	9,72	0,229	2,31
	(0,260)	(0,107)			
UK					
1965.I-1984.IV	1,210	-0,229	6,64	0,303	2,14
	(0,181)	(0,111)			
US					
1965.I-1984.IV	1,200	-0,245	4,09	0,349	2,03
	(0,156)	(0,110)			

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS with Cochrane-Orcutt correction

Table 18: Social transfers received by households

$\log(TPH/PCP) = a + b.LUR$

Country/ sample	estimated coefficients[1,2] a	b	SER	$\bar{R}^2$	DW
DE	-0,71	0,012	4,14	0,228	0,23
1975.I-1984.IV	(0,02)	(0,003)			
FR	-0,67	0,02	12,43	0,362	0,02
1975.I-1984.IV	(0,02)	-			
UK	3,95	0,02	11,47	0,041	0,05
1975.I-1984.IV	(0,02)	-			
US	-1,23	0,04	9,38	0,250	0,06
1975.I-1984.IV	(0,09)	(0,01)			

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: OLS

Interest payments by the government consist mainly of the service of the public debt. Interest charges are determined by interest rates and by the size and composition of debt. Structural differences between countries are very large in this respect, so that only a very stylized representation is given. Government debt is calculated from a benchmark (from the FINPUB database) by accumulating government deficits. In doing so, it is assumed implicitly that government deficits are not monetary financed. This assumption can however easily be relaxed in simulation. An apparent interest rate on government debt is derived from the interest payments on the one hand and the government debt on the other. This apparent interest rate on government debt is explained endogenously as a function of the long-term interest rate, with a long-run coefficient which has been constrained to 1 (see Table 16).

Taxes follow the disaggregation for policy instruments presented in section 2.3. The only tax component that is modelled endogenously is the flow of households' income taxes (TYH). In order to capture in one way or another the progressiveness of the tax systems, the equation assumes that the growth rate of income taxes is proportional to the growth rate of income, the coefficient of proportionality being higher than one. In order to estimate this coefficient, the growth rate of the tax base has been approximated by the growth rate of the sum of the wage bill, households' non-wage income and net current transfer received by households. The estimated coefficient of proportionality (see Table 17) is in the order of 1,8 for Germany and 1,2-1,3 for the other three countries. Thus, the German QUEST module will contain a somewhat higher degree of tax progressiveness. All other tax variables are obtained from an exogenous average tax rate applied to the tax base.

Endogenisation of transfers is limited to social benefits received by households. A very simple specification was adopted, in which transfers are fully indexed to the consumption price index and depend further only on the unemployment rate which represents the number of recipients (see Table 18).

The block provides as output the respective agents' balances: households' saving (SAVH), companies' saving (SAVC), government deficit (DEFG) and the current account of the balance of payments (BPC). A fully consistent system going into the detail of the income flows and the intersectoral balancing process was not envisageable given the restrictions on the data. Minor flows had to be neglected or further adjustments had to be introduced, mainly for the government deficit and the balance of payments.

In particular, the balance of payments requires special adjustment to link the national accounts aggregates to the balance of payments data. These reconciliation factors have been introduced on each flow with the rest of the world, trade in goods and services, factor income and transfers. The link between factor income and domestic income depends on the national accounts system using GDP or GNP as the main aggregate. Transfers to the rest of the world are left exogenous and are not imputed to any domestic agent. Factor income flows could be endogenised in a further stage of the model. For the time being, factor income from abroad (YXX) and factor income paid abroad (YXM) are simply proportional to total export earnings and imports, respectively.

Table 19: Money demand

$$\log(M3/PY) = a + b.\log(M3(-1)/PY(-1)) + c.(1-b).\log(YQ) + d.(1-b).\log(1+RS/100) + e.(1-b)\dot{P}Y.4$$

Country/ sample	estimated coefficients[1,2] a	b	c	d	e	SER	$\bar{R}^2$	DW
DE	0,12	0,84	1,39	-0,31	-2,04	0,80	0,996	1,99
1973.II-1984.IV	(0,13)	(0,05)	(0,16)	(0,25)	(0,74)			
FR	-0,25	0,86	0,63	-1,54	-	1,04	0,975	2,06
1973.II-1984.IV	(0,23)	(0,06)	(0,18)	(0,64)				
UK[3,4]	-0,09	0,76	0,65	-0,93	-0,87	1,02	0,969	2,23
1976.I-1984.IV	(0,72)	(0,04)	(0,27)	(0,38)	(0,25)			
US[5]	-0,41	0,92	1,30	-0,73	-3,68	0,50	0,998	2,16
1973.II-1984.IV	(0,15)	(0,03)	(0,16)	(0,51)	(1,23)			

Notes: [1] Standard errors in brackets and SER in percentage points
[2] Estimation method: NLS
[3] Interest rate lagged two quarters
[4] Dummy variable reflecting the change in monetary policy in 1981 in the UK: 0,01 (0,006)
[5] Dummy variable reflecting the M3 redefinition in 1983 in the US: 0,04 (0,005)

Table 20: Short-term interest rate[1]

$$RS = a + b.RS(-1) + c.\dot{Y}Q.100 + d.UCAP + e(L).\dot{P}CP.100 + f.LUR + g.\dot{M}3.100 + h.(BPC/Y) + i.EXCHR + j.RS^f$$

with RS^f = foreign short-term interest rate (US-rate for DE, UK; DE-rate for FR)

Country/ sample	estimated coefficients[2,3] a	b	c	d	e	f	g	h	i[6]	j	SER	$\bar{R}^2$	DW
DE	-23,98	0,46	-	0,30	0,40	-0,27	-	-	5,22	0,33	0,99	0,906	1,51
1973.II-1984.IV	(7,00)	(0,11)		(0,08)	(0,18)	(0,21)			(2,09)	(0,08)			
FR	-2,80	0,46	-	-	-	-	-	-0,35	1,03	0,36	1,23	0,826	1,76
1973.II-1984.IV	(2,33)	(0,10)						(0,19)	(0,44)	(0,07)			
UK	0,64	0,56	-	-	-	-	0,09	-0,41	-	0,40	1,57	0,726	1,82
1973.II-1984.IV	(1,02)	(0,09)					(0,04)	(0,15)		(0,12)			
US[4,5]	-5,41	0,47	0,27	-	0,78	-	0,26	-	-	-	1,08	0,863	1,83
1973.II-1984.IV	(1,60)	(0,12)	(0,07)		(0,14)		(0,11)						

Notes: [1] $\dot{X} = X/X_{-4}-1$
[2] Standard errors in brackets and SER in percentage points
[3] Estimation method: OLS with Almon lags (US: e with 4 lags, degree 1, constraint tail)
[4] Dummy variable representing the 1980 credit control measures in the US: -6,15 (1,18)
[5] Dummy variable reflecting the 1980 switch in the US monetary policy: 2,83 (0,64)
[6] For DE: difference between the actual and the equilibrium DM/USD exchange rate. This is determined by PPP and the equilibrium current account balance, taken to be the average current balance over the last 8 quarters. The equilibrium exchange rate is thus the fitted value of the estimated equation:

$$EXCHR = 1{,}36 + \log(P_{DE}/P_{US}) - 0{,}000163 \log\left[\sum_{i=0}^{8}\left(\frac{1}{8}\frac{BPC_{DE}}{Y_{DE}}\right)_{-i} \Big/ \sum_{i=0}^{8}\frac{1}{8}\left(\frac{BPC_{US}}{Y_{US}}\right)_{-i}\right]$$

For FR: FF/ECU exchange rate

3.7 The monetary sector

3.7.1 Money demand

Money demand M3 is determined endogenously in this block (see Table 19). A broad concept of the money stock has been chosen, in order to cope with the often encountered instability of money demand functions. Also for stability reasons it was decided to limit estimation to the period of floating exchange rates, because a change of regime has provoked shifts in the money demand function. The functional specification of the money demand function follows the traditional approach in which a simple transaction demand for money model is used as a starting point and the corresponding log-linear equation is estimated with an additional assumption of partial adjustment in terms of actual real money balances towards the desired ones. Real GNP represents a scale variable in this equation, and the short term interest rate represents the opportunity cost of holding money. Expected inflation, as a proxy for the return on goods and services, is also included; of the three inflationary expectations models tested, the best results were found with static expectations. The partial adjustment mechanism of actual to desired money balances outperformed the error-correction model, which was also tested.

In the preferred equations, the long-run income elasticity was not constrained to 1, since for two countries (Germany and France) estimates were significantly different from 1.

3.7.2 Interest rates

The monetary authorities' policy reaction function determines the short-term interest rate (RS) (see Table 20). It is assumed that the money market rate is the instrument of the monetary authorities. Final as well as intermediate targets of monetary policy enter the reaction function. Two categories of target variables are distinguished:

(i) internal targets
(growth of national income, utilization rate of productive capacity, inflation rate, unemployment rate, growth of the money stock, ...)

(ii) external targets
(current balance, exchange rate, capital movements, ...)

Whether or not these target variables enter the monetary authorities' policy reaction function, depends largely on country-specific institutional factors. The principle of a similar specification across countries, which is a basic feature of QUEST, is therefore somewhat relaxed in this specific case. For Germany, the inflation rate, the unemployment rate and the rate of capacity utilization were found to be the most important internal targets. The US-interest rate and the DM-dollar exchange rate appear as the relevant external targets. For France, the EMS-constraint appears in the

Table 21: Long-term interest rate[1]

$RL = a + b.RL(-1) + c(L).RS + d.VARRS + e(L).\dot{PCP}.100 + f.DEFG/Y$

with VARRS = variance of the short-term interest rate over the last two years

Country/ sample	estimated coefficients[2,3] a	b	c	d	e	f	ϱ	SER	$\bar{R}^2$	DW
DE	1,50	0,68	0,11	0,07	-	-	-	0,46	0,906	1,99
1973.II-1984.IV	(0,50)	(0,08)	(0,04)	(0,02)						
FR	0,06	0,84	0,10	-	0,09	-	-	0,42	0,967	2,27
1973.II-1984.IV	(0,39)	(0,05)	(0,04)		(0,04)					
UK[3]	3,97	0,28	0,32	-	0,12	-	-	0,84	0,795	2,08
1973.II-1984.IV	(1,06)	(0,14)	(0,08)		(0,05)					
US	0,16	0,74	0,24	-	-	0,14	-0,34	0,43	0,968	1,99
1973.II-1984.IV	(0,19)	(0,06)	(0,05)			(0,04)	(0,15)			

Notes: [1] $\dot{X} = X/X_{-4} - 1$

[2] Standard errors in brackets and SER in percentage points

[3] Estimation method: OLS with distributed lags (DE: c with 2 lags
FR: c with 2 lags
e with Almon lags (6 lags, degree 1, constraint tail)
UK: c with 2 lags
e with Almon lags (6 lags, degree 1, constraint tail)
US: c with 2 lags)
US: with Cochrane-Orcutt correction for autocorrelation

[3] Dummy variable for the first oil shock in the UK: 0,75
(0,41)
Dummy variable for the second oil shock in the UK: -1,02
(0,48)

list of external targets: the FF/ECU rate enters the equation, as well as the German short-term interest rate. Also the current balance as a percentage of GDP is a target variable. For the UK, the growth of the money stock is the most important internal target. The US short-term interest rate and the current balance as a percentage of GDP are the external targets. For the US only internal targets are found to be of significance. These are: the inflation rate, the growth rate of GDP and the growth rate of the money stock.

In the equation determining the long-term interest rate (RL), a simple treatment of the term structure of interest rates is adopted, according to which the long-term rate is the sum of the current and expected future rates of one period bonds, plus a risk premium. Interest rate expectations are assumed to follow an auto-regressive and/or a partial adjustment scheme. The risk premium depends on the variance of short-term rates and on the relative supply of long-term assets, which is represented by the government deficit as a percentage of GDP (see Table 21).

It has been decided to keep exchange rates exogenous at this stage of the project.

The monetary part of the QUEST-model, as it is described above, allows for three different monetary policy regimes. In the first one, which can be labelled as perfectly accomodating, the monetary authorities' policy reaction function is overridden and the central bank meets an increased demand for money at an unchanged money market rate. In the standard regime, the central bank follows the estimated monetary policy reaction function. In the third regime, a non-accomodating monetary policy is simulated by fixing the money stock at its baseline level and by inverting the money demand function to solve for the corresponding short-term interest rate.

Table 22: Imports of non-energy goods[1]

$$\log(MNQ) = a + k.\log(MNQ(-1)) + b.(\log(YTTQ.Z) - k.\log(YTTQ(-1).Z(-1))) + c.(1-k).\log(PMN/PYTT) + d.(UCAP-k.UCAP(-1))$$

Country/ sample	estimated coefficients[2] a	b	c	d	k	SER[3]	$\bar{R}^2$	DW
DE[4]	-4,759	1,382	-1,342	0,336	0,447	1,75	0,990	2,16
1974.II-1984.IV	(1,028)	(0,100)	(0,254)	(0,146)	(0,089)			
FR	-2,740	1,133	-0,807	1,100	0,607	1,52	0,994	1,98
1974.I-1984.IV	(0,880)	(0,131)	(0,193)	(0,260)	(0,085)			
UK	-13,348	1,579	-0,269	0,390	0,337	3,44	0,976	1,94
1970.II-1984.IV	(2,558)	(0,061)	(0,075)	(0,147)	(0,126)			
US	-7,066	1,630	-0,795	0,553	0,399	3,06	0,983	2,26
1974.II-1984.IV	(1,670)	(0,079)	(0,184)	(0,163)	(0,138)			

Notes: [1] "Energy" is defined as SITC 33 for the UK and the US and as SITC 3 for France and Germany. The variable Z is common across countries, and represents a trendwise exponential trade integration effect of about 3% p.a. before 1975 and 1,1% afterwards
[2] Standard errors between brackets; estimation method: NLS
[3] Standard error of the regression in percentage points
[4] For the period 1974.II-1977.III, a dummy coefficient was added to coefficient d, with value 0,129 and standard error 0,033

Table 23: Imports/apparent consumption of energy[1]

Country/ sample	estimated coefficients[2] a	b	c	d	ϱ	SER[3]	$\bar{R}^2$	DW
DE	-	1,299	-0,195	-	-	4,15	0,515	1,58
1973.I-1984.IV		(0,268)	(0,078)					
FR	-7,173	1,545	-0,386	-	0,686	4,65	0,862	2,14
1969.I-1984.IV	(1,610)	(0,292)	(0,090)		(0,100)			
UK	-7,537	1,386	-0,641	3,374	0,270	8,32	0,662	1,88
1976.I-1984.IV	(11,809)	(1,081)	(0,125)	(1,650)	(0,171)			
US	-	1,591	-0,427	-	0,435	9,44	0,376	1,97
1975.I-1984.IV		(0,773)	(0,218)		(0,138)			

Notes: [1] For the definitions of energy concepts used, see Table 22
[2] Standard errors between brackets
[3] Standard error of the regression in percentage points

Specifications

Germany: $G_4(MEQ) = b(L).G_4(YTTQ) + c(L).G_4(PME/PYTT)$
c(L): PDL 8 2 TAIL Mean lag: 3 quarters

France: $\log(MEQ) = a + b.\log(YTTQ) + c(L).\log(PME/PYTT)$
c(L): PDL 12 2 TAIL Mean lag: 5 quarters

United Kingdom: $\log(CEQ) = a + b(L).\log(YQ-EX.YEQ-IITQ) + c(L).\log(PME/PY) + d.IITQ/YQ_{-1}$
b(L): PDL 4 2 BOTH Mean lag: 2 quarters
c(L): PDL 8 2 TAIL Mean lag: 2 quarters
$MEQ = CEQ + XEQ - EX.YEQ$

Unites States: $G_4(MEQ) = b.G_4(YTTQ) + c(L).G_4(PME/PYTT)$
c(L): PDL 8 2 TAIL Mean lag: 3 quarters

NOTE: $G_4(X) = X/(X_{-1}+X_{-2}+X_{-3}+X_{-4}).4 - 1$

3.8. International trade

3.8.1 In the structural models

International trade is split between goods and services. Only the trade in goods is treated on a bilateral basis. A further breakdown of imports of goods between energy and non-energy has been introduced in order to take account correctly of the propagation of oil price shocks. International flows of services are not linked, but nevertheless are incorporated in the national models as an element of the balance of payments.

3.8.1.1 Trade in goods[1]

The main purpose of the trade linkage is to translate all import volumes and export prices into export volumes and import prices. The determination of international trade in goods is based, for each country, on the weak separability of a production function which is used to satisfy a given final demand. Conceptually, this leads to a two-stage approach in which, first, total imports of (energy and non-energy) goods are determined, which are next allocated among 24 trade partners. Aggregating these bilateral exports leads to total exports, while the international trade structure is also used to calculate the relevant world prices which influence import price formation to a large extent. This approach implies that export volumes and import prices may be considered as exogenous variables for the country models, but as endogenous ones for the linkage module. For import volumes and export prices, the converse holds.

Imports of non-energy goods (MNQ) depend on final demand (corrected for trendwise trade integration), the corresponding import price index relative to the final demand deflator and the degree of capacity utilization (in order to represent the influence on imports of excess goods demand on the domestic market). The dynamic specification of the double logarithmic equations is derived from a Koyck lag on the relative price variable. The estimation results are given in Table 22. As stability tests have pointed to breaks after the first oil shock, except for the UK, sample periods have generally been shortened. Correcting the final demand variable for trade integration effects implies that the elasticity of non-energy imports with respect to final demand is lower for policy simulations than it would otherwise be, implying larger (Keynesian) multipliers, at least in unlinked mode. The corrected elasticities range from 1,1 to 1,6. The long-run relative price elasticities are generally well determined and range from -0,3 to -1,3. Also the effect of the degree of capacity utilization is well determined, and results in semi-elasticities between 0,2 and 1,1.

Since imports of energy goods (MEQ) are assumed to be derived in the same framework as imports of non-energy goods, the specifications of the equations for the former resemble closely those for the latter (except for the United Kingdom, which is a special case, see Box 2). Imports of energy are thus a function of final demand (not corrected for trade integration since

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[1] See Italianer (1987) for a theoretical derivation and extensive discussion and presentation of the first version of the trade linkage model.

Table 24: Imports of non-factor services[1]

log(MSQ) = a + b(L).log(YTTQ) + c(L).log(PMS/PYTT) + d.log(MSQ(-1))

Country/ sample	estimated coefficients[2,3] a	b	c	d	ϱ	SER[4]	$\bar{R}^2$	DW
DE[5]	-4,336	1,175	-0,841	-	-0,290	3,64	0,869	1,93
1975.II-1984.IV	(0,577)	(0,095)	(0,418)		(0,165)			
FR[6]	-3,073	0,929	-1,298	-	0,422	2,87	0,897	1,70
1977.III-1984.IV	(4,770)	(0,350)	(0,621)		(0,140)			
UK[7]	-2,212	1,065	-0,473	0,439	-	2,05	0,935	1,92
1971.I-1984.IV	(0,735)	(0,116)	(0,078)	(0,093)				
US	-5,670	1,213	-0,807	-	-	2,51	0,973	1,93
1975.IV-1984.IV	(0,526)	(0,084)	(0,083)					

Notes: [1] National accounts definition, excluding factor income

[2] Standard errors between brackets

[3] Estimation methods: NLS with first-order autocorrelation correction for DE and FR; NLS for the UK and OLS for the US

Dynamics: b(L) and c(L) represent polynomials in the lag operator L. The values given for b and c are the long-run coefficients

DE: b(L) = b c(L) = c.L for 1975.II-1982.IV
= c for 1983.I -1984.IV

FR: b(L) = b c(L) = c.L

UK: b(L) = b.(1-d) c(L) = c.(1-d)

US: b(L) = b.L c(L) = c

[4] Standard error of the regression in percentage points

[5] Dummies for 1980.III-1982.IV and 1983.I-1984.IV

[6] Dummy for 1980.IV -1984.IV, data are in base 1980

[7] Dummy for 1971.I -1976.IV, Durbin-h = 0,425

Table 25: Exports of non-factor services[1]

log(XSQ) = a + b(L).log(XMQ+MMQ) + c(L).log(PXS/PMS) + d.log(XSQ(-1))

Country/ sample	estimated coefficients[2,3] a	b	c	d	ϱ	SER[4]	$\bar{R}^2$	DW
DE	-1,600	0,869	-2,149	0,492	-0,735	5,79	0,811	1,92
1975.III-1984.IV	(0,539)	(0,114)	(0,748)	(0,131)	(0,128)			
FR[5]	-2,463	1,017	-1,307	-	-	3,29	0,776	1,89
1980.I-1984.IV	(1,395)	(0,306)	(0,585)					
UK[6]	0,428	0,608	-1,126	0,793	-	2,13	0,945	1,89
1970.IV-1984.IV	(0,255)	(0,108)	(0,318)	(0,047)				
US	-0,218	0,700	-0,805	0,878	-0,593	3,16	0,976	1,97
1972.III-1984.IV	(0,175)	(0,182)	(0,274)	(0,032)	(0,150)			

Notes: [1] National accounts definition, excluding factor services

[2] Standard errors between brackets

[3] Estimation methods: NLS with first-order autocorrelation correction for DE and US; OLS for FR and NLS for the UK

Dynamics: b(L) and c(L) represent polynomials in the lag operator L. The values given for b and c are the long-run coefficients

DE: b(L) = b.(1-d) c(L) = c.(L^2-dL^3)

FR: b(L) = b.L c(L) = c

UK: b(L) = b.(1-d) c(L) = c.(1-d)

US: b(L) = b.(1-d) c(L) = c.(1-d).L

[4] Standard error of the regression in percentage points

[5] A second equation estimated for 1976.I - 1984.IV gave less satisfactory results, but is used for historical simulations preceding 1980.

[6] Durbin-h = 0,454

this is less relevant for energy) and the energy import price relative to the deflator of final demand. The influence of the degree of capacity utilisation is not present for energy imports, so it has not been included. The estimation results, presented in Table 23, show elasticities with respect to final demand between 1,3 and 1,6, thus of the same order of magnetude as those for non-energy goods. The relative price elasticities are markedly lower than for non-energy goods, and range from -0,2 to -0,4 if one exludes the United Kingdom, which is better capable in substituting foreign energy by energy from indigenous sources than other countries (see Box 2).

Together with the export prices (discussed in the section on prices), import volumes of goods are an exogenous input for the bilateral trade flow model (see subsection 3.8.3).

3.8.1.2 Trade in non-factor services

Imports of non-factor services (MSQ) have been assumed to be derived in the same production function framework as imports of goods. This leads to a specification with imports of non-factor services depending on final demand and the corresponding import price relative to the final demand deflator. Compared to the specification for imports of non-energy goods, some simplifications had to be made due to the heterogeneity of non-factor services (travel versus transport, origin or destination of transport services not necessarily related to good flows). Trade integration effects and the degree of capacity utilisation are therefore not present.

Estimation results are given in Table 24. Volume elasticities range from 0,9 to 1,2, while relative price effects vary between -0,5 and -1,3. Statistically these results are well determined, but depend largely on the dynamics of the equations.

Given the approach to imports of non-factor services, exports of non-factor services (XSQ) should theoretically be a function of some world demand variable for services and the export price of services relative to a competitors' price index. In the absence of data concerning these variables, world demand has been proxied by the sum of imports and exports of goods of the country in question, while competitors' prices are assumed to be represented by the import price of services. The presence of imports in the volume variable is linked to the fact that a share of the transport services related to imports of goods is provided by domestic transporters on the account of the exporting firm. As for imports of services, extensive testing of dynamic specifications was required in order to arrive at a set of plausible estimation results, presented in Table 25. Long-run volume elasticities vary between 0,6 and 1,0 while the relative price (in this case: terms of trade) effect is stronger than for imports of services, notably for Germany (-2,1 versus -0,8) and the UK (-1,1 versus -0,5).

Box 2: <u>The treatment of energy for an oil producer</u>

The distinction of imports of goods between energy and non-energy in the structural models necessitates a specific treatment for oil producing countries such as the United Kingdom. In the model for this country, oil* is treated using the identity: apparent oil consumption (CEQ) equals domestic oil production (EX.YEQ) plus oil imports (MEQ) minus oil exports (XEQ). Oil production is exogenous,while oil exports of the UK are linked to oil production through the following simple equation:

$$\log(XEQ) = a + b_0.\log(YEQ) + b_1.\log(YEQ_{-1})$$

Sample	a	b_0	b_1	b_0+b_1	ρ	SER	$\bar{R}^2$	DW
1976.II-1984.IV	-1,256	0,492	0,629	1,121	0,721	7,24	0,964	2,37
	(1,034)	(0,179)	(0,171)	(0,133)	(0,028)			

Standard error between brackets and SER in percentage points

This equation implies that UK energy exports are entirely determined by production, and thus by supply. The consequences of this specification for the trade linkage are treated in Box 3. Apparent consumption of oil is explained by a behavioural equation, such that imports are determined residually. The estimation results for the equation for apparent consumption are included in Table 22 of the main text. The explanatory volume variable is defined as domestic non-petroleum production excluding changes in stocks, and has an elasticity of 1,4. In the relative price variable, the energy import price has been taken as a proxy for the deflator for total (domestic + foreign) petroleum deliveries, which does not seem unrealistic and leads to a long-run relative price elasticity of -0,6, which is fairly high compared to the other countries' results. The coefficient on the - scaled - stock variable implies that a change in stocks equivalent to one percent of last-period GDP, leads to a corresponding percentage change in petroleum consumption (including stocks) of 3,4%. In order to interpret these elasticities in terms of imports of energy, they should be divided approximately by the share of energy imports in the volume of apparent consumption. In 1980 prices this share decreased from 119% in 1976 to 59% in 1984 in the UK.

Finally, in order to deflate energy exports of the UK, a behavioural equation links the energy export deflator to world oil prices expressed in domestic currency:

$$G(PXE) = b_0.G(POIL.EXCHR) + b_1.G(POIL.EXCHR)_{-1}$$

Sample	b_0	b_1	b_0+b_1	Dummy	SER	$\bar{R}^2$	DW
1970.III-1984.IV	0,598	0,133	0,731	-0,604	8,06	0,533	2,30
	(0,119)	(0,048)	(0,118)	(0,207)			

- Standard error between brackets
- $G(X) = X/X_{-1}-1$
- Dummy is for 1974.I

* For imports and exports, "oil" is defined as SITC 33 (petroleum products); for production, "oil" is defined as "extraction of oil and gas".

3.8.2 In the trade-feedback models

The main purpose of the trade-feedback models is to provide an "echo" for the structural models. Generally, they only consist of equations for the volumes and price deflators for imports and exports of total goods. Export volumes and import prices are a result from the trade linkage, so the core of each trade-feedback model is formed by an import volume and export price equation. Given the limited number of variables, imports of goods (MMSQ) are related, in a reduced-form equation, to exports of goods and the terms of trade. If the elasticities with respect to these two explanatory variables equal both unity, this implies that the ratio between the values of exports and imports of goods is constant in the long run. Since such a condition is particularly important for developing countries, it has been imposed on a priori grounds for 3 zones: the OPEC, the NICs and the rest-of-the-world zone, which comprises the remaining developing countries. For the other countries and zones an upper bound equal to 1 has been imposed for these two elasticities only in estimation. Estimation results for the error correction or partial adjustment forms of the equations are presented in Table 26. The economic significance of these results is fairly limited, although for a country like Japan historically low elasticities of imports with respect to final demand seem to be confirmed by the relatively low elasticiy of imports with respect to exports.

