TRADE VOLUME EFFECTS OF THE EURO: AGGREGATE AND SECTOR ESTIMATES

by

Harry Flam and Håkan Nordström

INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES
Stockholm University

Seminar Paper No. 746

Trade Volume Effects of the Euro: Aggregate and Sector Estimates

by
Harry Flam and Håkan Nordström

Papers in the seminar series are published on the internet
in Adobe Acrobat (PDF) format.
Download from http://www.iies.su.se/

ISSN: 1653-610X

Seminar Papers are preliminary material circulated to
stimulate discussion and critical comment.

June 2006
Institute for International Economic Studies
Stockholm University
S-106 91 Stockholm
Sweden

Trade volume effects of the euro: Aggregate and sector estimates

Harry Flam*
Institute for International Economic Studies and CES

Håkan Nordström**
Swedish Board of Trade

August 27, 2003

Abstract

The gravity model is used to estimate the trade volume effects of the creation of the European currency union. The euro is estimated to have raised the level of aggregate trade between euro countries in 1998-2002 compared to 1989-1997 by 15 per cent and the level of trade with outside countries by 8 per cent. The effect is clearly increasing over time. Estimates for one-digit SITC sectors yield a concentration of effects to highly processed manufactures, indicating that the spillover is caused by increasing vertical specialization across countries.

* harry.flam@iies.su.se. Flam gratefully acknowledges financial support from Handelsbankens forskningsstiftelser.
** hakan.nordstrom@kommers.se
We thank José Mauricio Prado Jr. for excellent research assistance.

1. Introduction

The question of whether the European currency union will create more trade between members and possible divert trade with non-members has attracted great interest in recent years among researchers and policymakers alike. Answers have been provided based on data for other currency unions and for countries at very different levels of development. We add to the small number of studies that have estimated the trade effects directly on data for the European currency unions and for countries with similar characteristics. We extend the previous studies by estimating effect on exports (one-way trade) instead of bilateral (two-way) trade to separate the effects the effect on exports *from* euro to non-euro countries from the effect on exports *to* euro countries. Furthermore, we provide estimates not only for the aggregate but also for different sectors in order to see whether the effects are present in certain sectors and absent in other. The results support recent research findings of increasing international vertical specialization and provide an explanation for increased trade not only between euro countries but also with outside countries.

The seminal paper by Rose (2000) on the currency union effect on trade volume did not forecast the effect of the European currency union but was motivated by it. Rose estimated a gravity model of trade on data for 186 countries and other entities for which trade statistics are collected. He found that a common currency increases bilateral trade by 235 percent on average, controlling for a host of factors, including country size, distance and other geographical factors, language, colonial history, and exchange rate volatility. His paper was immediately criticized on several grounds. First, critics argued that it was just more likely that extensive trade gave rise to currency unions than the other way around. Second, a common currency and extensive trade could be jointly caused by missing variables. Third, the observations of currency unions in Rose' sample – one per cent of the total – were not a random selection of countries and their particular characteristics were not fully controlled for. Fourth, estimates based mostly on small and poor island states and former or present colonies could not be used for making inferences about the effects of the European currency union. Finally, Rose (2000) is a pooled cross-section study, answering the question: Do countries with a

common currency trade more? More relevant for the effects of the euro would be to use panel data to capture the time dimension and to answer the question: Does the switch to euro cause more trade?

The first and second criticisms have been adressed by Tenreyro and Barro (2003) among others. They observe that many countries share currencies as a result of their decision to adopt the currency of an anchor country and not because of their mutual economic relations. The joint probability that two client countries independently adopt the currency of the same anchor country is used as an instrumental variable in the estimation of the currency union effect. They conclude that a large currency union effect exists and that it is not caused by endogeneity. The second and third criticisms have been dealt with by Persson (2001). He uses statistical techniques to find a control group of countries with characteristics closely matching those of the currency union countries, except for having a common currency. He also used non-parametric methods to allow for non-linearities. His estimates of the currency union effect were much lower than those of Rose and insignificant. However, when Rose (2001) applied Persson´s methods on a larger data set, including a greater number of observations of common currencies, he found significant effects of 21-43 per cent. Furthermore, when he re-estimated the gravity equation on panel data for a longer time period and with a closely matched control group the common currency effect was a significant 685 per cent. A survey and discussion of the research on currency union effects, with references to other attempts at coming to grips with the problems of endogeneity, missing variables and sample characteristics can be found in Rose (2002).

Two approaches have been followed in addressing the fourth criticism that estimates for other currency unions cannot be used to infer the effects of the European currency union. Rose and van Wincoop (2001) exploit the structural model developed by Anderson and van Wincoop (2003). The basic idea is that trade between any two countries is a function of the bilateral trade costs as well as the trade costs with all other trading partners. The greater bilateral trade relative to trade with other trading partners is initially, the smaller will be the increase in trade following the adoption of a common currency since trade costs already are relatively small. Using estimates from previously existing currency unions and taking account of the trade cost and trade pattern of the

euro countries, Rose and van Wincoop predict that the euro will increase trade between the euro countries by about 60 per cent.

A second approach estimates effects directly on data for the European currency union. Obviously, this has become possible only recently, as sufficient time series data have accumulated since January 1, 1999, when the exchange rates of eleven EU countries were irreversibly fixed *visavi* each other. (Greece joined the currency union as the twelfth member on January 1, 2001.) This approach solves the problem of making predictions out of sample and escapes the other points of criticism to some extent. To date, three studies exist, by Bun and Klaassen (2002), by Barr, Breedon and Miles (2003) and by Micco, Stein and Ordoñez (2003). Bun and Klaassen employ a model that is similar to the gravity model but assumes that real exchange rate and common currency effects are cumulative over time and consequently use dynamic panel estimation. They find that the short run effect is 4 and the long run effect 38 per cent. Barr *et al* estimate a standard gravity model on a panel consisting of 17 European countries and data from 1978 to the first quarter of 2002. The currency union effect is estimated at 29 per cent.

The study by Micco et al is the most detailed of the three. They estimate a gravity equation on a panel of 22 OECD countries and yearly data for 1992-2002. The currency union effect is estimated with two alternative specifications. One specification uses a year dummy common to the euro countries for the whole period. The other specification uses a euro country dummy during the currency union years and restricts the coefficients to be identical across years. In the first specification, the euro effect on trade is estimated to be about 18 per cent in 1999 and about 28 per cent in 2002. In the second specification, the average effect per year is estimated at 13 per cent. Micco et al also investigate whether the introduction of the euro has diverted trade for euro countries from non-euro to other euro countries. They find the opposite; trade between euro and non-euro countries is estimated to have increased by an average of 8 per cent over the currency union period.

Our study extends the study by Micco et al. First, we use unilateral trade – exports in one direction – and not bilateral trade – exports in both directions – as the dependent variable. This is motivated by the positive spillover effect on trade between euro and

non-euro countries found by Micco et al. We want to investigate whether exports from euro to non-euro countries have been affected differently than exports from non-euro to euro countries. Second, we estimate effects for nine one-digit SITC sectors in addition to the aggregate effects. Separating the spillover effects and estimating effects on the sector level may help us to uncover the underlying mechanisms behind the spillover effect, which has no immediate explanation. We use a panel with 20 OECD countries and yearly data for 1989-2002.

2. Our specification of the gravity equation

We estimate a gravity equation with a somewhat non-standard specification.[1] Our specification differs from the standard by having one-way trade (exports) instead of two-way trade (exports plus imports) as the dependent variable. In a two-country world economy this does not matter since bilateral trade is balanced so that exports plus imports equals twice exports. In a world economy consisting of three countries, bilateral trade could in principle be unidirectional: A exports only to B, which exports only to C, which exports only to A. Our specification gives two observations for each country pair instead of one with the standard specification. The two observations will in principle have explanatory variables with the same values but dependent variables with quite different values. Consequently, estimates will tend to be less precise than with the standard specification.

Table 1 lists and explains our independent variables:

Table 1

We estimate the gravity equation using OLS with dummies for each country pair (not listed in the table). The country pair dummies capture all factors that are particular to the pair and constant over time. Variables such as distance, border contiguity and language similarity are therefore subsumed in the bilateral fixed effects.

[1] For theoretical foundations of the gravity equation, see e.g. Anderson (1979), Helpman and Krugman (1985), Deardorff (1998) or Harrigan (2003). We note only that the gravity equation can be derived from the Ricardian model with a continuum of products, the Heckscher-Ohlin model with more goods than factors and unequal factor prices, or the monopolistic-competition-increasing-returns model of trade.

Having exports as the dependent variable, it becomes necessary to take account of changes in real exchange rates. This is less necessary with bilateral trade as the dependent variable, since changes in the bilateral real exchange rate will have offsetting effects in bilateral trade. We include both the bilateral real exchange rate and the average of third countries' real exchange rate against the importing country; an appreciation of competitors' real exchange rates will favor the exporting country.

The EEA year dummies, common to all EU countries and Norway, control for decreasing trade costs connected to the Single Market. A dummy to control for the entry of Austria, Finland and Sweden in 1995 is included for similar reasons. Effects of the Uruguay Round are captured by a dummy that takes on a value of unity for trade between European and non-European countries during the period 1995-2002.

