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Bank of Finland Discussion Papers, No. 2/1995

Provided in Cooperation with:
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Suggested Citation: Hoej, Liselotte (1995) : Fundamental equilibrium exchange rate: a case study of the Finnish Markka, Bank of Finland Discussion Papers, No. 2/1995, ISBN 951-686-440-6, Bank of Finland, Helsinki,
https://nbn-resolving.de/urn:nbn:fi:bof-20140807328

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BANK OF FINLAND
DISCUSSION PAPERS

2/95

Liselotte Høj

Research Department
10.1.1995

Fundamental Equilibrium Exchange Rate — A Case Study of the Finnish Markka

SUOMEN PANKIN KESKUSTELUALOITTEITA • FINLANDS BANKS DISKUSSIONSUNDERLAG

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BANK OF FINLAND DISCUSSION PAPERS 2/95

Liselotte Høj*

Research Department
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Fundamental Equilibrium Exchange Rate — A Case Study of the Finnish Markka

* This report was written while Ms. Høj worked as a visiting scholar at the Bank of Finland Research Department in September to December 1994. The views expressed in the report are those of the author and do not necessarily reflect the official position of the Bank of Finland.

ISBN 951-686-440-6
ISSN 0785-3572

Suomen Pankin monistuskeskus
Helsinki 1995

Abstract

The purpose of this paper is to estimate the Fundamental Equilibrium Exchange Rate (FEER) for the Finnish economy and to derive a relationship between the current account and the real exchange rate in the macroeconomic equilibrium. FEER is defined as the real exchange rate which delivers a sustainable current account balance when the economy is growing at its equilibrium (non-inflationary) rate. The results emphasize the effects of the collapse of the Finnish-Soviet trade in 1991 on both the equilibrium rate of output and the equilibrium exchange rate. The assessment of the exchange rate situation prevailing in late 1994 points to the conclusion that there may be emerging conflicts in Finland between the targets of external and internal balance, unless structural reforms or the recovery of the international economy move the fundamentals from their present position.

Tiivistelmä

Tämän tutkimuksen tarkoituksena on kuvata vaihtotaseen ja reaalisen valuuttakurssin välillä vallitsevaa riippuvuussuhdetta Suomen kansantaloudessa ja arvioida Suomen markan tasapainovaluuttakurssia. Tasapainovaluuttakurssi määritellään reaalisena valuuttakurssina, joka toteuttaisi kestävän vaihtotaseen tasapainon talouden kasvaessa tasapainoista (ei-inflatorista) uraa pitkin. Tulokset korostavat Neuvostoliiton-kaupan romahduksen vuonna 1991 aiheuttamia vaikutuksia sekä tuotannon että valuuttakurssin tasapainotasoihin. Vuoden 1994 lopun valuuttakurssitilanteen arviointi viittaa siihen, että talouden sisäisen ja ulkoisen tasapainon välillä saattaa olla syntymässä ristiriita elleivät Suomen kansantalouden rakennemuutos tai kansainvälisen talouden kasvu muuta valuuttamarkkinoilla vaikuttavia perustekijöitä.

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1 Introduction

The word turmoil has often been used for describing the last couple of years in the European currency markets. And indeed a great many changes have taken place. One of the major events was the big currency crisis in the autumn of 1992, which resulted in the floating of the Finnish markka, the British pound, the Italian lira as well as the Swedish krona. The crisis culminated in the suspension of the ERM's narrow band in August 1993.

According to the EC central bank governors' report from April 1993 (just three months before the collapse of the ERM), one factor behind the turmoil in the currency markets was a lack of confidence, not least because policy-makers had allowed the currencies of various countries to get out of line with economic fundamentals.

This of course raises the question: what is the fundamental or underlying value of the exchange rate? There is no unequivocal answer to this question. But studies from 1990/1991 regarding the Fundamental Equilibrium Exchange Rate (FEER) for the major ERM countries[1] already then pointed out misalignment between the European currencies and the respective countries' economic fundamentals. It was predicted that these tensions would increase as a result of German unification. However, looking at the past years' events alone, it would still be an exaggeration to suggest that the calculations of FEERs in the beginning of the decade actually predicted what was going to happen, but to some extent the studies gave a good indication of the direction.

This paper focuses on one of the new EU member states – Finland. The purpose is to examine the calculations of FEER for the Finnish economy and then derive a relationship between the current account and the real exchange rate in a macroeconomic equilibrium.

Economic developments in Finland over the past ten years have resembled a roller-coaster ride, with an economic boom in the late 1980s followed by a deep recession in the beginning of the 1990s. The Finnish currency has been among the most volatile in this decade, and the monetary regime has changed from a fixed exchange rate regime over a trade-weighted basket index in the 1980s to an ECU link in 1991 and finally the floating of the Finnish markka in the autumn of 1992. Unlike other European countries, the collapse of the Soviet Union has impacted strongly on the economic cycle and has also played a crucial key role for developments in the currency market.

This paper is structured into four parts. Following the introduction, we describe the concept of, and the method for calculating, FEER. In part three we examine the particular model used in this paper, and finally the results are discussed in part four.

---

[1] Conducted by among others the originator of FEER, John Williamson "FEER and the ERM" (1991) and Ray Berell and J.W. in't Veld "FEER and the path to EMU" (1991).

2 What is FEER?

The fundamental equilibrium exchange rate is defined as the real exchange rate which delivers a "sustainable" current account balance while the economy is growing at its "natural" rate, or expressed in a different way, FEER is the real exchange rate consistent with macro balance - internal as well as external. Since changes in bilateral exchange rates will leave the balance of payments unchanged as long as the effective exchange rate is constant, FEER is defined in terms of the real effective exchange rate.

In order to estimate FEER, three things are required,

1) an econometric model for the trade sector, consisting of equations expressing the dependence of output and the balance of payments on demand and competitiveness.
2) an interpretation of what is meant by internal balance
3) an interpretation of what is meant by external balance.

We have used the article "Fundamental Equilibrium Exchange Rates for the G7" by Ray Barell and Simon Wren-Lewis (CEPR Discussion Paper No. 323) as our main source. In their work of estimating FEER, they use the econometric estimates embodied in the National Institutes's world model – GEM. We have used the same concept, but in a simplified version to derive a model for the Finnish trade sector.[2]

The concept is that trade volumes are explained by domestic (GDP) and world (OECD) activity (MFOR), price competitiveness as mesured by the real exchange rate (R) and real oil prices (ROIL), while trade prices are a weighted average of domestic and world prices. Domestic and foreign price levels are measured by the producer (wholesale) price indices in Finland (WPI) and the OECD, respectively (OWPI).

The model used is *static*, which means that as a rule we do not allow for any lags and dynamics in the equations. Hence our estimations of elasticities represent medium to long-term effects. The model then gives us an expression of the trade balance such as

BGS=f(R,GDP,MFOR, ROIL....)

Treating the income dividend and payment flows (IPD) as an exogenous variable we have an expression of the current account

BCA=BGS+IPD

---

[2] In estimating the price equations the GEM model takes account of the effect of world commodity prices and the share of commodities in exports as well as imports of goods. We have ignored this, and commodity prices are thus not an endogenous variable in the model. Instead we have used the real price of oil in our estimations. Another major deviation from the GEM model is that we consider world activity as exogenous. Our results do thereby not take into consideration whether "world" GDP is on trend or not.

