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Industrial Country Spreadsheet Trade Models: New Tools For Economic Analysis

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Industrial Country Spreadsheet Trade Models: New Tools for Economic Analysis

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Preface

Information available as of 17 October 1986 was used in this report.

Econometric models for mainframe computers have become conventional tools for analyzing international trade flows. In a system of equations, a model combines a theoretical representation of the economy, a statistical analysis of the key relationships, and assumptions about external events. The solution of the system of equations produces conditional estimates of the future and can be used to estimate an economy's sensitivity to alternative sets of assumptions about future developments.

The advent of economic spreadsheets, designed to operate in the personal computer (PC) environment, provides an alternative approach to quantitative economic analysis. Economic spreadsheets greatly reduce maintenance costs and allow for greater accessibility by analysts with a minimum of training in computer use.

This project combines the standard econometric modeling approach with the spreadsheet approach through the use of simple econometric models that reside in complex PC spreadsheets. As a result, advanced econometric methods are put to work in an environment that can be maintained and used with a minimal expenditure of time and resources.

The industrial country spreadsheet trade models can be used to examine the impact of price, income, and exchange-rate changes on GDP and the balance of payments. Specifically, the models are designed to gauge the effects of changes in the prices of food, energy, raw materials, and manufactured goods on import and export demand. The models are also capable of estimating income effects across trading partners through the impact on import and export demand. Because exchange rates play a prominent role in the models by converting export prices into partner import prices, the models can be used to measure the impact of exchange-rate changes on domestic and trading-partner GDP and balance of payments.

The results obtained from balance-of-payments models for each of the developed countries, combined with a simple model of world trade relationships, are described in this paper. The first section gives a brief overview of the methodologies used and explains how to interpret the results. The second section examines the individual balance-of-payments model for each country. The third section demonstrates potential uses of the models, including the calculation of price and income influences on the

balance of payments. The fourth section describes the linkage model that measures the impact of changes in any particular country on the rest of the world. The final section demonstrates typical uses for the model by examining the transmission of changes in GDPs, price levels, and exchange rates between individual countries and country groups. Several appendixes describe in greater detail the methodologies used to obtain the results.

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Industrial Country Spreadsheet Trade Models: New Tools for Economic Analysis

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Introduction

This paper examines a set of spreadsheet models of the balance of payments of OECD countries and the trade linkages between those countries and their trading partners. Each OECD member [1] is modeled separately, and the rest of the world is divided into four aggregate groups: OPEC, Communist countries, newly industrialized countries (NICs), and other developing countries. The methodology used here involves aggregate trade in goods and services broken down into five major commodity groups: agricultural products, raw materials, energy, manufactured goods, and services. The individual country models operate on semiannual data and are generally based on relationships estimated over the 1970-85 period. The linkage model joins the countries through trade-share analysis: each country's exports depend on its trade partners' imports, and import prices depend on partner export prices.

The individual balance-of-payments models and the linkage model have been designed primarily to determine the degree of trade interdependence between countries and their trading partners. These models can be used to measure the quantitative impact of income, price, and exchange-rate changes in any country or group of countries on all of its trading partners.

More specifically, the individual country models are used to assess the impact on a particular country of:
- Changes in world income or world prices.
- Changes in that country's income or prices.

The linkage model is used (with the country models) to assess the impact on one or more countries of:
- Changes in income or prices in another country.
- Changes in exchange rates.

[1] The United States is included as a trade partner and for comparison purposes.

Individual Country Balance-of-Payments Models: Basic Structure

Each country's balance-of-payments model is stored in a separate spreadsheet containing detailed historical data, forecasts for exogenous variables, and regression coefficients. The various elements interact to produce conditional forecasts of key endogenous variables, including the current account balance. Imports and exports of different categories of goods and services are endogenous to the model; prices, income, and transfers are all exogenous. A detailed display of key sections of the model is shown in appendix D.

The Demand for Imports

The demand for imports is divided into four categories of goods plus a services category:
- Food products.
- Raw materials.
- Energy.
- Manufactures.
- Services.

For each of the OECD countries, regression analysis was used to relate the demand for a given category to the country's income, the price of the goods within the specific category, and a Koyck-lag term to capture long-run effects. The estimation techniques are discussed in appendix B, and the estimated coefficients may be found in appendix C. The demand for a given import category is positively related to domestic income (that is, as a country's income rises, demand for the good also rises); it is negatively related to price (as the price rises, demand for the good falls). The relative price of imports is defined as the ratio of the import price for a particular category to its export price, which serves as a proxy for the competing domestic price. No attempt is made to estimate price elasticities for services, because reliable price data are unavailable. The demand for a given import category in any period is also positively related to the quantity

imported in the previous period. This single lagged term indicates a declining, infinite lag structure; the quantity imported each period depends on income and price in all of the previous periods.

The estimated income and price elasticities have the expected signs, and their summary statistics are shown in table 1. This table displays the average short-run and long-run elasticities across countries for both price and income; the largest values among the countries are also reported—the smallest value, zero, is not shown. In some cases, significant results were not obtained with the regression structure outlined above. The alternate forms used for these regressions are explained in appendix C.

Our regression analysis yielded insignificant coefficients for some of the countries within each category of imports. In the cases of Greece, Iceland, Portugal, Spain, and Turkey, this result is due to a lack of data prior to 1982. As more data become available, our estimation of these coefficients should improve.

Insignificant elasticities of demand were estimated in some cases. Insufficient data were responsible for most of these estimation problems, as some countries only reported data from 1982. Among those countries reporting data since 1970, a few, with small domestic production in a particular import category, had inelastic demand functions—for example, Japan for raw materials and several other countries for energy.

Table 1
Imports of Goods:
Income and Price Elasticities

	High	Average
Food		
Price		
Short run	−0.60 (Turkey)	−0.19
Long run	−1.49 (Netherlands)	−0.33
Income		
Short run	1.77 (France)	0.69
Long run	4.18 (Belgium)	1.23
Raw materials		
Price		
Short run	−1.15 (Denmark)	−0.33
Long run	−3.45 (Switzerland)	−0.72
Income		
Short run	1.18 (Netherlands)	0.38
Long run	3.62 (Switzerland)	0.75
Energy		
Price		
Short run	−0.55 (Portugal)	−0.08
Long run	−1.62 (France)	−0.26
Income		
Short run	1.30 (Portugal)	0.11
Long run	2.88 (Germany)	0.31
Manufactures		
Price		
Short run	−1.42 (Sweden)	−0.58
Long run	−4.21 (Ireland)	−1.26
Income		
Short run	4.10 (Turkey)	1.05
Long run	4.92 (Finland)	1.91
Services		
Income	3.60 (Turkey)	1.75

The Demand for Exports

The demand for exports is divided into four categories of goods plus a services category:

- Food products.
- Raw materials.
- Energy.
- Manufactures.
- Services.

For each of the OECD countries, regression analysis was used to relate the demand for a given category to world income and the price of the goods within the specific category, and a Koyck-lag term was used to capture long-run effects. The estimated coefficients may be found in appendix C. The demand for a given export category is positively related to world income (that is, as the world's income rises, demand for the good also rises). Because it is a more reliable data series, total OECD income is used as a proxy for

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world income. Export demand is negatively related to price (as the price rises, demand for the good falls). The relative price of exports is defined as the ratio of the export price for a particular category to its import price, which serves as a proxy for the competing world price. No attempt is made to estimate price elasticities for services, because reliable price data are unavailable. The demand for a given export category is positively related to the quantity exported in the previous period. This lagged term indicates a declining, infinite lag structure; the quantity exported each period depends on income and price in all of the previous periods.

