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THE KTKV MODEL OF THE ECONOMICS DEPARTMENT OF THE BANK OF FINLAND  
A Semiannual Model for Forecasting World Economic Prospects

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## ABSTRACT

The most recent version of the so called KTKV model is reported in this volume. The model has been estimated at the Economics Department of the Bank of Finland. It is designed to improve the ability of making independent forecasts of world economic prospects. Thus, the structure of the model is based on rather pragmatic matters. All the main components of world trade are generated though part of the trade flows are dealt with through analysis of the current balances of the (geographical) areas concerned. As several key variables are exogenous, many important simultaneous behavioural processes are omitted. However, in the course of several forecasting rounds, the KTKV model has shown its applicability in structuring the forecasting process and reducing the efforts required to reach a consistent view of world trade and inflation as well as of Finland's export markets and her price competitiveness.

INFORMATION: Seija Määttä, tel. 183 2519

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## 2 SOME INTRODUCTORY NOTES

The KTKV model<sup>1</sup> of the Economics Department of the Bank of Finland is a tool designed to contribute to the forecasting of developments in the economic environment of the Finnish economy. It plays a key role in structuring and formalising the process of making independent forecasts of international economic trends over a time horizon of three years ahead.

The early version of the KTKV was developed in 1980 - 82. At this stage the model was principally a computing framework and data management system. Since then the model, while being in permanent use, has been gradually refined and extended. For instance, a price block was introduced in 1982.

KTKV has clearly contributed to the quality of forecasts. Since, however, a number of weaknesses became apparent in the course of forecasting rounds, all the equations have been reconsidered during the past year or so.

The basic structure of the KTKV-model was introduced in Pyyhtiä (1983).<sup>2</sup> It has not subsequently been changed, even though all equations have been re-estimated. In this connection, the recursive nature of earlier versions of the model has been altered.

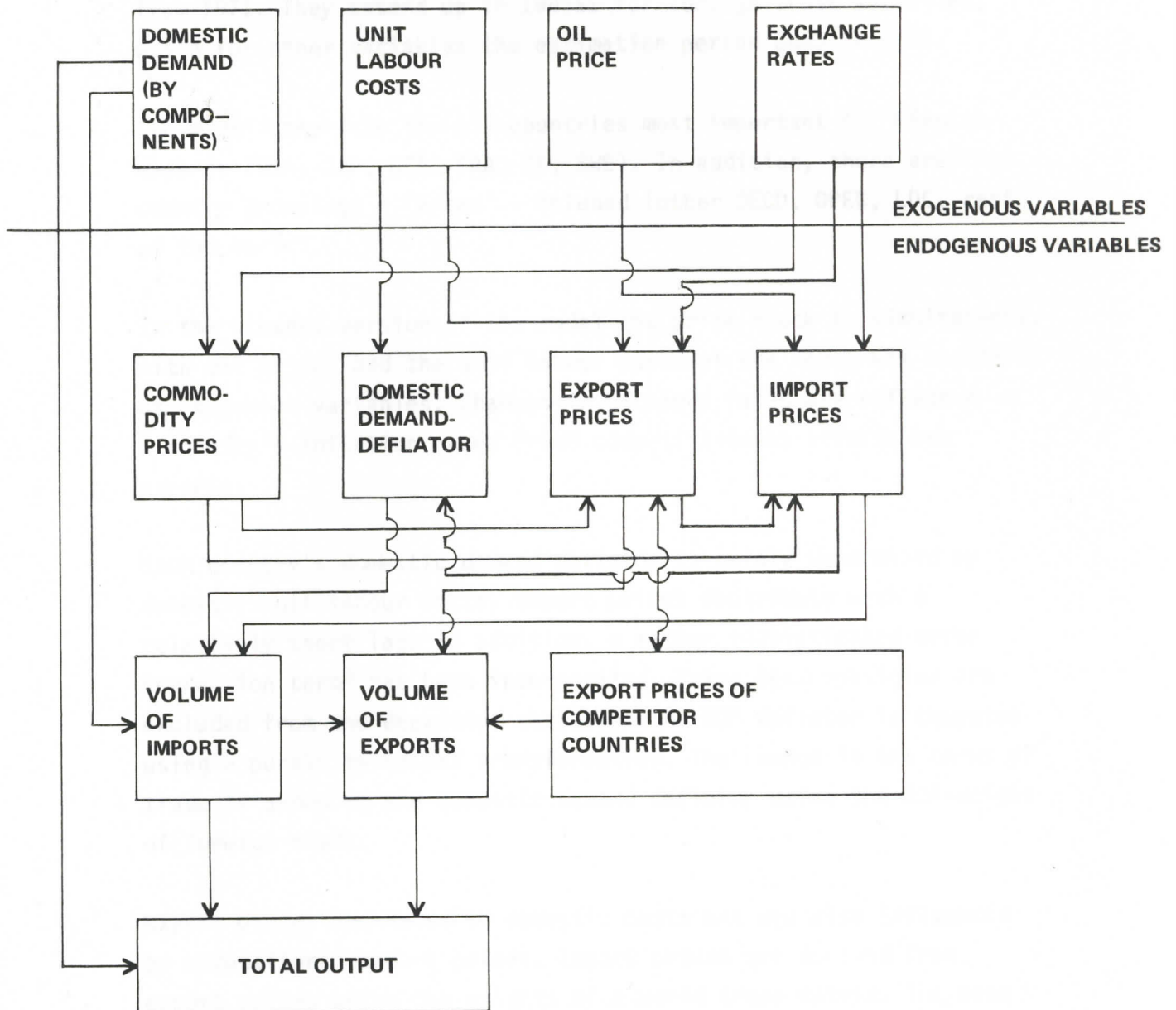
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<sup>1</sup>The following persons have been the main contributors in different phases of development of the KTKV model: Johnny Åkerholm, Timo Hämäläinen, Tapio Peura, Timo Rajakangas, Jan Boekelman and Ilmo Pyyhtiä, who completed the model and constructed its computing system. Timo Tyrväinen has been in charge of the most recent development work. In this connection Alwin Moes has carried out the econometric work and estimated all the equations included in this paper. Hannele Kuosmanen and Reijo Siiskonen have carried out the incorporation of new equations and the simulation tests of the model.

<sup>2</sup>Ilmo PYYHTIÄ: Kansainvälisen talouden malli: yleisrakenne ja hintalohko. Suomen Pankin kansantalouden osasto. Keskustelualoitteita. Huhtikuu 1983. (In Finnish only.)



CHART 1. BLOCK DIAGRAM OF THE MAJOR COMPONENTS OF THE KTKV MODEL



The actual model comprises 436 variables, 76 of which are strictly speaking exogenous. In addition, there are 56 constant correction terms designed to adjust output. There are 288 equations, 32 of which are behavioural. The rest are constant coefficient equations based on the world trade matrix or identities. Estimations have been based on semiannual data. The choice of estimation period has been affected by availability of the data required. The period may be different for different series. As a rule, estimations start from 1971. They extend up to 1985S1 for foreign trade variables, while for other variables the estimation period ends in 1983.

The model comprises the six countries most important for Finnish exports (USA, JAP, GER, FRA, UK, SWE). In addition, there are four country groupings - "areas" - included (other OECD, OPEC, LDC, rest of the world).

In the present version of the model the price block is simultaneous, with oil prices and the unit labour costs of the above six countries as exogenous variables. Changes in exchange rates are reflected in a country's inflation rate. Price competitiveness affects net exports.

Each country's domestic demand deflator is mainly determined by domestic unit labour costs. Import prices contribute with a relatively short lag. In addition, a rather sophisticated error correction term<sup>3</sup> has been incorporated. Taxes less subsidies are excluded from the dependent variable. The GDP deflator is computed using a purely technical transformation. The change in the terms of trade is added to the domestic demand deflator using the GDP-weight of foreign trade.

Export prices are based on domestic costs but are also influenced by competitors' export prices. Import prices are derived from export prices using the weights of a world trade matrix. The base year for the constant weights is 1980.

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<sup>3</sup>See Teun KLOEK: Dynamic Adjustment when the Target is Nonstationary. *International Economic Review*, Vol. 25, No. 2, June 1984.

The components of domestic demand are exogenous for the six industrial countries mentioned above. Their imports are determined by total domestic demand as well as by the competitiveness of domestic producers. Other countries' imports are allocated to export markets for each of the countries using the weights of the world trade matrix. The outcome given by fixed shares is adjusted to take into account the prevailing level of a country's competitiveness. Exogenous imports of the four areas mentioned also contribute to the growth of a country's export markets. Having calculated the foreign trade flows, the model gives a country's GDP as a residual. In the course of forecasting rounds, the consistency of the outcome is checked through careful analysis of projected current balance developments.

The effects on world trade of the four areas mentioned above are mainly studied by analysing the prospects for their external balances. The model gives the export incomes and import prices of these country groupings. An area's exogenous import volume is then chosen so as to generate a reasonable path for the current balance concerned. Financial restrictions facing an area are taken into account in this connection. As a rule, the world current balance discrepancy is assumed to remain broadly unchanged over the forecasting period.

The equation for commodity prices reported here actually stems from an earlier version of the KTKV-model. It is a rather simple equation relating commodity prices mainly to inventory changes in industrial countries. The exchange rate of the US dollar is included as an additional variable. More sophisticated equations have been estimated, however. This work has been carried out mainly in line with ideas of a recent OECD study on this subject,<sup>4</sup> in which commodities are divided into four subgroups (food, tropical beverages, non-ferrous metals and minerals, and agricultural raw materials). The relevant equations have been reported in Paulaharju

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<sup>4</sup>See OECD (1985): Commodity Prices in Interlink, DES/WP1/EM(85).



(1985).<sup>5</sup> It is likely that they will be incorporated into the KTKV model in the near future.

A matrix introducing all the variables of the model is included in this volume. It should clarify some of the structural features of the model. All the behavioural equations and basic identities are also included.<sup>6</sup> The theoretical foundations underlying the equations are not, however, presented in the present paper.<sup>7</sup> The final set of graphs consists of selected results from some dynamic simulation tests.

July, 1986

Timo Tyrväinen

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<sup>5</sup>Satu PAULAHARJU: Raaka-aineiden maailmanmarkkinahintoihin vaikuttavista tekijöistä. Suomen Pankin kansantalouden osasto. Keskustelualoitteita 10/85. (In Finnish only.)

<sup>6</sup>t-values are in brackets below estimated parameters; the lower figure indicates White t-values with correction of heteroscedasticity.

<sup>7</sup>For more detailed background, see an unpublished memo by Alwin MOES dated 4.4.1985.

## VARIABLES OF THE KTKV MODEL (1)

SUPPLY AND DEMAND	US	JAP	GER	FR	UK	SWE	FIN
<b>GDP</b>							
volume in nat. currency	USQ	JAQ	GEQ	FRQ	UKQ	SWQ	FIQ
%-change at annual rate	USQAD	JAQAD	GEQAD	FRQAD	UKQAD	SWQAD	FIQAD
deflator	USPQ	JAPQ	GEPQ	FRPQ	UKPQ	SWPQ	FIPQ
%-change at annual rate	USPQAD	JAPQAD	GEPQAD	FRPQAD	UKPQAD	SWPQAD	FIPQAD
<b>IMPORTS</b>							
volume in nat. currency	USM	JAM	GEM	FRM	UKM	SWM	FIM
%-change from prev. period	USMD	JAMD	GEMD	FRMD	UKMD	SWMD	FIMD
%-change at annual rate	USMAD	JAMAD	GEMAD	FRMAD	UKMAD	SWMAD	FIMAD
volume in 80-USD	USMDOL	JAMDOL	GEMDOL	FRMDOL	UKMDOL	SWMDOL	FIMDOL
unit value	USPM	JAPM	GEPM	FRPM	UKPM	SWPM	FIPM
unit value in USD		JAMDOL	GEMDOL	FRMDOL	UKMDOL	SWMDOL	FIMDOL
<b>TOTAL SUPPLY</b>							
volume in nat. currency	USTS	JATS	GETS	FRTS	UKTS	SWTS	FITS
%-change at annual rate	USTSAD	JATSAD	GETSAD	FRTSAD	UKTSAD	SWTSAD	FITSAD
<b>EXPORTS</b>							
volume in nat. currency	USX	JAX	GEX	FRX	UKX	SWX	FIX
%-change at annual rate	USXAD	JAXAD	GEXAD	FRXAD	UKXAD	SWXAD	FIXAD
volume in 80-USD	USXDOL	JAXDOL	GEXDOL	FRXDOL	UKXDOL	SWXDOL	FIXDOL
unit value	USPX	JAPX	GEPX	FRPX	UKPX	SWPX	FIPX
unit value in USD		JAPXDOL	GEPXDOL	FRPXDOL	UKPXDOL	SWPXDOL	FIPXDOL
competitors' export prices	USWPX	JAWPX	GEWPX	FRWPX	UKWPX	SWWPX	FIPWPX
growth of export markets	USXDM	JAXDM	GEXDM	FRXDM	UKXDM	SWXDM	FIXDM
<b>PRIVATE CONSUMPTION</b>							
volume in nat. currency	USC	JAC	GEC	FRC	UKC	SWC	FIC
%-change at annual rate	USCAD	JACAD	GECAD	FRCAD	UKCAD	SWCAD	FICAD
<b>GOVERNMENT CONSUMPTION</b>							
volume in nat. currency	USG	JAG	GEG	FRG	UKG	SWG	FIG
%-change at annual rate	USGAD	JAGAD	GEGAD	FRGAD	UKGAD	SWGAD	FIGAD
<b>FIXED INVESTMENT</b>							
volume in nat. currency	USI	JAI	GEI	FRI	UKI	SWI	FII
%-change at annual rate	USIAD	JAIAD	GEIAD	FRIAD	UKIAD	SWIAD	FIIAD
<b>INVENTORY INVESTMENT</b>							
volume in nat. currency	USS	JAS	GES	FRS	UKS	SWS	FIS
GDP-contribution at ann. rate	USSK	JASK	GESK	FRSK	UKSK	SWSK	FISK
<b>TOTAL DEMAND</b>							
Volume in nat. currency	USTD	JATD	GETD	FRTD	UKTD	SWTD	FITD
%-change at annual rate	USTDAD	JATDAD	GETDAD	FRTDAD	UKTDAD	SWTDAD	FITDAD
<b>TOTAL DOMESTIC DEMAND</b>							
Volume in nat. currency	USDD	JADD	GEDD	FRDD	UKDD	SWDD	FIDD
%-change at annual rate	USDDAD	JADDAD	GEDDAD	FRDDAD	UKDDAD	SWDDAD	FIDDAD
deflator	USPDDI	JAPDDI	GEPDDI	FRPDDI	UKPDDI	SWPDDI	FIPDDI
%-change at annual rate	USPDDIAD	JAPDDIAD	GEPDDIAD	FRPDDIAD	UKPDDIAD	SWPDDIAD	FIPDDIAD
<b>FINAL DOMESTIC DEMAND</b>							
Volume in nat. currency	USFD	JAFD	GEFD	FRFD	UKFD	SWFD	FIFD
%-change at annual rate	USFDAD	JAFDAD	GEFDAD	FRFDAD	UKFDAD	SWFDAD	FIFDAD

## VARIABLES OF THE KTKV MODEL (2)

DEMAND AND SUPPLY (CONTINUED)	OECD	EUROPE	COUNTR. IMPOR- TANT TO FINNISH EXPORTS	OTHER OECD	OECD	OPEC	LDC	REST OF THE WORLD
GDP vol., %-change at annual rate deflator, %-change at ann. rate	OEQAD OEPQAD	EUQAD EUPQAD	SVQAD SVPQAD		OEQAD OEPQAD			
IMPORTS volume, Index vol., %-change from prev. period vol., %-change at annual rate volume in 80-USD unit value in USD unit value in FIM	OEMAD	EUMAD	SVMAD  SVPMDOL SVPFMIM	OOMI OOMD OOMAD OOMDOL	OEMAD	OPMI OPMD OPMAD  OPMDOL	DCMI DCMD DCMAD  DCMDOL	COMI COMD COMAD  COMDOL
EXPORTS volume, Index vol., %-change from prev. period vol., %-change at annual rate unit value in USD unit value in FIM	OEXAD	EUXAD	SVXAD SVPXDOL SVPXFIM	OOXI OOXD  OOPX	OEXAD	OPXI OPXD  OPPX	DCXI DCXD  DCPX	COXI COXD  COXP
PRIVATE CONSUMPTION vol., %-change at annual rate	OECAD	EUCAD			OECAD			
GOVERNMENT CONSUMPTION vol., %-change at annual rate	OEGAD	EUGAD			OEGAD			
FIXED INVESTMENTS vol., %-change at annual rate	OEIAD	EUIAD			OEIAD			
INVENTORY INVESTMENTS GDP-contribution at annual rate	OESK	EUSK			OESK			
TOTAL DOMESTIC DEMAND vol., %-change from prev. period vol., %-change at annual rate deflator, %-change at ann. rate	EDDAD EPDDIAD	UDDAD UPDDIAD	SVDDAD SVPDDIAD	OODDD	EDDAD EPDDIAD			
FINAL DOMESTIC DEMAND vol., %-change at annual rate	EFDAD	UFDAD			EFDAD			



## VARIABLES OF THE KTKV MODEL (3)

OTHER VARIABLES	US	JAP	GER	FR	UK	SWE	FIN
unemployment rate, %	USUN	JAUN	GEUN	FRUN	UKUN	SWUN	FIUN
exchange rates in USD		JPY	DEM	FRF	GBP	SEK	FIM
exchange rates in FIM	USDF	JPYF	DEMF	FRFF	GBPF	SEKF	
unit labour costs in national currency	USULC	JAULC	GEULC	FRULC	UKULC	SWULC	FIULC

Relative unit labour costs in FIM (14 countries/Finland, 1963-82=100)	COMP1.A.E.
Relative unit labour costs in national currency (14 countries/Finland, 1963-82=100)	COMP2.A.E.
Unit labour costs in national currency (14 countries, 1863-82=100)	COMP3.A.E.
Unit labour costs (Finland, 1963-82=100)	COMP4.A.E.
Spot-prices of crude oil, USD/b	OP
Oil price index (1975=100)	OPI
Commodity prices excl. energy %-change at annual rate	VINO VINOAD
world trade, %-change at annual rate	WOTRAD
Finlands export markets	FITRAD
3 MONTHS EURODOLLAR RATE	E100

Total Domestic Demand Deflators

USPDDTS UNITED STATES DOMESTIC DEMAND DEFLATOR

USPDDTS =

$$.31298 \Delta \log (.3USULC + .7USULC_{-1}) +$$

(4.837)  
(5.420)

$$.09825 \Delta \log (.8USPM + .2USPM_{-1}) -$$

(3.987)  
(4.610)

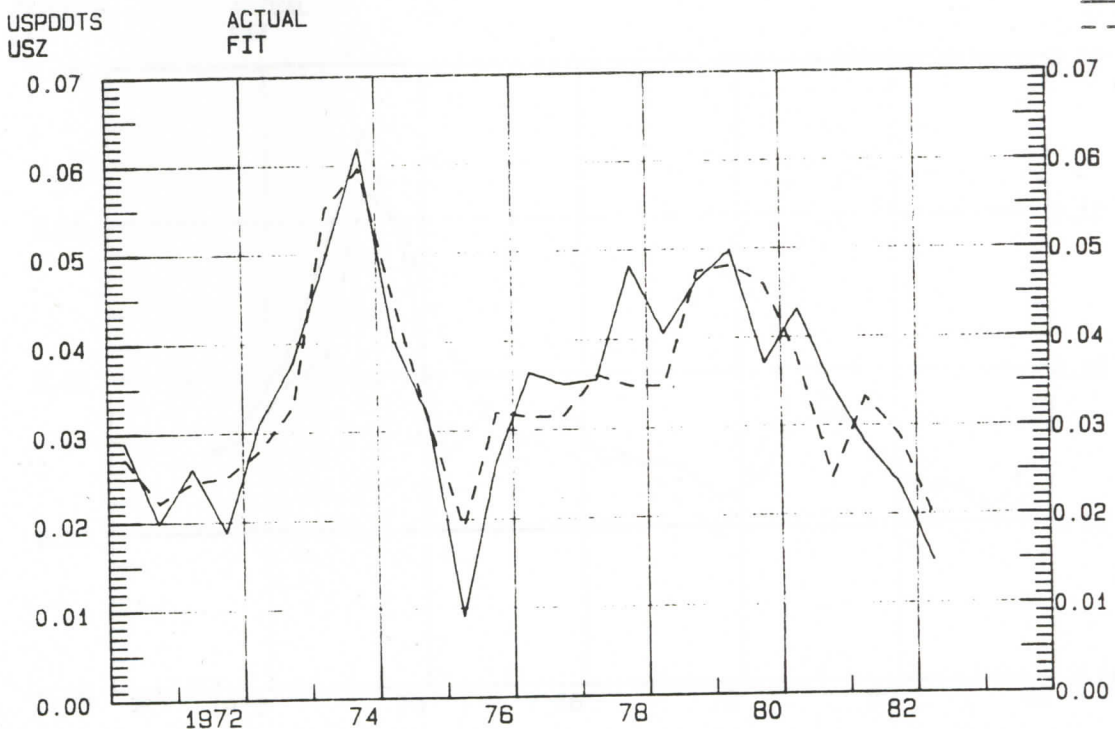
$$.03634 (A-B) + .01640$$

(.669) (2.705)  
(.915) (2.869)

R<sup>2</sup> = .760  
 SEE = .00627  
 DW = 1.959  
 Estimation period 71S1 - 83S1

USPDDTS  $\log (USPDDI/USPDDI_{-1}) + \log ((1-USTINDLSS)/(1-USTINDLSS_{-1}))$   
 USULC unit labour costs  
 USPM imports unit value index  
 A  $\log (USPDDI_{-1} * (1-USTINDLSS_{-1}))$   
 B  $\log (USULC_{-1} + USM_{-1}/USQ_{-1} * (USPM_{-1} - USULC_{-1}))$   
 USPDDI domestic demand deflator index (75=1)  
 USMTIDLSS indirect taxes less subsidies

UNITED STATES DOMESTIC DEMAND DEFLATOR (FIT)



