NBER WORKING PAPER SERIES

ONE MONEY, ONE MARKET: ESTIMATING THE EFFECT OF COMMON CURRENCIES ON TRADE

Andrew K. Rose

Working Paper 7432
http://www.nber.org/papers/w7432

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 1999

This paper began in a series of conversations with Harry Flam; without him, the paper would not have been written. I also thank Nils Bohlinda, Rob Feenstra, Michael Ferrantino and Gian-Maria Milesi-Ferretti for help with the data, and Joshua Aizenman, Samuel Bentolila, David Begg, Michele Boldrin, Dick Cooper, Barry Eichengreen, Charles Engel, Antonio Fatas, Raquel Fernandez, Michael Ferrantino, Jeff Frankel, Jeff Frieden, Miriam Green, Elhanan Helpman, Harry Huizinga, Ben Lockwood, Rich Lyons, Danny Quah, Richard Portes, Assaf Razin, Helene Rey, Ken Rogoff, Andre Sapir, Larry Schembri, Alan Winters, Charles Wyplosz, seminar participants at DG2 and Harvard, and the members of the *Economic Policy* panel for comments and encouragement. Asher Isaac provided inspiration. The data set and a current version of the paper are available at my website. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

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JEL No. F33

ABSTRACT

A gravity model is used to assess the separate effects of exchange rate volatility and currency unions on international trade. The panel data set used includes bilateral observations for five years spanning 1970 through 1990 for 186 countries. In this data set, there are over one hundred pairings and three hundred observations, in which both countries use the same currency. I find a large positive effect of a currency union on international trade, and a small negative effect of exchange rate volatility, even after controlling for a host of features, including the endogenous nature of the exchange rate regime. These effects are statistically significant and imply that two countries that share the same currency trade three times as much as they would with different currencies. Currency unions like EMU may thus lead to a large increase in international trade, with all that entails.

Andrew K. Rose
Haas School of Business
University of California
Berkeley, CA 94720-1900

B.T. Rocca Jr. Professor of International Business
Economic Analysis and Policy Group
and NBER, CEPR
arose@haas.berkeley.edu
haas.berkeley.edu/~arose

1. Introductory Adverbs

1.1 What?

Question: What is the effect of a common currency on international trade? Answer: Large.

More technically, in this paper, I use a large cross-country panel data set to show that two countries with the same currency trade more than comparable countries with their own currencies. Much more; perhaps over three times as much. While reducing exchange rate volatility also increases trade, the effect of a common currency appears to be an order of magnitude larger than that of eliminating exchange rate volatility but retaining separate currencies.

1.2 Why?

The effect of a common currency on trade is an important issue. (I use the terms "currency union" and "common currency area" interchangeably.) The increase in trade stemming from a common currency is one of the few undisputed gains from European 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 – and most economists – 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, thought that sharing a common currency would lead to an increase in the depth of trading relations, while precluding the "beggar thy neighbor" competitive devaluations that can destroy a common market. Indeed, a common currency could have a larger effect on trade than even a radical reduction in exchange rate volatility. The primary objective of this paper is to resolve the argument by estimating the separate effects of exchange rate volatility and common currencies on trade.

If a common currency does substantially increase trade, there will be important repercussions. First, there will be an increase in trade disputes and frictions simply because the volume of international trade rises. Second, if greater international competition leads to layoffs and associated labor market pressures, there could be an increase in pleas for continuation or enlargement of the social safety net. Third, higher levels of trade may lead to more synchronization of business cycles across countries. More generally, closer economic integration is likely to lead to greater political integration. Fourth, other countries – like the UK, Sweden and Denmark in Europe, but also Argentina, Canada and others – may find it more worthwhile to join a common currency area, leading to a further increase in global integration. Fifth, and most importantly, a big increase in trade will lead to substantial extra gains from trade for consumers inside the currency union.

