EMU and Swedish Trade

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Abstract

This paper estimates the effect of joining European Economic and Monetary Union (EMU) on Swedish Trade. Sweden is very open to international trade: exports and imports combined together amount to two-thirds of Swedish GDP. Almost half of this trade is with the Euro-zone. The empirical evidence presented here shows that currency unions are associated with substantially higher trade and welfare. I estimate that trade with the Euro-zone would increase considerably if Sweden joins EMU. Sweden's trade with the Euro-zone would probably rise by over fifty percent and could conceivably triple. A trade increase of this magnitude could result in a substantial boost to Swedish output and welfare.

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The effect of a common currency on trade is an important issue. The increase in trade stemming from a common currency is one of the few undisputed gains from European Economic and Monetary Union (EMU). Even EMU-skeptics such as Feldstein (1997) agree that substituting a single currency for several national currencies reduces the transactions costs of trade within that group of countries. Indeed, this was one of the official motivations behind the EMU project (European Commission, 1990).

Clearly it is cheaper to trade between two countries that use the same currency than between countries with their own monies. The question is: How much? Skeptics believe that (intra-EU) trade may only rise a little because of the Euro. For instance, the 1993 *Economic Report of the President* (pp 294-295) states "… There is uncertainty as to how much additional benefit will be yielded by the permanent fixing of exchange rates implied by a single currency." This seems reasonable: exchange rate volatility was low before EMU, and whatever volatility remained could be inexpensively hedged through the use of forward contracts and other derivatives. Europhiles, in contrast, think that sharing a common currency will lead to an increase in the depth of trading relations, while precluding the "beggar thy neighbor" competitive devaluations that can destroy a common market.

The primary objective of this paper is to resolve the argument by *estimating* the effect of currency union on trade using empirical data. The results are clear. Currency unions *do* in fact have an effect on trade. And it is large; possibly as big as the effect of joining a free trade area like the European single market or NAFTA. In particular, *I estimate that joining EMU is likely*

to increase Sweden's trade with the Euro-area substantially, leading to a significant increase in Swedish welfare.

If entering EMU *does* substantially increase Sweden's trade with the Euro countries, there will be important repercussions. Perhaps most importantly, a big increase in trade will lead to substantial extra gains from trade, primarily for consumers. In my work with Frankel (2000), I estimate that joining EMU may eventually raise Swedish GDP by over 20%, although this effect would be spread over decades. The reason is that more open economies tend to grow more quickly and consequently enjoy higher standards of living, even controlling for other factors.

To summarize: Sweden has much to gain from entering EMU in terms of increased trade and consequently higher GDP, gains that have been under-stated in the existing academic literature.

Methods for Determining the Relationship between Currency Unions and Trade

The relationship between currency union and international trade is clearly important. Thus, it is no surprise that economists have worked hard to quantify the effects of reduced exchange rate volatility on trade. Sadly, there is almost no consensus in the area, save that the effect (if any) is difficult to estimate, even with high-tech time-series econometrics.

Much ink has been spilled on the issue of international trade and the international monetary regime; there is a long and inglorious tradition of ambiguous, weak and negative results. For instance, the Calmfors Commission (1997, p. 50) stated "Many empirical studies have been done on the effects of exchange-rate fluctuations on the volume of foreign trade. The somewhat surprising, but fairly unanimous, conclusion is that these fluctuations seem to

influence foreign trade very little, if at all. This conclusion must be regarded as fairly robust, because the various studies have been done with different methods."

Essentially, researchers have looked at periods of high and low exchange rate volatility and attempted to map them into trade during the same periods. Unfortunately, time-varying exchange rate volatility simply does not seem to have a strong effect on international trade or investment patterns. Basically, exchange rate volatility for most of the OECD was low in the 1960s, much higher in the 1970s and 1980s, and moderate in the 1990s. The problem, for this literature, is that trade has risen more or less continuously. Unsurprisingly, it has been difficult to establish a consensual view about this effect, or even its sign.

Not only is this literature weak; it is not even clear that it is asking the right question. Having even a very stable exchange rate is not the same as being a member of a currency union. Sharing a common currency is a much more serious and durable commitment than a fixed exchange rate. This is manifest empirically in much more intense trade *inside* countries than *between* countries, a phenomenon known as "home bias" in international trade. McCallum (1995) quantifies the size of the intra-national bias at more than twenty to one (although this estimate is much disputed, e.g., by Anderson and van Wincoop, 2000). In particular, he finds that trade between two Canadian provinces is more than 20 times larger than trade between a comparable Canadian province/American state pair. Part of this home bias effect may stem from the fact that a single currency is used inside a country.