## Total Domestic Demand Deflators

## JAPDDTS JAPAN DOMESTIC DEMAND DEFLATOR

JAPDDTS =

$$.29343 \Delta \log (.7\text{JAULC} + .3\text{JAULC}_{-1}) +$$

(2.888)  
(4.412)

$$.12473 \Delta \log (.8\text{JAPM} + .2\text{JAPM}_{-1}) -$$

(3.866)  
(5.941)

$$.8038 \Delta \log (\text{C}-\text{D}) + .02752$$

(1.506) (3.999)  
(1.459) (3.408)

$$R^2 = .678$$

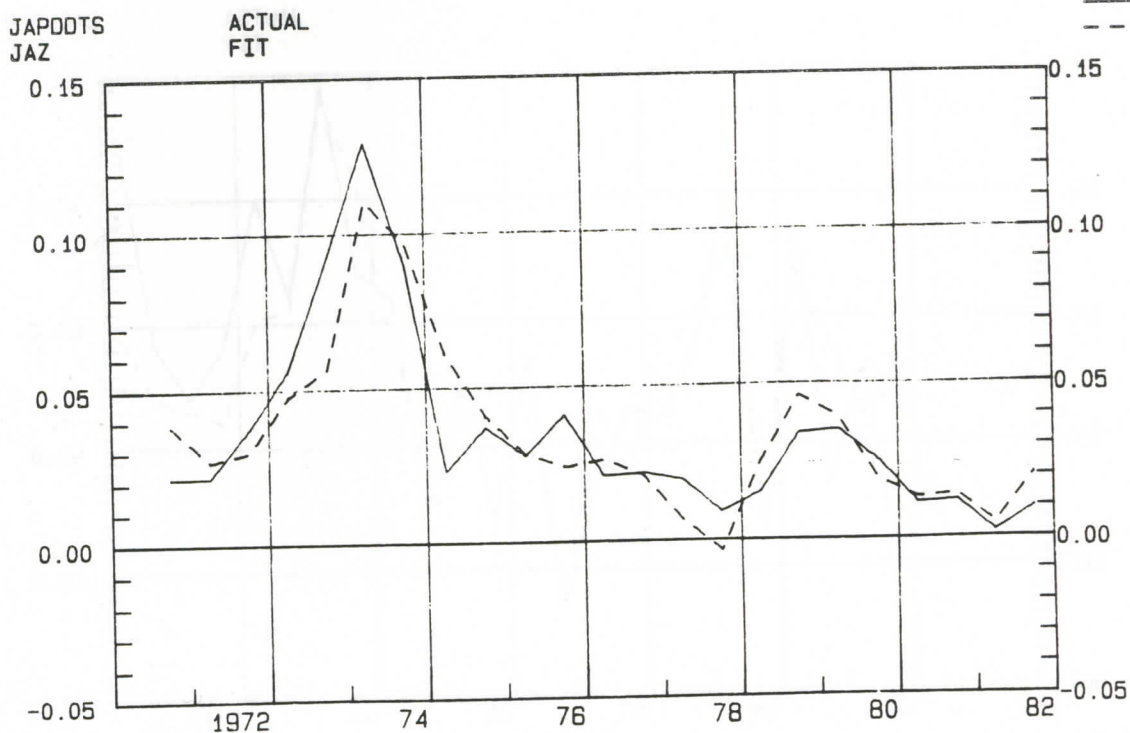
$$\text{SEE} = .01445$$

$$\text{DW} = 1.701$$

Estimation period 71S2 - 82S2

JAPDDTS  $\log (\text{JAPDDI}/\text{JAPDDI}_{-1}) + \log ((1-\text{JATINDLSS})/(1-\text{JATINDLSS}_{-1}))$   
 JAULC unit labour costs  
 JAPM imports unit value index  
 C  $\log (\text{JAPDDI}_{-1} * (1-\text{JATINDLSS}_{-1}))$   
 D  $\log (\text{JAULC}_{-1} + \text{JAM}_{-1}/\text{USQ}_{-1} * (\text{JAPM}_{-1} - \text{JAULC}_{-1}))$   
 JAPDDI domestic demand deflator index (75=1)  
 JATINDLSS indirect taxes less subsidies

## JAPAN DOMESTIC DEMAND DEFLATOR (FIT)





## Total Domestic Demand Deflators

## GEPDDTS GERMANY DOMESTIC DEMAND DEFLATOR

GEPDDTS =

$$.27891 \Delta \log (.7\text{GEULC} + .3\text{GEULC}_{-1}) +$$

(3.256)  
(4.199)

$$.11354 \Delta \log (.8\text{GEPM} + .2\text{GEPM}_{-1}) -$$

(3.689)  
(4.887)

$$.01778 \text{GEDUM}_{-1} - .01959 \text{GEDUM2} + .01724$$

(2.489) (2.692) (7.945)  
(4.933) (6.344) (11.352)

$$R^2 = .691$$

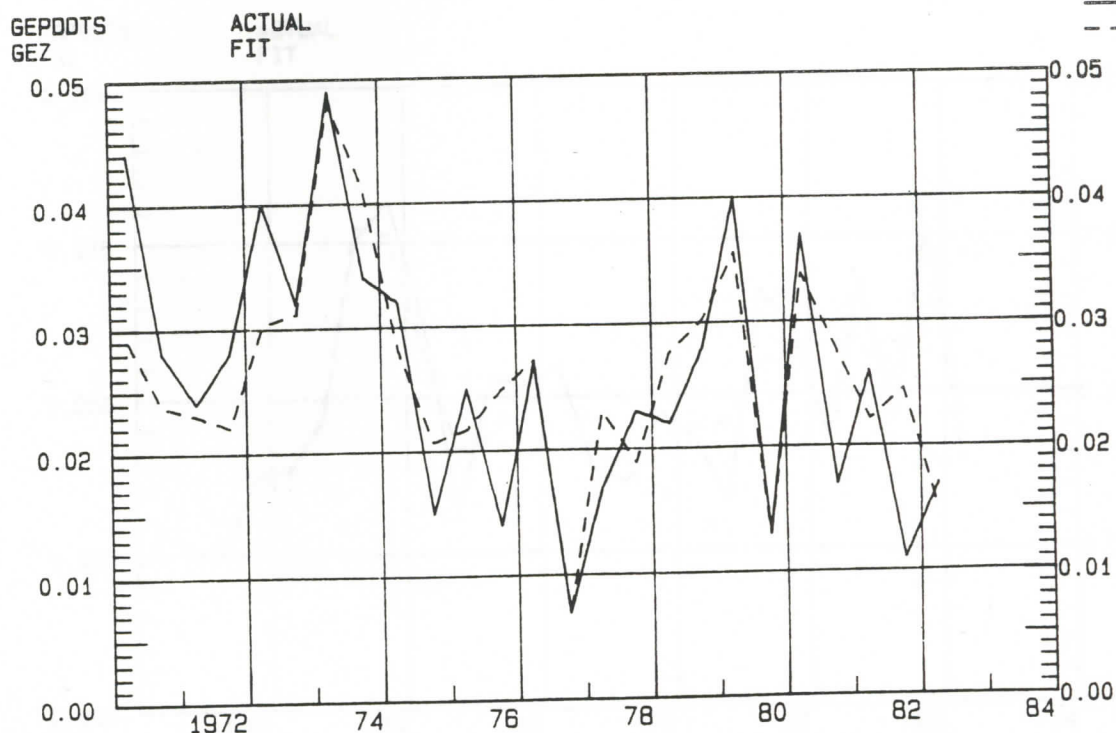
$$\text{SEE} = .0700$$

$$\text{DW} = 1.471$$

Estimation period 71S1 - 83S1

GEPDDTS  $\log (\text{GEPDDI}/\text{GEPDDI}_{-1}) + \log ((1-\text{GETINDLSS})/(1-\text{GETINDLSS}_{-1}))$   
 GEULC unit labour costs  
 GEPM imports unit value index  
 GEDUM1 dummy variable (77S2=1)  
 GEDUM2 dummy variable (80S2=1)  
 GEPDDI domestic demand deflator index (75=1)  
 GETINDLSS indirect taxes less subsidies

## GERMANY DOMESTIC DEMAND DEFLATOR (FIT)



## Total Domestic Demand Deflators

FRPDDTS FRANCE DOMESTIC DEMAND DEFLATOR

FRPDDTS =

$$.34399 \Delta \log (.7FRULC + .3FRULC_{-1}) +$$

(4.075)  
(4.585)

$$.14843 \Delta \log (.8FRPM + .2FRPM_{-1}) -$$

(4.967)  
(7.331)

$$.10288 (E-F) + .02509 STOP + .01389$$

(1.327) (2.787) (1.842)  
(2.182) (6.868) (2.724)

$$R^2 = .819$$

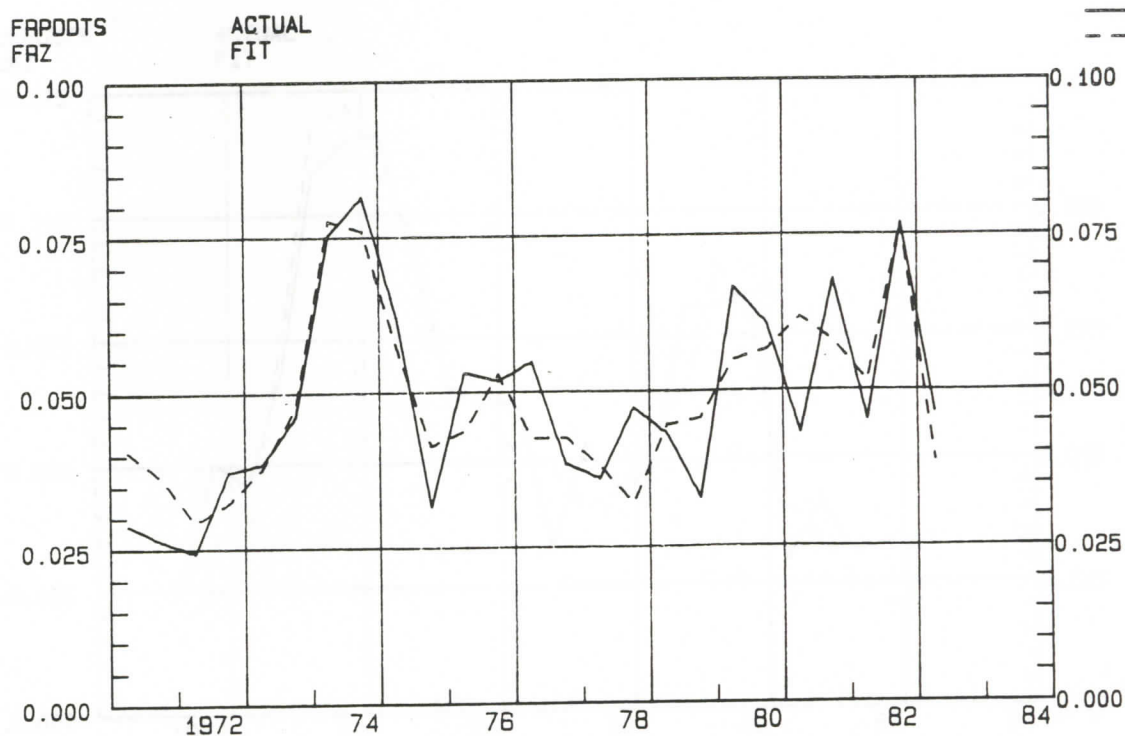
$$SEE = .00911$$

$$DW = 2.049$$

Estimation period 71S1 - 83S1

FRPDDTS  $\log (FRPDDI/FRPDDI_{-1}) + \log ((1-FRTINDLSS)/(1-FRTINDLSS_{-1}))$   
 FRULC unit labour costs  
 FRPM imports unit value index  
 $E = \log (FRPDDI_{-1} + FRM_{-1} * (FRPM_{-1} - FRULC_{-1}))$   
 F  $\log (FRULC_{-1} + FRM_{-1} * (FRPM_{-1} - FRULC_{-1}))$   
 STOP dummy variable (82S2=1)  
 FRPDDI domestic demand deflator index (75=1)  
 FRTINDLSS indirect taxes less subsidies

FRANCE DOMESTIC DEMAND DEFLATOR (FIT)



## Total Domestic Demand Deflators

## UKPDDTS UNITED KINGDOM DOMESTIC DEMAND DEFLATOR

UKPDDTS =

$$.62974 \Delta \log (.7UKULC + .3UKULC_{-1}) +$$

(16.279)  
(21.336)

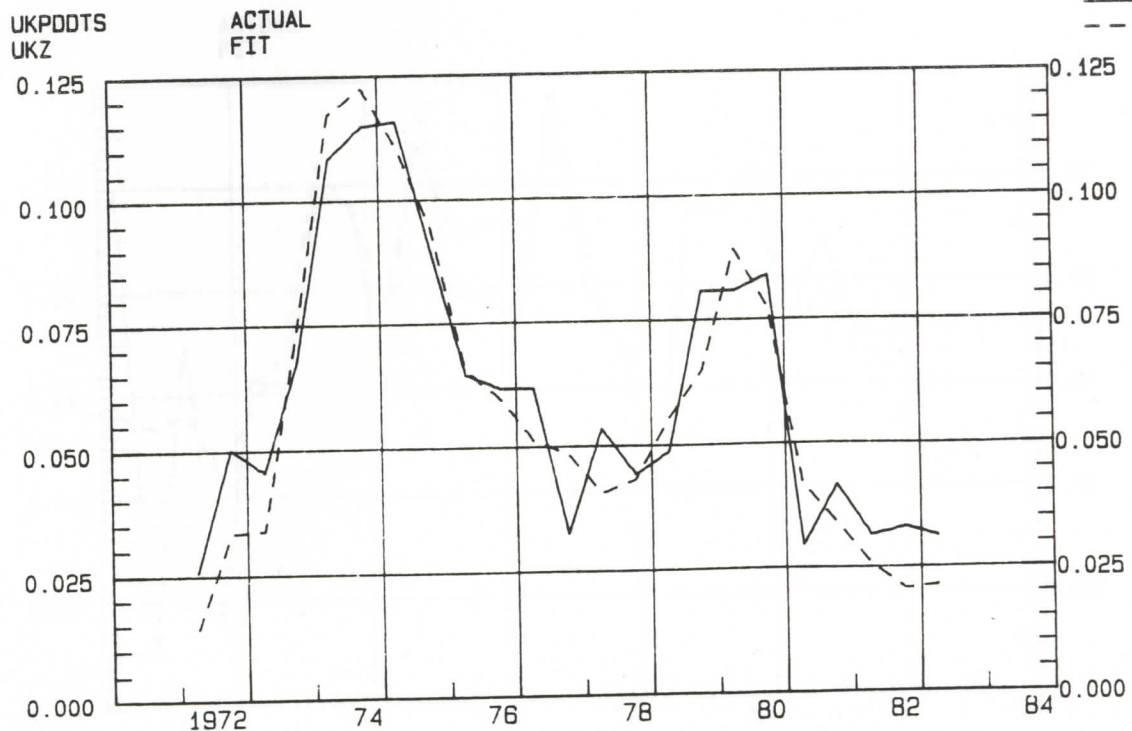
$$.27287 \Delta \log (.8UKPM + .2UKPM_{-1})$$

(8.192)  
(9.848)

$R^2$  = .929  
 SEE = .01022  
 DW = 1.852  
 Estimation period 72S1 - 83S1

UKPDDTS  $\log (UKPDDI/UKPDDI_{-1}) + \log ((1-UKTINDLSS)/(1-UKTINDLSS_{-1}))$   
 UKULC unit labour costs  
 UKPM imports unit value index  
 UKPDDI domestic demand deflator index (75=1)  
 UKTINDLSS indirect taxes less subsidies

## UNITED KINGDOM DOMESTIC DEMAND DEFLATOR (FIT)





## Total Domestic Demand Deflators

## SWPDDTS SWEDEN DOMESTIC DEMAND DEFLATOR

SWPDDTS =

$$.18540 \Delta \log \text{SWULC} + .09261 \Delta \log \text{SWPM} -$$

(3.072) (2.214)  
(4.493) (2.453)

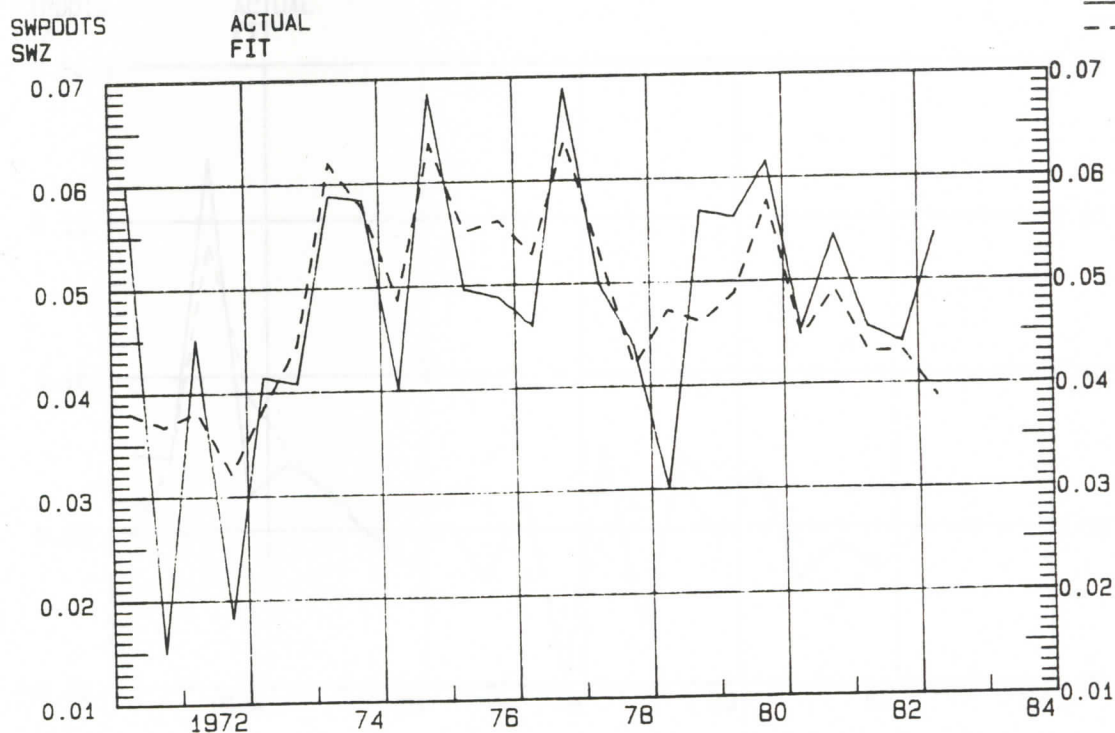
$$.10425 (I-J) + .03887$$

(2.229) ( 8.423)  
(2.094) (11.323)

$R^2$  = .459  
SEE = .01034  
DW = 2.469  
Estimation period 71S1 - 83S1

SWPDDTS  $\log (\text{SWPDDI}/\text{SWPDDI}_{-1}) + \log ((1-\text{FITINDLSS})/(1-\text{SWTINDLSS}_{-1}))$   
SWULC unit labour costs  
SWPM imports unit value index  
I  $\log (\text{SWPDDI}_{-1}*(1-\text{SWTINDLSS}_{-1}))$   
J  $\log (\text{SWULC}_{-1}+\text{SWM}_{-1}/\text{SWQ}_{-1}*(\text{SWPM}_{-1}-\text{SWULC}_{-1}))$   
SWPDDI domestic demand deflator index (75=1)  
TINDLSS indirect taxes less subsidies

## SWEDEN DOMESTIC DEMAND DEFLATOR (FIT)



Total Domestic Demand Deflators

FIPDDTS FINLAND DOMESTIC DEMAND DEFLATOR

FIPDDTS =

$$.2864 \Delta \log (.3\text{FIULC} + .7\text{FIULC}_{-1}) +$$

(3.665)  
(4.932)

$$.43025 \Delta \log (.8\text{FIPM} + .2\text{FIPM}_{-1}) -$$

(6.560)  
(5.318)

$$.01338$$

(2.205)  
(2.304)

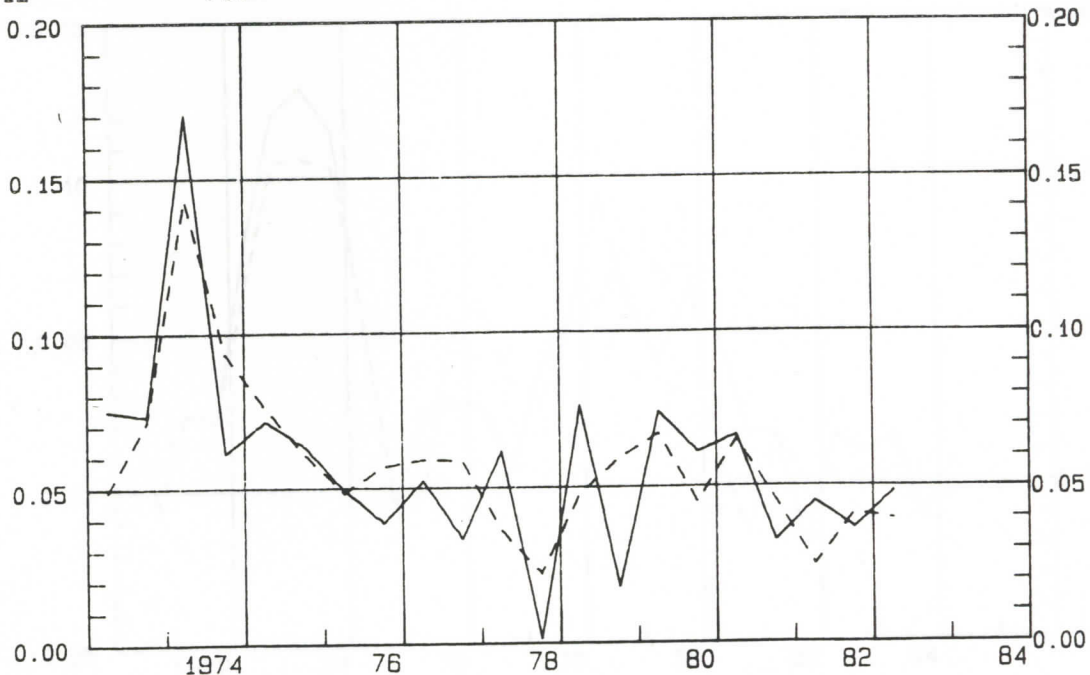
R<sup>2</sup> = .794  
 SEE = .01813  
 DW = 1.748  
 Estimation period 73S1 - 83S1