Six dummy variables have been included to control for the effects on measured trade of changes in the way trade statistics are collected. Cross-border trade within the EU-15 was in principle checked and recorded at the border before the launch of the Single Market in 1993 (1995 for Austria, Finland and Sweden). Subsequently, trade is recorded by self-reporting of firms and by collecting statistics from firm samples. However, imports by EU countries from non-EU countries are in many instances recorded as imports from the EU countries through which they were trans-shipped. This has led to a substantial recorded decrease in imports from non-European countries to inland and peripheral EU countries, and to a corresponding recorded increase in imports from non-European countries in countries to which the goods first arrive, in particular Belgium and the Netherlands, a phenomenon known as "the Rotterdam effect". We attempt to control for this by the inclusion of dummy variables for the EU-12 starting in 1993 and for Austria, Finland and Sweden starting in 1995 respectively.

The variables of primary interest are the three dummy variables for exports between euro countries, exports from euro to non-euro countries and exports from non-euro to euro countries respectively. We will estimate two alternative specifications, one in which euro dummy variables are set for the whole period and the coefficients are allowed to vary across years, and one in which they are set for the euro period and coefficients are restricted to be constant. The first specification identifies effects that are common to that category of exports relative to exports between non-euro countries

each year. The second specification is a difference in difference comparison; three categories of exports receive a "euro treatment" during the latter part of the period whereas the fourth category receives no treatment. Significant dummy coefficients can be attributed to the introduction of the euro.

3. What do the raw data show?

Before turning to the results, it is of interest to see if we can see indications of euro effects in the raw trade data. Our country sample consists of 20 industrialized countries which are broadly similar in terms of economic development. The ten euro countries are Austria, Belgium-Luxembourg (treated as one country in trade statistics), Finland, France, Germany, Ireland, Italy, Netherlands, Portugal and Spain. Greece, which entered the currency union in 2001, was not included in the sample because of its late entry and because it has been late in reporting industry trade data. The ten non-euro countries are Australia, Canada, Denmark, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and United States. We classify trade into four categories: (1) exports between euro countries, (2) exports from euro to non-euro countries, (3) exports from non-euro to euro countries, and (4) exports between non-euro countries.

Figure 1, panel a) provides a description of the growth of trade of all four categories, while *panel b)* provides a description of the growth of trade of the first three categories relative to the fourth.

Figure 1, panel a) and b)

Panel a) shows that the trade of all four categories increase at approximaterly the same rate until the year 2000, when exports between non-euro countries and from non-euro to euro countries start to decrease. *Panel b)* shows the same development in relative terms. The first three categories increased their trade relative to trade between non-euro countries somewhat in the 1990's. Starting in 2000, exports between euro countries and exports from euro to non-euro countries take off.

It is not at all clear that these developments can be explained by the introduction of the common currency in 1999. First, trade between euro countries decreases relative to trade between non-euro countries between 1999 and 2000. Second, it is exports from

euro to non-euro countries that show the highest increase absolutely and relatively, not exports between the euro countries. Any euro effects on trade have to be uncovered by estimating the partial effects of the various factors that are thought to determine the volume of trade.

4. Euro effects on aggregate trade: when do they begin, what is the trend?

The gravity equation is first estimated with a year dummy for each of the three categories of bilateral trade involving euro countries: exports between euro countries, exports from euro to non-euro countries and exports from non-euro to euro countries. The benchmark is exports between the three non-euro EU countries and between them and non-EU countries. Exports between non-EU countries are not included in the benchmark because of a lack of trade data on the industry level. The estimation will tell whether the levels of exports of the three categories involving euro countries differ significantly year by year from the level of exports between non-euro countries. We are in particular interested to see whether the levels of exports involving euro countries increase relative to the level of exports of non-euro countries with the introduction of the euro. Significantly higher coefficients after than before would indicate a euro effect on the volume of trade. The estimation will also tell us in what year the euro effect kicks in and if the effect is increasing over time.

The results are shown in *Table 2*. *Figure 2* gives a graphical representation of the estimates of the euro dummies.

Figure 2

Table 2

The black staples in the figure show by how many per cent the level of exports between euro countries differ from the level of exports between non-euro countries. Similarly, the grey and white staples show by how many per cent exports from euro to non-euro countries and exports from non-euro to euro countries respectively differ. There is no clear pattern before 1997 and the point estimates are relatively small. Starting in 1997, all three coefficients become positive and show an increasing trend. The trend is strongest for exports between euro countries and weakest for exports from

non-euro to euro countries. Thus, *Figure 2* strongly suggests that something is boosting trade involving euro countries starting in the latter part of the 1990's. We need to test for significant differences in coefficient estimates between years to determine whether there is a break in the time series and whether there is a significant increasing trend in the coefficients. *Table 3,* panels *a) – c)*, present the χ^2 – values for the F-tests of coefficient differences:

Table 3

Panel a) clearly shows that a break occurs in 1998 for exports between euro countries; the 1998 and 1999 coefficients are significantly greater than those for every previous year except 1994 and 1995. The increasing trend is also clear; the 1998 and 1999 coefficients are significantly smaller than those of 2001 and 2002. *Panel b)*, for exports from euro to non-euro countries, does not show a break in 1998, but the trend increase is visible although not as marked as in the case of exports between euro countries. *Panel c)*, for exports from non-euro to euro countries, does not give evidence of a break in 1998 or of an increasing trend.

It is clear from *Figure 2* and *Table 3* that something causes an increase in trade starting in 1998 between the euro countries and to a lesser extent in exports from the euro to the non-euro countries relative to trade between non-euro countries. (It also seems that the year dummies pick up a stronger business cycle in 1994 and 1995 in Europe than in other parts of the world.) We cannot find any other explanation for the break than the start of the currency union in 1999. Our conclusion is strengthened by the fact the the the effect is increasing over time. That the euro effect seems to start in 1998 and not in 1999 is not as puzzling as it may seem. It became increasingly certain in the course of 1998 that the currency union would come into effect as planned on January 1, 1999. On March 25, the European Commission and the European Monetary Institute published their convergence reports, recommending that eleven countries join the currency union. The special meeting of the European Council in early May followed the recommendation and determined the exchange rates at which the national currencies were to be converted into the common currency. Thus, the worries that some

countries would not be able to meet the budget and debt criteria for membership were put to rest and the uncertainty surrounding the conversion rates was dissolved. Furthermore, it was possible to hedge against any exchange rate changes during the remainder of 1998. In other words, exchange rates could be fixed already eight months before the start of the currency union. It is therefore quite natural that euro effects on trade can be seen already in 1998.

5. Euro effects on aggregate trade: how large are they?

The estimates with year dummy coefficients tell us that the euro effects start in 1998 rather than in 1999. When we next estimate the average euro effects for the euro period, we set the euro dummies for 1998-2002 and not 1999-2002. The estimates will tell whether the levels of exports involving euro countries differ from the levels during the pre-euro period and from the level of exports between non-euro countries. *Table 4* presents the results:

Table 4

The euro effects on trade can be seen at the top of column (6). The estimated effect on exports between euro countries corresponds to 15 per cent, on exports from euro to non-euro countries to 8 per cent and on exports from non-euro to euro countries to 7.5 per cent. Thus, we find a subtantial spillover to trade between the eurozone and countries on the outside, as do Micco et al (2003). Contrary to our expectations, exports *to* the euro countries are increased to the same extent as exports *from* euro countries. We postpone a discussion of what factors could explain the spillover effect.

It should be stressed that the euro effects shown in *Table 4* are averages for the euro period relative to the average for 1989-1997 and relative to exports between non-euro countries 1989-2002.[2] As seen in *Figure 2* or *Table 2*, the effects are increasing over time and indicate that the long run effects could be much larger. The corresponding estimates for 2001-2002 are approximately 25, 15 and 9 per cent

[22] Calculated as $e^{\text{coefficient value}} - 1$ = effect in per cent.

respectively (calculated by subtracting averages for 1989-1997 from averages for 2001-2002).

Have we really identified trade increases caused by the introduction of the euro? The relatively short time that has passed since its introduction is a source of uncertainty. It is possible that the estimates reflect missing variables, most of which are beyond our imagination. One possibility – which seems remote – is the outbreak of "europhoria", an epidemic that should not be particularly long-lived. Another possibility is that the IT-bubble hit non-euro countries harder than euro countries, and that this has affected exports in a way that is not fully captured by changes in GDP. It is on the other hand reassuring that the effects seem to kick in precisely when they are expected to and moreover that they show a clear and steady increase over time.

Practically all of the other estimates in *Table 4* have the expected sign and are highly significant. We find that the elasticities of exports with respect to GDP of the exporting and importing country sum to 2.4, which is consistent with the observed trend increase in the ratio of trade to GDP in the postwar period.

Furthermore, the elasticity of exports with respect to the real exchange rate is roughly unity, while the elasticy of exports with respect to competitors' real exchange rate is lower; the difference indicates some degree of product differentiation.

The (average) standard deviation of first differences of logs of monthly nominal exchange rates in our sample is 1.6 per cent (as compared to 7 per cent in Rose' (2000) sample). Reducing the average exchange rate volatility by one standard deviation to zero is estimated to increase trade by 1.5 per cent.[3] This estimate is lower by a magnitude than the 13 per cent found by Rose (2000), but similar to the estimates obtained by Tenreyro (2003) in panel data.