The determination of export prices (PXMS) in the trade-feedback models differs between energy exporters and other countries and zones. Of the 21 trade-feedback countries/zones, 7 have been identified for which energy exports as a percentage of total exports are important: the Netherlands, Canada, Australia, Norway, OPEC, the Centrally Planned Economies and the rest-of-the-world zone. For these countries export prices net of energy (PXNS) have been calculated using the world oil price (POIL) as a proxy for energy prices and using the share of energy in their total exports of goods. These non-energy export price proxies, together with the non-energy export price of the United Kingdom, allow to define for each country or zone a non-energy import price (PMNSZ), being equal to a weighted average of 1) non-energy export prices for the energy exporting countries/zones and 2) the total export prices for the other countries/zones. These non-energy import prices are the main explanatory variable in the export price equations for the trade-feedback models. They serve to transmit price shocks not directly originating in changes in oil prices. Estimates for this relationship are presented in Table 27. They show that, in the long run, generally a large proportion (60-100%) of non-energy import price shocks is transformed into an export price change. This is partly due to the openness of the economies, and partly due to the absence of domestic cost variables. For the energy exporting countries, the total export price is furthermore influenced by the world oil price. These equations, also shown in Table 27, are simply a rewriting of the net-of-energy export price definitions, with the non-energy export price substituted by the non-energy import price with an a priori elasticity equal to 0,5, except for OPEC, where it is assumed to have no influence. Although estimations mostly confirmed the a priori values imposed in these equations, they were left as such to ensure the consistency between the total export price and the non-energy export price, notably for the case where the oil price changes.

Table 26: Imports of goods in the trade-feedback models

$$\log(MMSQ) = a + k.(b.\log(XMSQ/XMSQ_{-1}) + c.\log(PXMS/PMMS)) + (1-d).(b.\log(XMSQ_{-1}) + c.\log(PXMS_{-1}/PMMS_{-1})) + d.\log(MMSQ_{-1})$$

Country	Estimated coefficients[1]							
	a	b	c	d	k[2]	SER[3]	$\bar{R}^2$	DW
BLEU	0,623	0,898	0,889	0,420	0,848	2,51	0,705	2,16
	(0,835)	(0,140)	(0,267)	(0,168)	(0,132)			
Denmark	3,006	0,374[5]	1	0,440	1-d	3,39	0,728	1,93
	(0,793)		*	0,124				
Greece	4,014	0,547	0,630	0	1	12,41	0,311	1,94
	(0,953)	(0,134)	(0,253)	*	*			
Spain	2,503	0,304[6]	0,375[7]	0,609	1-d	4,58	0,501	1,87
	(1,275)			(0,142)				
Ireland	0,876	0,641[6]	1	0,706	1-d	5,39	0,914	2,11
	(0,364)		*	(0,086)				
Italy	0,550	0,943[5]	0,379[3]	0,208	1-d	6,43	0,683	1,70
	(1,231)			(0,106)				
Portugal	3,044	0,614[8]	1	0,107	1-d	11,02	0,769	1,01
	(0,435)		*	(0,056)				
Nether-	2,014	0,516[6]	0,377[8]	0,578	1-d	3,18	0,632	2,25
lands	(1,010)			(0,117)				
Canada	1,309	0,760[5]	1	0,422	1-d	5,46	0,778	1,78
	(0,779)			(0,121)				
Japan	1,094	0,462[8]	0,566[6]	0,804	1-d	3,17	0,823	1,83
	(0,794)			(0,089)				
Australia	0,549	0,854[6]	0,337[9]	0,596	1-d	6,42	0,588	1,55
	(1,429)			(0,132)				
Austria	1,345	0,681[5]	0,842[6]	0,546	1-d	3,11	0,906	2,15
	(0,504)			(0,099)				
Finland	1,335	0,619	0,363	0,582	0,629	6,44	0,161	2,17
	(1,101)	(0,260)	(0,677)	(0,152)	(0,330)			
Norway[4]	6,229	0,171[9]	0,515[5]	0,097	1-d	5,33	0,608	2,01
	(1,292)			(0,139)				
Sweden	1,555	0,579	0,829	0,590	0,902	4,32	0,444	1,79
	(0,865)	(0,200)	(0,344)	(0,140)	(0,360)			
Switzer-	0,025	1	1	0,808	0,761	3,58	0,532	2,31
land	(0,009)	*	*	(0,082)	(0,131)			
Rest of	0,672	0,736	0,740[3]	0,727	0,645	7,82	0,282	2,27
OECD	(0,849)	(0,320)	(0,472)	(0,123)	(0,305)			
OPEC	-0,063	1	1	0,861	0,052	3,39	0,431	1,30
	(0,015)	*	*	(0,027)	(0,058)			
CPEs	1,046	0,671[5]	0,339[9]	0,703	1-d	0,86	0,990	0,76
	(0,429)			(0,075)				
NICs	0,019	1	1	0,891	0,241	2,56	0,118	1,83
	(0,008)	*	*	(0,058)	(0,126)			
Rest of	0,036	1	1	0,842	1,024	2,76	0,643	0,27
the world	(0,020)	*	*	(0,086)	(0,129)			

Notes: [1] Standard errors between brackets. An asterisk indicates an a priori imposed value. Sample period: 1976.I-1984.IV

[2] If k = 1-d, the model becomes a partial adjustment model

[3] Estimated standard error of the equation

[4] For Norway, a dummy was estimated for 1976.I-1978.I with value 0.165 (0.041)

[5] Long run value. Short run value significant at 1%

[6] Long run value. Short run value significant at 5%

[7] Long run value. Short run value significant at 15%

[8] Long run value. Short run value significant at 10%

[9] Long run value. Short run value not significant at 15%

Table 27: Export prices in the trade-feedback models

Non-energy exporters:

$$\log(PXMS) = a + k.b.(\log(PMNSZ/PMNSZ_{-1}) + \log(PMNSZ_{-1}/PMNSZ_{-2}))/2 + (1-d).b.(\log(PMNSZ_{-1}) + \log(PMNSZ_{-2}))/2 + d.\log(PXMS_{-1})$$

Country	Estimated coefficients[1]					SER	$\bar{R}^2$	DW
	a	b.(1-d)	c	d	k			
BLEU	-0,055		1	0	1	5,47	0,486	0,27
	(0,009)		*	*	*			
Denmark	1,177		0,739	0	1	4,62	0,854	0,40
	(0,226)		(0,052)	*	*			
Greece	0,455		0,898	0	1	7,55	0,756	2,08
	(0,378)		(0,086)	*	*			
Spain	0,498		0,886)	0	1	5,99	0,837	1,57
	(0,290)		(0,066)	*	*			
Ireland	0,477	0,161	0,605	0,734	1	4,11	0,933	1,76
	(0,237)	(0,213)		(0,248)	*			
Italy	-0,013		1	0,395	1	3,30	0,278	1,89
	(0,007)		*	(0,104)	*			
Portugal	1,367		0,688	0	1	10,32	0,520	1,44
	(0,486)		(0,110)	*	*			
Japan	0,282		0,594	0,851	0,809	3,41	0,122	1,45
	(0,181)		(0,389)	(0,102)	(0,552)			
Austria	0,783		0,822	0	1	5,75	0,822	0,39
	(0,283)		(0,064)	*	*			
Finland	-0,003		1	0,309	1	2,85	0,187	1,93
	(0,005)		*	(0,103)	*			
Sweden	0,452	0,268	0,722	0,629	1	5,13	0,853	1,56
	(0,276)	(0,128)		(0,142)	*			
Switzer-	0,056	0,511	0,975	0,476	1	5,61	0,892	1,04
land	(0,297)	(0,264)		(0,229)	*			
Rest of	0,178	0,622	0,935	0,335	1	4,95	0,905	1,53
OECD	(0,237)	(0,224)		(0,210)	*			
NICs	0,188		0,923	0,454	1,287	1,35	0,733	1,98
	(0,071)		(0,032)	(0,123)	(0,142)			

Energy exporters:

$$\log(PXMS) = v.\log(POIL) + b.(\log(PMNSZ) + \log(PMNSZ_{-1}))/2 + \text{residual}$$

$$\log(PXNS) = (\log(PXMS) - v.\log(POIL/PPOIL*100))/(1-v) + \text{scale factor}[3]$$

	v[4]	b
Netherlands	0.15	0.5
Canada	0.10	0.5
Australia	0.20	0.5
Norway	0.40	0.5
OPEC	1	0
CPE	0.15	0.5
Rest of the World	0.15	0.5

Notes: [1] Standard errors between brackets and SER in percentage points
[2] Estimated standard error of the equation
[3] Scaling to obtain 1980 = 100, PPOIL = 1980 average level of POIL
[4] A priori shares of energy in total exports. Source: Commission

As for the structural models, the import volumes and export prices form an input for the trade linkage module, discussed next.

3.8.3 The linkage system

Together with the export prices (discussed in the section on prices), import volumes of goods are an exogenous input for the bilateral trade flow model. This model determines, on the basis of import volumes and export prices, bilateral export flows between the 25 countries/zones of the QUEST model, in total 605 flows. The bilateral export flow equations determine the volume share of exports of country i in imports of country j as a function of the export price of country i relative to the import price of country j (i.e. the weighted average of all countries' export prices with import shares on market j as weights). After correcting for adding-up properties, the sum of bilateral exports originating in country i determines total exports (XMSQ) of country i, while all bilateral exports going to a country j determine the weighting scheme for export prices which forms the basis for the determination of the import price (PMMS) of country j. In Table 28 the last two columns present root mean-squared percentage errors for export volumes and import prices calculated on this basis from a dynamic simulation over the period 1980-1984. The first part of the same table presents the implied export price elasticities for total exports, also obtained by simulation (the corresponding bilateral price elasticities may be found in ITALIANER (1987)). They represent an average of the bilateral relative price elasticities, and their long-run values vary between -0,65 and -1,50, their simple average being equal to about -1. The speed of adjustment of bilateral trade flows to relative price changes is presently rather high with, on average, 88% of a price shock effect being realized within the year after the shock.

The above results refer to a linkage model for total trade. The distinction between non-energy and energy imports has necessitated ad-hoc modifications to the bilateral trade flow model in order to deal with this distinction and in order to assure the correct propagation of oil-price shocks. The modifications introduced are discussed in Box 3.

Box 3: The treatment of energy in international trade

Starting from the country models and international trade linkage module described in the text, this box lists the modifications introduced in order to deal as correctly as possible with energy. In doing so, emphasis was put on the correct propagation of oil price shocks.

a) As described in subsection 3.8.2, proxies for non-energy export prices were defined for 7 energy exporters. Together with the non-energy export price for the United Kingdom and the total export prices of the remaining countries and zones (which are thus considered to be "non-energy" implicitly), this allows the calculation of non-energy import prices, i.e. weighted averages of 1) non-energy export prices for the 8 energy exporters and 2) non-energy export prices for the 16 remaining countries (the OPEC export price is excluded). The weights used were bilateral import shares for total trade due to lack of information on bilateral energy flows, thus introducing some bias.

b) For trade flows not originating in one of the 8 energy-exporting countries/zones, the import price (for total goods) in the relative price term has been replaced by the non-energy import price calculated as described under a).

c) For trade flows originating in one of the 8 energy-exporting countries except the UK and OPEC, the same has been done as under b) but in addition their (total) export price in the relative price term has been replaced by the non-energy export price proxy, and the relative price term has been multiplied by one minus the share of energy in total exports from Table 27. The latter implicitly entails the assumption that the law of one price holds for energy products from different geographical origins, which seems reasonable.

d) For bilateral exports from the UK to all countries/zones except Germany, France, the United Kingdom and the United States, the same has been done as under c), but using the observed non-energy export price deflator and the observed share of energy in total exports.

e) For bilateral exports from OPEC to all countries/zones except Germany, France, the United Kingdom and the United States the bilateral price elasticity has been set equal to zero under the assumptions that 1) OPEC only competes with other energy exporters and 2) the law of one price holds for energy products.

f) The equations for bilateral exports from the UK to Germany, France and the United States have each been cut into two parts. The first part consists of an expression multiplying total energy exports of the UK by the fixed bilateral share of each of the three countries in UK total energy exports (D: 14,5%, F: 13,3%, US: 16,5%). This part may thus be considered as a supply equation for bilateral energy exports from the UK to each of the three countries. The second part of the equation adds to this an expression equal to the original equation, but with the relative prices modified as under d) and with the total import volume variable replaced by imports of non-energy goods. So the second part represents the bilateral non-energy exports from the UK to each of the three countries.

Box 3: The treatment of energy in international trade (continued)

g) Finally, in the equations for bilateral exports from the OPEC zone to Germany, France, the United Kingdom and the United States, the relative price elasticities were put equal to zero, the volume variable (total imports) was replaced by imports of energy and, except for the flow to the UK, an additive term was introduced representing the inverse of the UK energy supply variables described under f).

As a consequence of these ad-hoc changes, relative price effects among energy producers have been eliminated in the linkage module. If there is an oil price decline, the OPEC (or other energy exporters, for that matter) will not gain market shares in world trade of goods if import volumes (non-energy goods and energy)and export prices of non-energy goods remain unchanged. It will only gain market shares because lower energy prices will stimulate energy imports in general, and thus OPEC exports. Furthermore, energy exports from the UK are supply-determined. Any autonomous increase in UK energy exports will be subtracted from OPEC exports and vice versa, thus treating OPEC as the swing producer. This system will work progressively as more structural models become available.

Table 28: Characteristics of the linkage system

	Cumulative export price elasticities for exports of total goods[1]						Root mean-squared percentage error from a dynamic simulation of the linkage system 1980.I-1984.IV[2]	
Country	Q_1	Q_2	Q_3	year 1	year 2	year 5	Export volume	Import price
BLEU	-0,37	-0,47	-0,52	-0,56	-0,60	-0,67	1,9	0,17
Denmark	-0,60	-0,79	-0,89	-0,95	-1,06	-1,08	1,7	0,32
FR of Germany	-0,47	-0,62	-0,70	-0,75	-0,82	-0,83	1,7	0,14
Greece	-0,58	-0,72	-0,75	-0,76	-0,79	-0,73	9,1	0,26
Spain	-0,54	-0,73	-0,82	-0,85	-0,89	-0,90	6,0	0,45
France	-0,42	-0,56	-0,63	-0,67	-0,72	-0,73	1,6	0,17
Ireland	-0,57	-0,80	-0,93	-1,01	-1,12	-1,18	4,2	0,41
Italy	-0,71	-0,90	-0,97	-1,00	-1,03	-1,06	3,8	0,30
The Netherlands	-0,43	-0,57	-0,64	-0,68	-0,76	-0,80	1,7	0,23
Portugal	-0,32	-0,53	-0,67	-0,74	-0,93	-1,08	5,4	0,41
United Kingdom	-0,55	-0,78	-0,90	-0,97	-1,07	-1,12	2,8	0,19
United States	-0,56	-0,71	-0,79	-0,84	-0,92	-0,95	2,1	0,14
Canada	-0,48	-0,59	-0,64	-0,66	-0,55	-0,65	2,5	0,19
Japan	-0,51	-0,74	-0,87	-0,96	-1,04	-1,10	5,3	0,13
Australia	-0,72	-0,90	-0,96	-0,99	-1,04	-1,05	3,6	0,22
Austria	-0,29	-0,43	-0,52	-0,58	-0,71	-0,79	1,6	0,14
Finland	-0,70	-0,85	-0,90	-0,91	-0,88	-0,93	3,1	0,27
Norway	-0,57	-0,82	-0,97	-1,05	-1,16	-1,16	3,5	0,33
Sweden	-0,51	-0,66	-0,72	-0,74	-0,77	-0,81	3,9	0,26
Switzerland	-0,41	-0,56	-0,62	-0,66	-0,71	-0,73	2,4	0,39
Rest of OECD	-0,82	-1,06	-1,17	-1,22	-1,51	-1,49	4,5	0,26
OPEC	-0,38	-0,50	-0,59	-0,65	-0,76	-0,86	3,8	0,26
CPEs	-0,46	-0,56	-0,59	-0,65	-0,74	-0,77	4,0	0,19
NICs	-0,42	-0,64	-0,78	-0,88	-1,08	-1,30	2,9	0,12
Rest of world	-0,95	-1,20	-1,31	-1,38	-1,53	-1,39	8,7	0,14

Notes: [1] The bilateral export functions are of the following form (i = exporter, j = importer)

$$\log (X_{ij}/PXMS_i) = a_{ij} + \log(MMSZ_j/PMMSZ_j) + b_{ij}.\log(X_{ij}(-1)/PXMS_i(-1)/MMSZ_j(-1).PMMSZ_j(-1)) + c_{ij}(1-b_{ij}).\log(PXMS_i/PMMSZ_j) + \text{dummies}$$

This implies aggregate export functions with an elasticity of 1 with respect to weighted world demand and a relative export price elasticity which is a weighted average of the c_{ij} coefficients. The long run value and the dynamic profile of these relative export price elasticities are given here, for the first 4 quarters after a price shock, and after 8, 12 and 20 quarters, respectively.

[2] The RMSPEs give a good indication of the ability of the bilateral trade flow in predicting, given import volumes and export prices, export volumes and import prices.

4. SIMULATION PROPERTIES[1]

4.1 Simulation modes

The QUEST model may be simulated under three alternative monetary policy regimes when considering, for example, a government spending shock.

i) Standard monetary policy

In this mode, model simulations are characterised as follows:
- the money supply is determined by the demand for money function;
- the short-term interest rate is determined by the monetary authorities' reaction function.

Since the short-term interest rate is allowed to react to the policy shock via the authorities' reaction function, which in turn will have its impact on the money supply via the demand for money function in which it is one of the arguments, this mode can also be labelled as partially accommodating. Except for the tests in subsection 4.2.1, this monetary policy mode was used for all simulations.

ii) Accommodating monetary policy (fixed interest rate)

In this mode, the money supply is again determined by the demand for money function. The short-term interest rate is however fixed at its baseline level. Since interest rates are unaffected by the policy shock, the money supply fully accommodates demand.

iii) Non-accommodating monetary policy (fixed money stock)

In this mode, the money supply is fixed at its baseline level. The money demand equation is renormalised to determine the market clearing short-term interest rate, whereas the short-term interest rate equation is overridden. For given increases in GNP/GDP and prices, the extent to which interest rates need to increase to keep money demand at its target level is determined by the relevant money demand function elasticities. Note that the lagged short-term interest rate in the money demand function for the UK is replaced by its current value in this mode.

Concerning government spending, two modes are available. Government consumption and investment may be kept fixed at their baseline values in nominal or real terms. When fixed in nominal terms, real government

[1] It would have been a logical step, after presentation of the estimation results and before looking at the behaviour of the model when influenced by shocks, to regard its historical tracking record, e.g. in the form of dynamic simulation residuals. Technically, the absence of an endogenous determination of the (raw) residuals of equations estimated with a correction for autocorrelation have so far downgraded the value of such historical simulations. The model will, therefore, have to be rewritten in order to perform such tests. Apart from this technical reason, the fact that the equations have been estimated such as to contain - statistically confirmed - a priori reasonable economic behaviour rather than a good statistical fit (thus limiting the use of dummies), render such an exercise less interesting than a thorough analysis of the model's economic properties.

investment is determined by dividing nominal government investment by the total investment deflator, while real government consumption is calculated by dividing nominal government consumption by an average index of nominal wage cost and consumer prices (weighted by the share of wages and non-wage expenditure in government consumption, respectively). When fixed in real terms, nominal government investment is equal to real government investment multiplied by the total investment deflator, while nominal government consumption is the sum of employment in the public sector (exogenous) multiplied by nominal wage cost (endogenous) and real non-wage government consumption (exogenous) multiplied by consumer prices (endogenous). In the simulations presented in this paper, both government consumption and investment were always kept fixed at their baseline or ex-ante shocked levels in real terms.

Finally, the models may be chosen to operate in unlinked or linked mode. In unlinked mode, foreign demand and import prices of goods are exogenous in each country model. The bilateral export equations do still operate however, such that gains in competitiveness will increase exports in a way consistent with the linked mode. In the latter case, import prices and foreign demand become completely endogenous, and there will be spillover effects between countries through international trade in goods.

It should be remembered that all simulations are run with exogenous exchange rates. The simulation period ranges from the first quarter of 1977 to the fourth quarter of 1983 as these are the years, for which all country modules can be simulated jointly. Individual country modules may be run over a longer time span. This paper presents the simulation results only for the first five years of the simulation period and only for a number of variables of central importance. A more detailed presentation of the simulation results than in this part of the paper can be found in two separate volumes (part II and part III) which can be obtained from the authors upon request. Concerning the simulation period preliminary tests indicate that - with the notable exception of the oil price shock - for the majority of shocks the simulation results are only to a comparatively small extent baseline dependent.

4.2 Non-linked simulations

4.2.1 Government investment increase

In analyzing the effects of changes in fiscal policy a first set of simulations concerns a sustained increase in general government fixed investment. The size of the shock is equivalent to 1 percent of baseline real GDP/GNP. As the size of the fiscal policy multipliers[1] depends on the conduct of monetary policy, three alternative monetary policy assumptions are investigated in turn.

4.2.1.1 With monetary policy reaction function

As set out above, the standard versions of the QUEST country modules contain both a money demand equation and a short-term interest equation,

[1] Strictly speaking, the form in which the simulations are presented in this paper is not the classical multiplier formula $\Delta Y / \Delta G$ where Y is real GDP/GNP and G real government spending, but $\Delta Y/Y$. Since in the simulations presented below $\Delta G/Y = 1\%$, both formulas are equivalent in this particular case.

Table 29: NON-LINKED QUEST SIMULATION: GOVERNMENT INVESTMENT INCREASE 1% OF BASELINE GDP, STANDARD MONETARY POLICY

		GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....:	YEAR 1	1.20	1.35	1.02	1.75	1.33
.....	2	0.96	1.83	1.07	1.46	1.33
.....	3	0.51	1.60	0.64	0.22	0.74
.....	4	0.48	1.01	0.34	-0.00	0.46
.....	5	0.36	0.35	0.28	0.28	0.32
PRIVATE CONSUMPTION .:	YEAR 1	0.43	0.36	0.19	0.65	0.41
REAL	2	0.63	0.95	0.38	0.63	0.65
.....	3	0.40	1.09	0.27	-0.08	0.42
.....	4	0.42	0.86	0.15	-0.19	0.31
.....	5	0.47	0.53	0.19	0.18	0.35
TOTAL PRIVATE .....:	YEAR 1	2.06	2.22	1.26	2.70	2.06
INVESTMENT.....	2	1.64	4.28	2.09	2.02	2.51
.....	3	0.16	4.38	0.80	-1.12	1.06
.....	4	-0.03	2.71	0.10	-1.47	0.32
.....	5	-0.05	0.61	0.03	-0.47	0.03
STOCKBUILDING .....:	YEAR 1	0.22	0.31	0.16	0.21	0.23
(%BASELINE GDP).....	2	0.06	0.38	0.13	0.14	0.18
.....	3	-0.11	0.18	-0.02	-0.17	-0.03
.....	4	0.02	-0.05	-0.09	-0.14	-0.07
.....	5	0.01	-0.20	-0.05	-0.02	-0.06
REAL FOREIGN BALANCE :	YEAR 1	-0.63	-0.60	-0.44	-0.27	-0.48
(%BASELINE GDP).....	2	-0.75	-0.94	-0.61	-0.39	-0.67
.....	3	-0.64	-1.09	-0.63	-0.38	-0.68
.....	4	-0.77	-1.00	-0.67	-0.52	-0.74
.....	5	-0.91	-0.91	-0.80	-0.74	-0.84
PRIVATE CONSUMPTION .:	YEAR 1	0.26	0.17	0.17	0.35	0.24
DEFLATOR	2	0.54	0.66	0.63	1.46	0.82
.....	3	0.55	1.26	1.22	2.65	1.42
.....	4	0.71	1.74	1.76	3.65	1.97
.....	5	0.89	2.06	2.21	4.64	2.45
GDP/GNP DEFLATOR ....:	YEAR 1	0.34	0.25	0.09	0.47	0.29
.....	2	0.73	0.90	0.69	1.73	1.01
.....	3	0.78	1.67	1.49	3.05	1.75
.....	4	1.06	2.30	2.17	4.16	2.42
.....	5	1.32	2.71	2.71	5.22	2.99
NOMINAL WAGE RATE ...:	YEAR 1	0.96	0.22	0.11	0.80	0.52
.....	2	1.25	0.93	0.59	2.12	1.22
.....	3	1.31	1.89	1.33	3.42	1.99
.....	4	1.81	2.79	2.07	4.61	2.82
.....	5	2.17	3.44	2.69	5.75	3.51
TOTAL EMPLOYMENT ....:	YEAR 1	0.26	0.17	0.19	0.74	0.34
.....	2	0.62	0.59	0.54	1.04	0.70
.....	3	0.48	0.87	0.59	0.37	0.58
.....	4	0.30	0.88	0.45	-0.06	0.39
.....	5	0.18	0.67	0.32	-0.00	0.29
UNEMPLOYMENT RATE ...:	YEAR 1	-0.25	-0.17	-0.18	-0.68	-0.32
(LEVEL DEVIATION).....	2	-0.59	-0.56	-0.51	-0.98	-0.66
.....	3	-0.47	-0.82	-0.57	-0.35	-0.55
.....	4	-0.29	-0.82	-0.42	0.05	-0.37
.....	5	-0.17	-0.61	-0.29	0.00	-0.27
SHORT-TERM INTEREST .:	YEAR 1	0.56	0.32	0.45	0.96	0.57
RATE	2	0.98	0.55	0.67	1.52	0.93
(LEVEL DEVIATION).....	3	0.57	0.60	0.59	1.38	0.79
.....	4	0.49	0.50	0.52	1.56	0.77
.....	5	0.51	0.42	0.60	1.85	0.85
GOVERNMENT FINANCIAL :	YEAR 1	-0.47	-0.61	-0.73	-0.38	-0.55
BALANCE.....	2	-0.40	-0.29	-0.64	-0.45	-0.44
(%BASELINE GDP).....	3	-0.65	-0.19	-0.81	-1.11	-0.69
.....	4	-0.75	-0.37	-1.05	-1.54	-0.93
.....	5	-0.84	-0.84	-1.21	-1.59	-1.12
CURRENT BALANCE .....:	YEAR 1	-0.54	-0.61	-0.62	-0.33	-0.52
(%BASELINE GDP).....	2	-0.55	-0.81	-0.68	-0.37	-0.60
.....	3	-0.46	-0.85	-0.51	-0.22	-0.51
.....	4	-0.55	-0.70	-0.41	-0.29	-0.49
.....	5	-0.64	-0.58	-0.52	-0.46	-0.55

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the latter representing monetary authorities' behaviour in the money market. In this policy setting, the main immediate effect of an increase in government investment is to raise final demand and - as capacity adjusts only slowly - the degree of capacity utilization. Initially, the profit share in GDP increases due to the lagged wage and employment response. As a result, private investment is stimulated at the same time by demand and profits, making it in all countries to be the most dynamic GDP component in the first two years (see Table 29). Private consumption is mainly driven by the rise in households' real disposable income and the reduction in the unemployment rate. The last component of domestic final demand, inventory investment, shows a relatively strong rise in the first two years of the simulation period, ranging from 0,1 percent of baseline GDP/GNP in Germany to 0,3 in France. This "pro-cyclical" behaviour reflects the important role of the transactions/precautionary motive in stockbuilding as well as work in progress.