One might imagine that trying to measure the effects of a common currency on trade is a purely academic (i.e., trivial) exercise. The only countries that have adopted a common currency of late are the EMU-12, for whom there are necessarily few data. True enough. But there is no reason to rely on before and after differences to estimate the effect of currency unions on trade,

just as one need not use *time-series* variation to discern the effects of exchange rate volatility on trade. This paper exploits *cross-sectional* variation – using evidence across countries – to trace the effects of currency unions on trade.

Is a cross-country approach to investigating currency unions doomed to failure since there are so few of them? Not at all. Above and beyond the twelve current members of EMU, some ninety "countries" are currently in some sort of official common currency scheme (thirty-one of these areas are official dependencies or territories), as shown in the table.[1] The empirical work in this paper hinges on exploiting these linkages. In particular, the question is: "Do countries inside currency unions tend to trade more, holding other factors constant?" The other factors held constant are dictated by the "gravity" model of international trade, a framework with a long track record of success.

----- Insert Table 1 around here ------

Estimating the Relationship with a Gravity Equation

The strategy of this paper is to link cross-country variation in currency arrangements to cross-country variation in international trade. Of course, many things affect trade above and beyond international monetary relations. While these other factor are not of direct interest, their effects need to be taken into account so as to be able to see if there is any remaining role for currency unions. Ordinarily, this would be difficult in applied economics. But in this context,

[1] Most currency unions occur where one of the geographic units does not issue its own currency, and uses that of another. A few occur where there is massive currency substitution (also known as "dollarization") and two currencies exist with a long-term peg at 1:1. I do not include currency boards (such as Hong Kong or Argentina), countries that are informally or unofficially dollarized (such as Brazil or Russia), or events like German Unification in 1990, or the re-integration of Okinawa with Japan in 1972.

there is a simple and persuasive model in which one can embed the objects of interest to me: the "gravity" model of international trade.

The gravity model is a very simple empirical model that explains the size of international trade between countries. It models the flow of international trade between a pair of countries as being proportional to their economic "mass" (read "national income") and inversely proportional to the distance between them (literally interpreted). The gravity equation acquired its name since a similar function describes the force of gravity in Newtonian physics.

The gravity model of international trade has a remarkably consistent (and thus, for economics, unusual) history of success as an empirical tool. The responses of trade to both income and distance are consistently signed correctly, economically large, and statistically significant in an equation that explains a reasonable proportion of the cross-country variation in trade.

The technical details – presentation of the precise model, methodology and data set – are presented briefly in the appendix. The appendix also presents the actual estimates of the model. There are six different sets of estimates to demonstrate that the results do not depend strongly on the exact specification of the econometric model.

Unsurprisingly, the standard features of the gravity model of international trade work well. For instance, both higher GDP and higher GDP per capita (for the country pairing) increase trade. The coefficients are statistically significant and economically reasonable; both higher income per capita and larger country size increase trade less than proportionately. The greater the distance between two countries, the lower their trade. All three of these traditional "gravity" effects are intuitively reasonable, similar in magnitude to existing estimates, and very statistically significant. Sharing a land border, a language, or a regional trade agreement also

increase trade by economically and statistically significant amounts. Ex-colonies and their colonizers, countries with the same colonizer, and geographically disparate areas of the same state (for instance France and its overseas departments) all have disproportionately intense trade, consistent with intuition and received wisdom. Landlocked countries and geographically large countries trade less; islands trade more. The equations fit the data well, explaining almost two-thirds of the variation in bilateral trade linkages. All this is well and good.

Above and beyond all of these real – and conventional – factors, there is compelling evidence that the international monetary regime matters. Countries that use the same currency tend to trade disproportionately, even holding up to eleven other real factors constant. The effect (which is measured as the exponential of the coefficient on the currency union dummy) is economically large. A reasonable estimate is that *countries with the same currency trade over three times as much with each other as countries with different currencies*!

Without taking the precise estimates too literally, it seems clear that trade is substantially higher for countries that use the same currency, holding other things equal. This positive result stands in contrast to received wisdom. For instance, the European Commission (1990, p 73) wrote: "Since the empirical research has not found any robust relationship between exchange rate variability and trade it is not possible to estimate the increase in intra-EC trade that might derive from the irrevocable fixing of exchange rates." The mistake the EC made was in identifying currency union with the elimination of exchange rate volatility, when belonging to a currency union is clearly very different from simply stabilizing exchange rates.

Extensive sensitivity analysis has been performed to check the robustness of these results; skeptical readers can check it out in Rose (2000b). In particular, the results do not depend sensitively on the exact way that the equation is specified or estimated, or the exact way that the

variables are measured. An extensive search for omitted variables – which might lead one to conclude incorrectly that currency unions affect trade when it is really some third factor that matters – turned up nothing. Reverse causality also does not explain away the findings. In all, some fifty different perturbations of the basic model yield no smoking gun. The effect of currency unions on trade remains large and significant throughout.

