OECD Economics Department Working Papers No. 38

Tracking the U.S. External Deficit, 1980-1985: Experience with the OECD INTERLINK Model

Pete Richardson

https://dx.doi.org/10.1787/602500188875

OECD

General Distribution

OECD

DEPARTMENT OF ECONOMICS AND STATISTICS

WORKING PAPERS

No. 38: TRACKING THE U.S. EXTERNAL DEFICIT, 1980-1985: EXPERIENCE WITH THE OECD INTERLINK MODEL

by

Pete Richardson

Econometric Unit

February 1987

OCDE

OECD

GENERAL DISTRIBUTION

ECONOMICS AND STATISTICS DEPARTMENT

WORKING PAPERS

This series of Working Papers is designed to make available, to a wider readership, selected studies which the Department has prepared for use within OECD. Authorship is generally collective, but main individual authors are named. The Papers are generally available in their original language, English or French, with a summary in the other.

Comment on the Papers is invited, and may be sent to OECD, Department of Economics and Statistics, 2 rue André Pascal, 75775 Paris, Cedex 16, France. Additional copies of the Papers on a limited basis can be forwarded on request.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

3148

TRACKING THE U.S. EXTERNAL DEFICIT, 1980-1985: EXPERIENCE WITH THE OECD INTERLINK MODEL

by

Pete Richardson (1)

---

1. The author is Head of the Econometric Unit, Economics and Statistics Department. He would like to thank numerous colleagues, in particular, Andrew Dean, Mike Feiner and Richard Herd, for comments on an earlier draft of this paper. The views expressed are his own; responsibilities for any residual errors are shared with the model.

   This paper was prepared as a contribution to the Brookings Institute Workshop on U.S. Current Account Imbalances, January 1987. The aim of this study was to provide a comparative analysis of the ability of world macroeconomic models to track U.S. current account developments in the 1980s.

This paper provides an analysis of the recent evolution of the U.S. current account external deficit in the context of the OECD Secretariat world model, INTERLINK. It seeks to assess to what extent developments in the U.S. current balance since 1980 might be viewed as being surprising, at least by the standards of the relationships embodied in the current U.S. trade block of that model.

* * * * * * *

Cet article analyse l'évolution récente du déficit du compte courant des Etats-Unis dans le contexte du modèle INTERLINK, le modèle mondial du Secrétariat de l'OCDE. Le but est d'évaluer dans quelle mesure les développements constatés depuis 1980 dans la balance courante des Etats-Unis peuvent être considérés comme surprenants, au moins selon les critères des relations qui figurent actuellement dans le bloc des échanges des Etats-Unis dans le modèle.

TABLE OF CONTENTS

Annex

THE STRUCTURE OF THE U.S. TRADE BLOCKS IN THE OECD INTERLINK MODEL

TABLES

ANNEX TABLES

TRACKING THE U.S. EXTERNAL DEFICIT, 1980-1985: EXPERIENCE WITH THE OECD INTERLINK MODEL

I. INTRODUCTION

1. This paper provides an analysis of the recent evolution of the U.S. current account external deficit in the context of the OECD world model, INTERLINK. It seeks to assess to what extent developments in the U.S. current balance since 1980 might be viewed as being surprising, at least by the standards of the relationships embodied in the current U.S. trade block of that model.

2. With many of the model equations involved estimated on data sets which end in the late 70s, the exercise also represents a post-sample tracking analysis. To the extent that observed errors are correlated with key economic variables, this also provides some powerful insights into the possible variability of responses and imprecision in U.S. trade sector relationships over the recent past. The extent to which systematic errors reflect structural breaks in behaviour rather than original specification errors remains to be explored by future estimation work.

3. General background to the OECD INTERLINK model and, in particular, the relevant structure of the U.S. trade sector is given in an accompanying technical annex, "The Structure of the U.S. Trade Block in the OECD INTERLINK Model". The following sections consider in turn a brief analysis of major developments in U.S. external balances since 1980, a discussion of technical issues affecting the interpretation of results for residual analyses of the INTERLINK system and then a presentation of results for the period 1980-1985, both for single equations and for full U.S. trade block simultaneous solutions. A final section draws some overall conclusions on the evidence of bias or structural change over the period, which are relevant to the forecasting and the related simulation properties of the model.

II. DEVELOPMENTS IN THE U.S. EXTERNAL BALANCE SINCE 1980

4. As background to the evaluation of the model results which follow, this section looks briefly at developments in the U.S. external balance from 1980 to the first half of 1986 from a largely statistical viewpoint.

5. The basic ingredients of the sustained deterioration in the U.S. balance of payments current account position over the period in question are summarised in Table 1 opposite, in terms of the starting and terminal levels of the various nominal balances (in 1980 and the most recent half-year), and the year-on-year changes in balances between these dates. On this basis, one sees that although there has been some small deterioration on the invisibles account, the most significant part of the emerging deficit, which has grown to around 3 1/2 per cent of GNP by mid-1986, has been in the visible trade balance, with a general improvement in the balance for non-manufactures more than offset by a major deterioration in the manufactures balance. In terms of timing, incremental changes in the various balances show the latter deterioration to be under way as early as 1981, reaching a peak in 1984 and decelerating slightly thereafter. With regard to the current balance, the peak deterioration in 1984 is significantly greater, given a deterioration in both trade and services balances in that year.

6. Table 1, of course, conceals a much richer story insofar as the various balances involved are each the differences in large nominal magnitudes which in turn embody real and price components. Table 2, therefore, takes the description a step further by looking at the year-on-year movements in nominal goods and services balances into separate contributions which can be associated directly with the changes in real export and import volumes and the terms of trade. The basis of this decomposition is given by the identity relationships set out in the footnote to that table. The valuation basis chosen, that of using the starting levels of volumes and prices for each period to evaluate the contribution of changes over the succeeding period, is one of a number of plausible alternatives, but does not materially affect the results. The absence of a significant "cross-product" residual is also encouraging.

7. Viewed from this perspective, a number of points emerge. For manufactures, the deterioration in nominal balance has been entirely on the volume side, with exports and imports showing major but not surprising differences in timing. For export volumes, the deterioration has been broadly concurrent with the appreciation of the dollar, though the overall position stabilised soon after its peak movement in 1982. With respect to import volumes, significant increases in the negative contribution to the balance have been broadly concurrent with the cycle in domestic demand growth, though clearly the relative cheapness of imports in the period of appreciation is also likely to have been a contributing factor. The terms of trade contribution for manufactures shows a one-off improvement in 1981 which has been broadly maintained over the period.

8. The origin of movements in the balance of non-manufactures are rather more diverse. For export volumes, the main deterioration reflects generally poor performance in U.S. exports of foodstuffs and raw materials over much of the period, associated perhaps with supply factors. For import volumes, the most important contribution has come from energy imports which in the wake of the second oil shock fell sharply in the first three years. Except for 1981, the terms of trade contribution for non-manufactures has been broadly positive. The decomposition for goods and services shows little significant difference from that for total goods, with a somewhat stronger negative contribution from goods and services

Table 1

U.S. CURRENT BALANCE MOVEMENTS, 1980-1986(1)

	level $b 1980	Year-on-year changes (U.S. $b) 1981	1982	1983	1984	1985	1986(1)	level $b 1986(1)
Current balance	2	4	-15	-38	-60	-11	-19	-137
Net transfers	-7	0	-2	-1	-3	-3	2	-14
Factor income	30	3	-4	-7	-5	7	0	24
Non-factor services	4	3	-1	1	-7	-3	1	-2
Trade balance	-25	-2	-8	-31	-45	-12	-22	-145
of which: Non-manufactures	-40	6	10	-4	3	12	5	-8
Manufactures	15	-8	-18	-27	-48	-24	-27	-137

Memorandum items	1980	1981	1982	1983	1984	1985	1986(1)
External balance (as share of GNP)	0.1	0.2	-0.3	-1.4	-2.8	-2.9	-3.3
Real GNP (% p.a.)	-0.2	1.9	-2.5	3.6	6.4	2.7	2.5
Domestic demand (% p.a.)	-1.8	2.2	-1.9	5.1	8.3	3.4	3.3
Effective exchange rate(1) level	1.00	1.12	1.24	1.31	1.42	1.49	1.28
% p.a.	-0.4	12.4	10.6	5.7	8.3	4.4	-18.2