The interpretation of "internal balance" is related to the notion of NAIRU (the non-accelerating inflation rate of unemployment), meaning the level of activity which keeps inflation constant. Even though the definition is widely used, there is still scope for a discussion about how to calculate the NAIRU. As shown in part three we use a Phillips curve argument to derive the trend GDP (GDPT) from the *supply* side of the economy.

An interpretation of "external balance" is even more difficult, and hence leaves substantially more scope for subjective and partly normative judgements. The traditional interpretation of external balance as overall balance (a capital flow that finances the current account imbalance without the need for a change in reserves) does not suffice, because different interest rates are consistent with different capital flows and therefore with correspondingly different current accounts and hence exchange rates. We need a criterion to distinguish between "structural" and "speculative" capital flows. Unfortunately, it is very difficult to make distinctions like that in practice. One simple and traditional rule of thumb is to aim at a balanced current account. But this is not a sensible objective, and countries may often benefit by exporting or importing capital over a long period of years. As a result, the determination of structural cash flows is based on a subjective judgement taking into account that the deficit has to be sustainable in the medium term, so that confidence is maintained. Our considerations on this topic are outlined in part three.

Having defined the trade balance BGS, capital income flows IPD, the trend GDP (GDPT) and the criterion for the long-term current account target (structural cash flows SCF) we can calculate FEER as the exchange rate that would be consistent with the current account target if income returned to the trend value immediately.

SCF = BGS(FEER, GDPT)+IPD

In other words, the balance of payments is in equilibrium when the path of structural capital flows is equal to the path of the trend current account. The exchange rate path, FEER, that produces this equilibrium is our fundamental equilibrium exchange rate.

Determining the real exchange rate

Before calculating FEER, we need to define the real exchange rate which is used first to estimate competitiveness and secondly serves as the "actual" level in comparison with the estimated level of the FEER.

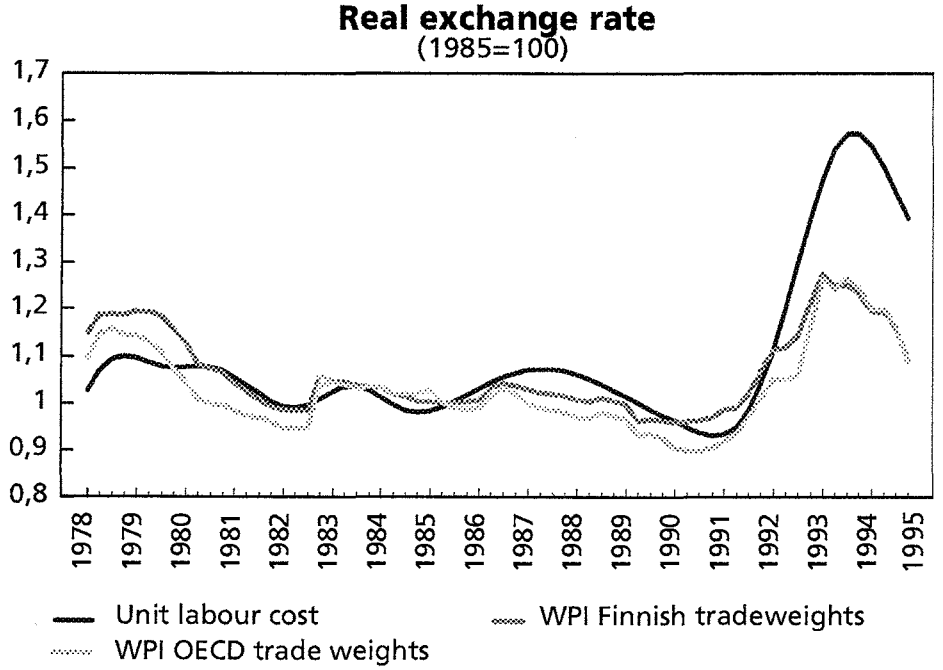
The real exchange rate is an expression of relative foreign and domestic prices expressed in a common currency. The definition is not trivial; first of all, it raises the question of which price index to use – unit labour costs, export prices, consumer prices, wholesale prices etc. For our purpose, we have chosen wholesale prices or producer prices, which in themselves are not ideal, partly because they include imported goods, partly because they ignore prices of

tradeables since they include non-tradeables and exclude other tradeables such as capital goods. The advantage though is that wholesale prices are readily available and presumably of high and comparable quality. Another price index often used is unit labour costs, which of course has the advantage of taking account of productivity gains and thus gives a more accurate picture of production cost. However, the problem is how to measure productivity, which in itself is endogenous.

Having chosen which price index to use, the next step is how to weigh foreign prices - fixed trade weights, rolling trade weights etc. We have made two sets of calculations resulting in two parallel models. In the first one we use "OECD trade weights", taking the 14 most important OECD countries as an approximation for the "world" and making their accumulated exports in 1985 sum to 100. The weights then correspond to each of these countries' market share of "OECD" trade. The second approach uses Finnish exports shares in 1985 to the 14 most important export countries to derive the trade weights. In the first model the USA carries a weight of 17.8 %, while Sweden's weight is 2.54 %; in the second model the corresponding weights are 8.5 % for the USA and 19.8 % for Sweden[3].

As shown in the accompanying figure, differences between the two weighing schemes for calculating the real exchange rates are limited, with the "OECD trade weight" being a little lower than the "Finnish trade weights" in the 1970s and 1980s, but from 1993 the two definitions have been broadly identical.

Figure 1



[3] In the appendix the weights of the two approaches are shown in detail.

The difference between using wholesale prices and unit labour costs as a way to calculate competitiveness is clearly more evident. While the patterns are alike until 1990, relative unit labour costs draw a much more favourable picture of Finnish competitiveness since the devaluation in November 1991. The reason, of course, is the enormous gain in productivity as well as the real fall in wage rates during the recession years. With production getting closer to full capacity, especially in the export sector, and the ongoing wage negotiations pointing to wage increases above the average for Europe, the gap between the real exchange rate calculated by wholesale prices and unit labour costs will probably narrow in the coming year. But the difference between relative prices and relative costs still leaves scope for discussion about the "true" picture of competitiveness.

3 The model

The first step in calculating FEER is to calculate the underlying balance for exports and imports of goods and services. This is simply done by multiplying the volumes of exports and imports by the relevant prices and using the identity of the trade balance.

Balance of trade:

BGS=XGW*PXGW+ XGE*PXGE + XS*PXS - MG*PMG -MS*PMS

where BGS is the balance of trade in goods and services, XGW and XGE are exports of goods to western Europe and eastern Europe, respectively, in 1985 prices, XS is the volume of exports of services, PXG, PXE and PXS are price indices (1985=100), and similarly for imports.

In the case of Finland, it is necessary to distinguish between exports of goods going west and east (east meaning the former Soviet Union and eastern European countries). Before the major political changes in the former Soviet Union in 1991, exports to that country were based on a bilateral clearing system and thus not determined by open market conditions. We will return to Finland's trade with the east in detail below, as it has been one of the crucial factors behind the last years' currency movements.

