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Harry Flam

The Impact of the Euro on International Trade and Investment:

A Survey of Theoretical and Empirical Evidence

Sieps
Swedish Institute for European Policy Studies

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PREFACE

This report is one of two reports published in December 2009 on Sweden and the European Monetary Union. The other report, *Aggregate and Regional Business Cycle Synchronisation in the Nordic Countries*, is written by Anna Larsson.

With the tenth anniversary of the introduction of the European single currency, the euro, this year, the performance of the European Monetary Union (EMU) has received increasing attention. In addition, the economic and financial crisis and the strong depreciation of the Swedish krona have triggered the public debate on Swedish EMU membership to resurface after being politically dead since the referendum in 2003.

In a series of publications SIEPS evaluates and discusses different arguments for and against entering a monetary union like the euro area. The principal gain from joining a monetary union is improved economic efficiency resulting from increased trade and investment. Before the launch of the EMU, assessments of the size of these effects were diverse. Ten years with a common currency has provided us with sufficient data to allow statistical analysis. This SIEPS report surveys and analyses a large number of studies estimating the impact of the euro on trade and FDI. The report concludes that the effect on trade, between euro countries as well as between euro and non-euro countries, is sizeable and larger than most *ex ante* calculations. Moreover, the common currency effect on FDI is also positive, although less significant.

By issuing this report SIEPS hopes to make a contribution to both the academic and the popular debate on monetary unions and European economic integration.

Anna Stellinger
Director, SIEPS

The Swedish Institute for European Policy Studies, SIEPS, conducts and promotes research and analysis of European policy issues. The results are presented in reports and at seminars. SIEPS strives to act as a link between the academic world and policy-makers at various levels.

ABOUT THE AUTHOR

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EXECUTIVE SUMMARY

The goal of the European Union is 'an ever closer union among the peoples of Europe'. From the beginning, economic integration has been used as an instrument to further that goal: elimination of tariffs on industrial products in the 1960s, exchange rate cooperation since the 1970s, the establishment of a Single Market for goods, services, capital and labour since the 1980s and –the latest step – the introduction of a common currency and common monetary policy in 1999. The Single Market and the common currency were marketed under the slogan "One Market, One Money".

Against this background, it is important to know whether the common currency has delivered on its promise, namely to promote more trade and investment between the countries that have joined the European currency union. It is especially important for those countries that have chosen not to join for the time being – Denmark, Sweden and the United Kingdom – and also for the new member states that will eventually seek to join. If it can be shown that the euro has promoted more trade and investment between the members of the monetary union, the argument for joining becomes stronger.

Academic economists specialising in the relation between exchange rate uncertainty and trade did not share the expectations of more trade before the launch of the monetary union. Their empirical research showed that a reduction in the volatility of nominal exchange rates had a very small or no effect on trade. They therefore concluded that the move from the limited exchange rate volatility that existed within the framework of the Exchange Rate Mechanism – the European Union's exchange rate cooperation – to a common currency and thus no exchange rates would have a negligible impact on trade. The same conclusion was also drawn in respect of foreign direct investment (FDI), although much less research had been carried out on the effect of exchange rate volatility on FDI.

Sufficient time has passed with a common currency for data to accumulate and allow statistical analysis. To date, at least eighteen studies on the impact of the euro on trade and six studies on FDI have been carried out. They are surveyed here in some detail in order to arrive at conclusions about the effect that the introduction of the euro has had on trade and FDI between members of the currency union and also between members and non-members.

The theoretical model that is used to analyse the impact of the euro on trade and FDI is called the gravity model. The model simply postulates that the volume of exports or investment from one country to another – correspond-

ing to the force of gravity in physics – is a function of the GDP of the sending and receiving country – corresponding to the mass of two bodies. The greater the GDP of the sending or receiving country, the larger are the exports or investments. The model also postulates that different kinds of frictions will diminish the volume of exports or investments. The amount of friction is determined by geographical distance, shared language, shared history, and fiscal and administrative barriers, among other factors. The gravity model is widely used in empirical research and usually has high explanatory power. Despite the analogy to the law of gravity, it is derived from standard consumer theory and can be derived from standard models in trade theory as well.

The major difficulty for any statistical analysis is to isolate the effect of the euro from all other influences on trade and investment. The method used is taken from tests of a new medical procedure or drug: similar countries are divided into two groups, one that has been "treated" with the euro and one that has not. The difference in the level of trade or investment before and after treatment is measured for both groups, after the influence of all conceivable factors other than the common currency have been accounted for. The difference between before and after is compared between the two groups. Any difference between the differences is interpreted as caused by the euro.

Of the eighteen studies of euro effects on trade, fifteen find statistically significant positive effects, most of them quite substantial. The differences between studies mostly depend on the length of the euro period – the effect tends to increase with time –, on what countries are in the control group – the effect becomes much greater if developing countries are included – and on the precise specification of the gravity model. Our conclusion is that trade between euro countries is higher by 10 to 30 % and trade between euro and non-euro countries by half as much between 2002 and 2006 compared with 1995 to 1998 and compared with trade between non-euro countries.

Three studies conclude that what is estimated as a euro effect on trade is part of a long-term trend of increasing trade between the countries which formed the currency union relative to other countries. It seems clear that such a trend exists, but it is not strong enough to explain away all of what other studies estimate to be a euro effect. Additionally, one must consider what has caused the trend. It seems likely that it depends significantly on the earlier measures of economic integration taken by the European Union. If so, it cannot be used to explain the effects of the latest of such measures.

What can explain such sizeable effects of the euro on trade? The most likely explanation is the complete elimination of nominal exchange rate uncertainty. The earlier empirical research on the effects of exchange rate volatility on trade found practically no effect of reducing the volatility, but there seems to be a fundamental difference between a reduction and complete elimination.

FDI can be undertaken for many different reasons. A common reason is to jump barriers to trade. In this case, exports and FDI are substitutes and we should expect a positive impact of the euro on trade to have a negative effect on FDI. Another reason is to take advantage of cost differences across countries; the surge in FDI from Western to Eastern Europe is an example. In this case, exports and FDI are complements. Yet another reason is strategic; by acquiring firms in other countries, firms hope to gain in competitiveness and perhaps to pre-empt existing competitors. The different kinds of motives behind FDI make the expected impact of the euro ambiguous a priori.

Six studies have examined the impact of the euro on FDI. Five of these conclude that the effect has been statistically significant, positive and quite substantial. The estimates range from 16 to 200 % for FDI between euro countries. One study disputes these findings on the grounds that the other studies have not allowed the impact of the Single Market on FDI to vary over time. It can be expected that its effect should increase over time, since decisions on investments should take longer and since the Single Market has been implemented gradually. We conclude that the euro has had a positive impact on FDI between euro countries as well as on FDI from non-euro countries to euro countries, but note that this conclusion is uncertain given the need to control correctly for the Single Market and considering the relatively small number of studies.

1 INTRODUCTION

The question of whether the euro has had an effect on international trade and investment is important. The European monetary union is a major building block in the construction of the European Union, and was marketed as a complement to the Single Market under the slogan "one market, one money". It was argued that to realise the full potential of trade and investment within the European Union, a common currency was needed. Whether the monetary union is deemed a success or not depends to a large extent on whether it is seen as having fulfilled the high expectations in this regard. Furthermore, whether the three countries that have chosen not to adopt the euro – Denmark, Sweden and the UK – will join in the future will, in part, depend on trade and investment benefits.

Sufficient time has now passed for data and empirical research to accumulate, thus making it possible to draw conclusions about the trade and investment effects of the euro with reasonable certainty. The purpose of this report is to survey the available theoretical and empirical evidence. Two such surveys have been made, by Baldwin (2006) and Baldwin et al, (2008). The latter conclude that the euro has had positive but quite small effects on trade. The present survey arrives at a different conclusion, namely that the effects are quite large.

Trade effects are surveyed first. Section 2 deals with relevant theory and section 3 with empirical evidence. Section 4 turns to foreign direct investment and discusses theoretical links between international trade and investment, particularly whether one should expect an increase in trade to be accompanied by an increase or decrease in cross-border investment. Section 5 surveys the empirical evidence on investment effects.

2 SHOULD THE EURO BE EXPECTED TO AFFECT TRADE?

Different currencies between trade partners constitute a barrier to trade. Most obviously, an exporter will typically be paid in foreign currency and will have to incur the cost of exchanging the foreign currency into domestic currency according to the rate of exchange. Furthermore, the exporter will be faced with uncertainty about the value of the export revenue in domestic currency to the extent that the payment is made some time after the agreement between buyer and seller. The exporter may prefer to buy certainty about the future exchange rate by selling the foreign currency amount in the forward market, at a cost. Hence, trade between trade partners with different currencies entails transaction costs in the form of exchange and – usually – insurance costs.

Such transaction costs are not large. They have been estimated at 0.2 % of GDP for Sweden, based on wage and other costs of the foreign exchange departments of commercial banks in Sweden, with account taken of the share of foreign exchange transactions necessitated by foreign trade (Calmfors et al, 1997). The ratio of the value of trade (exports plus imports) to GDP for Sweden is approximately 0.95. The European Commission (1990) has estimated the cost for the member countries to be of a similar magnitude. On top of the financial costs, exporters and importers incur administrative costs in handling foreign exchange that are hard to estimate.