1. Against weighted OECD currencies only; (+) indicates U.S. dollar appreciation.

Table 2

APPROXIMATE DECOMPOSITION(1) OF CHANGES IN NOMINAL U.S. TRADE BALANCES, 1980-1985

	Year-on-year changes (U.S. $bn)				
	1981	1982	1983	1984	1985
Goods and services (N.A. basis)					
Change in nominal balance,	2	-8	-31	-38	-20
of which contributions from:					
Export volumes	3	-30	-14	22	-8
Import volumes	-11	8	-32	-83	-17
Terms of trade	10	15	14	8	5
residual	0	-1	1	1	0
Goods (BoP basis)					
Change in nominal balance,	-3	-9	-30	-46	-12
of which contributions from:					
Export volumes	-7	-29	-11	15	-4
Import volumes	-2	12	-31	-58	-15
Terms of trade	7	9	11	-2	7
residual	-1	-1	1	-1	0
Non-manufactures					
Change in nominal balance,	4	9	-3	2	12
of which contributions from:					
Export volumes	0	-5	-7	7	-6
Import volumes	10	9	-8	-5	13
Terms of trade	-7	5	12	0	5
residual	1	0	0	0	0
Manufactures					
Change in nominal balance,	-8	-18	-27	-49	-24
of which contributions from:					
Export volumes	-8	-24	-4	8	2
Import volumes	-12	3	-23	-53	-28
Terms of trade	14	4	-1	-2	2
residual	-2	-1	1	-1	0

1. Decomposition of changes in balances are based on the following identity:

$$B(2) - B(1) = \underbrace{[X(2)-X(1)].PX(1)}_{\text{"Export Volumes"}} - \underbrace{[M(2)-M(1)].PM(1)}_{\text{"Import Volumes"}}$$

$$+ \underbrace{[PX(2)-PX(1)].X(1) - [PM(2)-PM(1)].M(1)}_{\text{"Terms of Trade"}}$$

$$+ \underbrace{[PX(2)-PX(1)].[X(2)-X(1)] - [PM(2)-PM(1)].[M(2)-M(1)]}_{\text{"residual cross-product"}}$$

import volumes in 1984 partially offset by the relatively more favourable positive contributions from export volumes and the overall terms of trade.

III. SOME NECESSARY QUALIFICATIONS

9. Whether or not a qualitative explanation can be found for the origins and growth of the U.S. external deficit, a key question remains whether it can be explained in quantitative terms, i.e. in the context of some representation of the quantitative relationships between the various components of U.S. trade and other economic variables, both for the United States and the rest of the world. In this respect, the analysis of the single equation and simultaneous system errors of an appropriate macroeconomic model should be generally useful. Where such a model is empirically well-based, the relevant comparison is between actual outturn and those implied by historically "well-established" relationships. To the extent that most models also incorporate strong prior assumptions, either in the form of imposed parameters or imposed structure, such priors will also be important.

10. In any event, though, the usefulness of such information also depends on how generally reliable the model has been over the estimation sample period. As with other forms of post-sample stability tests, the more accurate a model is in the sample period, in terms of low error variances, the more reliable post-sample tests for structural breaks may be. To the extent that individual equations are generally poor or the degree of accuracy quite variable across equations, then such evidence is likely to be ambiguous. One researcher's "structural break" may well correspond to another researcher's "specification error" and at best we may be left with statements to the effect that various speeds of adjustment and orders of magnitude for parameters turned out to be different from what was previously believed to be acceptable. Such comparisons may nevertheless provide quite powerful insights from the point of view of specification testing and future model development.

11. Before discussing the results of dynamic tracking tests for the U.S. trade sector equations of the model, some specific qualifications are in order concerning the general structure and use of the INTERLINK system. These are relevant to the interpretation of results, both general and specific, which emerge from exercises of this nature.

12. Until recently, Secretariat use of the INTERLINK model for forecasting analysis has been largely confined to a one- to two-year time horizon. Given such a short-term orientation, the trade sector equations are largely expressed in terms of rates of change. With residuals set to zero from a fixed starting point, as in the present exercise, tracking errors therefore represent a cumulative prediction error. A particularly large error, for example in 1981, would, unless fully offset in a subsequent period, have continuing effects over the full period of analysis. This feature may be particularly important for longer-term projections.

13. The trade equations are also part of the oldest "core" sector of the model and for many of them the present exercise therefore represents a full post-sample tracking analysis. Although residual checks and dynamic tracking tests of this kind are an integral part of the methods and procedures used in forecasting with INTERLINK, the use of a uniform and mechanistic zero add-factor extrapolation rules implicit in this present exercise is not. In practice, the relevant analysts make an assessment of past equation errors, looking for evidence of systematic positive or negative biases, taking account of the possibility of variability in specific parameters, speeds of response, autocorrelation of errors and known excluded factors. Where any of these factors are considered important to the forecast period, then explicit adjustments are introduced through add-factor settings and, exceptionally, temporary changes to parameters or equations. Corrections of the standard version of the model for known and persistent sources of bias, insofar as new equation estimates are necessary, are generally slower to emerge, but are given significant weight in determining research priorities. Some comments on areas where known defects currently exist, for example import prices, are incorporated in the discussion of the following section.

14. Given the varied uses of the model, the acceptability of simulation properties and consistency of equation design within a world system are often given more weight than single-equation goodness-of-fit. In some areas of the model, for example investment income, the present equations were not chosen specifically for their predictive accuracy, but as an acceptable representation for simulation purposes of a more detailed forecasting procedure. In other areas, for example, energy prices, the present equations were imposed as a reasonable "technical assumption".

IV. SINGLE EQUATION PERFORMANCE SINCE 1980

15. The current and following sections provide basic statistics and analysis relevant to the tracking performance of the INTERLINK U.S. trade sector for the period 1980 to end-1985, based on single-equation dynamic and simultaneous trade block solutions. The relevant model predictions were derived from block and sub-block solutions in which all relevant equation residual add-factors were set to zero. No allowance has been made for serial correlation, though as noted earlier many equations are in rate-of-change form. All essential U.S. and non-U.S. "domestic" variables have been maintained at their actual historical values. Partial block simulations with minimal identity feedbacks were also performed to give some indication of the impact of single-equation tracking errors on selected trade aggregates and sub-aggregates, real GNP and the GNP deflator.

16. In all associated tables, the reporting convention used relates to actual prediction errors rather than equation residuals. The various quantities shown are therefore measured in terms of forecast less actual baseline values, either in nominal values or expressed as a percentage of the actual outturn. Contrary to the usual econometric notation for residuals, positive (negative) errors therefore indicate over- (under-) prediction. Relevant information on estimation sample lengths and estimated

standard errors, where available, are summarised in the accompanying note on model structure.

17. Tables 3 to 6 provide a summary of single-equation dynamic prediction errors and related equation error diagnostics. The following paragraphs provide an outline of the main features by general trade category and commodity group.

i) Trade Volumes

a) Manufactures

18. For exports of manufactures volume the main feature has been systematic overprediction in 1981 and 1982 followed by substantial underprediction from 1983. In terms of volume growth, the equation copes reasonably well in 1982, the point where exports fell most substantially with cumulative rise in the dollar, but goes on to predict a further substantial fall for 1983.

19. Table 4 decomposes the single-equation predictions for manufactures import and export volume growth into the individual contributions from the activity and competitiveness variables included in the equations. Given this breakdown, two main points emerge for export volumes. First, the patterns of residuals and independent variable contributions are such that the lag distribution associated with the competitiveness response seems to have been rather more front-loaded than those incorporated in the model. Thus, although the fall in competitiveness is seen to have some negative effect on the equation prediction for 1981, this is much too small, given relatively strong growth in U.S. markets, to account for the 5 per cent fall in export volumes in that year. Given a mean lag of one-and-a-half years for the competitiveness response, the equation also wrongly predicts the peak competitiveness effect to be in 1983. Secondly, the overall negative correlations between prediction errors and the lag-weighted competitiveness variable suggests that the overall elasticity at 4 is perhaps too high (crude calculations suggest by up to 25 per cent). Of course, both conclusions are tentative; the competitor price variable used is a construct based on the weighted average of competitors' prices for manufactures in all markets. To the extent that actual competitor prices may have adjusted disproportionately for goods competing directly with U.S. goods, so as to increase profit margins, then the measured deterioration in U.S. competitiveness would have been too great.