Trade prices

In the model, trade prices of goods are explained as a combination of domestic and OECD wholesale prices. In the case of import prices, the world price of oil in Finnish markka terms also serves as an explanatory variable. Services prices are assumed to be linked to domestic/OECD consumer prices.

For the estimations we use the ordinary least squares method. As a matter of principle, as mentioned earlier, we do not allow for lags in the equations. How-

ever, to obtain statistically satisfactory results we had to use first differences for the estimation of the price equations.

$PXGW = (OWPI/r)^{A}\ WPI^{1-A}$
$PXGE = DUM*(OWPI/r)^{B}\ PD^{1-B} + (1-DUM)(OWPI/r)^{A}\ WPI^{1-A}$
$PXS = (OCPI/r)^{C}\ CPI^{1-C}$
$PMG = (OWPI/r)^{D1}\ WPI^{D2}\ (POIL/r)^{1-D1-D2}$
$PMS = (OCPI/r)^{E}\ CPI^{1-E}$

where

OWPI is the foreign wholesale price index in US dollar (1985=100)
OCPI is the foreign consumer price index in US dollar (1985=100)
POIL is the oil price index in US dollar (1985=100)
r is the FIM/USD exchange rate index (1985=100)
WPI is the Finnish wholesale price index (1985=100)
CPI is the Finnish consumer price index (1985=100)
DUM is a dummy for the collapse of the Soviet Union in 1990

The power of the equations represents the elasticities, which by definition (geometric average) will sum to 1 for each price equation. In the appendix the models for OECD trade weights and Finnish trade weights, respectively, are shown in detail; in this context we will only comment on the latter.

Trade price	Foreign price elasticity	Domestic price elasticity
PXGW	0.43	0.56
PXGE	0.38/0.43	0.61/0.56
PMG	0.52 0.11(oil)	0.37
PXS	0.28	0.72
PMS	0.41	0.59

For export prices of goods to the west, the elasticity with respect to foreign prices is 0.43, meaning that a 1 % increase in foreign prices will have a spill-over effect on Finnish export prices of 0.43 % all other things being equal. This is on the high side if we compare with the findings for the G7 countries, but in line with expectations for a small open economy. Export prices to the east have been estimated separately until the end of 1990, and as can be seen the domestic effect is slightly higher. After 1991 we assume that competitive conditions and price-setting are the same for the two markets. As could be expected, the foreign price effect plays a more dominating role in the price-setting of imports of goods, with a total effect from abroad (the real exchange rate and

the real oil price) of 63 %. Looking at services prices, the domestic price influence overshadows the international effect, which is in line with expectations for exports of services, but quite surprising when it comes to prices of imported services[4].

Trade volumes

In the model, export volumes of goods to the west are explained by export price competitiveness, the real oil price and an activity variable related to international trade. In this case we use the imports of Finland's 14 most important western trading partners weighted by the Finnish export weights as a measure of world trade. Also the estimation of import volumes of goods is straightforward – a function of economic activity (GDP) in Finland and price competitiveness.

However, with the estimations of the aggregate services volumes of imports and exports, respectively, we ran into statistical difficulties. The reason is probably the heterogeneous nature of services – transport, travel and other services including banking, insurance etc. Looking at imports of services, for instance, travelling expenses have dropped significantly as a result of the depreciation of the markka, while there has been a significant increase in "other services" – banking, insurance etc. – since 1991. The statistical consequence was that when GDP was used as the activity variable, the competitiveness variable in terms of real consumer prices turned out to have the wrong sign. Instead we have estimated imports of services by exports of goods (exports of goods are "FOB – free on board", which means that transport services provided by foreign carriers will show up as imports of services), domestic GDP, a trend and a dummy for the strike in 1986. Exports of services are a function of exports of goods (transport services provided by Finnish companies), real consumer prices and the dummy.

Finally, to estimate exports to the east we had to take account of the bilateral trade agreement effective until 1991. The impact of Finnish-Soviet trade on the Finnish economy in general has been pivotal[5]. The share of exports and imports to the east has ranged from above 20% of total trade in the beginning of the 1980s to less than 5 % after the collapse of the Soviet Union in the beginning of this decade. In brief, the clearing system (effective until the end of 1990) was based on five-year trade agreements which consisted of lists of quotas for goods to be exported by each country to the other during the agreement period. In practice, from the Finnish point of view this mechanism for determining the level of bilateral trade worked as follows: the quotas of the five-year agreements were based on estimated import levels and on long-term

[4] In the study concerning the G7 countries Ray Barell and Simon Wren-Lewis assume that import prices of services can be described solely by foreign consumer prices.

[5] For a more detailed description of the bilateral trade system, see Ilkka Kajaste "Soviet Trade and the Finnish Economy" (1992).

export contracts concerning capital goods, mainly machinery and ships. The bulk of Finnish imports from the Soviet Union (80 %) consisted of crude oil and other energy products. It was attempted to maintain the balance in the clearing account annually, but whenever substantial imbalances built up in the clearing account, the trade flows were usually the item that was adjusted. The wide fluctuations of Soviet export shares, especially in the 1980s, were mainly a reflection of the change in the price of oil. In an attempt to estimate Soviet trade we therefore use the real oil price as well as the level of economic activity in Finland as explanatory variables.

Since the beginning of 1991 trade between Finland and the former Soviet Union has been conducted on the basis of convertible currencies. Unfortunately, this fact does not make the estimation of exports to the east any easier. In 1991 exports to the east dropped to a historical low of FIM 6bn, but have since increased substantially and are now back at the level of the years prior to the collapse of the Soviet Union of around FIM 14bn. Unfortunately, the statistical material from the former Soviet Union does not provide any evidence in a macroeconomic framework of these developments. As a result, we had to estimate trade from 1991 by a trend (exogenous), which of course is not a very satisfying solution. To compensate for this, we have run parallel simulations of FEER, treating exports to the east as exogenous.

The volume equations as well as the elasticities regarding exports of goods to the west and imports of goods are shown below. Details on eastern exports and services are given in the appendix.

$XGW = k1\ RWPI^{A1}\ MFOR^{A2}\ ROIL^{A3}$
$XGE = DUM * k2\ ROIL^{B1}\ GDP^{B2} + (1-DUM)\ k3 + e^{Trend}$
$MG = k5\ RWPI^{-C1}\ GDP^{C2}\ ROIL^{-C3}$
$XS = k4\ RCPI^{D1}\ XGW^{D2}\ XGE^{D3}\ DUM1^{-D4}$
$MS = k6\ XGW^{E1}\ GDP^{E2}\ DUM1^{E3}\ e^{TREND}$