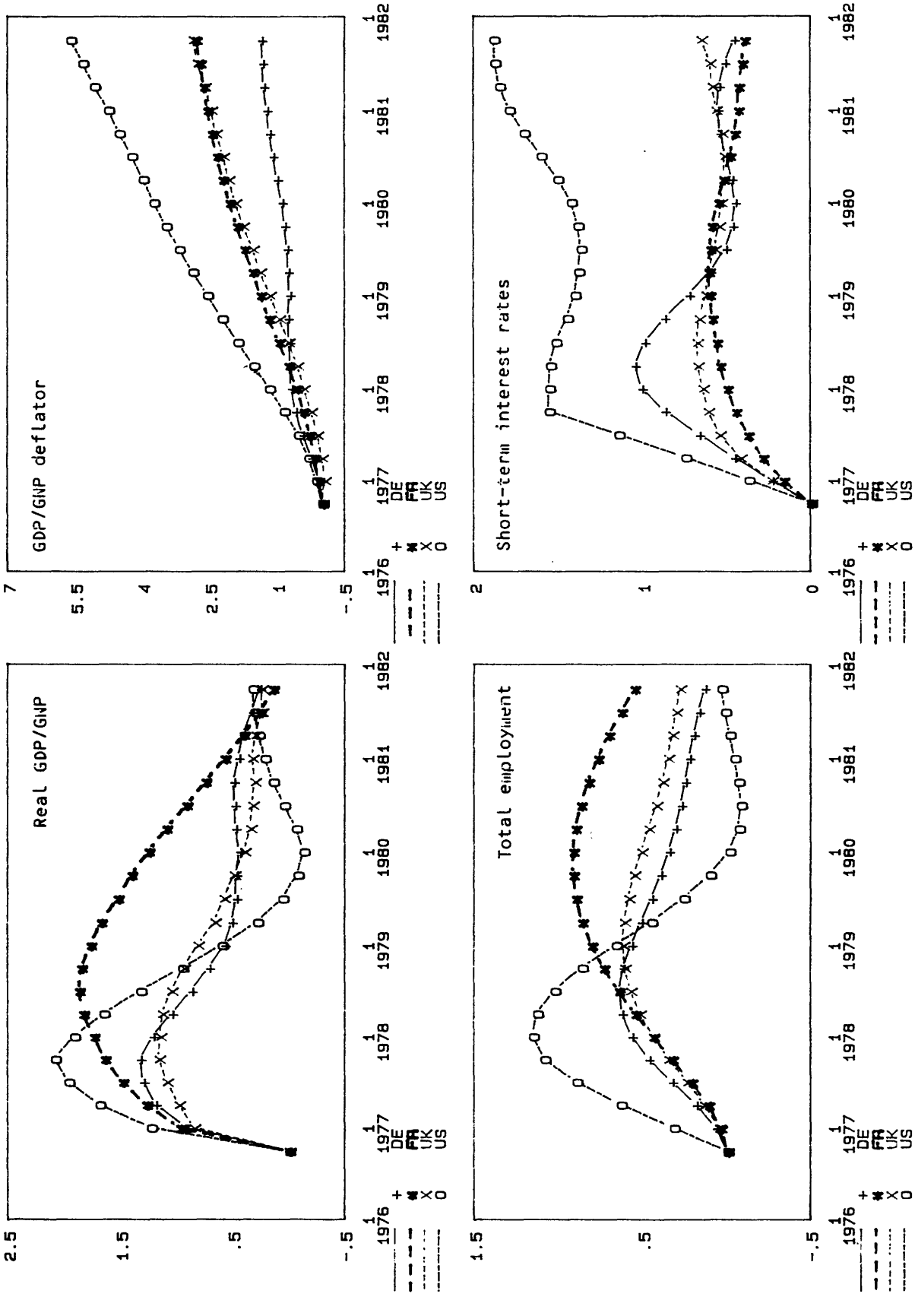
The real foreign balance on the other hand, deteriorates, initially due to higher imports in response to higher final demand and degrees of capacity utilization, later on also due to lower exports as a consequence of higher export prices. Although both effects are particularly strong in the US model, this is not reflected in the real foreign balance as a percent of GNP due to the comparatively smaller share of foreign trade in GNP in the United States. Overall, the foreign trade leakages in the case of an increase in public investment are substantial in the QUEST model, when action is taken by one country only (see the discussion on joint action in section 4.3.1). Thus, over a five year period, the increase in domestic demand is almost twice as high as the increase in GDP in the three European modules.

In terms of GDP, the multiplier lies on average over a 5 year period in the order of 0,7% of baseline GDP, for all countries, except France. For France the multiplier is situated at the upper end of the acceptable range, as GDP rises by significantly more than 1 percent, mainly in response to the strong profit effect in the investment equations and the absence of an inflation term in the consumption equation (real balance effect). Overall, the major part of the GDP response is located in the first two years. But although the dynamic profile of the GDP response differs somewhat between countries, GDP multipliers are relatively uniform after 5 years. Cyclical behaviour and speed of reaction of the US model are marked compared to the other countries, leading even to negative private investment and consumption multipliers in years 4 and 5.

The employment effects associated with the rise in economic activity appear with a lag of, on average, one year (see Graph 1). Size and time profile of the employment gains reflect fairly closely the evolution of the GDP multipliers in the different country modules. In those countries where either real wages rise quickly (F.R.Germany) or where the influence of real wages on potential employment is subject to only short lags (United States), the immediate decrease in potential employment tends to lower the employment gains, although only moderately.

As far as the wage and price reaction is concerned, the models reveal some degree of diversity. In Germany nominal wages react quickly and strongly to the productivity gains. The price response, on the other hand, is relatively weak so that after 5 years consumer prices are only 1 percent

Graph 1: Non-linked QUEST simulation: increase in government investment by 1% of baseline GDP, standard monetary policy; quarterly multipliers for real GDP, GDP deflator, total employment and short-term interest rates



higher than in the baseline. The other extreme is given by the United States where the strong wage response due to the Phillips curve effect sets in motion a sort of wage-price spiral. Thus, after 5 years consumer prices are roughly 5 percent higher than in the baseline. For France and the United Kingdom the model behaviour lies somewhat between the two polar cases, Germany and US. Although nominal wages rise faster in the simulation with the French model, reflecting shorter indexation lags with respect to inflation and the inclusion of a terms of trade effect, price increases are of a similar magnitude compared to the UK model. This can be explained mainly by the lower speed of adjustment of prices to wages in the French model.

Concerning the behaviour of real wages, the following observations can be made. In all countries real wages do not rise to the same amount as labour productivity in the first 1-2 years. Consequently, profitability is higher than in the baseline thereby stimulating private investment. After 2-4 years, depending upon the country, the growth in per capita real wage cost exceeds the gain in labour productivity, thus leading to higher unit labour costs. This effect is relatively pronounced in the German and French module, while it is absent in the UK and only weak in the US modules. The roots of this model behaviour can be traced back to the fact that in the first two countries wages adjust faster to prices than prices do to wages. As a result, real unit labour cost are significantly higher than in the baseline in these two countries, even in the medium term. The phenomenon can also be observed when looking at the profit share in GDP/GNP, a variable that captures "supply-side" factors in the determination of private productive investment. Only in the first 1 - 3 years, depending on the country, is the profit share higher than in the baseline. After this initial period it is lower in all countries. The result is that investment in all four countries is affected negatively by a declining profit share towards the end of the simulation period.

Interest rates in all four models rise, although due to different factors. While in the German model nominal short-term rates rise in response to higher inflation, higher capacity utilization and lower unemployment, the main transmission mechanism in the French and the UK model is the current account deterioration. The strongest rise in short-term interest rates is observed in the US model, where the comparatively high rate of inflation together with the GDP growth contributes to a rise in nominal short term interest rates that attains almost two percentage points after 2 years. Although the rise in short-term interest rates feeds through to nominal long-term interest rates, real long-term rates vary in fact only little or decline even slightly in all countries but the United States. In the latter country, real long-term interest rates begin to rise from the third year onwards, thereby exerting a negative influence on productive as well as residential investment.

At the same time, higher inflation and interest rates reverse the initial improvement in the general government budget deficit in response to the higher tax revenues associated with stronger income growth. The corresponding transmission mechanisms are twofold. On the one hand, transfer payments to households rise, as these payments are indexed on consumer prices. On the other hand, interest payments on government debt increase both due to the higher deficit and higher nominal long-term interest rates.

Table 30: NON-LINKED QUEST SIMULATION: GOVERNMENT INVESTMENT INCREASE 1% OF BASELINE GDP, FIXED SHORT-TERM INTEREST RATES

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	1.30	1.36	1.03	1.79	1.37
..... 2	1.37	1.90	1.09	1.75	1.53
..... 3	0.80	1.72	0.68	0.60	0.95
..... 4	0.35	1.18	0.41	-0.10	0.46
..... 5	0.11	0.50	0.32	-0.01	0.23
PRIVATE CONSUMPTION .: YEAR 1	0.52	0.37	0.19	0.65	0.43
REAL 2	0.97	0.97	0.39	0.70	0.76
..... 3	0.73	1.14	0.27	-0.02	0.53
..... 4	0.42	0.93	0.15	-0.39	0.28
..... 5	0.30	0.60	0.19	-0.17	0.23
TOTAL PRIVATE .....: YEAR 1	2.32	2.29	1.31	2.74	2.16
INVESTMENT..... 2	2.92	4.64	2.23	3.00	3.20
..... 3	1.60	5.09	1.04	0.47	2.05
..... 4	0.17	3.66	0.41	-0.99	0.81
..... 5	-0.52	1.58	0.35	-0.45	0.24
STOCKBUILDING .....: YEAR 1	0.28	0.31	0.16	0.26	0.25
(%BASELINE GDP)..... 2	0.29	0.39	0.14	0.29	0.28
..... 3	-0.01	0.20	0.01	0.01	0.06
..... 4	-0.10	-0.03	-0.02	-0.14	-0.07
..... 5	-0.09	-0.20	-0.00	-0.07	-0.09
REAL FOREIGN BALANCE : YEAR 1	-0.68	-0.61	-0.44	-0.28	-0.50
(%BASELINE GDP)..... 2	-0.99	-0.97	-0.62	-0.44	-0.76
..... 3	-0.91	-1.15	-0.66	-0.48	-0.80
..... 4	-0.82	-1.08	-0.72	-0.58	-0.80
..... 5	-0.87	-0.99	-0.84	-0.78	-0.87
PRIVATE CONSUMPTION .: YEAR 1	0.28	0.17	0.17	0.35	0.24
DEFLATOR 2	0.67	0.67	0.64	1.54	0.88
..... 3	0.76	1.29	1.24	2.96	1.56
..... 4	0.85	1.81	1.80	4.21	2.17
..... 5	0.99	2.16	2.29	5.27	2.68
GDP/GNP DEFLATOR ....: YEAR 1	0.37	0.25	0.09	0.48	0.30
..... 2	0.92	0.91	0.69	1.84	1.09
..... 3	1.08	1.71	1.51	3.43	1.93
..... 4	1.25	2.39	2.23	4.81	2.67
..... 5	1.46	2.84	2.80	5.96	3.26
NOMINAL WAGE RATE ...: YEAR 1	1.04	0.22	0.11	0.82	0.55
..... 2	1.65	0.94	0.59	2.28	1.37
..... 3	1.77	1.94	1.35	3.90	2.24
..... 4	2.06	2.89	2.11	5.32	3.10
..... 5	2.38	3.61	2.78	6.54	3.83
TOTAL EMPLOYMENT ....: YEAR 1	0.28	0.17	0.19	0.75	0.35
..... 2	0.74	0.60	0.54	1.17	0.77
..... 3	0.70	0.90	0.61	0.61	0.71
..... 4	0.39	0.94	0.48	-0.02	0.45
..... 5	0.08	0.75	0.35	-0.19	0.25
UNEMPLOYMENT RATE ...: YEAR 1	-0.27	-0.17	-0.18	-0.70	-0.33
(LEVEL DEVIATION)..... 2	-0.71	-0.57	-0.52	-1.11	-0.73
..... 3	-0.67	-0.85	-0.58	-0.58	-0.67
..... 4	-0.37	-0.88	-0.45	0.02	-0.42
..... 5	-0.07	-0.69	-0.32	0.17	-0.23
SHORT-TERM INTEREST .: YEAR 1	0.00	0.00	0.00	0.00	0.00
RATE 2	0.00	0.00	0.00	0.00	0.00
(LEVEL DEVIATION)..... 3	0.00	0.00	0.00	0.00	0.00
..... 4	0.00	0.00	0.00	0.00	0.00
..... 5	0.00	0.00	0.00	0.00	0.00
GOVERNMENT FINANCIAL : YEAR 1	-0.41	-0.61	-0.72	-0.31	-0.51
BALANCE..... 2	-0.16	-0.26	-0.61	-0.18	-0.30
(%BASELINE GDP)..... 3	-0.39	-0.12	-0.75	-0.71	-0.49
..... 4	-0.67	-0.25	-0.97	-1.29	-0.80
..... 5	-0.87	-0.69	-1.12	-1.39	-1.02
CURRENT BALANCE .....: YEAR 1	-0.59	-0.61	-0.62	-0.34	-0.54
(%BASELINE GDP)..... 2	-0.74	-0.84	-0.69	-0.43	-0.67
..... 3	-0.66	-0.90	-0.55	-0.31	-0.60
..... 4	-0.56	-0.78	-0.46	-0.29	-0.52
..... 5	-0.56	-0.65	-0.56	-0.43	-0.55

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Thus, in the United States model simulation where both inflation and interest rates are high, government current expenditure (i.e. excluding investment) rises faster than current receipts. As a result, the government budget deficit deteriorates significantly more in the US than in the other three countries. However, also in those countries the public investment increase is not "self-financing" in the sense that the resulting higher GDP growth would create sufficient revenues to eliminate the initial negative budgetary impact in the medium-term. It may be asked, therefore, whether the revenue effects of public expenditure policies are sufficiently taken into account.

With respect to the medium-term properties of the QUEST model, two specificities are most noteworthy. First, compared to other models, price effects in the consumption equation (real balance effect) are relatively important. Secondly, although the supply block captures the main supply side mechanisms, potential output and employment are not very sensitive and influence actual employment only with long lags.

4.2.1.2 With fixed short-term interest rates

Although this is not envisaged for the standard use of the model, QUEST can also be simulated with exogenous short-term interest rates in order to mimic the pursuit of an "accommodating" monetary policy. As expected, the fact of keeping short-term interest rates constant at their baseline levels tends to increase - on average over a 5-year period - the GDP multiplier of a public investment shock compared to the case with a policy reaction function (see Table 30). Although short-term interest rates also influence inventory investment directly, the main transmission mechanism is the influence short-term rates have on long-term interest rates and thereby indirectly on investement, consumption (in Germany and the United Kingdom) and the budget deficit (interest payments on public debt).

Overall, the effect of keeping short-term interest rates constant is only small in terms of GDP. In three out of the four countries (Germany, France and the United States) GDP is on average only 0,1 percent higher per year than in the simulation with endogenous interest rates. In the United Kingdom the effects are even smaller both because the interest rate rise in the simulation with a policy reaction function is only moderate and because the influence of interst rates in the UK model is relatively weak (see also section 4.2.2). As in the German model short-term interest rates are the only determinant of long-term rates, the simulation of an accommodating monetary policy stance tends to stimulate private consumption and investment, especially in the first three years. It is noticeable, however, that even in this case, as for the United Kingdom, the size of the GDP multiplier does not reach one in the medium term.

In France and the United States the main effect of constant short-term interest rates consists of higher private investment as a consequence of a more moderate rise in long-term interest rates. In the latter country, the deterioration of the general government budget deficit is also significantly smaller than in the simulation with endogenous short-term interest rates.

With respect to inflation, the consequences of pursuing an "accommodating" monetary policy are only minor compared to the "standard monetary policy" mode, i.e. using a policy reaction function. Only in the US module the

Table 31: NON-LINKED QUEST SIMULATION: GOVERNMENT INVESTMENT INCREASE 1% OF BASELINE GDP, FIXED MONEY SUPPLY

		GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....:	YEAR 1	0.59	1.32	1.02	1.59	1.13
.....	2	0.19	1.67	1.05	1.05	0.99
.....	3	0.27	1.27	0.58	0.07	0.55
.....	4	0.13	0.54	0.22	0.17	0.26
.....	5	0.11	-0.12	0.11	0.03	0.03
PRIVATE CONSUMPTION .:	YEAR 1	-0.07	0.36	0.19	0.60	0.27
REAL	2	-0.15	0.91	0.38	0.53	0.42
.....	3	-0.07	0.96	0.27	-0.04	0.28
.....	4	-0.04	0.66	0.14	0.09	0.21
.....	5	0.03	0.34	0.19	0.37	0.23
TOTAL PRIVATE .....:	YEAR 1	0.46	2.01	1.23	2.34	1.51
INVESTMENT.....	2	-1.58	3.32	1.96	0.57	1.07
.....	3	-2.06	2.45	0.46	-2.26	-0.35
.....	4	-2.52	0.00	-0.55	-2.00	-1.27
.....	5	-2.79	-2.33	-0.93	-2.51	-2.14
STOCKBUILDING .....:	YEAR 1	-0.13	0.30	0.16	0.12	0.11
(%BASELINE GDP).....	2	-0.25	0.35	0.12	-0.06	0.04
.....	3	-0.02	0.12	-0.06	-0.26	-0.05
.....	4	-0.06	-0.11	-0.18	-0.14	-0.12
.....	5	-0.04	-0.22	-0.18	-0.24	-0.17
REAL FOREIGN BALANCE :	YEAR 1	-0.32	-0.59	-0.43	-0.25	-0.40
(%BASELINE GDP).....	2	-0.19	-0.87	-0.60	-0.31	-0.49
.....	3	-0.28	-0.92	-0.59	-0.31	-0.53
.....	4	-0.31	-0.77	-0.60	-0.47	-0.54
.....	5	-0.35	-0.68	-0.68	-0.60	-0.58
PRIVATE CONSUMPTION .:	YEAR 1	0.14	0.17	0.17	0.33	0.20
DEFLATOR	2	0.16	0.63	0.63	1.28	0.67
.....	3	0.21	1.16	1.20	2.21	1.19
.....	4	0.28	1.55	1.70	3.05	1.65
.....	5	0.32	1.77	2.09	3.90	2.02
GDP/GNP DEFLATOR ....:	YEAR 1	0.16	0.25	0.09	0.44	0.24
.....	2	0.19	0.85	0.68	1.52	0.81
.....	3	0.30	1.54	1.47	2.54	1.46
.....	4	0.41	2.05	2.10	3.46	2.01
.....	5	0.46	2.34	2.56	4.36	2.43
NOMINAL WAGE RATE ...:	YEAR 1	0.48	0.22	0.11	0.74	0.39
.....	2	0.31	0.89	0.58	1.82	0.90
.....	3	0.57	1.76	1.31	2.82	1.62
.....	4	0.67	2.49	2.01	3.85	2.26
.....	5	0.78	2.95	2.56	4.73	2.75
TOTAL EMPLOYMENT ....:	YEAR 1	0.16	0.17	0.19	0.68	0.30
.....	2	0.21	0.56	0.53	0.83	0.53
.....	3	0.15	0.78	0.58	0.20	0.43
.....	4	0.11	0.71	0.40	0.02	0.31
.....	5	0.04	0.42	0.24	-0.04	0.16
UNEMPLOYMENT RATE ...:	YEAR 1	-0.15	-0.16	-0.18	-0.63	-0.28
(LEVEL DEVIATION).....	2	-0.20	-0.53	-0.51	-0.78	-0.51
.....	3	-0.15	-0.73	-0.55	-0.19	-0.41
.....	4	-0.11	-0.66	-0.38	-0.02	-0.29
.....	5	-0.04	-0.39	-0.22	0.04	-0.15
SHORT-TERM INTEREST .:	YEAR 1	2.67	1.20	0.85	2.54	1.82
RATE	2	1.63	2.07	1.49	2.63	1.95
(LEVEL DEVIATION).....	3	1.86	2.32	2.10	2.54	2.21
.....	4	1.90	2.21	2.73	4.27	2.78
.....	5	2.04	1.96	3.17	5.56	3.18
GOVERNMENT FINANCIAL :	YEAR 1	-0.78	-0.63	-0.74	-0.51	-0.66
BALANCE.....	2	-0.98	-0.38	-0.68	-0.82	-0.71
(%BASELINE GDP).....	3	-1.06	-0.40	-0.90	-1.45	-0.95
.....	4	-1.23	-0.71	-1.21	-1.82	-1.25
.....	5	-1.37	-1.30	-1.45	-2.27	-1.60
CURRENT BALANCE .....:	YEAR 1	-0.27	-0.59	-0.62	-0.30	-0.45
(%BASELINE GDP).....	2	-0.14	-0.74	-0.66	-0.26	-0.45
.....	3	-0.21	-0.70	-0.47	-0.16	-0.38
.....	4	-0.22	-0.49	-0.32	-0.29	-0.33
.....	5	-0.26	-0.37	-0.37	-0.35	-0.34

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price level is noticeably higher after 5 years (0,7 percentage points) than with endogenous short-term interest rates. When compared to non-accommodating monetary policy (see next section), it can therefore be said that the standard monetary policy mode is somewhat biased towards accommodating monetary policy.

4.2.1.3 With fixed money supply

Another possible monetary policy regime is one of "non-accommodating" monetary policy. Technically, this policy stance has been simulated in the present simulation exercise by keeping money supply (M3) constant at its baseline level. Short-term interest rates are then determined by inverting the money demand function.

As can also be seen in Table 31, the main effect of this monetary policy regime is the occurrence of higher interest rates. Compared to the simulation with standard monetary policy, short-term interest rates are on average roughly 1,5 percentage points higher per year for Germany, France and the United Kingdom, while the increase is even in the order of 2 percentage points in the case of the United States. The same tendency can be detected with respect to long-term interest rates, although to a lesser extent.

The consequences of this response of interest rates differ markedly between countries. The strongest impact can be observed for Germany, where private consumption, private investment and inventory investment are on average lower than in the baseline. As a result, the GDP multiplier is very small and reaches only less than half its size in the simulation with standard monetary policy.

In France as well, the effect of higher interest rates on final demand is quite strong, but it is nevertheless smaller than in Germany so that the medium term GDP multiplier is still close to one. For the United Kingdom the multipliers are hardly affected since, as has been mentioned above, interest rates have only a very limited effect in the UK model. Although the interest rise in the US simulation is very strong, due to the fact that - as in the German model - the income elasticity in the money demand function exceeds one, the GDP multiplier is only moderately lower than in the simulation with endogenous money supply and interest rates. However, as expected, the deterioration in the budget deficit is much stronger, reaching even 2 percent of GNP in the fifth year.

Table B1: Comparison of QUEST and INTERLINK simulation results: increase in government investment with exogenous short-term interest rates

Country	Year	Germany QUEST	Germany INTERL	France QUEST	France INTERL	UK QUEST	UK INTERL	US QUEST	US INTERL	SIMPLE MEAN QUEST	SIMPLE MEAN INTERL.
Real GDP/GNP	1	1.3	1.0	1.4	0.6	1.0	0.9	1.8	1.2	1.4	0.9
	2	1.4	1.5	1.9	1.0	1.1	1.2	1.8	1.3	1.5	1.3
	3	0.8	1.5	1.7	1.3	0.7	1.0	0.6	1.1	1.0	1.2
	4	0.4	0.9	1.2	1.4	0.4	0.8	-0.1	1.1	0.5	1.1
	5	0.1	0.5	0.5	1.5	0.3	0.7	-0.0	1.0	0.2	0.9
Real private consumption	1	0.5	0.4	0.4	0.1	0.2	0.3	0.7	0.3	0.4	0.3
	2	1.0	0.7	1.0	0.2	0.4	0.6	0.7	0.5	0.8	0.5
	3	0.7	0.7	1.1	0.2	0.3	0.7	-0.0	0.5	0.5	0.5
	4	0.4	0.5	0.9	0.3	0.2	0.7	-0.4	0.6	0.3	0.5
	5	0.3	0.5	0.6	0.4	0.2	0.7	-0.2	0.7	0.2	0.6
Real private investment	1	2.3	1.2	2.3	1.0	1.3	1.2	2.7	1.5	2.2	1.2
	2	2.9	2.4	4.6	2.2	2.2	2.5	3.0	2.0	3.2	2.3
	3	1.6	2.8	5.1	3.2	1.0	2.5	0.5	2.3	2.1	2.7
	4	0.2	2.0	3.7	3.8	0.4	2.4	-1.0	3.0	0.8	2.8
	5	-0.5	0.7	1.6	4.1	0.4	2.3	-0.5	3.6	0.2	2.7
Real foreign balance[1]	1	-0.7	-0.4	-0.6	-0.3	-0.4	-0.5	-0.3	-0.4	-0.5	-0.4
	2	-1.0	-0.7	-1.0	-0.4	-0.6	-0.7	-0.4	-0.5	-0.8	-0.6
	3	-0.9	-0.8	-1.2	-0.6	-0.7	-0.7	-0.5	-0.6	-0.8	-0.7
	4	-0.8	-0.8	-1.1	-0.7	-0.7	-0.8	-0.6	-0.8	-0.8	-0.8
	5	-0.9	-0.7	-1.0	-0.9	-0.8	-1.0	-0.8	-1.1	-0.9	-0.9
GDP/GNP deflator	1	0.4	0.1	0.3	-0.0	0.1	0.1	0.5	0.3	0.3	0.1
	2	0.9	0.7	0.9	0.2	0.7	0.7	1.8	1.2	1.1	0.7
	3	1.1	1.1	1.7	0.5	1.5	1.5	3.4	2.3	1.9	1.4
	4	1.3	1.1	2.4	0.9	2.2	2.3	4.8	3.5	2.7	2.0
	5	1.5	0.6	2.8	1.2	2.8	2.7	6.0	4.8	3.3	2.3
Nominal wage rate	1	1.0	0.4	0.2	0.0	0.1	0.1	0.8	0.6	0.6	0.3
	2	1.7	1.0	0.9	0.3	0.6	0.7	2.3	1.7	1.4	0.9
	3	1.8	1.2	1.9	0.6	1.4	1.7	3.9	2.9	2.2	1.6
	4	2.1	0.8	2.9	1.0	2.1	2.5	5.3	4.5	3.1	2.2
	5	2.4	0.2	3.6	1.4	2.8	3.0	6.5	6.0	3.8	2.7
Total employment	1	0.3	0.3	0.2	0.1	0.2	0.3	0.8	0.5	0.4	0.3
	2	0.7	0.9	0.6	0.3	0.5	0.7	1.2	0.8	0.8	0.7
	3	0.7	1.3	0.9	0.4	0.6	0.8	0.6	0.7	0.7	0.8
	4	0.4	1.4	0.9	0.5	0.5	0.7	-0.0	0.5	0.5	0.8
	5	0.1	1.2	0.8	0.6	0.4	0.6	-0.2	0.4	0.3	0.7
Broad money supply	1	0.5	0.4	0.5	0.1	0.3	0.2	0.3	0.3	0.4	0.3
	2	1.5	1.5	1.6	0.6	0.9	0.9	1.0	1.2	1.3	1.1
	3	1.9	2.6	2.6	1.1	1.4	1.5	1.4	2.0	1.8	1.8
	4	1.8	2.8	3.3	1.6	2.0	2.1	1.9	3.1	2.3	2.4
	5	1.7	2.2	3.5	2.0	2.5	2.5	2.6	4.2	2.6	2.7
Government financial balance[1]	1	-0.4	-0.8	-0.6	-1.2	-0.7	-0.9	-0.3	-0.7	-0.5	-0.9
	2	-0.2	-0.5	-0.3	-1.4	-0.6	-0.8	-0.2	-0.5	-0.3	-0.8
	3	-0.4	-0.3	-0.1	-1.5	-0.8	-0.7	-0.7	-0.5	-0.5	-0.8
	4	-0.7	-0.4	-0.3	-1.4	-1.0	-0.9	-1.3	-0.5	-0.8	-0.8
	5	-0.9	-0.6	-0.7	-1.5	-1.1	-1.2	-1.4	-0.6	-1.0	-1.0

Note: [1] Deviation in % of baseline GDP/GNP

Table B2: Comparison of QUEST and INTERLINK simulation results: increase in government investment with exogenous money supply