20. For manufactured import volumes, the single-equation tracking errors are relatively large and show an increasing degree of underprediction over time. Even so, given the actual volatility of imports in this category, the equation does reasonably well in capturing the broad pattern and timing of import growth over the period. Table 4 again provides some useful insights into the factors influencing the equation predictions. Here it can be seen that the progressive increase in residuals over the period largely reflects the failure to pick up the full extent of the sharp rises in 1981 (5 1/2 per cent predicted against 9 per cent actual), 1983 (9 1/2 per cent predicted against 15 per cent actual), and 1984 (20 per cent predicted against 30 per cent actual). Crude comparisons between

Table 3

SINGLE-EQUATION DYNAMIC TRACKING ERRORS: U.S. TRADE VOLUMES

	1980	1981	1982	1983	1984	1985
	% deviations from actual levels(1)					
Export volumes(2)						
Manufactures	-2.1	6.4	8.3	-6.8	-10.3	-14.2
Non-manufactures	0.4	1.7	4.2	11.7	15.9	27.2
Total goods (BoP basis)	-1.5	5.1	3.9	-1.8	-3.3	-3.7
Non-factor services	-6.7	-7.8	-6.0	-11.3	-6.7	-6.0
Factor services	-5.3	-2.6	-6.5	0.8	-1.4	-6.8
Total goods and services (N.A. basis)	-3.0	1.4	-0.2	-2.5	-3.2	-4.7
Import volumes(2)						
Manufactures	-0.9	-4.0	-5.3	-8.6	-15.8	-18.5
Non-manufactures	8.1	14.7	13.5	17.0	25.9	42.2
Total goods (BoP basis)	3.2	3.5	1.8	0.2	-3.2	-2.0
Non-factor services	-1.9	-1.9	0.7	5.9	3.0	6.4
Factor services	-0.8	2.5	10.3	24.3	17.3	43.0
Total goods and services (N.A. basis)	2.0	2.7	3.0	3.9	0.4	5.0
Goods and services balance (% of real GNP)	-0.6	-0.1	-0.3	-0.7	-0.4	-1.1

1. Tracking errors are measured as percentage deviations from actual outcomes: (+) indicates overprediction; (-) indicates underprediction

2. Aggregates based on aggregated residuals from individual single equations.

Table 4

DECOMPOSITION OF SINGLE-EQUATION PREDICTIONS
OF U.S. MANUFACTURES VOLUME GROWTH

	1980	1981	1982	1983	1984	1985
	year-on-year % change					
Export volumes						
Contributions from:						
(a) World demand	4.7	6.5	-5.0	3.0	11.3	4.0
(b) Price competitiveness	4.3	-3.3	-12.5	-15.2	-9.0	-6.9
Total predicted growth(1)	9.0	3.1	-17.5	-12.6	1.8	-3.1
Residual	0.7	-8.2	2.0	10.0	4.0	4.5
Actual growth	9.7	-5.1	-15.1	-2.7	5.8	1.4
Import volumes						
Contributions from:						
(a) U.S. demand	-0.8	5.3	-4.2	8.1	17.8	7.1
(b) Price competitiveness	-2.4	-0.9	1.7	3.2	2.3	1.4
Total predicted growth	-3.1	4.3	-2.6	11.5	20.2	8.5
Residual	1.3	4.8	0.9	3.4	10.0	3.3
Actual growth	-1.8	9.2	-1.7	14.8	30.1	11.8

Table 5

SINGLE-EQUATION DYNAMIC TRACKING ERRORS: U.S. TRADE PRICES DEFLATORS

	1980	1981	1982	1983	1984	1985
	% deviations from actual levels(1)					
Export price deflators						
Manufactures	3.8	0.5	-0.6	4.6	2.2	3.5
Non-manufactures	-2.0	-5.4	-7.9	-13.1	-12.3	-12.2
Total goods(2)(BoP basis)	2.0	-1.2	-3.7	-0.6	-3.0	-0.6
Services	1.8	6.4	5.4	4.5	5.2	5.7
Total goods and services (N.A. basis)	1.9	1.6	0.5	1.4	0.8	2.0
Import price deflators						
Manufactures	-3.0	-5.7	-11.2	-11.7	-16.2	-17.1
Non-manufactures	-1.2	-2.2	-1.3	-5.6	-10.5	-12.2
Total goods(2)(BoP basis)	-2.1	-4.2	-7.4	-9.6	-14.5	-15.8
Services	0.4	-6.7	-10.1	-10.4	-11.8	-12.7
Total goods and services (N.A. basis)	-1.5	-4.9	-8.2	-9.8	-14.0	-15.2
Goods and services						
Terms of trade	3.4	6.5	8.7	11.2	14.8	17.2
Memorandum item:						
Effective exchange rate (1980 = 1.00)	1.00	1.12	1.24	1.31	1.42	1.49
% change	-0.4	12.4	10.6	5.7	8.3	4.4

1. Tracking errors are measured as percentage deviations from actual outcomes:

   (+) indicates overprediction;
   (-) indicates underprediction

2. Aggregates based on aggregated residuals from individual single equations.

Table 6

SINGLE-EQUATION TRACKING ERRORS: U.S. INVESTMENT INCOME

	1980	1981	1982	1983	1984	1985
	deviations from actual levels(1)					
Credits(2)						
Effective rate of return on assets (% pts.)	-0.6	-0.4	-0.3	0.4	-0.1	-0.8
Total receipts ($bn)	-3.8	-2.3	-5.6	0.6	-1.2	-6.2
Debits(2)						
Effective rate of return on liabilities (% pts.)	-0.3	-0.2	0.9	1.6	0.8	1.8
Total payments ($bn)	-0.3	1.3	5.6	12.8	11.7	27.9
Investment income balance	-3.5	-3.6	-11.2	-12.2	-12.8	-34.1
Memorandum item						
Short-term interest rates						
U.S. asset weighted	10.9	13.3	10.1	8.0	8.8	7.3
U.S. liabilities weighted	11.4	13.9	10.5	8.6	9.5	7.5

1. Tracking errors measured as deviation from actual levels:

   (+) indicates overprediction
   (-) indicates underprediction

2. Nominal income flows and balance based on the errors for the rates of return applied to actual asset and liability stocks.

residuals and the demand component suggest a marginal response during the period of the order of 3.0, compared with the estimated elasticity of 2.0.

21. For the volume balance in manufactures, the single-equation errors tend to offset but nonetheless imply a general underprediction of the cumulative deficit, ranging from $12 billion to $20 billion in 1982 prices.

b) Non-manufactures

22. Although food, raw materials and energy are treated separately in the model, they are for convenience summarised as a group in Table 3.

23. For export volumes, the main feature is a cumulative overprediction from 1982. The relevant model equations are essentially imposed with unit market growth elasticities so that the extent of overprediction indicates the degree to which exports failed to grow in line with world demand. Excluding energy, exports in this category in fact fell by 30 per cent over the period, which cannot be easily explained by a demand-based model.

24. Cumulative overprediction is also a feature of the corresponding import volume equations, reflecting the failure of primarily activity-based equations to predict the sustained falls in raw materials and energy imports over the period. For energy, the pattern of substitution effects for the first half of the period given by the equation is broadly correct but is more than offset by strong activity effects in the latter half of the period, reflecting relatively buoyant growth of domestic demand. On balance, the outcomes for energy would be seen to be consistent with a lower and more gradual activity response.