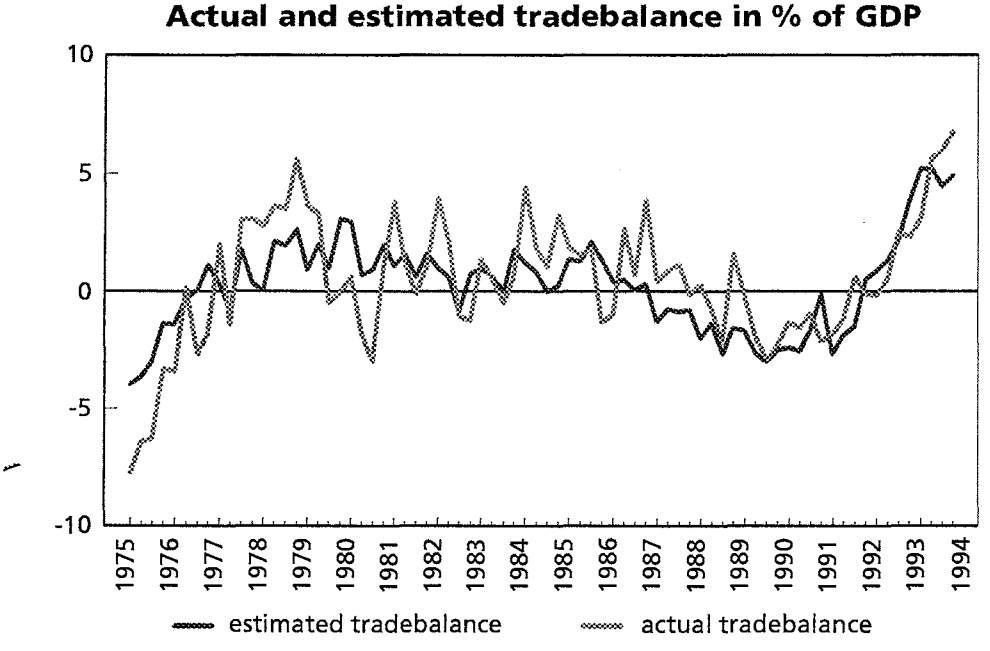
where

ki is the constant of the equations
MFOR is imports of Finland's major export countries (1985=100)
ROIL is the real oil price POIL/r*WPI
RPXG is export competitiveness OWPI/r*PXGW
RWPI is the real exchange rate OWPI/r*WPI
RCPI is the real exchange rate for services OCPI/r*CPI
GDP Finnish GDP volume (1985 prices)

Volume	Activity elasticity	Competitiveness/price elasticity
XGW	1.23	0.52 0.19 (oil)
MG	0.96	0.36 0.07 (oil)

The activity elasticity regarding exports is above unity in this model, indicating that Finnish export goods are quite sensitive to foreign demand (elastic goods)[6]. For imports of goods to Finland, the income elasticity is around unity, which is rather low compared to the findings for the G7 countries, where income elasticity ranged from 1.5 to 2.8. It should be borne in mind that the Finnish import structure differs from that of most other countries in the way that oil and raw materials account for about 70 % in volume terms and 60 % in value terms of total imports. Regarding price elasticities, the sensitivity is higher for exports than for imports. If the total effect of international prices is taken into account, the simple Marshall-Lerner condition is met, indicating that a depreciation improves the balance of trade.

Figure 2



[6] However, by limiting the estimation period to the 1980s we get an elasticity close to unity.

Figure 2 shows the estimated trend trade balance and the actual observed trade balance. Since we do not allow for dynamics, the equations are medium term in nature. Therefore we do not expect them to track actual developments quarter by quarter, but any discrepancies should be temporary.

Capital income and transfer flows

To get from the trade balance to the current account we have to define capital income and transfer flows:

IPD = (NETINV/EX + NETTRANS)/(GDP*PGDP)

where NETINV is Finnish net investment, which is assumed to be exogenous in foreign currency, EX the exchange rate, and NETTRANS is net transfers and other expenditure which are exogenous in FIM. This gives us the following expression for the current account:

BCA = BGS + IPD
where BGS = (R,GDP..)

Treating capital income and transfer flows as predetermined means that our concept of FEER will be static and conditional on actual balance of payments developments before each period. Thus, we do not attempt to calculate FEER paths.

The trend GDP

The next step in calculating FEER is to determine the internal balance, which theoretically is defined as the level of activity which that keeps inflation constant.

To calculate the trend GDP we first estimate GDP from the supply side of the economy using the "accelerationist" Phillips curve argument, where inflation π is a function of inflation in the last period (an indicator of inflation expectations) and the current GDP gap.

(the equations are in logarithmic form)

$$\pi = \pi_{-1} + \delta\,(GDP - GDP^{*})$$

assuming $GDP^{*} = \alpha + \beta\ Trend + \gamma\ R$

then $GDP = \alpha + \beta\ Trend + \gamma\ R + 1/\delta(\pi - \pi_{-1})$

Estimated with the data from 1975.1 to 1993.4 the result is:

$$GDP = 11.081 + 0.00659\ Trend - 0.65122\ RWPI - 0.065\ \Delta\ INFL$$
$$(200) \quad (43.8) \quad (-13.5) \quad (7.2)$$

$R^2 = 0.97$
DW = 0.61
SD = 0.025

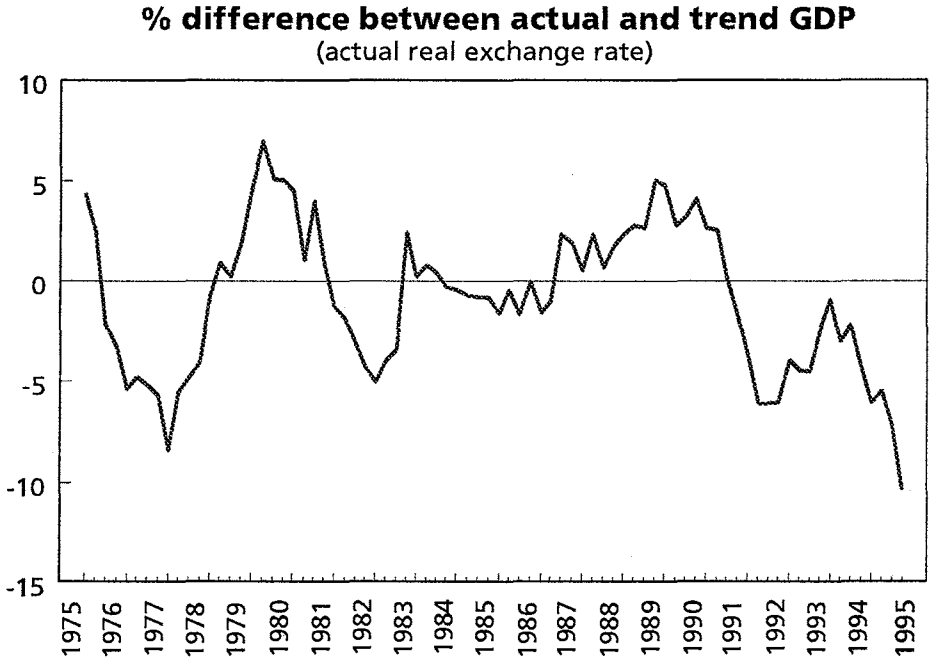
We have used the *acceleration of wage increases* as an indicator of the surprise changes in the rate of inflation (INFL). This, of course, is a rough approximation and can hardly be regarded as a complete model for GDP. Further study of the topic is probably necessary to improve the model[7]. It is also worth noting that the concepts of the noninflationary level of GDP and FEER used in this paper are explicitly medium term in nature. This means that the equilibrium growth rate of productive capacity is treated as fixed.