Of course one should remember that no currency union of the size and scope and EMU has been attempted before. Most currency unions involve countries that are either small or poor (or both). The enormous impact that currency unions seem to have on these nations may thus be much bigger than the effect of EMU on European trade. (Then again, it may not; "home bias" in trade indicates that a large expansion of intra-European trade is plausible.)

Only time will tell for sure, so it is best not to take the estimation results too literally. Still, one can adjust the estimates to take into account existing trade patterns. Sweden's external trade is already integrated with that of the Euro area. But even taking these patterns into account, I estimate in the appendix that joining EMU will lead Swedish trade to increase by more than 50%.

To summarize, the gravity model of international trade works well in a variety of different dimensions. This bolsters confidence in my main finding: *there is a large positive effect of a common currency on trade*.

Understanding the Relationship

It is clear that a common currency should encourage trade. The puzzle is that the effect seems to be so enormous. Why does sharing a currency have such an enormous effect on trade? There are many possible explanations. A common currency represents a serious government

commitment to long-term integration. This commitment could, in turn, induce the private sector to engage in much more international trade. Perhaps hedging exchange rate risk is much more difficult than commonly believed, as business managers often state. Alternatively, a common currency could induce greater *financial* integration, which then leads to stronger trade in goods and services. More generally, money facilitates trade in its roles as both unit of account and as medium of exchange. Fewer, more widely accepted moneys facilitate more trade, as has been recognized since at least Mundell (1961). Still, it is wisest to conclude that we simply don't know why a common currency seems to facilitate trade so much. The most obvious benefit – foregoing the cost of hedging exchange rate risk – appears to be low, especially for a sophisticated open country like Sweden.

Nevertheless, even if we don't know *why* a common currency makes a big difference, it is plausible *that* it does. The evidence presented here has separated the common currency component from the other characteristics that differentiate within-country *intra*national trade from cross-country *inter*national trade. The evidence of *intra*national bias is disputed but substantial; trade within countries appears to be large compared to trade between countries, even for countries within well-integrated areas like the European Union. Countries have a number of important aspects for commercial trade, including a common currency, common cultural norms, common legal system, common history, common norms, and so forth. A common currency is a piece of this package; and it seems to be an important piece. One need not take my precise estimates too literally to agree with this reasoning.

Impact on Sweden

Sweden is an open economy. Data from both the IMF's *International Financial Statistics* and the OECD's *Main Economic Indicators* is tabulated in Table 2. The IMF's data indicates that trade in goods and services as a proportion of GDP exceeded 80% in 1999; the OECD figures for trade in goods alone are somewhat lower. t is clear that Sweden is a very open economy.

----- Insert Table 2 around here ------

Sweden currently does approximately just less than half of its external trade with the twelve current EMU countries. The exact figures are in Table 3, and vary slightly depending on whether one uses data on trade in goods and services from Statistics Sweden or trade in goods alone from the OECD's "Monthly Statistics of Foreign Trade." But over 40% of Sweden's exports go to countries within the Euro area, and around half of Swedish imports come from those countries. Thus EMU accounts for almost half of Swedish trade.

----- Insert Table 3 around here ------

This combination of strong ties to the Euro area and openness means that Sweden has potentially a lot to gain from the trade boost which joining EMU may provide. In my work with Frankel (2000), I estimate that Swedish entry into EMU could result eventually in a tripling of Swedish trade with EMU, raising total trade for Sweden conceivably to almost 150% of GDP. In that work, we also find that every one percent increase in trade (relative to GDP) eventually raises income per capita by roughly 1/3 of a percent over the long run. If our estimates are

accurate, the total increase in Swedish GDP that results from the trade expansion spurred by GDP could be substantial. While our estimates lack precision, we estimate the eventual boost to Swedish GDP to be as much as 24%. Of course, there is considerable uncertainty about these results, and one should not take the precise estimates too seriously. The effects will probably take decades to appear fully. Further, most countries in currency unions are considerably smaller than Sweden, so that the expansion of Swedish trade may be overstated; I show in the appendix that adjusting for these effects reduces the impact of EMU on Swedish welfare to a still large 11%. But even an effect that is half as large would still be of enormous consequence.

Broader Implications

The findings presented in this paper imply that EMU may lead to an expansion of trade inside Europe. The rise in trade could be enormous; my estimate is that intra-European trade may eventually triple. It will also be unexpected.

As a result, there will be great benefits for consumers. The most important consequence of increased trade is increased gains from trade. As the deadweight loss of using different currencies vanishes, competitive pressures increase, prices fall and consumers gain. The size of these gains may be large; Frankel and Romer (1999) estimate that increasing the ratio of trade to GDP by one percentage point raises income per person by between one-half and two percent. Given potential gains of this magnitude, trade need not triple for a common currency to induce large welfare gains! There may also be dynamic gains if growth rates increase.