Elimination of currency-related transaction costs for imports can, under standard assumptions, be expected to lead to lower domestic prices of imports and increased imports from euro countries, so-called trade creation in the terminology of customs union theory. Part of the increase will be at the expense of non-euro countries, so-called trade diversion. The welfare gains consist of savings in resources previously used in connection with currency exchange and hedging which take the form of an increased consumer surplus (lower prices on imports). Elimination of currency-related transaction costs for exports can be expected to increase exports to euro countries, that is, trade creation on the export side, and to reduce exports to non-euro countries (trade diversion). The welfare gains consist of savings of resources which take the form of an increased producer surplus on exports owing to increased net revenues.

The effects of the elimination of currency transaction costs on some but not all imports are analogous to the elimination of tariffs on imports from some but not all imports when a customs union is created. We expect increased

trade between members of a currency or customs union – trade creation – and decreased trade with non-members – trade diversion. We expect, however, one important difference. The elimination of tariffs in a customs union entails a transfer of tariff revenue on imports from the government to consumers of imports, in the form of an increased consumer surplus. This is not a welfare gain for the importing country, only a transfer from the government to consumers. The elimination of currency transactions costs on all imports from currency union members, and consequently lower prices on imports, is on the other hand a pure welfare gain, which benefits consumers. [1]

The estimated currency-related transaction costs for trade are very small and can therefore not be expected to have any substantial effects on trade and welfare. We have to look elsewhere for factors that could have a substantial effect on trade. It is clear that the uncertainty to which exchange rates give rise is one such factor. In fact, the history of the international monetary system since the gold standard in the late nineteenth century is a history of repeated attempts at reducing exchange rate uncertainty. Policymakers and businessmen have always been convinced that exchange rate uncertainty is detrimental to trade.

Academic economists have not been so convinced, for both theoretical and empirical reasons. Exchange rate volatility will, in fact, increase average profits in theory under standard assumptions about profit functions and should therefore serve to increase trade. Profit is a function of the output price and the costs of inputs. The profit function is convex in price, which means that profits increase more than proportionately for a given increase in price. For example, the average profit of a price of 120 half the time and 80 half the time is higher than if the price is 100 all the time. The reason is that a typical producer will use different optimal combinations of inputs at different prices. Only if the producer were to use the same combination of inputs at different prices would the average profit change in proportion to the price. Exchange rate changes give rise to changes in the price in domestic currency for exporters (assuming that they keep the price in foreign currency constant). Hence, their average profits increase as the volatility in the exchange rate increases.

A different theoretical approach to analysing the effects of exchange rate uncertainty on trade is to view starting or ceasing to trade, or expanding or

[1] Creating a customs union also opens up the possibility of diverting imports from lower-cost non-members to higher-cost but tariff-free imports from members, which is a welfare loss and can dominate the welfare gains.

contracting existing trade, as a decision to invest or disinvest, and to apply the option theory of investment developed by Majd and Pindyck (1987), Dixit and Pindyck (1994) and others. The traditional investment model says that an investment should be undertaken when its net present value is positive (or above a certain threshold). The model disregards the fact that investments are irreversible to some extent and that having the flexibility to undertake an investment constitutes an option value. Exercising the option means giving up that flexibility and therefore constitutes a cost. In the context of trade, a decision to start exporting or importing will entail some investment costs, such as market research and marketing, and perhaps building new production capacity. The costs of these investments are only partially reversible. Moreover, they can be timed. There is a positive option value of waiting to start or expand trading, since the exchange rate may become more favourable, in which case the investment becomes more profitable, or become unfavourable, in which case the investment can become unprofitable and should not be undertaken. Analogously, there is an option value of waiting to stop or reduce investing, since the conditions can improve if the exchange rate becomes more favourable and the investments made would be lost. The value of the option to wait increases with the degree of uncertainty, that is, the volatility of the exchange rate. Consequently, increased exchange rate volatility should serve to reduce trade.

The extensive survey of much empirical literature from the 1980s and 1990s on the effects of exchange rate volatility on trade by McKenzie (1998) arrives at the conclusion that trade is affected very little or not at all. Some recent research, e.g. by Rose (2000) and Klein and Shambaugh (2006), does find substantial effects.

It should be borne in mind that the empirical research on exchange rate volatility and trade is probably of limited relevance for the present circumstances. Most of the research used cross-sectional data for countries with floating exchange rates and answered the question: "Does the volume of trade differ between countries with different exchange rate volatility?" The question that we want to answer is: "Does the volume of bilateral trade change when pairs of countries switch from a regime with less than credible exchange rate bands to one without exchange rates?" To answer that question, one needs panel data for countries that have undertaken such a switch, data which were practically non-existent until the advent of the European currency union. One can also question the fact that research on exchange rate volatility and trade predominantly used high-frequency, mostly quarterly, data. Exports and import decisions should not be expected to be made on the basis of short-term changes in exchange rates, both

because hedging is common and because the theory of investment under uncertainty tells us that irreversibility causes inertia in such decisions. Ultimately, the trade effects of switching regimes are a question that can only be answered empirically.

Starting with the empirical observations by Roberts and Tybout (1997), Eaton, Kortum and Kramarz (2004) and others that only a small proportion of all manufacturing firms sell their products abroad, a lot of theoretical and empirical work has taken seriously the fact that firms are heterogeneous with respect to productivity and size and has investigated the consequences thereof. Firms that export have been observed to be larger and more productive on average than firms that do not export. The assumption is that the higher productivity of exporters allows them to cover fixed costs of exporting and to become larger than non-exporters. The elimination of currency transaction costs and exchange rate uncertainty should have the same effect as an increase in productivity and induce existing exporters both to increase exports and make exporting sufficiently profitable for some non-exporters. In other words, the introduction of the euro should have effects on what are known as the intensive and extensive margins of trade.[2]

[2] Melitz (2003) has generalised the standard Heckscher-Ohlin model of trade to encompass effects on both the intensive and extensive margins.

3 ESTIMATION OF EURO EFFECTS ON TRADE

The standard model used to estimate the volume of trade between two countries is the gravity model. It postulates that exports from country A to country B depend on the economic size of each country, measured by its GDP, the distance between them, the cost of exporting from A to other countries relative to B, and the cost of exporting to B from countries other than A. Distance should be understood in a wide sense. It includes geographical distance, but also other geographical factors that promote or discourage trade, such as access to sea ports, inland location or common land borders. It also includes cultural factors, such as a common legal and administrative system, common language or common colonial history, and various policy measures to promote or discourage trade, such as tariffs, preferential trading areas and administrative procedures or – the focus of our interest here – a common currency. The gravity model of trade is usually very successful in explaining bilateral trade in empirical applications.

The gravity model can be written as an equation in the following general form. Usually, the data are transformed into logarithms so that estimated coefficients measure the percentage change in trade resulting from a 1 per cent change in the respective explanatory variable, holding other variables constant.

(1) Exports from A to B = Constant + GDP of A + GDP of B + Common currency [if any] + Cost of exporting from A to B + Cost of exporting from A to countries other than B + Cost of exporting from other countries to B + Error term

"Cost" should be taken to mean all kinds of trade frictions: natural, such as geographical and cultural, as well as man-made, such as tariffs or different currencies. The fact that not only trade frictions between A and B but also between A and other importers and between B and other exporters are included means that it is the relative trade frictions of exporting from A to B that matter, as demonstrated by Anderson and van Wincoop (2003).

Most studies of the effects of the euro on trade (and also on investment) use the gravity equation and time series data. The data are organised in so-called panels (groups), one for each pair of countries. By comparing the development of trade over time, before and after 1999, for a large number of country pairs where both countries have adopted the euro with the development for a large number of country pairs where the countries have different currencies, it should be possible to identify the effects of the euro. The hypothesis is that trade between pairs of euro countries on aver-

age has increased more than trade between countries with different currencies starting in 1999, after controlling for everything that may have an impact on trade except common or different currencies.

In fact, the statistical method used to identify trade effects of the euro is the same as that used in clinical medical trials to identify the effects of a new drug or a new procedure. In medical trials, one group of patients is subjected to treatment with the new drug or procedure and is compared with a control group that is not treated (or treated with a completely inert drug). Care is taken to ensure that the two groups are alike in terms of relevant characteristics, such as health status, age or gender, so that any change in health status between the groups can be attributed to the treatment or the absence thereof.

In determining the effect of the euro, one is faced with the problem that countries have not been randomly assigned to be treated or untreated by the euro. This, in turn, gives rise to two types of problems. First, it is possible that those countries that had the strongest reason to share a currency, because their trade with one another was relatively large and growing, decided to join the currency union, whereas the countries that did not join were less compelled to do so. In other words, one is faced with the problem of whether the common currency caused trade or trade caused the common currency. The causality problem is inherently difficult to solve. Second, it becomes important to control for systematic differences between euro and non-euro countries that could cause different effects on trade that are unrelated to the euro. For example, euro countries could, in principle, have had a higher growth rate than non-euro countries since 1999 and this could have caused trade between euro countries to grow at a higher rate than between non-euro countries. Therefore, it is important to control for different rates of GDP growth, as seen in gravity equation (1).