The estimated income and price elasticities have the expected signs, and their summary statistics are shown in table 2. This table displays the average short-run and long-run elasticities across countries for both price and income; the largest values among the countries are also reported. In some cases, country data do not conform to the regression structure outlined above. Details concerning the forms that were adopted in these cases and the logic underlying the adopted forms may be found in appendix C.

Inelastic demand functions were estimated in several cases among countries reporting data since 1970. These results apply to countries with small domestic production of the export categories involved, particularly raw materials and energy. In the case of agriculture, the prevalence of government subsidy schemes also plays an important role in determining the estimated elasticities.

Balance-of-Payments Aggregates

The export and import volumes of total goods theoretically equal the sums of the component volumes of food, raw materials, energy, and manufactures. Data-reporting anomalies, however, lead to some divergence between these series. To adjust for these divergences, bridge equations are employed for exports and imports using a simple regression of total goods volume against the sum of the volume components. This methodology is discussed in appendix B, and the regression results may be found in appendix C.

The existence of data anomalies for many countries also prevented the use of a simple weighted average of commodity prices in the derivation of the aggregate goods export and import prices. Instead, bridge equations are employed for exports and imports using the simple regression of aggregate price against the weighted average of the individual prices. The regression results may be found in appendix C.

Table 2
Export of Goods:
Income and Price Elasticities

	High	Average
Food		
Price		
Short run	−1.27 (United States)	−0.29
Long run	−3.07 (United States)	−12.21
Income		
Short run	1.78 (Sweden)	0.50
Long run	3.08 (Sweden)	0.96
Raw materials		
Price		
Short run	−0.84 (Canada)	−0.20
Long run	−1.50 (Canada)	−0.31
Income		
Short run	1.98 (Netherlands)	0.45
Long run	2.45 (Netherlands)	0.67
Energy		
Price		
Short run	−4.09 (Norway)	−0.46
Long run	−24.40 (Norway)	−2.69
Income		
Short run	5.33 (New Zealand)	0.73
Long run	25.72 (New Zealand)	3.04
Manufactures		
Price		
Short run	−1.17 (United States)	−0.35
Long run	−5.86 (Japan)	−1.01
Income		
Short run	1.81 (Australia)	0.63
Long run	4.52 (Netherlands)	1.46
Services		
Income	7.35 (Turkey)	1.88

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A similar problem arises in the conversion from total goods volumes and prices to nominal dollar values of exports and imports. Bridge equations are employed in this case to adjust for these data anomalies. The regression results may be found in appendix C.

The current account balance is defined as the sum of the trade balance, exports of services, investment income credits, official transfers, and private transfers minus imports of services and investment income debits—all reported in dollars. The merchandise trade balance is defined as the dollar value of goods exports minus goods imports. Private and official transfers along with investment income credits and debits are taken to be exogenous to the model.

Using the Country Models: Income and Price Effects

One of the principal assets of these models is their ability to assess the quantitative impact of economic growth and inflation on a country's exports, imports, and current account balance. Specifically, they are designed to answer questions such as:

- What is the effect of a given change in the world price of food, energy, raw materials, or manufactures on the current account balance of a specific country?
- What is the effect of a given change in a country's real income on the current account balance and import volume of that country?
- What is the effect of a given change in world income on the current account balance and export volume of a specified country?
- What is the impact on a country's real GDP of changes in imports or exports due to price and income changes?

Income Effects

Two sets of scenarios were used to examine the responsiveness of each country to domestic and world income changes. For the first scenario, domestic income is increased by 1 percent with no change in world income or prices. The resulting impact on the current account balance of each country is displayed in table 3, while table 4 shows the impact on import volumes. In each case, import volume increases and the current account balance deteriorates by an amount that increases over time.

Table 3 *Million US $*
Domestic GDP: Impact on the Current Account Balance [a]

	First Year	Second Year	Third Year
Australia	−87	−119	−151
Austria	−747	−805	−837
Belgium	−622	−803	−923
Canada	−1,059	−1,578	−1,800
Denmark	−231	−261	−283
Finland	−224	−423	−470
France	−6,285	−9,268	−10,562
Greece	−39	−39	−39
Iceland	NEGL	NEGL	NEGL
Ireland	−121	−209	−274
Italy	−1,613	−2,066	−2,253
Japan	−1,192	−1,638	−1,820
Netherlands	−816	−1,181	−1,439
New Zealand	−112	−136	−148
Norway	−233	−288	−318
Portugal	−74	−83	−84
Spain	−151	−225	−274
Sweden	−734	−809	−860
Switzerland	−488	−676	−832
Turkey	−250	−279	−270
United Kingdom	−3,264	−4,704	−5,361
United States	−6,015	−9,545	−11,309
West Germany	−4,286	−6,428	−7,564

[a] Changes in current account balance due to a 1-percent increase in domestic GDP.

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This type of scenario can be used to estimate the impact of unexpected changes in GDP on a country's current account balance. The data in table 3 show that Japan's current account balance changes by only $2 billion after three years of a 1-percent change in

Table 4 *Percent*
Domestic GDP: Impact on Goods Import Volumes [a]

	First Year	Second Year	Third Year
Australia	0.1	0.2	0.3
Austria	0.6	0.6	0.6
Belgium	0.3	0.5	0.6
Canada	1.1	1.6	1.7
Denmark	0.2	0.3	0.3
Finland	1.2	2.3	2.5
France	4.2	6.3	6.3
Greece	0.2	0.2	0.2
Iceland	NEGL	NEGL	NEGL
Ireland	NEGL	NEGL	NEGL
Italy	1.2	1.4	1.4
Japan	0.4	0.6	0.7
Netherlands	0.6	1.0	1.3
New Zealand	1.3	1.6	1.6
Norway	0.4	0.7	0.7
Portugal	0.7	0.7	0.7
Spain	0.3	0.5	0.6
Sweden	1.5	1.6	1.7
Switzerland	0.5	0.9	1.1
Turkey	1.4	1.5	1.5
United Kingdom	2.4	3.4	3.6
United States	1.4	2.1	2.3
West Germany	1.7	2.8	3.2

[a] Percentage change in import volume due to a 1-percent increase in domestic GDP.

Table 5 *Million US $*
World Income: Impact on Current Account Balances [a]

	First Year	Second Year	Third Year
Australia	387	484	544
Austria	765	947	1,004
Belgium	616	790	858
Canada	1,061	1,748	2,155
Denmark	326	497	588
Finland	182	273	322
France	2,285	3,101	3,480
Greece	67	81	84
Iceland	3	4	4
Ireland	64	69	70
Italy	699	788	892
Japan	1,827	3,119	4,251
Netherlands	1,674	2,522	3,018
New Zealand	52	59	68
Norway	334	482	659
Portugal	81	89	95
Spain	375	380	390
Sweden	715	933	1,033
Switzerland	524	659	709
Turkey	273	298	329
United Kingdom	1,482	2,388	2,916
United States	1,936	3,510	4,514
West Germany	2,444	3,602	4,271

[a] Change in current account balance due to a 1-percent increase in world income.