Even more visible consequences of an increase in trade caused by EMU may take place outside EMU. If EMU causes radically increased intra-European trade and its benefits, other countries may well take the plunge, spreading currency unions even further. Many countries

both inside Europe and elsewhere are toeing the water at present. Above and beyond Sweden, the UK and future EU-entrants are contemplating joining EMU. Argentina, Mexico, and Canada are considering adopting the American dollar, while Ecuador and El Salvador have recently done so. If the benefits of a common currency have been underestimated, more will consider relinquishing monetary sovereignty.

A large increase in trade precipitated for whatever reason (such as the introduction of a common currency) brings benefits but may bring also tensions. For instance, there may be an increase in trade disputes as a result of the increase in trade. A common currency may create much trade, but it may also divert trade from low-cost non-European producers to less efficient European producers who benefit from being in EMU (though in my research I find no evidence of harmful trade diversion in the data). An increase in trade also affects the very sustainability of the currency union. As trade increases, business cycles can in principle move either more asynchronously (as countries specialize to take advantage of comparative advantage) or more closely together (if most shocks are monetary or most trade is intra-industry trade). The relationship between trade and business cycle synchronization depends on the nature of business cycle shocks and the evolving economic structure of the countries. Historically, closer international trade between countries has been associated with more synchronized business cycles. Thus, an increase in intra-European trade precipitated by EMU, could make EMU itself more sustainable by increasing the synchronization of European business cycles.

Conclusion

The decision to enter a currency union is based on many economic and political criteria. This paper has ignored nearly all of them. Still, currency union-skeptics are skeptical in part

because they perceive few advantages from a common currency. One of the few undisputed benefits of joining a currency union is the encouragement of trade. That effect has not been quantified until recently. Instead, economists have used the negligible effect on trade of eliminating exchange rate volatility. As a result, the current consensus is that currency unions have hardly any effect on trade. The case for a common currency is accordingly perceived as being weak.

I contend that such skepticism is unwarranted, so that a potent argument in favor of currency unions has been under-stated in the literature. Data for the many countries that share currencies in the real world point to an unambiguous conclusion. Even after taking a host of other considerations into account, countries that share a common currency engage in substantially higher international trade. And more trade results in higher income. My estimate is that Swedish trade with the Euro area could conceivably rise by more than 50% as a result of Swedish entry into EMU, resulting in a boost to Swedish welfare of over ten percent in the long run.

The case for currency unions is stronger than commonly considered. The cost of foregoing independent monetary policy may be low. Even perfectly effective monetary policy has a small effect if the welfare costs of business cycles are small. Frankel and Rose (1998) argue that business cycles may become more synchronized across countries because of currency union, further lowering the opportunity cost of national monetary policy. Further, currency union may be an efficient institutional arrangement to handle credibility problems, as Alesina and Barro (2000) discuss.

More importantly, I have tried to show in this paper that currency union reduces trade barriers associated with national borders, leading to substantial increases in both trade and

welfare. That is, a national currency seems to be a significant barrier to trade. Reducing these barriers through joining EMU will result in increased international trade for Sweden. The data indicates that this effect may be large, in excess of 50% for EMU. It will be unexpected. And it will be beneficial; my estimate is that Swedish welfare will rise by more than 10% as a result of EMU.

Sovereign monies are important (though perhaps inadvertent) national barriers to trade. The monetary barriers are now falling across Europe. Sweden should seriously consider whether it wishes to forgo this historic opportunity for a beneficial expansion of its European trade.

Table 1: Currency Unions, 1970-1995

Australia
Christmas Island (territory)
Cocos (Keeling) Islands (territory)
Norfolk Island (territory)
Kiribati
Nauru
Tuvalu
Tonga (pre ’71)

Denmark
Faroe Islands (part of Denmark)
Greenland (part of Denmark)

East Caribbean Currency Area
Anguilla (territory of UK)
Antigua and Barbuda
Dominica
Grenada
Montserrat (territory of UK)
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines

France
French Guiana (overseas department)
French Polynesia (overseas territory)
Guadeloupe (OD)
Martinique (OD)
Mayotte (territorial collectivity)
New Caledonia (OT)
Reunion (OD)
Saint Pierre and Miquelon (TC)
Wallis and Futuna Islands (OT)
Monaco

France and Spain
Andorra

India
Bhutan

Belgium
Luxembourg

CFA Franc Zone
Benin
Burkina Faso
Cameroon
Central African Republic
Chad
Comoros
(Republic of) Congo
Cote d’Ivoire
Equatorial Guinea (post '84)
Gabon
Guinea-Bissau
Mali (post '84)
Niger
Senegal
Togo

Italy
San Marino
Vatican

Morocco
Western Sahara

Norway
Svalbard (territory)

South Africa
Lesotho
Namibia
Swaziland

Switzerland
Liechtenstein

New Zealand
Cook Islands (self-governing, associated with NZ)
Niue (self-governing, associated with NZ)
Pitcairn Islands (territory of UK)
Tokelau (territory of NZ)