25. With prediction errors for both export and import volumes of non-manufactures positive for most of the period, the overall error for the volume balance is somewhat smaller. In contrast with manufactures, the net effect is an overprediction of the deficit of the order of $10 billion to $25 billion in 1982 prices. Combining this result with that for manufactures, the prediction errors for total goods volumes are generally very small, at most implying a volume deficit greater by $7.5 billion in 1983.

c) Services

26. For non-factor services export volumes, the equation persistently underpredicts. Two points are worth noting. First, the general level of underprediction (of the order of 6 to 7 per cent) comes from the failure to account for the particularly large, 10 1/2 per cent increase in non-factor service exports in 1980. Thereafter, prediction errors are reasonably stable, except for 1983, where the equation predicts a larger fall in export volumes than occurred (-7 1/2 per cent predicted against -1/2 per cent actual). Examination of the relevant independent variables in that year shows a major contributory factor to be a significant (5 per cent) fall in non-U.S. service import volumes. Insofar as residuals beyond 1983 return to a stable level, this would suggest a difference in timing of the response rather than an inappropriate elasticity. Again, this might imply a problem with the choice of measure for market growth rather than the associated parameter estimates.

27. Prediction errors for imports of non-factor services are well within the standard error of the estimated equations for the first three years. Thereafter there has been a tendency to overpredict, by roughly 6 per cent in 1983 and 1985. There is no clear evidence of bias with respect to either activity or competitiveness elasticities.

28. An analysis of results for factor-related services, which are produced in a nominal framework, is given in later paragraphs. In real terms, exports for this category are generally underpredicted, whilst imports substantially overpredicted. The net effect has been to generally underpredict the real surplus on investment income.

d) Goods and services

29. Aggregating over all goods and services volumes, the general tendency has been to underpredict total exports in real terms and consistently overpredict real imports over the period. The net effect on the volume balance shown at the foot of Table 3 is a relatively stable negative prediction error for the level contribution to domestic income, averaging about 1/2 per cent of GNP over the period.

ii) Trade prices

30. The single-equation dynamic prediction errors for price deflators corresponding to the volume categories in Table 3 are shown in Table 5. As for trade volumes, aggregate and semi-aggregate prediction errors are given on the basis of aggregated single-equation results.

a) Manufactures

31. For manufactures export prices the equation has tended to overpredict for much of the period, by an average 2 1/2 per cent, but with no clear source of systematic bias. This is not the case for the corresponding import deflator equation, which underpredicts by significant and progressively larger amounts over the period, 17 per cent by 1985. Equation residuals are clearly correlated with the exchange rate and therefore consistent with the view that importers to the United States took the opportunity to raise their margins substantially with the rise in the dollar.

32. In terms of the equation, this result implies that too large a weight is given to the so-called "shadow price" of imports based on the U.S. weighted prices of exporters. Although earlier research based on samples ending in the late 1970s is reasonably unambiguous in support of a weight close to unity for the United States, more recent estimates suggest a weight closer to 0.6, and these have been given some weight in recent Secretariat forecasts. As discussed in the background note on model structure, such a modification has wider implications for the consistency of import prices in the world system and the overall robustness of the result across countries is therefore being examined in current Secretariat research.

33. The combined prediction errors for manufactures deflator imply a substantial overprediction of the terms of trade over the period.

b) Non-manufactures

34. The equations for non-manufactures export price deflators consistently underpredict over the period. A dominant element comes from energy prices where the equation -- representing no more than a neutral technical assumption -- clearly failed to pick up the full effect of the second oil shock. Although there is some reversal as the dollar price of energy eased from 1983, underprediction of energy prices remains substantial, at 20 per cent in 1985. For both food and raw materials, the equations fail to pick up much of the considerable price variability, with a general tendency towards underprediction, particularly in the second half of the period. For the group as a whole, therefore, the model again appears to give too much weight to world prices, although much of this is due to oil prices.

35. For non-manufactures import prices, there is also a tendency towards underprediction, though by moderate amounts in the first three years. For both food and raw materials, the profile of residuals, like that for manufactures, suggest that too great a weight is given to the "shadow price" of imports. Raw materials, in particular, have been subject to little or no downward pressure over the period, as suggested by the equation, indeed quite the reverse in 1983 and 1984. The energy import price equation, in contrast, tends to overpredict but by a relatively stable 6 per cent over the period.

36. The combination of import and export deflator prediction errors implies a general underprediction of the non-manufactures terms of trade, notably in the first four years.

c) Services

37. The service price deflator equations appear to suffer from two extreme hypotheses. For service credits, the current equation overpredicts substantially from 1981, in a way that suggests that some weight (perhaps 10 per cent to 20 per cent) should also be given to world prices. For service debits progressive underprediction, as for manufactures, would seem to imply too large a weight for world prices and the need for a greater domestic cost influence (of the order of 30 per cent).

d) Goods and services

38. Aggregating the various prediction errors across goods and services, the overall results for exports is a small net overprediction over the period, with the significant underprediction for non-manufactured goods more than offset by overprediction for manufactures and services. For import prices, the single-equation prediction errors are uniformly in one direction, negative, and consistent with the view that U.S. import prices adjusted less than fully to dollar appreciation. The overall result for the goods and services terms of trade is a large and rising positive error, that is an overprediction of the relative price of exports to imports.

iii) Investment income

39. The main features of the single-equation performance of the investment income block are shown in Table 6, in terms of prediction errors for the effective rates of return on assets and liabilities. The implication for nominal credit and debit flows and balances are also evaluated on the basis of actual asset and liability stocks.

40. For assets, the prediction errors for the first half of the period are relatively small and stable. Overprediction in 1983 reflects the failure to pick up the full effect of the fall in interest rates on effective yields in that year but is progressively reversed in 1984 and 1985. In terms of nominal flows, total receipts are underpredicted by an average $3 billion.

41. For liabilities, the prediction errors are small and negative for the first two years. Thereafter, the equation fails to capture the full extent of the fall in liabilities-weighted rates, consistent with a faster adjustment process and significantly higher long-run coefficient, perhaps as high as 0.7, compared with an estimated 0.43. Given the steady increase in the liability stock over the period, the implied overprediction of payments rises sharply in later years. The combined equation errors imply a progressive underprediction of net investment income since 1982.

V. FULL TRADE BLOCK PERFORMANCE

42. The full-system tracking errors for the U.S. trade block are presented in Tables 7 to 10. Given the sizable single-equation prediction errors for the individual components presented in the previous section, the main focus of interest lies in the extent to which such errors work through the system and impact on its principal outputs -- the nominal U.S. balances and the trade contributions to the growth of real GNP and domestic inflation.

43. With regard to nominal balances, the full trade block predictions shown in Table 7 are surprisingly accurate, with a zero average error over the six years considered and a maximum prediction error of a little under +$20 billion in 1984. For the balance of services, prediction errors are generally negative and, with the exception of 1985, where investment income payments are seriously overpredicted, are relatively minor. Prediction errors for the visible trade balance are mostly positive, consistent with a smaller deficit, reflecting a more optimistic model result for the manufactures balance which more than offsets relatively stable negative prediction errors for the non-manufactures balance. In nominal terms, the scale of both exports and imports of manufactures are underpredicted, substantially so towards the end of the period. The errors for imports are, however, consistently more negative, implying increasing prediction errors for the net manufactures balance.