FIPDDTS  $\log (\text{FIPDDI}/\text{FIPDDI}_{-1}) + \log ((1-\text{FITINDLSS})/(1-\text{FITINDLSS}_{-1}))$   
 FIULC unit labour costs  
 FIPM imports unit value index  
 FIPDDI domestic demand deflator index (75=1)  
 FIMNDLSS indirect taxes less subsidies

FINLAND DOMESTIC DEMAND DEFLATOR (FIT)

FIPDDTS  
FIZ

ACTUAL  
FIT



Export prices

USPX UNITED STATES EXPORT PRICE DEFLATOR

$\Delta \log \text{USPX} =$

$$.22976 \Delta \log (.5 \text{VIND} + .5 \text{VIND}_{-1}) + .73502 \Delta \log (.3 \text{USULC} +$$

(3.806) (4.602)  
(4.221) (4.322)

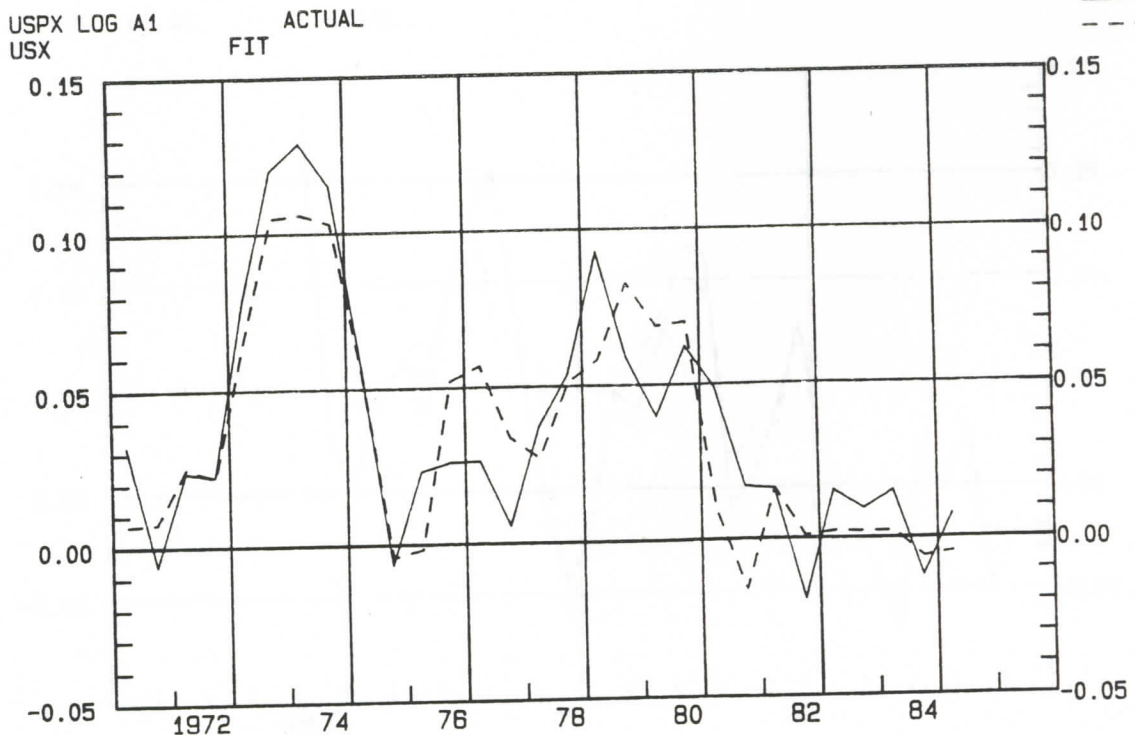
$$.7 \text{USULC}_{-1}) + .23276 \Delta \log \text{USWPX}$$

(2.248)  
(2.281)

$R^2 = .666$   
 $\text{SEE} = .02038$   
 $\text{DW} = 1.831$   
 Estimation period 71S1 - 85S1

USPX exports, unit value index (in USD)  
 VIND raw materials price index excl. energy  
 USULC unit labour costs  
 USWPX competitors' export price index

UNITED STATES EXPORT PRICES (FIT)





## Export prices

## JAPXDOL JAPAN EXPORT PRICE DEFLATOR

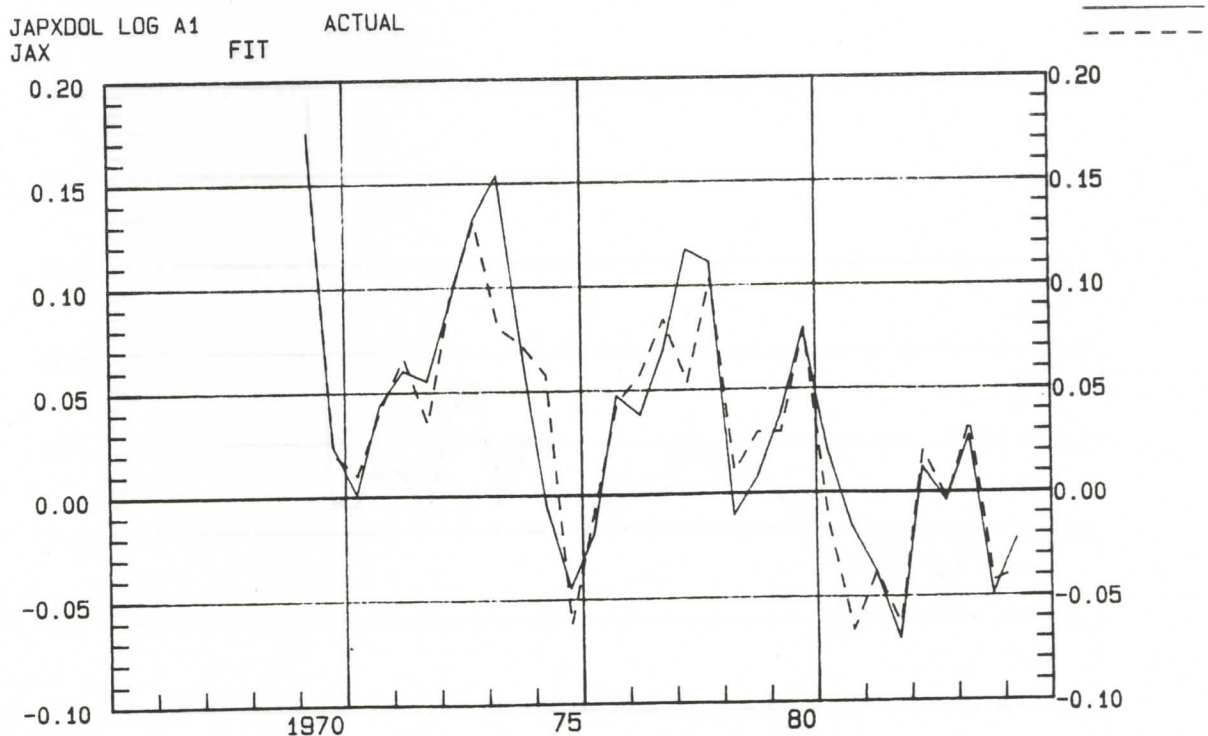
 $\Delta \log \text{JAPXDOL} =$ 

$$\begin{array}{rcl}
 .20874 \Delta \log (\text{VINO}_{-1}) + & .50689 \Delta \log \text{JAWPX} + & .40520 \Delta \log \text{JPY} \\
 (3.935) & (6.738) & (5.309) \\
 (2.792) & (7.507) & (6.436)
 \end{array}$$

$R^2$  = .823  
 SEE = .02687  
 DW = 1.977  
 Estimation period 70S1 - 85S1

JAPXDOL export unit value index (in USD)  
 VIND raw materials price index excl. energy  
 JAWPX competitors' export price index  
 JPY exchange rate to USD (75=1)

## JAPAN EXPORT PRICES (FIT)



## Export prices

## GEPXDOL GERMANY EXPORT PRICE DEFLATOR

 $\Delta \log \text{GEPXDOL} =$ 

$$\begin{aligned} &.26017 \Delta \log (.5 \text{ GEULC} + .5 \text{ GEULC}_{-1}) + .50298 \Delta \log \text{GEWPX} + \\ (1.928) & & (5.486) \\ (2.275) & & (5.035) \end{aligned}$$

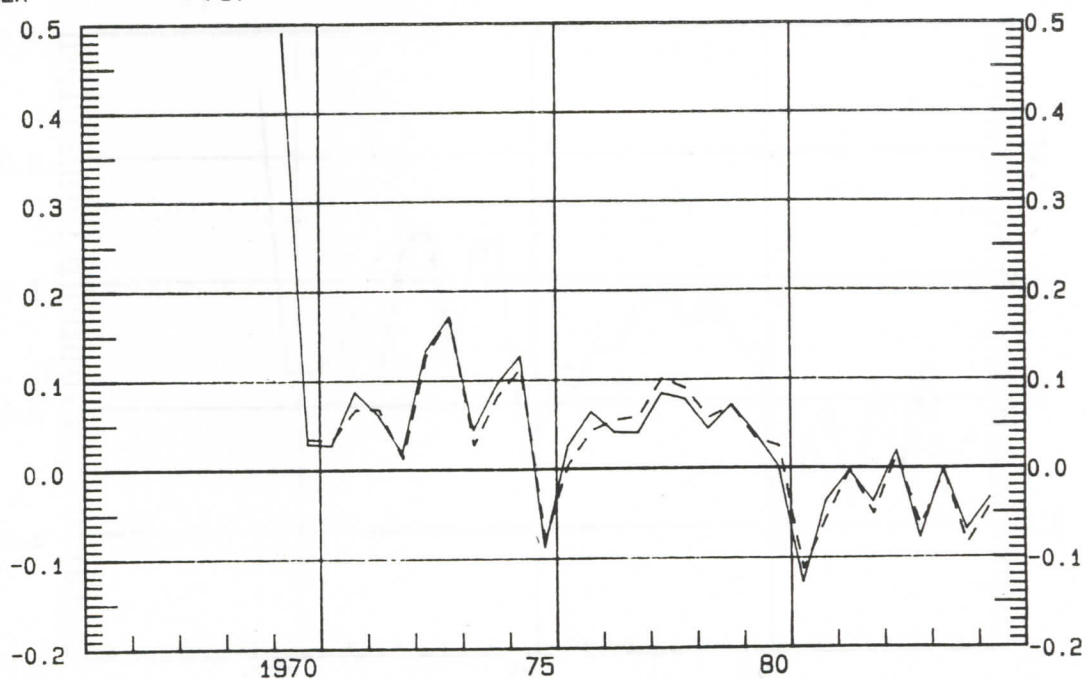
$$\begin{aligned} &.66584 \Delta \log \text{DEM} \\ (12.387) & \\ (10.735) & \end{aligned}$$

$R^2$  = .958  
 SEE = .01364  
 DW = 1.946  
 Estimation period 70S2 - 85S1

GEPXDOL export unit value index  
 GEULC unit labour costs  
 GEWPX competitors' export price index  
 GEM exchange rate to USD (75=1)

## GERMANY EXPORT PRICES (FIT)

GEPXDOL LOG A1 ACTUAL  
 GEX FIT



## Export prices

## FRPXDOL FRANCE EXPORT PRICE DEFLATOR

$$\Delta \log \text{FRPXDOL} =$$

$$.16221 \Delta \log (.5 \text{FRULC} + .5 \text{FRULC}_{-1}) + .83149 \Delta \log \text{FRWPX} +$$

(2.310) (18.966)  
(2.554) (23.068)

$$.40993 \Delta \log \text{FRF}$$

(10.179)  
( 9.302)

$$R^2 = .967$$

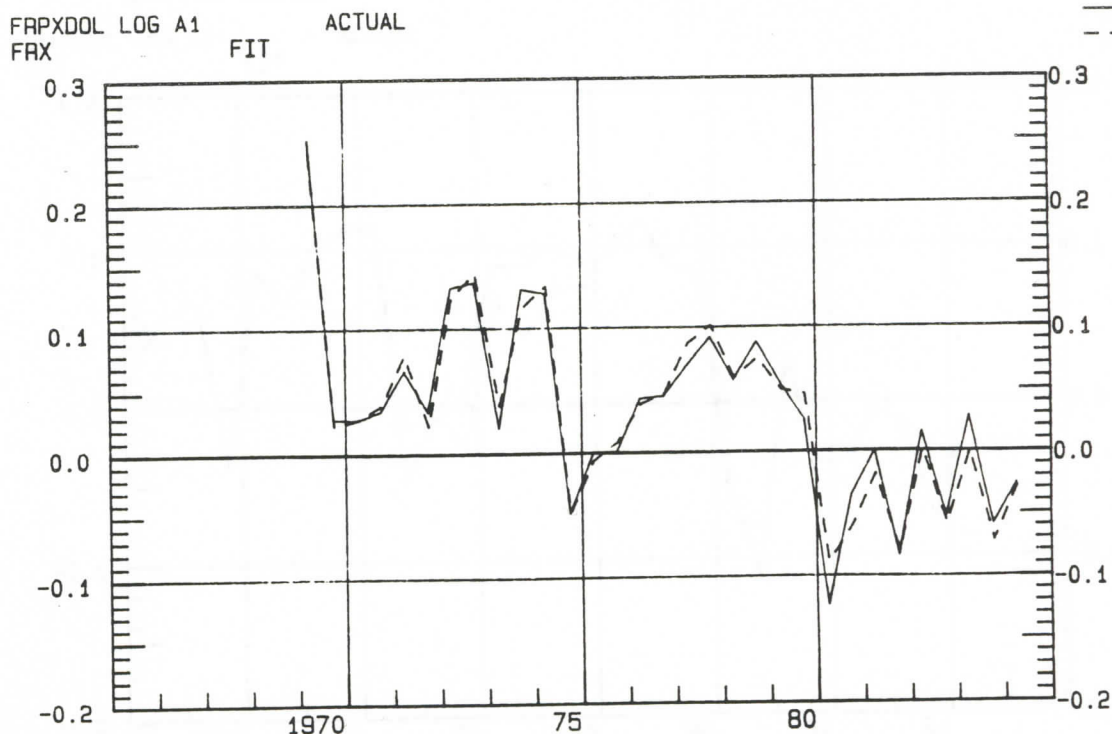
$$\text{SEE} = .01428$$

$$\text{DW} = 1.720$$

Estimation period 70S1 - 85S1

FRPXDOL export unit value index  
FRULC unit labour costs  
FRWPX competitors' export price index  
FRF exchange rate to USD (75=1)

## FRANCE EXPORT PRICES (FIT)





## Export prices

## UKPX DOL UNITED KINGDOM EXPORT PRICE DEFLATOR

$$\Delta \log \text{UKPX DOL} =$$

$$\begin{aligned} &.02161 \Delta \log \text{VINO} + .29123 \Delta \log (.7\text{UKULC} + .3 \text{UKULC}_{-1}) - \\ &(.516) \qquad \qquad \qquad (1.827) \\ &(.670) \qquad \qquad \qquad (1.708) \end{aligned}$$

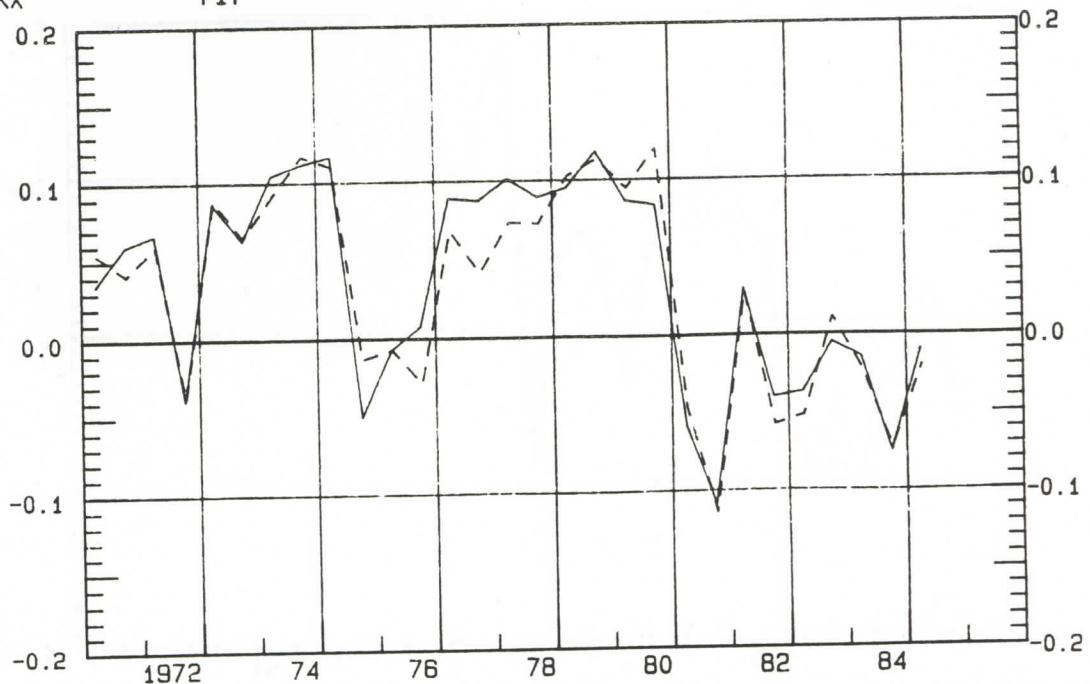
$$\begin{aligned} &.30428 \Delta \log (\text{UKPX DOL}/\text{UKWPX})_{-1} + .86306 \Delta \log \text{GBP} \\ &(3.555) \qquad \qquad \qquad (14.008) \\ &(3.287) \qquad \qquad \qquad (13.650) \end{aligned}$$

$R^2$  = .933  
 SEE = .01798  
 DW = 2.291  
 Estimation period 71S1 - 85S1

UKPX DOL export unit value index  
 VIND raw materials price index, excl. energy  
 UKULC unit labour costs  
 GBP exchange rate to USD (75=1)

## UNITED KINGDOM EXPORT PRICES (FIT)

UKPX DOL LOG A1 ACTUAL  
 UKX FIT



## Export prices

## SWPXDOL SWEDEN EXPORT PRICE DEFLATOR

$$\Delta \log \text{SWPXDOL} =$$

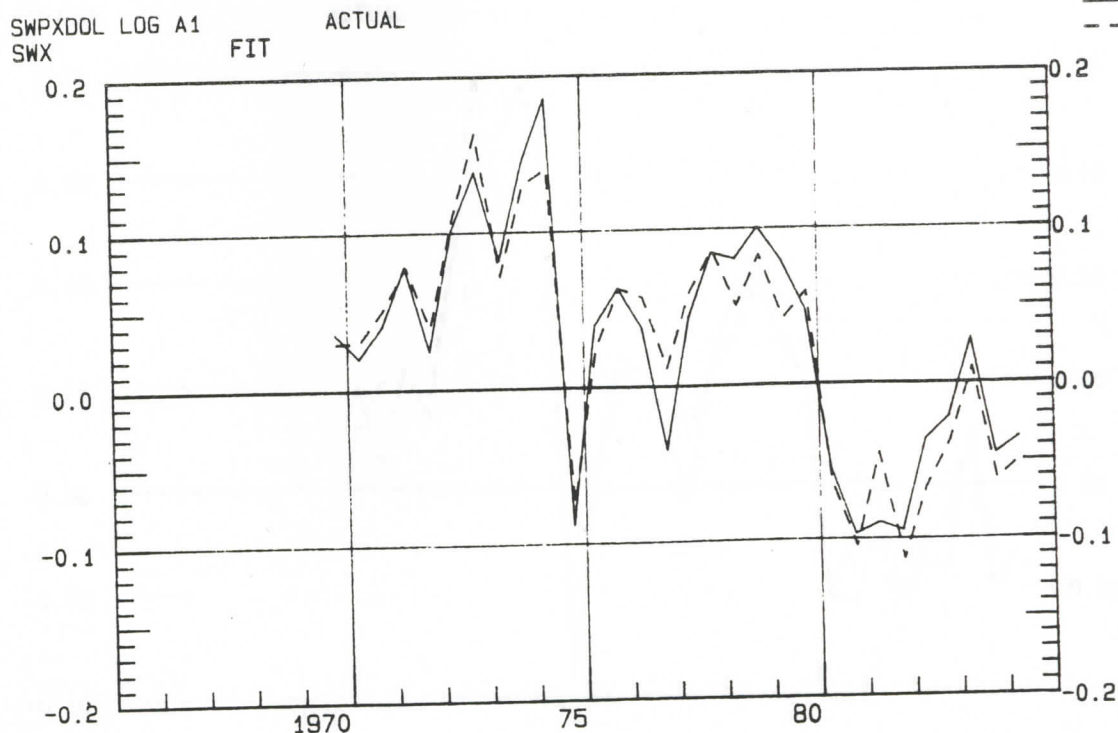
$$\begin{aligned} &.10551 \Delta \log \text{VINO}_{-1} + .30703 \Delta \log (.3\text{SWULC} + .7\text{SWULC}_{-1}) + \\ (2.118) & \quad (2.256) \\ (2.673) & \quad (2.386) \end{aligned}$$

$$\begin{aligned} &.67569 \Delta \log \text{SWWPX} + .60941 \Delta \log \text{SEK} \\ (4.855) & \quad (6.193) \\ (5.651) & \quad (5.176) \end{aligned}$$

$R^2 = .898$   
 $\text{SEE} = .02285$   
 $\text{DW} = 2.018$   
 Estimation period 70S2 - 85S1

SWPXDOL export unit value index  
 VIND raw materials price index, excl. energy  
 SWULC unit labour costs  
 SWWPX competitors' export price index  
 SEK exchange rate to USD (75=1)