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GDP, demonstrating a low level of sensitivity to domestic changes. France's current account balance is much more sensitive to changes in domestic GDP, however, shifting by nearly $11 billion after three years in response to a 1-percent change in GDP.

The second scenario measures the effect on each country of a 1-percent increase in world income assuming no change in domestic income or prices. The resulting changes in current account balances and export volumes are displayed in tables 5 and 6. As expected, export volume and the current account balance increases over time for each country.

This type of scenario can be used to measure the sensitivity of individual countries to changes in the world economy. In this case, the current account balance in Japan is more sensitive to income changes than in France. Japan would suffer a deterioration of over $4 billion after three years of a 1-percent reduction in world income, while France's current account balance would be reduced by only $3.5

Table 6 *Percent*
World Income: Impact on Goods Export Volumes [a]

	First Year	Second Year	Third Year
Australia	1.0	1.2	1.2
Austria	1.7	2.2	2.2
Belgium	0.6	0.8	0.9
Canada	0.9	1.5	1.7
Denmark	1.2	2.0	2.2
Finland	0.9	1.5	1.8
France	1.4	2.1	2.3
Greece	0.9	1.3	1.4
Iceland	NEGL	NEGL	NEGL
Ireland	NEGL	NEGL	NEGL
Italy	0.2	0.3	0.4
Japan	0.6	1.3	1.8
Netherlands	1.9	3.1	3.7
New Zealand	0.3	0.7	1.2
Norway	2.2	5.2	8.4
Portugal	0.1	0.1	0.1
Spain	0.2	0.2	0.2
Sweden	1.6	2.1	2.2
Switzerland	1.1	1.4	1.5
Turkey	0.1	0.1	0.1
United Kingdom	1.1	2.0	2.4
United States	0.8	1.3	1.6
West Germany	0.7	1.2	1.4

[a] Percentage change in export volume due to a 1-percent increase in world income.

Table 7 *Million US $*
Food Prices: Impact on Current Account Balances [a]

	First Year	Second Year	Third Year
Australia	574	605	636
Austria	−216	−221	−228
Belgium	11	39	66
Canada	253	272	283
Denmark	379	408	497
Finland	−46	−30	−22
France	665	701	741
Greece	NEGL	6	2
Iceland	NEGL	NEGL	NEGL
Ireland	185	198	195
Italy	−631	−702	−736
Japan	−1,618	−1,801	−1,929
Netherlands	579	596	630
New Zealand	273	289	297
Norway	38	38	38
Portugal	−13	−15	−13
Spain	−28	−31	−23
Sweden	−109	−115	−115
Switzerland	−174	−190	−204
Turkey	77	6	−21
United Kingdom	−388	−409	−435
United States	−56	179	338
West Germany	−537	−584	−631

[a] Change in current account balance due to a 10-percent increase in world food prices.

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billion. Although its economy is much smaller, Canada would suffer a disproportionate deterioration in its current account balance of over $2 billion because of its heavy reliance on foreign trade.

Price Effects

Four scenarios were examined for each country to analyze the impact of changes in the world price of each of the goods categories. For each scenario, one country was examined independently and faced a 10-percent increase in both the export and import price of a particular commodity. Countries that export more of the product than they import will generally register improvements in their current account balances, and the reverse is true for countries that import more than they export. The relative price elasticities of import and export demand also play an important role in this analysis, leading to unexpected results for some countries. The results are summarized in tables 7-10.

Table 8
Energy Prices: Impact on Current Account Balances [a]

Million US $

	First Year	Second Year	Third Year
Australia	398	405	401
Austria	−460	−477	−481
Belgium	−455	−421	−425
Canada	564	524	529
Denmark	−137	−104	−96
Finland	−124	−114	−114
France	−1,225	−1,133	−1,237
Greece	−116	−101	−98
Iceland	−2	−2	−2
Ireland	−68	−64	−66
Italy	−1,441	−1,240	−1,244
Japan	−3,844	−3,204	−3,245
Netherlands	164	50	55
New Zealand	−42	−37	−36
Norway	875	745	801
Portugal	−42	−42	−45
Spain	−810	−784	−838
Sweden	−238	−216	−218
Switzerland	−218	−200	−204
Turkey	−604	−631	−640
United Kingdom	906	701	714
United States	−2,772	−2,399	−2,390
West Germany	−1,388	−1,249	−1,371

[a] Change in current account balance due to a 10-percent increase in world energy prices.

Table 9
Raw Materials Prices: Impact on Current Account Balances [a]

Million US $

	First Year	Second Year	Third Year
Australia	561	627	673
Austria	−210	−218	−227
Belgium	−229	−249	−253
Canada	899	929	1,052
Denmark	36	39	45
Finland	−86	−73	−61
France	−72	−95	−124
Greece	−4	0	1
Iceland	−2	−2	−2
Ireland	20	17	16
Italy	−845	−921	−984
Japan	−1,677	−1,902	−2,085
Netherlands	−25	−47	−41
New Zealand	98	100	104
Norway	−35	−38	−39
Portugal	4	3	4
Spain	−324	−333	−339
Sweden	210	223	234
Switzerland	−85	−97	−100
Turkey	−188	−230	−230
United Kingdom	−372	−416	−450
United States	980	1,319	1,536
West Germany	−509	−578	−632

[a] Change in current account balance due to a 10-percent increas 25X1 world raw material prices.

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This type of scenario would prove very helpful in measuring the impact of the large energy price increases and decreases that have occurred over the past several years and are expected to recur in the future. The results in table 8 clearly show the gainers and losers—with respect to the current account balances—of an increase in energy prices. Norway, the United Kingdom, Australia, and the Netherlands are identified as enjoying improved current account balances as a result of increases in the price of energy. Japan and the United States suffer the largest deterioration in current account balance in this scenario.

In some cases the impact on the current account balance reverses over time, indicating differing short-run and long-run elasticities. In table 7, for example, the current account balance of the United States worsens in the first year following an increase in food prices, but improves in later years. This outcome is a direct result of the estimated coefficients; these show

Table 10 *Million US $*
Manufacturing Export Prices:
Impact on Current Account Balances [a]

	First Year	Second Year	Third Year
Australia	801	808	882
Austria	−2,210	−6,580	−6,750
Belgium	−41	−2,453	−2,959
Canada	−2,456	−8,014	−10,577
Denmark	1,944	2,011	2,137
Finland	422	376	317
France	351	−5,882	−7,593
Greece	−16	−60	−58
Iceland	39	43	47
Ireland	−546	−2,194	−3,610
Italy	−2769	−2,083	−2,160
Japan	−167	−22,498	−38,064
Netherlands	3,804	2,223	1,453
New Zealand	−622	−874	−972
Norway	974	412	210
Portugal	478	321	329
Spain	2,690	1,953	1,363
Sweden	−926	−1,620	−1,763
Switzerland	−1,365	−5,029	−7,590
Turkey	158	−26	−3
United Kingdom	−387	−7,992	−11,575
United States	−38,430	−82,576	−107,050
West Germany	−8,793	−29,616	−39,555

[a] Change in current account balance due to a 10-percent increase in manufacturing export prices.

that the long-run elasticity of demand for food imports is high relative to both the short-run elasticity of demand for food imports and the long-run elasticity of demand for food exports.