1.3 How?

With such important and interesting issues at hand, 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. In any case, having even a very stable exchange rate may not be the same as being a member of a common currency area. Sharing a common currency is a much more serious and durable commitment than a fixed 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, a result corroborated by Helliwell (1996). 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-11, 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 and exchange rate volatility on trade.

Is a cross-country approach to investigating currency unions doomed to failure since there are so few of them? Not at all. One need not go back to the nineteenth century precedents of the Latin and Scandinavian Monetary Unions to find examples of countries with common currencies. Above and beyond the eleven current members of euroland, ninety-one "countries"

are currently in some sort of official common currency scheme (thirty-two of these areas are official dependencies or territories).[1] My empirical work hinges on exploiting these linkages. This is done in the context of the "gravity" model of international trade, a framework with a long track record of success.

1.4 Where?

In section II, I provide a short survey of the literature on the effects that the monetary regime has on international trade. The "gravity" approach is surveyed briefly in section III, which is followed by a section outlining my methodology and data set. My empirical results, which constitute the heart of the paper, are presented in section V. I use a model that explains bilateral trade flows between two countries with their combined output, size, the distance between them, and a number of other controls. Even after taking these other effects into account, two countries that share the same currency trade substantially more than countries with their own currencies; my point estimate is that trade is over three times higher between common-currency countries. Exchange rate volatility reduces trade, but to a much smaller degree. I go to lengths to show that these results are insensitive to the exact econometric methodology. The paper concludes with a discussion of the implications.

2. Old Stuff

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.[2] 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 continuously. Unsurprisingly, time-series literature has found it difficult to establish a consensual view about this effect, or even its sign. As a result, research in this area has dried up of late; it seems impossible to make progress using the time-series variation in the data. Among the standard references are Hooper and Kohlhagen (1978) and Kenen and Rodrik (1986); the European Commission (1990) and International Monetary Fund (1984) provide summaries.

Should we be concerned that it is difficult to detect any large negative effect of exchange rate volatility on trade? Perhaps not. Negative results may be reasonable on theoretical grounds. Since profit functions may be convex functions of input costs, exports (or, more generally, output) can be an *increasing* function of exchange rate uncertainty. Unless the firm is extremely risk averse, it can then take advantage of *ex ante* uncertain exchange rate swings, and disproportionately export when the exchange rate is advantageous. This would result in higher overall exports, explaining the absence of a negative volatility: trade relationship. And there are alternative explanations of the negative results. It may be difficult to measure exchange rate volatility. The data sets may not be broad enough. Inappropriate techniques may have been used. Or the results may stem from the increasing prevalence of foreign exchange derivatives that allow firms to hedge most exchange rate risk, at least where such markets exist.

For all these reasons, the presumption now seems to be that the effect of exchange rate volatility on trade may be zero or negative but is certainly not large. This has led economists as diverse as Feldstein (1991), Obstfeld (1997), and Wyplosz (1997) to conclude that the gains from

eliminating currency fluctuations within Europe in terms of increased trade are small. There is little in the empirical time-series literature to contradict this view.

But there is an alternative way to proceed. Panel and cross-sectional methods for analyzing data are increasingly popular in international macroeconomics.[3] I now turn to that approach to see if it can shed more light on the issue.

3. The Force (of Gravity) is with Me

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, one needs to model their effects so as to be able to see if there is any remaining role for exchange rate volatility and/or currency unions. Ordinarily, this would be difficult in economics. Happily in this context, there is a simple and persuasive model in which one can embed the objects of interest: the gravity model of international trade.

The "gravity" model is a very simple empirical model that explains the size of international trade between countries. The model has a lineage that stretches back to Tinbergen (1962) and Pöyhönen (1963). 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 elasticities of trade with respect 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. Indeed in their recent survey on the empirics of international trade, Leamer and Levinsohn (1995, p. 1384) describe the gravity model as having provided "... some of the clearest and most robust empirical findings in economics."