44. From the point of view of nominal balances, therefore, both the scale and growth of the U.S. current balance deficit since 1980 appear to

Table 7

FULL-SYSTEM TRACKING ERRORS: NOMINAL U.S. BALANCES

	1980	1981	1982	1983	1984	1985
	deviations from actual levels ($bn)					
Current balance	-8	4	1	-5	19	-8
Net factor income	-3	-2	-9	-9	-7	-26
Non-factor services	-2	1	0	-7	-2	-4
Trade balance	-3	5	10	11	28	22
Non-manufactures	-9	-13	-10	-7	-9	-18
Manufactures	5	18	20	18	37	40
of which: Exports	1	6	2	-4	-15	-21
Imports	-4	-12	-18	-22	-52	-61

Table 8

FULL-SYSTEM TRACKING ERRORS: U.S. TRADE VOLUMES

	1980	1981	1982	1983	1984	1985
	% deviations from actual levels(1)					
Export volumes						
Manufactures	-2.9	4.3	3.5	-5.2	-9.3	-13.1
Non-manufactures	0.4	1.7	4.2	11.7	15.9	27.2
Total goods	-2.1	3.5	3.7	-0.6	-2.6	-2.9
Non-factor services	-6.9	-8.8	-7.6	-12.5	-8.0	-7.5
Factor income	-6.8	-8.6	-11.7	-4.1	-6.9	-12.8
Total goods and services (N.A. basis)	-3.8	-1.1	-1.9	-3.0	-4.2	-5.8
Import volumes						
Manufactures	-0.5	-2.4	-0.4	-0.8	-6.9	-7.2
Non-manufactures	7.9	13.8	12.1	15.1	23.8	39.7
Total goods	3.3	4.1	4.3	4.6	2.3	5.3
Non-factor services	-2.1	0.8	9.0	16.7	14.4	21.0
Factor incomes	-2.0	7.1	17.5	30.5	23.0	48.1
Total goods and services (N.A. basis)	1.9	4.2	7.0	9.2	6.7	12.9
Goods and services balance (% of GNP)	-0.7	-0.6	-0.9	-1.4	-1.3	-2.3

1. Tracking errors are measured as percentage deviations from actual outcomes: (+) indicates overprediction; (-) indicates underprediction

Table 9

FULL-SYSTEM TRACKING ERRORS: U.S. TRADE PRICES(1)

	1980	1981	1982	1983	1984	1985
	% deviations from actual levels					
Export prices						
Manufactures	3.5	-0.4	-2.1	2.1	-0.9	-0.9
Non-manufactures	-2.2	-4.1	-6.2	-11.2	-9.5	-9.6
Total goods	2.0	-1.4	-3.4	-2.1	-3.8	-4.4
Services	1.8	6.5	5.4	4.5	5.2	5.7
Total goods and services (N.A. basis)	1.9	1.4	-0.2	0.3	-0.5	-0.7
Import prices						
Manufactures	-3.0	-5.7	-11.2	-11.7	-16.2	-17.1
Non-manufactures	-1.4	-3.0	-2.8	-6.6	-10.0	-9.6
Total goods	-2.2	-4.2	-7.9	-10.1	-14.6	-15.8
Services	0.4	-6.7	-10.1	-10.4	-11.8	-12.7
Total goods and services (N.A. basis)	-1.5	-4.8	-8.5	-10.1	-13.9	-14.8
Goods and services terms of trade (% of GNP)	3.4	6.2	8.3	10.4	13.4	14.1
Implicit error for the GNP deflator (%)	0.4	0.7	1.0	1.3	1.8	2.1

1. The calculation of aggregate deflators involves both predicted volumes and prices for the individual categories. Corresponding tracking errors are therefore not simple averages of errors for component prices.

Table 10

FULL-SYSTEM TRACKING ERRORS: U.S. INVESTMENT INCOME

	1980	1981	1982	1983	1984	1985
Credits						
Effective rate of return on assets (pts.)	-0.6	-0.4	-0.3	0.4	-0.1	-0.8
Total receipts ($bn)	-3.7	-2.3	-5.9	0.2	-1.8	-7.0
Debits						
Effective rate of return on liabilities (pts.)	-0.3	-0.2	0.9	1.6	0.8	1.8
Total payments ($bn)	-0.7	-0.1	3.1	8.9	5.6	19.0
Investment income balance ($bn)	-3.0	-2.2	-9.0	-8.7	-7.4	-26.0

be reasonably well-captured by the model, given both the scale of the gross flows involved and the variability of domestic and world circumstances. This is clearly not the case for the various splits between prices and volumes or exports and imports. The comparison of Tables 8 and 9 with their single-equation counterparts 3 and 5 provides a number of important insights into the interaction of prediction errors in the model.

45. For export volumes, one of the main contrasts between single-equation and trade block solutions is the general reduction in the negative prediction errors for manufactures. This reflects the impact of the underprediction of import prices on export costs and export prices, thereby reducing the predicted impact of U.S. competitiveness losses. For non-factor services, the overprediction of the services deflator works in the opposite direction, adding to the predicted loss of competitiveness and the underprediction of services volumes. With investment income credits relatively well-captured in nominal terms, the overprediction of the services deflator also implies a significant underprediction of the corresponding volume series. Thus, although the volume errors for total goods exports are generally smaller in the full block solution, those for goods and services are larger and more negative.

46. For import volumes, price prediction errors have a greater impact. The systematic underprediction of manufactures import prices yields a significant reduction in the degree of overprediction for manufactures volumes through competitiveness effects. For non-manufactures goods, the main differences in the trade block results reflect the underprediction of export volumes which, through the effect of weighted expenditures, tends to give some slight reduction in the degree of overprediction. For total goods, the overall result is a relatively stable and positive error in the range of 2 1/2 per cent to 5 1/2 per cent. The prediction errors for service import volumes are generally larger, given the underprediction of the services deflator. For real goods and services imports as a whole, there is therefore a general tendency towards greater overprediction. Given this and the overall increase in negative errors for export volumes, the real goods and services balance is more adverse in the full block solution, varying between -1/2 per cent and -2 1/2 per cent as a share of GNP over the period. Between 1980 and 1985, this is equivalent to a net downward bias in the ex-ante contribution to GNP growth of a little over 1/4 per cent per annum.

47. As outlined above, the main interaction of residuals for trade prices concerns the effect of the underprediction of import costs on export prices. To the extent that the negative errors for import deflators are relatively unchanged whilst those for total export deflators switch from positive to negative, the errors in the terms of trade are generally reduced, significantly so towards the end of the period. The direct impact of errors on the terms of trade on the GNP deflator level, i.e. for a given path of the domestic demand deflator, rises over the period from 1/2 per cent to 2 per cent, equivalent to 1/4 per cent per annum. However, in full model solution -- permitting also the full impact of import price errors to feed through into domestic costs -- the cumulative error in the terms of trade would be more or less fully offset at the level of the GNP deflator by a corresponding underprediction of the domestic demand deflator.

48. It is interesting to note that the individual residuals for prices and volumes interact in a way which tends to reduce the overall prediction errors for the nominal goods and services balance. This largely reflects the fact that for imports the overall relative price elasticity is sufficiently close to unity for errors on the import price level to be offset through the competitiveness response. This is not generally the case for exports, where system results imply consistently more negative prediction errors.

49. Turning finally to investment income flows, in Table 10, there is no change in prediction errors for the effective rates of return, the determining interest rates and exchange rates being exogenous to both single-equation and trade block solutions. For nominal balances, however, cumulative prediction errors in the overall current account feed into the stock of liabilities. Compared with the single-equation results, the net effect is relatively small but generally implies some reduction in the degree of overprediction of debit outflows and therefore some small improvement in the corresponding net balance.

VI. SUMMARY CONCLUSIONS

50. The main points to emerge from the above analysis may be summarised as follows:

a) Terms of trade. For goods and services as a whole, the prediction errors for export prices have been relatively small. For import prices, however, the effects of dollar appreciation appear to have been a good deal less than assumed by the model, and these are therefore significantly underpredicted. For the nominal value of imports, this has a relatively minor effect, given a competitiveness elasticity close to unity. The net effect of prediction errors for the terms of trade on the GNP deflator in a full-system solution is also likely to be quite small, given due allowance for the pass-through of import price errors to domestic costs and prices.

b) Import volumes for manufactures are significantly underpredicted by the model, reflecting a higher-than-assumed marginal propensity to import. For goods and services as a whole, however, import volumes are significantly overpredicted, reflecting positive errors for all other categories. For non-manufactures, this may imply too high an activity elasticity. In the case of investment income, significant overprediction is due to the seemingly small but powerful overprediction of the rate of return on liabilities, associated with perhaps too low and too slow a response with respect to changes in short-term interest rates.

c) Export volumes prediction errors are predominantly negative. In the case of manufactures, this is associated with too slow and possibly too large an adjustment to movements in price competitiveness. For non-manufactures, the model provides no explanation of consistently poor performance over the period.

d) Net trade volumes. Given the negative correlation between errors for export and import volumes, the model gives a net underprediction of GNP growth over the period of the order of 1/4 per cent per annum.

e) Current balance. For the current balance as a whole, the model performs extremely well over the period. This result comes about, however, because of off-setting errors between the manufactures balance, which has been rather worse, and the services balance, which has been rather better than the model would imply.