The Trade Linkage Model: Description

A simplified model linking all of the countries, but without commodity detail, is stored in a separate spreadsheet containing historical data on export and import volumes, price indexes, and bilateral trade flows. Trade shares and the effects of trade interdependence are estimated by the interaction of these different elements. The model performs all of the necessary conversions between dollars and other currencies and between real and nominal values. Key sections of the model are displayed in appendix E.

Specifically, the model is designed to answer questions such as:

- What is the effect of a change in the domestic demand of a particular country on the GDPs and balances of payments of its trade partners?
- What is the effect of a change in the price of a country's exports on the import price faced by its trade partners?
- What are the impacts of particular exchange-rate changes on other countries?

Structure of the Linkage Model

The linkage model consists of selected trade, income, and price data for each of the OECD countries and aggregates for the Communist countries, OPEC, the NICs, and the rest of the world. Real GDP for each reporter is broken down into domestic demand, exports, and imports. Domestic demand is considered exogenous to the model; exports of goods and services are a function of partner imports of goods and services and bilateral trade shares; and imports are a function of relative prices and domestic income. Price indexes for both imports and exports are included, with export prices exogenous and import prices a function of partner export prices. Dollar exchange rates and bilateral trade-flow data are included as exogenous to the model.

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The key element of the model is the trade-share matrix, which measures the bilateral trade flows between each pair of reporters. Through this matrix, an increase in any country's export price will feed into its partners' import price, thus affecting the partner country's import demand. Similarly, changes in import demand will affect partner countries' exports. Because exchange rates play a role in the conversion of export prices into import prices, they also contribute to the interactions.

The spreadsheet produces summary tables that provide results for key variables, including GDP growth rates, current account balances in dollars, and real effective exchange rates. These figures are calculated using all of the simultaneous interactions present in the model.

Import Determination

Real imports of goods and services are estimated as a function of domestic demand and the relative price of imports, using a geometrically declining infinite lag structure. The values of the coefficients are calculated using simulations of the individual country models, in order to reflect most accurately the actual elasticities. Each country has a different lag structure, which is consistent with the implicit values determined using its individual model.

The level of import demand calculated by the model for each country is used in the determination of partner countries' exports. A country with 25 percent of the market in a country that increases its imports would receive a boost to its exports equal to 25 percent of the import increase. Because the model contains all countries of the world, any change in total imports will be met by an equal change in total exports throughout the rest of the world. Imports and exports are then combined with domestic demand to determine real GDP for each country. Only domestic demand is determined exogenously in this model, using OECD forecasts in most cases.

Import-Price Determination

Each country's exogenously determined export price level feeds into its trading partners' import price levels. These prices feed through all of the relevant exchange rates in order to determine the actual relative prices. The weights applied to each export price in order to determine import prices are based on bilateral trade shares. Countries with very close trade relations will have closely interdependent prices.

The determination of import and export prices, combined with the determination of import and export volumes, leads directly to the calculation of the current account balance for each country. Export prices, exchange rates, and trade shares also combine to determine real effective exchange rates for each country.

Examples of Using the Trade Linkage Model

The linkage model can be used (with the country models) to assess the impact on partner countries of changes in economic growth, inflation, and import demand in a particular country. Alternatively, it can be used to estimate the impact of exchange-rate changes. The model also offers a convenient way of calculating various economic data, such as real effective exchange rates or imports as a share of GDP.

Impacts of Changes in Big Seven Import Demand

The trade linkage model can be used to estimate the impact of changes in import demand in particular countries on the GDP growth rates and the current account balances of their trade partners. For example, the scenarios displayed in table 11 show the effects of a 10-percent increase in the level of import demand by each of the Big Seven. The effects range from negligible amounts for countries with little bilateral trade to a 3.3-percent increase in Irish GDP as a result of increased British imports.

This type of scenario can be used to compare the effects of applying the same policy in different countries. For example, the results in table 11 have implications for the encouragement of "locomotive" policies [2] in Japan and West Germany. According to model results, increases in West German import demand have a much larger impact on world GDP than increases in Japanese imports. Policymakers can compare the relative benefits of each country pursuing this type of policy.

Dependence on Exports to Communist Countries

Another example of the model's use is the estimation of the share of a country's GDP attributable directly or indirectly to exports to the Communist countries. This is done by comparing the baseline case to the case where exports to Communist countries are cut to zero. The calculated shares range from negligible for several countries to 0.5 percent of GDP for Finland

[2] Expansionary policies in key countries designed to increase world GDP through increased import demand.

Table 11
Big Seven Import Demand:
Impact on World GDP [a]

Percentage points

	Canada	Japan	United States	West Germany	Italy	United Kingdom	France
Australia	NEGL	0.9	0.4	0.1	0.1	0.1	0.1
Austria	NEGL	0.1	0.3	1.8	0.5	0.3	0.2
Belgium	NEGL	NEGL	0.5	1.6	0.5	0.8	1.3
Canada		0.1	2.6	NEGL	NEGL	NEGL	NEGL
Denmark	NEGL	0.2	0.5	0.7	0.2	0.5	0.2
Finland	0.1	0.1	0.4	0.5	0.1	0.6	0.2
France	0.1	0.1	0.4	0.6	0.4	0.3	
Greece	NEGL	0.1	0.2	0.6	0.4	0.2	0.3
Iceland	NEGL	0.3	1.4	0.5	0.1	0.9	0.2
Ireland	0.1	0.2	0.9	1.0	0.3	3.3	0.7
Italy	NEGL	NEGL	0.5	0.6		0.2	0.5
Japan	0.1		1.2	0.2	0.1	0.1	0.1
Netherlands	NEGL	NEGL	0.4	2.0	0.4	0.8	0.6
New Zealand	0.1	0.8	0.8	0.2	0.1	0.6	0.1
Norway	NEGL	0.1	0.4	1.1	0.1	1.6	0.5
Portugal	0.1	0.1	0.5	0.7	0.2	0.7	0.5
Spain	NEGL	0.1	0.4	0.4	0.2	0.3	0.5
Sweden	0.1	0.1	0.6	0.5	0.1	0.4	0.2
Switzerland	0.1	0.4	0.8	1.2	0.7	0.6	0.5
Turkey	NEGL	NEGL	0.4	0.6	0.2	0.4	0.1
United Kingdom	0.1	0.1	0.6	0.5	0.1		0.3
United States	0.4	0.2		0.1	NEGL	0.1	NEGL
West Germany	0.1	0.1	0.6		0.4	0.4	0.4
OPEC	NEGL	0.5	0.3	0.1	0.2	NEGL	0.1
COMECON	NEGL	0.1	0.1	0.3	0.2	0.1	0.1
NICs	0.1	0.2	0.9	0.1	NEGL	0.1	NEGL
Rest of the world	NEGL	0.3	0.4	0.2	0.1	0.1	0.1

[a] Impact on real GDP growth of a 10-percent real increase in import demand.

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and are shown in table 12. Such calculations are very straightforward in the linkage model because GDP and bilateral trade data are available in an easily accessible spreadsheet.