We derive the trend GDP (GDPT) by simply setting the acceleration in wage increases to 0; this leaves us with an average/trend growth rate of 2.6 % p.a. and an elasticity in respect of the real exchange rate of minus 0.65. Note the negative sign which implies that a depreciation of the markka will reduce the trend GDP, meaning that the potential for GDP growth consistent with a constant inflation rate will decline — and vice versa in the case of an appreciation of the currency.

Figure 3 pictures the deviation of actual GDP growth from trend GDP growth given the *actual historical observed exchange rates* since 1975. The economic cycles shown are in line with the general opinion — economic recession after the oil crises, an overheating of the economy in the late 1980s followed by a deep recession in the beginning of the 1990s. What is interesting though is that after the floating of the markka in the autumn of 1992 GDP was on trend. In other words the actual GDP gap, which stands at around 10 %, is a result of the appreciation of the markka by approximately 15 % since 1993, and the interpretation of the GDP gap is that the Finnish economy can grow by 10 % above the normal trend (2.6 % p.a.) without triggering any changes in the inflation rate given the actual level of the real exchange rate.

[7] As can be seen from the model specification, we are able to get a pretty good fit for GDP, but the stability of the equation lacks. (We have experimented with different variables, and time series like house prices do indeed improve the Durbin-Watson test. The problem in this context is that house prices/the wealth effect is a demand variable rather than a supply variable, and in that sense inconsistent). A complete macroeconomic model would of course include a wage equation which takes account of structural variables as well as the effect of for instance changes in tax rates.

Figure 3



"Structural" capital flows

The final step before we are able to calculate FEER is to determine the "structural" capital flows, and as mentioned above this is not a trivial task. By definition, the current and capital accounts of the balance of payments must balance. However, for the purpose of calculating FEER we have to distinguish between "structural" and "speculative" capital flows. "Structural" capital flows are defined as the capital flows related to long-term profitability differentials and to underlying portfolio preferences — direct investment is an example of structural capital flows. In contrast, short-term speculative flows are clearly not structural because "stock adjustment" tends to be generated fairly rapidly by interest rate differentials or short-term exchange rate expectations. The position of portfolio investment flows is less clear — in some cases these may reflect the possibility of short-term returns, while in others they can represent a response to more long-term factors. Unfortunately, it is very difficult to quantify the notion of "structural" capital flows in practice. Given these uncertainties, the determination of structural cash flows is based on a subjective judgement taking into account that the deficit has to be sustainable in the medium term[8]. This means that the current account deficits are not allowed to follow a path that would jeopardise the debt/GDP ratio at an "acceptable" level.

[8] In this respect our study does not differ from any other studies. Williamson (1990) limits the current account deficit/surplus targets to a maximum of 1.5 % of GDP, while Ray Barrel and Simon Wren-Lewis (1989) in their paper have current account targets ranging from -1% to +2% of GDP for the G7 countries.

Finnish current account deficits have been quite volatile. On average the current account deficit amounted to 2 % of GDP in the 1980s, with the net foreign debt stable around 15 % – 20 %, which is an acceptable level for a small, non-energy-producing country also in an international context. In the beginning of this decade the deficit surged to between 5 % and 6 % of GDP, with the foreign debt rising to around 50 % of GDP (the amount of foreign debt in terms of FIM is of course influenced by the currency depreciation) – a development which is not satisfying.

To account for the uncertainty of determining structural capital flows, which instinctively are very important to our simulation of FEER, we have made two scenarios. In the first one, we set the current account target to 2 % of GDP for the whole period (1975 – 1994), and in the second we restrict the target to -1.5 % from 1975 to 1992 and balance in 1993 and 1994.

Having determined a model for the trade sector and made the necessary assumptions about structural capital flows, we are now ready to calculate the real exchange rate (FEER) which ensures that the current account match the structural capital flows and is consistent with the GDP consistent with NAIRU (based on the calculated exchange rate).

4 FEERs – empirical results

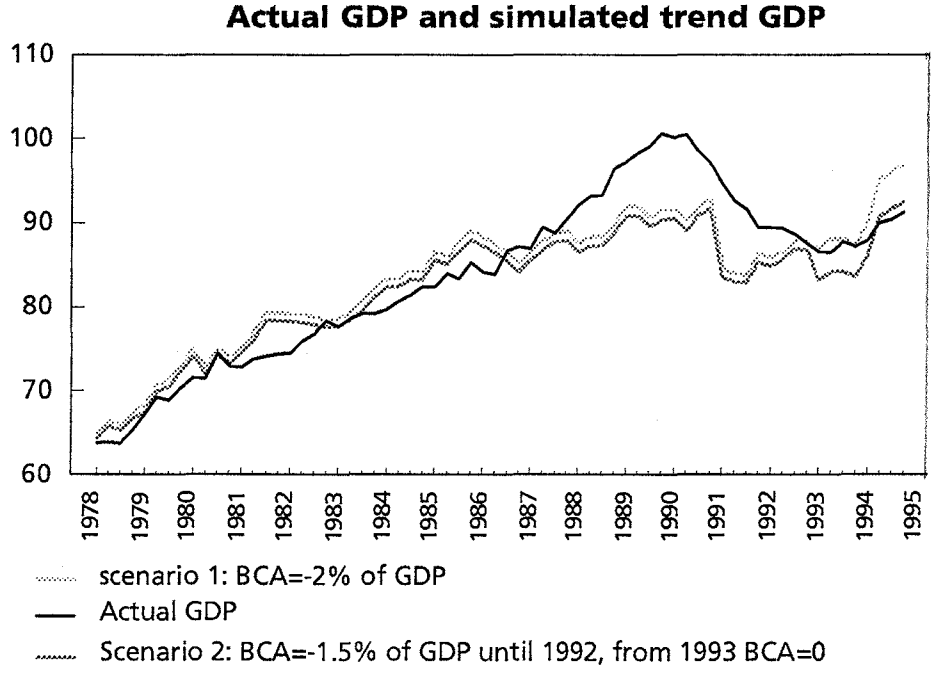
In this section we will discuss the results of the simulation of our two scenarios. We will only comment on 1) the calculated trend GDP compared to actual GDP and 2) FEER compared to the actual level of the real exchange rate[9].

Figure 4 shows the actual real GDP and simulated real trend GDP, respectively. Note that the simulated GDP trend is based on the calculated real exchange rate (FEER) which fulfils the requirement of a current account target of -2 % of GDP and -1.5 %/0 % of GDP, respectively. The deviations between actual and trend GDP are shown in Figure 5.