The entry of Austria, Finland and Sweden into the EU had no significant effect on their exports to other EU countries. This could be expected, since they were part of the Single Market, except for agricultural products, prior to their entry into the EU.

[3] Calculated as $e^{[-0.940 \times (-0.0158)]} - 1 = 0.015$, where 0.0158 is the average standard deviation of exchange rate variability in our sample.

Trade liberalization following the Uruguay Round is estimated to have increased trade between Australia, Canada, Japan, New Zealand, Switzerland and United States on one side and the rest of the European countries on the other by about 11 per cent.

Finally, we can see that the change in the way trade statistics are collected has had large and very significant effects on *recorded* trade in the expected directions. Exports from non-European countries to the EU-10 and the EU-3 decreased as recorded, and exports from Belgium and Netherlands to the rest of the EU increased. One estimate has the wrong sign, namely non-EU countries' exports to Belgium and Netherlands after the launch of the Single Market in 1993; we expected a recorded increase but the sign is negative and significant.

Not shown in *Table 4* are the coefficient estimates for the EU year dummy. They are however very close the estimates of the EU year dummy in *Table 2*. The estimates in both tables are generally positive and highly significant. EU membership is estimated to raise the level of trade between EU countries by about 15 per cent. A higher level is expected, but contrary to expectation we do not find a rising trend reflecting the increasing integration due to the Single Market.

5. Robustness checks

We check the sensitivity of our results in *Table 4* with respect to changes in the length of the pre-euro period, the exclusion of countries and country groups and the exclusion of explanatory variables.[4]

Table 5 shows the results of shortening the time period before the introduction of the euro.

Table 5

The estimates are stable in terms of sign and significance. The exception is the estimate of the effect of nominal exchange rate uncertainty, which is mostly insignificant. The estimates are also remarkably stable in terms of magnitude; subtantial

[4] We have also tested for sensitivity to clustering of various types of observations for which error terms may not be independently distributed, which could affect the standard errors. The euro estimates remain significant at the 1 per cent level regardless of the way observations are clustered.

changes occur only when the pre-euro time period has been shortened to three or four years.

Table 6 shows the results of eliminating individual countries or country groups.

Table 6

Most estimates are very robust to the exclusion of individual countries or country groups. The main exception is the effect of nominal exchange rate volitility, which is quite sensitive to the exclusion of individual countries (as it was to shortening the pre-euro period). We can also see that the euro effect for exports from euro to non-euro countries becomes insignificant when non-EU countries are excluded from the sample. This means that the euro did not boost exports from euro countries to the three euro outsiders in the EU, Denmark, Sweden and United Kingdom, when the benchmark consists of exports between the outsiders. The effect is, on the other hand, significant and of the same order of magnitude as in the full country sample when non-European countries are excluded. The conclusion to be drawn is that the euro has boosted exports from the euro countries to the European non-EU countries in our sample, Norway and Switzerland. In the case of exports from non-euro to euro countries, no effect of excluding non-EU or non-European countries can be seen.

Looking at changes in the magnitude of the euro effect on trade between euro countries, we can see that the exclusion of non-European and in particular non-EU countries reduces the effect. The benchmark when non-European countries are excluded becomes trade between the non-euro countries of the EU and between them and Norway and Switzerland. When non-EU countries are excluded the benchmark becomes trade between Denmark, Sweden and United Kingdom. The reduced effects imply that trade between between these three countries is on a higher level than between them and non-EU and non-European countries, which is to be expected. In the case of excluding individual countries from the sample, the exclusion of Sweden matters most for the euro effect on trade between the euro countries. This implies that Sweden's trade with other non-euro countries is relatively small.

Table 7 shows the results of excluding explanatory variables.

Table 7

The estimated euro coefficients are sensitive in terms of magnitude to the exclusion of GDP and real exchange rates, but the high significance of the estimates remain. The year dummies, on the other hand, affect both the magnitude and significance of the result. Their inclusion is apparently quite important to separate effects common to the whole sample on the one hand and effects common to trade involving euro countries on the other.

6. Euro effects on trade in different sectors

We have estimated the gravity equation for nine different goods producing sectors in addition to the aggregate economy. Sector effects are interesting in their own right and they can help us to find explanations for the spillover effect on trade between euro and non-euro countries.

We should not expect that the specification used for the aggregate level performs equally well on the sector level. First of all, trade on the sector level reflects comparative advantage to some extent. For example, Danish and Swedish exports and imports of pulp and paper reflect their respective scarcity and abundance of forest land; Denmark will have relatively small exports and large imports while the opposite is the case for Sweden. Second, shocks to individual sectors and even to individual firms will play a role. Two Swedish examples illustrate this. Swedish exports of pharmaceutical products increased very strongly during the 1990's, much due to the success of the drug Losec produced by AstraZeneca. Generics have now taken a share of the market. The other example is the telecommunications company Ericsson. Ericsson products made up almost 15 per cent of Swedish exports in the year 2000. Following the crisis of the telecommunications industry, the share fell to only 5 per cent in 2002. Comparative advantage and shocks to individual sectors call for including sector output in both the exporting and importing country as explanatory variables. Failure to do so could bias the estimates since sector outputs and changes in sector outputs are likely to be correlated with GDP and changes in GDP. Unfortunately, time series of real value

added for one-digit SITC sectors for the 20 countries involved are not readily available and we have therefore not included sector outputs as explanatory variables. Our estimates must be considered with this in mind.

Table 7 presents estimates of euro effects for nine one-digit SITC sectors.

Table 8

The sector estimates are much more irregular than the aggregate estimates as expected. Significant euro effects are concentrated to a few sectors: beverages and tobacco, chemical products, including pharmaceuticals, and products from manufacturing industries. In other words, we find that the euro effects are concentrated to goods that require relatively much processing and are differentiated (not standardized or homogeneous). Beverages and tobacco do not fit the first characteristic but are differentiated consumer goods. We will argue that the concentration of euro effects to these sectors is not random, but can be explained by a relatively high degree of vertical specialization across national borders, particularly in manufacturing, and by relatively high investments in marketing and distribution for differentiated products.

The relation between vertical specialization and international trade has been studied by Hummels, Ishii and Yi (2001) and by Yi (2003) among others. Hummels et al estimate that the use of imported inputs in goods that are exported grew by almost 30 per cent for ten OECD and four emerging market countries between 1970 and 1990 and that this accounted for 30 per cent of the growth in these countries' exports. Yi provides an explanation for how the relatively small tariff reductions on manufactures in the postwar period can have caused large increases in trade. His extreme example captures the essence of the argument:

> A good is produced in N sequential stages, with each stage produced in a different country. The first stage involves value added only. All remaining stages involve infinitesimally small value added. Then, when tariffs fall by one percentage point, the cost of producing this good will fall by N percent, in contrast to a 1 percent decline in the cost of a 'regular' traded good. In addition, because of the tariff reductions, it may be efficient for goods that were previously produced entirely in

one country to now become vertically specialized. This will also lead to an increase in trade.

Yi also provides an explanation for why the effects can be non-linear, i.e. for why successive, small reductions in tariffs eventually can cause large increases in trade: "Suppose that tariffs are initially sufficiently high that there is no vertical specialization. Now tariffs begin to fall. At first, they are still sufficiently high that vertical specialization does not occur. Nevertheless, trade still increases for standard reasons. As tariffs continue to fall, vertical specialization becomes more of a possibility. Eventually, a critical rate is reached at which vertical specialization starts to occur."

The effects described by Yi of tariff reductions apply, we argue, also to the reduction in trade costs provided by a common currency and can explain why a relatively small trade cost reduction can result in relatively large trade increases. It can also explain why euro effects can be seen in exports *from* as well as exports *to* euro countries. Replacing national currencies with a common currency reduces the cost of trade across national borders within the eurozone. The cost of goods that are produced in successive stages in different countries in the eurozone is therefore reduced by the introduction of the common currency. The size of the cost reduction is related to the degree of international vertical specialization. The introduction of the common currency also gives incentives for some firms to switch from national to international vertical specialization. Goods that benefit from these cost reductions become more competitive in markets outside the euro area as well. Consequently, exports from euro to non-euro countries increase. Some of the products that experience an expansion of production and trade as a result of the currency union use inputs imported from outside the eurozone. Producers of such inputs in non-euro countries may therefore find that they can export more to euro countries than before the creation of the currency union. (Some of them may of course not be so lucky; they will find that demand for their products is diverted to producers in the eurozone.) There is also an effect on the input side for producers in non-euro countries. Cheaper inputs imported from euro countries will make their products cheaper as well, and will in turn make possible more exports to the eurozone. Hence, it is no mystery that the introduction of a common currency can

create more trade with outside countries in both directions, in addition to more trade within the currency union itself. Increased vertical specialization across national boundaries can also explain the successive increase in the euro effects that we see in our results. We do not expect firms to change their sourcing patterns suddenly; such changes should take time to implement.