The Impact of Exchange-Rate Changes

The trade linkage model can estimate the impact of a change in a given exchange rate on any particular country's GDP, current account balance, and import price index. The direct effect will result from a change in the price of imports from the country whose exchange rate has changed. Indirect effects result from the impacts on the import prices of other

Table 12 *Percent*
Communist Import Demand: Contribution to Industrialized Country GDP [a]

Australia	0.1
Austria	0.4
Belgium	0.1
Canada	0.1
Denmark	0.1
Finland	0.5
France	NEGL
Greece	0.1
Iceland	0.2
Ireland	0.1
Italy	0.1
Japan	NEGL
Netherlands	0.1
New Zealand	0.1
Norway	NEGL
Portugal	NEGL
Spain	0.1
Sweden	0.1
Switzerland	0.1
Turkey	0.1
United Kingdom	0.1
United States	NEGL
West Germany	0.1

[a] Difference in GDP between the baseline case and the case where exports to Communist countries are cut to zero.

Table 13
Real Effective Exchange Rates: Movement Between March 1985 and September 1986

	Percent Change
Australia	−29.8
Austria	9.1
Belgium	5.9
Canada	−6.1
Denmark	8.4
Finland	2.6
France	6.4
Greece	−19.6
Iceland	−3.5
Ireland	8.3
Italy	8.4
Japan	51.9
Netherlands	12.1
New Zealand	−0.8
Norway	−5.4
Portugal	−0.9
Spain	5.7
Sweden	0.7
Switzerland	16.6
Turkey	−38.3
United Kingdom	−1.4
United States	−22.1
West Germany	14.7

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countries, which affect exports from the country in question. Appendix A displays the results of appreciations of each of the Big Seven currencies.

Other Uses

The model's large data base can be used to easily make calculations that might otherwise be very time consuming. For example, the linkage model uses its trade-share, exchange-rate, and price data to calculate real effective exchange rates. Dollar exchange rates are deflated by unit labor costs for each country and then converted to implicit bilateral rates for every pair of countries. For a given reporter, weights are applied to each of its bilateral exchange rates on the basis of the importance of trade with the corresponding partner. Both imports and exports are included in the weighting, but less-developed and Communist countries are excluded. Table 13 shows the changes in real effective exchange rates since the dollar's peak early in 1985.

Another example of using the model's data base is the calculation as a share of GDP of a country's exports to or imports from another geographic area. As an

Table 14
Imports From NICs [a]
as a Share of GDP

Percent

Australia	2.3
Austria	2.2
Belgium	3.8
Canada	6.6
Denmark	2.4
Finland	1.9
France	1.7
Greece	1.2
Iceland	4.9
Ireland	5.4
Italy	2.1
Japan	3.1
Netherlands	3.0
New Zealand	4.2
Norway	2.7
Portugal	2.4
Spain	1.7
Sweden	2.6
Switzerland	3.6
Turkey	1.7
United Kingdom	2.4
United States	0.7
West Germany	2.4

[a] Brazil, Mexico, Taiwan, South Korea, Singapore, and Hong Kong.

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illustration, table 14 shows, for each industrial country, imports from the NICs as a share of GDP. Shares range from 0.7 percent in the United States to 6.6 percent in Canada.

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Appendix A

Big Seven Exchange-Rate Effects

Table 15a
The US Dollar's Impact on Industrialized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	0.2	0.3	−0.2	0.1
Austria	0.7	1.3	0.3	1.3
Belgium	0.3	0.6	−0.5	NEGL
Canada	3.1	4.7	2.9	19.4
Denmark	0.3	0.6	NEGL	0.3
Finland	0.3	0.4	−0.1	0.2
France	0.3	0.6	0.1	2.8
Greece	0.2	0.3	0.3	0.3
Iceland	1.0	1.7	0.1	0.1
Ireland	2.0	3.7	NEGL	0.6
Italy	0.4	0.7	1.1	4.1
Japan	1.1	1.7	−1.9	22.9
Netherlands	0.4	3.7	−1.0	−0.1
New Zealand	1.2	1.6	0.1	0.4
Norway	0.3	0.5	0.1	0.5
Portugal	0.4	0.7	0.1	0.2
Spain	0.4	0.6	0.1	1.5
Sweden	0.7	0.9	−0.1	1.1
Switzerland	0.6	1.0	NEGL	1.0
Turkey	0.3	0.6	0.1	0.5
United Kingdom	0.4	0.8	NEGL	3.9
United States	−1.3	−2.1	3.4	−65.0
West Germany	0.4	0.6	−2.8	2.9

[a] Changes resulting from a 10-percent appreciation of the US dollar.

Table 15b
The Japanese Yen's Impact on Industrialized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	0.1	0.1	−1.1	−0.8
Austria	0.5	1.0	0.2	1.0
Belgium	−0.3	−0.4	−0.5	−0.9
Canada	−0.7	−1.0	−3.2	−6.7
Denmark	−0.2	−0.2	−0.3	−0.5
Finland	NEGL	NEGL	−0.2	−0.2
France	−0.1	−0.1	−1.4	−2.4
Greece	NEGL	NEGL	−0.1	−0.2
Iceland	−0.4	−0.7	NEGL	−0.1
Ireland	0.1	0.3	NEGL	NEGL
Italy	−0.2	−0.3	−1.1	−2.3
Japan	−0.7	−1.2	20.3	2.7
Netherlands	−0.2	−0.2	−0.6	−1.0
New Zealand	1.4	2.5	NEGL	0.4
Norway	NEGL	NEGL	−0.3	−0.2
Portugal	−0.1	−0.2	−0.1	−0.2
Spain	−0.1	−0.2	−0.6	−0.8
Sweden	NEGL	−0.1	−0.3	−0.4
Switzerland	NEGL	NEGL	−0.4	−0.3
Turkey	−0.2	−0.2	−0.2	−0.4
United Kingdom	−0.2	−0.3	−2.0	−3.5
United States	0.4	0.6	−3.2	20.6
West Germany	−0.4	−0.3	−3.5	−5.9

[a] Changes resulting from a 10-percent appreciation of the yen.

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Table 15c
The West German Deutsche Mark's Impact on Industrialized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	−0.1	−0.1	−0.5	−0.6
Austria	7.4	10.7	4.0	13.7
Belgium	−0.1	NEGL	−2.3	−2.5
Canada	−0.2	−0.3	−1.1	−2.2
Denmark	NEGL	0.1	−0.9	−0.8
Finland	0.3	0.2	−0.4	−0.2
France	0.2	0.4	−3.4	−1.7
Greece	0.3	0.3	−0.2	−0.1
Iceland	−0.2	−0.3	NEGL	−0.1
Ireland	0.7	1.4	NEGL	0.2
Italy	0.2	0.2	−2.7	−1.6
Japan	−0.1	−0.1	−3.2	−5.6
Netherlands	0.6	1.3	−2.1	−0.2
New Zealand	0.2	5.7	NEGL	NEGL
Norway	0.3	0.6	−0.4	NEGL
Portugal	NEGL	0.1	−0.2	−0.2
Spain	NEGL	NEGL	−1.0	−0.8
Sweden	0.7	0.6	−0.2	0.6
Switzerland	1.1	2.1	−1.0	0.8
Turkey	−0.1	0.1	−0.4	−0.5
United Kingdom	NEGL	NEGL	−3.2	−3.3
United States	0.1	0.1	−2.2	2.6
West Germany	−1.5	−2.5	20.4	−0.3

[a] Changes resulting from a 10-percent appreciation of the deutsche mark.