What is the preferred way of dealing with the above and other issues that have been faced by studies of the euro effects on trade and investment?[3]

One-way or two-way trade: the gravity equation (1) is derived for bilateral trade in one direction, i.e. for exports from A to B or exports from B to A as the dependent variable, and not for the sum of bilateral trade. Bilateral trade costs are not necessarily symmetric: country A will normally face different trade costs in exporting to B than what B is facing when exporting to A. Many studies use the sum of bilateral trade as the dependent vari-

[3] Baldwin and Taglioni (2007) provide a comprehensive and more technical review of common errors in implementing the gravity equation.

able. This may result in biased estimates of the euro effect on trade if trade generally is unbalanced, but will not matter if trade is balanced.

Nominal or real variables: the gravity equation (1) is derived from the expenditure function and trade and GDP are therefore expressed in nominal terms. The common practice, however, is to work with trade and GDP in real terms. If so, the nominal trade and GDP data have to be converted to constant prices by the appropriate price indices. This meets with no problem in the case of GDP, where GDP deflators are generally available, but does pose a problem in the case of trade, where price indices are not generally available. Producer price indices can be used as a proxy, as in Flam and Nordström (2003, 2007). When the nominal data have been converted to constant prices, they need to be expressed in a common currency, usually US dollars. Here, most studies convert the constant price time series into US dollars using the current exchange rate for each year. This means that the GDP observations are contaminated by changes in real exchange rates caused by changes in relative price levels and nominal exchange rates.[4] Instead, the dollar exchange rate for a given year should be used, and the real exchange rate – relative price levels and the nominal exchange rate – should be controlled for explicitly on the right-hand side. To sum up, the trade data should be either in terms of current prices in a common currency at current exchange rates or in terms of constant prices in a common currency at a given year's exchange rate, controlling for real exchange rate changes. The advantage of the latter approach is that the effect of GDP can be identified separately from the effect of the real exchange rate.

Factors that are constant over time or allowed to change: the impact of trade frictions that are constant over time can be estimated with the help of so-called fixed effects (dummy) variables in the statistical analysis. Many factors are constant over the time period considered, such as cultural factors or geographical distance. Other trade frictions may change over time and account should be taken of this fact. The effect of the Single Market is one example. The Single Market was officially launched at the start of 1993, but many directives were issued by the European Commission or enacted by national parliaments later, and still other measures have not yet been implemented. In addition, the measures making up the Single Market should take effect gradually.

[4] Baldwin and Taglioni (2007) argue that deflating by a US price index may also introduce a bias, but that the inclusion of a time dummy variable neutralises any potential bias.

"Multilateral trade resistance": the right-hand side of equation (1) includes the cost of exporting from A to countries other than B and the cost of importing from countries other than A to B, which is what Anderson and van Wincoop (2003) dubbed "multilateral trade resistance" or what effectively is the relative cost of exporting to B. Multilateral trade resistance can be partially accounted for by exporter and importer specific dummy variables. They capture each exporter's average relative cost of exporting across countries and over time. An alternative is to account for multilateral trade resistance by country-pair fixed effects. They will capture everything that is fixed over time when one exports from A to B, including multilateral trade resistance as well as all other trade frictions, such as geographical distance. Ideally, the exporter and importer or country-pair specific effects should be allowed to vary over time, since the multilateral trade resistance terms in equation (1) contain prices. The problem with this is that all time-dependent trade frictions may be captured by the specific effect, including the euro effect, as in Berger and Nitsch (2007). Probably the best way to deal with this dilemma is to include time-independent pair-specific effects and various time-dependent factors, such as EU membership, the Single Market and participation in the currency union, but one should be aware of the risk that each time-dependent factor may capture the effects of other factors as well.

Country sample: the choice of countries in the control group determines the results to some extent. They should be as similar to the euro countries as possible in terms of per capita income and general level of development. Most studies choose to include other West European countries and high-income OECD countries in other parts of the world. Baldwin (2006) and Baldwin et al (2008) argue that the control group should consist of other EU members in order to control better for EU membership. It may be the case that controlling for EU membership by a dummy variable is less than ideal, but then the control group effectively narrows down to only three countries, Denmark, Sweden (which became a member as late as 1995) and the United Kingdom and to only six observations of unilateral trade per year. There is a real risk that the small number of countries in the control group will introduce some idiosyncrasy that will affect the result.

Time period: it is preferable to include several years after 1999 in order to increase the certainty of the statistical results and capture possibly increasing effects over time. Some studies were conducted somewhat prematurely and include only two to four years with the euro. The time period before 1999 should not be too long if omitted variables exist that affect countries differently. Importantly, there seems to be a trend of increasing trade be-

tween euro countries relative to trade between other countries that is not captured by included variables. If so, the euro effects will be overestimated.

Macro or micro data: firm-level data are only available for a few countries and for a relatively few years. It would be preferable to use such data, as they would make estimates more precise and could separate effects on exports that existed before 1999 (the so-called intensive margin) and on new exports (the so-called extensive margin). Most studies have used macro data.

4 Empirical evidence of euro effects on trade

Table 1 lists studies of euro effects on trade and their main results in alphabetical order.

Barr, Breedon and Miles (2003)
This study uses a panel of quarterly data for eleven euro and six non-euro European countries. It estimates that the euro has boosted trade by 29 % between euro countries on data ending in the first quarter of 2002. The comparison is with trade between non-euro countries. It finds no significant effects on trade between euro and non-euro countries. The study is noteworthy for the way in which it tries to deal with the problem of causality, that is, whether increasing trade caused the formation of a currency union or the currency union caused increased trade.[5] The study is also noteworthy for finding substantial and negative effects of exchange rate volatility.

De Nardis and Vicarelli (2003)
The final year is 2000, which makes for a short period with the euro, although it is assumed that the currency union starts in 1998, since the decision to fix exchange rates irrevocably was taken in May of that year. The panel data include eleven euro countries and nineteen other countries and the gravity equation has a dynamic specification, which means that lagged values of the dependent variable exert an influence. Trade is estimated to increase by 6 % between euro countries relative to trade between euro and non-euro countries plus trade between non-euro countries. The relatively low estimate is probably because of the assumed, unexplained lagged effects of the dependent variable and the inclusion of trade between euro and non-euro countries in the control group. Exports and GDP are in volumes, but the real exchange rate is not controlled for.

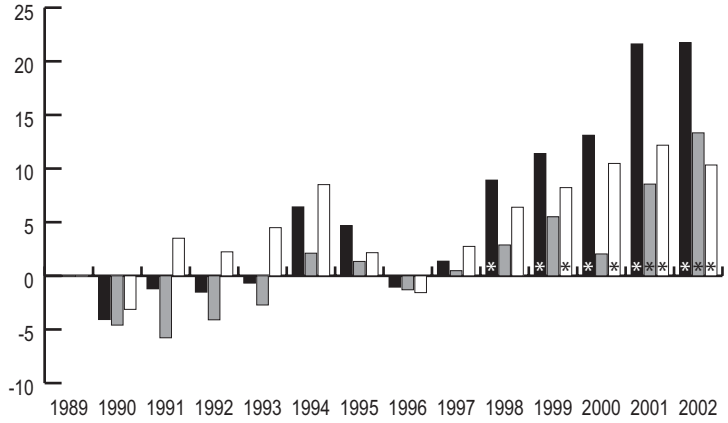
Flam and Nordström (2003)
This study uses yearly panel data for ten euro and ten non-euro countries, of which five are European. It finds that the euro effect on one-way trade between euro countries is 15 % on data ending in 2002 and that the effect on trade between euro and non-euro countries relative to trade between non-euro countries is about 8 %. The study is noteworthy for providing estimates on the sector level, where it finds that the effects are concentrated

[5] It instruments for the currency union by the co-movement of output prior to 1999 (and for exchange rate volatility by the co-movement of prices). The instrumental variable estimate is 25 %.

Table 1 Summary of studies of the euro effect on trade

Author(s)	Period	Method	Results	
			Within euro area	Between euro and non-euro area
Baldwin, R., F. Skudelny and D. Taglioni (2006)	1991-2002	Cross-section	26-83%	22-24%
Baldwin, R. and D. Taglioni (2006)	1994-2003	Panel	3-4%	3-4%
Baldwin, R. et. al. (2008)	1990-2006	Panel	2%	0-1%
Barr, D. , F. Breedon and D. Miles (2003)	1978-2002	Panel	29%	[not estimated]
Berger, H. and V. Nitsch (2008)	1948-2003	Panel	0%	[not estimated]
Brouwer, J., R. Paap and J.-M. Viaene (2007)	1990-2004	Panel	0-15%	Mixed results
Bun, M. and F. Klaassen (2007)	1967-2002	Panel	3%	[not estimated]
Chen, N. and D. Novy (2009)	1999-2004	Panel	0%	[not estimated]
Chintrakarn, P. (2008)	1994-2002	Panel	9-14%	No trade diversion
De Nardis, S. and C. Vicarelli (2003)	1980-2000	Dynamic panel	2-6%	[not estimated]
De Nardis, S. , R. de Santis, R. and C. Vicarelli (2008)	1988-2004	Dynamic panel	17% (4% in short run)	[not estimated]
Faruqee, H. (2004)	1992-2002	Panel	14%	8%
Flam, H. and H. Nordström (2003)	1989-2002	Panel	15%	8%
Flam, H. and H. Nordström (2007)	1995-2006	Panel	28%	12-14%
Frankel, J. (2008)	1948-2006	Panel	10-25% (small sample) 300% (large sample)	[not estimated] [not estimated]
Gomes, T., C. Graham, J. Helliwell, T. Kano, J. Murrey and L. Schembri (2006)	1980-2003	Panel	0-22%	[not estimated]
Micco, A., E. Stein and G. Ordoñez (2003)	1992-2002	Panel	9-13%	1-9%

Figure 1 Year by year effects of the euro on trade



* Significant at 10% or higher

Source: Flam and Nordström (2003).

on manufacturing industries. To deal with the problem of causality between trade and the currency union, year-by-year effects on trade are estimated and found to be significant and increasing, starting in 1998. The 1998 start is probably explained by the fact that exchange rates were irrevocably fixed in early May of that year. The time pattern of the effects indicates causation from the common currency to trade; see Figure 1. Year-by-year effects of the Single Market are also estimated. Their impact becomes highly significant in 1995, two years after the official start of the Single Market, reaches a maximum and then tapers off. The time patterns of Single Market and euro effects are what would be expected: both are gradual and the Single Market effect reaches its maximum in 1999, whereas the euro effects on trade within the euro area become significant in 1998 and show an increasing trend.