We have noted another characteristic than a high degree of processing for the products that are most affected by the euro, namely that they are relatively differentiated. This is true for beer, cigarettes and cars for example. To introduce a new brand or a new line of cars in a national market requires a relatively large up-front investment in marketing and retail distribution. The return to the investment is spread over a period of many years and will depend on the nominal exchange rate, among other factors. Fixing the nominal exchange by the introduction of a common currency could increase investments that were previously thought to be too risky and consequently lead to increased trade. Thus, we argue that the relatively high marketing and distribution costs that have to be paid up-front when launching differentiated goods contribute to explain the positive effects on trade of a common currency.

7. Trade effects for Denmark, Sweden and the United Kingdom of joining the currency union

The trade effects for the three euro outsiders, Denmark, Sweden and the United Kingdom, of joining the currency union can readily be calculated using the aggregate estimates in *Table 2* or *Table 4*. The average trade effect over the first five years, 1998-2002, for the euro countries is estimated at 15 per cent in *Table 4*, and the average effect on trade with outside countries is estimated at about 8 per cent. By joining, the three outsiders should expect that the level of their trade with the other euro countries becomes 15 – 8 = 7 per cent higher during the first five years of membership. Their trade with countries outside the currency union will also increase by about 8 per cent. Hence, total trade with countries in our sample would increase by 7-8 per cent. Providing that trade with other non-euro countries will increase by as much as with the non-euro countries in our sample, trade with all countries would also increase by 7-8

per cent. The individual effects for Denmark, Sweden and the United Kingdom may be slightly different depending on their industry and trade patterns and other factors.

The 7-8 per cent is probably an underestimate of the steady state effects of joining the currency union since the effects are increasing over time. The level of exports is about 20 per cent higher in 2002 than in 1989-1997 between euro countries, and about 10 per cent higher for exports and imports with non-euro countries; see *Table 2* and *Figure 2*. Based on these figures, by joining the currency union exports and imports with euro countries can be exptected to increase by 20 - 10 = 10 per cent, and exports and imports with non-euro countries also by 10 per cent. Thus, total trade can expected to increase by about 10 per cent with the countries in our sample (which in the case of Sweden make up 80 per cent of total trade). The increasing trend suggests that the long-run effects are substantially greater. Micco et al (2003) and Bun and Klaassen (2003) estimate that the long run effect for trade in the eurozone is 35-40 per cent.

Our predictions are for the currency union effects on trade. To this must be added the positive effects of eliminating nominal exchange rate volatility in trade within the eurozone. We estimated that a reduction of the average exchange rate volatility would result in an increase in trade of 1.5 per cent. Consequently, we should add about 0.75 per cent – depending on the share of trade with other euro countries – to our predictions of the euro effect on trade.

8. Summary and concluding comments

We have employed the gravity model to estimate the effects on the volume of trade caused by the introduction of the euro in 1999. We use trade between the three euro outsiders in the EU, Denmark, Sweden and United Kingdom, and between them and seven non-EU OECD countries as the benchmark. The seven are: Norway and Switzerland in Europe and Australia, Canada, Japan, New Zealand, United States. (Trade between the seven non-EU countries are not included.) By having exports as the dependent variable instead of bilateral exports as in the standard specification, we are able to separate euro effects on exports *from* euro to non-euro countries on the one hand, and exports from non-euro *to* euro countries on the other. Our data cover four years with the euro, 1999-2002.

We found that the introduction of the euro has increased trade between euro countries by 15 per cent on average for the period 1998-2002 compared to the benchmark for the period 1989-2002. Exports from euro to non-euro countries and from non-euro to euro countries increased by 8 and 7.5 per cent respectively. When the euro effects were estimated with year dummies we found the same pattern; exports between euro countries increased approximately twice as much as between euro and non-euro countries. The year effects show a very clear increasing trend starting in 1998, with significantly greater increases at the end of the euro period than at the beginning.

The rising trend indicates that we have identified effects caused by the introduction of the euro. These should take hold gradually, as producers adjust production and supply patterns to the currency union.

The relatively large increase estimated for trade between euro and non-euro countries could be explained by increasing vertical specialization along the lines suggested by Yi (2003). He provides an explanation for why small reductions in trade costs can cause large increases in trade and also for how they can make trade increase non-linearly. The single currency reduces the cost of vertical specialization inside the euro area and makes goods produced there more competitive. This leads to increased exports from euro to non-euro countries and at the same time to increased demand for inputs imported from non-euro countries. Producers outside the eurozone will be able to purchase cheaper inputs from the euro countries, which makes them more competitive and can increase their exports back to the euro countries.

In addition to estimating euro effects on aggregate exports, we have estimated effects on one-digit SITC sector exports. The estimates show a wider distribution and less significance than the aggregate estimates, but the pattern is clear. Significant estimates are concentrated to goods that are relatively differentiated and processed. This supports the explanation of increased trade between euro and non-euro countries as caused by increased vertical specialization across countries. Significant effects can also be seen for beverages and tobacco, which are highly differentiated consumer goods. It requires a relatively large up-front investment in marketing and retail distribution to introduce such goods in a new national market (as is also true for many of the goods produced by manufacturing industries, such as cars.) The returns are

spread over many years into the future. We argue that the elimination of nominal exchange rate uncertainty between the euro countries has stimulated such investments and thereby has increased trade.

Finally, we calculate the trade effects for Denmark, Sweden and the United Kingdom of joining the European currency union based on our estimates for aggregate trade. Their trade will increase both with the euro countries and with non-euro countries. We predict that the level of trade will be about 8 per cent higher on average during the first five years in the currency union and about 10 per cent higher in the fifth year. Most of the increase is caused by the common currency, but somewhat less than one percentage point is due to the elimination of nominal exchange rate volatility in trade with countries in the currency union.

References

Anderson, James, 1979, "The theoretical foundation for the gravity equation," *American Economic Review* 69, 106-116.

Anderson, James and Eric van Wincoop, 2001, "Gravity with gravitas: a solution to the border puzzle," NBER Working Paper 8079, forthcoming in *American Economic Review*.

Barr, David, Francis Breedon and David Miles, 2003, "Life on the outside: economic conditions and prospects outside Euroland," Imperial College, University of London, manuscript

Bun, Maurice and Franc Klaassen, 2002, "Has the euro increased trade?," http://www1.fee.uva.nl/pp/klaassen/

Deardorff, Alan, 1998, "Determinants of bilateral trade: does gravity work in a neoclassical world?," in Jeffrey Frankel (ed.), *The regionalization of the world economy*, University of Chicago Press.

Helpman, Elhanan and Paul Krugman, 1985, *Market structure and foreign trade*, MIT Press.

Hummels, David, Jun Ishii and Kei-Mu Yi, 2001, "The nature and growth of vertical specialization in world trade," *Journal of International Economics* 54, 75-96.

Micco, Alejandro, Ernesto Stein and Guillermo Ordoñez, 2003, "The currency union effect on trade: early evidence from EMU," http://www.economic-policy.org/paneldrafts.asp

Persson, Torsten, "Currency unions and trade: how large is the treatment effect?," *Economic Policy* 33, 435-448.

Rose, Andrew K. and Eric van Wincoop, 2000, "National money as a barrier to international trade: the real case for currency union," http://faculty.haas.berkeley.edu/arose/

Rose, Andrew K., 2000, "One money, one market: the effect of currency unions on trade," *Economic Policy* 30, 7-46.

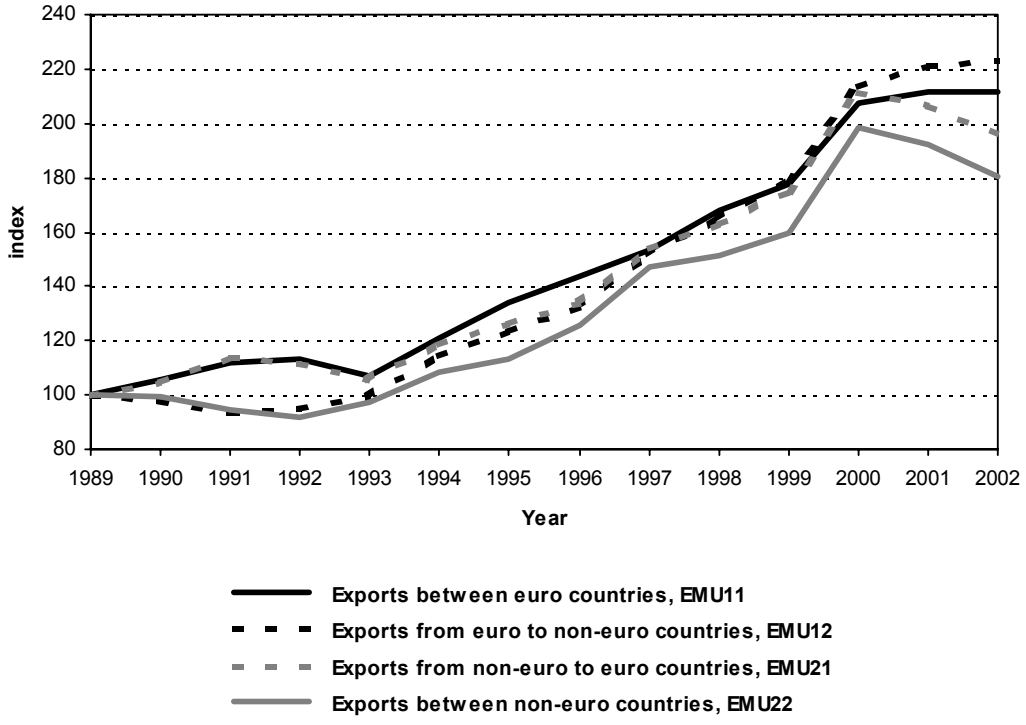
Rose, Andrew K., 2001, "Currency unions and trade: the effect is large," *Economic Policy* 33, 449-461.