## SWEDEN EXPORT PRICES (FIT)



## Export prices

## FIPXDOL FINLAND EXPORT PRICE DEFLATOR

 $\Delta \log \text{FIPXDOL} =$ 

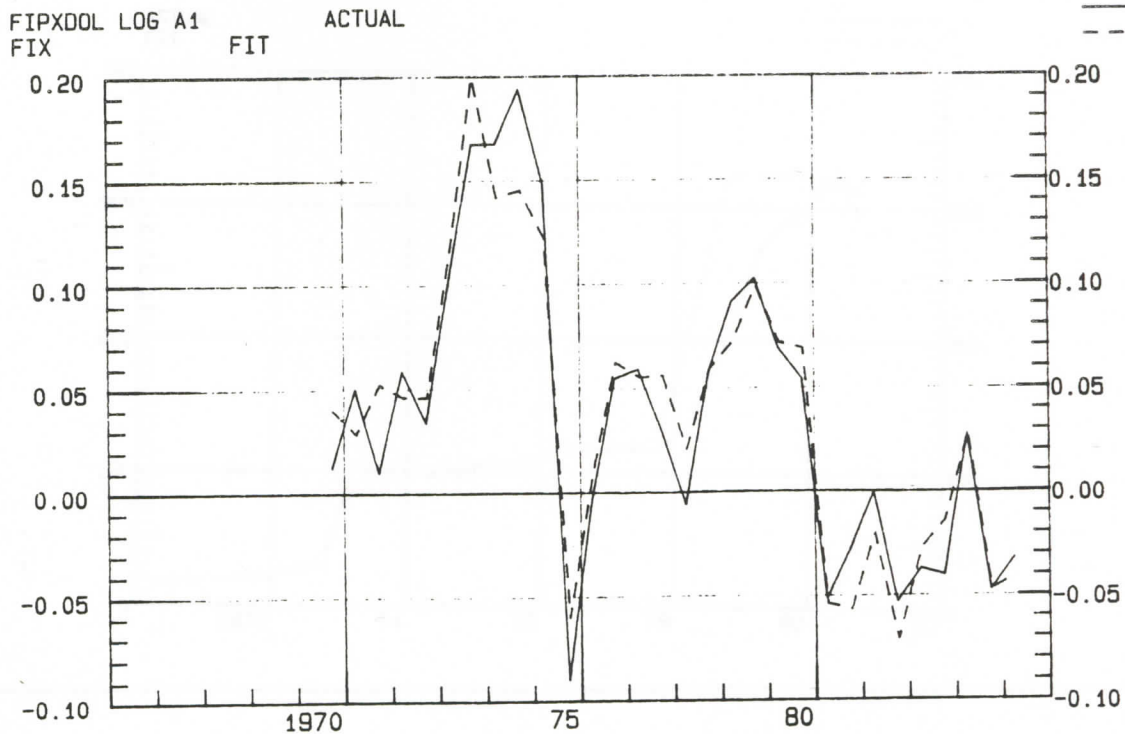
$$\begin{aligned} &.21640 \Delta \log \text{VIND}_{-1} + .23008 \Delta \log (.3\text{FIULC} + .7\text{FIULC}_{-1}) + \\ (4.488) & & (1.964) \\ (4.249) & & (1.829) \end{aligned}$$

$$\begin{aligned} &.77251 \Delta \log \text{FIWPX} + .31657 \Delta \log \text{FMK} \\ (5.324) & & (2.216) \\ (5.460) & & (2.504) \end{aligned}$$

$R^2$  = .894  
 SEE = .02285  
 DW = 1.920  
 Estimation period 70S2 - 85S1

FIPXDOL export unit value index  
 VIND raw materials price index, excl. energy  
 FIULC unit labour costs  
 FIWPX competitors' export price index  
 FMK exchange rate to USD (75=1)

## FINLAND EXPORT PRICES (FIT)





## Export prices

OPPX	OPEC COUNTRIES EXPORT PRICES
------	------------------------------

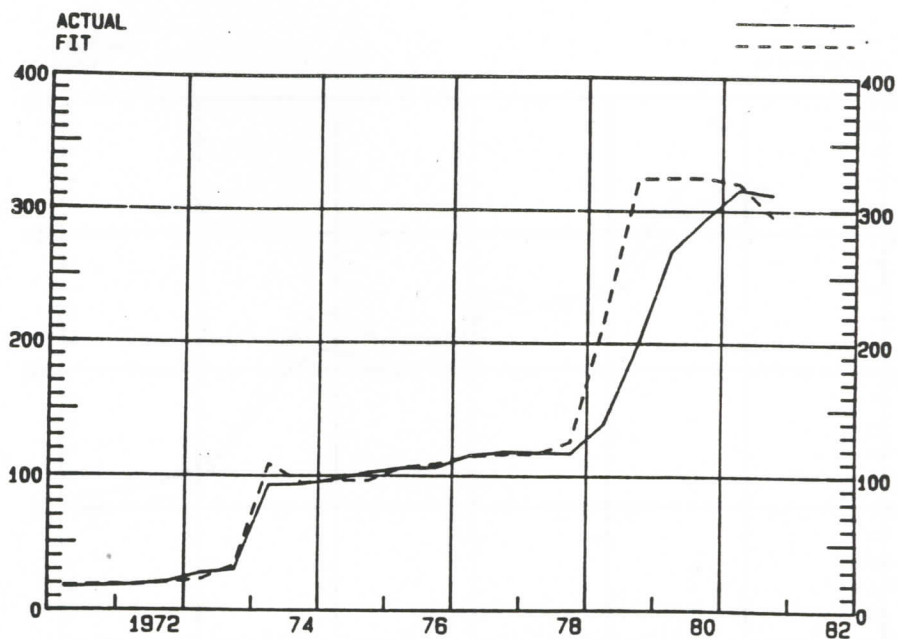
OPPX =
--------

8.90383 OP + 3.79348
(129.756) (3.224)

R <sup>2</sup>	=	.999
SEE	=	3.395
DW	=	1.616
Estimation period 71S1 - 81S2		

OPPX	export unit value index
OP	crude oil price \$/bar

## EXPORT PRICES, OPEC-COUNTRIES



## Export prices

## DCPX DEVELOPING COUNTRIES EXPORT PRICES

DCPX =

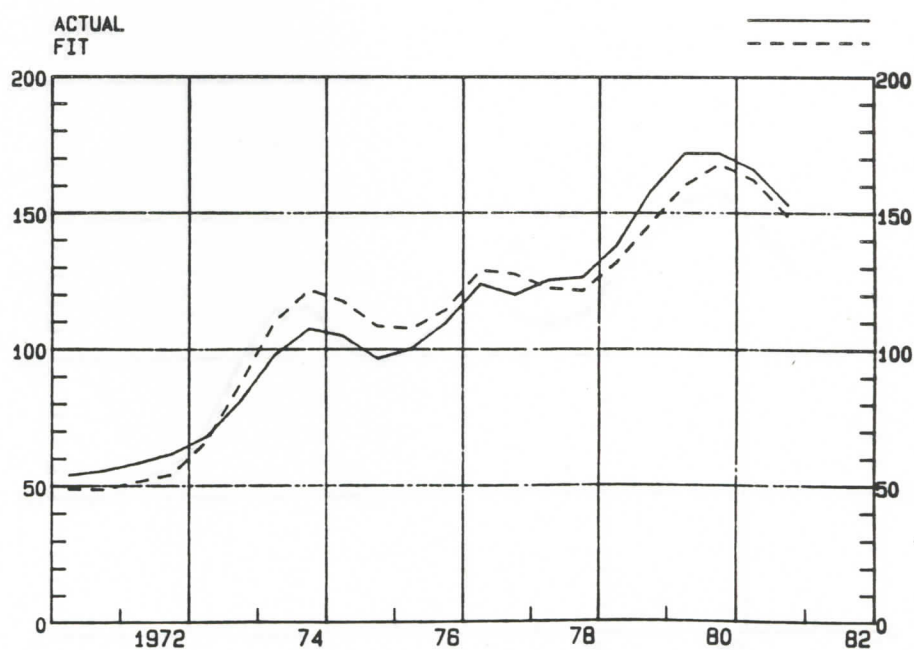
$$.56257 \text{ VINO} + .35705 \text{ VINO}_{-1} + .18752 \text{ VINO}_2 - 6.92340$$

(19.809)            (19.812)            (19.801)            (1.106)

R<sup>2</sup>        = .952  
 SEE       = 8.661  
 DW        = .277  
 Estimation period 71S1 - 81S2

DCPX        export unit value index  
 VINO       commodity price index (oil excl.)

## EXPORT PRICES, DEVELOPING COUNTRIES



## Commodity prices (excl. energy)

VINO

COMMODITY PRICES, ENERGY EXCL.

 $\Delta VINO =$ 

$$\begin{array}{rcccc} .57600 & \Delta VINO & + & 71.79792 & \Delta DEM & + & 5.94949 & OESK & + & .45203 \\ (3.598) & & & (3.031) & & & (3.746) & & & (0.246) \end{array}$$

$$R^2 = 0.627$$

$$SEE = 7.942$$

$$DW = 2.207$$

Estimation period 71S1 - 81S2

VINO

commodity price index, non energy

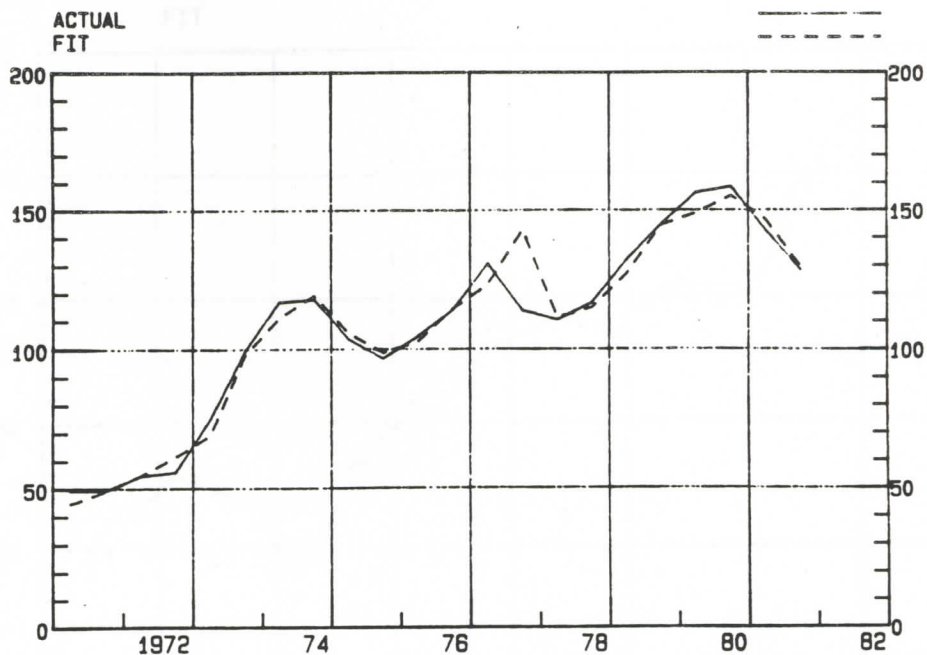
DEM

dollar rate of German mark, USD/DEM

OESK

inventory investments of OECD countries

## COMMODITY PRICES

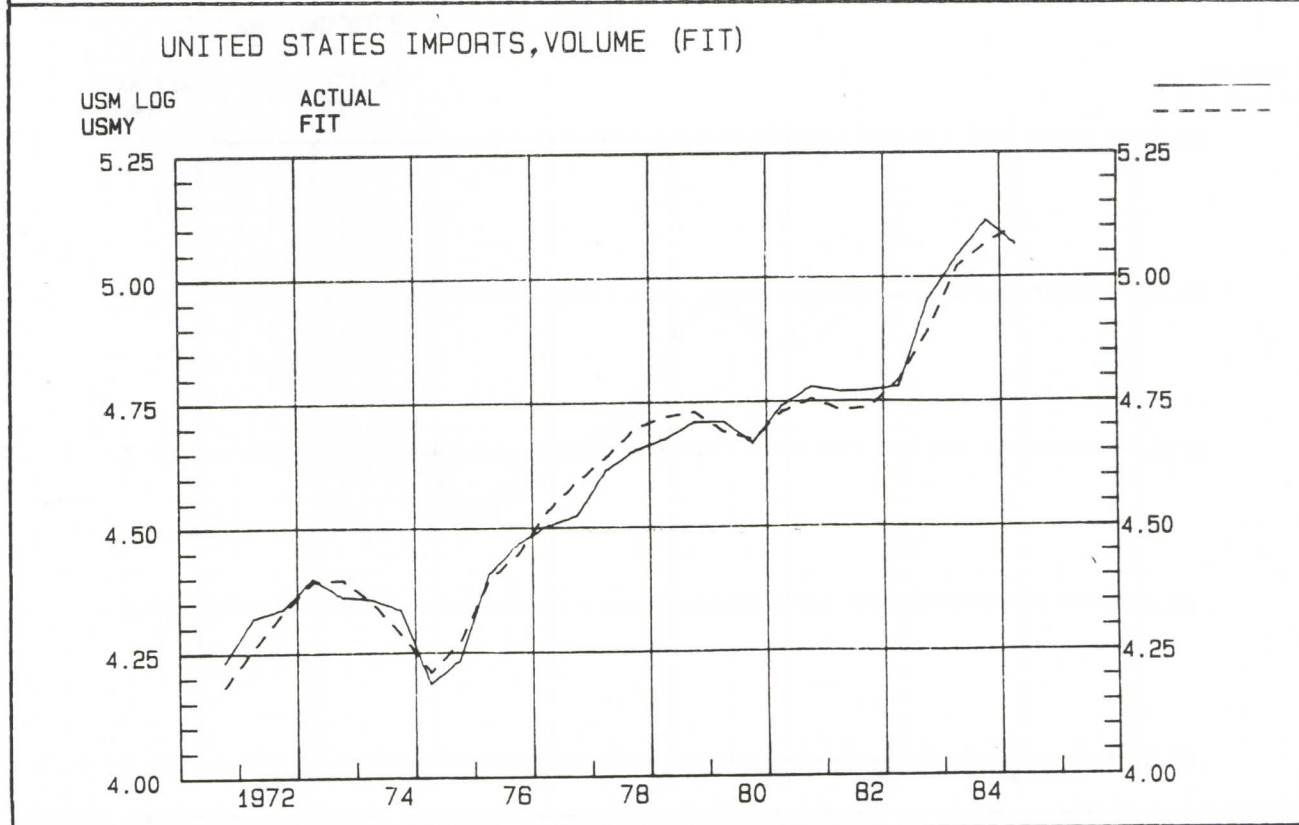




Import volumes

USM	UNITED STATES IMPORTS, VOLUME (80 - USD)
$\log \text{ USM} =$ $-.15318 \log(\text{USPM}/\text{USPDDI})_{-1} + 2.04869 \log \text{ USDD}$ (2.579) (8.088) (2.783) (7.449)  $+ .16834 \log (\text{USM})_{-1} - 10.95779$ (1.570) (7.838) (1.572) (7.034)	
$R^2 = .981$ $\text{SEE} = .03522$ $\text{DW} = 1.903$ Estimation period 71S2 - 85S1	

USM	imports, volume (80-USD; local currency)
PM	imports, unit value index
PDDI	(total) domestic demand price deflator
DD	(total) domestic demand



## Import volumes

JAM JAPAN IMPORTS, VOLUME (80 - USD)

$\log \text{JAM} =$

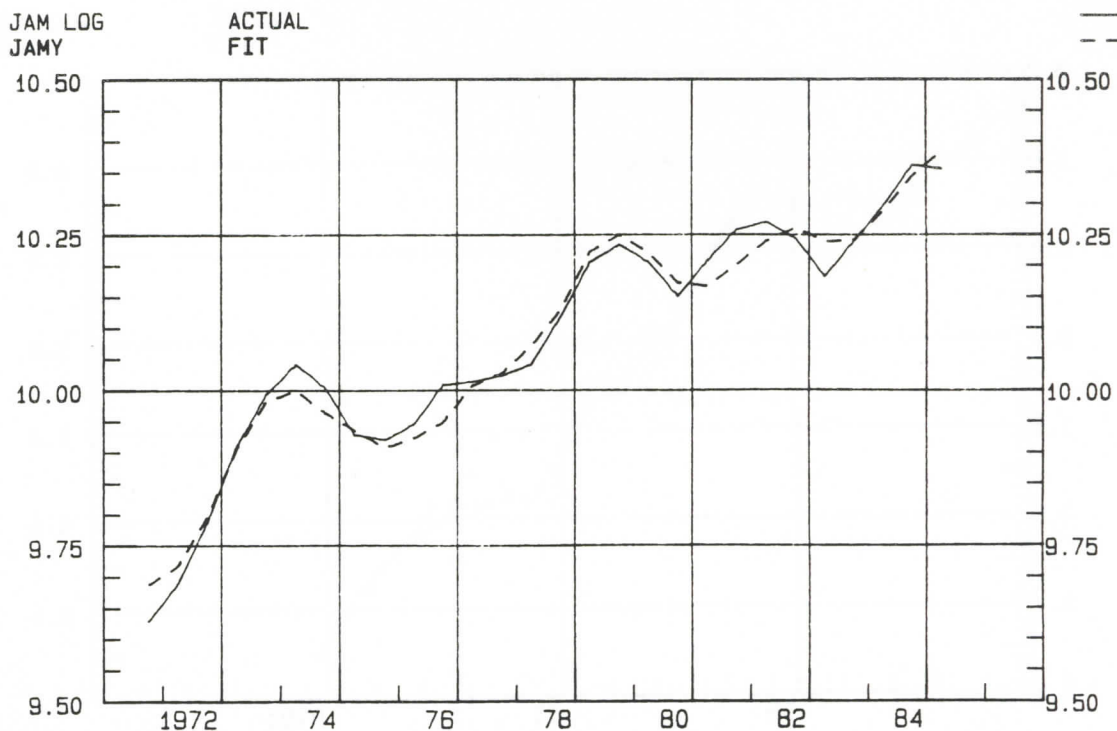
$$\begin{aligned} &-.19607 \log(\text{JAPM}/\text{JAPDDI})_{-1} + .81400 \log \text{JADD} \\ &(3.764) \qquad \qquad \qquad (5.232) \\ &(5.060) \qquad \qquad \qquad (4.811) \end{aligned}$$

$$\begin{aligned} &+ .49162 \log (\text{JAM})_{-1} - 4.67629 \\ &(4.445) \qquad \qquad \qquad (4.594) \\ &(4.311) \qquad \qquad \qquad (3.780) \end{aligned}$$

$R^2$  = .999  
 SEE = .02826  
 DW = 1.598  
 Estimation period 71S2 - 85S1

JAM imports, volume (80-USD; local currency)  
 JAPM imports, unit value index  
 JAPDDI (total) domestic demand price deflator  
 JADD (total) domestic demand

JAPAN IMPORTS, VOLUME (FIT)



## Import volumes

GEM GERMANY IMPORTS, VOLUME (80 - USD)

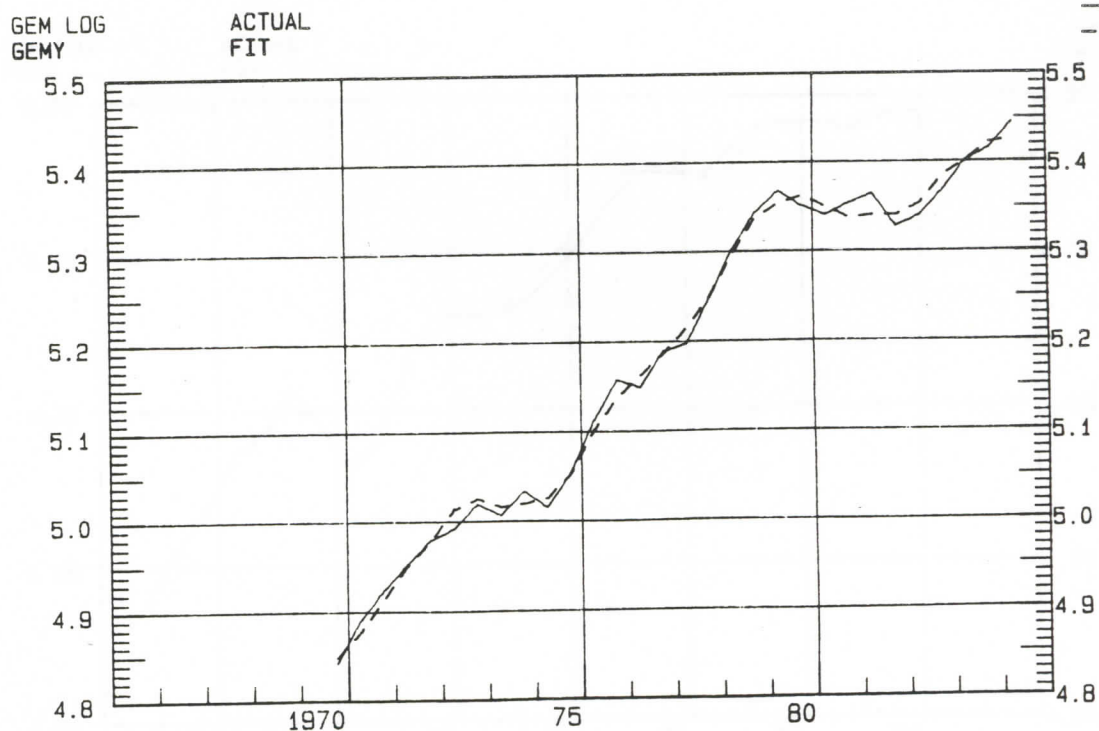
log GEM =

$$\begin{array}{r}
 .99816 \log(\text{GEDD}) + .20163 \log(\text{GEM})_{-1} + .00723 \text{TREND} - \\
 (7.358) \quad (1.983) \quad (5.217) \\
 (8.279) \quad (2.152) \quad (5.732) \\
 \\
 2.49139 \\
 (4.559) \\
 (5.381)
 \end{array}$$

$R^2$  = .995  
 SEE = .01312  
 DW = 1.906  
 Estimation period 70S2 - 85S1

GEM imports, volume (80-USD; local currency)  
 GEDD (total) domestic demand  
 TREND (time) trend variable

GERMANY IMPORTS, VOLUME (FIT)





## Import volumes

FRM FRANCE IMPORTS, VOLUME (80 - USD)

log FRM =

$$-.18341 \log(\text{FRPM}/\text{FRPDDI})_{-1} + 1.78832 \log \text{FRDD}$$

(2.746) (8.616)  
(3.501) (9.415)