Micco, Stein and Ordoñez (2003)

This study has been the most influential on the subject. It contains several sets of estimates on data ending in the first half of 2002 for 22 countries, eleven of which are euro countries. My preferred estimate is 14 % for trade (the sum of exports and imports) between euro countries and 9 % for trade between euro and non-euro countries relative to trade between eleven

non-euro countries. The causality problem is handled in the same way as in Flam and Nordström (2003) and with the same general results.

Faruqee (2004)
The study uses the same dataset as in Micco, Stein and Ordoñez (2003). Its contribution is to take account of the non-stationarity of the time series. OLS applied to non-stationary time series may yield invalid estimates. The dynamic OLS estimate of the euro effect on trade between euro countries is 7 to 8 % when the control group consists of trade between euro and non-euro countries as well as between non-euro countries, and 14 % when the control group consists of trade between non-euro countries only. The study is noteworthy also for providing country estimates and showing that the euro effect varies considerably across countries but is not owed to one or two outliers.

Baldwin, Skudelny and Taglioni (2005)
In contrast with other studies, this study pools the data. It thereby answers the question: Do countries that belong to the currency union trade more than other countries? Studies based on panel data answer the question: Do countries trade more when they become members of the currency union? The estimates are considerably higher than in other studies, and range from 19 % to 112 % for trade between euro countries, depending on the precise specification, and from 22 % to 24 % for trade between euro and non-euro countries. The study is notable for being the only study to present a theoretical explanation of why elimination of relatively insignificant trade barriers can yield very large effects. The authors build on the stylised fact that exporters tend to be large firms and that most firms do not export. In their model, small firms are relatively more affected by reduced uncertainty about the net revenue from exporting. Elimination of nominal exchange rate uncertainty leads to relatively more exports by small firms and to small firms becoming exporters. The effect is shown to be nonlinear and increasing as the uncertainty becomes smaller.

Baldwin and Taglioni (2006)
Baldwin and Taglioni base their estimates of euro effects on very disaggregated data, namely bilateral exports at the six-digit level of the Harmonized System. Some 5 000 products at this level of aggregation, 20 countries and 10 years (1994-2003) yield 16 million observations with positive trade flows. The large number of observations forces the authors to aggregate: they look at exports from single countries to the aggregate of nineteen destination countries and exports from the aggregate of nineteen

source countries to single destination countries. Introduction of the euro is estimated to have raised trade by 3 to 4 % both between euro and between euro and non-euro countries (with the largest estimates from non-euro to euro countries). The study is also noteworthy for being the first to attempt to estimate effects on the intensive and extensive margins of trade. The estimates indicate positive and modest effects on both margins. All estimates in the study are for individual countries as either source of destination countries. This makes it hard to evaluate the average effect.

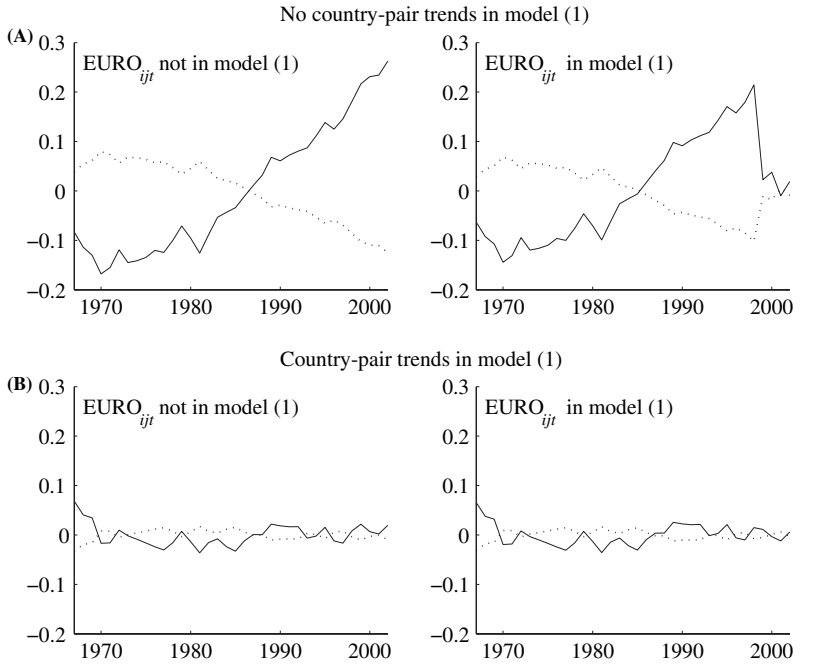
Gomes, Graham, Helliwell, Kano, Murrey and Schembri (2006)
This is a critical examination of the study by Micco et al (2003). It extends the time period from 1992-2002 to 1980-2003 and finds clear evidence of a longer-term trend of increasing trade between the countries that joined the currency union and of decreasing trade with other EU countries for the EU countries that did not join, namely Denmark, Sweden and the UK. The authors conclude that Micco et al (2003) have not identified euro effects on trade but longer-term trends that have other causes than the switch to a common currency. Two other studies below make essentially the same argument.

Baldwin and Taglioni (2007)
This paper is noteworthy for its focus on the specification of the gravity equation. The paper argues, correctly, that the influence of "multilateral trade resistance" (Anderson and van Wincoop, 2003), which can be proxied by exporter and importer fixed effects, should be time-variant. They also argue that the country-pair fixed effects, which are used to capture the influence of geographical and cultural distance, should also be time-variant, since some of the distance factors, such as transportation costs, are changing over time. This is correct in principle. The problem is that the country-pair fixed effects risk capturing more than distance factors and may, in particular, capture euro effects. A comparison of different specifications in the paper provides strong evidence that this is indeed the case. When time-varying exporter, importer and country-pair fixed effects are included simultaneously, the euro's effect on trade in the currency union becomes significantly negative and economically quite large.

Bun and Klaassen (2007)
Bun and Klaassen convincingly make the same point as Gomes et al (2006). Figure 2 is reproduced from their study.

The two upper panels show that the residuals of the standard gravity equation estimated for euro effects are trending upwards (the solid lines). The

Figure 2 Long term trend in the data



Source: Bun and Klaassen (2007).

specification behind the left-hand panel is without a dummy variable for trade between euro countries. The right-hand panel shows what happens when a dummy variable is added: it picks up the trend from 1999 and onwards. The two lower panels show the same experiment, except that the gravity equation now includes country-pair specific time effects that are allowed to vary over time. Now, the time series of residuals is without trend and is practically the same without and with a dummy for trade between euro countries. The euro effect on trade between euro countries is reduced to a mere 3 % by the addition of country-pair specific, time-variable effects.[6]

[6] The study also improves on the standard error computations by making standard errors robust not only to heteroscedasticity but also to serial and cross-sectional correlation. The non-stationarity and co-integration features of the data have also been accounted for.

It is clear that there are different trends in trade between the countries that adopted the euro compared with trade of the three EU countries that did not, and that this is likely to be captured by the euro dummy variable. On the other hand, there is a risk that the country-pair specific variables that are added to correct for the omitted variable bias create a bias against a euro effect, that is, there is a risk that the country-pair specific, time-variable effects pick up the euro effect.[7]

Micco et al (2003) and Flam and Nordström (2003) find a clear break in the year-by-year euro estimates before and after the start of the currency union, especially for trade between euro countries. Their specification of the gravity equation includes time-constant country-pair dummies and variable time effects common to all countries.

Flam and Nordström (2007)
This study differs from the authors' earlier study by including more years with the euro and by providing separate estimates for existing trade – the intensive margin – and new trade – the extensive margin. The euro is estimated to have increased trade between euro countries by 26 % in 2002/06 compared with 1995/98 and compared with trade between non-euro countries, and to have increased trade between euro and non-euro countries by about 12 %. Changes in the extensive margin are approximated by changes in the number of products at the six-digit level of the Harmonized System of product classification. They are estimated to be proportionally greater than effects on the intensive margin.

Baldwin and Taglioni (2008)
The authors argue that account should be taken of the fact that the effects of both the Single Market and the euro take hold gradually. They use indices of monetary and financial integration and of Single Market integration; both based on the number of measures taken and the degree of implementation, and combine these with dummy variables for the euro and the Single Market. The result is that the euro effect almost disappears – it is a mere 2 % on trade within the currency union. Two criticisms can be made of the procedure. First, the indices are to a great extent arbitrary – it is practically impossible to assign appropriate weights to different measures and to measure the impact of different degrees of implementation of different measures. Second, any effect of the euro will be estimated relative to the indices, which themselves are part and parcel of the Single Market

[7] Bun and Klaassen (2007) state in passing that adding a linear trend or nonlinear trend for each country pair yielded very similar results to the year effects.

and the currency union, respectively. The fact that the currency union has brought increased financial integration should not be subtracted from the currency union's effect on trade.