Tenreyro, Silvana and Robert J. Barro, 2003, "Economic effects of currency unions," NBER Working Paper 9435.

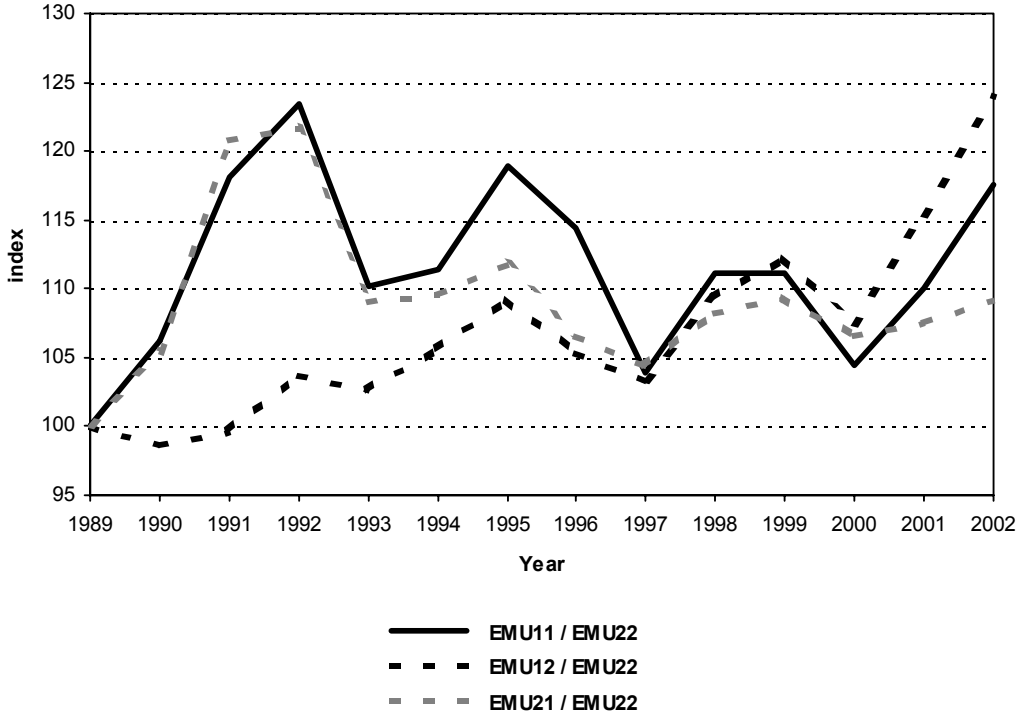
Yi, Kei-Mu, 2003, "Can vertical specialization explain the growth of world trade?," *Journal of Political Economy* 111, 52-102.

Figure 1. Export performance, 1989-2002

a) Absolute export performance



b) Relative export performance



Source: Eurostat, own calculations.

Figure 2. Year dummy effects

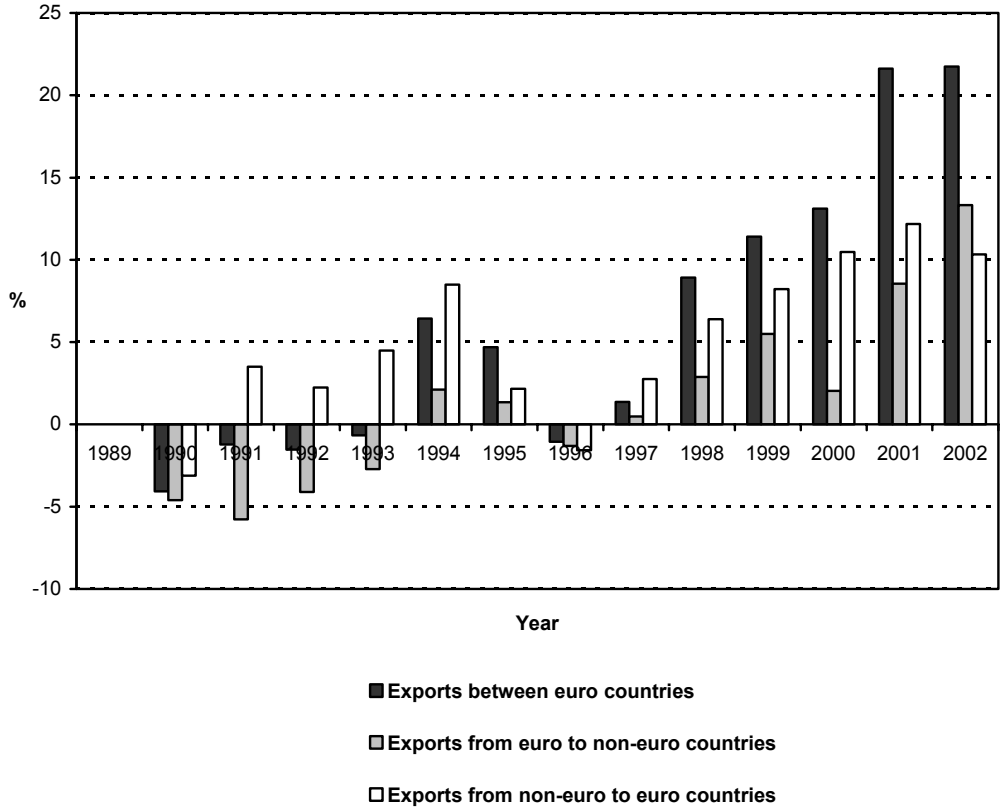


Table 1. Determinants of log of exports from country *i* to country *j*

Symbol	Description of variable
EMU11	Dummy for exports between euro countries
EMU12	Dummy for exports from euro to non-euro countries
EMU21	Dummy for exports from non-euro to euro countries
Ln(RYi)	Log of GDP of exporting country
Ln(RYj)	Log of GDP of importing country
Ln(REXRij)	Log of real exchange rate between exporting and importing country
Ln(REXRcj)	Log of average real exchange rate between third countries and importing country
nomexr	Standard deviation of first differences of logs of montly nominal exchange rates between exporting and importing country
eunew	Dummy for Austria, Finland and Sweden 1995-2002
UR	Dummy for Uruguay Round liberalization 1995-2002 between countries not in same free trade area
weu10t1993	Dummy for exports from non-European countries to EU-10 1993-2002
wbnt1993	Dummy for exports from non-European countries to Belgium and Netherlands 1993-2002
bneu12t1993	Dummy for exports from Belgium and Netherlands to EU countries 1993-2002
weu3t1995	Dummy for exports from non-European countries to Austria, Finland and Sweden 1995-2002
wbnt1995	Dummy for exports from non-European countries to Belgium and Netherlands 1995-2002
bneu3t1995	Dummy for exports from Belgium and Netherlands to Austria, Finland and Sweden 1995-2002
eut	Year dummies common for EEA countries
t	Year dummies common for all countries
fxd	Bilateral (fixed effects) dummy

Table 2. Results with year EMU dummies

ln(RYi)	1.228***	EUt1990	0.065*	emu11t1990	-0.042	emu12t1990	-0.047	emu21t1990	-0.032
	(0.072)		(0.035)		(0.051)		(0.045)		(0.053)
ln(RYj)	1.138***	EUt1991	0.085**	emu11t1991	-0.012	emu12t1991	-0.060	emu21t1991	0.034
	(0.069)		(0.035)		(0.049)		(0.043)		(0.049)
ln(REXRij)	-1.058***	EUt1992	0.120***	emu11t1992	-0.015	emu12t1992	-0.042	emu21t1992	0.022
	(0.052)		(0.034)		(0.047)		(0.041)		(0.048)
ln(REXRcj)	0.726***	EUt1993	0.043	emu11t1993	-0.007	emu12t1993	-0.028	emu21t1993	0.044
	(0.069)		(0.034)		(0.046)		(0.040)		(0.048)
eunew	0.014	EUt1994	0.039	emu11t1994	0.062	emu12t1994	0.021	emu21t1994	0.082*
	(0.013)		(0.033)		(0.045)		(0.039)		(0.046)
UR	0.100***	EUt1995	0.128***	emu11t1995	0.046	emu12t1995	0.013	emu21t1995	0.021
	(0.018)		(0.035)		(0.046)		(0.041)		(0.046)
nomexr	-1.016**	EUt1996	0.206***	emu11t1996	-0.011	emu12t1996	-0.013	emu21t1996	-0.016
	(0.456)		(0.036)		(0.046)		(0.041)		(0.048)
wbnt1993	-0.268***	EUt1997	0.170***	emu11t1997	0.014	emu12t1997	0.005	emu21t1997	0.027
	(0.050)		(0.034)		(0.045)		(0.039)		(0.046)
weu10t1993	-0.244***	EUt1998	0.176***	emu11t1998	0.085*	emu12t1998	0.028	emu21t1998	0.062
	(0.027)		(0.036)		(0.049)		(0.042)		(0.049)
bneu12t1993	0.060***	EUt1999	0.174***	emu11t1999	0.108**	emu12t1999	0.054	emu21t1999	0.079*
	(0.018)		(0.037)		(0.048)		(0.042)		(0.047)
wbnt1995	0.166***	EUt2000	0.131***	emu11t2000	0.123**	emu12t2000	0.020	emu21t2000	0.100*
	(0.043)		(0.039)		(0.054)		(0.046)		(0.054)
weu3t1995	-0.457***	EUt2001	0.087**	emu11t2001	0.196***	emu12t2001	0.082*	emu21t2001	0.115**
	(0.038)		(0.040)		(0.054)		(0.046)		(0.054)
bneu3t1995	0.228***	EUt2002	0.138***	emu11t2002	0.197***	emu12t2002	0.125**	emu21t2002	0.098*
	(0.025)		(0.045)		(0.060)		(0.049)		(0.056)
obs	4732								
panels	338								
R2	0.99								

Robust standard errors in parentheses.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Year and bilateral (fixed effects) dummies included but not reported.