Table 15d
The French Franc's Impact on Industrialized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	NEGL	−0.1	−0.2	−0.1
Austria	0.5	1.2	0.3	1.2
Belgium	0.2	0.6	−1.3	−0.7
Canada	−0.1	−0.2	−0.5	−1.0
Denmark	−0.1	NEGL	−0.2	−0.3
Finland	0.1	0.1	−0.1	NEGL
France	−0.9	−1.8	12.1	2.1
Greece	0.1	0.1	−0.1	−0.1
Iceland	−0.1	−0.2	NEGL	NEGL
Ireland	0.5	1.1	NEGL	0.2
Italy	0.3	0.4	−1.2	0.9
Japan	NEGL	−0.1	−1.4	−2.4
Netherlands	0.1	0.4	−0.7	−0.3
New Zealand	0.1	0.1	NEGL	NEGL
Norway	0.1	0.2	−0.1	0.1
Portugal	0.2	0.4	−0.1	NEGL
Spain	0.2	0.4	−0.5	0.4
Sweden	0.2	0.1	−0.1	0.2
Switzerland	0.4	0.8	−0.4	0.4
Turkey	−0.1	NEGL	−0.1	−0.2
United Kingdom	NEGL	0.1	−1.3	−0.9
United States	NEGL	0.1	−0.7	2.2
West Germany	0.1	0.2	−3.5	−2.1

[a] Changes resulting from a 10-percent appreciation of the franc.

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Table 15e
The British Pound's Impact on Industralized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	NEGL	−0.1	−0.4	−0.4
Austria	0.3	0.6	0.1	0.5
Belgium	−0.1	NEGL	−0.8	−0.9
Canada	−0.1	−0.2	−0.7	−1.2
Denmark	NEGL	0.1	−0.3	−0.3
Finland	0.2	0.2	−0.2	NEGL
France	0.1	0.2	−1.3	−0.8
Greece	0.1	NEGL	NEGL	−0.1
Iceland	NEGL	NEGL	NEGL	NEGL
Ireland	4.9	7.8	0.2	1.7
Italy	NEGL	NEGL	−0.7	−0.5
Japan	NEGL	−0.1	−1.7	3.0
Netherlands	0.2	0.4	−0.8	−0.4
New Zealand	0.6	0.7	NEGL	0.2
Norway	0.4	0.6	−0.1	0.3
Portugal	0.1	0.2	−0.1	−0.1
Spain	NEGL	NEGL	−0.4	−0.2
Sweden	0.5	0.5	NEGL	0.7
Switzerland	0.3	0.4	−0.2	0.2
Turkey	NEGL	0.1	−0.1	−0.1
United Kingdom	−0.8	−1.2	12.4	6.4
United States	0.1	0.1	−1.0	2.3
West Germany	NEGL	NEGL	−2.5	−2.5

[a] Changes resulting from a 10-percent appreciation of the pound.

Table 15f
The Italian Lira's Impact on Industralized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	NEGL	−0.1	−0.2	−0.1
Austria	1.7	4.0	0.9	2.8
Belgium	NEGL	NEGL	−0.3	−0.4
Canada	−0.1	−0.2	−0.5	−1.0
Denmark	NEGL	NEGL	−0.2	−0.2
Finland	0.1	0.1	−0.1	NEGL
France	0.3	0.4	−1.0	1.0
Greece	0.3	0.3	NEGL	0.1
Iceland	−0.1	−0.2	NEGL	NEGL
Ireland	0.2	0.4	NEGL	0.1
Italy	−1.4	−2.0	6.7	−2.1
Japan	NEGL	−0.1	−1.3	−2.5
Netherlands	0.1	0.2	−0.2	−0.1
New Zealand	0.1	0.1	NEGL	NEGL
Norway	NEGL	NEGL	−0.1	−0.1
Portugal	0.1	0.1	−0.1	−0.1
Spain	0.1	0.1	−0.3	NEGL
Sweden	0.1	NEGL	−0.1	0.1
Switzerland	0.6	0.9	−0.1	0.7
Turkey	NEGL	0.1	−0.1	−0.1
United Kingdom	NEGL	NEGL	−0.8	−0.9
United States	NEGL	0.1	−0.5	2.3
West Germany	0.1	NEGL	−2.3	−1.7

[a] Changes resulting from a 10-percent appreciation of the lira.

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Table 15g
The Canadian Dollar's Impact on Industrialized Countries

	Real GDP Growth [a] *(percentage points)*		Current Account Balance [a] *(billion US $)*	
	First Year	Second Year	First Year	Second Year
Australia	−0.1	−0.2	−0.2	−0.4
Austria	NEGL	NEGL	NEGL	NEGL
Belgium	−0.2	−0.1	−0.1	−0.4
Canada	−2.2	−3.3	4.1	−7.8
Denmark	−0.1	−0.1	−0.1	−0.2
Finland	NEGL	NEGL	−0.1	NEGL
France	NEGL	NEGL	−0.5	−1.1
Greece	NEGL	−0.1	NEGL	−0.1
Iceland	−0.3	−0.5	NEGL	−0.1
Ireland	−0.1	−0.1	NEGL	NEGL
Italy	−0.1	−0.2	−0.5	−1.1
Japan	−0.2	−0.3	−4.9	−9.3
Netherlands	−0.1	−0.1	−0.2	−0.4
New Zealand	NEGL	NEGL	−0.1	−0.1
Norway	NEGL	NEGL	−0.1	NEGL
Portugal	−0.1	−0.1	NEGL	−0.1
Spain	−0.1	−0.1	−0.2	−0.4
Sweden	−0.1	−0.2	−0.2	−0.3
Switzerland	−0.1	−0.2	−0.2	−0.3
Turkey	−0.1	−0.1	NEGL	−0.2
United Kingdom	−0.1	−0.1	−0.7	−1.3
United States	0.5	0.8	4.5	33.8
West Germany	−0.1	−0.2	−1.1	−2.4

[a] Changes resulting from a 10-percent appreciation of the Canadian dollar.

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Appendix B

Data and Methodology

Data

The data for this project are all obtained on floppy disk from the OECD, Paris. The series are reported on a semiannual basis, generally beginning with the first half of 1970. New diskettes become available each June and December, and the balance-of-payments spreadsheets are designed to incorporate revised and updated data by using the Lotus 1-2-3 File/Combine command. No labor-intensive data maintenance or update procedure is required.

Koyck Lags

Econometric relationships often assume that the dependent variable depends not only on the current values of the independent variables but also on their values in earlier periods. Direct estimation of the coefficients of these lagged variables is usually impossible, however, as a result of multicollinearity and degrees-of-freedom problems. The Koyck-lag approach gets around this difficulty by including the dependent variable, lagged one period, among the independent variables. This is functionally equivalent to expressing the dependent variable as a function of the values of the independent variables in the current and all preceding periods.