From the late 1970s until the middle of the 1980s the actual real GDP was on average slightly below trend, most obviously in 1981 when the GDP gap reached 5 % caused by the effect of the recession after the second oil crisis. In 1986 the trend was reversed; the oil price plunged to a low of the 1980s, and as a result Finnish trade to the east settled at a lower level. This was one of the factors which drove down the trend GDP. In the late 1980s Finland experienced an economic boom. In these years the capital markets were deregulated and the private sector's debt ratio increased. As shown by the figures, a noticeable over-

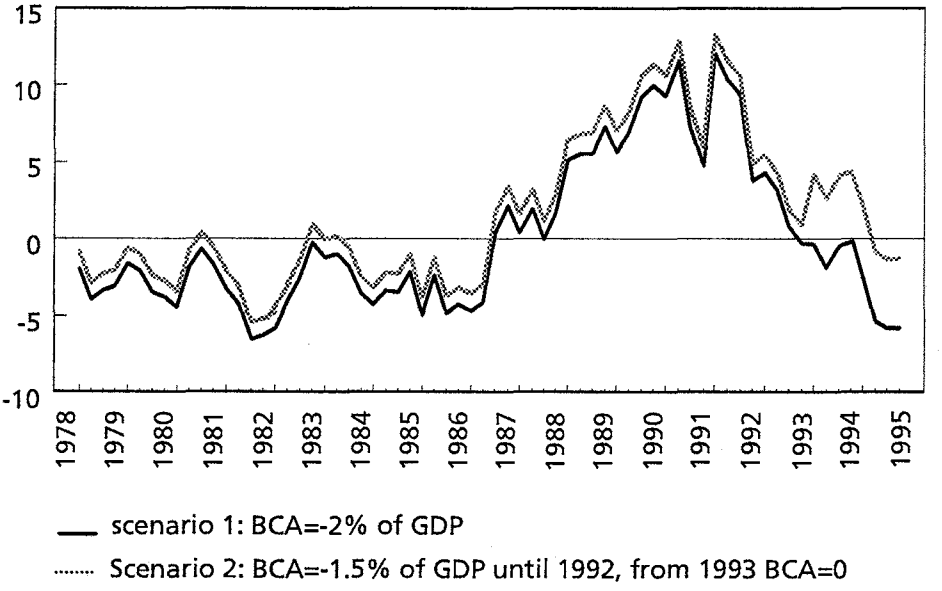
[9] Note that our calculations of FEER as well as the trend GDP depend on the historical values of overseas asset and liability stocks, and hence the equilibrium exchange rate we calculate at each point in time is conditional on the history of the actual current account.

Figure 4



heating of the economy took place, peaking at around 10 % above the trend level by the end of the decade. At the same time Finland witnessed more than a doubling of the current account deficit from around 2 % of GDP in 1988 to above 5 % of GDP in the beginning of this decade.

Figure 5

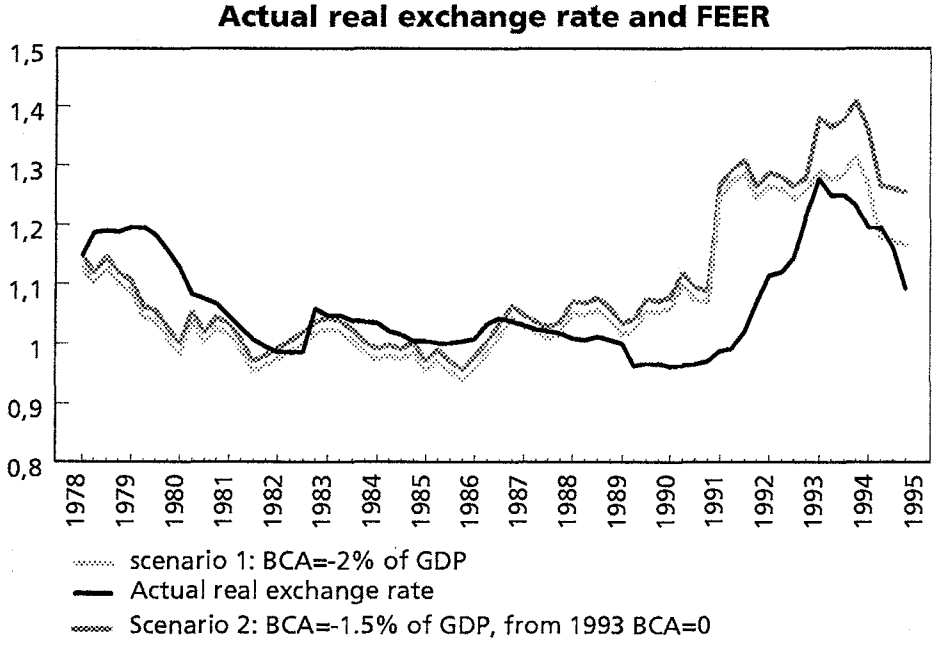


The collapse of the Soviet Union and the ending of the clearing account system contributed to a drop in the total amount of exports to the east from more than FIM 14bn in 1990 to less than FIM 7bn in 1991. The effect was a noticeable decline in the trend by around 6 % – 7 %.

By the end of 1992 – and after a substantial decline in actual GDP – actual GDP was back on trend. Of particular interest is, of course, the current (1994) GDP gap. In scenario 1, where we allow for a current account deficit of 2 % of GDP, the current GDP gap is 5.5 %. This means that the economy can grow for one year by around 5 % faster than trend (which as mentioned earlier is 2.6 % p.a.) without causing any upward pressure on inflation – given that the real exchange rate stays at the current level, and the medium-term target for the current account is -2 % of GDP. Obviously, the GDP gap in scenario 2, where we restrict the current account to balance in 1993 and 1994, is smaller: currently 1.5% below the trend, which means that if the economy grows at a rate of 4 % in 1995 – as predicted by official forecasts – the gap will be closed, and growth above trend will trigger an increase in the inflation rate. Again, this interpretation is based on the assumption that the real exchange rate is constant or rather stays at the FEER level.

We now focus on the implications for FEER compared with the actual observed real exchange rate which are shown in Figure 6 and Figure 7.

Figure 6



According to the model, the markka was undervalued by 10% by the end of the 1970s; the reason for this is that we restrict the current account target to -2 % and -1.5 % of GDP, respectively, while the actual outcome was a temporary surplus in 1979 of around 2 % of GDP. From the early 1980s until 1988 the

real exchange rate was very much in line with FEER. But from 1989 we saw an increasing overvaluation of the markka, accumulating to 10 % by the end of 1991.