Annex

THE STRUCTURE OF THE U.S. TRADE BLOCKS IN THE OECD INTERLINK MODEL

1. This annex provides background information on the structure of the U.S. trade block in the current version of the OECD INTERLINK model, relevant to the analysis of the model's tracking performance given in the accompanying note "Tracking the U.S. External Deficit, 1980-1986".

2. A list of references relating to some of the research material underlying the INTERLINK model and also more general studies describing the use of the system and its properties is appended to this annex. The relevant research studies for the trade block are, however, largely unpublished, although useful general background is given by OECD (1979) and (1984) and Llewellyn et al. (1985). The following sections provide a general description of the relevant equations by subject block along with a tabular summary of long-run elasticities, lag distributions, and, where available, associated sample statistics.

I. IMPORT VOLUMES

3. Import volumes are modelled explicitly for four categories of goods -- foodstuffs, raw materials, energy, and manufactures (SITCs 0+1, 2+4, 3, and 5-9, respectively) -- and also non-factor services. A summary of parameters and sample statistics is given in Table A1. The relevant equations are all of a broadly similar, demand function form and are expressed in rates of change. Table A1 also includes implicit elasticities for total goods and total goods and services categories. These are based on the partial simulation responses of the full set of equations.

4. For imports of food and raw materials, there are no competitiveness terms and the activity terms relate to the unlagged rates of change of private real consumption and industrial production respectively, both with less than unit elasticities. The imports of energy equation is derived from an estimated total energy demand function with relevant parameters based on those for total demand divided by a constant imported energy share coefficient. The activity term is a weighted average of business

Table A1

U.S. TRADE EQUATIONS: IMPORT VOLUMES

Import category	Activity term(3)	Competitiveness term	Sample stats
Food (MFV) (rate of change)	Consumers expenditure Elasticity = 0.57 Mean/max lags 0/0	---	63-79 SE = 4%
Raw materials (MRV) (rate of change)	Industrial production Elasticity = 0.82 Mean/max lags 0/0	---	63-79 SE = 13%
Energy (MEV) (rate of change)	Wtd. expenditures Elasticity = 1.5 Mean/max lags 0.5/1	Real oil price Elasticity: -1.1 Mean/max lags 1.0/3.5	60-78 n.a.
Manufactures (MMV) (rate of change)	Wtd. expenditures Elasticity = 2.0 Mean/max lags 0/0	Relative price Elasticity = -0.80 Mean/max lags 1.0/2.5	60-78 SE = 4.7%
Total goods (MGV) (implicit)	Wtd. expenditures Elasticity = 1.91	Relative price Elasticity = -0.80	(implicit)
Non-factor services (rate of change) (MSRV)	Wtd. expenditures Elasticity = 1.12 Mean/max lags 0/0	Relative price Elasticity = -1.0 Mean/max lags 0.5/1.0	60-79 SE = 2.8%
Goods and services (MGSV)	Wtd. expenditures Elasticity = 1.63	Relative price Elasticity = -0.75	(implicit)

1. All equations are semi-annual; mean and maximum lags are expressed in terms of years.

2. Weighted expenditure terms are based on IO weighted total expenditure components; individual weights are shown in the appended model listing.

3. Implicit elasticities based on partial simulation responses.

intermediate energy use and input-output weighted final expenditures. The price term uses the real price of imported energy with a three-and-a-half-year maximum lag.

5. The imports of manufactures equation is programmed with its separate independent variables coded in terms of working variables to permit the decomposition of predictions into separate activity and competitiveness contributions. The activity term is based on input-output weighted final expenditures, with an overall elasticity of 2.0, and the competitiveness term is measured by the ratio of manufactured import price to the domestic demand deflator, with a 2 1/2-year maximum lag, and an elasticity of 0.8. The equation for non-factor services includes an elasticity with respect to weighted expenditures of 1.1 and a competitiveness term measured as the ratio of the services deflator to that of domestic demand with a unit elasticity. Investment income debits (interest, profits and dividends) are derived in a nominal framework as described in the later section IV.

II. EXPORT VOLUMES

6. Export volumes are modelled for the same commodity groups as imports and a summary of relevant features, parameters and weighting systems are given in Tables A2 and A3.

7. A common approach is used in modelling each export category which is broadly dictated by the requirements of a consistent world system. For each category of goods and services and each exporter, a real market growth variable is constructed, based on a weighted average of the import volume demands for that commodity group in each individual market. Fixed weighting procedures are used for the imports of each of 22 OECD Member countries and 6 non-OECD regional markets in the model based on the relative importance of each market to each exporter, by commodity. In the current version of the model these are based on commodity trade matrices for 1982. The relevant U.S. market weights are shown in Table A3. For system consistency, market growth elasticities are in general imposed in the region of unity. An exception is for non-factor services, where for the United States a freely-estimated value of 0.8 is used.

8. For two categories of exports, manufactures and non-factor services, price competitiveness terms are also included based on the relative price of exports to those of weighted competitors. Competitor prices are double-weighted, first on the basis of the relative importance of individual competitors in each market and, secondly, the relative importance of individual markets to U.S. exports. The relevant competitor weights are also given for these two categories in Table A3, by exporter. An important limitation of such an approach is that it uses average export prices rather than bilateral trade prices and therefore fails to pick up market-specific price tendencies. The lack of comprehensive bilateral price data on the scale required for a 30-by-30 country linked system, however, makes this a necessary constraint on the model.

Table A2

U.S. TRADE EQUATIONS: EXPORT VOLUMES

Export category	Market growth(2)	Competitiveness term	Sample stats
Food (XFV) (rate of change)	Elasticity = 1.0 Mean/max lag 0/0	----	imposed
Raw materials (XRV) (rate of change)	Elasticity = 1.0 Mean/max lag 0/0	----	imposed
Energy (XEV) (rate of change)	Elasticity = 1.0 Mean/max lag 0/0	----	imposed
Manufactures (XMV) (rate of change)	Elasticity = 1.0 Mean/max lag 0/0	Relative export price Elasticity = -1.4 Mean/max lags 1.5/2.5	63-78 SE = 2.5%
Total goods (XGV)	Market growth Elasticity = 1.0	Relative export price Elasticity = -1.0	(implicit)
Non-factor services (XSRV) (rate of change)	Elasticity = 0.77 Mean/max lags 0/0	Relative export price Elasticity = -0.3 Mean/max lags 0.5/1	62-79 SE = 3.3%
Goods and services (N.A. basis) (XGSV)	Market growth Elasticity = 0.72	Relative export price Elasticity = -0.6	(implicit)

1. All equations are semi-annual; mean and maximum lags are expressed in terms of years.

2. Activity terms are U.S. market-weighted import volumes for the relevant categories; for further information and corresponding expenditure elasticities, see Table A3.

3. Relative export price terms are the ratio of the U.S. export price to weighted competitors prices for the corresponding categories (see Table A3).