Table 3. Significance of differences between years, year EMU dummy coefficients

a) Exports between euro countries

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1990		0.41	0.36	0.64	5.96**	4.04**	0.51	1.73	7.65***	10.84***	10.39***	21.41***	17.14***
1991	0.41		0.01	0.02	3.67*	2.16	0	0.46	5.32**	8.41***	8.04***	18.76***	14.57***
1992	0.36	0.01		0.05	4.38**	2.56	0.02	0.66	6.36**	9.84***	9.23***	21.13***	15.96***
1993	0.64	0.02	0.05		3.77*	2.06	0.01	0.33	5.33**	8.55***	8.02***	19.39***	14.72***
1994	5.96**	3.67*	4.38**	3.77*		0.21	4.13**	2.04	0.35	1.43	1.83	8.72***	6.64***
1995	4.04**	2.16	2.56	2.06	0.21		2.38	0.86	1.01	2.6	2.91*	10.81***	8.25***
1996	0.51	0	0.02	0.01	4.13**	2.38		0.51	6.19**	9.81***	9.12***	21.2***	15.97***
1997	1.73	0.46	0.66	0.33	2.04	0.86	0.51		4.06**	7.39***	7.03***	18.6***	13.62***
1998	7.65***	5.32**	6.36**	5.33**	0.35	1.01	6.19**	4.06**		0.33	0.71	5.8**	4.45**
1999	10.84***	8.41***	9.84***	8.55***	1.43	2.6	9.81***	7.39***	0.33		0.12	3.8*	2.91*
2000	10.39***	8.04***	9.23***	8.02***	1.83	2.91*	9.12***	7.03***	0.71	0.12		2.09	1.69
2001	21.41***	18.76***	21.13***	19.39***	8.72***	10.81***	21.2***	18.6***	5.8**	3.8*	2.09		0
2002	17.14***	14.57***	15.96***	14.72***	6.64***	8.25***	15.97***	13.62***	4.45**	2.91*	1.69	0	

F-test, chi2-values.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

b) Exports from euro to non-euro countries

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1990		0.09	0.02	0.26	3.25*	2.32	0.74	1.91	3.31*	6.04**	2.26	8.11***	12.56***
1991	0.09		0.22	0.78	5.21**	3.84*	1.57	3.44*	5.14**	8.79***	3.56*	10.89***	15.85***
1992	0.02	0.22		0.18	3.64*	2.49	0.69	2.11	3.67*	7.02***	2.38	9.09***	13.98***
1993	0.26	0.78	0.18		2.39	1.49	0.19	1.1	2.48	5.39**	1.46	7.52***	12.24***
1994	3.25*	5.21**	3.64*	2.39		0.05	1.12	0.3	0.05	0.93	0	2.46	5.96**
1995	2.32	3.84*	2.49	1.49	0.05		0.61	0.07	0.17	1.29	0.03	2.9*	6.43**
1996	0.74	1.57	0.69	0.19	1.12	0.61		0.33	1.36	3.62*	0.71	5.66**	10.02***
1997	1.91	3.44*	2.11	1.1	0.3	0.07	0.33		0.52	2.33	0.18	4.29**	8.52***
1998	3.31*	5.14**	3.67*	2.48	0.05	0.17	1.36	0.52		0.48	0.04	1.7	4.66**
1999	6.04**	8.79***	7.02***	5.39**	0.93	1.29	3.62*	2.33	0.48		0.7	0.49	2.62
2000	2.26	3.56*	2.38	1.46	0	0.03	0.71	0.18	0.04	0.7		1.94	4.84**
2001	8.11***	10.89***	9.09***	7.52***	2.46	2.9*	5.66**	4.29**	1.7	0.49	1.94		0.79
2002	12.56***	15.85***	13.98***	12.24***	5.96**	6.43**	10.02***	8.52***	4.66**	2.62	4.84**	0.79	

F-test, chi2-values.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

c) Exports from non-euro to euro countries

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1990		2.02	1.38	2.76*	6.71***	1.47	0.12	1.84	4.14**	6.25**	6.34**	8.1***	5.82**
1991	2.02		0.09	0.05	1.44	0.11	1.48	0.04	0.43	1.26	1.84	2.85*	1.61
1992	1.38	0.09		0.29	2.41	0	0.89	0.02	0.96	2.18	2.68	3.97**	2.39
1993	2.76*	0.05	0.29		1.13	0.38	2.39	0.22	0.21	0.9	1.48	2.44	1.27
1994	6.71***	1.44	2.41	1.13		3.06*	7.1***	2.61	0.28	0.01	0.17	0.58	0.13
1995	1.47	0.11	0	0.38	3.06*		1	0.03	1.16	2.67	3.11*	4.49**	2.69
1996	0.12	1.48	0.89	2.39	7.1***	1		1.4	3.89**	6.52**	6.34**	8.22***	5.61**
1997	1.84	0.04	0.02	0.22	2.61	0.03	1.4		0.91	2.34	2.84*	4.16**	2.42
1998	4.14**	0.43	0.96	0.21	0.28	1.16	3.89**	0.91		0.21	0.67	1.33	0.56
1999	6.25**	1.26	2.18	0.9	0.01	2.67	6.52**	2.34	0.21		0.22	0.67	0.17
2000	6.34**	1.84	2.68	1.48	0.17	3.11*	6.34**	2.84*	0.67	0.22		0.09	0
2001	8.1***	2.85*	3.97**	2.44	0.58	4.49**	8.22***	4.16**	1.33	0.67	0.09		0.1
2002	5.82**	1.61	2.39	1.27	0.13	2.69	5.61**	2.42	0.56	0.17	0	0.1	

F-test, chi2-values.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Results with EMU period (1998-2002) dummies

	(1)	(2)	(3)	(4)	(5)	(6)
EMU11	0.244***	0.164***	0.161***	0.165***	0.163***	0.139***
	(0.020)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)
EMU12	0.244***	0.125***	0.126***	0.127***	0.115***	0.077***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.017)
EMU21	0.018	0.056***	0.057***	0.058***	0.071***	0.072***
	(0.020)	(0.019)	(0.019)	(0.019)	(0.020)	(0.018)
ln(RYi)	0.711***	1.165***	1.162***	1.164***	1.186***	1.222***
	(0.071)	(0.072)	(0.072)	(0.073)	(0.072)	(0.071)
ln(RYj)	1.336***	1.182***	1.179***	1.181***	1.178***	1.146***
	(0.068)	(0.069)	(0.069)	(0.070)	(0.070)	(0.069)
ln(REXRij)		-1.095***	-1.091***	-1.084***	-1.061***	-1.058***
		(0.051)	(0.051)	(0.051)	(0.052)	(0.050)
ln(REXRcj)		0.697***	0.690***	0.676***	0.660***	0.722***
		(0.069)	(0.069)	(0.069)	(0.070)	(0.067)
nomexr			-0.825*	-0.760	-0.881*	-0.940**
			(0.468)	(0.471)	(0.466)	(0.443)
eunew				0.029**	0.037***	0.013
				(0.012)	(0.012)	(0.013)
UR				-0.002	0.036*	0.105***
				(0.018)	(0.019)	(0.018)
weu10t1993					-0.174***	-0.252***
					(0.026)	(0.025)
wbnt1993					-0.061	-0.246***
					(0.041)	(0.046)
bneu12t1993					0.059***	0.063***
					(0.018)	(0.017)
weu3t1995						-0.470***
						(0.038)
wbnt1995						0.135***
						(0.041)
bneu3t1995						0.235***
						(0.024)
obs	4732	4732	4732	4732	4732	4732
panels	338	338	338	338	338	338
R2	0.99	0.99	0.99	0.99	0.99	0.99

Robust standard errors in parentheses.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Year, EU membership and bilateral (fixed effects) dummies included but not reported.