This relationship can be illustrated by the estimation of imports (m) in period t as a function of prices (p) in period t, income (y) in period t, and imports in period $t-1$; that is:

$$M_t = a \times P_t + b \times Y_t + c \times_{t-1}$$

Similarly for period $t-1$

$$M_{t-1} = a \times P_{t-1} + b \times Y_{t-1} + c \times M_{t-2}$$

Substituting the second equation into the first yields

$$M_t = a \times P_t + b \times Y_t + c \times a \times P_{t-1} + c \times b \times Y_{t-1} + c2 \times M_{t-2}$$

The substitution process can then be successively repeated to eliminate M_{t-2}, M_{t-3}, and so on, leaving only current and lagged values of prices and income on the right-hand side of the equation.

The principal drawbacks of the Koyck method are that it imposes a geometrically declining lag structure and—more important—that it imposes the same lag structure on all of the independent variables. We believe that these shortcomings are outweighed by the Koyck method's ease of use and by the fact that it has won widespread acceptance in econometric model building.

Bridge Equations

Because aggregate and component data series are generally created through the use of different methodologies, a lack of consistency exists in the OECD balance-of-payments data bank. To correct for these anomalies, bridge equations are employed in the individual country balance-of-payments models. Bridge equations are created by regressing one seris against another in cases where the two series should theoretically be equivalent

For example one source may provide data on total exports while another provides data on exports by category. If the value for total exports created by adding together the components does not match the reported aggregate value, the following equation will be estimated, where X1 and X2 are two series that should be equivalent but are calculated in different ways:

$$X1 = a + b \times X2$$

If the data sources are consistent, the estimated value for a will be close to zero and the value for b will be close to one. Coefficients that diverge significantly from these values identify data with a high degree of inconsistency. The econometrically estimated coefficients allow us to create a historically consistent aggregate series from its components.

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Appendix C

Regression Results

The general form of the regressions uses a price and income term, combined with a Koyck lag. In some cases—primarily because of insufficient data—unacceptable results were obtained when using the form based on price, income, and lagged quantity. In these cases, acceptable results were obtained by employing one of four alternate forms:

- Income and lagged price.
- Income, price, and lagged price.
- Price, income, and lagged income.
- Price and lagged income.

In all cases, the usual infinite lag was replaced by a one-period lag. For services, attempts to incorporate lag terms were unsuccessful. The specific results are identifiable, by heading, in this appendix.

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Regression Results: Elasticities

	Australia	Austria	Belgium/ Luxembourg	Canada	Denmark	Finland	France	Greece	Iceland	Ireland	Italy	Japan	Netherlands	New Zealand	Norway	Portugal	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	West Germany
Raw materials imports																							
Price	−0.40	−0.45	−0.34	−0.68	−1.15	−0.14	−0.09			−1.04	−0.04		−0.36	−0.34	−0.12				−1.11		−0.36	−0.68	−0.26
Income	0.13	0.33	0.64	0.50	0.39	0.09	0.07			0.26	0.99		1.18	1.16	0.52				1.17		0.11	0.35	0.92
Lagged quantity	0.47	0.74	0.62	0.59	0.12	0.88	0.46			0.54	0.26		0.41	0.16	0.17				0.67		0.41	0.27	0.12
Manufactures imports																							
Price	−0.01	−1.76		−0.35		−1.27	−0.29	−0.59		−1.23	−0.69	−0.64	−0.20	−1.62	−0.40	−0.04	−0.45	−1.42	−0.46	−0.69	−0.17	−0.83	−0.09
Income	0.06	1.46		0.85		0.16	2.42	0.24		0.57	1.57	0.91	0.38	1.23	0.32	2.73	0.32	1.75	0.23	4.10	2.32	1.29	1.12
Lagged quantity	0.94			0.50		4.75				0.70	0.27	0.44	0.79	0.25	0.63	−2.70	0.76	0.16	0.87	−0.48	0.44	0.54	0.58
Food imports																							
Price	−0.04	−0.10	−0.10	−0.18	−0.25	−0.25	−0.04			NEGL	−0.57	−0.08	−0.29	−0.49	−0.30			−0.17	−0.50	−0.60	−0.02	−0.45	−0.05
Income	0.22	0.57	1.27	0.73	1.10	0.16	1.77			0.17	0.75	0.43	0.47	1.37	0.48			0.51	1.48	3.07	0.19	0.70	0.51
Lagged quantity	0.88	0.57	0.69	0.35	0.48	0.33				1.51	0.19	0.56	0.80	0.33	0.11			0.20	0.18	−0.16	0.20	0.34	0.62
Energy imports																							
Price		−0.01			−0.33		−0.39									−0.55	−0.43						−0.20
Income		0.12			0.15		0.18									1.30	0.41						0.46
Lagged quantity		0.73			0.75		0.75									0.08	0.57						0.83
Raw materials exports																							
Price	−0.50		−0.65	−0.84	−0.03		−0.07					−0.62	−0.15	−0.26	−0.12	−0.06		−0.44	−0.13			−0.50	−0.20
Income	0.79		0.77	0.79	0.86		0.07					0.38	1.98	0.60	0.52	0.32		0.44	1.73			0.09	1.15
Lagged quantity	0.15		0.37	0.43	0.61		0.74					0.17	0.19	0.15	0.17	0.22		0.20	0.15			0.60	0.34
Manufactures exports																							
Price	−0.29	−0.29	−0.84	−0.65	NEGL	−0.04	−0.95	−0.17				−0.68	−0.10					−0.24	−0.75		−1.00	−1.17	−0.92
Income	1.81	1.46	0.35	0.85	1.09	0.94	1.10	0.58				0.40	1.75					1.45	0.83		0.98	0.54	0.44
Lagged quantity	0.31	0.35	0.42	0.61	0.58	0.60	0.47	0.48				0.88	0.61					0.38	0.37		0.64	0.67	0.68
Food exports																							
Price	−0.25		−0.70		−0.11	−0.41	−0.13				−0.41	−0.94	−0.37					−0.76	−0.31			−1.27	−0.45
Income	0.83		0.88		0.68	1.12	0.94				1.71	1.42	0.60					1.78	0.36			0.87	0.45
Lagged quantity	0.27		0.41		0.56	0.61	0.58				0.21	0.33	0.55					0.42	0.36			0.58	0.64
Energy exports																							
Price		−0.02	−0.11								−1.76			−2.36	−4.09		−0.05			−1.97	−0.10	−0.09	
Income		1.92	0.01								1.11			5.33	2.77		1.94			1.84	0.91	1.07	
Lagged quantity		0.26	0.23								0.91			0.79	0.83		0.06			0.39	0.76	0.48	
Total export volume (bridge equation)	0.97	0.96	1.27	1.11	1.03	0.92	1.15	3.52	0.50	1.04	1.01	1.01	1.18	0.96	0.79	2.16	0.85	0.98	1.12	0.66	0.93	1.05	1.11
Total import volume (bridge equation)	1.05	1.00	1.28	1.18	1.05	0.73	1.32	1.37	0.46	1.04	1.06	1.14	1.11	1.09	1.05	0.31	0.68	1.09	1.12	0.67	1.11	1.06	1.48
Total export price (bridge equation)	1.01	1.05	0.99	0.95	0.99	1.00	0.99	0.55	0.97	0.98	0.99	1.05	0.91	0.99	1.20	0.97	1.21	0.97	0.88	2.06	1.01	0.99	0.87
Total import price (bridge equation)	0.97	1.00	0.95	0.93	0.98	1.05	0.94	0.81	0.86	0.98	0.99	0.97	0.93	0.98	0.98	0.96	1.10	0.97	0.90	1.18	0.95	0.96	0.74
Dollar exports (bridge equation)	1.00	1.06	0.99	1.04	1.01	0.99	0.97	0.86	0.04	0.96	0.97	0.98	0.90	1.00	0.96	0.63	0.79	0.99	1.05	1.01	0.99	1.04	0.96
Dollar imports (bridge equation)	1.00	1.01	0.90	1.00	0.97	0.94	0.90	0.87	0.23	0.95	0.94	0.93	0.89	0.94	0.92	0.58	1.05	0.91	1.00	0.95	0.94	0.97	0.93
Service imports (income)	0.82	3.02	2.87	0.92	3.12	0.46	2.84	1.51		1.63	1.58	1.23	2.19	1.56	1.64		1.07	2.66	3.12	3.60	1.34	0.90	2.16
Service exports (income)	3.01	2.27	1.37	1.53	0.89	1.34	1.23		0.90	2.63	1.88	2.30	1.43	2.25	1.48	2.93	2.43	1.85	1.15	7.35	0.65	0.22	2.04