Country	Year	Germany QUEST	Germany INTERL	France QUEST	France INTERL	UK QUEST	UK INTERL	US QUEST	US INTERL	SIMPLE MEAN QUEST	SIMPLE MEAN INTERL.
Real GDP/GNP	1	0.6	0.9	1.3	0.6	1.0	0.9	1.6	1.1	1.1	0.9
	2	0.2	0.9	1.7	0.9	1.1	0.9	1.1	0.8	1.0	0.9
	3	0.3	0.6	1.3	1.1	0.6	0.4	0.1	0.5	0.6	0.7
	4	0.1	0.4	0.5	1.0	0.2	0.2	0.2	0.4	0.3	0.5
	5	0.1	0.5	-0.1	0.9	0.1	0.1	0.0	0.3	0.0	0.5
Real private consumption	1	-0.1	0.3	0.4	0.1	0.2	0.2	0.6	0.3	0.3	0.2
	2	-0.2	0.3	0.9	0.2	0.4	0.2	0.5	0.4	0.4	0.3
	3	-0.1	0.2	1.0	0.2	0.3	0.1	-0.0	0.3	0.3	0.2
	4	-0.0	0.2	0.7	0.3	0.1	0.1	0.1	0.4	0.2	0.3
	5	0.0	0.3	0.3	0.3	0.2	0.1	0.4	0.5	0.2	0.3
Real private investment	1	0.5	0.9	2.0	0.9	1.2	0.7	2.3	1.0	1.5	0.9
	2	-1.6	1.0	3.3	1.7	2.0	0.4	0.6	-0.2	1.1	0.7
	3	-2.1	0.6	2.5	2.1	0.5	-1.1	-2.3	-0.8	-0.4	0.2
	4	-2.5	0.1	0.0	1.8	-0.6	-2.5	-2.0	-0.7	-1.3	-0.3
	5	-2.8	-0.1	-2.3	1.1	-0.9	-3.3	-2.5	-1.0	-2.1	-0.8
Real foreign balance[1]	1	-0.3	-0.4	-0.6	-0.3	-0.4	-0.5	-0.3	-0.3	-0.4	-0.4
	2	-0.2	-0.5	-0.9	-0.4	-0.6	-0.5	-0.3	-0.4	-0.5	-0.5
	3	-0.3	-0.5	-0.9	-0.5	-0.6	-0.4	-0.3	-0.5	-0.5	-0.5
	4	-0.3	-0.5	-0.8	-0.6	-0.6	-0.3	-0.5	-0.6	-0.5	-0.5
	5	-0.4	-0.6	-0.7	-0.6	-0.7	-0.4	-0.6	-0.8	-0.6	-0.6
GDP/GNP deflator	1	0.2	0.1	0.3	-0.0	0.1	-0.0	0.4	0.3	0.2	0.1
	2	0.2	0.5	0.9	0.2	0.7	0.3	1.5	1.0	0.8	0.5
	3	0.3	0.8	1.5	0.4	1.5	0.7	2.5	1.5	1.5	0.9
	4	0.4	0.7	2.1	0.7	2.1	0.9	3.5	2.0	2.0	1.1
	5	0.5	0.7	2.3	1.0	2.6	1.0	4.4	2.4	2.4	1.3
Nominal wage rate	1	0.5	0.4	0.2	0.0	0.1	0.1	0.7	0.6	0.4	0.3
	2	0.3	0.8	0.9	0.2	0.6	0.5	1.8	1.3	0.9	0.7
	3	0.6	0.8	1.8	0.5	1.3	1.0	2.8	2.0	1.6	0.6
	4	0.7	0.7	2.5	0.9	2.0	1.3	3.9	2.6	2.3	1.4
	5	0.8	0.8	3.0	1.2	2.6	1.3	4.7	3.2	2.8	1.6
Total employment	1	0.2	0.2	0.2	0.1	0.2	0.3	0.7	0.5	0.3	0.3
	2	0.2	0.4	0.6	0.3	0.5	0.6	0.8	0.5	0.5	0.5
	3	0.2	0.3	0.8	0.4	0.6	0.6	0.2	0.2	0.4	0.4
	4	0.1	0.2	0.7	0.5	0.4	0.4	0.0	0.1	0.3	0.3
	5	0.0	0.1	0.4	0.5	0.2	0.3	-0.0	-0.0	0.2	0.2
Short-term interest rate	1	2.7	0.9	1.2	0.5	0.9	0.9	2.5	0.6	1.8	0.7
	2	1.6	1.8	2.1	1.2	1.5	1.7	2.6	1.0	2.0	1.4
	3	1.9	1.4	2.3	1.9	2.1	1.8	2.5	1.1	2.2	1.6
	4	1.9	0.8	2.2	2.3	2.7	1.7	4.3	1.3	2.8	1.5
	5	2.0	0.8	2.0	2.5	3.2	1.7	5.6	1.4	3.2	1.6
Government financial balance[1]	1	-0.8	-0.9	-0.6	-1.3	-0.7	-1.0	-0.5	-0.8	-0.7	-1.0
	2	-1.0	-0.9	-0.4	-1.6	-0.7	-1.1	-0.8	-0.8	-0.7	-1.1
	3	-1.1	-1.0	-0.4	-2.0	-0.9	-1.4	-1.5	-1.1	-1.0	-1.4
	4	-1.2	-1.2	-0.7	-2.3	-1.2	-1.9	-1.8	-1.4	-1.3	-1.7
	5	-1.4	-1.4	-1.3	-2.7	-1.5	-2.3	-2.3	-1.6	-1.6	-2.0

Note: [1] Deviation in % of baseline GDP/GNP

Box 4: Comparison with INTERLINK

In order to evaluate the simulation properties of the QUEST model in the light of other multi-country econometric models, this box compares the QUEST simulation results for a public investment shock with either fixed short-term interest rates or fixed money supply with the corresponding OECD INTERLINK simulations. The INTERLINK model has been chosen as for this model the most extensive set of multiplier tables covering a 5-year period is readily available. This is not (yet) the case for other multi-country models like the EPA, HERMES, ATLAS, MIMOSA etc. models. The comparison is confined to a public investment shock, as for this shock the simulation design is the most directly comparable.

Overall, the QUEST and INTERLINK simulation results are fairly similar (see Tables B1 and B2). However, a few differences are noticeable. Generally, the speed of adjustment in the QUEST model is higher than in the INTERLINK model, i.e. the time profile of the multipliers is more "front-loaded". This phenomenon could be due to the fact that QUEST has been estimated on quarterly data, while INTERLINK has been estimated on semi-annual data. For the first 2-3 years, the GDP/GNP multipliers of the QUEST modules exceed the respective multipliers the INTERLINK modules. But the dampening or real balance effects are stronger i QUEST. For the German and French modules this concerns mainly foreign trade, while in the UK and US modules private consumption is affected most. In part, these dampening effects can be traced back to the fact that the rise in nominal wages and prices in the QUEST model is somewhat higher than the one observed in the INTERLINK model. Thus, on average, over a five year period, QUEST is slightly less "expansionary" in terms of real GDP/GNP or final demand components than INTERLINK, and therefore even less "keynesian".

The mechanisms outlined above are clearly reflected in the multipliers presented in Tables B1 and B2. With respect to the simulation with exogenous short-term interest rates it appears that the different QUEST country modules show more uniformity in the time profile of their response than the respective modules of the INTERLINK model. Thus, for example, the QUEST GDP/GNP multipliers are bell-shaped for all countries, while in the French INTERLINK module the multiplier continues to rise. Similarly, while in all QUEST modules inflation rises continuously, this is not the case for the German INTERLINK module, where inflation is decreasing in the fifth year. The same module also shows an employment response that differs significantly from the one observed in the QUEST simulation. It should be mentioned, however, that there are also a number of inter-country differences that appear in both models, for example the relatively marked inflationary response in the United States modules and the strong rise of private investement in the French modules.

In the simulation with fixed money supply differences between the QUEST and the INTERLINK simulation results are smaller than in the accommodating monetary policy simulation. Apart from the general QUEST characteristics mentioned above, some differences seem to be noteworthy: generally, interest rates in the QUEST simulations rise more than in the INTERLINK simulations. As a result, private fixed investment in the QUEST exercise is on average below its level in the baseline, while it is slightly above its baseline level in the INTERLINK exercise. In addition, the interest rate increase is the cause for a negative private consumption multiplier in the German QUEST module. While with respect to employment and the external balance, both models show a very similar behaviour, the French INTERLINK module shows a surprisingly strong deterioration of the budget deficit, despite lower interest rates and price levels than in the French QUEST module simulation.

Source for the INTERLINK simulations: P.RICHARDSON, A review of the simulation properties of OECD's INTERLINK model, OECD, Working Paper Nr.47, July 1987. The simulations have been run over the time period 1983-1987.

Table 32: NON-LINKED QUEST SIMULATION: EX-ANTE DECREASE IN SHORT-TERM INTEREST RATES BY 1 PERCENTAGE POINT

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	0.30	0.06	0.02	0.12	0.12
..... 2	0.65	0.25	0.07	0.39	0.34
..... 3	0.38	0.42	0.14	0.30	0.31
..... 4	0.28	0.52	0.22	-0.23	0.20
..... 5	0.25	0.50	0.15	-0.32	0.14
PRIVATE CONSUMPTION .: YEAR 1	0.25	0.01	0.00	0.03	0.07
REAL 2	0.55	0.08	0.01	0.09	0.18
..... 3	0.49	0.17	0.01	0.02	0.17
..... 4	0.42	0.23	0.01	-0.27	0.10
..... 5	0.41	0.21	-0.02	-0.33	0.07
TOTAL PRIVATE .....: YEAR 1	0.77	0.33	0.15	0.24	0.37
INVESTMENT..... 2	2.20	1.40	0.42	1.33	1.34
..... 3	2.01	2.36	0.77	1.57	1.68
..... 4	1.89	3.00	1.05	0.21	1.54
..... 5	2.24	3.21	1.08	-0.09	1.61
STOCKBUILDING .....: YEAR 1	0.18	0.01	0.01	0.08	0.07
(%BASELINE GDP)..... 2	0.36	0.05	0.04	0.19	0.16
..... 3	0.12	0.07	0.11	0.15	0.11
..... 4	0.05	0.05	0.22	-0.04	0.07
..... 5	0.06	0.00	0.14	-0.05	0.04
REAL FOREIGN BALANCE : YEAR 1	-0.15	-0.02	-0.01	-0.02	-0.05
(%BASELINE GDP)..... 2	-0.42	-0.11	-0.04	-0.07	-0.16
..... 3	-0.39	-0.20	-0.09	-0.10	-0.20
..... 4	-0.38	-0.25	-0.16	-0.05	-0.21
..... 5	-0.46	-0.24	-0.14	-0.04	-0.22
PRIVATE CONSUMPTION .: YEAR 1	0.06	0.01	0.00	0.02	0.02
DEFLATOR 2	0.25	0.04	0.02	0.14	0.11
..... 3	0.31	0.13	0.06	0.42	0.23
..... 4	0.34	0.23	0.15	0.63	0.34
..... 5	0.45	0.33	0.26	0.65	0.42
GDP/GNP DEFLATOR ....: YEAR 1	0.08	0.01	0.00	0.02	0.03
..... 2	0.37	0.07	0.02	0.18	0.16
..... 3	0.44	0.18	0.07	0.49	0.29
..... 4	0.51	0.31	0.18	0.72	0.43
..... 5	0.67	0.43	0.31	0.73	0.53
NOMINAL WAGE RATE ...: YEAR 1	0.23	0.01	0.00	0.05	0.07
..... 2	0.69	0.06	0.01	0.26	0.26
..... 3	0.70	0.19	0.06	0.59	0.38
..... 4	0.86	0.37	0.15	0.77	0.54
..... 5	1.12	0.57	0.29	0.78	0.69
TOTAL EMPLOYMENT ....: YEAR 1	0.05	0.00	0.00	0.04	0.02
..... 2	0.26	0.05	0.02	0.19	0.13
..... 3	0.32	0.13	0.05	0.23	0.18
..... 4	0.21	0.21	0.10	-0.05	0.12
..... 5	0.14	0.27	0.12	-0.23	0.08
UNEMPLOYMENT RATE ...: YEAR 1	-0.05	-0.00	-0.00	-0.04	-0.02
(LEVEL DEVIATION)..... 2	-0.25	-0.04	-0.02	-0.18	-0.12
..... 3	-0.30	-0.12	-0.05	-0.22	-0.17
..... 4	-0.21	-0.20	-0.09	0.04	-0.11
..... 5	-0.14	-0.25	-0.11	0.21	-0.07
SHORT-TERM INTEREST .: YEAR 1	-1.36	-1.46	-1.55	-1.41	-1.45
RATE 2	-1.38	-1.76	-1.99	-1.47	-1.65
(LEVEL DEVIATION)..... 3	-1.47	-1.72	-2.07	-1.35	-1.65
..... 4	-1.69	-1.69	-2.05	-1.58	-1.75
..... 5	-1.72	-1.68	-2.08	-1.74	-1.80
GOVERNMENT FINANCIAL : YEAR 1	0.16	0.03	0.03	0.11	0.08
BALANCE..... 2	0.42	0.13	0.11	0.34	0.25
(%BASELINE GDP)..... 3	0.39	0.26	0.20	0.38	0.31
..... 4	0.39	0.39	0.28	0.17	0.30
..... 5	0.44	0.49	0.30	0.11	0.34
CURRENT BALANCE .....: YEAR 1	-0.13	-0.03	-0.01	-0.02	-0.05
(%BASELINE GDP)..... 2	-0.32	-0.10	-0.05	-0.08	-0.14
..... 3	-0.28	-0.18	-0.11	-0.09	-0.17
..... 4	-0.27	-0.22	-0.18	0.01	-0.17
..... 5	-0.32	-0.22	-0.14	0.02	-0.16

DATE: 4.11.88
UNLESS INDICATED OTHERWISE, ALL VARIABLES ARE EXPRESSED IN PERCENTAGE DIFFERENCE WRT BASELINE SIMULATION

4.2.2 Interest rate decrease

The effects of a lower short-term interest rate are simulated through a sustained downward adjustment in the add-factor for the short-term interest rate equation, which remains endogenous otherwise. This corresponds to the standard monetary policy case presented above.

The principal mechanisms involved in this simulation are the following (see Table 32). Short- and long-term interest rates are linked in the model through the long-term interest rate equation, with the long-term rate adjusting to movements in the short rate, allowing for inflation acceleration in the case of France and of the United Kingdom and, in the case of the United States, involving the public deficit to GDP ratio.

The effect of a lower short-term rate is therefore a gradual decrease of the long-term rate. After five years, the long-term interest rate is thus 0,7 percentage points lower than in the baseline simulation for Germany, 1,0 percentage points for France, 0,9 percentage points for the UK and 1,6 percentage points for the US. The more pronounced decrease of the long-term rate in the US results from the absence of a significant inflation influence in the US equation. Moreover, the full adjustment to an increase in the short rate takes place within one year, whereas in other countries the adjustment is either not complete, or involves longer time lags. The lower long-term interest rate feeds directly into the investment equations. The fastest response of private investment is found in the German model, whereas the largest overall investment response is that for France. The effect is rather weak in the UK-model, where the multiplier remains inferior to 1% of baseline GDP after five years. This is due to the low investment response in the UK. Also in this case, the US-model shows a strong cyclical effect. The capacity increase resulting from higher investment raises potential output after five years, in a range going from 0,1% deviation with respect to the baseline simulation for the UK to 0,6% deviation for France.

Private consumption is directly affected by the lower interest rate which represents the influence on savings and on the cost of consumption credit. It is affected indirectly by the productivity effect of the investment increase on wages and the resulting increase of real disposable income. The simulation shows that private consumption is almost unaffected by the interest rate decrease in the UK, while it is 0,4% higher than in the baseline solution after five years in Germany. Since also the response of private investment to the interest rate decrease is lower in the UK, the difference with respect to the baseline of domestic demand amounts to only 0,3% after five years, compared to 0,7% in Germany and 0,8% in France.

The interest rate decrease reduces the relative cost of capital with respect to labour. Theoretically, this would imply some substitution from labour towards capital. Since however this substitution effect was not supported by the data in estimation, the only impact on employment comes, via demand, from the (positive) real interest rate effect on investment. As a result of the more buoyant demand, this impact is particularly strong in the French case.

Table 33: NON-LINKED QUEST SIMULATION: EX-ANTE DECREASE IN NOMINAL WAGE RATES OF 1 PERCENT

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	0.07	0.01	0.04	0.13	0.06
..... 2	0.58	0.26	0.25	0.25	0.34
..... 3	0.75	0.64	0.34	0.25	0.49
..... 4	0.41	0.78	0.38	0.17	0.44
..... 5	0.32	0.71	0.43	-0.04	0.35
PRIVATE CONSUMPTION .: YEAR 1	-0.02	-0.16	-0.09	0.11	-0.04
REAL 2	0.22	-0.24	-0.02	0.20	0.04
..... 3	0.31	-0.11	-0.03	0.05	0.05
..... 4	0.05	0.00	-0.06	-0.02	-0.01
..... 5	-0.07	-0.04	-0.09	-0.16	-0.09
TOTAL PRIVATE .....: YEAR 1	-0.31	-0.50	-0.05	0.28	-0.14
INVESTMENT..... 2	0.30	0.17	0.18	0.20	0.21
..... 3	1.15	1.79	0.26	0.32	0.88
..... 4	0.16	2.36	0.25	0.25	0.76
..... 5	-0.32	2.25	0.33	-0.32	0.48
STOCKBUILDING .....: YEAR 1	-0.09	-0.02	-0.01	-0.02	-0.03
(%BASELINE GDP)..... 2	0.08	0.02	0.01	0.02	0.03
..... 3	0.11	0.10	-0.02	0.07	0.06
..... 4	-0.07	0.07	-0.04	0.03	-0.00
..... 5	-0.04	-0.00	0.02	-0.06	-0.02
REAL FOREIGN BALANCE : YEAR 1	0.22	0.23	0.10	0.04	0.15
(%BASELINE GDP)..... 2	0.32	0.36	0.23	0.07	0.25
..... 3	0.25	0.28	0.34	0.10	0.24
..... 4	0.43	0.26	0.42	0.12	0.31
..... 5	0.45	0.31	0.41	0.16	0.33
PRIVATE CONSUMPTION .: YEAR 1	-0.47	-0.80	-0.47	-0.44	-0.54
DEFLATOR 2	-0.77	-1.10	-1.08	-0.84	-0.95
..... 3	-0.70	-1.11	-1.41	-0.88	-1.03
..... 4	-0.69	-1.04	-1.59	-0.90	-1.05
..... 5	-0.61	-0.95	-1.64	-0.91	-1.03
GDP/GNP DEFLATOR ....: YEAR 1	-0.72	-1.10	-0.68	-0.56	-0.76
..... 2	-1.08	-1.45	-1.42	-0.94	-1.22
..... 3	-0.99	-1.47	-1.84	-0.97	-1.32
..... 4	-1.00	-1.41	-2.02	-0.99	-1.36
..... 5	-0.88	-1.30	-2.05	-0.99	-1.31
NOMINAL WAGE RATE ...: YEAR 1	-1.67	-1.85	-1.19	-1.00	-1.43
..... 2	-1.77	-2.21	-1.76	-1.00	-1.69
..... 3	-1.57	-2.18	-2.15	-1.05	-1.74
..... 4	-1.58	-2.01	-2.30	-1.07	-1.74
..... 5	-1.26	-1.74	-2.30	-1.04	-1.59
TOTAL EMPLOYMENT ....: YEAR 1	0.02	0.00	0.01	0.11	0.04
..... 2	0.21	0.06	0.09	0.24	0.15
..... 3	0.51	0.21	0.20	0.20	0.28
..... 4	0.59	0.39	0.29	0.19	0.36
..... 5	0.50	0.51	0.34	0.04	0.35
UNEMPLOYMENT RATE ...: YEAR 1	-0.02	-0.00	-0.01	-0.11	-0.03
(LEVEL DEVIATION)..... 2	-0.20	-0.05	-0.08	-0.22	-0.14
..... 3	-0.50	-0.19	-0.19	-0.19	-0.27
..... 4	-0.57	-0.37	-0.27	-0.17	-0.34
..... 5	-0.48	-0.47	-0.30	-0.04	-0.32
SHORT-TERM INTEREST .: YEAR 1	-0.17	-0.03	-0.05	-0.24	-0.12
RATE 2	-0.22	-0.12	-0.08	-0.63	-0.26
(LEVEL DEVIATION)..... 3	0.34	-0.07	-0.09	-0.29	-0.03
..... 4	0.25	-0.03	-0.13	-0.14	-0.01
..... 5	0.11	-0.06	-0.14	-0.23	-0.08
GOVERNMENT FINANCIAL : YEAR 1	-0.14	-0.05	0.04	0.10	-0.01
BALANCE..... 2	0.06	0.03	0.19	0.18	0.11
(%BASELINE GDP)..... 3	0.22	0.20	0.16	0.17	0.19
..... 4	0.13	0.35	0.21	0.16	0.21
..... 5	0.11	0.50	0.24	0.05	0.23
CURRENT BALANCE .....: YEAR 1	0.08	0.07	-0.02	0.00	0.03
(%BASELINE GDP)..... 2	0.10	0.14	-0.03	0.01	0.05
..... 3	0.05	0.05	0.01	0.03	0.04
..... 4	0.21	0.03	0.07	0.05	0.09
..... 5	0.25	0.10	0.08	0.10	0.13

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The government balance improves considerably for all countries. This improvement results from higher tax revenues as higher demand raises the tax bases, and from lower payments on the outstanding debt as interest rates fall. Also here the quickest response is that of the German model, whereas the largest overall response is found in the case of France. For the German and French models, the revenue effect dominates, whereas in the UK and US models the improvement of the government balance is more due to the direct effect on interest payments.

4.2.3 Wage rate decrease

The simulation of a wage decrease is carried out through a 1 percent, one-period downward adjustment in the residual for the wage rate equation, representing an external shock to an otherwise endogenous process of wage determination. Since the wage equation is expressed in growth rates, this is tantamount to a sustained ex ante decrease of 1% in the wage rate level.

The direct effects of such an ex-ante nominal wage decrease are a reduction of labour costs and a reduction of domestic prices. The simultaneity of wages and prices has important dynamic effects through the adjustment of the value-added price on wage costs, the definition of the consumption price as a weighted aggregate of the import price and the value-added price and the indexation of wages on consumption prices. In France and Germany, where wages adjust fast on prices, the highest reaction of wages is found after two years, whereas for the UK and the US this appears only after four years (see Table 33). For the US, the greater nominal wage inertia is reflected in a lower ex post effect, which is 1,0% on average over five years, while it is 1,8% on average for the European countries. Since, however, the weight of the wage costs in the consumption prices is higher in the US model, this difference is not fully reflected in the consumption price effect, which amounts to 0,8% on average over the five years for the US and to 1,0% on average for the other countries.

Real unit labour costs are on average 0,7 to 0,9% lower in France and in Germany, where labour productivity lags behind the real wage decrease. In the UK model, this productivity effect is absent, thus resulting in average real unit labour costs which are on average 2,0% lower than in the baseline simulation. Also in the US this effect is weak, but, given the greater nominal wage inertia, real unit labour costs decrease to a lesser extent than in the other countries.

On the supply side, two effects result from the wage decrease. One is the capacity increasing profitability effect on investment following the reduction of labour costs and the other is the shift from capital to labour following the decrease in real wage costs. The shock operates also through the recursive channel linking potential employment and potential output to investment. The decrease of the degree of capacity utilization resulting from the increase of the potential aggregates is almost fully compensated by the demand increase in all countries. The overall effect on investment is negative only for the first year (except for the US-model), but thereafter investment is on average higher than in the baseline simulation. Both effects have a positive impact on employment, which is 0,5% higher after five years than in the baseline simulation in Germany and France, and 0,3% higher in the UK. In the US-model, the usual short cycle appears also here; the largest effect on employment is found after two years, and it diminishes afterwards.

Table 34: NON-LINKED QUEST SIMULATION: EX-ANTE DECREASE IN SOCIAL SECURITY CONTRIBUTIONS OF FIRMS BY 1% OF GDP

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	0.47	0.44	0.42	0.76	0.52
..... 2	1.46	1.38	1.02	1.42	1.32
..... 3	1.58	2.16	1.08	1.01	1.46
..... 4	0.91	2.21	0.97	0.40	1.12
..... 5	0.69	1.73	0.96	-0.04	0.83
PRIVATE CONSUMPTION .: YEAR 1	0.60	0.26	0.53	0.90	0.57
REAL 2	1.40	0.76	1.12	1.69	1.24
..... 3	1.54	1.28	1.19	1.37	1.34
..... 4	1.05	1.48	1.08	1.02	1.16
..... 5	0.82	1.26	1.02	0.83	0.98
TOTAL PRIVATE .....: YEAR 1	0.08	-0.16	0.29	1.25	0.37
INVESTMENT..... 2	1.32	2.25	1.20	1.81	1.64
..... 3	2.20	5.75	1.07	0.81	2.46
..... 4	0.06	6.32	0.61	-0.75	1.56
..... 5	-0.82	5.13	0.53	-1.92	0.73
STOCKBUILDING .....: YEAR 1	-0.10	0.06	0.04	0.02	0.01
(%BASELINE GDP)..... 2	0.19	0.24	0.10	0.15	0.17
..... 3	0.15	0.33	0.00	0.11	0.15
..... 4	-0.14	0.17	-0.10	-0.05	-0.03
..... 5	-0.06	-0.07	0.00	-0.16	-0.07
REAL FOREIGN BALANCE : YEAR 1	0.21	0.25	0.03	-0.01	0.12
(%BASELINE GDP)..... 2	0.25	0.25	0.09	-0.08	0.13
..... 3	0.15	-0.05	0.21	-0.09	0.06
..... 4	0.45	-0.11	0.33	-0.09	0.15
..... 5	0.43	0.02	0.27	-0.12	0.15
PRIVATE CONSUMPTION .: YEAR 1	-0.75	-1.45	-0.75	-0.65	-0.90
DEFLATOR 2	-1.14	-1.81	-1.63	-0.88	-1.37
..... 3	-0.99	-1.55	-1.91	-0.24	-1.17
..... 4	-0.93	-1.12	-1.90	0.43	-0.88
..... 5	-0.71	-0.69	-1.69	1.02	-0.52
GDP/GNP DEFLATOR ....: YEAR 1	-1.14	-1.99	-1.12	-0.85	-1.27
..... 2	-1.58	-2.40	-2.19	-0.99	-1.79
..... 3	-1.41	-2.07	-2.54	-0.27	-1.57
..... 4	-1.35	-1.56	-2.45	0.48	-1.22
..... 5	-1.00	-1.01	-2.16	1.13	-0.76
NOMINAL WAGE RATE ...: YEAR 1	-0.86	-1.59	-0.35	0.21	-0.65
..... 2	-0.81	-2.00	-1.16	0.84	-0.78
..... 3	-0.45	-1.51	-1.49	1.58	-0.47
..... 4	-0.32	-0.66	-1.35	2.34	0.00
..... 5	0.45	0.32	-0.96	3.08	0.72
TOTAL EMPLOYMENT ....: YEAR 1	0.10	0.05	0.07	0.40	0.16
..... 2	0.59	0.33	0.38	0.96	0.56
..... 3	1.13	0.80	0.68	0.79	0.85
..... 4	1.19	1.23	0.80	0.43	0.91
..... 5	0.96	1.40	0.82	0.02	0.80
UNEMPLOYMENT RATE ...: YEAR 1	-0.10	-0.05	-0.07	-0.37	-0.15
(LEVEL DEVIATION)..... 2	-0.57	-0.31	-0.36	-0.90	-0.53
..... 3	-1.09	-0.75	-0.65	-0.75	-0.81
..... 4	-1.15	-1.15	-0.75	-0.40	-0.86
..... 5	-0.91	-1.30	-0.75	-0.02	-0.74
SHORT-TERM INTEREST .: YEAR 1	-0.16	0.03	0.07	-0.14	-0.05
RATE 2	0.00	0.03	0.19	-0.28	-0.01
(LEVEL DEVIATION)..... 3	0.88	0.21	0.22	0.43	0.43
..... 4	0.63	0.26	0.13	0.73	0.44
..... 5	0.40	0.17	0.13	0.65	0.34
GOVERNMENT FINANCIAL : YEAR 1	-0.58	-0.57	-0.55	-0.37	-0.52
BALANCE..... 2	-0.15	-0.21	-0.22	-0.05	-0.16
(%BASELINE GDP)..... 3	0.07	0.25	-0.32	-0.20	-0.05
..... 4	-0.14	0.54	-0.35	-0.53	-0.12
..... 5	-0.23	0.62	-0.37	-0.89	-0.22
CURRENT BALANCE .....: YEAR 1	-0.01	-0.06	-0.23	-0.10	-0.10
(%BASELINE GDP)..... 2	-0.06	-0.12	-0.42	-0.20	-0.20
..... 3	-0.12	-0.38	-0.33	-0.16	-0.25
..... 4	0.16	-0.40	-0.15	-0.08	-0.12
..... 5	0.20	-0.21	-0.17	-0.04	-0.06

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UNLESS INDICATED OTHERWISE, ALL VARIABLES ARE EXPRESSED IN PERCENTAGE DIFFERENCE WRT BASELINE SIMULATION

Private consumption is negatively affected by the decrease of real disposable income which results from the wage decrease, but it is positively affected by the lower inflation rates. For France and the UK, the former effect is stronger than the latter, thus resulting in a negative deviation of private consumption from its baseline value. For Germany and the US the opposite is true, although after three years, due to the already mentioned cyclical factors, the deviation becomes negative also for the US. The average increase of German private consumption results also from a different treatment of non-wage income in the German model, where no effect of self-employed income (which is related to the nominal wage rate) is included, thus resulting in an increase of non-wage income following the profit rise.