Turkey
Northern Cyprus

UK
Falkland Islands (territory)
Gibraltar (territory)
Guernsey (dependency)
Jersey (dependency)
Man, Isle of (dependency)
Saint Helena (territory)
Scotland (?)
Ireland (pre '79)

USA
American Samoa (territory)
Guam (territory)
US Virgin Islands (territory)
Puerto Rico (commonwealth associated with US)
Northern Mariana Islands (commonwealth in political union with US)
Swedish Virgin Islands (territory of UK)
Turks and Caicos islands (territory of UK)
Bahamas
Bermuda
Liberia
Marshall Islands
Micronesia
Palau
Panama
Barbados (? 2:1)
Belize (? 2:1)

Singapore
Brunei

Table 2: Swedish Openness

Panel A

	1995	1996	1997	1998	1999
Exports	694	686	774	828	863
Imports	576	569	645	709	754
GDP	1713	1756	1813	1890	1972
X/Y	41%	39%	43%	44%	44%
M/Y	34%	32%	36%	38%	38%
(X+M)/Y	74%	71%	78%	81%	82%

Billions of SEK. Data from IMF *International Financial Statistics* CD-ROM.

Panel B

	1996	1997	1998	1999
Exports, monthly	47.4	52.7	56.3	58.4
Imports, monthly	37.4	47.8	45.4	47.2
GDP	1756.4	1823.8	1905.3	1994.9
X/Y	32%	35%	35%	35%
M/Y	26%	31%	29%	28%
(X+M)/Y	58%	66%	64%	64%

Billions of SEK. Source: OECD *Main Economic Indicators*.

Table 3: Swedish Bilateral Trade Patterns

Panel A

	Exports		Imports		X Shares		M Shares		Trade Intensity	
Country	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999
Germany	72224	63908	95530	83099	11%	11%	17%	18%	14%	14%
UK	62213	54585	52061	48263	9%	10%	10%	10%	9%	10%
USA	62038	52304	37043	27444	9%	9%	7%	6%	8%	8%
Norway	49552	45039	44675	33688	8%	8%	8%	7%	8%	8%
Denmark	38117	34903	41537	33642	6%	6%	8%	7%	7%	7%
Finland	37081	32240	30340	25543	6%	6%	6%	6%	6%	6%
France	34328	30506	31983	29831	5%	5%	6%	6%	6%	6%
Netherlands	33155	35022	41613	38326	5%	6%	8%	8%	6%	7%
Belgium	27372	25149	19997	17753	4%	4%	4%	4%	4%	4%
Italy	25434	21188	17735	16244	4%	4%	3%	4%	4%	4%
Spain	19364	20235	7541	8351	3%	4%	1%	2%	2%	3%
Japan	17981	13475	16934	12954	3%	2%	3%	3%	3%	3%
China	14184	10750	6854	5130	2%	2%	1%	1%	2%	2%
Poland	11181	10437	7293	5159	2%	2%	1%	1%	2%	2%
Turkey	8586	8473	2249	1335	1%	1%	0%	0%	1%	1%
Switzerland	7695	8562	7297	7836	1%	1%	1%	2%	1%	2%
Canada	7613	5476	2016	1876	1%	1%	0%	0%	1%	1%
Mexico	7560	3681			1%	1%	0%	0%	1%	0%
Austria	6584	6122	5363	4812	1%	1%	1%	1%	1%	1%
Australia	6578	6956			1%	1%	0%	0%	1%	1%
Hong Kong	5242	3579	7846	6645	1%	1%	1%	1%	1%	1%
Taiwan	5090	4161	4493	3612	1%	1%	1%	1%	1%	1%
Brazil	5060	5605	2128	1812	1%	1%	0%	0%	1%	1%
Greece	4963	3942			1%	1%	0%	0%	0%	0%
Saudi Arabia	4631	2392			1%	0%	0%	0%	0%	0%
Ireland	4469	3791	9965	6987	1%	1%	2%	2%	1%	1%
Malaysia	4442	1951	2953	1136	1%	0%	1%	0%	1%	0%
Russia	3999	3302	4487	2961	1%	1%	1%	1%	1%	1%
Singapore	3977	3203			1%	1%	0%	0%	0%	0%
Portugal	3913	3772	3168	3229	1%	1%	1%	1%	1%	1%
Estonia			6684	4176	0%	0%	1%	1%	1%	0%
South Korea			3120	2142	0%	0%	1%	0%	0%	0%
Latvia			2907	2872	0%	0%	1%	1%	0%	0%
Czech Rep.			2664	2150	0%	0%	0%	0%	0%	0%
Thailand			2341	1680	0%	0%	0%	0%	0%	0%
All	7E+05	6E+05	5E+05	5E+05						
EU-15	4E+05	3E+05	4E+05	3E+05	56%	59%	65%	69%	60%	63%
EMU-12	3E+05	2E+05	3E+05	2E+05	41%	43%	48%	51%	44%	46%

Values, Jan-Oct. Source: Statistics Sweden.