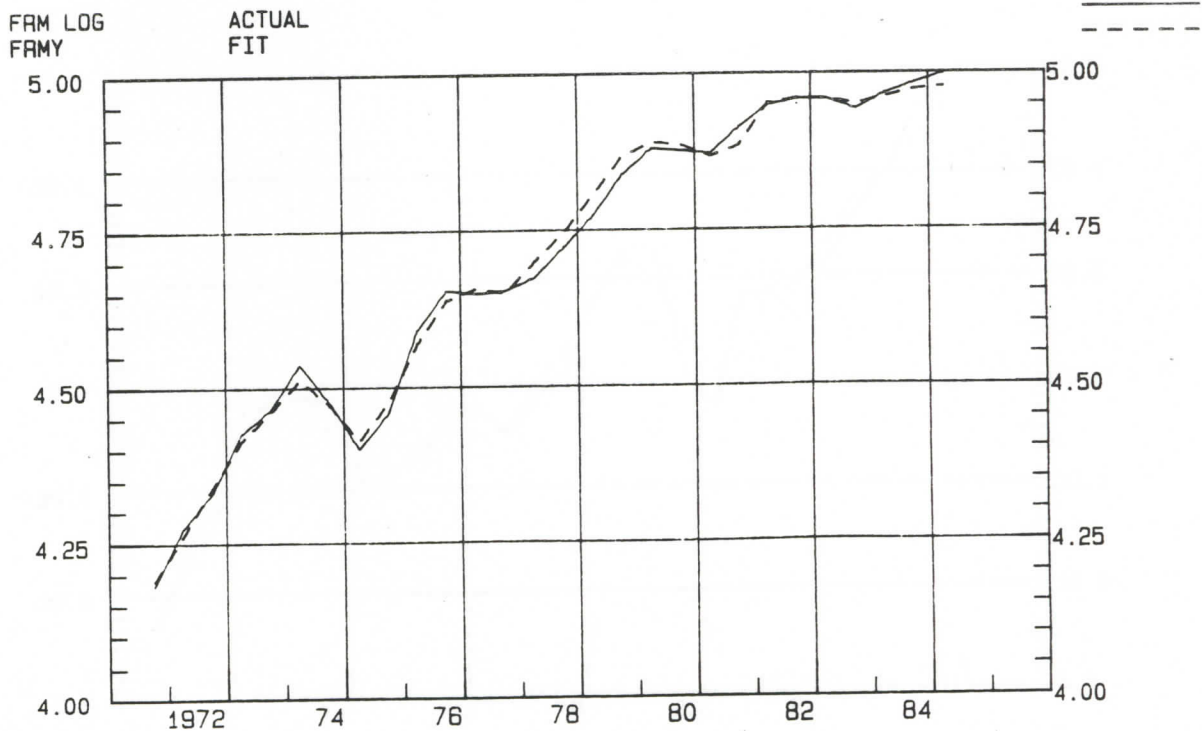
$$+ .23940 \log (\text{FRM})_{-1} - 7.59522$$

(2.698) (8.449)  
(3.027) (9.221)

R<sup>2</sup> = .996  
 SEE = .01576  
 DW = 1.994  
 Estimation period 71S2 - 85S1

FRM imports, volume (local currency)  
 FRPM imports, unit value index  
 RPDDI domestic demand price deflator  
 FRDD (total) domestic demand

FRANCE IMPORTS, VOLUME (FIT)



## Import volumes

UKM UNITED KINGDOM IMPORTS, VOLUME (80 - USD)

$\log \text{UKM} =$

$$-.04490 \log(\text{UKPM}/\text{UKPDDI})_{-1} + 1.55424 \log \text{UKDD}$$

(.771) (7.420)  
(1.012) (7.638)

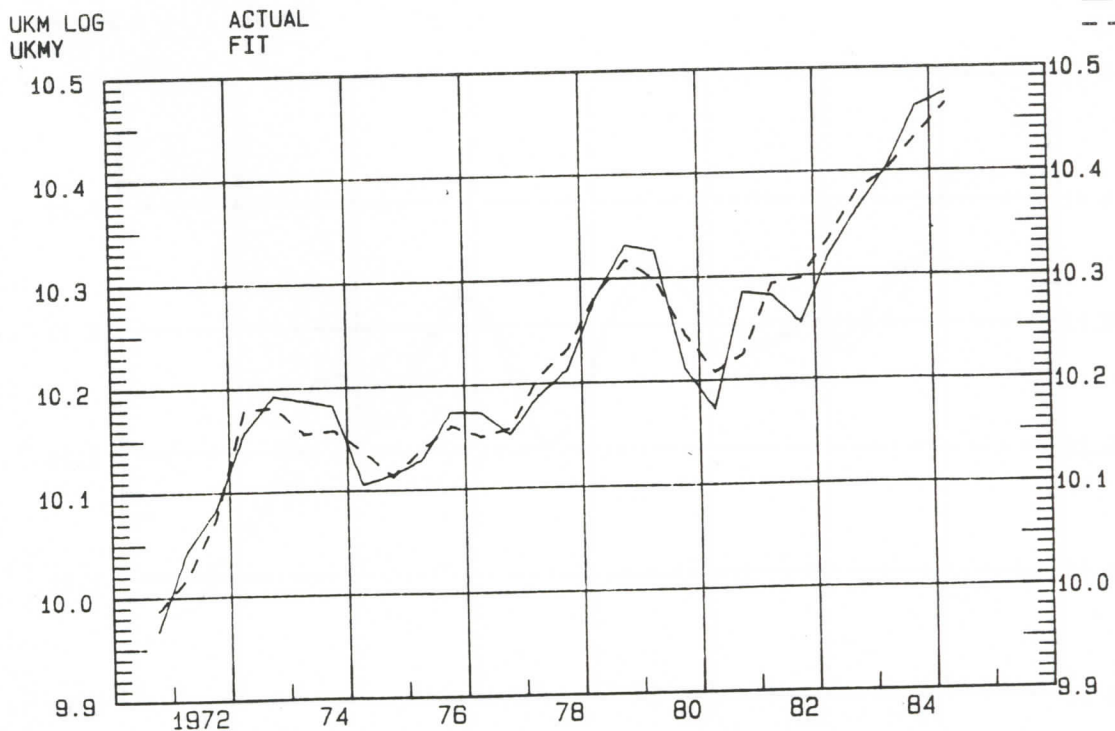
$$+ .27457 \log (\text{UKM})_{-1} - 10.61993$$

(2.557) (6.993)  
(2.620) (7.538)

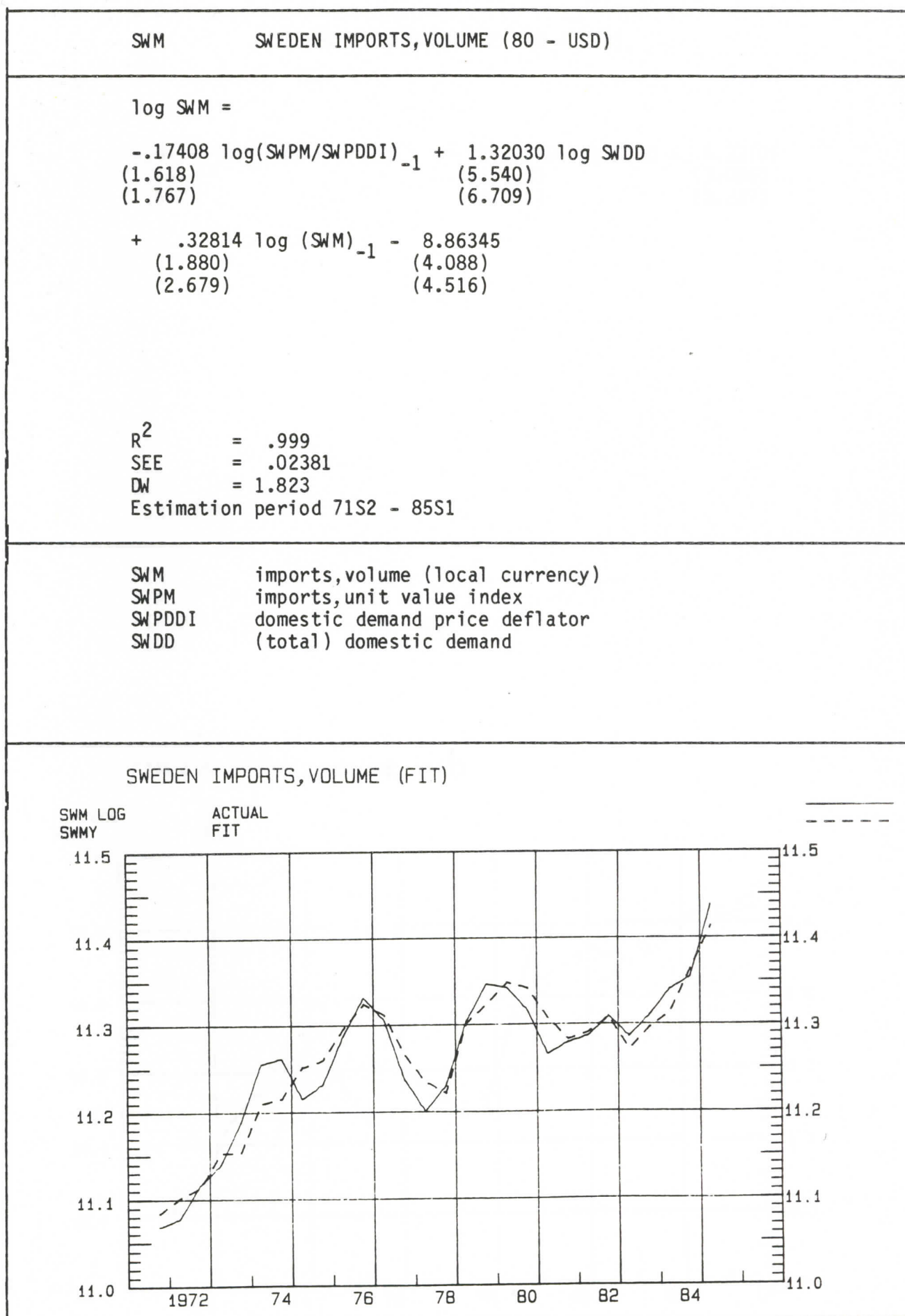
$R^2 = .958$   
SEE = .02602  
DW = 2.007  
Estimation period 71S2 - 85S1

UKM imports, volume (local currency)  
UKPM imports, unit value index  
UKPDDI domestic demand price deflator  
UKDD (total) domestic demand

UNITED KINGDOM IMPORTS, VOLUME (FIT)



## Import volumes





## Import volumes

FIM FINLAND IMPORTS, VOLUME (80 - USD)

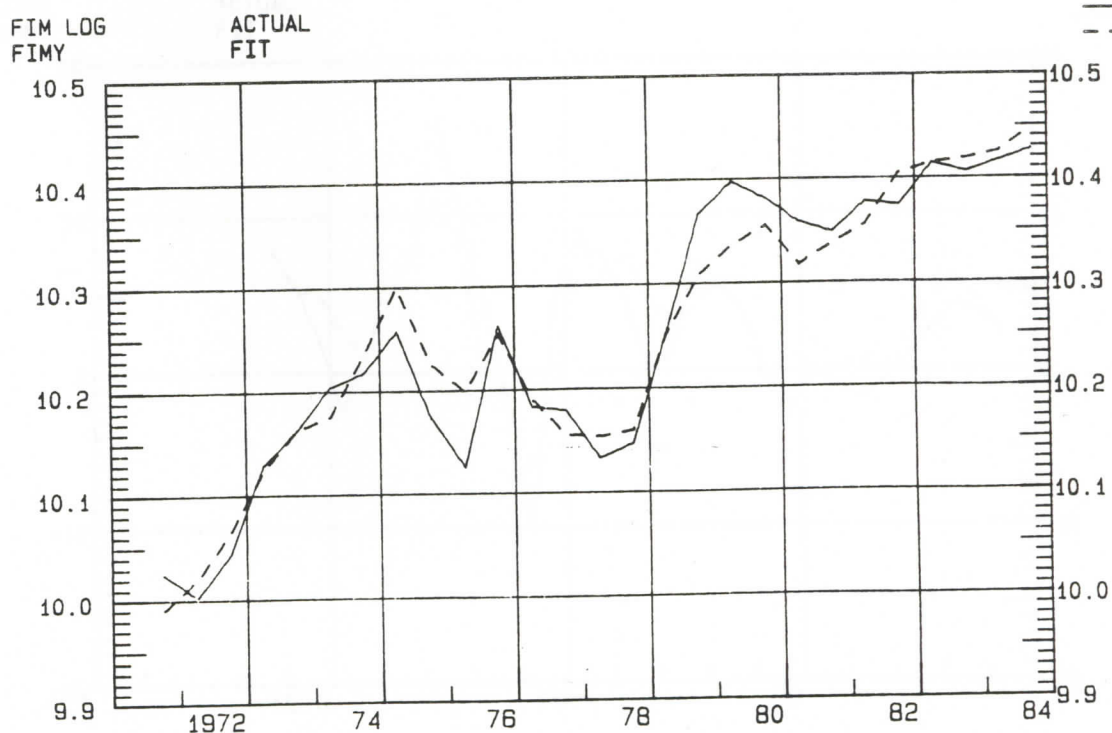
log FIM =

$$\begin{array}{r}
 -.07150 \log(\text{FIPM}/\text{FIPDDI})_{-1} + 1.27855 \log \text{FIDD} - 4.33101 \\
 (.465) \qquad\qquad\qquad (10.412) \qquad\qquad\qquad (3.096) \\
 (.530) \qquad\qquad\qquad (10.881) \qquad\qquad\qquad (3.237)
 \end{array}$$

$R^2$  = .998  
 SEE = .02908  
 DW = 2.101  
 Estimation period 71S1 - 85S1

FIM imports, volume (local currency)  
 FIPM imports, unit value index  
 FIPDDI domestic demand price deflator  
 FIDD (total) domestic demand

FINLAND IMPORTS, VOLUME (FIT)



## Import volumes

OOMD OTHER OECD-COUNTRIES IMPORTS, VOLUME (80 - USD)

OOMD =

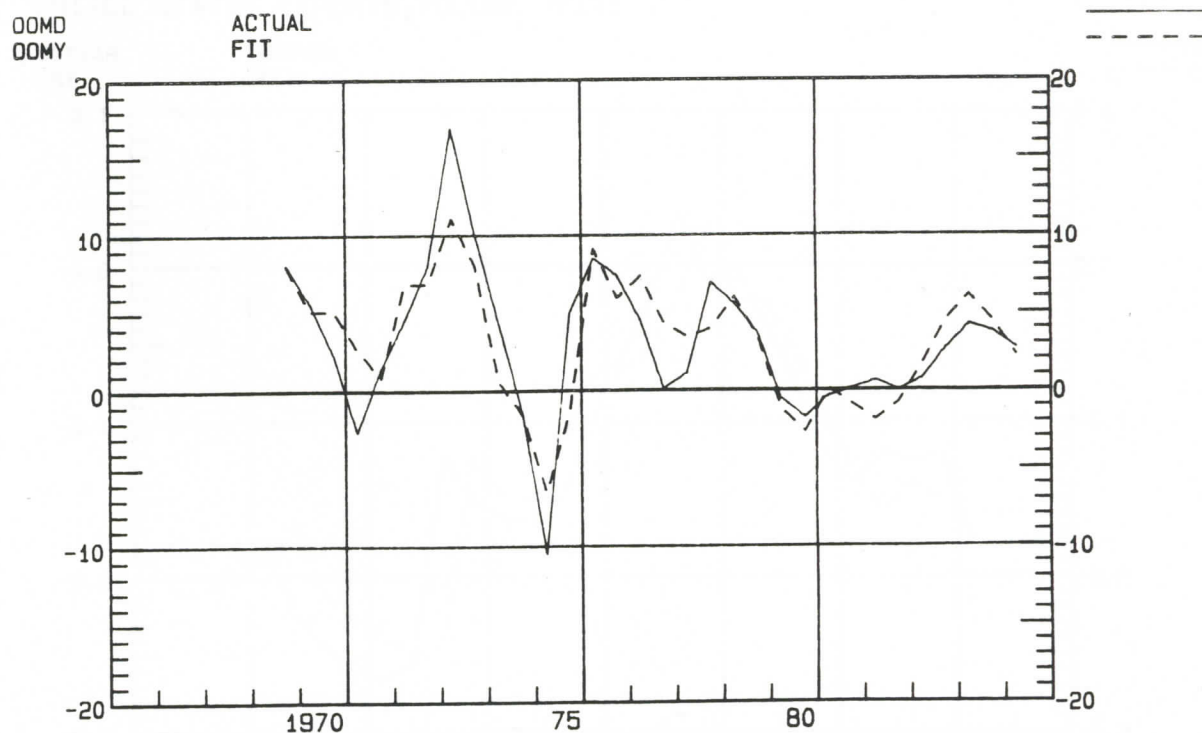
$$2.11056 \text{ OODDD} + .52994 (\text{OOMD})_{-1} - 1.78834$$

(6.599) (5.393) (2.357)  
(5.669) (3.854) (2.175)

$R^2$  = .706  
SEE = 2.67744  
DW = 1.780  
Estimation period 69S2 - 85S1

OOMD imports, volume (USD), percentage change  
OODDD (total) domestic demand, percentage change

OTHER OECD-COUNTRIES IMPORTS, VOLUME (FIT)



## Export volumes

USXDOL      UNITED STATES EXPORTS, VOLUME (80 - USD)

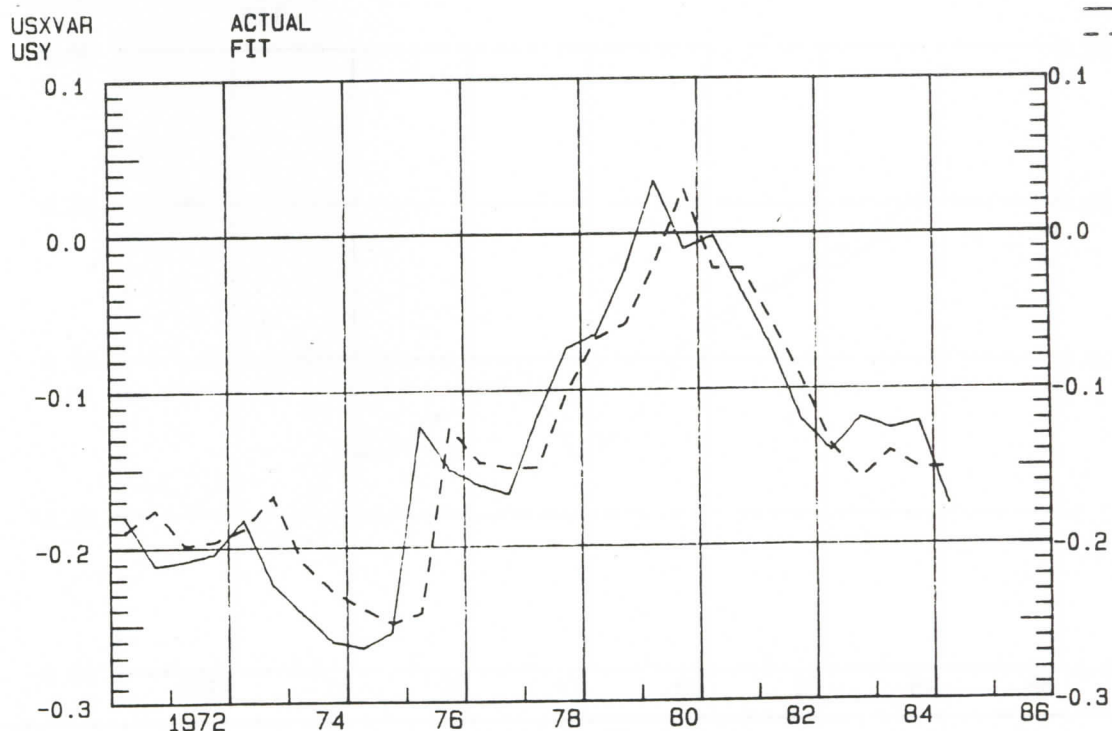
$\log(\text{USXDOL}/\text{USXDM}) =$

$$\begin{array}{rcl}
 -.12196 \log(\text{USPX}/\text{USWPX}) + & .88941 \log(\text{USXDOL}/\text{USXDM})_{-1} - & -.01103 \\
 (1.776) & (10.472) & (.797) \\
 (2.171) & (9.063) & (.821)
 \end{array}$$

$R^2$       = .811  
 SEE      = 0.03691  
 DW       = 1.949  
 Estimation period 71S1 - 85S1

XDOL      exports, volume (80-USD)  
 XDM       exports given by market growth  
 PX        export price deflator  
 WPX      competitors' export price deflator

UNITED STATES EXPORTS, VOLUME (FIT)





## Export volumes

JAXDOL JAPAN EXPORTS, VOLUME (80 - USD)

$\log(\text{JAXDOL}/\text{JAXDM}) =$

$$\begin{array}{rcl}
 -.25807 \log(\text{JAPXDOL}/\text{JAWPX}) + & .98807 \log(\text{JAXDOL}/\text{JAXDM})_{-1} + & .02676 \\
 (1.398) & (18.007) & (2.949) \\
 (1.215) & (23.975) & (4.852)
 \end{array}$$