Finally, the overall effect on GDP/GNP is positive on average. For Germany, the UK and the US this is mostly due to the significant improvement of the foreign balance following the increase in price competitiveness; for France from the third year on the increase in investment becomes more important.

4.2.4 Social security contribution decrease for employers

This shock is simulated through a decrease of the exogenous average employers' social security contribution rate corresponding to a sustained decrease of employers' contributions of 1% of nominal baseline GDP (see Table 34). As in the previous simulation (a 1% nominal wage decrease), the decrease of employers' social security contributions results in a reduction of labour costs, which has both a profitability effect and a real interest rate effect as a result of the price decreases. Private investment in equipment is thus affected negatively in the first year following the real interest rate increases in Germany and France. From the second year on however, the profitability effect is stronger in all countries, which leads to a positive deviation of private investment from its baseline solution. This deviation is particularly high in the French model, where it amounts to 6,3% after four years. This comes in part from a very buoyant residential investment, following the decrease in the unemployment rate, a variable which does not affect residential investment in the other country models. In a later stage of the project, it is envisaged to enhance the homogeneity across countries in this respect. It is also due to productive investment, which is substantially higher than in the baseline simulation. The reason for this is that, contrary to the German and US models, the wage rate equation in the French model contains no productivity effect. Thus, the productivity increase which results from the social contributions decrease is not compensated by a wage increase in this model. As a result, the profit share increases by 0,9% on average, as compared to 0,5% for the German model, 0,5% for the UK model, and 0,1% for the US model. This in turn raises productive investment by 3,9% on average, as compared to 0,8% on average for the other country models.

Total employment improves considerably, as it is affected positively both by the shift from capital into labour as by the higher demand. Also the effect on private consumption is positive: households' real disposable income is 1 to 1,3% higher than in the baseline simulation after five years, whereas the price level is lower.

Table 35: NON-LINKED QUEST SIMULATION: EX-ANTE DECREASE IN HOUSEHOLDS' DIRECT TAXES BY 1% OF GDP

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	0.72	0.62	0.45	0.69	0.62
..... 2	0.90	1.31	0.67	1.26	1.03
..... 3	0.43	1.38	0.49	0.81	0.78
..... 4	0.33	1.13	0.27	0.30	0.51
..... 5	0.29	0.70	0.21	0.23	0.36
PRIVATE CONSUMPTION .: YEAR 1	1.34	0.86	0.88	0.91	0.99
REAL 2	2.04	1.78	1.34	1.73	1.72
..... 3	1.84	2.17	1.33	1.72	1.77
..... 4	1.77	2.25	1.21	1.54	1.69
..... 5	1.81	2.14	1.24	1.67	1.72
TOTAL PRIVATE .....: YEAR 1	1.24	1.18	0.49	1.01	0.98
INVESTMENT..... 2	1.59	2.90	1.09	1.89	1.87
..... 3	0.13	3.49	0.64	0.43	1.17
..... 4	-0.45	2.80	0.07	-1.12	0.33
..... 5	-0.32	1.51	-0.09	-1.31	-0.05
STOCKBUILDING .....: YEAR 1	0.13	0.13	0.07	0.07	0.10
(%BASELINE GDP)..... 2	0.11	0.29	0.09	0.15	0.16
..... 3	-0.09	0.22	0.02	-0.00	0.04
..... 4	-0.02	0.07	-0.05	-0.10	-0.03
..... 5	0.03	-0.06	-0.04	-0.07	-0.04
REAL FOREIGN BALANCE : YEAR 1	-0.39	-0.27	-0.19	-0.10	-0.24
(%BASELINE GDP)..... 2	-0.66	-0.64	-0.36	-0.26	-0.48
..... 3	-0.55	-0.85	-0.41	-0.33	-0.53
..... 4	-0.57	-0.90	-0.41	-0.40	-0.57
..... 5	-0.70	-0.89	-0.49	-0.55	-0.66
PRIVATE CONSUMPTION .: YEAR 1	0.15	0.06	0.06	0.11	0.10
DEFLATOR 2	0.45	0.35	0.30	0.70	0.45
..... 3	0.47	0.80	0.65	1.62	0.88
..... 4	0.52	1.24	1.00	2.58	1.34
..... 5	0.68	1.60	1.31	3.51	1.77
GDP/GNP DEFLATOR ....: YEAR 1	0.24	0.08	0.06	0.13	0.13
..... 2	0.65	0.47	0.34	0.78	0.56
..... 3	0.67	1.05	0.80	1.79	1.08
..... 4	0.78	1.63	1.23	2.85	1.62
..... 5	1.02	2.12	1.61	3.87	2.15
NOMINAL WAGE RATE ...: YEAR 1	0.60	0.07	0.04	0.29	0.25
..... 2	1.10	0.48	0.27	1.12	0.74
..... 3	1.04	1.17	0.69	2.20	1.28
..... 4	1.32	1.93	1.16	3.31	1.93
..... 5	1.67	2.62	1.57	4.37	2.56
TOTAL EMPLOYMENT ....: YEAR 1	0.14	0.07	0.07	0.27	0.14
..... 2	0.46	0.34	0.28	0.71	0.45
..... 3	0.43	0.61	0.37	0.60	0.50
..... 4	0.24	0.72	0.32	0.23	0.38
..... 5	0.15	0.67	0.23	0.05	0.27
UNEMPLOYMENT RATE ...: YEAR 1	-0.13	-0.06	-0.07	-0.25	-0.13
(LEVEL DEVIATION)..... 2	-0.45	-0.32	-0.27	-0.67	-0.42
..... 3	-0.42	-0.57	-0.36	-0.57	-0.48
..... 4	-0.23	-0.68	-0.30	-0.21	-0.35
..... 5	-0.14	-0.62	-0.21	-0.04	-0.25
SHORT-TERM INTEREST .: YEAR 1	0.31	0.14	0.19	0.34	0.24
RATE 2	0.79	0.36	0.39	1.00	0.64
(LEVEL DEVIATION)..... 3	0.53	0.48	0.40	1.21	0.66
..... 4	0.32	0.47	0.35	1.33	0.62
..... 5	0.40	0.45	0.38	1.51	0.69
GOVERNMENT FINANCIAL : YEAR 1	-0.73	-0.86	-0.81	-0.73	-0.78
BALANCE..... 2	-0.47	-0.56	-0.65	-0.51	-0.55
(%BASELINE GDP)..... 3	-0.61	-0.36	-0.70	-0.76	-0.61
..... 4	-0.75	-0.48	-0.84	-1.18	-0.81
..... 5	-0.77	-0.80	-0.96	-1.46	-1.00
CURRENT BALANCE .....: YEAR 1	-0.33	-0.28	-0.27	-0.13	-0.25
(%BASELINE GDP)..... 2	-0.49	-0.57	-0.42	-0.28	-0.44
..... 3	-0.39	-0.70	-0.37	-0.27	-0.43
..... 4	-0.40	-0.69	-0.27	-0.26	-0.41
..... 5	-0.49	-0.65	-0.33	-0.33	-0.45

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Except for the US model, where imports of goods and services are more than 2% higher than in the baseline simulation after two years, the overall real foreign balance is also positively affected in this shock, mainly as a result of export increases following the cost and price reductions. As a result of the strong effect of the unemployment rate on wages, the nominal wage rate increases considerably. This raises prices after four years, thus creating a competitive disadvantage for the US, which results in a negative multiplier on the real foreign balance.

The decrease of the government receipts (which include social security contributions) is compensated by lower expenditures only in the French model from the third year on. This comes mainly from a decrease in social transfer payments as the unemployment rate is lower. In the other countries however, this effect is too weak as to compensate for the loss in social security receipts.

4.2.5 Direct tax decrease for households

This simulation is effectuated through a 1 percent of GDP, one period downward adjustment in the residuals for the equation determining the growth rate of direct taxes for households (see Table 35). This represents an external shock to an otherwise endogenous process.

The direct effect of this shock is to raise households' real disposable income, which is ex-post on average 2,0% higher than in the baseline simulation. This in turn boosts private consumption, which is 2,0% above its baseline value after two years in Germany, 1,3% in the UK and 1,7% in the US. In France, the maximum effect is only reached after 4 years, where private consumption is 2,3% higher than in the base case.

The wage rate equations do not allow for a repercussion of tax effects on wage claims, which implies that the tax cut will not have an effect on wage costs. On the other hand, the strong consumption demand results in investment increases, but also in higher import demand and more rapid inflation rates. Together with the higher wage rates this leads to a general rise of production costs and finally in a decrease in exports. The situation of the real foreign balance therefore deteriorates in all four countries and especially in France, where the more buoyant consumption demand leads to an import demand which is 3,3% higher than its baseline level after 3 years, compared with an average for the four countries of 2,3%.

The loss in government receipts resulting from the direct tax cut is partly compensated by higher indirect tax receipts following the increased private consumption and by higher social security receipts following the general increase in the wage bill. Since however government expenditure increases, mainly due to higher debt payments and to higher government consumption following the price and wage increases, the overall government financial balance deteriorates considerably.

A comparison of the effects of a direct tax decrease for households to a decrease of the social security contributions by firms, both by 1% of GDP, shows that the positive impact on GDP is higher for all countries in the

Table 36: NON-LINKED QUEST SIMULATION: DEPRECIATION OF THE NATIONAL CURRENCY BY 10%

		GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....:	YEAR 1	3.36	2.03	1.32	1.07	1.94
.....	2	3.47	3.65	1.32	1.02	2.37
.....	3	1.45	3.38	0.76	0.49	1.52
.....	4	1.77	1.80	0.30	0.25	1.03
.....	5	1.65	0.17	-0.21	0.18	0.45
PRIVATE CONSUMPTION .:	YEAR 1	0.13	-0.02	-0.71	0.12	-0.12
REAL	2	0.42	0.78	-0.92	-0.06	0.05
.....	3	-0.73	1.17	-1.05	-0.42	-0.26
.....	4	-0.70	0.52	-1.14	-0.60	-0.48
.....	5	-0.56	-0.58	-1.11	-0.59	-0.71
TOTAL PRIVATE .....:	YEAR 1	2.46	1.61	0.63	1.27	1.49
INVESTMENT.....	2	4.37	7.80	1.54	1.14	3.71
.....	3	-1.49	8.17	0.93	-0.07	1.88
.....	4	-1.71	3.84	0.55	-0.54	0.53
.....	5	-0.55	-0.71	-0.03	-0.50	-0.45
STOCKBUILDING .....:	YEAR 1	0.61	0.38	0.19	0.11	0.32
(%BASELINE GDP).....	2	0.18	0.73	0.18	0.07	0.29
.....	3	-0.74	0.43	0.12	-0.12	-0.08
.....	4	-0.01	-0.14	0.13	-0.10	-0.03
.....	5	0.09	-0.51	-0.07	-0.06	-0.14
REAL FOREIGN BALANCE :	YEAR 1	2.24	1.35	1.43	0.70	1.43
(%BASELINE GDP).....	2	2.27	0.99	1.42	0.82	1.37
.....	3	2.88	0.68	1.11	0.88	1.39
.....	4	2.51	0.88	0.76	0.82	1.24
.....	5	1.98	1.18	0.53	0.68	1.09
PRIVATE CONSUMPTION .:	YEAR 1	1.60	1.56	1.69	0.55	1.35
DEFLATOR	2	3.87	3.83	3.94	1.64	3.32
.....	3	3.97	5.26	5.95	2.72	4.48
.....	4	4.59	6.43	7.63	3.87	5.63
.....	5	5.48	7.22	8.89	5.01	6.65
GDP/GNP DEFLATOR ....:	YEAR 1	0.21	0.05	-0.30	0.21	0.04
.....	2	2.90	2.82	2.69	1.42	2.45
.....	3	2.89	4.53	5.14	2.66	3.81
.....	4	3.73	5.92	7.26	3.96	5.22
.....	5	4.94	6.96	8.79	5.15	6.46
NOMINAL WAGE RATE ...:	YEAR 1	2.26	0.70	0.86	0.54	1.09
.....	2	5.08	3.52	3.13	1.57	3.33
.....	3	4.79	5.65	5.47	2.88	4.70
.....	4	6.72	7.60	7.47	4.26	6.51
.....	5	8.41	9.06	9.02	5.53	8.00
TOTAL EMPLOYMENT ....:	YEAR 1	0.64	0.22	0.23	0.43	0.38
.....	2	1.97	0.99	0.62	0.68	1.07
.....	3	1.56	1.64	0.63	0.44	1.07
.....	4	0.90	1.66	0.40	0.18	0.79
.....	5	0.67	1.09	0.10	0.06	0.48
UNEMPLOYMENT RATE ...:	YEAR 1	-0.62	-0.21	-0.22	-0.40	-0.36
(LEVEL DEVIATION).....	2	-1.90	-0.94	-0.59	-0.64	-1.02
.....	3	-1.51	-1.54	-0.60	-0.42	-1.02
.....	4	-0.87	-1.56	-0.38	-0.17	-0.74
.....	5	-0.64	-1.01	-0.09	-0.06	-0.45
SHORT-TERM INTEREST .:	YEAR 1	1.76	0.73	0.45	0.83	0.94
RATE	2	4.44	0.72	0.11	1.54	1.70
(LEVEL DEVIATION).....	3	2.54	0.85	-0.04	1.50	1.21
.....	4	1.99	0.66	-0.09	1.72	1.07
.....	5	2.50	0.31	-0.21	1.95	1.14
GOVERNMENT FINANCIAL :	YEAR 1	0.98	0.44	0.10	0.36	0.47
BALANCE.....	2	1.80	1.47	0.20	0.46	0.98
(%BASELINE GDP).....	3	0.99	2.04	0.34	0.30	0.92
.....	4	1.12	1.96	0.24	0.14	0.86
.....	5	1.26	1.39	0.17	0.15	0.74
CURRENT BALANCE .....:	YEAR 1	0.82	-0.04	-0.48	0.34	0.16
(%BASELINE GDP).....	2	1.43	0.12	0.46	0.56	0.64
.....	3	1.87	-0.00	0.58	0.78	0.81
.....	4	1.55	0.28	0.71	0.85	0.85
.....	5	1.33	0.88	0.89	0.74	0.96

DATE: 21.12.88
UNLESS INDICATED OTHERWISE, ALL VARIABLES ARE EXPRESSED IN PERCENTAGE DIFFERENCE WRT BASELINE SIMULATION

latter case. The direct effect of a reduction of labour costs is repercussed to all categories of final demand, whereas in the tax reduction simulation it is only domestic demand which is positively affected, while the real foreign balance deteriorates.

The government balance is less affected in the social security shock than in the tax shock, which can also be attributed to the more buoyant domestic production in the former case.

4.2.6 Currency depreciation

This shock is simulated through a sustained 10% decrease of the exogenous exchange rate (see Table 36). As is discussed in section 4.3, the analysis of exchange rate changes on a single country basis is limited since it ignores international feedbacks which are often crucial to the results for GDP, prices and the current account. The relevance of the results which are presented in this subsection lies therefore mainly in their comparison with the linked simulation of section 4.3.3.

The depreciation has an immediate impact on import prices, which are from the first year on some 9 to 10% higher than in the baseline simulation, and this in all countries. Export prices increase more gradually; the lowest increase is found in the US where it amounts to 6,2% after five years, whereas competitivity gains are almost completely eroded after five years in France.

As a result of the high speed of adjustment, J-curve effects are absent in the US and very limited in the other countries: the currency depreciation has a negative impact on the current balance only for the first quarter of the simulation period in the German and French models and for the first three quarters in the UK model.

The high real foreign balance multiplier in the German model - 2,4% on average over five years as compared to 0,9% on average for the other countries - can be attributed to the very high import price elasticity of the German model, which results in strong import substitution effects.

The competitiveness gains are reflected in lower imports and higher exports. This in turn stimulates domestic demand in the short run. Increasing import costs are further reflected in higher domestic nominal wage and price levels. With wages lagging behind consumer prices, real wages will however be lower than in the baseline simulation in the beginning of the period in the UK and US models. This negative effect on demand causes private investment to increase only slightly in the UK model, whereas it increases up to 8,2% in the French model. In the German and US models, the investment response becomes negative after two years, due to the lower profitability.

Finally, the average effect of a currency depreciation on GDP is positive in all four models. It reaches a maximum in the second year of the shock in Germany and France, and already in the first year in the UK and the US. The following decrease of the GDP-response reflects the erosion of competitiveness gains, a lower consumption demand as a result of real wage decreases and a lower investment demand, both as a result of lower profitability and lower domestic demand.

Table 37: QUEST simulation: government investment increase by 1% of baseline GDP, standard monetary policy; comparison of linked and unlinked simulations

	Year	Germany S	Germany L	France S	France L	United Kingdom S	United Kingdom L	United States S	United States L
Real GDP/GNP	1	1.20	1.26	1.35	1.39	1.02	1.04	1.75	1.81
	2	0.96	1.13	1.83	1.98	1.07	1.11	1.46	1.63
	3	0.51	0.63	1.60	1.81	0.64	0.68	0.22	0.37
	4	0.48	0.55	1.01	1.20	0.34	0.37	-0.00	0.09
	5	0.36	0.46	0.35	0.43	0.28	0.28	0.28	0.38
Total real exports	1	-0.09	0.11	0.04	0.21	-0.01	0.05	-0.19	0.22
	2	-0.48	-0.06	-0.25	0.16	-0.22	-0.07	-0.92	0.04
	3	-0.59	-0.18	-0.76	-0.30	-0.64	-0.47	-1.92	-0.87
	4	-0.75	-0.35	-1.05	-0.65	-1.12	-0.98	-2.77	-1.69
	5	-1.02	-0.61	-1.44	-1.22	-1.51	-1.42	-3.62	-2.29
Real foreign balance (% baseline GDP)	1	-0.63	-0.60	-0.60	-0.58	-0.44	-0.43	-0.27	-0.24
	2	-0.75	-0.68	-0.94	-0.91	-0.61	-0.59	-0.39	-0.32
	3	-0.64	-0.55	-1.09	-1.06	-0.63	-0.60	-0.38	-0.28
	4	-0.77	-0.65	-1.00	-0.97	-0.67	-0.64	-0.52	-0.40
	5	-0.91	-0.78	-0.91	-0.87	-0.80	-0.77	-0.74	-0.59
GDP/GNP deflator	1	0.34	0.36	0.25	0.25	0.09	0.09	0.47	0.48
	2	0.73	0.81	0.90	0.92	0.69	0.70	1.73	1.82
	3	0.78	0.89	1.67	1.77	1.49	1.54	3.05	3.29
	4	1.06	1.18	2.30	2.51	2.17	2.27	4.16	4.59
	5	1.32	1.49	2.71	3.01	2.71	2.86	5.22	5.87
Government financial balance (% baseline GDP)	1	-0.47	-0.44	-0.61	-0.60	-0.73	-0.72	-0.38	-0.36
	2	-0.40	-0.32	-0.29	-0.23	-0.64	-0.63	-0.45	-0.37
	3	-0.65	-0.58	-0.19	-0.09	-0.81	-0.79	-1.11	-1.03
	4	-0.75	-0.70	-0.37	-0.24	-1.05	-1.04	-1.54	-1.49
	5	-0.84	-0.77	-0.84	-0.73	-1.21	-1.21	-1.59	-1.54

Unless otherwise indicated, all variables are expressed in percentage difference with respect to baseline simulation
S = single country mode (unlinked)
L = linked simulation

4.3 The effects of linkage

The linkage module of the QUEST model permits a study of the feedback effects of an individual country's actions, or to analyse the impact of shocks or policies which cross national boundaries. Obviously, the present structure of the model, which contains structural models for four countries and trade-feedback models for the 21 remaining countries or zones, implies the presence of asymmetries in the system. The essentially reduced form-type trade-feedback models will not react in the same way to shocks as the complete country models. Furthermore, except for the influence of US interest rates, international transmission takes place through the volume and price effects of traded goods alone, thus excluding trade in services or capital flows. Keeping these limitations in mind, the introduction of linkage may nevertheless serve to illustrate some features which would otherwise be difficult to capture with national models alone. This section desribes the simulation results of three types of simulations illustrating such features. The first set of simulations concerns the feedback effects of a government expenditure shock, and includes a simulation of concerted action for comparison with individual country shocks. A second simulation looks at the consequences of an oil-price shock. This case is interesting given the presence of a structural model for the United Kingdom as an energy producer and the fact that energy is treated explicitly in the model, albeit in an ad-hoc fashion. The third set of simulations looks at the effects of a currency depreciation, in this case, the US dollar. Here again, the distinction between linked and non-linked simulation is crucial.

4.3.1 Government investment increase and concerted action

The simplest way to trace the effects of linkage is by comparing the simulation results for a government investment shock in linked mode to those in unlinked mode. This comparison is presented in Table 37, while Tables 38 and 39 give the cross-country multipliers for these single country fiscal shocks. The linkage implies that part of the import leakage which takes place if there is an increase in demand is returned in the form of higher exports through an increase in foreign demand. As Table 38 shows, the effects on foreign GDP may reach a quarter of a percentage point in some cases. The negative contribution of the real foreign balance to GDP caused by the import leakage will thus be attenuated. This will contribute positively to the effect on GDP and, indirectly, on the government financial balance. The extent of the attenuation depends mainly on the elasticity of imports with respect to final demand: the larger this elasticity, the larger will be the positive impact of the linkage, ceteris paribus. The relationship between the size of the final demand elasticity of imports and the relative size of the effects from linkage on the real foreign balance is crucial in explaining the simulation results presented here. The fact that the final demand variable in the equation for imports of non-energy goods has been corrected for trade integration effects has lowered the corresponding elasticity considerably (cf. ITALIANER (1987)). Consequently, the effect from linkage has been attenuated a priori. The interpretation

Table 38: Linked QUEST simulation: government investment increase by 1% of baseline GNP, standard monetary policy; cross multipliers for the structural models
(% difference from baseline)

Effect on:		Country taking action: Germany			France			United Kingdom			United States		
	Year	XTQ	YQ	PY	XTQ	YQ	PY	XTQ	YQ	PY	XTQ	YQ	PY
Germany	1	0.11	1.26	0.36	0.43	0.14	0.04	0.17	0.06	0.02	0.36	0.05	0.01
	2	-0.06	1.13	0.81	0.77	0.27	0.14	0.30	0.11	0.06	0.84	-0.00	0.01
	3	-0.18	0.63	0.89	0.85	0.24	0.20	0.33	0.10	0.08	0.94	-0.01	-0.02
	4	-0.35	0.55	1.18	0.71	0.13	0.23	0.30	0.07	0.10	1.02	0.09	0.03
	5	-0.61	0.46	1.49	0.47	0.04	0.27	0.28	0.07	0.13	1.35	0.17	0.11
France	1	0.52	0.15	-0.00	0.21	1.39	0.25	0.18	0.05	0.00	0.37	0.10	-0.00
	2	0.73	0.28	0.09	0.16	1.98	0.92	0.33	0.14	0.03	0.72	0.26	0.06
	3	0.55	0.20	0.22	-0.30	1.81	1.77	0.31	0.16	0.10	0.65	0.26	0.20
	4	0.52	0.09	0.31	-0.65	1.20	2.51	0.24	0.13	0.18	0.69	0.21	0.34
	5	0.50	0.02	0.38	-1.22	0.43	3.01	0.18	0.06	0.24	0.94	0.21	0.50
United Kingdom	1	0.23	0.06	0.01	0.21	0.06	0.01	0.05	1.04	0.09	0.35	0.09	0.01
	2	0.38	0.11	0.06	0.44	0.13	0.05	-0.07	1.11	0.70	0.71	0.17	0.09
	3	0.35	0.08	0.16	0.45	0.12	0.15	-0.47	0.68	1.54	0.69	0.10	0.22
	4	0.31	0.06	0.26	0.35	0.07	0.27	-0.98	0.37	2.27	0.65	-0.01	0.39
	5	0.27	0.03	0.35	0.15	-0.01	0.37	-1.42	0.28	2.86	0.85	0.00	0.56
United States	1	0.20	0.03	0.01	0.15	0.02	0.01	0.13	0.02	0.01	0.22	1.81	0.48
	2	0.35	0.06	0.04	0.34	0.06	0.03	0.24	0.04	0.03	0.04	1.63	1.82
	3	0.34	0.04	0.10	0.43	0.07	0.09	0.28	0.04	0.07	-0.87	0.37	3.29
	4	0.35	0.03	0.16	0.41	0.03	0.16	0.25	0.02	0.11	-1.69	0.09	4.59
	5	0.35	0.02	0.22	0.29	-0.02	0.22	0.24	0.00	0.16	-2.29	0.38	5.87

XTQ = real exports of goods and services
YQ = real GDP/GNP
PY = GDP/GNP deflator

Table 39: Linked QUEST simulation: government investment increase by 1% of baseline GNP, standard monetary policy, cross trade multipliers

(% difference from baseline)