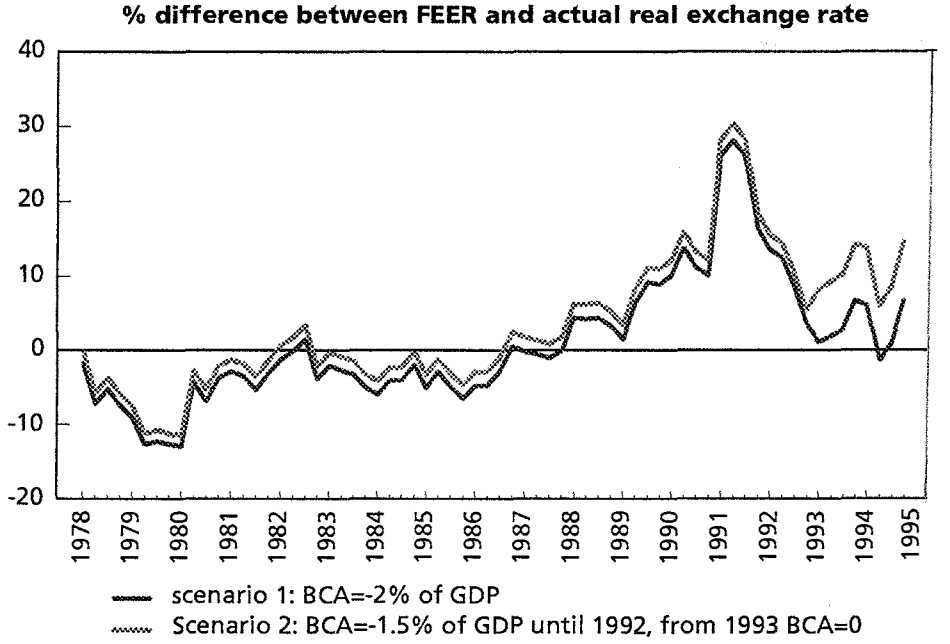
The collapse of the former Soviet Union and consequently Finnish-Soviet trade caused an additional depreciation of FEER by around 15 %, bringing the total overvaluation suddenly to well above 20 %. It was at this level that Finland in May 1991 decided to link the Finnish markka to the ECU. This decision was taken after a wave of currency speculation, but ultimately the decision, amounting to little more than a change in the currency composition of the peg, failed to restore the credibility of the markka. In November, market pressures became too heavy, and a devaluation of around 10 % was necessary. The large improvement in competitiveness did not suffice to restore confidence. However, according to the results of the present calculations, this can be explained by the extreme size of initial disequilibrium. The situation thus remained fragile in 1992, and as a result of the general lack of confidence in the European currencies, Finland decided to abolish the ECU link and the markka was allowed to float from September 1992. The depreciation of the real exchange rate by an additional 15 % from September 1992 to the beginning of 1993 brought the real exchange rate into line with FEER in scenario 1 (current account target = -2 % of GDP), while the overvaluation in scenario 2 has lessened, but not been eliminated.

The estimated overvaluation according to the FEER criteria is 7 % and 15 %, respectively, in the two scenarios[10]. This might seem surprising – and very much out of line with developments in the currency market in the previous year, where an appreciation of the markka has brought the nominal as well as the real exchange rate close to the pre-floating level. In particular, the results do not imply overvaluation at the present level of economic activity.

A closer interpretation of the results is therefore required. If GDP moves back to the trend level – meaning additional 5 % real growth in scenario 1 – and afterwards stays on trend, then the real exchange rate has to depreciate by around 7 % – and stay at that level – to sustain a current account target of -2 % in the medium term (4 – 6 years). In scenario 2, where actual GDP is 1.5 % below trend, the real exchange rate has to depreciate by around 14% to sustain a balanced current account in the medium term. All these conjectures are based on the prevailing structure of the Finnish economy as reflected in the parameters of the model.

[10] The last currency observation is from 16 November, when the FIM/USD was quoted at 4.7 and FIM/ECU at 5.8. Since then the markka has weakened, and at end-1994 the currency trades at FIM/USD 4.87 and FIM/ECU 5.91, respectively.

Figure 7



According to this interpretation, it is important to underline that we do not imply that this is where actual exchange rates "should be" under these assumptions. And as mentioned earlier actual exchange rates may differ from FEERs because of short-term expectations, interest rate differentials etc. And indeed the current economic picture looks favourable. For the first time in almost 15 years, Finland will run a current account surplus in 1994 of around 2% of GDP, and inflation in terms of wholesale prices as well as consumer prices has in the last year been below the average inflation of Finland's trading partners.

Although caution is warranted regarding the accuracy of the model[11], the indications of the model are nevertheless clear. It shows that at the current level of the real exchange rate there is a potential risk that the current account will swing into red again as activity recovers, so that the period with a current account surplus turns out to be only temporary.

The model also gives an indication of a GDP gap which is lower than the 10 % first anticipated when looking at the NAIRU based on the actual real exchange rate (Figure 3). As a matter of fact, in scenario 2 current GDP was only slightly below trend, which raises the question of the stability of inflation if GDP grows as predicted by for instance the ministry of finance. Critical in this context is of course the functioning of the labour market and other factors which influence domestic price developments and competitiveness. The model used in the

[11] Differences between the trend and actual current account may also stem from changes in trade volumes and prices not explained by our equations. As mentioned earlier, discrepancies should only be temporary. However, there is always a risk that recent discrepancies represent a long-term shift in structure, rather than temporary errors.

present study assumes that the supply behaviour of the economy is determined simply by a trend and the real exchange rate, as measured from historical developments, bur obviously institutional changes might either improve or worsen the situation compared to the past average performance.

5 Conclusion

To give an unequivocal and incontestable picture of the fundamental level of a currency is hardly possible. However, calculations of FEER based on the assumption that the economy must be in equilibrium — both externally (the current account) and internally (non-inflationary growth) may give an indication of the underlying level. Short term, significant deviations between the real exchange rate and FEER are thus "permissible", but longer term it may prove difficult to maintain credibility in the market if the nominal/real exchange rate is not consistent with economic fundamentals.

In the case of Finland, trade with the former Soviet Union has been a major influence in overall economic developments with spill-over effects on the exchange rate. Our calculations thus show that the immediate consequence of the collapse of the Soviet Union was a decline in trend GDP by 6 % — 7 % and a sudden weakening of the equilibrium exchange rate for the markka by about 15 per cent, which is clearly more than shown by calculations from, for instance, the finance ministry. Against this background in particular, it is not surprising that the ECU peg adopted in May 1991 did not prove to be durable.

The autumn 1991 devaluation and the depreciation of the markka following the floating in September 1992 as well as a sharp rise in productivity have resulted in a significant improvement of the export sector's competitiveness. On top of this, Finland will for the first time since 1979 run a surplus on the current account in 1994. Based on current performance, the past years' gradual appreciation of the markka is thus warranted. However, our calculations suggest that on a slightly longer term outlook the current level of the real exchange rate may not allow a rapid recovery in the economy while maintaining a sustainable current account balance. The discrepancy is not historically large, at least if one accepts the current account target of -2 per cent of GDP. Nevertheless, the analysis points to the conclusion that there may be an emerging policy conflict between the targets of external and internal balance unless structural reforms in Finland or the recovery of the international economy move the fundamentals from their present position.

Appendix

MODEL 1: Finnish trade weights

Estimation period: 1975.1 to 1993.4
All variables are in logarithms except the trend and dummies
1-period difference used in the price equations
The volumes are in 1985-prices and the price indices are 1985 = 100.