$R^2 = .943$

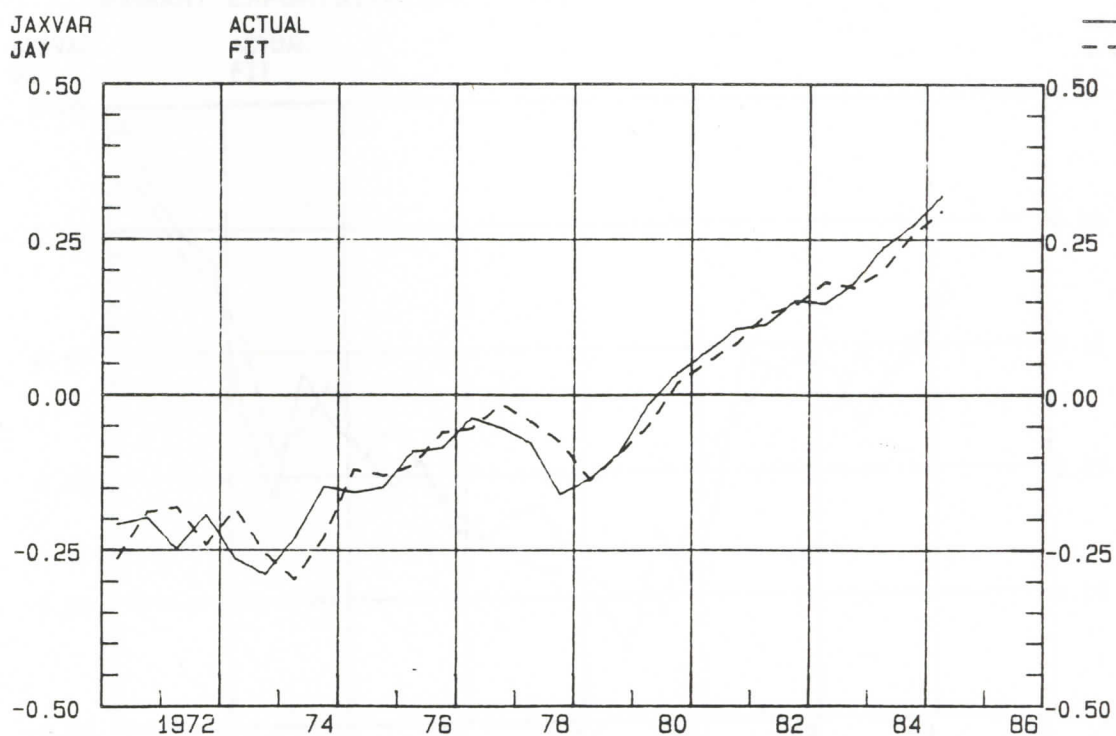
SEE = .04252

DW = 1.918

Estimation period 71S1 - 85S1

JAXDOL exports, volume (80-USD)  
 JAXDM exports given by market growth  
 JAPXDOL export price deflator  
 JAWPX competitors' export price deflator

JAPAN EXPORTS, VOLUME (FIT)



## Export volumes

GEXDOL GERMANY EXPORTS, VOLUME (80 - USD)

$\log(\text{GEXDOL}/\text{GEXDM}) =$

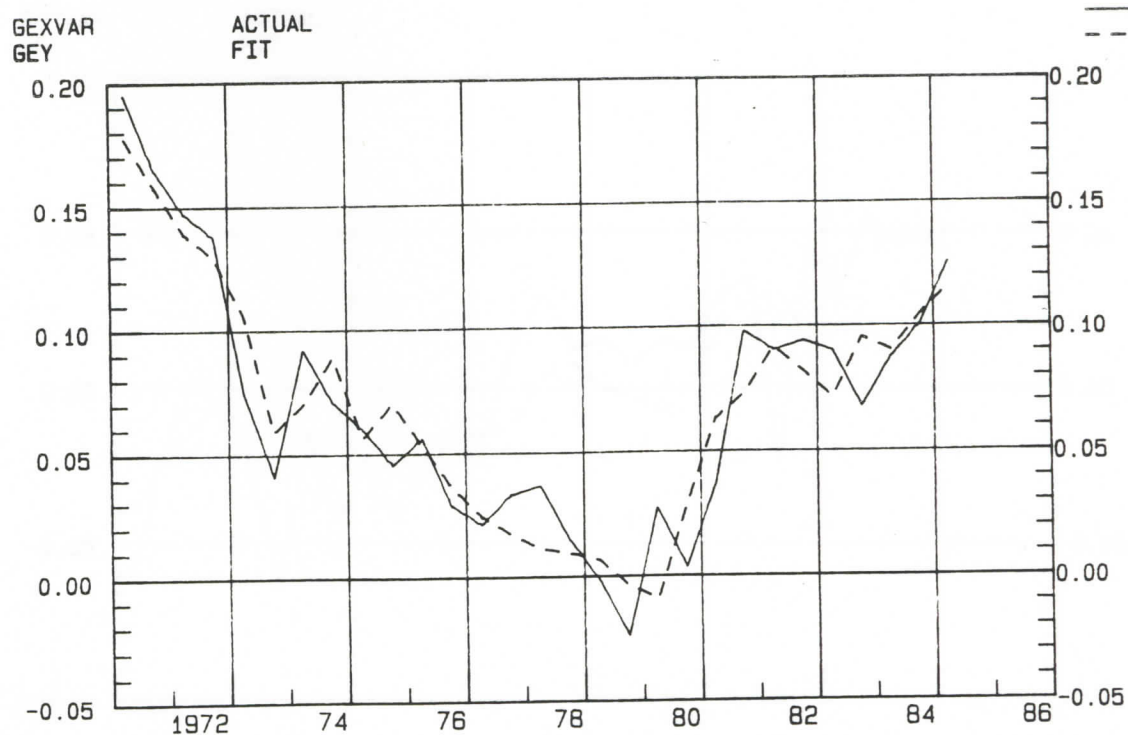
$-.45218 \log(\text{GEPXDOL}/\text{GEWPX}) + .32938 \log(\text{GEXDOL}/\text{GEXDM})_{-1} -$   
 (5.202) (2.569)  
 (4.936) (2.286)

$.00409 \text{ TREND} + .09807$   
 (3.939) (4.146)  
 (3.814) (3.801)

$R^2 = .875$   
 $\text{SEE} = .01934$   
 $\text{DW} = 2.333$   
 Estimation period 71S1 - 85S1

GEXDOL exports, volume (80-USD)  
 GEXDM exports given by market growth  
 GEPXDOL export. price deflator  
 GEWPX competitors' export price deflator  
 TREND time-trend variable

GERMANY EXPORTS, VOLUME (FIT)



## Export volumes

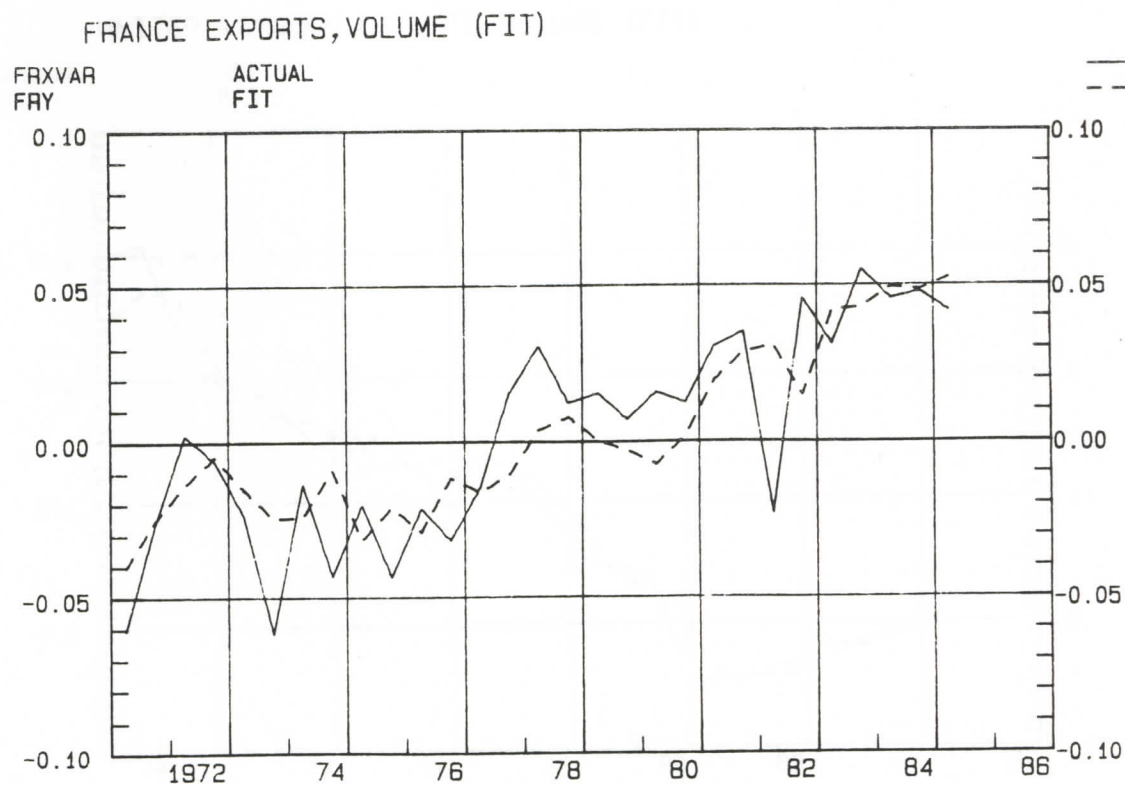
FRXDOL FRANCE EXPORTS, VOLUME (80 - USD)

 $\log(\text{FRXDOL}/\text{FRXDM}) =$ 

$$\begin{array}{rcl}
 -.21003 \log(\text{FRPXDOL}/\text{FRWPX}) + & .43180 \log(\text{FRXDOL}/\text{FRXDM})_{-1} + & .01289 \\
 (3.152) & (3.434) & (1.976) \\
 (3.424) & (3.983) & (2.099)
 \end{array}$$

$R^2$  = .643  
 SEE = .02080  
 DW = 2.344  
 Estimation period 71S1 - 85S1

FRXDOL exports, volume (80-USD)  
 FRXDM exports given by market growth  
 FRPXDOL export price deflator  
 FRWPX competitors' export price deflator



## Export volumes

UKXDOL UNITED KINGDOM EXPORTS, VOLUME (80 - USD)

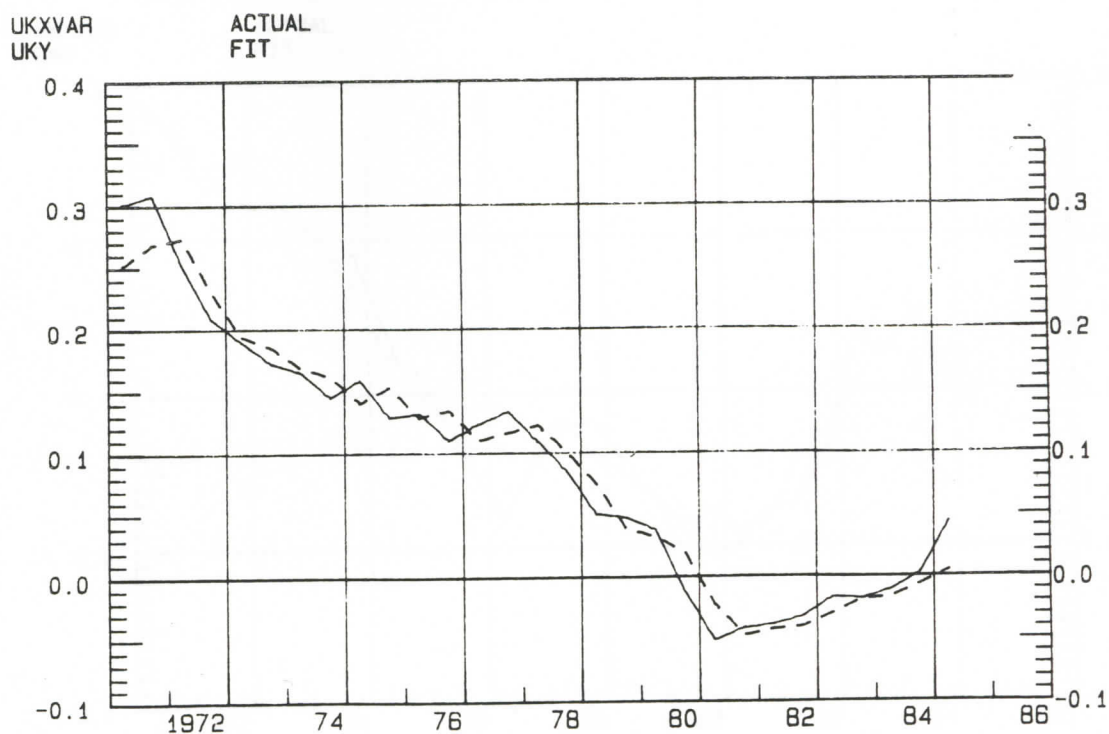
$\log(\text{UKXDOL}/\text{UKXDM}) =$

$$\begin{array}{rcl}
 -.10212 \log(\text{UKPXDOL}/\text{UKWPX}) + & .87683 \log(\text{UKXDOL}/\text{UKXDM})_{-1} + & .01331 \\
 (1.823) & (18.333) & (1.379) \\
 (1.667) & (13.599) & (1.331)
 \end{array}$$

$R^2$  = .959  
 SEE = .02177  
 DW = 1.331  
 Estimation period 71S1 - 85S1

UKXDOL exports, volume (80-USD)  
 UKXDM exports given by market growth  
 UKPXDOL export price deflator  
 UKWPX competitors' export price deflator

UNITED KINGDOM EXPORTS, VOLUME (FIT)





## Export volumes

SWXDOL SWEDEN EXPORTS, VOLUME (80 - USD)

$\log(\text{SWXDOL}/\text{SWXDM}) =$

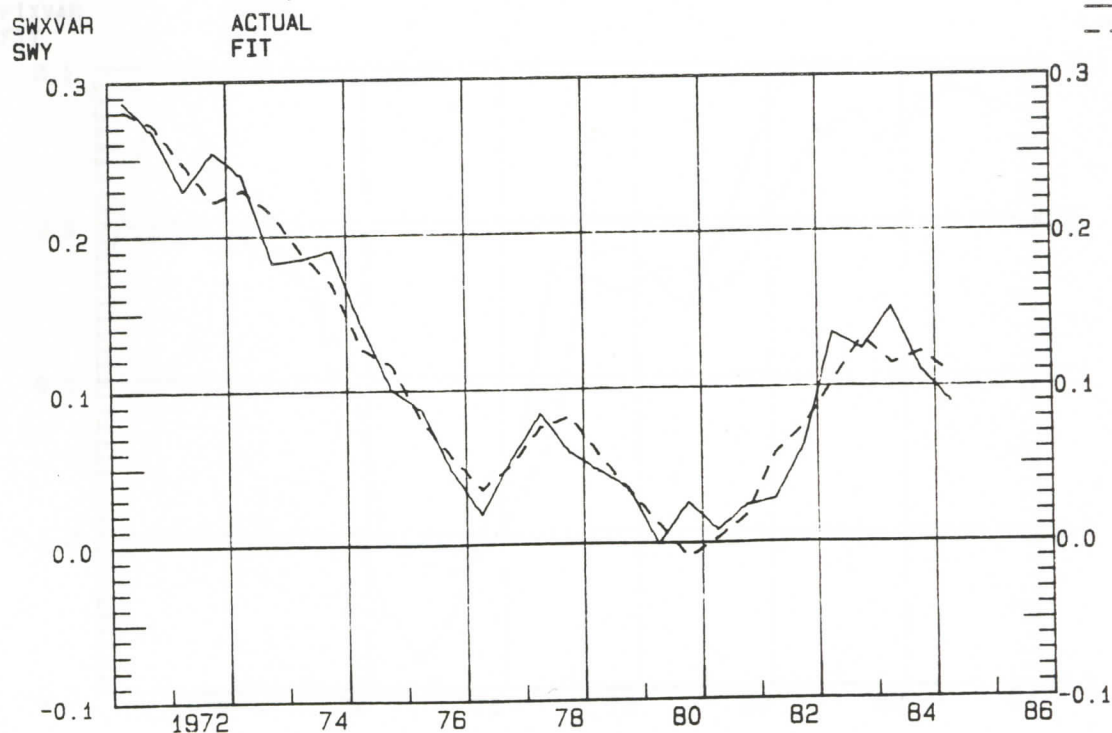
$-.40218 \log(\text{SWPXDOL}/\text{SWWPX}) + .46037 \log(\text{SWXDOL}/\text{SWXDM})_{-1} -$   
 (5.634) (4.738)  
 (6.239) (5.422)

$.00484 \text{ TREND} + .10832$   
 (4.370) (4.109)  
 (5.109) (4.805)

$R^2 = .952$   
 $\text{SEE} = .01976$   
 $\text{DW} = 2.291$   
 Estimation period 71S1 - 85S1

SWXDOL exports, volume (80-USD)  
 SWXDM exports given by market growth  
 SWPXDOL export price deflator  
 SWWPX competitors' export price deflator  
 TREND time-trend variable

SWEDEN EXPORTS, VOLUME (FIT)



## Export volumes

FIXDOL FINLAND EXPORTS, VOLUME (80 - USD)

$\log(\text{FIXDOL}/\text{FIXDM}) =$

$$-.58764 \log(\text{FIPXDOL}/\text{FIWPX}) + .34780 \log(\text{FIXDOL}/\text{FIXDM})_{-1} +$$

(2.306) (2.074)  
(1.699) (1.893)

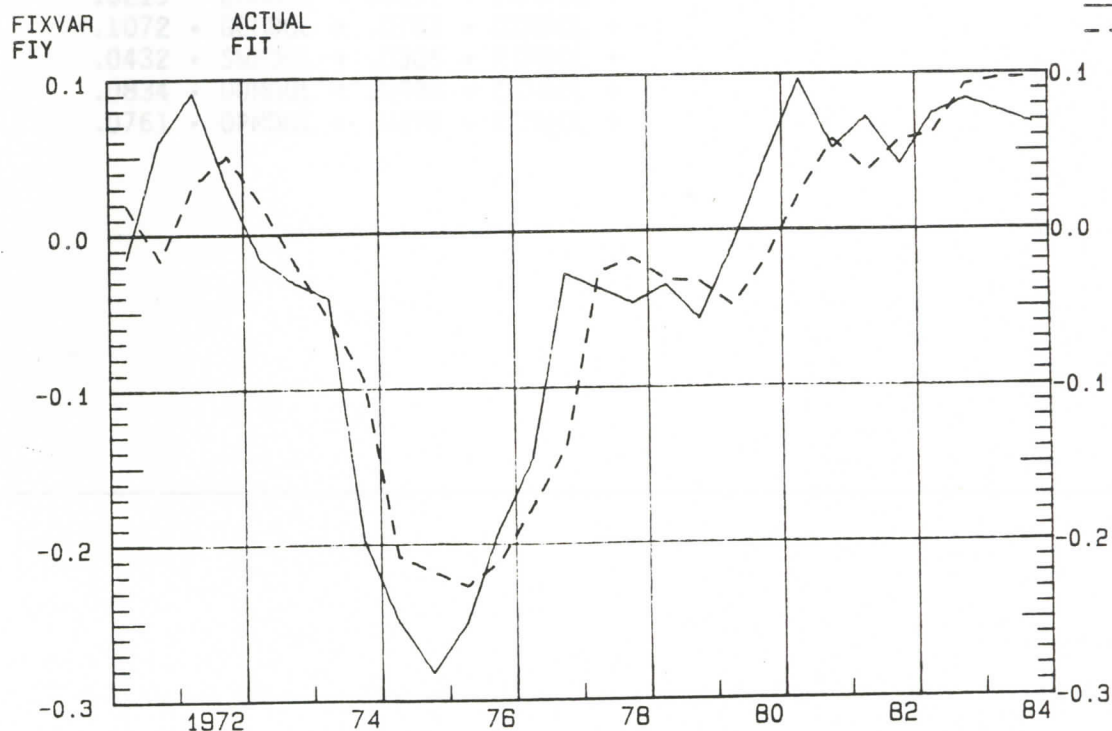
$$.00655 \text{ TREND} - .19587$$

(2.533) (2.776)  
(2.603) (2.340)

$R^2 = .543$   
SEE = .04608  
DW = 1.902  
Estimation period 71S1 - 85S1

FIXDOL exports, volume (80-USD)  
FIXDM exports given by market growth  
FIPXDOL export price deflator  
FIWPX competitors' export price deflator  
TREND time-trend variable

FINLAND EXPORTS, VOLUME (FIT)



## 5 MOST IMPORTANT IDENTITIES

## 5.1 EXPORT MARKETS

USXDM =

.174 • JAMDOL + .0754 • GEMDOL +  
 .0796 • FRMDOL + .1176 • UKMDOL +  
 .0729 • SWMDOL + .0581 • FIMDOL +  
 .1552 • OOMDOL + .0542 • COMDOL +  
 .1357 • OPMDOL + .1885 • DCMDOL

JAXDM =

.1303 • USMDOL + .0305 • BEMDOL +  
 .0205 • FRMDOL + .0331 • UKMDOL +  
 .0285 • SWMDOL + .0325 • FIMDOL +  
 .0316 • OOMDOL + .0615 • COMDOL +  
 .1503 • OPMDOL + .1248 • DCMDOL

GEXDM =

.0489 • USMDOL + .0177 • JAMDOL +  
 .1619 • FRMDOL + .1103 • UKMDOL +  
 .1675 • SWMDOL + .1264 • FIMDOL +  
 .1640 • OOMDOL + .1366 • COMDOL +  
 .1018 • OPMDOL + .0610 • DCMDOL

FRXDM =

.0219 • USMDOL + .0092 • JAMDOL +  
 .1072 • GEMDOL + .0755 • UKMDOL +  
 .0432 • SWMDOL + .0305 • FIMDOL +  
 .0834 • OOMDOL + .0698 • COMDOL +  
 .0761 • OPMDOL + .0493 • DCMDOL +

## EXPORT MARKETS

UKXDM =

.0403 USMDOL + .0139 JAMDOL +  
 .0669 GEMDOL + .0540 • FRMDOL +  
 .1184 • SWMDOL + .0860 • FIMDOL +  
 .0751 • OOMDOL + .0385 • COMDOL +  
 .0847 • OPMDOL + .0483 • DCMDOL

SWXDM =

.0067 • USMDOL + .0033 • JAMDOL +  
 .0211 • GEMDOL + .0153 • FRMDOL +  
 .0286 • SWMDOL + .1207 • FIMDOL +  
 .0236 • OOMDOL + .0186 • COMDOL +  
 .0129 • OPMDOL + .0089 • DCMDOL

FIXDM =

.0019 • USMDOL + .0008 • JAMDOL +  
 .0087 • GEMDOL + .0053 • FRMDOL +  
 .0153 • SWMDOL + .0682 • FIMDOL +  
 .0070 • OOMDOL + .0402 • COMDOL +  
 .0050 • OPMDOL + .0025 • DCMDOL

XDM = Export markets, in US dollars  
 MDOL = imports in US dollars

Weights are each country's shares of the total imports  
 of other countries



## EXPORT MARKETS

FITRAD = FINLAND'S EXPORT MARKETS, %-CHANGES

FITRAD =

.192 • SWMAD + .156 • UKMAD +  
 .131 • GEMAD + .056 • FRMAD +  
 .051 • USMAD + .013 • JAMAD +  
 .286 • OOMAD + .043 • OPMAD +  
 .076 • DCMAD