Table A3

U.S. TRADE EQUATIONS:
WEIGHTING PROCEDURES AND IMPLICIT EXPENDITURE ELASTICITIES

U.S. Export Market and Competitor Weights (1982 share basis)

1 = U.S. export market weights
2 = U.S. competitor export price weights

	Food	Raw materials	Energy	Manufactures		Non-factor services	
	(1)	(1)	(1)	(1)	(2)	(1)	(2)
Japan	15.6	20.6	23.8	7.3	20.0	13.4	6.3
Germany	2.9	5.6	3.7	4.9	14.2	5.3	9.0
France	1.3	2.2	6.0	3.4	7.8	5.6	5.9
United Kingdom	2.4	3.1	2.0	6.1	8.8	5.3	12.8
Italy	2.6	3.3	7.8	2.0	6.6	5.4	5.8
Canada	5.6	7.8	16.2	21.0	1.3	11.5	1.8
Austria	0.6	0.2	0.7	0.2	1.1	1.3	2.5
Belgium	2.6	3.5	3.3	2.0	3.3	1.2	3.2
Denmark	0.2	0.6	2.0	0.3	0.8	0.3	1.4
Finland	0.3	0.1	0.3	0.3	0.8	0.6	0.8
Greece	0.2	0.5	0.2	0.2	0.3	0.5	1.5
Iceland	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Ireland	0.1	0.1	0.3	0.6	0.6	0.2	0.3
Netherlands	4.0	5.8	5.0	2.1	2.9	2.3	3.1
Norway	0.4	0.5	0.9	0.4	0.7	1.6	0.2
Portugal	1.6	0.7	0.1	0.1	0.3	0.3	0.6
Spain	3.0	3.7	4.9	1.0	1.7	1.7	3.8
Sweden	0.4	0.3	1.3	1.0	2.4	2.1	2.1
Switzerland	0.6	0.5	0.5	1.2	2.7	0.8	2.7
Turkey	0.1	0.5	0.8	0.4	1.8	0.4	0.6
Australia	0.4	0.8	0.2	0.6	0.3	0.1	0.4
New Zealand	0.2	0.3	0.2	0.6	0.3	0.1	0.4
Non-OECD	54.8	39.3	19.3	41.6	20.6	38.6	33.8

Memorandum item

Implicit elasticities with respect to non-U.S. domestic expenditures

	Food	Raw materials	Energy	Manu-factures	Goods	Non-factor services	Goods&Serv
U.S. market growth	1.2	0.8	1.2	1.4	1.3	1.0	0.93
U.S. export volumes	1.2	0.8	1.2	1.4	1.3	0.8	0.90

9. To the extent that market growth elasticities in the system deviate from unity, that competitiveness elasticities are not identical, and that statistical discrepancies exist between measured world imports and exports then the overall system of equations thus defined may from time to time generate marginal differences in export and import volumes at the world level. The overall system, therefore, incorporates a secondary consistency check on corresponding world export and import growth rates by commodity and, allowing for transport and reporting lags, pro-rates any overall discrepancy to individual exporters. These adjustments are generally small, of the order of 1 per cent or less.

10. Table A2 provides a broad summary of parameters and corresponding lag distributions. The equations for manufactures and non-factor services were freely estimated, whilst those for commodities were imposed. The lower section of Table A3 translates the individual market growth elasticities into elasticities with respect to weighted non-U.S. expenditures, based on partial model simulations. These effectively represent a U.S. market-weighted average of non-U.S. import expenditure elasticities.

11. Average elasticities for total goods and total goods and services (including investment income) are also shown on the basis of 1982 weights. The treatment of investment income credits is discussed in Section IV.

III. TRADE PRICES

12. Tables A4 and A5 summarise the equations and the related weighting procedures for export and import deflators by commodity group.

13. The equations for food and raw material export prices in dollar terms are based on the recent work of Holtham et al. (1985). For food, the equation is in rate-of-change form with the food deflator adjusting according to growth in the weighted world commodity prices for food and tropical beverages, with an elasticity of 0.7, and domestic prices, with an elasticity of 0.3. For raw material exports the equation is in error-correction form incorporating domestic prices with a significant but essentially short-run influence and a full long-run adjustment to the weighted world commodity prices for metals, minerals and agricultural raw materials. The energy price equation is no more than a stylised assumption, in effect setting the growth in energy prices to that of world manufactures in dollar terms, implying a fixed real energy price. In the context of Secretariat forecasts, world energy prices are set judgementally on the basis of an off-model assessment of world oil and energy market balances. The model equation is therefore used primarily for simulation purposes.

14. The equation for manufactured export prices is in rate-of-change form and incorporates normalised unit labour costs, with an elasticity of 0.6, and weighted dollar competitor prices (competitor weights as defined in Table A3) and U.S. goods import prices with elasticities of 0.25 and 0.15, respectively. For non-factor services the deflator is equated to that for domestic demand with a unit elasticity. With dollar prices used throughout the export price block, no differential exchange rate effects are assumed.

Table A4

U.S. TRADE EQUATIONS: PRICES

	World prices(1)	Domestic costs/prices	Sample statistics
a) Export prices			
Food (PXFD) (rate of change)	Weighted world prices 0.678	GDP deflator 0.322	72-82 SE = 4.7%(2)
Raw materials (PXRD) (error correction)	Weighted world prices 1.0	GDP deflator Temporary effect only	72-82 SE = 6.6%(2)
Energy (PXED) (rate of change)	World manufac. price 1.0		(stylised assumption)
Manufactures (PXM)	Competitor prices 0.15 Import costs 0.25	Unit labour costs 0.60	63-79 SE = 1.9%
Non-factor services (rate of change) (PXS)	---	Domestic demand deflator 1.0	(n.a.)
b) Import prices	U.S. weighted world export prices(3)	GDP deflator	
Manufactures and services (PMM, PMS)	0.90	0.10	imposed
Non-manufactures (PMFD, PMRD, PMED)	1.0	0.0	imposed

1. Exchange rate effects are identical to those for world prices.

2. For further details, see Holtham et al.(1985).

3. Relevant weights are shown in Table A5.

Table A5

U.S. IMPORT PRICE WEIGHTS (1982 share basis)

Exporter	Food	Raw materials	Energy	Manufactures	Non-factor services
Japan	1.3	0.5	0.1	25.9	14.5
Germany	1.8	1.3	0.0	7.6	15.0
France	3.6	0.6	0.1	3.4	11.5
United Kingdom	4.0	0.9	6.0	5.0	9.9
Italy	2.0	0.7	0.3	3.1	10.9
Canada	9.7	50.2	10.0	19.5	9.6
Austria	0.2	0.0	0.0	0.3	0.9
Belgium	0.1	0.4	0.1	1.4	3.8
Denmark	1.5	0.8	0.0	0.3	1.0
Finland	0.2	0.5	0.0	0.3	0.4
Greece	0.3	0.1	0.2	0.1	0.8
Iceland	0.9	0.0	0.0	0.0	0.0
Ireland	0.5	0.1	0.0	0.2	0.3
Netherlands	1.8	0.8	0.3	1.1	3.2
Norway	0.6	0.2	2.0	0.3	1.1
Portugal	0.3	0.1	0.0	0.1	0.1
Spain	1.2	0.3	0.1	0.8	2.3
Sweden	0.1	0.2	0.0	1.2	1.1
Switzerland	0.3	0.0	0.0	1.4	1.0
Turkey	1.3	0.2	0.0	0.0	0.3
Australia	5.2	2.1	0.0	0.8	0.9
New Zealand	2.5	0.6	0.0	0.1	0.1
Non-OECD	60.6	39.4	80.8	27.1	11.3

15. The import price equation system in INTERLINK parallels that for export volumes. For each commodity group a "shadow price" of imports is calculated for each commodity group based on trade share-weighted dollar export prices for suppliers to each market. The relevant U.S. weights are shown in Table A5.

16. With the exception of manufactures and services, the growth of import prices is set to that of the "shadow price" subject to a notional two- to three-week average transport lag adjustment. For manufactures and services, however, there is a wealth of estimation evidence supporting the influence of a country's domestic prices in the determination of its import prices. Such specifications pose no problems for a full bilateral pricing system, but with an average export and import price approach, the need for global consistency implies the need for strong cross-country equation restrictions. The present set of manufactures import price equations for these two groups represents a "loose compromise" between such alternative forms of price equation. Growth in manufactures import prices for each country is related to the growth in the "shadow import price", adjusted for transport lags with a unit elasticity, and a price differential term -- the ratio of domestic inflation to weighted world inflation -- with an elasticity of 0.1. In effect, there is a uniform world price elasticity of 0.9 and a domestic price elasticity of 0.1. Such a system guarantees world consistency whilst permitting some domestic price influences. For manufactures, recent Secretariat research, however, suggests that a domestic price weight of 0.1 is probably too low for the United States and a number of other major economies, and major changes in the present system are therefore planned for the near future. In the context of recent Secretariat forecasts, a weight of the order of 0.4 has been used for the United States.

IV. INVESTMENT INCOME AND TRANSFERS

17. The investment income block is a recent addition to INTERLINK and is not fully documented elsewhere. Although the system is estimated on the basis of total investment income data, its design is primarily based on considerations related to portfolio investment and therefore does not take explicit account of the influence of profitability on the returns to fixed overseas investment. In the context of Secretariat forecasts, the effects of these factors are assessed judgementally.