Table 5. Time sensitivity

	1989 -	1990 -	1991 -	1992 -	1993 -	1994 -	1995 -
EMU11	0.139***	0.139***	0.144***	0.153***	0.164***	0.163***	0.172***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)
EMU12	0.077***	0.081***	0.084***	0.088***	0.090***	0.084***	0.089***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)
EMU21	0.072***	0.067***	0.064***	0.069***	0.072***	0.076***	0.089***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
ln(RYi)	1.222***	1.214***	1.128***	1.048***	0.962***	0.894***	0.864***
	(0.071)	(0.075)	(0.079)	(0.085)	(0.093)	(0.107)	(0.125)
ln(RYj)	1.146***	1.174***	1.141***	1.093***	1.012***	1.019***	1.077***
	(0.069)	(0.069)	(0.073)	(0.080)	(0.079)	(0.088)	(0.102)
ln(REXRij)	-1.058***	-1.057***	-0.999***	-0.924***	-0.848***	-0.835***	-0.811***
	(0.050)	(0.052)	(0.055)	(0.057)	(0.056)	(0.057)	(0.056)
ln(REXRcj)	0.722***	0.739***	0.651***	0.526***	0.442***	0.412***	0.380***
	(0.067)	(0.069)	(0.072)	(0.074)	(0.074)	(0.074)	(0.076)
nomexr	-0.940**	-0.438	-0.415	-0.925*	-0.468	0.166	0.373
	(0.443)	(0.452)	(0.477)	(0.497)	(0.559)	(0.595)	(0.633)
eunew	0.013	0.017	0.024*	0.019	0.015	0.019	
	(0.013)	(0.013)	(0.014)	(0.015)	(0.018)	(0.025)	
UR	0.105***	0.122***	0.134***	0.124***	0.107***	0.087**	
	(0.018)	(0.018)	(0.019)	(0.021)	(0.025)	(0.036)	
weu10t1993	-0.252***	-0.237***	-0.243***	-0.211***			
	(0.025)	(0.028)	(0.035)	(0.053)			
wbnt1993	-0.246***	-0.253***	-0.271***	-0.231***			
	(0.046)	(0.051)	(0.060)	(0.081)			
bneu12t1993	0.063***	0.084***	0.104***	0.112***			
	(0.017)	(0.019)	(0.021)	(0.027)			
weu3t1995	-0.470***	-0.463***	-0.466***	-0.448***	-0.411***	-0.440***	
	(0.038)	(0.041)	(0.045)	(0.051)	(0.065)	(0.088)	
wbnt1995	0.135***	0.132***	0.132***	0.138***	0.145***	0.135**	
	(0.041)	(0.042)	(0.044)	(0.046)	(0.049)	(0.064)	
bneu3t1995	0.235***	0.242***	0.242***	0.228***	0.219***	0.236***	
	(0.024)	(0.026)	(0.030)	(0.033)	(0.039)	(0.049)	
obs	4732	4394	4056	3718	3380	3042	2074
panels	338	338	338	338	338	338	338
R2	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Robust standard errors in parentheses.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Year, EU membership and bilateral (fixed effects) dummies included but not reported.

Table 6. Country and country group sensitivity

		excluding …									
	All	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Netherlands	Portugal	Spain
EMU11	0.139***	0.152***	0.130***	0.139***	0.141***	0.143***	0.126***	0.134***	0.158***	0.157***	0.139***
	(0.020)	(0.021)	(0.022)	(0.021)	(0.022)	(0.022)	(0.020)	(0.022)	(0.022)	(0.020)	(0.021)
EMU12	0.077***	0.080***	0.068***	0.085***	0.072***	0.076***	0.063***	0.074***	0.080***	0.115***	0.080***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)	(0.018)	(0.017)	(0.017)	(0.017)
EMU21	0.072***	0.095***	0.068***	0.066***	0.071***	0.072***	0.063***	0.069***	0.068***	0.086***	0.075***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
ln(RYi)	1.222***	1.251***	1.197***	1.238***	1.266***	1.221***	0.811***	1.224***	1.241***	1.229***	1.194***
	(0.071)	(0.073)	(0.070)	(0.074)	(0.075)	(0.077)	(0.100)	(0.077)	(0.073)	(0.073)	(0.075)
ln(RYj)	1.146***	1.122***	1.126***	1.206***	1.130***	1.140***	1.176***	1.147***	1.178***	1.162***	1.115***
	(0.069)	(0.072)	(0.072)	(0.073)	(0.073)	(0.075)	(0.092)	(0.075)	(0.072)	(0.070)	(0.072)
ln(REXRij)	-1.058***	-0.983***	-1.089***	-0.999***	-1.093***	-1.070***	-1.039***	-1.068***	-1.032***	-1.027***	-0.950***
	(0.050)	(0.048)	(0.052)	(0.054)	(0.053)	(0.054)	(0.051)	(0.054)	(0.052)	(0.050)	(0.053)
ln(REXRcj)	0.722***	0.633***	0.751***	0.694***	0.734***	0.743***	0.683***	0.733***	0.682***	0.712***	0.529***
	(0.067)	(0.067)	(0.071)	(0.070)	(0.071)	(0.072)	(0.068)	(0.074)	(0.071)	(0.068)	(0.072)
nomexr	-0.940**	-0.615	-0.760	-0.897*	-0.967**	-0.928*	-1.519***	-0.871	-0.896*	-0.973**	-0.552
	(0.443)	(0.462)	(0.476)	(0.469)	(0.476)	(0.483)	(0.470)	(0.544)	(0.474)	(0.443)	(0.461)
eunew	0.013	0.019	0.009	0.021	-0.004	0.001	0.020	0.005	0.012	0.037***	0.043***
	(0.013)	(0.016)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)	(0.014)	(0.013)	(0.012)	(0.013)
UR	0.105***	0.084***	0.092***	0.092***	0.121***	0.113***	0.117***	0.106***	0.112***	0.101***	0.111***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.019)
obs	4732	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
panels	338	300	300	300	300	300	300	300	300	300	300
R2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

- continued on next page –

Table 6. continued

	excluding…										non-	non-
	Denmark	Sweden	UK	Norway	Switz.	Australia	Canada	Japan	New Zeal.	USA	Europe	EU15
EMU11	0.149***	0.105***	0.137***	0.157***	0.123***	0.134***	0.153***	0.134***	0.134***	0.123***	0.114***	0.088***
	(0.025)	(0.027)	(0.024)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.025)	(0.025)
EMU12	0.098***	0.063***	0.065***	0.090***	0.054***	0.068***	0.092***	0.083***	0.071***	0.064***	0.064***	0.008
	(0.020)	(0.022)	(0.020)	(0.018)	(0.018)	(0.017)	(0.018)	(0.018)	(0.017)	(0.018)	(0.023)	(0.027)
EMU21	0.076***	0.058**	0.070***	0.090***	0.059***	0.063***	0.094***	0.066***	0.071***	0.068***	0.071***	0.071***
	(0.022)	(0.024)	(0.022)	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.019)	(0.020)	(0.024)	(0.025)
ln(RYi)	1.223***	1.261***	1.269***	1.285***	1.176***	1.191***	1.261***	1.178***	1.270***	1.195***	1.214***	1.194***
	(0.073)	(0.075)	(0.075)	(0.074)	(0.070)	(0.074)	(0.072)	(0.075)	(0.072)	(0.071)	(0.083)	(0.080)
ln(RYj)	1.100***	1.213***	1.175***	1.125***	1.188***	1.046***	1.097***	1.167***	1.189***	1.161***	1.077***	0.990***
	(0.071)	(0.070)	(0.073)	(0.068)	(0.074)	(0.067)	(0.070)	(0.074)	(0.068)	(0.072)	(0.074)	(0.072)
ln(REXRij)	-1.068***	-1.129***	-1.093***	-1.094***	-1.067***	-1.051***	-1.065***	-1.075***	-1.039***	-1.090***	-1.119***	-1.292***
	(0.053)	(0.056)	(0.061)	(0.047)	(0.052)	(0.050)	(0.052)	(0.055)	(0.051)	(0.054)	(0.066)	(0.063)
ln(REXRcj)	0.737***	0.850***	0.764***	0.654***	0.716***	0.692***	0.756***	0.767***	0.714***	0.857***	1.026***	1.024***
	(0.072)	(0.076)	(0.082)	(0.067)	(0.072)	(0.065)	(0.070)	(0.072)	(0.069)	(0.071)	(0.080)	(0.083)
nomexr	-0.999**	-0.941**	-1.169**	-0.666	-0.866*	-0.960**	-1.015**	-1.247***	-0.876**	-0.939**	-1.257***	-1.460***
	(0.474)	(0.475)	(0.493)	(0.453)	(0.479)	(0.433)	(0.447)	(0.468)	(0.438)	(0.466)	(0.448)	(0.448)
eunew	0.009	0.015	0.007	0.017	0.013	0.012	0.012	0.010	0.015	0.008	0.001	-0.002
	(0.014)	(0.015)	(0.014)	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)
UR	0.100***	0.102***	0.108***	0.043**	0.160***	0.101***	0.132***	0.093***	0.109***	0.088***		
	(0.019)	(0.019)	(0.019)	(0.020)	(0.027)	(0.019)	(0.019)	(0.019)	(0.018)	(0.019)		
obs	4200	4200	4200	4368	4368	4368	4368	4368	4368	4368	2912	2184
panels	300	300	300	312	312	312	312	312	312	312	208	156
R2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Robust standard errors in parentheses.