WOTRAD = WORLD TRADE , %-CHANGES

WOTRAD =

.016 • SWMAD + .061 • UKMAD +  
 .094 • GEMAD + .063 • FRMAD +  
 .142 • USMAD + .062 • JAMAD +  
 .263 • OOMAD + .080 • OPMAD +  
 .050 • COMAD + .163 • DCMAD

USMAD	CHANGE IN TOTAL IMPORTS OF
JAMAD	USA, JAPAN, GERMANY, FRANCE, UNITED KINGDOM,
GEMAD	SWEDEN, OTHER OECD COUNTRIES, OPEC COUNTRIES AND
FRMAD	DEVELOPING COUNTRIES RESPECTIVELY,
UKMAD	%-CHANGES
SWMAD	
OOMAD	
OPMAD	
DCMAD	

## 5.2 IMPORT PRICES

 $\Delta \log \text{USPM} =$ 

.1303 •  $\Delta \log \text{JAPXDOL}$  + .0489 •  $\Delta \log \text{GEPXDOL}$  +  
 .0218 •  $\Delta \log \text{FRPXDOL}$  + .0403 •  $\Delta \log \text{UKPCDOL}$  +  
 .0067 •  $\Delta \log \text{SWPXDOL}$  + .0019 •  $\Delta \log \text{FIPXDOL}$  +  
 .2525 •  $\Delta \log \text{OOPX}$  + .2152 •  $\Delta \log \text{OPPX}$  +  
 .2827 •  $\Delta \log \text{DCPX}$

 $\Delta \log \text{JAPMDOL} =$ 

.1738 •  $\Delta \log \text{USPX}$  + .0177 •  $\Delta \log \text{GEPXDOL}$  +  
 .0092 •  $\Delta \log \text{FRPXDOL}$  + .0138 •  $\Delta \log \text{SWPXDOL}$  +  
 .0008 •  $\Delta \log \text{FIPXDOL}$  + .1188 •  $\Delta \log \text{OOPX}$  +  
 .4180 •  $\Delta \log \text{OPPX}$  + .2451 •  $\Delta \log \text{DCPX}$

 $\Delta \log \text{GEPMDOL} =$ 

.0754 •  $\Delta \log \text{USPX}$  + .0305 •  $\Delta \log \text{JAPXDOL}$  +  
 .1072 •  $\Delta \log \text{FRPXDOL}$  + .0669 •  $\Delta \log \text{UKPXDOL}$  +  
 .0211 •  $\Delta \log \text{SWPXDOL}$  + .0087 •  $\Delta \log \text{FIPXDOL}$  +  
 .4177 •  $\Delta \log \text{OOPX}$  + .1156 •  $\Delta \log \text{OPPX}$  +  
 .1477 •  $\Delta \log \text{DCPX}$

 $\Delta \log \text{FRPMDOL} =$ 

.0795 •  $\Delta \log \text{USPX}$  + .0205 •  $\Delta \log \text{JAPXDOL}$  +  
 .1619 •  $\Delta \log \text{GEPXDOL}$  + .0540 •  $\Delta \log \text{UKPXDOL}$  +  
 .0153 •  $\Delta \log \text{SWPXDOL}$  + .0053 •  $\Delta \log \text{FIPXDOL}$  +  
 .3315 •  $\Delta \log \text{OOPX}$  + .1947 •  $\Delta \log \text{OPPX}$  +  
 .1273 •  $\Delta \log \text{DCPX}$

 $\Delta \log \text{UKPMDOL} =$ 

.1176 •  $\Delta \log \text{USPX}$  + .0331 •  $\Delta \log \text{JAPXDOL}$  +  
 .1103 •  $\Delta \log \text{GEPXDOL}$  + .0775 •  $\Delta \log \text{FRPXDOL}$  +  
 .0286 •  $\Delta \log \text{SWPXDOL}$  + .0153 •  $\Delta \log \text{FIPXDOL}$  +  
 .3746 •  $\Delta \log \text{OOPX}$  + .0910 •  $\Delta \log \text{OPPX}$  +  
 .1540 •  $\Delta \log \text{DCPX}$

 $\Delta \log \text{SWPMDOL} =$ 

.0729 •  $\Delta \log \text{USPX}$  + .0285 •  $\Delta \log \text{JAPXDOL}$  +  
 .1675 •  $\Delta \log \text{GEPXDOL}$  + .0432 •  $\Delta \log \text{FRPXDOL}$  +  
 .1184 •  $\Delta \log \text{UKPXDOL}$  + .0682 •  $\Delta \log \text{FIPXDOL}$  +  
 .2781 •  $\Delta \log \text{OOPX}$  + .1246 •  $\Delta \log \text{OPPX}$  +  
 .0985 •  $\Delta \log \text{DCPX}$

## IMPORT PRICES

 $\Delta \log \text{FIPMDOL} =$ 

.0581 •  $\Delta \log \text{USPX}$  + .0325 •  $\Delta \log \text{JADXDOL}$  +  
 .1264 •  $\Delta \log \text{GEPXDOL}$  + .0305 •  $\Delta \log \text{FRPXDOL}$  +  
 .0860 •  $\Delta \log \text{UKPXDOL}$  + .1207 •  $\Delta \log \text{SWPXDOL}$  +  
 .1660 •  $\Delta \log \text{OOPX}$  + .1619 •  $\Delta \log \text{OPPX}$  +  
 .2179 •  $\Delta \log \text{DCPX}$

USPM  
 JAPMDOL  
 GEPMDOL  
 FRPMDOL  
 UKPMDOL  
 SEPMDOL  
 FIPMDOL

IMPORT PRICES IN USD FOR USA, GERMANY, FRANCE,  
 UNITED KINGDOM, SWEDEN, FINLAND RESPECTIVELY

USPX  
 JAPXDOL  
 GEPXDOL  
 FRPXDOL  
 UKPXDOL  
 SWPXDOL  
 FIPXDOL

EXPORT PRICES IN USD FOR THE SAME COUNTRIES AS ABOVE

## 5.3 GDP DEFLATORS

$$\Delta \text{USPQ} = \Delta \text{USPDDI} + (\text{USM}/\text{USQ}) \cdot [\Delta(\text{USPX} - \text{USPM})]$$

$$\Delta \text{JAPQ} = \Delta \text{JAPDDI} + (\text{JAM}/\text{JAQ}) \cdot [\Delta(\text{JAPX} - \text{JAPM})]$$

$$\Delta \text{GEPQ} = \Delta \text{GEPDDI} + (\text{GEM}/\text{GEQ}) \cdot [\Delta(\text{GEPX} - \text{GEPM})]$$

$$\Delta \text{GFRPQ} = \Delta \text{FRPDDI} + (\text{FRM}/\text{FRQ}) \cdot [\Delta(\text{FRPX} - \text{FRPM})]$$

$$\Delta \text{UKPQ} = \Delta \text{UKPDDI} + (\text{UKM}/\text{UKQ}) \cdot [\Delta(\text{UKPX} - \text{UKPM})]$$

$$\Delta \text{SWPQ} = \Delta \text{SWPDDI} + (\text{SWM}/\text{SWQ}) \cdot [\Delta(\text{SWPX} - \text{SWPM})]$$

$$\Delta \text{FIPQ} = \Delta \text{FIPDDI} + (\text{FIM}/\text{FIQ}) \cdot [\Delta(\text{FIPX} - \text{FIPM})]$$

USPQ GDP DEFLATORS FOR USA, JAPAN, GERMANY, FRANCE,  
 JAPQ UK, SWEDEN AND FINLAND RESPECTIVELY  
 GEPQ  
 FRPQ  
 UKPQ  
 SWPQ  
 FIPQ

.. PDDI = DOMESTIC DEMAND DEFLATOR  
 .. M = VOLUME OF IMPORTS  
 .. Q = GDP, VOLUME  
 .. PX = EXPORT PRICES  
 .. PM = IMPORT PRICES



## 5.4 OTHER IDENTITIES

OEQAD =

$$.458 \cdot \text{USQAD} + .214 \cdot \text{JAQAD} + .139 \cdot \text{GEQAD} + \\ .102 \cdot \text{FRQAD} + .068 \cdot \text{UKQAD} + .019 \cdot \text{SWQAD}$$

EUQAD =

$$.424 \cdot \text{GEQAD} + .311 \cdot \text{FRQAD} + .207 \cdot \text{UKQAD} + \\ .058 \cdot \text{SWQAD}$$

OEQAD = GDP GROWTH IN OECD COUNTRIES, %-CHANGE

EUGAD = GDP GROWTH IN EUROPE, %-CHANGE

USQAD      GDP GROWTH IN USA, JAPAN, GERMANY, FRANCE, UK  
 JAQAD      AND SWEDEN, RESPECTIVELY, %-CHANGE  
 GEQAD  
 FRQAD  
 UKQAD  
 SWQAD

OTHER COMPONENTS OF DEMAND AND SUPPLY FOR "TOTAL OECD"  
 AS WELL AS FOR "EUROPE" ARE CALCULATED USING THE WEIGHTS  
 ABOVE.

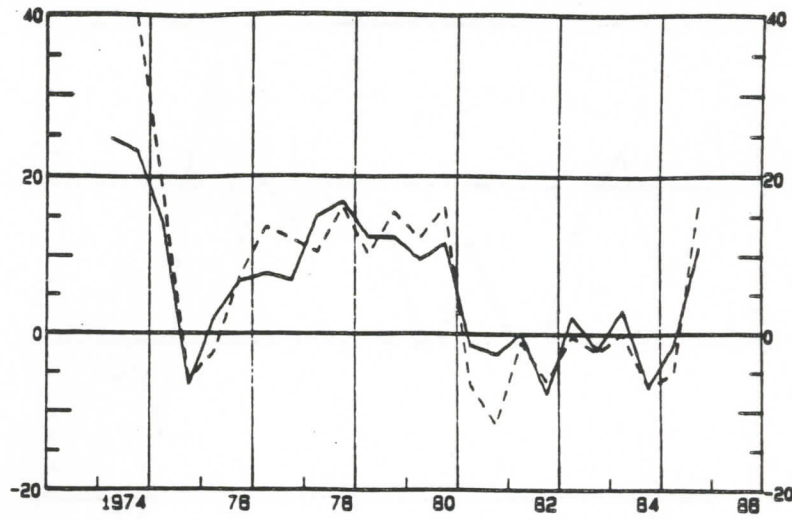
## 6 RESULTS OF DYNAMIC SIMULATIONS

The statistical and dynamic properties of the model were examined by means of dynamic ex-post simulations. The model was first run through the years 1974 - 1975, with the second half of 1973 as a starting point, using model-generated values as lagged endogenous variables. The values of the exogenous variables were the same as the actual ones. This simulation is referred to as the control solution.

The following charts depict the actual and simulated semiannual changes (at annual level) of the main aggregates. The model solution seems to follow actual performance fairly well. This is not surprising, since the model has a rather large exogenous part.

EXPORT PRICES OECD

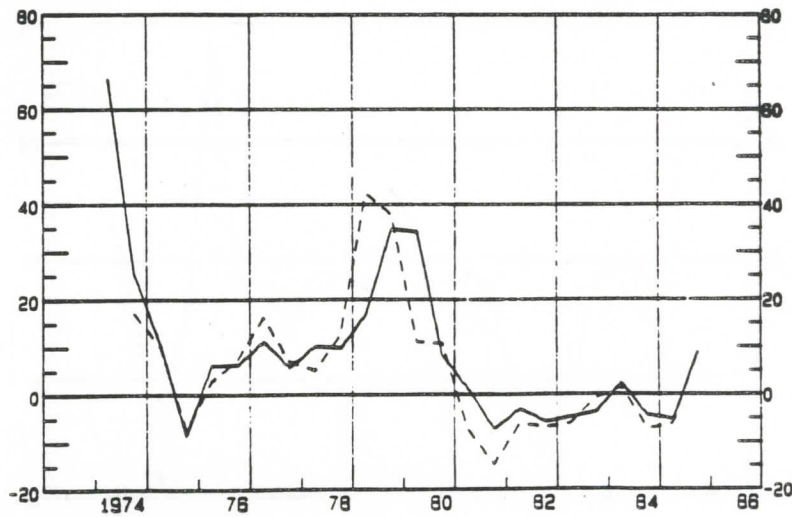
OEPXAD ACTUAL  
OEPXAD.K FIT



15-Apr-88

IMPORT PRICES

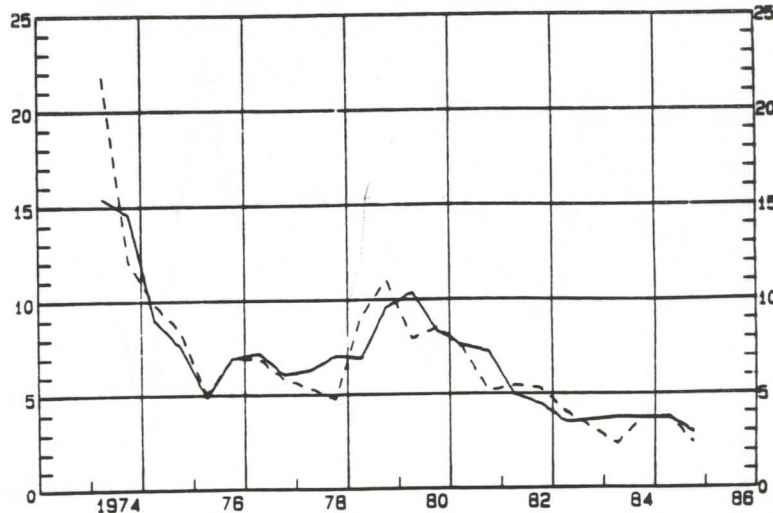
OEPMD ACTUAL  
OEPMD.K FIT



15-Apr-88

DOMESTIC DEMAND DEFLATOR OECD

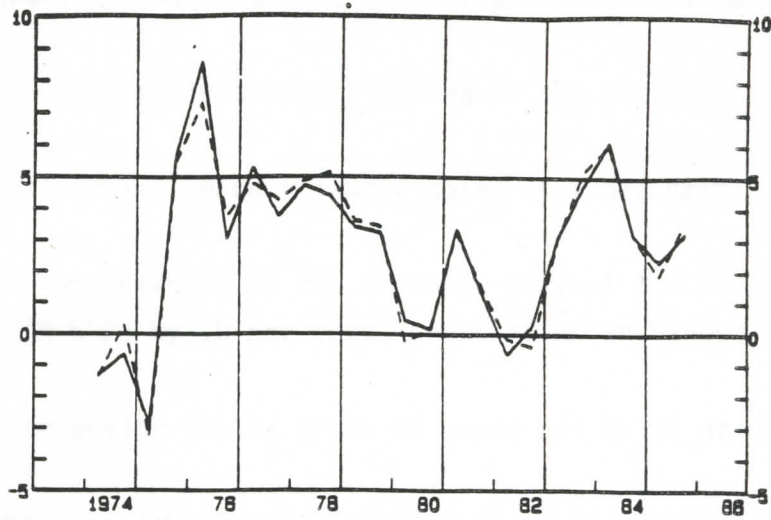
OEPDDIAD ACTUAL  
OEPDDIAD.K FIT



15-Apr-88

GDP OECD

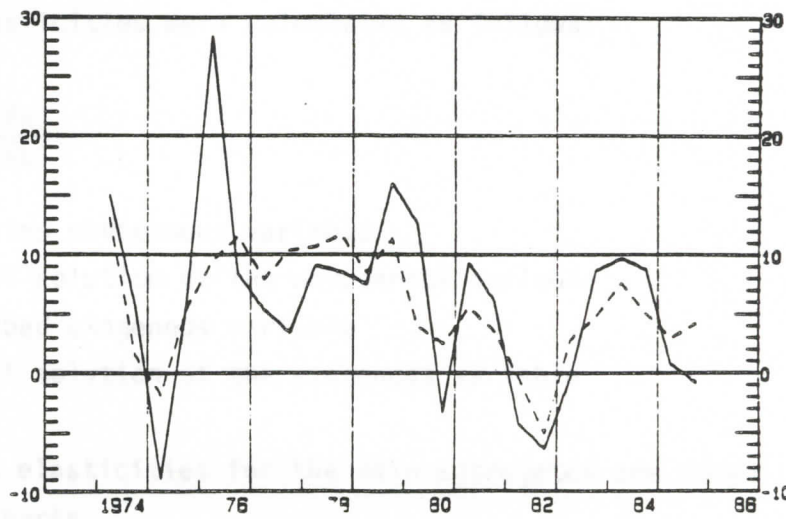
OEQAD ACTUAL  
OEQAD.K FIT



15-Apr-86

EXPORTS, VOLUME OECD

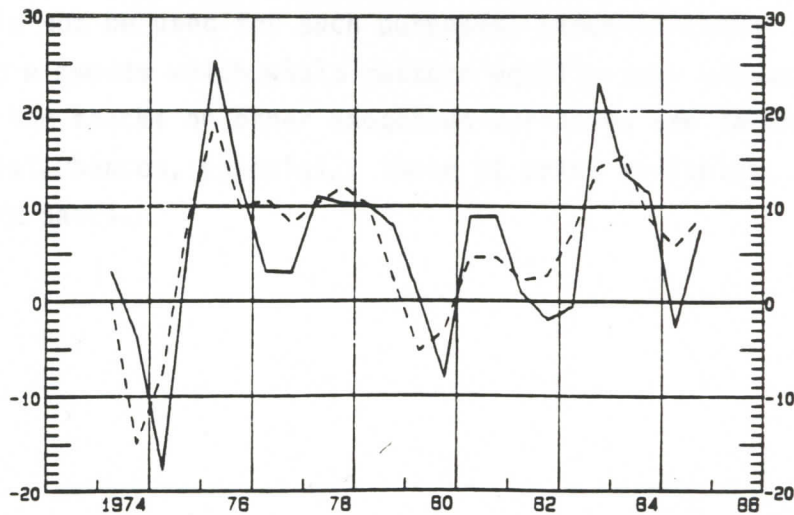
OEXAD ACTUAL  
OEXAD.K FIT



15-Apr-86

IMPORTS, VOLUME OECD

OEMAD ACTUAL  
OEMAD.K FIT



15-Apr-86



The sensitiveness of the dynamic solution to exogenous shocks was studied by means of four disturbance simulations as follows:

- I            An increase in domestic demand of one per cent
- II           An increase in unit labour costs of 1 per cent
- III          An appreciation in the exchange rate of the US dollar (FIM/USD) by 10 per cent, cross rates unchanged
- IV          A reduction in the price of crude oil by 10 per cent

All the shocks were implemented in the first half of 1974 and no recovery was assumed. Thus the "levels" of the disturbed variables stayed at the new level thereafter.

Dynamic elasticities were calculated as follows:

$$E = \frac{\log(Y_s/Y_k)}{\log(X_s/X_k)}$$

$Y_s$  = simulated endogenous variable

$Y_k$  = control solution of the endogenous variable

$X_s$  = disturbed exogenous variable

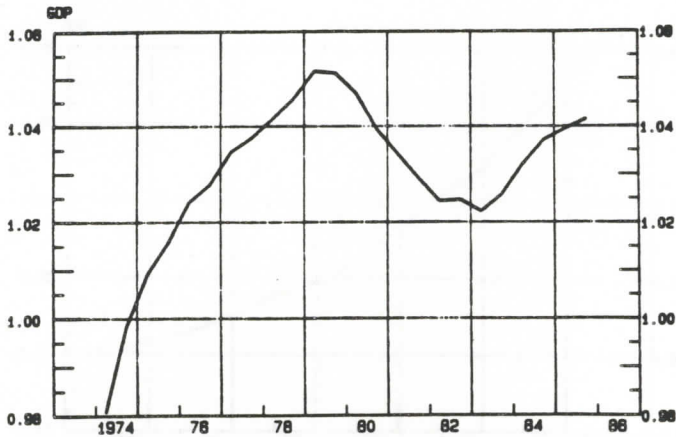
$X_k$  = control solution of the exogenous variable

The dynamic elasticities for the main aggregates are shown in the following charts.

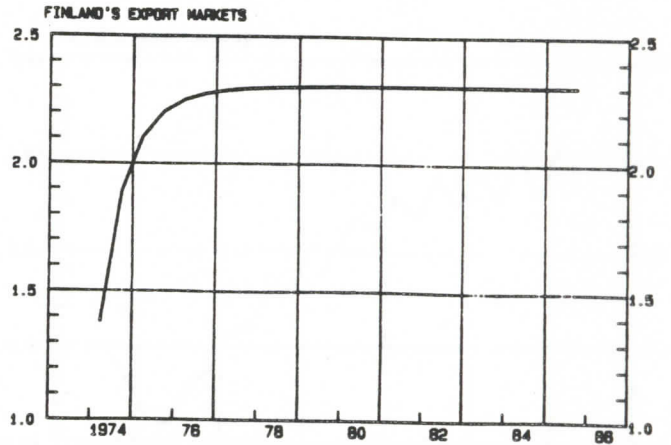
The model was not originally designed for policy simulations, as these simple exercises demonstrate. The present version of the model should not be used for such purposes, since it lacks stabilizing elements which would restore equilibrium. Unless the effects of the shocks on other exogenous variables are taken into account, disturbances, especially those of price variables, lead to expansionary paths.