Effect on:		Country taking action: Germany			France			United Kingdom			United States		
	Year	XMSQ	MMSQ	PXMS	XMSQ	MMSQ	PXMS	XMSQ	MMSQ	PXMS	XMSQ	MMSQ	PXMS
EC	1	0.41	0.85	0.13	0.40	0.71	0.04	0.17	0.39	0.04	0.39	0.13	0.03
	2	0.51	1.02	0.30	0.72	1.17	0.19	0.27	0.58	0.14	0.77	0.23	0.16
	3	0.38	0.73	0.36	0.68	1.12	0.36	0.19	0.46	0.26	0.68	0.08	0.32
	4	0.31	0.71	0.46	0.42	0.80	0.50	0.03	0.29	0.37	0.62	-0.04	0.49
	5	0.22	0.71	0.59	0.10	0.42	0.60	-0.08	0.22	0.46	0.89	0.02	0.64
OECD excl. EC	1	0.26	0.08	0.02	0.18	0.06	0.01	0.17	0.06	0.00	0.72	2.02	0.19
	2	0.40	0.14	0.10	0.38	0.14	0.05	0.30	0.10	0.04	1.04	2.54	0.68
	3	0.37	0.13	0.14	0.45	0.17	0.12	0.30	0.09	0.09	0.42	1.55	1.22
	4	0.39	0.13	0.18	0.41	0.14	0.18	0.25	0.05	0.15	0.04	1.52	1.70
	5	0.39	0.12	0.23	0.27	0.05	0.23	0.22	0.01	0.19	0.21	2.33	2.12
OECD	1	0.35	0.49	0.08	0.31	0.41	0.02	0.17	0.23	0.02	0.53	1.02	0.11
	2	0.46	0.61	0.21	0.57	0.69	0.12	0.28	0.36	0.09	0.89	1.31	0.40
	3	0.38	0.45	0.27	0.58	0.68	0.26	0.24	0.29	0.19	0.57	0.75	0.71
	4	0.34	0.45	0.23	0.42	0.51	0.36	0.13	0.19	0.27	0.36	0.66	1.03
	5	0.29	0.44	0.42	0.18	0.25	0.43	0.06	0.13	0.34	0.59	1.08	1.32
OPEC	1	0.23	0.04	0.00	0.31	0.06	0.00	0.12	0.02	0.00	0.84	0.14	0.00
	2	0.35	0.11	0.00	0.59	0.21	0.00	0.23	0.07	0.00	1.21	0.48	0.00
	3	0.32	0.13	0.00	0.63	0.33	0.00	0.22	0.09	0.00	0.88	0.51	0.00
	4	0.31	0.11	0.00	0.58	0.34	0.00	0.19	0.05	0.00	0.81	0.29	0.00
	5	0.32	0.07	0.00	0.40	0.25	0.00	0.17	-0.01	0.00	1.15	0.16	0.00
NICs	1	0.27	0.09	0.05	0.18	0.06	0.01	0.16	0.05	0.01	0.88	0.26	0.10
	2	0.39	0.21	0.14	0.37	0.18	0.08	0.25	0.13	0.07	1.44	0.74	0.40
	3	0.35	0.27	0.19	0.43	0.28	0.16	0.23	0.18	0.14	1.00	0.90	0.76
	4	0.35	0.32	0.22	0.37	0.33	0.22	0.19	0.20	0.20	0.82	0.93	1.09
	5	0.34	0.35	0.28	0.24	0.32	0.28	0.16	0.20	0.26	1.22	1.10	1.33
CPEs	1	0.27	0.09	0.02	0.16	0.05	0.00	0.09	0.03	0.00	0.25	0.07	0.01
	2	0.44	0.23	0.07	0.35	0.17	0.03	0.20	0.09	0.02	0.55	0.26	0.08
	3	0.45	0.27	0.09	0.45	0.25	0.07	0.22	0.13	0.05	0.65	0.37	0.18
	4	0.47	0.29	0.11	0.45	0.28	0.10	0.21	0.13	0.07	0.72	0.42	0.26
	5	0.49	0.30	0.14	0.35	0.25	0.13	0.20	0.13	0.09	1.00	0.53	0.33
Other developing countries	1	0.26	0.22	0.02	0.25	0.23	0.01	0.16	0.10	0.01	0.81	0.81	0.04
	2	0.42	0.34	0.08	0.47	0.41	0.05	0.25	0.18	0.06	1.43	1.25	0.19
	3	0.39	0.30	0.10	0.54	0.44	0.11	0.25	0.19	0.11	1.31	0.99	0.37
	4	0.41	0.30	0.12	0.47	0.32	0.16	0.21	0.17	0.16	1.33	0.83	0.56
	5	0.42	0.28	0.16	0.34	0.17	0.20	0.18	0.16	0.20	1.73	1.14	0.71
World	1	0.31	0.38	0.06	0.28	0.31	0.01	0.15	0.18	0.02	0.61	0.81	0.06
	2	0.43	0.49	0.17	0.54	0.55	0.09	0.26	0.29	0.08	0.99	1.12	0.29
	3	0.37	0.39	0.20	0.57	0.58	0.19	0.23	0.25	0.14	0.71	0.75	0.54
	4	0.35	0.39	0.24	0.44	0.45	0.26	0.16	0.17	0.20	0.56	0.65	0.79
	5	0.32	0.38	0.31	0.24	0.25	0.32	0.10	0.12	0.25	0.83	0.97	1.03

XMSQ = real exports of goods
MMSQ = real imports of goods
PXMS = deflator of exports of goods ($)

Table 40: QUEST simulation: government investment increase by 1% of baseline GDP, standard monetary policy; comparison of single country action with concerted action

(Simple means of effects on Germany, France, the UK and the US)

	Year	Single country action Unlinked (1)	Single country action Linked (2)	Concerted action Linked (3)
Real GDP/GNP	1	1.33	1.38	1.58
	2	1.33	1.46	1.85
	3	0.74	0.87	1.19
	4	0.46	0.55	0.76
	5	0.32	0.39	0.55
Total real exports	1	-0.06	0.15	0.99
	2	-0.47	0.02	1.55
	3	-0.98	-0.46	1.06
	4	-1.42	-0.92	0.51
	5	-1.90	-1.39	0.06
Real foreign balance (% baseline GDP)	1	-0.48	-0.46	-0.35
	2	-0.67	-0.63	-0.39
	3	-0.68	-0.62	-0.32
	4	-0.74	-0.67	-0.28
	5	-0.84	-0.75	-0.30
GDP/GNP deflator	1	0.29	0.30	0.32
	2	1.01	1.06	1.23
	3	1.75	1.87	2.25
	4	2.42	2.64	3.26
	5	2.99	3.31	4.18
Government financial balance (% baseline GDP)	1	-0.55	-0.53	-0.45
	2	-0.44	-0.39	-0.23
	3	-0.69	-0.62	-0.46
	4	-0.93	-0.87	-0.75
	5	-1.12	-1.06	-0.98

Unless otherwise indicated, all variables are expressed in percentage differences with respect to baseline simulation.

of this phenomenon is simple: given the smaller import leakage, part of the effect from linkage is already present in the unlinked simulation. Still, the effects from trade feedback on total exports are considerable. According to Table 37, introducing the linkage adds between 0,1 and 1,3 percentage points to the effect on total exports after 5 years. As seen in Tables 38 and 39, spillover effects on exports of other countries sometimes surpass one percentage point. The lower figure corresponds to the United Kingdom, and may be explained by the fact that for this country the impact of the shock on final demand, and thus on imports, is the smallest of all four countries considered. Despite a relatively high demand elasticity for imports of non-energy goods, the consequences of linkage for total exports therefore remain small for the United Kingdom.

Import leakages reduce the efficiency of single country actions. If several countries give a fiscal policy shock simultaneously, this should therefore enhance the effects on growth through a smaller deterioration of the real foreign balance. Table 40 presents the example of a concerted action by Germany, France, the United Kingdom and the United States in the form of a similar increase, by 1% of baseline GDP, of government investment. A comparison of the simple means of the effects on GDP/GNP per country reveals that, in the medium run, these effects are more than 40% higher in the case of concerted action. To a minor extent, this is also reflected in the government financial balance. The spillover effects from international trade reduce the negative contribution of the real foreign balance by almost 50% in the medium run. On the other hand, the price linkages will reinforce the effects on inflation. After 5 years, the price level is on average 25% higher in the case of concerted action compared to the single country action case. Although there is thus a trade-off between the effects on output and inflation when there is a concerted action, the relatively smaller effect on inflation suggests that the balance remains in favour of output.

4.3.2 Oil price decrease

The effects of an oil price decrease differ by country, depending on whether the country is identified in the model as a primary energy producer or not. If it is not, the oil price decrease lowers energy import prices and therefore augments energy import volumes through a relative price effect. To the extent that lower energy import prices work through in domestic prices, this effect should be attenuated somewhat in the medium run. On the other hand, the corresponding increase in terms of trade improves real spending power and increases profits, thus exerting positive effects on private consumption and investment. In the medium run, accelerator effects will disappear, so the increase in GDP will be reduced. In the trade-feedback models, lower energy prices work through in import volumes via an improvement in the terms of trade. When export prices are aligned to the changes in import prices, this terms of trade effect will be softened somewhat. For an oil producer such as the United Kingdom, in the case of the QUEST model, the terms of trade will be worse off compared to the non-oil producing countries. This may be expected to have a less positive effect on domestic demand, and to worsen the external balance. Looking at the simulation results of a decrease in world oil prices by 10%, as presented in Table 41, the effects described above do appear indeed.

Table 41: LINKED QUEST SIMULATION: DECREASE IN WORLD OIL PRICES BY 10%

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	0.42	0.40	0.17	0.23	0.30
..... 2	0.23	0.44	-0.00	0.18	0.21
..... 3	0.18	0.35	-0.10	0.01	0.11
..... 4	0.19	0.27	-0.09	0.14	0.13
..... 5	0.04	0.10	-0.09	0.10	0.04
PRIVATE CONSUMPTION .: YEAR 1	0.32	0.18	0.17	0.17	0.21
REAL 2	0.46	0.39	0.24	0.20	0.32
..... 3	0.38	0.36	0.15	0.08	0.24
..... 4	0.41	0.31	0.10	0.16	0.24
..... 5	0.34	0.24	0.04	0.14	0.19
TOTAL PRIVATE .....: YEAR 1	0.93	0.77	0.41	0.44	0.64
INVESTMENT..... 2	0.35	1.05	0.45	0.32	0.54
..... 3	-0.05	1.22	-0.15	-0.13	0.22
..... 4	0.01	1.05	-0.32	0.31	0.26
..... 5	-0.38	0.51	-0.37	0.29	0.01
STOCKBUILDING .....: YEAR 1	0.04	0.09	0.03	0.02	0.05
(%BASELINE GDP)..... 2	-0.00	0.09	0.00	0.02	0.03
..... 3	0.01	0.03	-0.04	-0.02	-0.01
..... 4	0.02	-0.01	-0.04	0.01	-0.01
..... 5	-0.04	-0.05	-0.02	-0.00	-0.03
REAL FOREIGN BALANCE : YEAR 1	0.03	0.05	-0.03	0.03	0.02
(%BASELINE GDP)..... 2	-0.09	-0.09	-0.21	-0.02	-0.11
..... 3	-0.03	-0.13	-0.13	-0.00	-0.07
..... 4	-0.06	-0.12	-0.06	-0.01	-0.06
..... 5	-0.04	-0.10	-0.04	-0.04	-0.05
PRIVATE CONSUMPTION .: YEAR 1	-0.13	-0.22	-0.19	-0.06	-0.15
DEFLATOR 2	-0.35	-0.36	-0.42	-0.00	-0.29
..... 3	-0.43	-0.24	-0.60	0.10	-0.29
..... 4	-0.42	-0.19	-0.76	0.16	-0.30
..... 5	-0.43	-0.18	-0.86	0.30	-0.29
GDP/GNP DEFLATOR ....: YEAR 1	0.15	0.02	0.03	0.12	0.08
..... 2	-0.05	-0.15	-0.25	0.13	-0.08
..... 3	-0.07	0.03	-0.51	0.26	-0.07
..... 4	0.04	0.17	-0.77	0.34	-0.05
..... 5	0.07	0.22	-0.99	0.48	-0.06
NOMINAL WAGE RATE ...: YEAR 1	0.31	-0.08	-0.08	0.09	0.06
..... 2	0.01	-0.21	-0.29	0.21	-0.07
..... 3	0.04	0.02	-0.48	0.29	-0.04
..... 4	0.21	0.19	-0.66	0.42	0.04
..... 5	0.21	0.30	-0.80	0.57	0.07
TOTAL EMPLOYMENT ....: YEAR 1	0.10	0.05	0.04	0.11	0.07
..... 2	0.19	0.17	0.06	0.14	0.14
..... 3	0.14	0.22	0.00	0.02	0.10
..... 4	0.12	0.22	-0.04	0.06	0.09
..... 5	0.07	0.18	-0.05	0.06	0.07
UNEMPLOYMENT RATE ...: YEAR 1	-0.10	-0.05	-0.04	-0.10	-0.07
(LEVEL DEVIATION)..... 2	-0.18	-0.16	-0.06	-0.13	-0.13
..... 3	-0.13	-0.21	-0.00	-0.02	-0.09
..... 4	-0.12	-0.21	0.03	-0.05	-0.09
..... 5	-0.07	-0.17	0.05	-0.06	-0.06
SHORT-TERM INTEREST .: YEAR 1	0.15	-0.09	-0.11	0.04	-0.00
RATE 2	0.07	-0.03	0.03	0.06	0.03
(LEVEL DEVIATION)..... 3	0.07	-0.04	0.06	0.08	0.04
..... 4	0.22	-0.01	0.14	0.15	0.13
..... 5	0.21	-0.04	0.30	0.20	0.17
GOVERNMENT FINANCIAL : YEAR 1	0.25	0.20	0.12	0.13	0.17
BALANCE..... 2	0.23	0.29	0.10	0.12	0.18
(%BASELINE GDP)..... 3	0.22	0.33	-0.01	0.05	0.15
..... 4	0.26	0.38	-0.06	0.10	0.17
..... 5	0.22	0.39	-0.14	0.11	0.14
CURRENT BALANCE .....: YEAR 1	0.28	0.29	0.20	0.18	0.24
(%BASELINE GDP)..... 2	0.16	0.11	-0.08	0.08	0.07
..... 3	0.27	0.12	-0.07	0.13	0.11
..... 4	0.32	0.22	-0.13	0.13	0.14
..... 5	0.36	0.28	-0.29	0.10	0.11

DATE: 5.12.88
UNLESS INDICATED OTHERWISE, ALL VARIABLES ARE EXPRESSED IN PERCENTAGE DIFFERENCE WRT BASELINE SIMULATION

Germany, France and the United States, which are considered to be non-oil producing countries in the QUEST model, increase their domestic demand due to the terms of trade increase. The effects on private consumption are stronger in the former two countries than in the United States due to the fact that for them terms-of-trade gains are partially reflected in real wage increases, thus having a stronger effect on real disposable income. Since the effect on private consumption is rather stable, the accelerator effect from the private consumption increase on investment peters out after a few years, thus causing a slowdown in the GDP increase. The positive effects on domestic demand are counteracted by a slightly negative contribution from the real foreign balance. This may be explained by the fact that the energy price decrease causes some substitution of domestic production factors by energy imports through a relative price effect on the volume of the latter. Notwithstanding the negative contribution of the real foreign balance, the current balance improves for Germany, France and the United States due to the more than offsetting improvement in the terms of trade. In the United Kingdom, the effects signalled for the other coutries appear as well, since the lower energy price increases apparent energy consumption which, with energy production and exports being exogenous, leads to an increase in energy imports. Since energy demand in the United Kingdom is more sensitive to price changes than in the other countries, the short-run affect on the real foreign balance is more negative due to higher additional energy imports. In the medium-term this is attenuated since the relative price decrease of energy becomes smaller as domestic prices are influenced by the disinflationary process. The deterioration of the terms of trade (which is not passed on into wages) erodes the profit rate, thus depressing investment and GDP. This effect, as well as a negative change for the current balance, occurs in the medium run only since the deterioration of the terms of trade due to the energy export price decrease is baseline dependent due to the relatively small share of energy in total exports in the beginning of the simulation period, which started in 1977. In the present situation, the seemingly positive effects in the short run would probably not take place.

4.3.3 Dollar devaluation

The dollar devaluation has been simulated in linked mode in the model by increasing dollar/foreign currency rates by 10% for all non-US countries and zones. For those countries or zones which are identified as oil exporters in the model, the fact that the oil price is kept exogenous in nominal dollar terms implies that they will devalue with the US dollar proportionally with the share of energy in their export basket. The OPEC, for instance, which is assumed to export oil exclusively, will thus completely follow the dollar devaluation. For the other countries an effective revaluation takes place, although the parities between them remain unchanged. Compared to the results for the dollar depreciation in unlinked mode, the main effect of linkage is that non-US countries and zones will, when faced with an effective revaluation of their currencies, adjust their export prices in local currency to make up for their loss of competitiveness. The competitive advantage of the United States will thus be reduced, and the positive contribution from the increase in its real foreign balance will be smaller. Comparing the results for the United States in linked and unlinked mode in Tables 36 and 42, it appears that the real foreign balance effect in the former case is about two-thirds of that

Table 42: LINKED QUEST SIMULATION: 10% DEPRECIATION OF THE US DOLLAR WITH RESPECT TO ALL CURRENCIES

	GERMANY	FRANCE	UK	USA	SIMPLE MEAN
REAL GDP/GNP .....: YEAR 1	-1.36	-0.93	-1.09	0.50	-0.72
..... 2	-1.29	-1.35	-1.14	0.49	-0.83
..... 3	-0.67	-1.16	-0.58	0.30	-0.52
..... 4	-0.53	-0.62	-0.28	0.23	-0.30
..... 5	-0.54	-0.12	-0.11	0.17	-0.15
PRIVATE CONSUMPTION .: YEAR 1	-0.23	-0.14	0.01	-0.07	-0.10
REAL 2	-0.34	-0.40	-0.03	-0.21	-0.24
..... 3	0.00	-0.44	0.13	-0.34	-0.16
..... 4	0.19	-0.14	0.30	-0.41	-0.02
..... 5	0.19	0.24	0.26	-0.42	0.07
TOTAL PRIVATE .....: YEAR 1	-1.96	-1.30	-1.90	0.41	-1.19
INVESTMENT..... 2	-2.11	-2.82	-2.98	0.41	-1.87
..... 3	-0.56	-2.69	-1.15	0.01	-1.10
..... 4	0.02	-1.19	-0.53	-0.13	-0.46
..... 5	-0.56	0.16	-0.53	-0.17	-0.28
STOCKBUILDING .....: YEAR 1	-0.27	-0.21	-0.17	0.04	-0.15
(%BASELINE GDP)..... 2	-0.17	-0.27	-0.14	0.02	-0.14
..... 3	0.15	-0.13	-0.03	-0.06	-0.02
..... 4	0.03	0.06	-0.08	-0.04	-0.01
..... 5	-0.06	0.16	-0.06	-0.03	0.00
REAL FOREIGN BALANCE : YEAR 1	-0.61	-0.39	-0.65	0.44	-0.30
(%BASELINE GDP)..... 2	-0.55	-0.31	-0.52	0.53	-0.21
..... 3	-0.71	-0.25	-0.44	0.57	-0.21
..... 4	-0.67	-0.36	-0.29	0.55	-0.19
..... 5	-0.48	-0.47	-0.13	0.49	-0.15
PRIVATE CONSUMPTION .: YEAR 1	-0.51	-0.39	-0.54	0.39	-0.26
DEFLATOR 2	-1.27	-1.15	-1.50	1.02	-0.73
..... 3	-1.45	-1.70	-2.44	1.60	-1.00
..... 4	-1.67	-2.15	-3.21	2.26	-1.19
..... 5	-1.97	-2.45	-3.75	2.95	-1.31
GDP/GNP DEFLATOR ....: YEAR 1	-0.13	-0.01	0.01	0.03	-0.03
..... 2	-1.03	-0.85	-1.21	0.75	-0.58
..... 3	-1.14	-1.47	-2.39	1.41	-0.90
..... 4	-1.36	-1.94	-3.34	2.17	-1.12
..... 5	-1.74	-2.31	-4.06	2.88	-1.31
NOMINAL WAGE RATE ...: YEAR 1	-0.92	-0.18	-0.29	0.27	-0.28
..... 2	-1.81	-1.09	-1.24	0.80	-0.84
..... 3	-1.89	-1.88	-2.40	1.54	-1.16
..... 4	-2.38	-2.56	-3.39	2.35	-1.49
..... 5	-2.96	-3.06	-4.12	3.11	-1.76
TOTAL EMPLOYMENT ....: YEAR 1	-0.30	-0.12	-0.21	0.18	-0.11
..... 2	-0.73	-0.41	-0.56	0.31	-0.35
..... 3	-0.63	-0.62	-0.59	0.24	-0.40
..... 4	-0.35	-0.60	-0.40	0.14	-0.30
..... 5	-0.19	-0.40	-0.22	0.09	-0.18
UNEMPLOYMENT RATE ...: YEAR 1	0.29	0.12	0.20	-0.17	0.11
(LEVEL DEVIATION)..... 2	0.71	0.39	0.53	-0.29	0.34
..... 3	0.61	0.59	0.56	-0.23	0.38
..... 4	0.34	0.56	0.37	-0.13	0.28
..... 5	0.18	0.37	0.20	-0.08	0.17
SHORT-TERM INTEREST .: YEAR 1	-0.49	-0.18	0.31	0.49	0.03
RATE 2	-0.99	-0.55	0.77	0.92	0.04
(LEVEL DEVIATION)..... 3	-0.48	-0.36	0.98	0.85	0.25
..... 4	-0.07	0.01	1.15	1.01	0.53
..... 5	-0.02	0.20	1.35	1.18	0.68
GOVERNMENT FINANCIAL : YEAR 1	-0.46	-0.29	-0.32	0.12	-0.24
BALANCE..... 2	-0.70	-0.58	-0.48	0.17	-0.40
(%BASELINE GDP)..... 3	-0.49	-0.71	-0.45	0.13	-0.38
..... 4	-0.42	-0.65	-0.39	0.07	-0.35
..... 5	-0.47	-0.48	-0.45	0.07	-0.33
CURRENT BALANCE .....: YEAR 1	-0.21	-0.05	-0.17	0.09	-0.09
(%BASELINE GDP)..... 2	-0.32	-0.05	-0.34	0.26	-0.11
..... 3	-0.37	-0.02	-0.51	0.38	-0.13
..... 4	-0.28	-0.11	-0.57	0.43	-0.13
..... 5	-0.17	-0.27	-0.66	0.38	-0.18

DATE: 2.12.88
UNLESS INDICATED OTHERWISE, ALL VARIABLES ARE EXPRESSED IN PERCENTAGE DIFFERENCE WRT BASELINE SIMULATION

in the latter. An analysis of the quarterly results (not shown here) reveals that in the linked simulation the United States current balance turns negative in the first quarter only, which is no surpise given the short lags in the trade linkage model. While the increase in the real foreign balance and the current balance are significantly smaller in linked mode compared to unlinked mode, the medium term effect on GNP is virtually the same in the two cases. The compensation comes from domestic demand. Private consumption is more positive in linked mode since the price decreases of US trade partners upon the dollar devaluation diminish the effect on US inflation, thus reducing the negative real wealth effect on private consumption. The profile of private investment is highly contrasting between linked mode and unlinked mode. The stronger increase in the real foreign balance in unlinked mode produces an accelerator effect which renders private investment more buoyant in unlinked mode for the first two years. After the accelerator effects have died out, lower real interest rate increases and less negative accelerator effects from decreasing private consumption in linked mode cause the negative contribution from investment to GDP to be smaller than in unlinked mode.

An interesting aspect of the linked US dollar devaluation are its effects on the other countries in the system. Their currencies are all revalued effectively, although their parities remain unchanged between themselves. This effective revaluation will lead to some loss of competitiveness and thus loss of exports, which will be attenuated to the extent that exporters adjust their prices downwards in local currency in order to remain competitive. Next to this price effect, exports of non-US countries are influenced negatively as well by a decrease in the demand for their exports due to the import volume decrease in the United States. Given the relatively high share of the United States in world imports and the fact that, either directly or indirectly, the decrease in exports for countries outside the US has negative consequences for their imports, a negative spiral is started which leads to a decrease in world trade. In the countries with structural models, this negative spiral is reinforced by negative accelerator effects on investments, thus decreasing the level of GDP by more than 1% in the short run. In the medium term, when this accelerator effect has worked itself out and private consumption has recovered through real balance effects (Germany and the United Kingdom) or real disposable income (France), the negative effects on GDP gradually decline, although they do not disappear completely.

5. CONCLUSIONS AND SUBJECTS FOR FURTHER RESEARCH

The modelling strategy for the QUEST model renders it a quarterly medium-term world model right from the outset: structural models are present only for Germany, France, the United Kingdom and the United States at this stage, but a quantitative description of their positioning in the world economy is guaranteed through the trade linkage system among 25 trade partners. The structural models themselves contain many features of the Keynesian-(neo)classical synthesis that has developed over the last decade.

On the real demand side, the dynamic form of the private consumption function places it in the permanent income/life-cycle tradition, amended to include elements of uncertainty and opportunity costs in terms of savings and wealth. Stock formation is mainly influenced by two traditional motives: transactions demand and precautionary demand. Private investment is decomposed into investment in equipment, residential construction and non-residential construction (structures). Private residential construction depends mainly on GDP and financing constraints, while the illiquid nature of this asset makes it sensitive to inflationary expectations. Private investment in equipment and investment in non-residential construction both depend, either directly or indirectly, on three components: a putty-clay type accelerator mechanism, real interest rates as a proxy for the real user cost of capital and a profit share corrected for the degree of capacity utilisation. The correction for capacity utilisation may be considered as a disequilibrium factor, while the profit share captures at the same time possible self-financing constraints as well as aspects of demand uncertainty.

The capital stock of private equipment next forms the exogenous input in the cost minimisation process of the producer, which determines potential (or classical) output and employment. Disequilibrium on the goods market spills over to the labour market in the form of the degree of capacity utilisation which conditions the translation of potential employment into actual employment. This combination of demand constraints and the effect of real wages (via potential employment) makes employment dependent on both Keynesian and classical components, in the sense of disequilibrium theory.

Wages are determined by an expectations-augmented Phillips curve, in some countries amended to include productivity and/or terms-of-trade effects. Forward tax shifting is not included. Prices for domestic final demand components depend on a domestic producer price (value added deflator) and import costs. This holds also for export prices, but for them margins are influenced by competitors' prices as well. The domestic producer price is a variable mark-up on wage costs, the mark-up being dependent on the degree of capacity utilisation and temporary import price increases.

Condensed appropriation accounts for households, firms and the government allow to calculate sectoral balances and the balance on the current account. Featuring in the accounts are progressive income taxes for households and an explicit treatment of government debt.

The monetary sector is represented through equations for money demand and interest rates, which may be combined into different options for monetary policy.

International trade in goods among the 25 partners is modelled through a consistent import allocation system on the basis of relative prices, modified to deal correctly with the propagation of oil-price shocks. With import volumes and export prices from the structural country models or trade-feedback models as inputs, the trade linkage module endogenously calculates export volumes and import prices, which would otherwise be (partially) exogenous in the country models. In non-linked mode, the effects of price competitiveness on exports are consistent with the trade linkage system. For the structural models, import volumes depend on final demand, relative prices and a disequilibrium effect from the goods market through the degree of capacity utilisation.

The blueprint described above introduces a certain similarity in the simulation properties of the structural country models. The dynamics in the wage-price nexus, for instance, cause expansionary demand shocks, the effects of which are relatively strong in the short run, to be rather short-lived. Fairly fast cyclical reactions also show up when there is an improvement in international competitiveness: J-curves do hardly appear. On the other hand, supply shocks such as a decrease in social contributions of employers or an oil price shock take more time to build up but have a more durable character. These properties of the model seem to confirm a priori expectations on the dynamic pattern of responses of the economy to demand and supply shocks.

Nevertheless, differences in coefficient estimates and selectiveness with respect to the inclusion of explanatory variables leave room for country-specific model behaviour as well. The French model, for instance, is more expansionary following a demand shock than the other models, among others due to the fact that the consequent inflationary pressure exerts no negative effects on private consumption. The German model is the least inflation-prone due to the fact that prices take much longer to adjust to wages than vice versa. The converse is true for the United States. Coupled with strong inflationary effects on private consumption, there is a very strong cyclical reaction in the United States model to expansionary shocks, with multipliers often returning to zero after three to four years. The model for the United Kingdom, finally, is characterised by a relatively weak influence from the monetary sphere on the real sphere, due to small interest rate effects on domestic final expenditures.

Taken together, the above features of the QUEST model, through their equal emphasis on supply and demand, make the model a representative of the current mainstream of eclectic applied econometrics. Further research will therefore put emphasis on the extension of the existing blueprint to the other member countries, as well as on re-estimation of the existing models where data with a new baseyear have become available. This does not preclude further refinements, within the existing framework, of the structural country models.

Such refinements are probably the least urgent on the real demand side. Concerning the labour market, the endogenisation of the participation rate is envisaged. A reconsideration of the wage-price nexus, given the prevailing intercountry differences and its important effects on the dynamic behaviour of the model, might also represent a task ahead. Sectoral income equations could be refined further, e.g. by introducing institutional lags in equations concerning public sector tax receipts. Furthermore, given the multinational character of the QUEST model, an extended endogenisation of international linkages is foreseen, concentrating, in a first instance, on exchange rate determination consistent with the working of the exchange rate mechanism of the EMS. Preliminary research in this direction has already shown some encouraging results.