Berger and Nitsch (2008)
This paper essentially makes the same point as Gomes et al (2006) and Bun and Klaassen (2007), namely that trade between the original euro countries has been increasing relative to other trade for a long time, and that the dummy variables introduced at the end of a long period only capture this trend. The paper introduces a time trend in a data set that extends back to 1948 and ends in 2002 and finds that the trend eliminates the euro effects. Several criticisms can be levied against such an approach. The authors explain the long-term trend by various policy measures that have been introduced over time as part of the construction of the EU. If the trend prior to 1999 can be explained by policy measures, and the increase in trade after 1999 is to be explained by the common currency, the former should not be used to explain away the latter. The linear trend is estimated to be 0.3 to 1.7 % per year. The estimated increase in trade around 1999 by other studies is much greater. Therefore, the trend cannot explain much of the substantial increase in 1999.

Berthou and Fontagné (2008)
Most studies use aggregate trade data. This study uses data on the trade of all French firms between 1999 and 2002. One advantage of disaggregated, so-called micro data is that they contain the number of destination countries per year, the number of products per firm, the number of shipments and the value per shipment. One disadvantage at present is that micro data only exist for a few countries and for a limited number of years, which means that estimates of euro effects are particular to the country for which data are available. The authors estimate that French exports to other euro countries increased by about 19 % over exports to non-euro countries in terms of an increase in the number of destination countries for each product and number of products exported – the extensive margin. No effect was found for the value of exports per product – the intensive margin.

Brouwer, Paap and Viaene (2008)
This study looks at euro effects on both trade and FDI. Its main purpose is to calculate the euro effects on trade and FDI for ten new EU member countries if they were to join the currency union, and to see if trade and FDI are substitutes or complements. Estimates of euro effects of the present euro countries are used to simulate euro effects for the new EU

members. The euro is estimated to have increased trade between present euro countries by about 7 % and exports from euro to new EU members by about 35 % in the preferred model. The difference in results from several other studies using a similar specification is probably owing to a different set of countries appearing in the control group.

Cafiso (2008)
Cafiso estimates the cost for trade of crossing the national border by using a measure of external relative to internal trade. He finds no significant change in panel data in what he calls the border effect around 1999 and therefore concludes that the euro effect on trade is owed to some other factor or factors than the cost of crossing the border.

Chintrakarn (2008)
This study uses a different econometric technique than all other studies in the euro-trade and euro-FDI literature.[8] The purpose is to deal better with the possibility that the countries that decided to join the European currency union share common characteristics that other countries lack (a selection problem). These characteristics may be observable as well as unobservable. Observable characteristics are dealt with by selecting control group country pairs that have similar observable characteristics to the currency union country pairs. Several ways of finding the most similar control group countries are used. Unobservable characteristics are controlled for by difference-in-differences comparisons. After a matching control group is found, the average level of trade of the currency union country pairs is compared with the average between the other country pairs. This means that the technique does not involve the estimation of coefficients based on a particular functional form of the gravity equation, which should be an advantage. The study finds that two countries sharing the euro trade between 9 and 14 % more than other country pairs. The results are very similar to gravity estimates for the same period (ending in 2002), which is reassuring. It is also reassuring that the choice of control group countries in other studies seems to be unaffected by a selection problem.

De Nardis, de Santis and Vicarelli (2008)
This and two of the author's earlier studies are the only ones to introduce dynamics into the panel data model, that is, add lagged values of the dependent variable on the right-hand side of equation (1). Past bilateral exports are meant to reflect fixed costs and inertia created by such costs.

[8] Persson (2001) introduced this technique in his critical examination of the seminal article by Rose (2000) on the effects on trade of currency unions in general.

The estimates should be interpreted as short-term effects. The euro effect is estimated to be relatively small or 4 %. The short run estimate can be used to obtain a longer run effect, which in turn will depend on an assumption of how long it takes before the euro effect is fully realised. The long run estimate, based on data for the period 1988 to 2004, is 17 %. It must be noted that these estimates are for exports between euro countries relative to exports between non-euro countries and between euro and non-euro countries. We know that the latter kind of exports seem to have been affected by the euro. The estimates would therefore have been greater if the benchmark had been limited to exports between non-euro countries. The estimates are also likely to be affected by the way the data have been deflated. Exports and GDP in current prices expressed in dollars at current exchange rates have been deflated by country-specific value-added deflators. This means that the constant price data are affected by changes in nominal exchange rates.

Flam and Nordström (2008)
This paper focuses on the effects on FDI, but compares effects on trade and FDI to show that controlling for time-varying effects of the Single Market has a relatively small effect on the estimates of euro effects on trade, but eliminates euro effects on FDI.

Frankel (2008)
This study addresses the question of why the euro effects on trade are estimated to be much smaller than the trade effects of other currency unions. Rose (2000) estimated that currency union members trade about three times as much with each other as with other countries. Frankel finds that the difference is not owed to different country size – euro countries are generally much larger than members of other currency unions – or lags – the European currency is young relative to other currency unions – or reverse causality – that other currency unions were formed because trade was already large. Instead, he finds the difference to be owed to sample size. When a large set of countries, rich as well as poor, and a much longer time period (1948 to 2006) are used, the trade effects of the euro and other common currencies become fairly similar in size and much larger than with a smaller set of developed countries in the sample and a shorter time period.

Chen and Novy (2009)
The focus of the study is on measuring trade barriers on a disaggregated (industry) level and to find if trade barriers have declined during the peri-

od 1999 to 2004 among a set of OECD countries. In essence, the trade barrier in a given industry is measured by the ratio of domestic to foreign bilateral trade. This measure is the dependent variable in a gravity equation with geographical, policy and various other control variables on the right-hand side. It is found that trade barriers have declined substantially, but that the introduction of euro notes and coins in 2002 contributed practically nothing to the decline. This is hardly surprising. The settlement of trade transactions is made via bank accounts, not by notes and coins, and the main contribution of the euro to trade comes from irrevocably fixed exchange rates, which were established in 1999.

Discussion and conclusions

The review of the literature gives rise to several questions regarding the relation between the European currency union and trade:

After controlling for all known factors that affect trade, is there an additional effect on trade between euro countries after 1999?

If an additional effect exists, what causes it?

If it is an effect of the euro, how large is it?

1. Additional effect or part of a long-term trend? The studies by Gomez et al (2006), Bun and Klaassen (2007), and Berger and Nitsch (2008) claim to show that no particular effect on trade exists after 1999. They do show that a long-term trend of a relatively high rate of growth in trade exists between the countries that formed the currency union in 1999. Bun and Klaassen (2007) include country-pair specific linear time trends and Berger and Nitsch (2008) a common linear time trend for euro countries. Once such trends are introduced into the statistical analysis, a very small or no increase in trade remains. Micco et al (2003) and Flam and Nordström (2003) demonstrate, on the other hand, that, after controlling for a host of factors that determine trade, that a significant break in the time series of the residual exists in 1999. The apparent contradiction between these two sets of findings is at least partly explained by the length of the time period. Bun and Klaassen (2007) and Berger and Nitsch (2008) use data for the periods 1967 to 2002 and 1948 to 2003, respectively. Even modest time trends – of about 1.5 % per year in Berger and Nitsch – estimated for a long time period will dwarf a relatively small increase at the very end. Flam and Nordström (2003) estimate a jump in trade between euro countries relative to non-euro countries of 10 % between 1997 and 1999, which is too large to be explained by any increase in the long-term trend. Unfortunately, one cannot take

account of time trends when working with much shorter time periods – most studies use all or part of the 1990s and the number of years with the euro that were available at the time – since the trend should be estimated on data for a sufficient number of years before the introduction of the euro.

Even if it were the case that the euro period fitted nicely into a longer-term trend of increasing trade between the countries that formed the currency union, it would be wrong to conclude that a euro effect does not exist. Berger and Nitsch (2008) attempt to explain the long-term trend by different measures taken by policymakers to promote European economic integration, such as the elimination of tariffs on industrial products in the 1960s, exchange rate cooperation starting in the 1970s, and the creation of the Single Market starting in the 1980s. To the extent that they are right, it is wrong to use the time trend caused by earlier policy measures to explain away the trade effects of currency union, the latest policy measure on the road to European economic integration.

2. Is it the euro? Baldwin and Taglioni (2008) have argued that estimates of the euro effect on trade are too large because insufficient account is taken of the effect of the Single Market. It is not sufficient, as some studies do, to control for the Single Market with a time-invariant dummy to capture any higher level of trade between countries participating in the Single Market. Instead, one must control for increasing effects of the Single Market over time. Baldwin and Taglioni use an index of the number of measures implemented in the participating countries as a proxy for the "size" of the Single Market and are left with quite small euro effects on trade. The index of Single Market implementation is questionable, however, since it gives all measures equal weight. Flam and Nordström (2003) provide year-by-year estimates of both the Single Market and the euro, and Flam and Nordström (2007) also allow time-varying effects. Both studies find that the euro estimates are little affected if the impact of the Single Market is allowed to vary over time. Their way of controlling for time-varying effects is less restrictive than that of Baldwin and Taglioni.