18. In general, the investment income block relates separate credit and debit flows in nominal terms to the stocks, appropriately revalued, and the corresponding effective rates of return on assets and liabilities. Asset and liability stocks are defined for given starting point assumptions through gross outflows and inflows of capital. For valuation purposes, it is assumed that each country invests in two currency baskets; one consisting of dollar assets, the other a weighted average of other currencies. The importance of the dollar in the portfolio is allowed to vary across countries as does the relative importance of other currencies in the second basket. For each country, the relative importance of non-dollar currencies is assumed to be given by fixed share matrices. (For U.S. assets and

liabilities, these are summarised in Table A6.) The nominal valuations of assets and liabilities are, however, allowed to change with movements in these exchange rates, as well as being affected by capital flows.

19. The central behavioural equations in the system are those for the effective rates of return on assets and liabilities. These are related to weighted short- and long-term interest rates in the currencies relevant to individual countries' assets and liabilities portfolios. Generally, these rates of return react with a lag to current interest rates, reflecting the tendency for portfolios to be valued at historic costs adjusted for Table exchange rate movements, rather than at current market values. The part of the portfolio in long-term fixed-rate bonds and loans which do not vary with current interests is assumed to be captured by the constant term. The estimated parameters and lag distributions in the rate of return equations can, therefore, be thought of as summarising the heterogenous composition of the outstanding stock of assets and liabilities.

20. Relevant estimated parameters for the effective returns on U.S. assets and liabilities are shown in Table A6. For the United States, estimation results support the inclusion of short-term rates only, both for assets and liabilities, with long-run coefficients substantially below unity. This would be consistent with a relatively large proportion of U.S. asset and liability flows being at fixed rates. For liabilities also there is a significant adjustment lag, with a mean of one-and-a-half semesters. For assets, a range of coefficient responses is shown reflecting the flexible weight influence of currency revaluations over the 1980-1986 period.

21. Private and official transfers, which are dealt with in net terms in the current account, are not formally modeled in INTERLINK and are set exogenously in the context of Secretariat forecasts.

Table A6

U.S. TRADE EQUATIONS: INVESTMENT INCOME

Effective rates of return		U.S. short-term rates	Non-U.S. short-term rates	Total
Assets (RAE) (1)		0.37 to 0.43	0.2 to 0.14	0.57
Sample 73-84				
SE = 0.3 (pts.)				
Liabilities (RLE)	Impact	0.18	0.0	0.18
	Long-run	0.42	0.01	0.43
Sample 73-84				
SE = 0.5 (pts.)				

Non-dollar security weight	U.S. assets (%)	U.S. liabilities (%)
Currencies		
United Kingdom	9	5
France	4	5
Germany	41	48
Netherlands	5	5
Canada	8	0
Japan	7	11
Switzerland	21	26
Other	5	0

1. Asset flow interest rate coefficients vary with currency revaluations; the ranges given correspond to those of the period 1980 to 1986. For liabilities, the U.S. dollar weight at 98% is too large for this to be significant.

OECD INTERLINK MODEL REFERENCE LIST

A. Model structure and research studies contributing to the INTERLINK model

1. Adams, Eguchi and Meyer-zu-Schlochtern (1969), "An Econometric Analysis of International Trade", OECD 1969.

2. Blundell-Wignall, Rondoni and Ziegelschmidt (1984), "The Demand for Money and Velocity in Major OECD Countries", OECD ESD Working Paper No. 13, February 1984.

3. Coe (1985), "Nominal Wages, the NAIRU and Wage Flexibility", OECD Economic Studies No. 5, Autumn 1985.

4. Coe and Gagliardi (1985), "Nominal Wage Determination in Ten OECD Economies", OECD ESD Working Paper No. 19, March 1985.

5. Helliwell, Sturm, Jarrett and Salou (1985), "Aggregate Supply in INTERLINK", OECD ESD Working Paper No. 26, November 1985.

6. Helliwell, Sturm, Jarrett and Salou (1986), "The Supply Side in OECD's Macroeconomic Model", OECD Economic Studies No. 6, Spring 1986.

7. Holtham (1984), "Multinational Modelling of Financial Linkages and Exchange Rates", OECD Economic Studies No. 2, Spring 1984.

8. Holtham and Kato (1986), "Wealth and Inflation Effects in the Aggregate Consumption Function", OECD ESD Working Paper No. 35, July 1986.

9. Holtham, Saavalainen, Saunders and Sutch (1985), "Commodity Prices in INTERLINK", OECD ESD Working Paper No. 27, November 1985.

10. Llewellyn and Richardson (1985), "Representing Recent Policy Concerns in INTERLINK", OECD Economic Studies No. 5, Autumn 1985.

11. Llewellyn, Samuelson and Potter (1985), Economic Forecasting and Policy, Routledge and Keegan Paul, London, 1985.

12. Masson and Richardson (1983), "Exchange Rate Expectations and Current Balances in the OECD INTERLINK System", reprinted as Chapter 4 of International Macroeconomic Modelling for Policy Decisions, Artus and Guvenen (eds.), Nijhof, 1986.

13. Meyer-zu-Schlochtern and Yajima (1970), "OECD Trade Model: 1970 Version", OECD Economic Outlook Occasional Studies, December 1970.

14. Mittelstädt (1983), "Use of Demand Elasticities in Estimating Energy Demand", OECD ESD Working Paper No. 1, March 1983.

15. OECD (1979), "The OECD International Linkage Model", OECD Economic Outlook Occasional Studies, January 1979.

16. Samuelson (1973), "A New Model of World Trade", OECD Occasional Economic Studies, December 1973.

17. Samuelson and Kurihara (1980), "OECD Trade Linkage Methods", Economic Bulletin No. 18, Economic Research Institute, Economic Planning Agency, Tokyo 1980.

B. INTERLINK-related simulation studies

1. Blundell-Wignall, Rondoni, Ziegelschmidt and Morgan (1984), "Monetary Policy in the OECD INTERLINK Model", OECD ESD Working Paper No. 16, September 1984.

2. Bryant, Henderson, Holtham, Hooper and Symansky (forthcoming), "Empirical Macroeconomics for Interdependent Economies", Brookings Conference, March 1986.

3. Cooper (1986), "External Constraints on European Growth", Brookings Conference on Impediments to European Economic Growth, October 1986.

4. Larsen and Llewellyn (1983), "Simulated Macroeconomic Effects of a Large Fall in Oil Prices", OECD ESD Working Paper No. 8, June 1983.

5. Larsen, Llewellyn and Potter (1983), "International Economic Linkages", OECD Economic Studies No. 1, Autumn 1983.

6. Masson, Blundell-Wignall and Richardson (1984), "Domestic and International Effects of Government Spending under Rational Expectations", OECD Economic Studies No. 3, Autumn 1984.

7. Muller and Price (1984), "Structural Budget Deficits and Fiscal Stance", OECD ESD Working Paper No. 14, July 1984.

8. OECD (1980), "Fiscal Policy Simulations with the OECD International Linkage Model", OECD Economic Outlook Occasional Studies, July 1980.

9. OECD (1981), "Effects of Hypothetical Exchange Rate Changes", Technical Annex to OECD Economic Outlook No. 30, December 1981.

10. OECD (1982), "Possible Effects of a Reduction in Energy Prices in the OECD Economy", Technical Annex to OECD Economic Outlook No. 31, July 1982.

11. OECD (1982), "Effects of Hypothetical Exchange Rate Changes", Technical Annex to OECD Economic Outlook No. 32, December 1982.

12. OECD (1984), Technical Notes to OECD Economic Survey of Germany, July 1984.

13. OECD (1984), OECD INTERLINK System Operations Manual, December 1984.

14. OECD (1985), "Growth and Imbalances", OECD Economic Outlook No. 37, June 1985.

15. OECD (1986), "A Ready Reckoner of a Hypothetical Change of Energy Prices in the OECD Economy", Technical Annex to OECD Economic Outlook No. 39, May 1986.

16. OECD (1986), Technical Notes to OECD Economic Survey of Canada, July 1986.