Panel B

	Imports		Exports		Export Share		Import Share		Trade Intensity	
	1998	**1999**	**1998**	**1999**	**1998**	**1999**	**1998**	**1999**	**1998**	**1999**
World	5388	5414	6895	6910						
EU-15	3695	3636	3924	3972	57%	57%	69%	67%	62%	62%
EMU-12	2778	2704	2862	2920	42%	42%	52%	50%	46%	46%

Millions US $, monthly rates.
Source: OECD *Monthly Statistics of International Trade*

Technical Annex

This appendix describes the model, methodology and data set used to estimate the effect of common currencies and exchange on trade.

The Gravity Methodology

An augmented gravity model is used to estimate the effects of currency unions and exchange rate volatility on trade. The model is "augmented" in that the standard gravity model only includes income and distance variables. In order to account for as many other factors as possible, the equation adds a host of extra conditioning variables as well as the all-important monetary variables:

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(Y_i Y_j)_t + \beta_2 \ln(Y_i Y_j / Pop_i Pop_j)_t + \beta_3 \ln D_{ij} + \beta_4 Cont_{ij} + \beta_5 Lang_{ij} + \beta_6 FTA_{ijt}$$
$$+ \beta_7 ComNat_{ij} + \beta_8 ComCol_{ij} + \beta_9 Colony_{ij} + \beta_{10} Land_{ij} + \beta_{11} \log(Area_i + Area_j)$$
$$+ \beta_{12} \log(Area_i Area_j) + \beta_{13} Island_{ij} + \gamma CU_{ijt} + \varepsilon_{ijt}$$

where i and j denotes countries, t denotes time, and the variables are defined as:

- X_{ij} denotes the value of bilateral trade between i and j,
- Y is real GDP,
- Pop is population,
- D_{ij} is the distance between i and j,
- $Cont_{ij}$ is a binary variable which is unity if i and j share a land border,
- $Lang_{ij}$ is a binary variable which is unity if i and j have a common official language,
- FTA_{ij} is a binary variable which is unity if i and j belong to the same regional trade agreement,

- $ComNat_{ij}$ is a binary variable which is unity if i and j are part of the same nation (e.g., France and its overseas departments),
- $ComCol_{ij}$ is a binary variable which is unity if i and j were colonies after 1945 with the same colonizer,
- $Colony_{ij}$ is a binary variable which is unity if i colonized j or *vice versa*,
- $Land_{ij}$ is 2 if both i and j are land-locked, 1 is one of them is, and 0 otherwise,
- $Area_i$ is the area of country i,
- $Island_{ij}$ is 2 if both i and j are islands, 1 is one of them is, and 0 otherwise,
- CU_{ijt} is a binary variable which is unity if i and j use the same currency at time t,
- β is a vector of nuisance coefficients, and
- ε_{ij} represents the myriad other influences on bilateral exports, assumed to be well behaved.

The coefficient of interest is γ, the effect of a currency union on trade flows. This is a coefficient that has not been estimated by others in the literature to my knowledge.

This equation is estimated with ordinary least squares, though the exact estimation technique turns out not to matter very much. I estimate various specifications of pooled regression with year controls (individual year results can be found in Rose, 2000b); the last column also includes country controls. To test the significance of individual coefficients, standard errors are reported which are robust to heteroskedasticity and clustering.

Substantial sensitivity analysis can be found in Rose (2000b). In that paper I show that my results are robust to: the exact measurement of *CU*, the exact measure of distance, the inclusion of extra controls, sub-sampling, and different estimation techniques.

The Data Set

The model is estimated using a data set with 41,678 bilateral trade observations spanning six different years (1970, 1975, 1980, 1985, 1990, and 1995). Observations are missing for some

of the regressors so the usable sample is smaller. All 186 countries, dependencies, territories, overseas departments, colonies, and so forth for which the United Nations Statistical Office collects international trade data are included in the data set. For convenience, all of these geographical units are referred to as "countries." In this sample, there are 406 observations where two countries trade and use the same currency.

The trade data are taken from the *World Trade Database*, a consistent recompilation of the UN trade data presented in Feenstra, Lipsey and Bowen (1997). This data set is estimated to cover 98% of all trade. Further description of the data set can be found in my Rose (2000b).

Standard Gravity Results

The results are tabulated in Table A1. The point estimates of the currency union effect indicate that two countries that use the same currency trade more. Lots more. Since $\exp(1.25) \approx 3.5$, the estimate without country-fixed effects indicates that currency union is associated with an increase in trade of around three hundred and fifty percent. The effect is statistically significant, with a high robust t-statistic. This despite the presence of eleven other controls (the least significant of which has a t-statistic of 2.6)! Adding country effects reduces both the economic and statistical impact of the currency union effect, but it remains economically large (a trade effect of over 230%) and statistically significant (the t-statistic is 4.6).[2]

----- Insert Table A1 around here ------

[2] Persson (2001) disputes the validity of this estimation technique, but see Rose (2001).