LIST OF REFERENCES

Catinat, M., R. Cawley, F. Ilzkovitz, A. Italianer and M. Mors: The Determinants of Investment, European Economy. N° 31, March 1987

Dramais, A.: COMPACT. A prototype macroeconomic model of the European Community in the World Economy, European Economy, N° 27, March 1986

Italianer, A.: Estimation and simulation of international trade linkages in the QUEST model, European Economy, N° 31, March 1987

Wymer, C.: Report on the Use of Macroeconomic Models in DG II, mimeo, 1982.

Appendix 1: List of countries and zones

Complete country models

1.	BL	Belgium-Luxembourg Economic Union (BLEU)
2.	DK	Denmark
3.	DE	Federal Republic of Germany
4.	GR	Greece
5.	SP	Spain
6.	FR	France
7.	IR	Ireland
8.	IT	Italy
9.	NL	Netherlands
10.	PO	Portugal
11.	UK	United Kingdom
12.	US	United States
14.	JA	Japan

Country trade-feedback models

13.	CA	Canada
15.	AU	Australia
16.	AT	Austria
17.	FI	Finland
18.	NO	Norway
19.	SE	Sweden
20.	SW	Switzerland

Zone trade-feedback models

21.	RO	Rest of OECD countries	: Iceland, New Zealand, Turkey
22.	OP	OPEC	: Algeria, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela
23.	CP	Centrally planned economies	: Albania, Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, Union of Soviet Socialist Republics
24.	NI	Newly industrialised countries	: Argentina, Brazil, Hong Kong, Israel, Republic of Korea, Philippines, Singapore, South Africa, Taiwan, Thailand, Yugoslavia
25.	RW	Rest of the world	: all countries not included elsewhere, incl. trade not specified in terms of destination

Note: Belgium and Luxembourg are treated as BL only in the trade linkage.

Appendix 2: List of variables

BPC	:	CURRENT BALANCE, BALANCE OF PAYMENTS BASED
BPC_NA	:	CURRENT BALANCE, NATIONAL ACCOUNTS BASED
BPT_NA	:	TRADE BALANCE, NATIONAL ACCOUNTS BASED
CEQ	:	REAL APPARENT DOMESTIC PETROLEUM CONSUMPTION
CG/EX.CG	:	NOMINAL GENERAL GOVERNMENT CONSUMPTION
CGQ/EX.CGQ	:	REAL GENERAL GOVERNMENT CONSUMPTION
CP	:	NOMINAL PRIVATE CONSUMPTION
CPQ	:	REAL PRIVATE CONSUMPTION
D***.***	:	DUMMY (FOR THE PERIOD INDICATED)
DEBT	:	GENERAL GOVERNMENT DEBT
DEFG	:	GENERAL GOVERNMENT DEFICIT
DELTA	:	DEPRECIATION RATE
DOLLAR	:	= 1 (AUXILIARY VARIABLE USED FOR SIMULATING A DEPRECIATION OF THE DOLLAR AGAINST ALL OTHER CURRENCIES IN LINKED MODE)
E.******	:	RESIDUAL FROM ESTIMATION (AFTER CORC CORRECTION)
EXCHR	:	= 1 (VARIABLE SYMBOLIZING THE EXCHANGE RATE IN THE TRADE-FEEDBACK COUNTRY MODULES)
EX.CNWGQ	:	REAL NON-WAGE GOVERNMENT CONSUMPTION
EX.EECU	:	EXCHANGE RATE LOCAL CURRENCY/ECU
EX.EXCHR	:	EXCHANGE RATE LOCAL CURRENCY/DOLLAR
EX.ICGQ	:	REAL GENERAL GOVERNMENT INVESTMENT IN CONSTRUCTION
EX.IEGQ	:	REAL GENERAL GOVERNMENT INVESTMENT IN EQUIPMENT
EX.L	:	TOTAL LABOUR FORCE
EX.LEEG	:	PUBLIC SECTOR EMPLOYMENT (INCL. ARMED FORCES)
EX.LSE	:	NUMBER OF SELF-EMPLOYED
EX.POPT	:	TOTAL POPULATION
EX.POPW	:	POPULATION IN WORKING AGE
EX.SCCR	:	AVERAGE EMPLOYER SOCIAL CONTRIBUTION RATE
EX.SCHR	:	AVERAGE EMPLOYEE SOCIAL CONTRIBUTION RATE
EX.SLRES	:	DIFFERENCE BETWEEN THE ACTUAL AND THE EQUILIBRIUM DM/DOLLAR EXCHANGE RATE
EX.SUBQ	:	SUBSIDIES AT CONSTANT PRICES
EX.TIR	:	INDIRECT TAX RATE
EX.TPX	:	NET UNREQUITED TRANSFERS PAID ABROAD,NAT. ACC. BASED
EX.TYCR	:	AVERAGE CORPORATE PROFIT TAX RATE
EX.VATR	:	PROXY FOR THE VAT RATE
EX.YEQ	:	REAL PETROLEUM AND GAS EXTRACTION
EX.YGR	:	PROFIT SHARE OF GOVERNMENT
EX.YWOR	:	AVERAGE OTHER LABOUR INCOME RATE
EX.YXMR	:	RATIO OF FACTOR INCOME PAID ABROAD TO TOTAL IMPORTS
EX.YXXR	:	RATIO OF FACTOR INCOME FROM ABROAD TO TOTAL EXPORTS
GOS	:	GROSS OPERATING SURPLUS
IEPQ	:	REAL PRIVATE FIXED INVESTMENT IN EQUIPMENT
IG/EX.IG	:	NOMINAL GENERAL GOVERNMENT FIXED INVESTMENT
IGQ/EX.IGQ	:	REAL GENERAL GOVERNMENT FIXED INVESTMENT
IHPQ	:	REAL PRIVATE FIXED INVESTMENT IN HOUSING
IIT	:	NOMINAL TOTAL INVESTMENT IN INVENTORIES
IITQ	:	REAL TOTAL INVESTMENT IN INVENTORIES
INTG	:	INTEREST PAYMENT ON PUBLIC DEBT
IPQ	:	REAL PRIVATE FIXED INVESTMENT
ISPQ	:	REAL PRIVATE FIXED INVESTMENT IN STRUCTURES
ITQ	:	REAL TOTAL FIXED INVESTMENT
KAPEQ	:	REAL GROSS STOCK OF PRIVATE EQUIPMENT
KAPIQ	:	REAL TOTAL STOCK OF INVENTORIES
LE	:	TOTAL EMPLOYMENT
LEE	:	TOTAL NUMBER OF EMPLOYEES
LEEP	:	NUMBER OF EMPLOYEES IN THE PRIVATE SECTOR
LEEPPOT	:	POTENTIAL EMPLOYMENT IN THE PRIVATE SECTOR
LU	:	UNEMPLOYMENT
LUR	:	UNEMPLOYMENT RATE
MEQ	:	REAL IMPORTS OF ENERGY
MESQ	:	REAL IMPORTS OF ENERGY IN DOLLARS
MM	:	NOMINAL IMPORTS OF GOODS
MMQ	:	REAL IMPORTS OF GOODS
MMS	:	NOMINAL IMPORTS OF GOODS IN DOLLARS - CIF - CUSTOMS DATA
MMSQ	:	REAL IMPORTS OF GOODS IN DOLLARS - CIF - CUSTOMS DATA
MMSZQ	:	QUASI-FOB REAL IMPORTS (SUM OF AN APPROXIMATION OF REAL BILATERAL IMPORTS IN DOLLARS) - CUSTOMS DATA
MMSZ	:	IMPORTS OF GOODS IN CURRENT DOLLARS, QUASI-FOB - CUSTOMS DATA
MNQ	:	REAL IMPORTS OF NON-ENERGY GOODS
MQEX12	:	REAL IMPORTS OF GOODS FROM EXTRA-EUR12,QUASI-FOB - CUSTOMS DATA
MQIN12	:	REAL IMPORTS OF GOODS FROM INTRA-EUR12,QUASI-FOB - CUSTOMS DATA
MS	:	NOMINAL IMPORTS OF SERVICES
MSQ	:	REAL IMPORTS OF SERVICES
MT	:	NOMINAL TOTAL IMPORTS
MTQ	:	REAL TOTAL IMPORTS
M3	:	MONEY SUPPLY - M3 -
ONE	:	= 1 (CORRECTION FACTOR TO IMPOSE ADDING-UP ON BILATERAL EXPORTS IN VALUE WITH RESPECT TO IMPORTS)
OPEN	:	TREND OF OPENNESS OF THE DOMESTIC MARKET
P	:	PROXY FOR THE VALUE ADDED DEFLATOR
PCP	:	DEFLATOR FOR PRIVATE CONSUMPTION
PIIT	:	DEFLATOR OF TOTAL INVESTMENT IN INVENTORIES
PIT	:	DEFLATOR OF TOTAL FIXED INVESTMENT
PLINK_R.****:		RECONCILIATION FACTOR CUSTOMS/NAT. ACCOUNTS DATA
PME	:	DEFLATOR OF IMPORTS OF ENERGY
PMES	:	DEFLATOR OF IMPORTS OF ENERGY IN DOLLAR
PMM	:	DEFLATOR OF IMPORTS OF GOODS
PMMS	:	IMPORTS OF GOODS PRICE INDEX IN DOLLAR CIF - 1980=100 - CUSTOMS DATA
PMMSZ	:	IMPORTS OF GOODS PRICE INDEX IN DOLLAR QUASI-FOB - 1980=100 - CUSTOMS DATA
PMN	:	DEFLATOR OF IMPORTS OF NON-ENERGY GOODS
PMNSZ	:	IMPORTS OF NON-ENERGY GOODS PRICE INDEX IN DOLLAR QUASI-FOB - 1980=100 - CUSTOMS DATA
PMS	:	DEFLATOR OF IMPORTS OF SERVICES

PMT	:	DEFLATOR OF TOTAL IMPORTS
POIL	:	PETROLEUM SPOT PRICE (SAUDI LIGHT) IN DOLLARS/BARREL
PXE	:	DEFLATOR OF EXPORTS OF ENERGY
PXM	:	DEFLATOR OF EXPORTS OF GOODS
PXMS	:	DEFLATOR OF EXPORTS OF GOODS IN DOLLAR FOB - 1980=100 - CUSTOMS DATA
PXN	:	DEFLATOR OF EXPORTS OF NON-ENERGY GOODS
PXNS	:	DEFLATOR OF EXPORTS OF NON-ENERGY GOODS IN DOLLAR,FOB- 1980=100
PXS	:	DEFLATOR OF EXPORTS OF SERVICES
PXT	:	DEFLATOR OF TOTAL EXPORTS
PXWP	:	INDEX OF PRICE COMPETITIVENESS (EXPORT PRICES RELATIVE TO COMPETITORS' PRICES)
PY	:	DEFLATOR OF GDP/DNP
PYTT	:	DEFLATOR OF TOTAL FINAL DEMAND
R.******	:	RESIDUAL ITEM (TO INSURE IDENTITY)
RC.MM	:	RECONCILIATION FACTOR NA/BOP FOR IMPORTS OF GOODS
RC.MS	:	RECONCILIATION FACTOR NA/BOP FOR IMPORTS OF SERVICES
RC.TPX	:	RECONCILIATION FACTOR NA/BOP FOR NET TRANSFERS
RC.XM	:	RECONCILIATION FACTOR NA/BOP FOR EXPORTS OF GOODS
RC.XS	:	RECONCILIATION FACTOR NA/BOP FOR EXPORTS OF SERVICES
RC.YX	:	RECONCILIATION FACTOR NA/BOP FOR NET FACTOR INCOME
RDG	:	IMPLICIT INTEREST RATE ON GOVERNMENT DEBT
RL/NSA_RL	:	LONG TERM INTEREST RATE (SEASONALLY UNADJUSTED)
RS/NSA_RS	:	SHORT TERM INTEREST RATE (SEASONALLY UNADJUSTED)
SAVC	:	COMPANIES' SAVING
SAVG	:	GENERAL GOVERNMENT SAVING
SAVH	:	HOUSEHOLDS' SAVING
SAVHR	:	HOUSEHOLDS' SAVING RATIO
SCC	:	EMPLOYERS' SOCIAL CONTRIBUTIONS
SCH	:	EMPLOYEES' SOCIAL CONTRIBUTIONS
SUB/EX.SUB	:	SUBSIDIES
TI	:	INDIRECT TAXES
TIME	:	TIME TREND
TPH	:	NET CURRENT TRANSFERS RECEIVED BY HOUSEHOLDS
TYC	:	CORPORATE PROFIT TAX
TYH	:	INCOME TAX
U.******	:	RESIDUAL FROM ESTIMATION
UCAP	:	UTILISATION RATE OF CAPACITY
ULC	:	UNIT LABOUR COST INDEX
UPRO	:	LABOUR PRODUCTIVITY PER PERSON EMPLOYED
VOIL	:	SHARE OF ENERGY IN THE VOLUME OF EXPORTS, MOVING AVERAGE (UK ONLY)
WC	:	WAGE COST PER EMPLOYEE
WMMSQ	:	EXPORT MARKET GROWTH (IMPORT VOLUMES WEIGHTED WITH BILATERAL EXPORT SHARES)
WPXMS	:	COMPETITORS' EXPORTS OF GOODS PRICES, DOUBLE-WEIGHTED
WPXNS	:	COMPETITORS' EXPORTS OF NON-ENERGY GOODS PRICES, DOUBLE-WEIGHTED
WR	:	WAGE RATE PER EMPLOYEE
X(I,J)	:	EXPORTS OF GOODS IN DOLLARS FROM I TO J, FOB - CUSTOMS DATA
XEQ	:	REAL EXPORTS OF ENERGY
XESQ	:	REAL EXPORTS OF ENERGY IN DOLLAR
XM	:	NOMINAL EXPORTS OF GOODS
XMQ	:	REAL EXPORTS OF GOODS
XMS	:	EXPORTS OF GOODS IN CURRENT DOLLARS, FOB - CUSTOMS DATA
XMSQ	:	REAL EXPORTS OF GOODS IN DOLLAR, FOB - CUSTOMS DATA
XMZQ	:	SUM OF BILATERAL REAL EXPORTS OF GOODS
XNQ	:	REAL EXPORTS OF NON-ENERGY GOODS
XQ(J)	:	REAL BILATERAL EXPORTS OF GOODS IN DOLLARS TO COUNTRY/ZONE J QUASI-FOB - CUSTOMS DATA
XQEX12	:	REAL EXPORTS OF GOODS IN DOLLAR TO EXTRA-EUR12 QUASI-FOB - CUSTOMS DATA
XQIN12	:	REAL EXPORTS OF GOODS IN DOLLAR TO INTRA-EUR12 QUASI-FOB - CUSTOMS DATA
XS	:	NOMINAL EXPORTS OF SERVICES
XSQ	:	REAL EXPORTS OF SERVICES
XT	:	NOMINAL TOTAL EXPORTS
XTQ	:	REAL TOTAL EXPORTS
XWM	:	INDEX OF MARKET SHARES (REAL EXPORTS DIVIDED BY EXPORT MARKET GROWTH)
XX(I,J)	:	EXPORTS OF GOODS IN DOLLARS FROM I TO J, FOB - DURING SIMULATION BEFORE ADJUSTMENT FOR ADDING UP CONDITION
Y	:	NOMINAL GROSS DOMESTIC/NATIONAL PRODUCT
YC	:	COMPANIES PROFIT BEFORE TAX
YDH	:	HOUSEHOLDS' DISPOSABLE INCOME
YDHQ	:	HOUSEHOLDS' REAL DISPOSABLE INCOME
YG	:	GENERAL GOVERNMENT TRADING SURPLUS AND PROFIT INCOME
YNWH	:	NON WAGE INCOME OF HOUSEHOLDS
YQ	:	REAL GROSS DOMESTIC/NATIONAL PRODUCT
YQPOT	:	REAL POTENTIAL OUTPUT
YTDQ	:	REAL TOTAL DOMESTIC DEMAND
YTTQ	:	REAL TOTAL FINAL DEMAND
YWB	:	WAGE BILL
YWH	:	COMPENSATION OF EMPLOYEES
YWO	:	OTHER LABOUR INCOME
YX	:	NET FACTOR INCOME FROM ABROAD, NAT. ACC. BASED
YXM	:	FACTOR INCOME PAID ABROAD, NAT. ACC. BASED
YXX	:	FACTOR INCOME FROM ABROAD, NAT. ACC. BASED
Z	:	TRADE INTEGRATION VARIABLE - FITTED VALUE OF A LOGISTIC SPLINE FUNCTION APPLIED TO THE OECD SHARE OF IMPORTS IN TOTAL FINAL DEMAND

NOTE: DOTTED VARIABLES REPRESENT QUARTERLY GROWTH RATES AND ARE - UNLESS INDICATED OTHERWISE - DEFINED AS: X/X(-1) - 1
'QUASI-FOB' MEANS
- FOR VALUES : IMPORTS CALCULATED BY ADDING UP BILATERAL EXPORT VALUES
- FOR VOLUMES: BILATERAL EXPORT VALUES DEFLATED BY TOTA EXPORT PRICES
- FOR PRICES : USING TOTAL EXPORT PRICES INSTEAD OF BILATERAL PRICES

Appendix 3: Model structure for a standard model

```
NOTE: THIS MODEL LISTING REPRESENTS THE MOST GENERAL FRAMEWORK.
      NOT FOR ALL COUNTRIES ALL THE MENTIONED VARIABLES APPEAR
      (E.G. SOME RESIDUAL ITEMS 'R.***' TO RESPECT IDENTITIES).
      IN THE SAME WAY, THE FUNCTIONAL FORMS FOR THE BEHAVIOURAL
      EQUATIONS COUNTAIN A VARIABLE IF IT IS USED IN AT LEAST
      ONE COUNTRY MODULE. FOR THE EXACT SPECIFICATION OF THE
      INDIVIDUAL COUNTRY MODULES SEE PART II OF THE 'QUEST'
      DOCUMENT (SEPARATE VOLUME)



*************************************************************************
     PARAMETERS USED THROUGHOUT THE MODEL
*************************************************************************


PGN     = 0 : GOVERNMENT EXPENDITURE EXOGENOUS IN REAL TERMS
        = 1 : GOVERNMENT EXPENDITURE EXOGENOUS IN NOMINAL TERMS

PLINK   = 0 : NON-LINKED, SINGLE COUNTRY MODE
        = 1 : LINKED MODE

PARGNP  = 0 : GDP DEFINITION
        = 1 : GNP DEFINITION


*************************************************************************
        THE GOODS MARKET
*************************************************************************


     REAL DEMAND

   YQ    == CPQ + CGQ + ITQ + IITQ + XTQ - MTQ          + R.YQ
   ITQ   == IPQ + IGQ                                   + R.ITQ
   IPQ   == IEPQ+ ISPQ+IHPQ
   IGQ   == EX.IG*100/PIT*R.IGQ*PGN
            + (1-PGN)*(EX.IEGQ+EX.ICGQ)
   XTQ   == XMQ + XSQ                                   + R.XTQ
   MTQ   == MMQ + MSQ                                   + R.MTQ
   MMQ   == MNQ + MEQ
   YTTQ  == CPQ + CGQ + ITQ + IITQ + XTQ                + R.YTTQ
   YTDQ  == CPQ + CGQ + ITQ + IITQ                      + R.YTDQ
   KAPIQ == KAPIQ(-1) + IITQ

    +  BEHAVIOURAL EQUATIONS EXPLAINING DEMAND
       COMPONENTS

   CPQ     = F(YDHQ,PCP,LUR,RL,EX.POPT)                 + U.CPQ
   CGQ     = (1-PGN)*F(EX.CNWGQ,EX.LEEG)
             PGN*F(EX.CG,WC,PCP)                        * R.CGQ
   ISPQ    = F(IEPQ,RL,PY,GOS/Y)                        + U.ISPQ
   IHPQ    = F(EX.POPT,PIT,YQ,RL,PY,LUR,YDHQ-CPQ,PCP)   + U.IHPQ
   IITQ    = F(ITQ+CPQ+CGQ+XTQ+R.YQ,KAPIQ,RS,PYTT,UCAP) + U.IITQ

   XQ(J)   = F(MMSZQ(J),PXMS/PMNSZ(J))                  + U.XQ(J) (EXCL. UK)
           = C(J)*XESQ+F(MMSZQ(J)-MESQ(J),PXMS/PMNSZ(J))+ U.XQ(J) (UK ONLY)
             (J: COUNTRIES WITH STRUCTURAL MODELS)
           = F(MMSZQ(J),VOIL,PXNS/PMNSZ(J))           + U.XQ(J) (UK ONLY)
             (J: COUNTRIES WITH TRADE-FEEDBACK MODELS)
   XMZQ    = (SUM J: XQ(J))
   XMQ     = (XMZQ*R.XMQ)*(1-PLINK)                                (EXCL. UK)
             +PLINK*XMSQ*PLINK_R.XMQ
   XSQ     = F(XMQ+MMQ,PXS/PMS)                         + U.XSQ
   MNQ     = F(YTTQ*Z,PMN/PYTT,UCAP)                    + U.MMQ
   MEQ     = F(YTTQ,PME/PYTT)                           + U.MEQ    (EXCL. UK)
   MSQ     = F(YTTQ,PMS/PYTT)                           + U.MSQ
   XEQ     = F(EX.YEQ)                                  + U.XEQ    (UK ONLY)
   XNQ     = (XMZQ-(SUM J: C(J))*XESQ)*R.XNQ*(1-PLINK)             (UK ONLY)
             + PLINK*(XMSQ-(SUM J: C(J))*XESQ)    * PLINK_R.XNQ
                  (J: COUNTRIES WITH STRUCTURAL MODELS)
   XMQ     = XNQ + XEQ                                             (UK ONLY)
   CEQ     = F(YQ-EX.YEQ-IITQ,PME/PY,IITQ)              + U.CEQ    (UK ONLY)
   MEQ     = CEQ + XEQ - EX.YEQ                                    (UK ONLY)
   XESQ    = XEQ                                        * R.XESQ   (UK ONLY)
   MESQ    = MEQ                                        * R.MESQ   (UK ONLY)
   MMSQ    = MMQ                                  * PLINK_R.MMSQ   (UK ONLY)
   VOIL    = F(XESQ/XMSQ)                                          (UK ONLY)

     NOMINAL VARIABLES

   XM    == (XMQ*PXM/100.)                                        (EXCL. UK)
   XM     = (XNQ*PXN+XEQ*PXE)/100                                 (UK ONLY)
   XS    == (XSQ*PXS/100.)
   XT    == XM + XS
   MM    == (MNQ*PMN+MEQ*PME)/100
```

```
MS     == (MSQ*PMS/100.)
MT     == MM + MS
Y      == CPQ*PCP/100. + ITQ*PIT/100. + IIT
          + CG + XT - MT
YTT    == Y + MT
CG      = (1-PGN)*F(EX.LEEG*WC,EX.CNWGQ*PCP*R.CG)+PGN*EX.CG
IG      = (1-PGN)*(EX.IEGQ+EX.ICGQ)*PIT/100*R.IG+PGN*EX.IG
IIT     = IITQ*PYTT/100                                  + R.IIT
```

ENDOGENOUS :

BEHAVIOURAL

CPQ	: REAL PRIVATE CONSUMPTION
CGQ	: REAL GOVERNMENT CONSUMPTION
ISPQ	: REAL PRIVATE FIXED INVESTMENT IN STRUCTURES
IHPQ	: REAL PRIVATE FIXED INVESTMENT IN HOUSING
IITQ	: REAL TOTAL INVESTMENT IN INVENTORIES
MNQ	: REAL IMPORTS OF NON-ENERGY GOODS
MEQ	: REAL IMPORTS OF ENERGY
MSQ	: REAL IMPORTS OF SERVICES
XSQ	: REAL EXPORTS OF SERVICES
CEQ	: REAL APPARENT DOMESTIC CONSUMPTION OF ENERGY (UK ONLY)
XEQ	: REAL EXPORTS OF ENERGY (UK ONLY)
XQ(J)	: REAL BILATERAL EXPORTS OF GOODS TO TRADE PARTNER J , QUASI-FOB - CUSTOMS DATA

DEFINITIONS

YQ	: REAL GDP/GNP
ITQ	: REAL TOTAL FIXED INVESTMENT
IPQ	: REAL PRIVATE FIXED INVESTMENT
IGQ	: REAL GENERAL GOVERNMENT FIXED INVESTMENT
XTQ	: REAL TOTAL EXPORTS
MTQ	: REAL TOTAL IMPORTS
MMQ	: REAL IMPORTS OF GOODS
YTTQ	: REAL TOTAL FINAL DEMAND
YTDQ	: REAL TOTAL DOMESTIC DEMAND
KAPIQ	: REAL STOCK OF INVENTORIES
XMQ	: REAL EXPORTS OF GOODS
XNQ	: REAL EXPORTS OF NON-ENERGY GOODS (UK ONLY)
XESQ	: REAL EXPORTS OF ENERGY IN DOLLAR
XMZQ	: SUM OF BILATERAL REAL EXPORTS OF GOODS
MESQ	: REAL IMPORTS OF ENERGY IN DOLLAR
MMSQ	: REAL IMPORTS OF GOODS IN DOLLAR, CIF CUSTOMS DATA
XM	: NOMINAL EXPORTS OF GOODS
XS	: NOMINAL EXPORTS OF SERVICES
XT	: NOMINAL TOTAL EXPORTS
MM	: NOMINAL IMPORTS OF GOODS
MN	: NOMINAL IMPORTS OF NON-ENERGY GOODS
MS	: NOMINAL IMPORTS OF SERVICES
MT	: NOMINAL TOTAL IMPORTS
IG	: NOMINAL GENERAL GOVERNMENT INVESTMENT
CG	: NOMINAL GENERAL GOVERNMENT CONSUMPTION
IIT	: NOMINAL INVENTORY INVESTMENT
Y	: NOMINAL GDP/GNP
YTT	: NOMINAL FINAL DEMAND
VOIL	: SHARE OF ENERGY IN THE VOLUME OF EXPORTS, MOVING AVERAGE (UK ONLY)

EXOGENOUS :

EXTERNAL (OUTPUT OF THE LINKAGE BLOCK)

XMSQ	: REAL EXPORTS OF GOODS IN DOLLARS-FOB- CUSTOMS DATA

PARAMETER :

C(J)	: FIXED SHARE OF TRADE PARTNER J IN REAL ENERGY EXPORTS (UK ONLY)

****

SUPPLY BLOCK

****

```
  IEPQ     = F(YTTQ,RL,PY,GOS*UCAP/Y,TIME)      + U.IEPQ
  KAPEQ    == (1-DELTA)*KAPEQ(-1) + IEPQ        + R.KAPEQ
  LEEPPOT  = F(YQPOT,WC/PY,TIME)
  YQPOT    = F(KAPEQ,LEEPPOT)                   + U.YQPOT
  LEEP     = F(LEEPPOT/YQPOT*YQ)                + U.LEEP
  UCAP     == YQ/YQPOT*100                      + R.UCAP
```

ENDOGENOUS :