   Micco et al (2003) and Flam and Nordström (2003, 2007) find that the year-by-year dummy variable estimates purported to capture euro effects on trade between currency union countries show a statistically significant break in 1999. Moreover, the estimates tend to increase over time (Flam and Nordström, 2007). These are strong indications

that the dummy variable picks up euro effects. It is difficult to come up with an alternative explanation.

3. How large is the euro effect? It can be seen in Table 1 that estimates of the euro effect on trade between euro countries and on trade between euro and non-euro countries differ greatly. Estimates of euro effects for trade between euro countries compared with trade between non-euro countries are larger than estimates for trade between euro countries compared with trade between euro and non-euro plus trade between non-euro countries. The reason is that trade between euro and non-euro countries has been positively affected by the euro. In other words, it makes a difference whether the control group consists of non-euro countries only or also includes trade between euro and non-euro countries.

   Estimates with only EU countries in the control group (Denmark, Sweden and the United Kingdom) or only European countries in the control group tend to be lower than when non-European countries are included as well. Indeed, Frankel (2008) shows that the euro effect is much larger when a large set of developing countries are brought into the control group, but does not put much faith in the results. The choice of control group obviously affects the estimates. Most studies use the richer OECD countries that are not members of the currency union. The study by Chintrakarn (2008) tells us that this choice of control group countries is justified. He uses a statistical matching method to find control group countries that are as similar to the euro countries as possible and arrives at essentially the same countries and very similar estimates.

   Otherwise, there are no discernible patterns in the results. The number of years with the euro does not seem to matter – relatively large estimates exist both for data ending in 2002 and data ending much later – and estimates do not differ systematically depending on whether the study is published or not.

   So how large are the euro effects on trade? There are good reasons not to introduce long-term trends with unknown causes into the analysis. Instead, one should stick to known factors, and specifically known policy measures such as the Single Market, and allow their effects to vary over time The period with the euro should obviously be as long as possible. This leaves us with only a few studies, namely those by de Nardis et al (2008), Flam and Nordström (2007) and Frankel (2008). Their estimates of euro effects on trade within the euro area vary between 10 and 30 %. The estimate by Flam and

Nordström (2007) is highest – 28 % – probably because they include trade between non-euro countries only in the benchmark, not trade between euro and non-euro countries.

One may ask what this means in terms of income or GDP? To give as good an answer to the question as possible would require the use of a general equilibrium model of the world economy or at least the European economy. The answer would, however, still be dependent on a number of questionable model features, parameter estimates and data. A back-of-the-envelope calculation can be made as follows. Assume that joining the currency union would result in 12 % higher imports. (This is the estimate given by Flam and Nordström, 2007. The shares of imports from euro and non-euro countries respectively are of no importance, since imports are estimated to increase by 12 % from both groups of countries.) Assume that the domestic resources used to produce the additional 12 % of exports used to buy the additional 12 % of imports have become 10 % more productive by an increased exploitation of comparative advantage, economies of scale and increase in the variety of inputs and final goods available to producers and consumers. Assume further that the additional exports contain additional imports, so that the domestic value added is 50 % of the additional value of exports. Assume also that the initial value of exports or imports relative to GDP is 50 %. This yields an increase in GDP of: 0.10 x 0.12 x 0.50 x 0.50 = 0.003 or 0.3 %. The estimate should not be taken literally – it can easily be halved or doubled by making other plausible assumptions – except to indicate that any increase in trade caused by the euro translates into a very small increase in income or GDP, probably a small fraction of 1 %.

5 SHOULD THE EURO BE EXPECTED TO AFFECT FDI?

There are several theoretical models that purport to explain FDI, that is, present causes and effects of FDI. Most of them can be applied to analyse the impact of switching from a national to a common currency. Unfortunately, their predictions differ, since each model focuses on different aspects of cross-border investments.

It is usual to classify FDI as horizontal and vertical although the distinction is not so clear-cut in practice.[9] The former usually refers to the establishment of local production for local sales, whereas the latter refers to the establishment of production in different locations depending on differences in costs owing to comparative advantage. Data for the US indicate that horizontal FDI dominates vertical FDI; foreign affiliates of US firms export back only about 15 % of their output (Brainard, 1997; Markusen, 2003).

Models of the so-called proximity-concentration trade-off assume FDI to be horizontal and a substitute for exports in a world of two countries; high trade costs make it profitable to incur the additional fixed cost associated with FDI and local sales instead of exporting to the local market. There is some empirical evidence in favour of such a trade-off. Brainard (1997), Carr, Markusen and Maskus (2003) and Yeaple (2003) find that FDI relative to exports increases with distance, but that distance by itself has a negative impact on FDI. Blonigen (2001) finds that new Japanese FDI in the US leads to increased exports of intermediate inputs and decreased exports of the finished products. If, however, a third or more countries are added, it is no longer certain that trade and horizontal FDI are substitutes. A particular form of horizontal FDI is so-called export-platform FDI, when multinationals establish foreign affiliates to sell not only in the host country market but also in the markets of neighbouring countries. Free trade within a common market such as the EU attracts multinationals to establish affiliates in one country to serve other countries within the common market. An example is Ireland, which has attracted a great amount of FDI from multinationals seeking better access to the rest of the EU market. Blonigen et al (2004) and Foad (2006) find evidence that higher GDP in neighbouring countries increases US FDI in individual European countries. Thus, in a multi-country world, trade and horizontal FDI can be complements as well as substitutes.

[9] Markusen (1983) provided the first formalisation of horizontal FDI, where trade and FDI are substitutes, and Helpman (1984) provided the first formalisation of vertical FDI, based on comparative advantage and factor proportions theory.

Vertical FDI is considered to be driven primarily by differences in wage costs. Labour-intensive parts of production are commonly located in low-wage countries. It is not clear how a change in transaction costs should affect vertical FDI. Neary (2007) demonstrates that a lower tariff in the host country discourages vertical FDI and encourages exports for the same reasons as with horizontal FDI, whereas a lower tariff in the source country encourages vertical FDI since it reduces the cost of exporting back to the parent firm. The net result of mutual, bilateral tariff reductions is therefore ambiguous.

A relatively small part of FDI takes the form of establishing or expanding production and other facilities abroad, so-called greenfield investment. About 70 to 80 % of FDI between OECD countries takes place in the form of mergers and acquisitions (Head and Ries, 2005). FDI by merger and acquisition can be motivated by trade cost considerations, as for horizontal FDI, or comparative advantage, as for vertical FDI, but can also be motivated by strategic considerations – reducing competition – or efficiency, for example by coordination of production or marketing or getting access to a superior technology. Gugler, Mueller, Yurtoglu and Zulehner (2003) find that 54 % of the cross-border mergers and acquisitions in OECD countries are conglomerate, i.e. strategic, 42 % horizontal and only 4 % vertical. The model of mergers and acquisitions by Neary (2007) shows that they tend to move in the same direction as trade, that is, becoming complementary, but that the effect of a small reduction in transaction costs on mergers and acquisitions is ambiguous.

In summary, it seems that vertical FDI and trade tend to be complements but that, in practice, vertical FDI is a minor part of total FDI. If horizontal FDI is dominant, trade and FDI tend to be substitutes. If, however, export-platform FDI is the main type of horizontal FDI, trade and FDI may be complements rather than substitutes. Furthermore, much FDI takes the form of mergers and acquisitions, where the motives can be strategic and the effects of the introduction of a common currency are ambiguous. All in all, it must be concluded that trade and FDI can be both complements and substitutes and that the net effect depends on the parameter values, that is, on the particular circumstances.

What can the different theories and models predict in terms of effects of introducing a common currency? First, the elimination of nominal exchange rate uncertainty should serve to increase FDI regardless of the reasons for FDI. The argument that there is an option value in waiting to undertake investments in connection with starting to export in the face of nominal exchange rate uncertainty is also valid and probably much

stronger for FDI than for trade. Second, a common currency means a reduction in currency transaction costs. This should also serve to increase FDI whatever the reason for them. The value-added chain in production is increasingly divided into more stages and spread over national borders in Europe. Even small reductions in transaction costs can add up to a considerable share of the total cost. Therefore, a common currency should promote vertical FDI within the euro area. A common currency should also serve to increase horizontal FDI, particularly in the form of platform FDI from countries located outside the euro area. They can now invest in production and distribution facilities in one euro country, which then serves as a platform for exports to other euro countries without currency transactions costs being incurred. In the case of both vertical and platform FDI, trade and FDI are complements.

6 EMPIRICAL EVIDENCE OF EURO EFFECTS ON FDI

Table 2 summarises the main results of studies on the euro impact on FDI. Only a third as many studies have been made on FDI effects as on trade effects. One reason may be the poor quality of FDI statistics. The main source is central banks, which collect data for balance of payments purposes; FDI is part of the capital account of the balance of payments. Central banks collect data on the flows and stocks of both incoming and outgoing investments. The correlation between data for the same flow and stock collected by different central banks – as incoming investment by one and outgoing investment by the other – is fairly high, but far from perfect. There is a large number of zeros in the flow data even between EU countries, which seems unlikely. Some countries collect FDI data for other purposes – such as employment and ownership – but these data are not comprehensive or standardised across countries.[10]

Data on part of FDI, namely mergers and acquisitions, collected by private firms do exist, however, and are increasingly used by researchers.