Since most currency union members are small, poor or remote, only about 1% of the observations are members of currency unions. Still, the paucity of observations does not appear to prevent them from having a strong and identifiable effect. *National money seems to be a significant trade barrier.*

More Sophisticated Results

A currency union should stimulate trade somewhat, since one money is more efficient than two as both unit of account and medium of exchange. The real question is: why is the impact so large? In a world with derivative markets (at least for developed countries), it is hard to believe that lower transactions costs could lead trade to rise so much. Perhaps the straightforward and direct interpretation of the gravity model is mis-leading or inappropriate. How to proceed?

Anderson and van Wincoop (2000), hereafter "AvW", derive a simple theoretical gravity equation that easily lends itself to interpretation and estimation. There are four advantages to using their structural approach. First, one can use the model to investigate the impact of a currency union among any set of countries, even those that have never been in a currency union. This is critical; without a structural model one may question the relevance of pre-EMU currency unions (which consist of small or poor countries) when considering the impact of EMU. Second, it provides an estimate of the tariff-equivalent of the national monetary barrier. Third, the model provides an explicit welfare metric. Finally, it may lead to a more accurate estimate of the impact of currency unions on trade.

Adopting the assumptions of complete specialization and identical constant elasticity of substitution (CES) preferences that are central to the previous theoretical gravity literature, AvW obtain a simple and intuitive equation:

$$x_{ij} = (y_i y_j / y^W)(t_{ij}/P_i P_j)^{1-\sigma}$$

where: x_{ij} is the nominal value of exports from i to j, y_i is the nominal GDP of country i, y^W is the nominal value of world output, σ is the elasticity of substitution between the countries' goods, t_{ij} is the gross price-markup due to trade costs, and P_i is i's "multilateral trade resistance," a price index that depends positively on trade barriers between i and *all* of its trading partners (not just j). Multilateral resistance can be solved as a function of all bilateral trade barriers, $\{t_{ij}\}$.

In the model, trade between a pair of countries depends on their bilateral trade barrier *relative* to average trade barriers with all trade partners. According to the theory, each region produces a fixed quantity of goods which have to be sold somewhere in the world (analogous to the assumption of fixed factor supplies commonly made in trade theory). More goods will be sold to a region with which the exporter has a relatively low trade barrier.

The theory has an intuitive implication for the impact of currency unions on trade flows. The stronger the level of pre-union trade among the members of a currency union, the smaller the percentage increase in trade among currency union members. If trade barriers are reduced among a set of countries that already trade a lot with each other, multilateral trade resistance will drop a lot and relative trade resistance will fall little. The drop in multilateral resistance of member countries reduces the impact on trade.

Pre-union trade levels can be high either because the countries have relatively low pre-union bilateral barriers (e.g. due to proximity or a regional trade agreement), or because the overall size of the union is large. These considerations imply a smaller effect of EMU on bilateral trade flows than most other currency unions. Existing currency unions, such as the East Caribbean Currency Area, are small and therefore imply a large effect on trade flows. We expect a smaller percentage increase in trade when Mexico or Canada dollarizes than when Argentina dollarizes, as Argentina trades less with the US than Canada or Mexico.

A rise in trade among members of the currency union implies a corresponding drop in trade with other countries and within member countries. That is, the model implies trade diversion as well as trade creation. But there is a positive welfare effect because fewer resources are wasted on trade costs. This is reflected in lower multilateral resistance; the price index P_i falls. Welfare, as measured by the CES consumption index, can be shown to be approximately proportional to $(1/P_i)^2$. The more countries trade with each other before joining the union, the larger is the welfare benefit from joining the currency union, but the smaller the percentage increase in trade among union members. That is, welfare rises the most in currency unions where trade rises the least.

I estimate the AvW model using a linear combination of the controls in Table A1 (other than land area and the GDP controls) for the bilateral trade barrier t_{ij}; details are available online. The model is estimated with country-fixed effects in place of the country-specific multilateral resistance terms. 1980 and 1990 data are used for a set of 143 countries for which there is complete bilateral data, which is necessary to solve for the impact of currency unions on multilateral resistance and trade. The currency union coefficient remains large and significant at .91, with a robust standard error of .18. The theory tells us that this is an estimate of $[(\sigma-1)$ ln

m], where (m-1) is the tariff equivalent of the national monetary barrier. If we use David Hummels' (2000) estimate of σ=5, the tariff-equivalent of the monetary barrier to trade is estimated to be 26%! While larger values of σ reduce this estimate, for almost any value of σ the monetary barrier accounts for a little over half of the AvW estimate of the total national border barrier.