If it works in practice, can it work in theory? Yes. While originally an entirely empirical model, the gravity model can now claim theoretical foundations. In fact, numerous theoretical aspirants have claimed the singular empirical success of the gravity model. These include: the 'Armington' model of nationally differentiated goods; models with increasing returns and monopolistic competition; models with national technological differences; 'reciprocal dumping' models of homogeneous goods; and models with internationally varying factor endowments. Deardorff (1998), Evenett and Keller (1998) and Feenstra, Markusen and Rose (1998) all provide recent contributions and references; see also Anderson (1979), Bergstrand (1985, 1989) and Bacchetta and van Wincoop (1998). Which particular theoretical model best describes the empirical findings of the gravity model is a matter of some dispute. But that is irrelevant here. All one needs to know is that the gravity model stands proudly on both theoretical and empirical legs. Indeed, the fact that my results are not tied to a specific model of international trade makes my results more general and thus more powerful (though they are necessarily less illuminating about any specific trade theory).

The gravity model has experienced something of a renaissance of late. It has been used extensively by Jeffrey Frankel and co-authors to refute the idea of a growing "yen bloc," to show that trade does indeed spur growth, and to investigate a host of other issues (e.g., Frankel and Wei, 1993, Frankel and Romer, 1999). Versions of the gravity model have also been used to investigate deviations from the law of one price (e.g., Engel and Rogers, 1996). The versatility,

credibility, and rugged track record of plausible empirical results are some of the reasons that economists continue to be attracted to the gravity model.

The closest antecedent to this paper is Frankel and Wei (1993), who also provide references to the small relevant literature. They use a smaller data set and focus on European exchange rate stabilization. They find that exchange rate uncertainty has only a faint effect on international trade. These weak findings also characterize Eichengreen and Irwin (1995), who analyze the interwar period. No previous author, to my knowledge, has considered the effect of currency unions on trade.

4. The Building

This section of the paper describes the methodology and data set used to estimate the effect of common currencies and exchange on trade.

4.1 Mortar

I use an augmented gravity model 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, my equation adds a host of extra conditioning variables as well as the all-important monetary variables:

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(Y_i Y_j)_t + \beta_2 \ln(Y_i Y_j / Pop_i Pop_j)_t + \beta_3 \ln D_{ij} + \beta_4 Cont_{ij} + \beta_5 Lang_{ij} + \beta_6 FTA_{ijt}$$
$$+ \beta_7 ComNat_{ij} + \beta_8 ComCol_{ij} + \beta_9 Colony_{ij} + \gamma CU_{ijt} + \delta V(e_{ij})_t + \varepsilon_{ijt}$$

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*,
- CU_{ijt} is a binary variable which is unity if i and j use the same currency at time t,
- $V(e_{ij})_t$ is the volatility of the bilateral (between i and j) nominal exchange rate in the period before 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 coefficients of interest to me are γ and δ. γ is the effect of a currency union on trade flows, a coefficient that has not yet (to my knowledge) been estimated. Of lesser interest to me is δ, which measures the response of bilateral trade to bilateral nominal exchange rate volatility. I hope that using cross-sectional variation allows me to estimate it with greater success than a time-series approach permits.

4.2 Bricks

The equation is estimated using a data set with 33,903 bilateral trade observations spanning five different years (1970, 1975, 1980, 1985, and 1990). (I am missing observations for some of the regressors so the usable sample is smaller for most purposes.) 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 (the list is tabulated in the appendix).[4] For convenience, I refer to all of these geographical units as "countries." Descriptive statistics are presented in the appendix.

In this data set, I have 330 observations where two countries trade and use the same currency.[5] Many (though not all) of the countries involved are small, poor or both, unlike most of the EMU-11.[6] Thus, any extrapolation of my results to EMU may be inappropriate since most currency union observations are for countries unlike those inside Euroland. Accordingly, I try not to take my exact point estimates too literally; it turns out that there is no reason to do so anyway.

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).[7] This data set is estimated to cover 98% of all trade. Since I usually pool the data across years, the nominal trade values, which are recorded in thousands of American dollars, are deflated by the American GDP chain price index.