BEHAVIOURAL

IEPQ	: REAL PRIVATE FIXED INVESTMENT IN EQUIPMENT
LEEPPOT	: POTENTIAL EMPLOYMENT IN THE PRIVATE SECTOR
LEEP	: NUMBER OF EMPLOYEES IN THE PRIVATE SECTOR
YQPOT	: POTENTIAL OUTPUT

```
DEFINITONS

            KAPEQ       : CAPITAL STOCK (PRIVATE EQUIPMENT)
            UCAP        : DEGREE OF CAPACITY UTILIZATION

EXOGENOUS :
----------

            DELTA       : DEPRECIATION RATE



*************************************************************************
      PRICES
*************************************************************************


   DEFLATORS:

    PY   == 100.*(Y/YQ)
   PXT   == 100.*(XT/XTQ)
   PMT   == 100.*(MT/MTQ)
   PMM   == 100.*(MM/MMQ)
   PYTT  == 100.*(CPQ*PCP/100+ITQ*PIT/100+IIT+CG+XT)/YTTQ
   PIIT  == 100.*(IIT/IITQ)

  +  BEHAVIOURAL EQUATIONS EXPLAINING VALUE-ADDED PRICES,
     CONSUMER PRICES, IMPORT/EXPORT PRICES OF GOODS ETC.

   PCP    = F(EX.VATR,OPEN,PMM,P)          *U.PCP
   PIT    = F(OPEN,PMM,P)                  *U.PIT
   PXM    = F(OPEN,PMM,P,WPXMS,EX.EXCHR)   *U.PXM              (EXCL. UK)
   PXM    == 100.*(XM/XMQ)                                    (UK ONLY)
   PXMS   == PXM/EX.EXCHR                  *PLINK_R.PXMS
   PXN    = F(OPEN,PMM,P,WPXNS,EX.EXCHR)   *U.PXN              (UK ONLY)
   PXNS   == PXN/EX.EXCHR                  *R.PXNS              (UK ONLY)
   PXE    = F(POIL*EX.EXCHR)               *U.PXE               (UK ONLY)
   PXS    = PY                             *R.PXS
   PMN    = PMNSZ*EX.EXCHR                 *R.PMN
   PME    = F(POIL*EX.EXCHR)               *U.PME
   PMES   == PME/EX.EXCHR*100              *R.PMES
   PMS    = PMN                            *R.PMS
   P      = F(WC,UCAP,PMM)                 *U.P

ENDOGENOUS :
-----------

BEHAVIOURAL
            PCP         : DEFLATOR FOR PRIVATE CONSUMPTION
            PIT         : DEFLATOR OF TOTAL FIXED INVESTMENT
            PXM         : DEFLATOR OF EXPORTS OF GOODS
            PXS         : DEFLATOR OF EXPORTS OF SEVICES
            PMN         : DEFLATOR OF IMPORTS OF NON-ENERGY GOODS
            PME         : DEFLATOR OF IMPORTS OF ENERGY
            PMS         : DEFLATOR OF IMPORTS OF SERVICES
            PXN         : DEFLATOR OF EXPORTS OF NON-ENERGY GOODS
                          (UK ONLY)
            PXE         : DEFLATOR OF EXPORTS OF ENERGY (UK ONLY)
            P           : VALUE-ADDED PRICES

DEFINITIONS
            PY          : DEFLATOR OF GDP
            PXT         : DEFLATOR OF TOTAL EXPORTS
            PMT         : DEFLATOR OF TOTAL IMPORTS
            PMN         : DEFLATOR OF IMPORTS OF GOODS
            PYTT        : DEFLATOR OF FINAL DEMAND
            PIIT        : DEFLATOR OF INVENTORY INVESTMENT
            PXNS        : DEFLATOR OF EXPORTS OF NON-ENERGY GOODS,
                          IN DOLLARS (UK ONLY)
            PMES        : DEFLATOR OF IMPORTS OF ENERGY, IN DOLLARS
            PXMS        : DEFLATOR OF EXPORTS OF GOODS, IN DOLLARS
                          FOB - 1980=100 - CUSTOMS DATA

EXOGENOUS :
-----------

            POIL        : PETROLEUM SPOT PRICE IN DOLLAR/BARREL
            OPEN        : TREND OF OPENNESS OF THE DOMESTIC MARKET

EXTERNAL    (OUTPUT OF THE LINKAGE BLOCK)
            PMNSZ       : IMPORTS OF NON-ENERGY GOODS PRICE INDEX IN DOLLAR
                          QUASI-FOB - 1980=100 - CUSTOMS DATA
            WPXMS       : DOUBLE-WEIGHTED COMPETITORS' EXPORT PRICES
                          OF GOODS IN DOLLAR
                          FOB - 1980=100 - CUSTOMS DATA
            WPXNS       : DOUBLE-WEIGHTED COMPETITORS' EXPORT PRICES
                          OF NON-ENERGY GOODS IN DOLLAR (UK ONLY)
                          FOB - 1980=100 - CUSTOMS DATA
```

```
*************************************************************************
       LABOUR MARKET  (WAGES,EMPLOYMENT AND UNEMPLOYMENT)
*************************************************************************

     LE   == LEE+EX.LSE
     LEE  == LEEP+EX.LEEG
     LU   == (EX.L-LE)
     LUR  == 100.*LU/EX.L
     UPRO == 1000000.*YQ/LE
     WC   == 1000000.*YWH/LEE
     ULC  == (WC/UPRO)*R.ULC

    +  BEHAVIOURAL EQUATIONS EXPLAINING EMPLOYMENT
       EARNINGS, WAGE COSTS  ETC.

     WR    = F(PCP,PY,LUR,UPRO)              + U.WR


   ENDOGENOUS :
   -----------

   BEHAVIOURAL
               WR          : WAGE RATE PER EMPLOYEE

   DEFINITIONS
               LE          : TOTAL EMPLOYMENT
               LEE         : TOTAL NUMBER OF EMPLOYEES
               LU          : UNEMPLOYMENT
               LUR         : UNEMPLOYMENT RATE
               UPRO        : LABOUR PRODUCTIVITY PER PERSON EMPLOYED
               WC          : WAGE COST PER EMPLOYEE
               ULC         : UNIT LABOUR COST INDEX

   EXOGENOUS :
   -----------

   STRUCTURAL
               EX.POPT     : TOTAL POPULATION
               EX.POPW     : POPULATION IN WORKING AGE
               EX.L        : TOTAL LABOUR FORCE
               EX.LSE      : NUMBER OF SELF-EMPLOYED
               EX.LEEG     : NUMBER OF EMPLOYEES IN THE PUBLIC SECTOR



*************************************************************************
      SECTORAL INCOMES
*************************************************************************

     YWB  == (LEE*WR/1000000.)
     YWH  == YWB + SCC + YWO
     GOS  == Y - YWH - TI + SUB  + R.GOS
     YDH  == YWB + TPH + YWO + YNWH - TYH - SCH
     YDHQ == YDH*100./PCP
     YC   == GOS - YNWH + INTG -YG + (1-PARGNP)*(YX + R.YC)
                                   + PARGNP*GOS*R.YC

    +  QUASI-BEHAVIOURAL EQUATIONS FOR PROFIT AND PROPERTY INCOME
       AND OTHER LABOUR INCOME

     YWO   = EX.YWOR*(YWB)
     YNWH  = F(EX.LSE*WR,GOS+INTG+YX*(1-PARGNP))    + U.YNWH
     YG    = EX.YGR*(GOS)
     INTG == RDG*DEBT/400


   ENDOGENOUS :
   -----------

   QUASI-BEHAVIOURAL
               YWO         : OTHER LABOUR INCOME
               YNWH        : NON WAGE INCOME OF HOUSEHOLDS
               YG          : GENERAL GOVERNMENT TRADING SURPLUS AND PROFIT
               INTG        : INTEREST PAYMENT ON PUBLIC DEBT

   DEFINITIONS
               YWB         : WAGE BILL
               YWH         : COMPENSATION OF EMPLOYEES
               GOS         : GROSS OPERATING SURPLUS
               YDH         : HOUSEHOLDS DISPOSABLE INCOME
               YDHQ        : HOUSEHOLDS REAL DISPOSABLE INCOME
               YC          : COMPANIES PROFIT BEFORE TAX

   EXOGENOUS :
   -----------

   STRUCTURAL
               EX.YGR      : PROFIT SHARE OF GOVERNMENT
               EX.YWOR     : AVERAGE OTHER LABOUR INCOME RATE
```

```
*************************************************************************
   PUBLIC EXPENDITURE : OPTIONS FOR INSTRUMENTS
*************************************************************************

     IG == EX.IG*PGN    + ((EX.IEGQ+EX.ICGQ)*PIT/100.*R.IG)*(1-PGN)
    IGQ == (EX.IG*100./PIT)*R.IGQ*PGN  + (EX.IEGQ+EX.ICGQ)*(1-PGN)
     CG == EX.CG*PGN + (EX.LEEG*WC/1000000+EX.CNWGQ*PCP/100*R.CG)*(1-PGN)
    CGQ == F(EX.CG,WC,PCP)*R.CGQ*PGN + F(EX.CNWGQ,EX.LEEG)*(1-PGN)
    SUB == EX.SUB*PGN  +  (EX.SUBQ*PY/100.)*(1-PGN)

   ENDOGENOUS:
   -----------

   DEFINITIONS
               CGQ/CG         : GENERAL GOVERNMENT CONSUMPTION
               IEGQ,ICGQ/IG   : GENERAL GOVERNMENT FIXED INVESTMENT
                                (EQUIPMENT, CONSTRUCTION, TOTAL)
               SUBQ/SUB       : SUBSIDIES

   EXOGENOUS :
   -----------

   POLICY
               EX.CGQ/EX.CG   : GENERAL GOVERNMENT CONSUMPTION
               EX.IEGQ,EX.ICGQ/EX.IG  :
                                GENERAL GOVERNMENT FIXED INVESTMENT
                                (EQUIPMENT, CONSTRUCTION, TOTAL)
               EX.SUBQ/EX.SUB: SUBSIDIES


*************************************************************************
       SOCIAL CONTRIBUTIONS, TAXES AND TRANSFERS
*************************************************************************

     SCC = EX.SCCR*(YWB)
     SCH = EX.SCHR*(YWB)
     TYH = F(YWB + YNWH + TPH)          + U.TYH
     TYC = EX.TYCR*(YC)
     TI  = (EX.VATR/(1.+EX.VATR))*
           CPQ*PCP/100+EX.TIR*(Y+MT)
     TPH = F(PCP,LUR)                   + U.TPH

   ENDOGENOUS :
   -----------

   BEHAVIOURAL
               TYH         : INCOME TAX
               TPH         : NET CURRENT TRANSFERS RECEIVED BY HOUSEHOLDS

   QUASI-BEHAVIOURAL
               SCC         : EMPLOYERS SOCIAL CONTRIBUTIONS
               SCH         : EMPLOYEES SOCIAL CONTRIBUTIONS
               TYC         : CORPORATE PROFIT TAX
               TI          : INDIRECT TAXES

   EXOGENOUS :
   -----------

   POLICY
               EX.SCCR     : AVERAGE EMPLOYER SOCIAL CONTRIBUTION RATE
               EX.SCHR     : AVERAGE EMPLOYEE SOCIAL CONTRIBUTION RATE
               EX.TYCR     : AVERAGE CORPORATE PROFIT TAX RATE
               EX.TIR      : OTHER INDIRECT TAX RATE
               EX.VATR     : VALUE-ADDED TAX RATE


*************************************************************************
NET ACQUISITIONS OF FINANCIAL ASSETS,SAVINGS RATIO AND GOVERNMENT DEBT
*************************************************************************

    SAVH  == YDH - CPQ*PCP/100.
    SAVHR == 100.*SAVH/YDH
    SAVC  == YC - TYC + PARGNP*R.SAVC*GOS
    SAVG  == - CG + YG + (TYH + TYC + SCC + SCH + TI)
             - SUB -INTG -TPH + R.SAVG*TPH
    DEFG  == - SAVG + IG + R.DEFG*ITQ*PIT/100.
    DEBT  == DEBT(-1) + DEFG

   ENDOGENOUS :
   -----------

   DEFINITIONS
               SAVH        : HOUSEHOLDS' SAVING
               SAVHR       : HOUSEHOLDS' SAVING RATIO
               SAVC        : COMPANIES' SAVING
               SAVG        : GENERAL GOVERNMENT SAVING
               DEFG        : GENERAL GOVERNMENT DEFICIT
               DEBT        : NOMINAL GOVERNMENT DEBT
```

```
*************************************************************************
        BALANCE OF PAYMENTS
*************************************************************************

     YXX     = XT*EX.YXXR
     YXM     = MT*EX.YXMR
     YX      == YXX - YXM
     BPT_NA== XT - MT + (1-PARGNP)*YX
     BPC_NA== BPT_NA - EX.TPX
     BPC     == BPC_NA + (RC.XM + RC.XS - RC.MM - RC.MS
              - RC.TPX)

    + QUASI BEHAVIOURAL EQUATIONS EXPLAINING THE RECONCIALIATION
      FACTORS OF NA AND BOP DATA

     RC.XM    = F(XM)       + R.RC.XM
     RC.XS    = F(XS)       + R.RC.XS
     RC.MM    = F(MM)       + R.RC.MM
     RC.MS    = F(MS)       + R.RC.MS
     RC.YX    = F(YX)       + R.RC.YX
     RC.TPX   = F(EX.TPX)   + R.RC.TPX

   ENDOGENOUS :
   -----------

   DEFINITIONS
                YX          : NET FACTOR INCOME FROM ABROAD
                BPT_NA      : BALANCE ON GOODS AND SERVICES NA BASED
                BPC_NA      : CURRENT BALANCE NATIONAL ACCOUNTS BASED
                BPC         : CURRENT BALANCE BOP BASED

   QUASI-BEHAVIOURAL
                YXX         : FACTOR INCOME FROM ABROAD
                YXM         : FACTOR INCOME PAID ABROAD
                RC.MM       : RECONCILIATION FACTOR NA/BOP FOR IMP.OF GOODS
                RC.MS       : RECONCILIATION FACTOR NA/BOP FOR IMP.OF SERVICES
                RC.XM       : RECONCILIATION FACTOR NA/BOP FOR EXP.OF GOODS
                RC.XS       : RECONCILIATION FACTOR NA/BOP FOR EXP.OF SERVICES
                RC.YX       : RECONCILIATION FACTOR NA/BOP FOR NET FACTOR INC.
                RC.TPX      : RECONCILIATION FACTOR NA/BOP FOR NET TRANSFERS

   EXOGENOUS :
   -----------

   EXTERNAL
                EX.TPX      : NET UNREQUITED TRANSFERS PAID ABROAD
                              (NA DEFINITION)



*************************************************************************
        TRADE-FEEDBACK MODELS
*************************************************************************

     OIL EXPORTERS : NETHERLANDS, UNITED KINGDOM, CANADA, AUSTRALIA, NORWAY,
                     OPEC, CENTRALLY PLANNED ECONOMIES, REST OF WORLD ZONE
     NON-OIL EXPORTERS : REMAINING COUNTRIES/ZONES


     MMSQ     = F(XMSQ,PXMS/PMMS)                + U.MMSQ
     PXMS     = F(VOIL,POIL,EXCHR,PMNSZ)         * R.PXMS (OIL EXPORTERS)
              = F(EXCHR,PMNSZ)                   * U.PXMS (NON-OIL EXPORTERS)

   ENDOGENOUS :
   -----------

   BEHAVIOURAL
                MMSQ        : REAL IMPORTS OF GOODS, IN DOLLARS
                              CIF - CUSTOMS DATA
                PXMS        : DEFLATOR OF EXPORTS OF GOODS, IN DOLLARS
                              FOB - 1980=100 - CUSTOMS DATA

   EXTERNAL : (OUTPUT FROM TRADE LINKAGE)
   ---------

                PMMS        : DEFLATOR OF IMPORTS OF GOODS, IN DOLLARS
                              CIF - 1980=100 - CUSTOMS DATA
                PMNSZ       : DEFLATOR OF IMPORTS OF NON-ENERGY GOODS
                              IN DOLLARS, QUASI-FOB - 1980=100 - CUSTOMS DATA
                XMSQ        : REAL EXPORTS OF GOODS, IN DOLLARS
                              FOB - CUSTOMS DATA
```

```
**************************************************************************
      LINKAGE BLOCK
**************************************************************************


   OIL EXPORTERS : NETHERLANDS, UNITED KINGDOM, CANADA, AUSTRALIA, NORWAY,
                   OPEC, CENTRALLY PLANNED ECONOMIES, REST OF WORLD ZONE
   NON-OIL EXPORTERS : REMAINING COUNTRIES/ZONES
   STRUCTURAL MODEL COUNTRIES : GERMANY, FRANCE, UNITED KINGDOM,
                                UNITED STATES
   TRADE-FEEDBACK COUNTRIES   : REMAINING COUNTRIES/ZONES

   INDEX I : FOR THE EXPORTING COUNTRY OR ZONE
   INDEX J : FOR THE IMPORTING COUNTRY OR ZONE
   INDEX K : FOR THE EXPORTING/IMPORTING COUNTRY OR ZONE OR REGIONAL
             AGGREGATION


LINKAGE SYSTEM IN DOLLARS:
--------------------------

  PXNS(I)     = (PXMS(I)**(1/(1-VOIL(I)))
                /(POIL/PPOIL*100)**(VOIL(I)/(1-VOIL(I)))      * R.PXNS(I)
                    (OIL EXPORTERS EXCLUDING OPEC AND UK)
              == PXMS(I)       (NON-OIL EXPORTERS)
  MMS(J)      == PMMS(J)*MMSQ(J)/100
  MMSZ(J)      = F(MMS(J))                                     + U.MMSZ(J)
  MMSZQ(J)    == MMSZ(J)/PMMSZ(J)*100


+ BEHAVIOURAL EQUATIONS EXPLAINING EXPORTS OF GOODS FROM I TO J

  XX(I,J)      = PXMS(I)*(F(MMSZQ(J),PXNS(I)/PMNSZ(J))         + U.XX(I,J))
                    (I: NON-OIL EXPORTERS)
               = PXMS(I)*(F(MMSZQ(J),VOIL,PXNS(I)/PMNSZ(J))    + U.XX(I,J))
                    (I: OIL EXPORTERS EXCLUDING OPEC AND UK)
               = PXMS(I)*(F(MMSZQ(J),VOIL,PXNS(I)/PMNSZ(J))    + U.XX(I,J))
                    (I: UK, J: TRADE-FEEDBACK COUNTRIES)
               = PXMS(I)*(C(J)*XESQ(UK)+F(MMSZQ(J)-MESQ(J),
               PXNS(I)/PMNSZ(J))                               + U.XX(I,J))
                    (I: UK, J: STRUCTURAL MODEL COUNTRIES)
               = PXMS(I)*(F(MMSZQ(J))                          + U.XX(I,J))
                    (I: OPEC, J: TRADE-FEEDBACK COUNTRIES)
               = PXMS(I)*(-C(J)*XESQ(UK)+F(MESQ(J))            + U.XX(I,J))
                    (I: OPEC, J: STRUCTURAL MODEL COUNTRIES)
  ONE(J)      == MMSZ(J)/SUM(I: XX(I,J))
  X(I,J)      == ONE(J)*XX(I,J)
  XMS(I)      == SUM(J: X(I,J))
  PMMSZ(J)    == SUM(I: X(I,J))/SUM(I: X(I,J)/PXMS(I))


LINKAGE OUTPUT DATA TO COUNTRY MODELS IN DOLLARS:
-------------------------------------------------

  XMSQ(I)     == XMS(I)/PXMS(I)*100
  PMNSZ(J)    == SUM(I: X(I,J))/SUM(I: X(I,J)/PXNS(I)) (I: EXCLUDES OPEC)
  PMMS(J)      = F(PMMSZ(J)) * U.PMMS(J)       (TRADE-FEEDBACK COUNTRIES)
  WPXMS(I)    == SUM(J: X(I,J)*SUM(K: X(K,J))/
                 SUM(K: X(K,J)/PXMS(K)))/SUM(J: X(I,J))
                                        (SUMMATIONS OVER K EXCLUDE I)
  WPXNS(I)    == SUM(J: X(I,J)*SUM(K: X(K,J))/
                 SUM(K: X(K,J)/PXNS(K)))/SUM(J: X(I,J))
                    (I: UK ONLY, SUMMATIONS OVER K EXCLUDE UK AND OPEC)
  EX.EXCHR(J)== EXCHR(J)/DOLLAR                (STRUCTURAL COUNTRY MODELS)
  EXCHR(J)    == 1/DOLLAR                      (TRADE-FEEDBACK MODELS)



PERFORMANCE INDICATORS:
-----------------------

  WMMSQ(I)    == SUM(J: X(I,J)*MMSQ(J))/SUM(J: X(I,J))
  XWM(I)       = XMSQ(I)/WMMSQ(I)
  PXWP(I)      = PXMS(I)/WPXMS(I)


REGIONAL AGGREGATIONS:
----------------------

EC12    : COMMUNITY COUNTRIES
ROEC    : OECD EXCLUDING EUR12
OECD    : OECD COUNTRIES
NODC    : NON-OIL DEVELOPING COUNTRIES (NICS + REST OF WORLD ZONE)
WT      : WORLD

  MMS(K)      == SUM(J: MMS(J))                (K: EC12,ROEC,OECD,NODC,WT)
  MMSQ(K)     == SUM(J: MMSQ(J))               (K: EC12,ROEC,OECD,NODC,WT)
  PMMS(K)     == MMS(K)/MMSQ(K)*100            (K: EC12,ROEC,OECD,NODC,WT)
  MMSZQ(K)    == SUM(J: MMSZQ(J))              (K: EC12,ROEC,OECD,NODC,WT)
  XMS(K)      == SUM(I: XMS(I))                (K: EC12,ROEC,OECD,NODC,WT)
  XMSQ(K)     == SUM(I: XMSQ(I))               (K: EC12,ROEC,OECD,NODC,WT)
  PXMS(K)     == XMS(K)/XMSQ(K)*100            (K: EC12,ROEC,OECD,NODC,WT)
  XQIN12(I)   == (SUM(J: X(I,J)))/PXMS(I)*100  (J: INTRA-EUR12 COUNTRIES)
  XQEX12(I)   == (SUM(J: X(I,J)))/PXMS(I)*100  (J: EXTRA-EUR12 COUNTRIES)
```

```
MQIN12(J)  == (SUM(I: X(I,J))/PXMS(I))*100   (I: INTRA-EUR12 COUNTRIES)
MQEX12(J)  == (SUM(I: X(I,J))/PXMS(I))*100   (I: EXTRA-EUR12 COUNTRIES)
XQIN12(K)  == SUM(I: XQIN12(I))              (K: EC12,ROEC,OECD,NODC,WT)
XQEX12(K)  == SUM(I: XQEX12(I))              (K: EC12,ROEC,OECD,NODC,WT)
MQIN12(K)  == SUM(J: MQIN12(J))              (K: EC12,ROEC,OECD,NODC,WT)
MQEX12(K)  == SUM(J: MQEX12(J))              (K: EC12,ROEC,OECD,NODC,WT)
```

ENDOGENOUS :

BEHAVIOURAL

MMSZ	:	IMPORTS OF GOODS IN CURRENT DOLLARS QUASI-FOB - CUSTOMS DATA
PMMS	:	IMPORTS OF GOODS PRICE INDEX IN DOLLAR CIF - 1980 =100 - CUSTOMS DATA

QUASI-IDENTITIES

XX(I,J)	:	EXPORTS OF GOODS IN DOLLARS FROM I TO J FOB - DURING SIMULATION BEFORE ADJUSTMENT FOR ADDING UP CONDITION

DEFINITIONS

EXCHR	:	= 1 (VARIABLE SYMBOLIZING THE EXCHANGE RATE IN THE TRADE-FEEDBACK COUNTRY MODULES)
EX.EXCHR	:	EXCHANGE RATE LOCAL CURRENCY/DOLLAR (STRUCTURAL MODEL COUNTRIES)
MMS	:	NOMINAL IMPORTS OF GOODS IN DOLLARS - CIF - CUSTOMS DATA
MMSQ	:	REAL IMPORTS OF GOODS IN DOLLARS - CIF - CUSTOMS DATA (REGIONAL AGGREGATIONS)
MMSZQ	:	QUASI-FOB REAL IMPORTS (SUM OF AN APPROXIMATION OF REAL BILATERAL IMPORTS IN DOLLARS) - CUSTOMS DATA
MQEX12	:	REAL IMPORTS OF GOODS FROM EXTRA-EUR12 QUASI-FOB - CUSTOMS DATA
MQIN12	:	REAL IMPORTS OF GOODS FROM INTRA-EUR12 QUASI-FOB - CUSTOMS DATA
ONE	:	= 1 (CORRECTION FACTOR TO IMPOSE ADDING-UP ON BILATERAL EXPORTS IN VALUE WITH RESPECT TO QUASI-FOB IMPORTS)
PMMS	:	IMPORTS OF GOODS PRICE INDEX IN DOLLAR CIF - 1980=100 - CUSTOMS DATA (REGIONAL AGGREGATIONS)
PMMSZ	:	IMPORTS OF GOODS PRICE INDEX IN DOLLAR QUASI-FOB - 1980=100 - CUSTOMS DATA
PMNSZ	:	IMPORTS OF NON-ENERGY GOODS PRICE INDEX IN DOLLAR - QUASI-FOB - 1980=100 - CUSTOMS DATA
PXMS	:	DEFLATOR OF EXPORTS OF GOODS IN DOLLAR FOB - 1980=100 - CUSTOMS DATA (REGIONAL AGGREGATIONS)
PXNS	:	DEFLATOR OF EXPORTS OF NON-ENERGY GOODS IN DOLLAR - FOB - 1980=100 (EXCLUDES UK AND OPEC)
PXWP	:	INDEX OF PRICE COMPETITIVENESS (EXPORT PRICES RELATIVE TO COMPETITORS' PRICES)
WMMSQ	:	EXPORT MARKET GROWTH (IMPORT VOLUMES WEIGHTED WITH BILATERAL EXPORT SHARES)
WPXMS	:	COMPETITORS' EXPORTS OF GOODS PRICES, DOUBLE-WEIGHTED
WPXNS	:	COMPETITORS' EXPORT PRICES OF NON-ENERGY GOODS, DOUBLE-WEIGHTED (UK ONLY)
X(I,J)	:	EXPORTS OF GOODS IN DOLLARS FROM I TO J FOB - CUSTOMS DATA
XMS	:	EXPORTS OF GOODS IN CURRENT DOLLARS FOB - CUSTOMS DATA
XMSQ	:	REAL EXPORTS OF GOODS IN DOLLAR FOB - CUSTOMS DATA
XQEX12	:	REAL EXPORTS OF GOODS IN DOLLAR TO EXTRA-EUR12 QUASI-FOB - CUSTOMS DATA
XQIN12	:	REAL EXPORTS OF GOODS IN DOLLAR TO INTRA-EUR12 QUASI-FOB - CUSTOMS DATA
XWM	:	INDEX OF MARKET SHARES (REAL EXPORTS DIVIDED BY EXPORT MARKET GROWTH)

EXOGENOUS

DOLLAR	:	= 1 (AUXILIARY VARIABLE USED FOR SIMULATING A DEPRECIATION OF THE DOLLAR AGAINST ALL OTHER CURRENCIES IN LINKED MODE)
POIL	:	PETROLEUM SPOT PRICE (SAUDI LIGHT) IN DOLLARS/BARREL
VOIL	:	SHARE OF ENERGY IN TOTAL EXPORTS (OIL EXPORTERS EXCLUDING UK)

EXTERNAL (OUTPUT FROM STRUCTURAL OR TRADE-FEEDBACK MODELS)

MESQ	:	REAL IMPORTS OF ENERGY IN DOLLARS
MMSQ	:	REAL IMPORTS OF GOODS IN DOLLARS - CIF - CUSTOMS DATA
PXMS	:	DEFLATOR OF EXPORTS OF GOODS IN DOLLAR FOB - 1980=100 - CUSTOMS DATA
PXNS	:	DEFLATOR OF EXPORTS OF NON-ENERGY GOODS IN DOLLAR - FOB - 1980=100 (UK ONLY)
XESQ	:	REAL EXPORTS OF ENERGY IN DOLLAR (UK ONLY)
VOIL	:	SHARE OF ENERGY IN TOTAL EXPORTS (UK ONLY)

PARAMETER

PPOIL : AVERAGE OF POIL (OIL PRICE) IN 1980 IN DOLLARS

NOTE: 'QUASI-FOB' MEANS
- FOR VALUES: IMPORTS CALCULATED BY ADDING UP BILATERAL EXPORT VALUES
- FOR VOLUMES: BILATERAL EXPORT VALUES DEFLATED BY TOTAL EXPORT PRICE
- FOR PRICES: USING TOTAL EXPORT PRICE INSTEAD OF BILATERAL PRICE

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