The .91 estimate implies that the currency union is estimated to raise bilateral trade by around 250% ($\exp(.91) \approx 2.48$), ignoring the effect on multilateral trade resistance. But this is warranted only in the unlikely case when there is a negligible amount of pre-union trade inside the currency union. To estimate the effect of currency unions on trade more realistically, we need to incorporate multilateral resistance effects. That is done in the Table A2 for a number of actual and hypothetical unions.

The theory allows one to estimate the effects of currency union for any set of countries, even if they have never been in one. The only assumption made is that the reduction in *bilateral* trade barriers for union members is the same as that for *existing* currency unions. I tabulate the average percentage change of trade among countries in the union, along with its standard error.

The key results are in the top two rows, which portray the experiment of Sweden joining the EMU-12 inside the Euro area. The first row portrays the average effects across all thirteen countries; the second row portrays the effect on Sweden. Other rows depict different currency unions, and are tabulated to provide a means of comparison.

----- Table A2 around here -----

The trade-creating effects of currency union were large in Table A1; the effects are smaller in Table A2. Instead of EMU causing Swedish trade to rise with the Euro area by 300%, it is estimated to rise by 53% (the average increase in trade for the Euro area plus Sweden is 52%), with a standard error of 11%. Evidently taking multilateral resistance into account makes the effects appreciably smaller.

The trade-creating effects of currency unions are smaller in Table 2; but the effects are large. (They are large even after dividing by two.) These large effects also characterize the other EMU and dollarization scenarios.

The last column of Table A2 reports the effect of currency unions on the welfare of their members, measured by the average percentage increase in the consumption index, (assuming σ=5). The welfare increases are large.

Table A1: Impact of Currency Union on International Trade, 1970-1995

Currency Union	2.11 (.13)	1.53 (.13)	1.22 (.13)	1.25 (.13)	1.37 (.13)	.86 (.19)
(Log) Distance	-1.22 (.01)	-1.09 (.02)	-1.09 (.02)	-1.04 (.02)	-1.06 (.02)	-1.31 (.03)
(Log Product) Real GDP per capita	.66 (.01)	.64 (.01)	.66 (.01)	.56 (.01)	.49 (.01)	1.06 (.04)
(Log Product) Real GDP	.78 (.01)	.79 (.01)	.80 (.01)	.88 (.01)	.94 (.01)	
Regional Trade Agreement		1.31 (.07)	1.25 (.07)	1.08 (.07)	1.17 (.07)	.46 (.12)
Common Language		.73 (.03)	.44 (.04)	.57 (.04)	.53 (.03)	.48 (.06)
Common Land Border		.37 (.07)	.43 (.07)	.62 (.07)	.63 (.07)	.30 (.13)
Common Colonizer			.65 (.05)	.47 (.05)	.45 (.05)	.68 (.08)
Same Nation			1.08 (.28)	.97 (.28)	.99 (.29)	.81 (.32)
Colonial Relationship			2.19 (.07)	1.99 (.07)	1.99 (.07)	1.74 (.13)
Number of Landlocked Countries				-.39 (.03)		
(Log of) Sum of Land Area				-.22 (.01)		
(Log of) Product of Land Area					-.15 (.01)	
Number of Island Countries					.04 (.02)	
R^2	.61	.62	.63	.64	.64	.72
RMSE	2.05	2.03	2.00	1.98	1.98	1.74
	Time Effects	Time Effects	Time Effects	Time Effects	Time Effects	Time, Country Effects

OLS estimation. Robust standard errors recorded in parentheses.
Sample size = 31,101.
Regressand is log of bilateral trade in real American dollars at 5-year intervals, 1970-1975.

Table A2: Impact of Currency Unions on Trade and Welfare

	% Trade Increase	% Welfare Increase
EMU-12 + Sweden	52 (11)	12.1 (3.3)
Effect on Sweden of joining EMU-12	53 (11)	11.8 (3.1)
EMU for original 11 members	58 (12)	11.1 (3.9)
EMU-11 + Greece	59 (12)	11.1 (3.0)
EMU + UK	44 (9)	13.8 (3.6)
EMU for all (15) EU members	40 (8)	14.4 (3.8)
Argentina dollarizes	132 (37)	1.7 (0.5)
Ecuador dollarizes	106 (26)	4.5 (1.4)
El Salvador dollarizes	89 (20)	6.6 (2.0)
Mexico dollarizes	53 (13)	12.4 (3.8)
Canada dollarizes	38 (9)	15.3 (4.3)
Mexico and Canada dollarize	27 (8)	18.4 (5.3)
Existing currency unions	91 (22)	5.0 (1.2)
World monetary union	10 (2)	21.3 (5.1)

Averages across countries except second row. Standard errors recorded in parentheses.

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