Significant at 10%; ** significant at 5%; *** significant at 1%.

Year, EU membership, “Rotterdam effect” and bilateral (fixed effects) dummies included but not reported.

Table 7. Specification sensitivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EMU11	0.139***	0.294***	0.224***	0.144***	0.131***	0.141***	0.163***	0.150***	0.104***
	(0.020)	(0.023)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.018)	(0.019)
EMU12	0.077***	0.160***	0.188***	0.077***	0.079***	0.098***	0.115***	0.081***	0.020
	(0.017)	(0.019)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)	(0.014)
EMU21	0.072***	0.150***	0.044**	0.072***	0.064***	0.052***	0.071***	0.076***	0.014
	(0.018)	(0.020)	(0.019)	(0.018)	(0.019)	(0.019)	(0.020)	(0.018)	(0.016)
ln(RYi)	1.222***		0.791***	1.225***	1.237***	1.188***	1.186***	1.227***	0.914***
	(0.071)		(0.069)	(0.071)	(0.070)	(0.072)	(0.072)	(0.070)	(0.062)
ln(RYj)	1.146***		1.268***	1.149***	1.174***	1.160***	1.178***	1.150***	0.839***
	(0.069)		(0.067)	(0.069)	(0.068)	(0.069)	(0.070)	(0.068)	(0.059)
ln(REXRij)	-1.058***	-0.662***		-1.061***	-1.083***	-1.103***	-1.061***	-1.041***	-0.972***
	(0.050)	(0.052)		(0.050)	(0.050)	(0.049)	(0.052)	(0.049)	(0.050)
ln(REXRcj)	0.722***	-0.041		0.728***	0.759***	0.752***	0.660***	0.683***	0.553***
	(0.067)	(0.072)		(0.067)	(0.067)	(0.067)	(0.070)	(0.064)	(0.067)
nomexr	-0.940**	-1.626***	-1.208**		-1.196***	-0.745	-0.881*	-0.881**	-1.383***
	(0.443)	(0.502)	(0.496)		(0.446)	(0.455)	(0.466)	(0.420)	(0.407)
eunew	0.013	-0.000	0.034**	0.016		0.004	0.037***	0.053***	0.007
	(0.013)	(0.014)	(0.014)	(0.012)		(0.012)	(0.012)	(0.012)	(0.012)
UR	0.105***	0.158***	0.134***	0.107***		0.038**	0.036*	0.045***	0.059***
	(0.018)	(0.020)	(0.019)	(0.018)		(0.018)	(0.019)	(0.013)	(0.014)
weu10t1993	-0.252***	-0.240***	-0.302***	-0.251***	-0.212***		-0.174***	-0.246***	-0.247***
	(0.025)	(0.028)	(0.025)	(0.025)	(0.024)		(0.026)	(0.024)	(0.024)
wbnt1993	-0.246***	-0.257***	-0.300***	-0.244***	-0.236***		-0.061	-0.237***	-0.244***
	(0.046)	(0.047)	(0.048)	(0.046)	(0.046)		(0.041)	(0.045)	(0.045)
bneu12t1993	0.063***	0.032	-0.002	0.063***	0.060***		0.059***	0.088***	0.057***
	(0.017)	(0.021)	(0.017)	(0.017)	(0.017)		(0.018)	(0.017)	(0.017)
weu3t1995	-0.470***	-0.477***	-0.505***	-0.470***	-0.426***	-0.391***		-0.467***	-0.477***
	(0.038)	(0.041)	(0.042)	(0.039)	(0.038)	(0.038)		(0.038)	(0.039)
wbnt1995	0.135***	0.114***	0.160***	0.133***	0.175***	0.053		0.130***	0.139***
	(0.041)	(0.042)	(0.046)	(0.041)	(0.041)	(0.038)		(0.041)	(0.042)
bneu3t1995	0.235***	0.199***	0.160***	0.234***	0.242***	0.233***		0.234***	0.229***
	(0.024)	(0.028)	(0.025)	(0.024)	(0.023)	(0.024)		(0.024)	(0.025)
EU dummies	yes	yes	yes	yes	yes	yes	yes	no	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	no
obs	4732	4732	4732	4732	4732	4732	4732	4732	4732
panels	338	338	338	338	338	338	338	338	338
R2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Robust standard errors in parentheses.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Bilateral (fixed effects) dummies included but not reported.

Table 8. Results for sectors (one-digit SITC rev. 3), 1995-2002

	SITC 1-9 Aggregate export	**SITC 0** Food & live animals	**SITC 1** Beverages & tobacco	**SITC 2** Crude materials, inedible, except fuels	**SITC 3** Mineral fuels, lubricants & related material	**SITC 4** Animal & vegetable oils, fats & waxes	**SITC 5** Chemicals & related products, n.e.s.	**SITC 6** Manufactured goods classified chiefly by materials	**SITC 7** Machinery & transport equipment	**SITC 8** Miscellaneous manufactured articles
EMU11	0.172***	0.014	0.352***	-0.033	-0.196	0.044	0.069*	0.124***	0.224***	0.071***
	(0.021)	(0.041)	(0.086)	(0.054)	(0.198)	(0.152)	(0.038)	(0.034)	(0.037)	(0.027)
EMU12	0.089***	0.047	0.129*	-0.063	-0.096	0.186	0.078**	0.002	0.087**	-0.002
	(0.018)	(0.037)	(0.072)	(0.052)	(0.172)	(0.125)	(0.033)	(0.032)	(0.035)	(0.023)
EMU21	0.089***	-0.088**	0.161*	-0.115***	0.075	0.139	0.059	0.088**	0.120***	0.009
	(0.019)	(0.039)	(0.087)	(0.044)	(0.167)	(0.133)	(0.036)	(0.036)	(0.036)	(0.025)
ln(RYi)	0.864***	-0.990***	-0.639**	0.928***	-0.652	1.926**	1.955***	-0.661***	1.142***	0.160
	(0.125)	(0.243)	(0.303)	(0.328)	(0.910)	(0.907)	(0.205)	(0.167)	(0.131)	(0.159)
ln(RYj)	1.077***	0.868***	1.370***	0.574**	0.580	0.645	1.105***	0.735***	1.044***	0.608***
	(0.102)	(0.225)	(0.442)	(0.248)	(0.722)	(0.547)	(0.164)	(0.126)	(0.160)	(0.144)
ln(REXRij)	-0.811***	-1.610***	-1.695***	-1.268***	-2.459***	-1.934***	-1.180***	-1.262***	-0.805***	-1.302***
	(0.056)	(0.115)	(0.224)	(0.131)	(0.371)	(0.332)	(0.095)	(0.091)	(0.105)	(0.072)
ln(REXRcj)	0.380***	1.341***	1.373***	0.821***	1.608***	1.979***	0.886***	0.912***	0.178	0.887***
	(0.076)	(0.167)	(0.322)	(0.206)	(0.560)	(0.504)	(0.143)	(0.125)	(0.154)	(0.110)
nomexr	0.373	4.622***	6.232**	-2.371	-2.005	0.804	-2.754**	2.279**	0.026	4.655***
	(0.633)	(1.327)	(2.763)	(1.615)	(4.926)	(3.977)	(1.198)	(1.059)	(1.112)	(0.867)
obs	2704	2702	2659	2702	2539	2460	2703	2704	2704	2704
R2	0.994	0.985	0.961	0.975	0.914	0.917	0.987	0.991	0.988	0.993

Robust standard errors in parentheses.

Significant at 10%; ** significant at 5%; *** significant at 1%.

Year, EU membership, “Rotterdam effect” and bilateral (fixed effects) dummies included but not reported.

SEMINAR PAPER SERIES

The Series was initiated in 1971. For a complete list of Seminar Papers, please contact the Institute.

2005

734.	*Mats Persson, Torsten Persson, and Lars E.O. Svensson*	Time Consistency of Fiscal and Monetary Policy: A Solution
735.	*Matthias Doepke and Fabrizio Zilibotti*	Patience Capital and the Demise of the Aristocracy
736.	*Alessandra Bonfiglioli*	How Does Financial Liberalization affect Economic Growht?
737.	*Alessandra Bonfiglioli*	Equities and Inequality
738.	*Virginia Queijo*	How Important are Financial Frictions in the U.S. and Euro Area?
739.	*Assar Lindbeck*	Sustainable Social Spending
740.	*Vasco Cúrdia and Daria Finocchiaro*	An Estimated DSGE Model for Sweden with a Monetary Regime Change

2006

741.	*Mats Persson and Claes-Henric Siven*	The Becker Paradox and Type I vs. Type II Errors in the Economics of Crime
742.	*Assar Lindbeck and Mats Persson*	A Model of Income Insurance and Social norms
743.	*Assar Lindbeck, Mårten Palme and Mats Persson*	Job Security and Work Absence: Evidence from a Natural Experiment
744.	*Martina Björkman*	Income Shocks and Gender Gaps in Education: Evidence from Uganda
745.	*Anna Larsson*	Monetary Regimes, Labour Mobility and Equilibrium Employment
746	*Harry Flam and Håkan Nordström*	Trade Volume Effects of the Euro: Aggregate and Sector Estimates

ISSN: 1653-610X
Stockholm, 2006
Institute for International Economic Studies