Empirical research to explain bilateral FDI has used the gravity model, but theoretical underpinnings of this practice were provided only recently. Kleinert and Toubal (2005) derive gravity equations for both bilateral horizontal FDI – with symmetric as well as heterogeneous firms as in Melitz

Table 2 The euro effect on FDI: summary of empirical results

		Results	
Author(s)	Period	Between euro countries	Between euro and non-euro countries
Brouwer, J, R. Paap and J. - M. Viaene (2008)	1980-2005	21%	52-129%
Coueurdacier N., R. de Santis and A. Aviat (2009)	1985-2004	155%	80%
de Sousa, J. and J. Lochard (2006)	1982-2004	26% (stock data) 62% (flow data)	[not estimated]
Flam, H. and H. Nordström (2008)	1995-2006	0%	significantly negative
Foad, H. (2006)	1988-2002	0.18% of GDP	[not estimated]
Petroulas, P. (2007)	1992-2002	16%	8%
Schiavo, S. (2007)	1980-2001	200%	100%

[10] Patterson, Montanjees, Motala and Cardillo (2004) describe in detail data availability, concepts and recording practices.

(2003) – and bilateral factor proportion-based vertical FDI. Head and Ries (2005) derive a gravity equation for bilateral, strategically motivated FDI. Bergstrand and Egger (2007) derive a gravity equation from the general-equilibrium knowledge-capital model generalised to three factors and three countries. This model generates both horizontal and vertical FDI plus trade. Thus, the use of the gravity equation to estimate effects of the euro on FDI is theoretically justified.

De Sousa and Lochard (2006)
This study uses a standard gravity equation, data for the period 1982 to 2004, FDI stocks as the dependent variable and ten OECD countries as the control group. It estimates that the euro has increased FDI between euro countries by 26 %. The estimate is remarkably robust to changes in the specification and the control group. Flow FDI data yield a much higher estimate of 62 %. The authors argue that the flow estimate should be higher, especially in the few years after the start of the currency union, since flows depend on the desired levels of FDI stocks.

Foad (2006)
Foad begins with the observation that, starting in 1999, FDI from the United States to euro countries shows a marked increase in unconditioned data, whereas FDI to the United Kingdom, Denmark and Sweden shows a marked decrease. United States FDI into Europe is export-oriented, and about one-third of the affiliates' output is exported to neighbouring markets. The study analyses trade and investment flows to see whether the establishment of the currency union has made the member countries more attractive targets for FDI and non-members less attractive. It proceeds in two stages. In the first, exports from host country markets are estimated. In the second stage, the predicted exports are included in a dynamic panel to explain FDI from the United States to European countries with a gravity equation, controlling for market size, the attractiveness of host countries as a platform for exports, and nominal exchange rate volatility. It does not use a control group and therefore does not control for unknown omitted variables as with difference-in-difference estimation. Exchange rate volatility is found not to have a significant effect whereas a dummy variable for currency union membership is very significant and robust. The euro is estimated to increase the stock of FDI in euro countries by the equivalent of 0.18 % of GDP between 1998 and 2002 as compared with 1985 to 1997.[11]

[11] FDI is measured relative to GDP to neutralise the effect of country size.

Foad suggests that the euro dummy may capture long-term, forward-looking exchange rate uncertainty, whereas the measure of exchange rate uncertainty captures high-frequency changes in the past. The study also looks at a counter-factual, namely the FDI presumably lost by Denmark, Sweden and the United Kingdom through not joining the currency union. The latter country is estimated to have lost approximately the equivalent of 2 % of GDP in FDI from the United States.

Petroulas (2007)
Petroulas uses a gravity equation and data for FDI flows between eighteen countries during the period 1992 to 2001. In order to mitigate the questionable quality of the data, he uses an average of the same FDI flow reported by the host and source country and, to fill in missing data where one observation exists, reported by either the host or the source country, he extrapolates. He estimates that the euro has increased FDI between euro countries by 16 %, from euro to non-euro countries by 11 % and from non-euro to euro countries by 8 %.

Schiavo (2007)
Schiavo also uses FDI flow data for 25 countries and the period 1980 to 2001. Like Petroulas (2007), he averages observations for the same flow reported by the host and source country, but does not include flows where one observation is missing. Schiavo provides both OLS and Tobit country-pair fixed effects estimates. The former must discard all observations with negative values. With OLS, the euro is estimated to increase FDI flows between euro countries by more than 200 %, and FDI flows between euro and non-euro countries (average for both directions) by close to 100 %. The corresponding Tobit estimates are 300 and 200 %. In both cases, nominal exchange rate volatility does not have any significant effects on FDI flows. An analysis of the residuals for the three non-euro EU members suggests that opting out of the euro has had a negative effect for Sweden, but not for Denmark and the United Kingdom.

The difference in results between Schiavo and Petroulas (2007) indicates that they are quite sensitive to the treatment of missing observations and negative values. They differ in that Petroulas "estimates" missing observations and uses absolute values for his dependent variable, including negative values, whereas Schiavo discards observations where data from either the host or source country are missing and, in his OLS estimation, also discards negative observations.

Brouwer, Paap and Viaene (2008)
This study also estimates a gravity equation, but on stock data for FDI and for the period 1980 to 2005. It includes fifteen older EU members and the ten countries that joined in 2004, plus four non-EU countries in the control group. It finds, when the gravity equation includes country-pair fixed effects and common time effects, that the euro impact on FDI is 21 % between euro countries, 129 % between euro countries and new member states (average for both directions), 52 % between euro countries and Denmark, Sweden and the United Kingdom. No significant effect is found for FDI between euro countries and non-EU countries.

It must be noted that the control group consists of only four countries, Canada, Japan, Switzerland and the United States, and therefore the results could be quite sensitive to the choice of control group. The high estimate for FDI between euro countries and the ten new EU members indicates that one variable is missing, namely the return on investments in different countries. After the break-up of the Soviet bloc and the transition to market economies, investments have been flowing to the new member states to take advantage of new markets and low wages. It is likely that the dummy for FDI between euro countries and the new member states has picked up an increasing trend.

Flam and Nordström (2008)
This study differs from the previous studies by allowing for time-varying effects of the Single Market. The panel consists of ten euro and ten non-euro countries, the time period is 1995 to 2006, and the dependent variable is FDI stocks. It finds that the euro increased FDI between euro countries by 35 % in 2002 to 2006 compared with 1995 to 1998 and compared with FDI between the ten control group countries, and by 19 % from euro to non-euro countries, when the Single Market is not controlled for. The estimate for FDI between euro countries is of the same order as the estimates in de Sousa and Lochard (2006) on stock data, Petroulas (2007) on flow data, and Brouwer et al (2008) on stock data, all of which control for a time-constant (level) effect of EU membership. When, however, Flam and Nordström introduce a time-varying effect of the Single Market, the positive euro effects become negative but insignificant. The previously insignificant effects on FDI from non-euro to euro countries become significant, negative and large (– 34 % in 1999 to 2001 and – 21 % in 2002 to 2006). Flam and Nordström then perform the same experiment with trade as the dependent variable and find that the euro effects generally become larger, not smaller, when time varying Single Market effects are controlled for. They draw the conclusion that the euro has had no or a negative impact on FDI.

Coueurdacier, de Santis and Aviat (2009)
This study uses data on mergers and acquisitions (M&As) – including company names, source and host countries, and the value of the transaction – collected by Thomson International for commercial purposes. A large share of FDI takes the form of M&As. The panel data cover M&As in ten manufacturing and ten service sectors from 21 source to 31 host countries between 1985 and 2004. It is claimed that these data on M&As cover about 75 % of all M&As in the world from 1999 to 2004. It is likely that these data are of considerably higher quality than the public data collected by OECD that are used in most other studies.[12]

The study estimates that the euro effect on FDI between euro countries in manufacturing industries is about 155 % and about 80 % from non-euro to euro countries. The effects of EU membership in manufacturing are estimated to be even larger: about 200 and 140 %, respectively. Most of the M&As took place within industries. Estimates of effects within manufacturing industries suggest a positive relation between effects on trade and M&As. These findings indicate that trade and FDI were complements on the aggregate level; the introduction of the euro made some firms increase their exports whereas other firms increased their FDI in the form of M&As. No significant effects on vertical FDI – M&As between sectors – were found within the euro area, but non-euro countries increased their vertical FDI in euro countries by about 140 %. Balassa indices of revealed comparative advantage and the market capitalisation of public stocks relative to GDP were included among the explanatory variables. The estimated coefficients suggest that trade liberalisation – through the Single Market – and the common currency made firms more competitive and induced them to acquire competitors in other countries. In contrast with manufacturing, no significant effects of the euro were found for services. The authors argue that this is owed to remaining barriers to trade in services that also function as barriers to M&As.