TRADE EQUATIONS

Western export of goods:

(1) XGW = 4.069 + 0.51774 RXGW + 1.2275 MFOR + 0.19128 ROIL
(20.3 (3.4) (27.25) (7.12)
R^2=92.2 DW=1.13 SD=0.076149

Eastern export of goods:

(2) XGE= DUM(-1.6403 + 0.40823 ROIL + 0.89289 GDP)
(-1.7) (7.4) (6.5)
+(1-DUM) * (1375.8 + 3.2957 RPXG)
(9.4) (5.2)
R^2=0.56 DW= 1.13 SD=0.165

Import of goods:

(3) MG = -0.884 - 0.36448 RWPI + 0.95564 GDP - 0.074277 ROIL
(-1.8) (-3.6) (16.38) (-3.5)
R^2=0.88 DW=1.35 SD=0.0646

Export of services:

(4) XS = 3.1240 + 0.41411 XGW +0.1412 XGE + 0.259 RCPI - 0.22 DUM1
(7.3) (11.9) (5.4 (2.8) (-5.3)
R^2=0.71 DW=1.04 SD=0.071

Import of services:

(5) MS = 0.17386 XGW + 0.53042 GDP - 0.14210 DUM1 + 0.011 TREND
(2.7) (10.0) (-5.027) (22.33)
R^2=0.99 DW=2.05 SD= 0.0546

Export prices of goods to the west:

(6) PXGW = 0.43389 (OWPI-r) + 0.56611 WPI
(4.3) (4.0)
R^2=0.542 DW=2.04 SD=0.017

Export prices of goods to the east:

(7) PXGE = DUM (0.389 (OWPI-r) + 0.61 WPI)
(1.5) (1.9)
+ (1-DUM) * (0.43(OWPI-r) + 0.56611 WPI)
(4.3) (4.9)
R^2=0.23 DW=2.19 SD=0.048

Import price of goods:

(8) PMG = 0.52001 (OWPI-r) + 0.37952 WPI + 0.11 (OIL-r)
(3.8) (9.3) (6.8)
R^2=0.84 DW=2.03 SD=0.012

Export price of services:

(9) PXS = 0.3 (OCPI-r) + 0.7 CPI
(2.3) (3.6)
R^2=0.38 DW=2.65 SD=0.026

Import price of services:

(10) PMS = 0.4089 (OCPI-r) + 0.5911 CPI
(6.2) (6.7)
R^2=0.73 DW=2.23 SD= 0.012

CAPITAL FLOWS

(11) IPD = (NETINV*EX+NETTRANS)/(GDP*PGDP)

(12) EX = (1/r)/0.1620

SUPPLY FUNCTION

(13) GDP = 11.081 - 0.65122 RWPI + 0.75710 ΔINFL + 0.0062613*TREND
(200) (-16.041) (7.2) (47.5)
R^2 =0.97 DW=0.61 SD= 0.025

Defines the trend GDP when the INFL variable is omitted

PRICE EQUATIONS

(14) PGDP = -0.0847 + WPI + 0.0035448*TREND

(15) CPI = -0.0862 + WPI + 0.0032936*TREND

(16) OCPI = -0.076813 + OWPI + 0.0035716*TREND

MODEL 2: OECD tradeweights

TRADE EQUATIONS

Western export of goods:

(1) XGW = 4.1702 + 0.5017 RXGW + 1.2079 MFOR + 0.17523 ROIL
(20.3) (3.4) (27.25) (7.12)
R^2=92.4 DW=1.15 SD=0.075

Eastern export of goods:

(2) XGE= DUM(-1.6403 + 0.40823 ROIL+ 0.89289 GDP)
(-1.7) (7.4) (6.5)
+ (1-DUM) * (1631.736 + 2.567 RPXG)
(9.4) (5.6)
R^2=0.56 DW= 1.13 SD=0.168

Import of goods:

(3) MG = -1.0897 - 0.38484 RWPI + 0.94317 GDP - 0.0647 ROIL
(-1.8) (-3.9) (18.2 (-3.3)
R^2=0.88 DW=1.455 SD=0.06

Export of services:

(4) XS = 3.3970 + 0.39411 XGW +0.1326 XGE +0.195 RCPI - 0.223 DUM1
(8.02) (11.3) (5.0) (1.9) (-5.4)
R^2=0.70 DW=0.98 SD=0.078

Import of services:

(5) MS = 0.17386 XGW + 0.53042 GDP - 0.14210 DUM1 + 0.011 TREND
(2.7) (10.0) (-5.027) (22.33)
R^2=0.99 DW=2.05 SD= 0.0546

Export prices of goods to the west:

(6) PXGW = 0.3306 * (OWPI-r) + 0.669 WPI
(4.3) (4.0)
R^2=0.515 DW=1.89 SD=0.018

Export prices of goods to the east:

(7) PXGE = DUM (0.3677 (OWPI-r) + 0.6323 WPI)
(1.5) (2.3)
+ (1-DUM) * (0.3306 (OWPI-r) + 0.669 WPI)
R^2=0.20 DW=2.27 SD=0.04

Import price of goods:

(8) PMG = 0.49362 (OWPI-r) + 0.41706 WPI + 0.089 (OIL-r)
(8.3) (4.8) (6.2)
R^2=0.81 DW=1.91 SD=0.013

Export price of services:

(9) PXS = 0.3 (OCPI-r) + 0.7 CPI
(2.3) (3.6)
R^2=0.38 DW=2.65 SD=0.026

Import price of services:

(10) PMS = 0.4089 (OCPI-r) + 0.5911 CPI
(6.2) (6.7)
R^2=0.73 DW=2.23 SD= 0.012

CAPITAL FLOWS

(11) IPD = (NETINV*EX+NETTRANS)/(GDP*PGDP)
(12) EX = (1/r)/0.1620

SUPPLY FUNCTION

(13) GDP = 11.05 - 0.57716 RWPI + 0.74172ΔINFL + 0.004192*TREND
(200) (-16.041) (7.3) (47.5)
R^2=0.96 DW=0.5 SD= 0.029

Defines the trend GDP when the INFL variable is omitted

PRICE EQUATIONS

(14) PGDP = -0.0847 + WPI + 0.0035448*TREND
(15) CPI = -0.0862 + WPI + 0.0032936*TREND
(16) OCPI = -0.11464 + OWPI + 0.0033311*TREND

where:

OWPI is the foreign wholesale price index in US-dollars (1985=100)
OCPI is the foreign consumer price index in US-dollars (1985=100)
POIL is the oilprice index in US-dollar (1985=100)
r is the USD/FIM exchange rate index (1985=100)
WPI is the Finnish wholesale price index (1985)=100
CPI is the Finnish consumer price index (1985=100)
PGDP is the Finnish GDP deflator (1985=100)
MFOR is imports of Finland's major export countries (1985=100)
ROIL is the real oil price POIL/r*WPI
RPXG is the export competitiveness WWPI/r*PXGW
RWPI is the real exchange rate WWPI/r*WPI
RCPI is the real exchange rate for services WCPI/r*CPI
GDP Finnish GDP volume (1985-prices)
OGDP OECD GDP (1985=100)
DUM is a dummy for the collapse of the Soviet Union in 1991
DUM1 is a dummy for the strike in 1986
NETINV is Finnish net investment expenditures in USD
NETTRANS is Finnish net transfers and other expenditures in FIM
ΔINFL is the acceleration of the wage annual increases

TRADE WEIGHTS-1985

	OECD	Finnish
Austria	1.4	1.5
Belgium	4.5	2.9
Canada	7.3	1.5
Denmark	1.4	5.2
France	8.5	7.7
Germany	15.3	17.0
Italy	6.6	4.2
Japan	14.7	2.2
Netherlands	5.7	5.8
Norway	1.7	5.2
Spain	-	2.0
Sweden	2.5	19.8
Switzerland	2.3	2.4
UK	8.4	15.9
USA	17.8	8.5

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