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Appendix D

Individual Balance-of-Payments Models

Models for individual countries were created in the environment of the Lotus 1-2-3 spreadsheet package. The regressions were estimated using the Lotus 1-2-3 regression facility, and the spreadsheet format is used to combine historical data and regression results for forecasting and scenario analysis. This appendix consists of the econometric representation of the typical country model. The coefficient values for each country are listed in Appendix B. Copies of the models on floppy disk are available on request from the West European Division, EURA.

Variables:

MAG	Agricultural products: import volume
MAGPI	Agricultural products: import price index
MEN	Energy products: import volume
MENPI	Energy products: import price index
MG	Total goods: import volume
MGPI	Total goods: import price index
MMG	Manufactured goods: import volume
MMGPI	Manufactured goods: import price index
MRM	Raw materials: import volume
MRMPI	Raw materials: import price index
NCABD	Current account balance: current dollars
NIICD	Investment income: credits in current dollars
NIIDD	Investment income: debits in current dollars
NMGD	Total goods: imports in current dollars
NMSD	Nonfactor services: imports in current dollars
NOTD	Net official transfers: current dollars
NPTD	Net private transfers: current dollars
NTBD	Trade balance: current dollars
NXGD	Total goods: exports in current dollars
NXSD	Nonfactor services: exports in current dollars
XAG	Agricultural products: export volume
XAGPI	Agricultural products: export price index
XEN	Energy products: export volume
XENPI	Energy products: export price index
XG	Total goods: export volume
XGPI	Total goods: export price index
XMG	Manufactured goods: export volume
XMGPI	Manufactured goods: export price index
XR	Exchange rate: domestic currency units per dollar
XRM	Raw materials: export volume
XRMPI	Raw materials: export price index
YD	Domestic income: volume
YW	World income: real dollars

Equations:

Import Demand

(1) $\log(MAG) = a1 + a2 \times \log(MAGPI/XAGPI) + a3 \times \log(YD) + a4 \times \log(MAG(-1))$

(2) $\log(MEN) = a1 + a2 \times \log(MENPI/XENPI) + a3 \times \log(YD) + a4 \times \log(MEN(-1))$

(3) $\log(MRM) = a1 + a2 \times \log(MRMPI/XRMPI) + a3 \times \log(YD) + a4 \times \log(MRM(-1))$

(4) $\log(MMG) = a1 + a2 \times \log(MMGPI/XMGPI) + a3 \times \log(YD) + a4 \times \log(MMG(-1))$

Export Demand

(5) $\log(XAG) = a1 + a2 \times \log(XAGPI/MAGPI) + a3 \times \log(YW) + a4 \times \log(XAG(-1))$

(6) $\log(XEN) = a1 + a2 \times \log(XENPI/MENPI) + a3 \times \log(YW) + a4 \times \log(XEN(-1))$

(7) $\log(XRM) = a1 + a2 \times \log(XRMPI/MRMPI) + a3 \times \log(YW) + a4 \times \log(XRM(-1))$

(8) $\log(XMG) = a1 + a2 \times \log(XMGPI/MMGPI) + a3 \times \log(YW) + a4 \times \log(XMG(-1))$

Total Goods Bridge Equations

(9) $MG = a1 + a2 \times (MAG + MEN + MRM + MMG)$

(10) $XG = a1 + a2 \times (XAG + XEN + XRM + XMG)$

(11) $$MGPI = a1 + a2 \times \frac{MAG \times MAGPI + MEN \times MENPI + MRM \times MRMPI + MMG \times MMGPD}{MAG + MEN + MRM + MMG}$$

(12) $$XGPI = a1 + a2 \times \frac{XAG \times XAGPI + XEN \times XENPI + XRM \times XRMPI + XMG \times XMGPD}{XAG + XEN + XRM + XMG}$$

(13) $NMGD = a1 + a2 \times (MG \times MGPD / XR)$

(14) $NXGD = a1 + a2 \times (XG \times XGPD / XR)$

Current Account Balance Aggregates

(15) $NTBD = NXGD - NMGD$

(16) $NCABD = NTBD + NXSD - NMSD + NIICD - NIIDD + NPTD + NOTD$

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Appendix E

Trade-Share Linkage Model

This model was created in the environment of the Lotus 1-2-3 spreadsheet package. The regression results were obtained from the individual country models and are combined in this spreadsheet in order to examine interactions between trade partners. These results can help with both forecasting and scenario analysis. This appendix consists of the econometric representation of key parts of the trade linkage model. Copies of this model are available on request from EURA/WE.

Variables:

DD_i	Real domestic demand: country $_i$
EX_i	Real exports: country $_i$
$EXPI_i$	Export price index: country $_i$
GDP_i	Real GDP: country $_i$
IM_i	Real imports: country $_i$
$IMPI_i$	Import price index: country $_i$
$REXR_i$	Real effective exchange rate: country $_i$
SH_{ij}	Country $_i$ imports: share coming from country $_j$
ULC_i	Unit labor cost: country $_i$
XR_i	Exchange rate: units of country $_i$ currency per dollar

Equations:

Real GDP

(1) $GDP_i = DD_i + EX_i - IM_i$

Import Demand

(2) $\log(IM_i) = a1 + a2 \times \log(DD_i) + a3 \times \log(IMPI_i/EXPI_i) + a4 \times \log(DD_i(-1)) + a5 \times \log(IMPI_i(-1)/EXPI_i(-1))$ and so on

Export Demand

(3) $EX_i = IM1 \times SH_{1i} + IM2 \times SH_{2i} + IM3 \times SH_{3i}$ and so on

Import Price Index

(4) $IMPI_i = EXPI1 \times SH_{i1} + EXPI2 \times SH_{i2}$ and so on

Real Effective Exchange Rate

(5) $REXR_i = ULC_i / XR_i \times ((SH_{1i} + SH_{i1}) / 2 \times XR1 / ULC1 + (SH_{2i} + SH_{i2}) / 2 \times XR2 / ULC2$ and so on)

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