Discussion and conclusions
It is harder to draw conclusions from the empirical research on the euro's impact on FDI than that on trade. Fewer studies have been made and the results differ by an order of magnitude. The three studies that use stock data from balance of payments statistics, Brouwer et al (2008), de Sousa and Lochard (2006) and Flam and Nordström (2008), arrive at lower estimates than two of the studies based on flow data, Coeurdacier et al (2007)

[12] Estimation is therefore made with Poisson Pseudo Maximum Likelihood, since OLS would yield excessively high estimates as shown by Santos Silva and Tenreyero (2006).

and Schiavo (2007). De Sousa and Lochard actually also check their estimates by using flow data and obtain a much higher estimate (62 % versus 26 % for FDI between euro countries in 1999 to 2004). The reason that the estimates are higher with flow data could be that there was a boom in FDI at the turn of the millennium, induced by a change in relative prices and returns on investments in connection with the stock market boom, and that the induced flows were part of the adjustment to desired new equilibrium stocks. The corresponding changes in stocks naturally tend to be much smaller. The low estimates based on stock data in the study by Petroulas (2007) do not fit the pattern. It is puzzling that his study and that by Schiavo (2007), which are both based on the same flow data ending in 2001, arrive at very different estimates, 16 % against 300 %. Part of the explanation could be that Schiavo's data include the 1980s in the reference period, when the level of FDI was generally much smaller, or that the studies deal differently with missing and negative values. The studies by Foad (2006) and Coeurdacier et al (2009) use flow data that are probably much more reliable than the balance of payments data. Both arrive at large impacts of the euro on FDI and on M&As respectively, both between euro countries and from non-euro to euro countries.

All empirical evidence points to quite substantial euro effects on FDI, except the evidence provided by Flam and Nordström (2008). The latter study controls for time-varying effects of the Single Market, which is not done in the other studies. It is likely that the Single Market takes effect gradually and that this should be controlled for. Flam and Nordström find that controlling for time-varying Single Market effects eliminates all euro effects or even makes some of them significantly negative. In contrast, trade effects of the euro are generally increased when time-varying Single Market effects are controlled for.

It is hard to draw a firm conclusion from the conflicting evidence. All studies but one find evidence of substantial euro effects on FDI. The great differences in estimates are disturbing and a reason for caution. The macro data on FDI are of poor quality, but the two studies that use micro data of much better quality also find substantial positive effects. We conclude that the euro has had a substantial impact on FDI, but note that the conclusion is uncertain until it can be shown that controlling for time-varying effects of the Single Market does not eliminate the impact of the euro on FDI.

SAMMANFATTNING PÅ SVENSKA

Målet för EU är ”en allt fastare union mellan de europeiska folken”. Ekonomisk integration har från början använts som ett verktyg för att nå målet: industritullarnas avskaffande på 1960-talet, växelkurssamarbete sedan 1970-talet, upprättandet av en inre marknad för varor, tjänster, kapital och arbetskraft sedan 1980-talet och – som det senaste steget – införandet av en gemensam valuta och en gemensam penningpolitik 1999. Den inre marknaden och den gemensamma valutan marknadsfördes under parollen ”One Market, One Money”.

Mot denna bakgrund är det viktigt att veta om den gemensamma valutan har hållit vad den lovat, nämligen att åstadkomma mer handel och investeringar mellan de länder som anslöt sig till den Europeiska valutaunionen. Detta är särskilt viktigt för de länder som har valt att inte ansluta sig tills vidare – Danmark, Storbritannien och Sverige – och för de nya medlemsstater som så småningom kommer att försöka ansluta sig. Om det kan påvisas att euron har åstadkommit mer handel och investeringar mellan medlemmarna i den monetära unionen blir argumentet för att ansluta sig starkare.

De akademiska ekonomer som hade studerat relationen mellan växelkursosäkerhet och handel delade inte förväntningarna före etablerandet av den monetära unionen om att euro skulle ge mera handel. Deras empiriska forskning visade att en minskning av volatiliteten i nominella växelkurser hade en mycket liten eller ingen effekt på handeln. De drog därför slutsatsen att ersättandet av den begränsade växelkursvolatilitet som hade funnits inom ramen för den s.k. växelkursmekanismen – EU:s valutasamarbete – med en gemensam valuta och därmed inga växelkurser skulle ha en försumbar effekt på handeln. Samma slutsats drogs också om utländska direktinvesteringar (foreign direct investment, FDI), även om betydligt mindre forskning hade genomförts om effekterna av växelkursvolatilitet på FDI.

Tillräckligt lång tid har passerat med en gemensam valuta för att det ska finnas tillräckligt med statistik för att tillåta statistisk analys. För närvarande har åtminstone 18 studier om eurons effekter på handel och 6 studier om dess effekter på FDI genomförts. De gås igenom i rapporten i syfte att nå en slutsats om vilken effekt införandet av euron har haft på handel och FDI mellan medlemmar av valutaunionen och även mellan medlemmar och utanförstående länder.

Den teoretiska modell som används för att analysera effekten av euron på handel och FDI kallas för gravitationsmodellen. Modellen säger helt enkelt att export- eller investeringsvolymen från ett land till ett annat – motsva-

rande gravitationen inom fysiken – är en funktion av BNP hos avsändar- och mottagarlandet – vilket motsvarar kropparnas massa inom fysiken. Ju större BNP, desto större export eller FDI. Modellen säger också att olika slags friktioner minskar export- eller investeringsvolymen. Storleken på friktionen bestäms av bland annat av det geografiska avståndet, språkliga likheter eller olikheter, eventuell gemensam historia samt fiskala och administrativa hinder. Gravitationsmodellen har en bred användning i empirisk forskning och har vanligtvis högt förklaringsvärde. Trots analogin med fysiken, härleds den från vanlig konsumtionsteori och kan även härledas från standardmodeller i utrikeshandelsteorin.

Den största svårigheten för den statistiska analysen är att isolera effekten av euron från alla andra influenser på handel och investeringar. Den metod som används är hämtad från kliniska test av nya medicinska behandlingar eller mediciner. Länderna delas in i två grupper, en som har ”behandlats” med euron och en som inte har behandlats. Länderna i kontrollgruppen bör vara så lika länderna i behandlingsgruppen som möjligt. Skillnaden i nivån på handeln eller FDI före och efter behandling mäts för båda grupperna sedan influensen av alla andra tänkbara faktorer har rensats bort. Skillnaden före och efter jämförs sedan mellan de två grupperna. En eventuell skillnad mellan skillnaderna tolkas som orsakad av euron, precis som en eventuell skillnad mellan skillnaderna i en klinisk test skulle tillskrivas den nya behandlingen eller medicinen.

Av de 18 studierna av euroeffekten på handeln finner 15 statistiskt säkerställda och positiva effekter, de flesta ganska betydande. Skillnaderna mellan studierna beror framförallt på europeriodens längd – effekterna tenderar att öka med tiden - , på vilka länder som ingår i kontrollgruppen – effekten blir mycket större om mindre utvecklade länder ingår, och på specifikationen av gravitationsmodellen. Vår slutsats är att handeln mellan euroländerna har ökat med 10 till 30 % och handeln mellan euro- och utanförstående länder med hälften så mycket från 1995-1998 till 2002-2006, jämfört med handeln mellan utanförstående länder.

Tre studier drar slutsatsen att det som har tolkats som euroeffekter på handeln i själva verket är del av en trendmässigt växande handel mellan de länder som anslöt sig till den monetära unionen relativt handeln mellan andra länder. Det förefaller klart att en sådan trend existerar, men den är inte tillräckligt stark för att kunna eliminera allt det som andra studier estimerar som en euroeffekt. Dessutom måste man beakta vad som kan ha orsakat trenden. Det är troligt att den väsentligen beror på tidigare åtgärder för ekonomisk integration inom EU. Om så är fallet, kan inte trenden användas för att förklara effekterna av den senaste av sådana åtgärder.

Vad kan förklara de stora effekter på handeln som man kommit fram till? Den troligaste förklaringen är att den nominella växelkursosäkerheten eliminerats helt och hållet. Den tidigare empiriska forskningen om effekten av växelkursvolatilitet på handel fann att en minskning av volatilitet praktiskt taget inte hade någon effekt, men det förefaller finnas en fundamental skillnad mellan en minskning och att helt och hållet eliminera volatiliteten.

Det finns många olika motiv till FDI. Ett vanligt motiv är att komma förbi olika handelshinder. I detta fall är export och FDI substitut och vi bör förvänta oss att en positiv effekt av euron på handeln får en negativ effekt på FDI. Ett annat motiv är att dra fördel av skillnader i kostnader mellan länder. Det stora flödet av investeringar från västra till östra Europa är ett exempel. I detta fall är handel och FDI komplement. Ett ytterligare motiv är strategiskt. Genom att köpa företag i andra länder hoppas det uppköpande företaget att få större konkurrenskraft och kanske att förekomma konkurrenter. De olika motiven till FDI gör att det är oklart på förhand vilka effekter vi ska vänta oss av införandet av euron.

Sex studier har gjorts om eurons effekt på FDI. Fem av dessa kommer fram till att effekten är statistiskt säkerställd, positiv och ganska stor. Estimaten spänner från 16 till 200 procent när det gäller FDI mellan euroländer jämfört med FDI mellan utanförstående länder. En studie tvivlar på dessa resultat därför att de andra studierna inte har tillåtit att effekten av den inre marknaden får variera över tiden. Det kan förväntas att den inre marknadens effekt ökar i början, eftersom beslut om investeringar tar tid och eftersom den inre marknaden har införts gradvis. Vi drar slutsatsen att euron har haft en positiv effekt på FDI mellan euroländerna och även på FDI från utanförstående länder, men noterar samtidigt att slutsatsen är osäker med tanke på att den inre marknadens inverkan inte har tagits hänsyn till på ett tillfredsställande sätt och att antalet studier är relativt litet.

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