# I

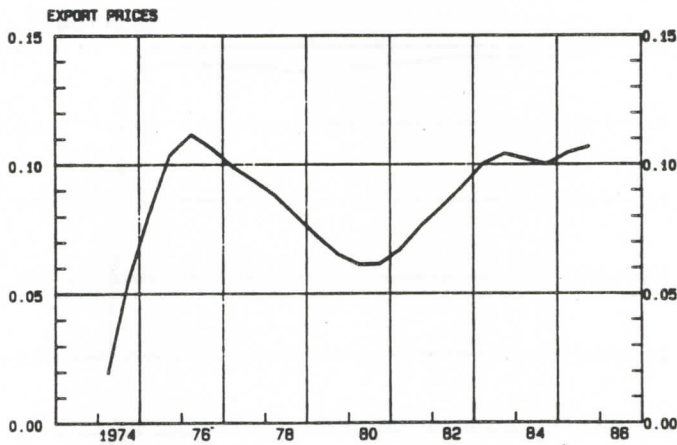
AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



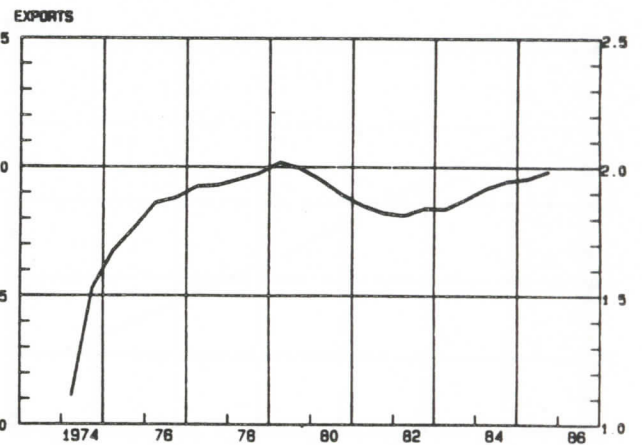
AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



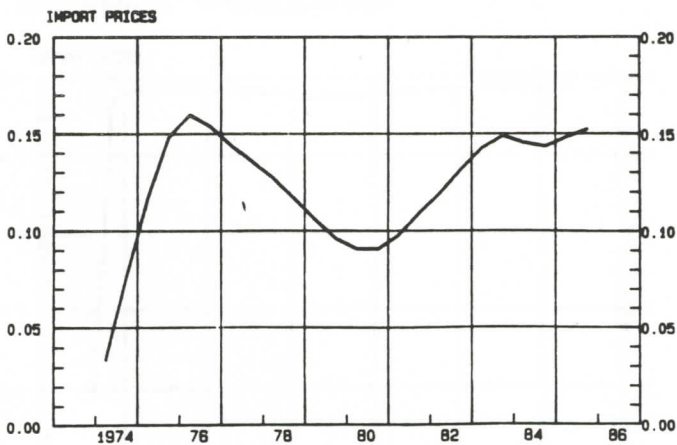
AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



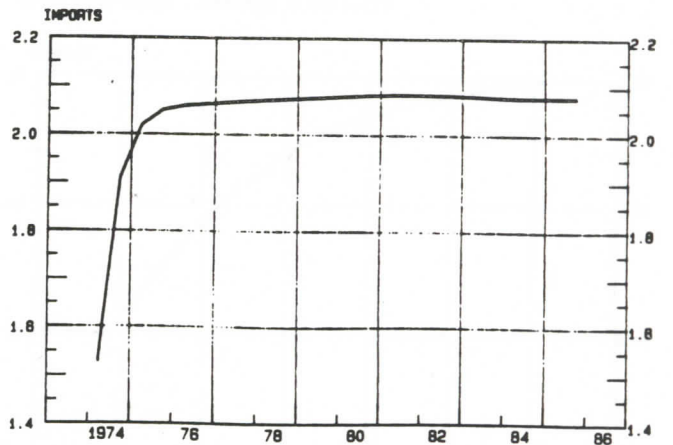
AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY

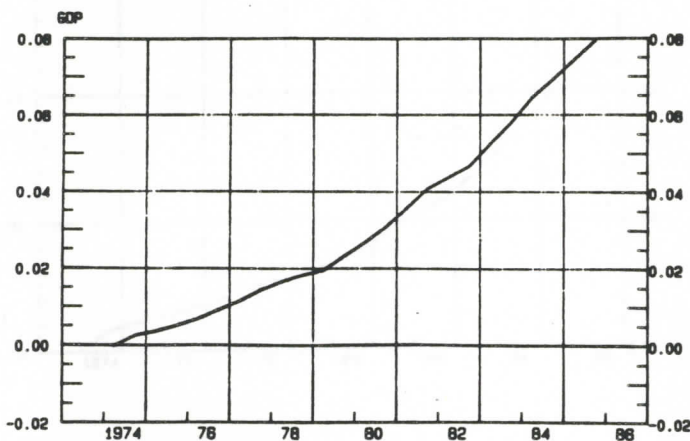


AN INCREASE OF DOMESTIC DEMAND BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY

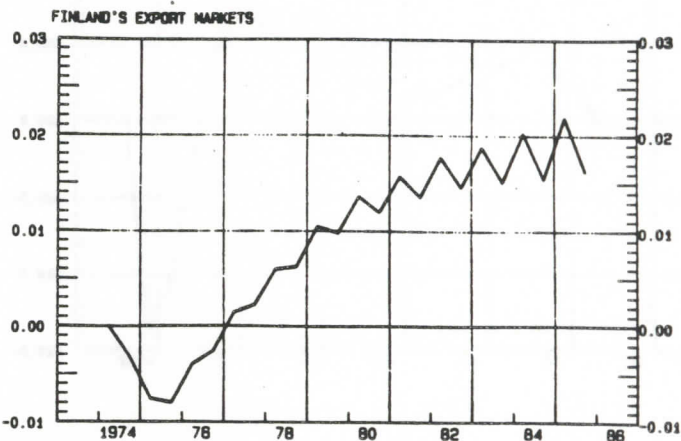


## II

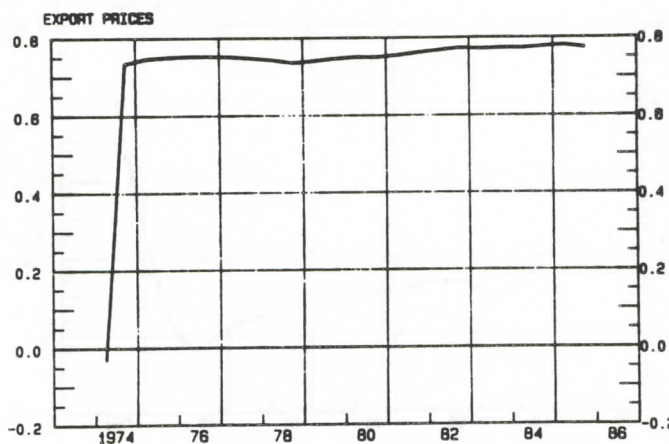
AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



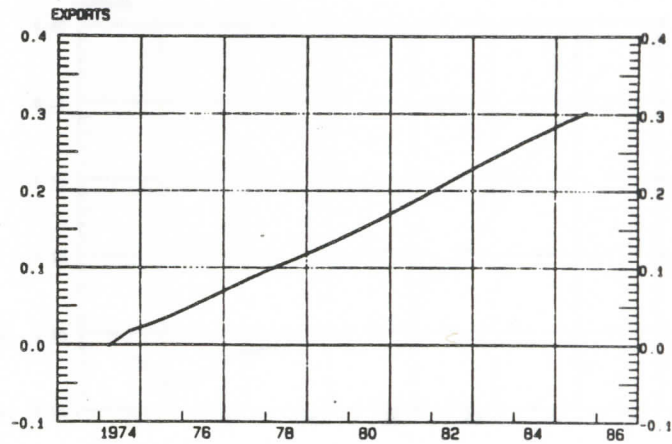
AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



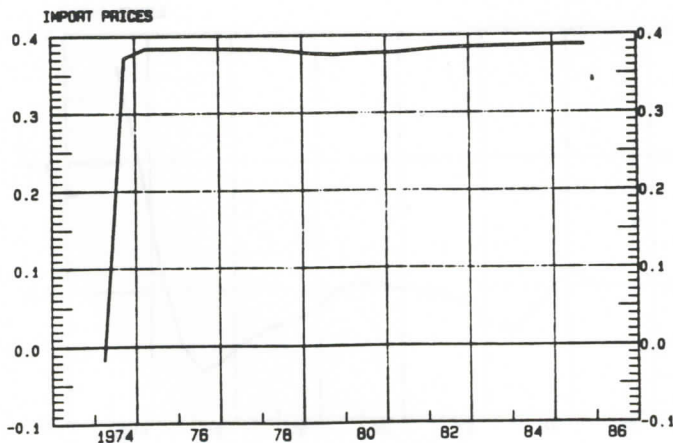
AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



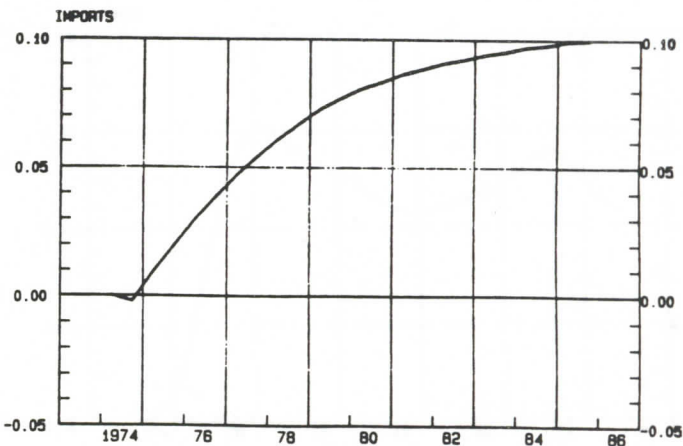
AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



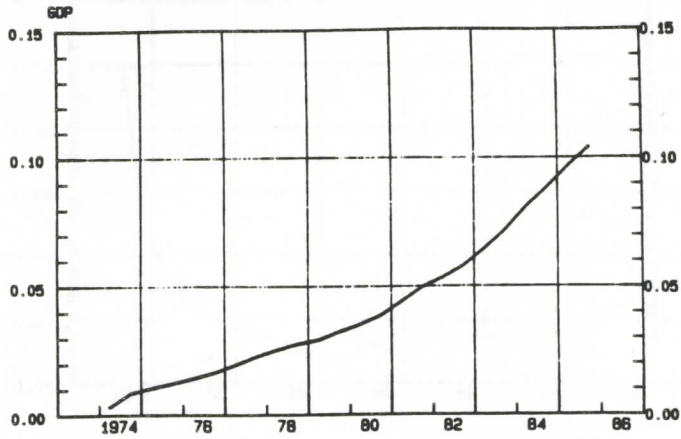
AN INCREASE OF UNIT LABOUR COSTS BY 1 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



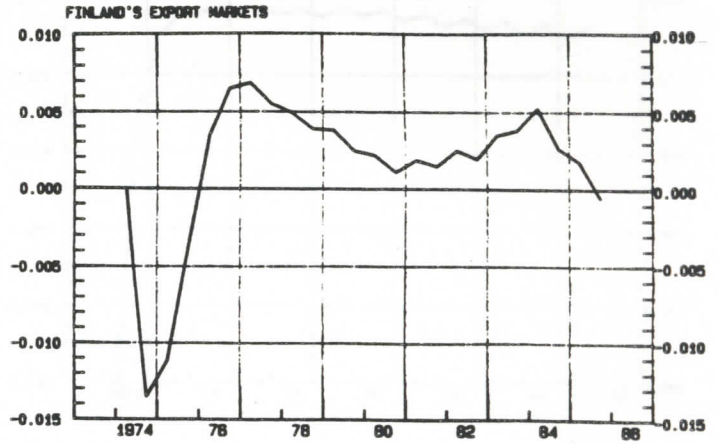


III

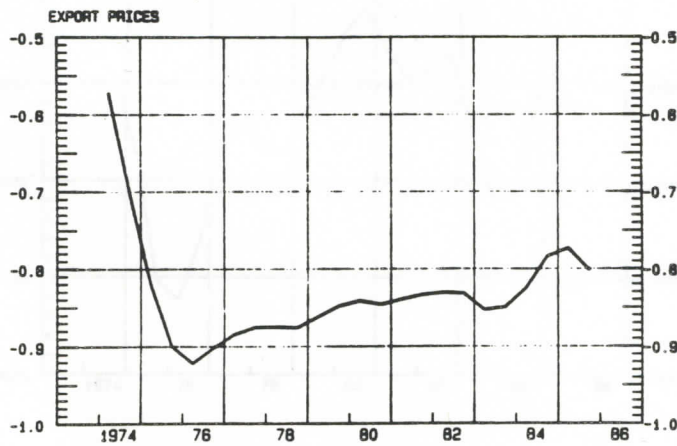
AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



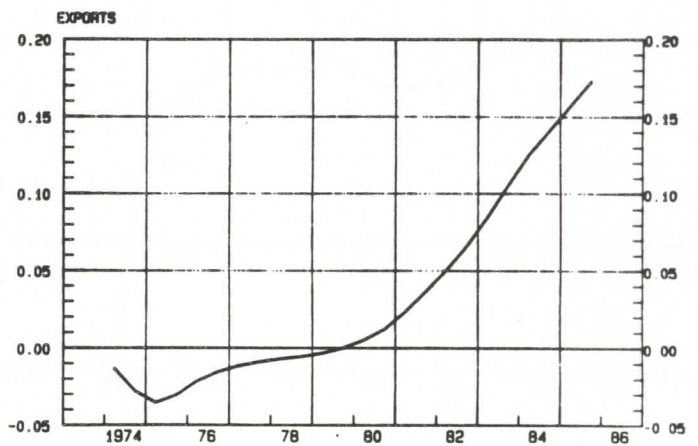
AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



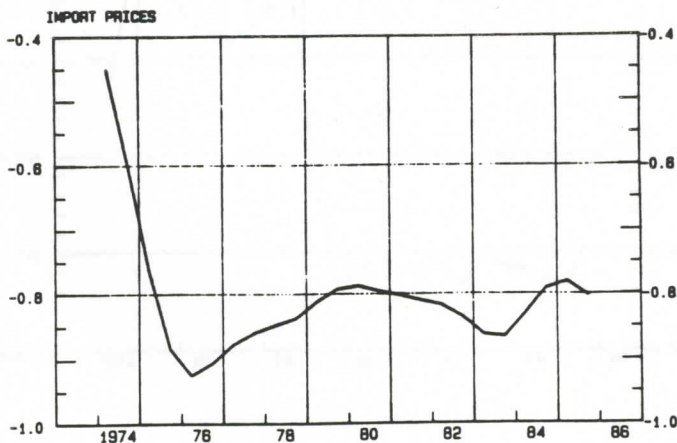
AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



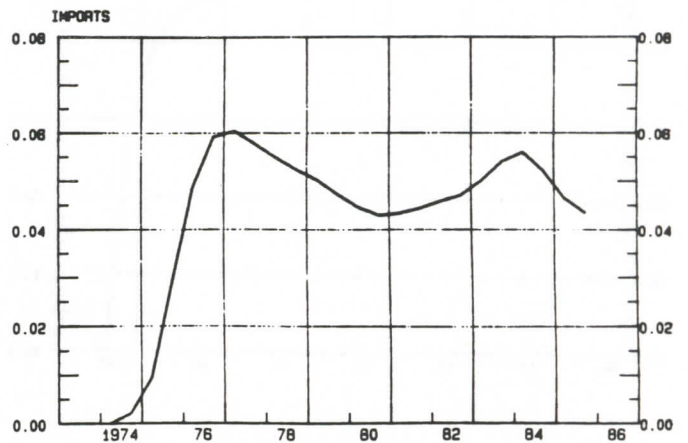
AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



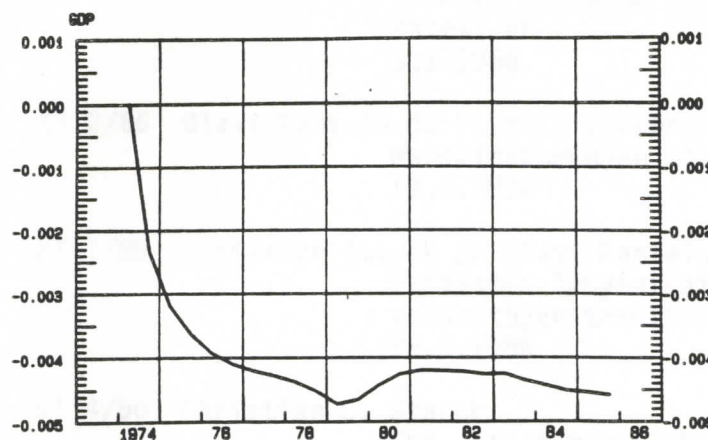
AN APPRECIATION OF THE US DOLLAR BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



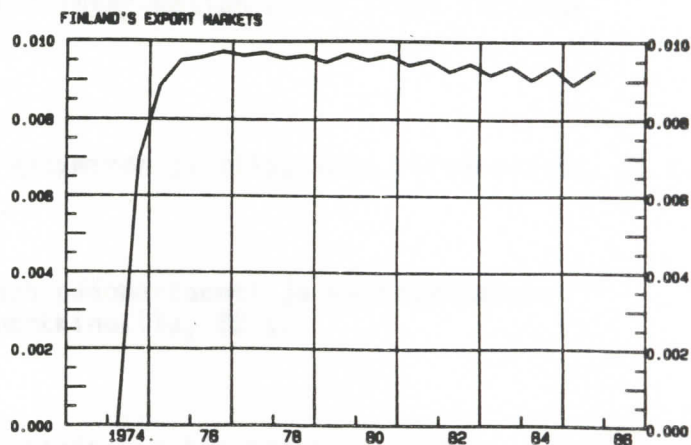


# IV

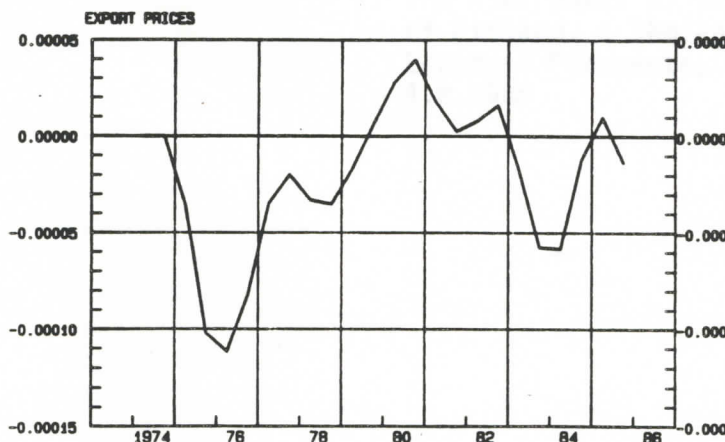
A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



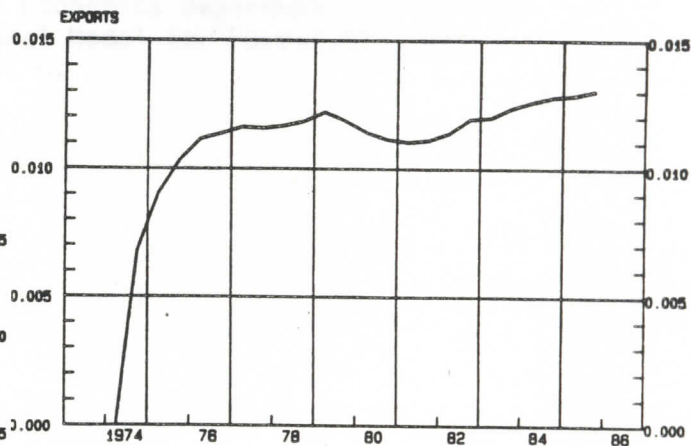
A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



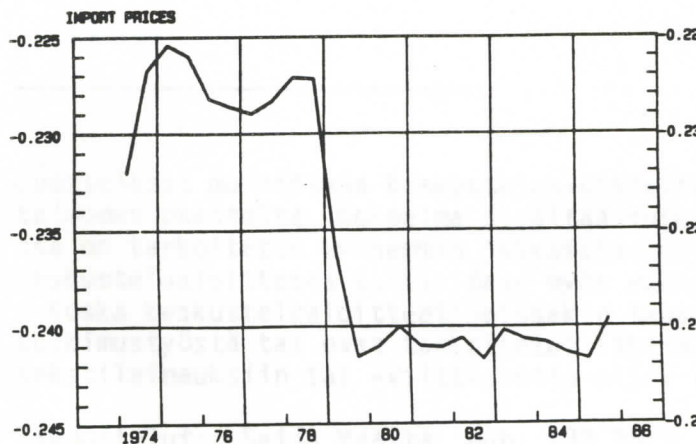
A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



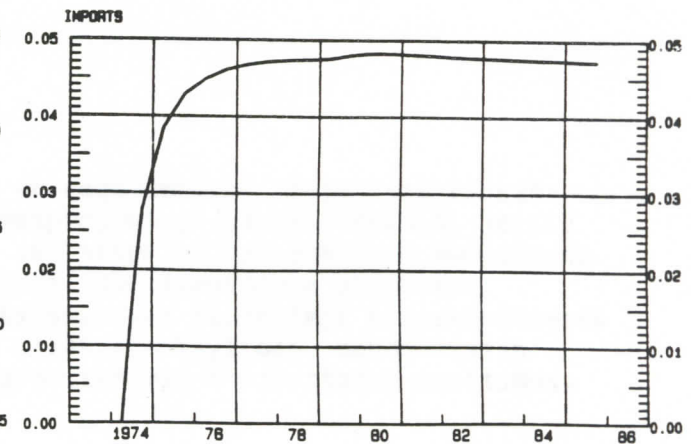
A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



A REDUCTION OF THE PRICE OF CRUDE OIL BY 10 PER CENT  
OECD COUNTRIES, DYNAMIC ELASTICITY



Kansantalouden osasto

4.8.1986

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- KT 1/86 Seppo Kostiainen and Heikki Taimio  
Forward Exchange Market Intervention under Fixed Exchange Rates, 28 s.  
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28.5.1986
- KT 4/86 Christian C. Starck  
The Intertemporal Elasticity of Substitution in Consumption: some Empirical Evidence from Finnish Data, 31 p.  
28.5.1986
- KT 5/86 Timo Tyrväinen, Alwin Moes, Hannele Kuosmanen and Reijo Siiskonen  
The KTKV Model of the Economics Department of the Bank of Finland. A Semiannual Model for Forecasting World Economic Prospects, 57 p.  
4.8.1986

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Luettelossa mainittuja keskustelualoitteita on rajoitetusti saatavissa kansantalouden osastolta. Kokoelma sisältää tutkimusprojekteja ja selvityksiä, joista osa on tarkoitettu myöhemmin julkaistavaksi sellaisenaan tai edelleen muokattuna. Keskustelualoitteina taltioidaan myös vanhempaa julkaisematonta aineistoa.  
- Koska keskustelualoitteet joissakin tapauksissa ovat raportteja keskeneräisestä tutkimustyöstä tai ovat tarkoitettut lähinnä sisäiseen käyttöön, mahdollisiin tekstilainauksiin tai -viittauksiin olisi varmistettava kirjoittajan suostumus.

Tiedustelut: Seija Määttä, puh. 183 2519