I use the *Penn World Table* 5.6 for population and real GDP per capita data, filled in with data from the World Bank *World Development Indicator* (taken from the 1998 WDI CD-ROM) where the former is missing.[8] For location (used to calculate Great Circle distance and contiguity), official language, colonial background, and other such information, I used the information at the CIA's web site.[9] A number of regional free trade agreements are included in

the FTA dummy: the EEC/EC; the Canada-US FTA; EFTA; the Australia/New Zealand closer economic relationship; the Israeli/US FTA; ASEAN; CACM; PATCRA; CARICOM; SPARTECA; and the Cartagena Agreement, using information at the WTO's web site.[10]

To measure the volatility of the exchange rate between countries i and j at time t, I estimate the standard deviation of the first-difference of the monthly natural logarithm of the bilateral nominal exchange rate (using *IFS* line ae) in the five years preceding period t. Thus, for the 1975 Algeria/Angola observation, the standard deviation of the first-difference of the log Algerian/Angolan exchange rate is estimated using monthly data from 1970 through 1974. To check whether the results are sensitive to the exact measure of exchange rate volatility, I also experiment with four alternate measures.[11]

It is interesting to note in passing that the simple correlation between (the log of bilateral) trade (value) and the common currency dummy is small and negative. I shall show that it is positive and both economically and statistically large, once other effects have been accounted for. The correlation between trade and exchange rate volatility is similarly small and negative. Bivariate correlations are tabulated in the appendix.

5. What's Cool

In this section the gravity model is applied to analyze the impact of common currencies and exchange rate volatility on trade. I then check the robustness of my results extensively.

5.1 The Killer App

Table 1 includes benchmark OLS estimates of the gravity equation. There are six columns: separate regressions for the five years of the sample, and finally a pooled regression

(with year controls). White's heteroskedasticity-consistent standard errors are reported in parentheses, but I try not to take the standard errors too literally.[12]

Unsurprisingly, the standard features of the gravity model work well.[13] The nuisance coefficients seem thoroughly reasonable. 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 statistically significant, with t-statistics often exceeding 50 in absolute value.[14] 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. The last finding is also consistent with the recent literature documenting "home bias" in trade. The equations fit the data relatively well, explaining over half of the variation in bilateral trade linkages. Few of the effects vary much over time, so pooling the data simply improves the precision of the coefficient estimates.[15]

Above and beyond all of these real factors, there is compelling evidence that the international monetary regime matters. Countries that use the same currency tend to trade disproportionately, even holding the nine real factors constant. The effect is economically large. Since $\exp.(1.21) \approx 3.35$, my point 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 γ estimates too literally, it seems clear that trade is substantially higher for countries that use the same currency, holding other things equal. Countries with volatile exchange rates also trade less. Both effects are significant at conventional statistical levels.[16]

Most of the extant literature presumes that a common currency is equivalent to reducing exchange rate volatility to zero (e.g., Frankel and Rose, 1998). Is this assumption reasonable? No. The effects of currency unions and exchange rate volatility are not only precisely estimated, but economically distinguishable. A reasonable estimate of the common currency coefficient (γ) is 1.2, an effect that is somewhat more important than the effect of being in a common regional free trade agreement (β_6)! A reasonable estimate of the coefficient on exchange rate volatility (δ) is -.017; the sample mean of exchange rate volatility (i.e., the mean of $V(e_{ij})_t$) is 5%, and its standard deviation is 7%. Hypothetically reducing exchange rate volatility by one standard deviation around its mean from 7% to 0%, would increase the log of bilateral trade by (-.017)(-7) = .12 or around thirteen percent (since exp.(.12 $\approx$ .13). That is, *entering a currency union delivers an effect that is over an order of magnitude larger than the impact of reducing exchange rate volatility from one standard deviation to zero.*[17]

To summarize, the gravity equation works well; it fits the data and delivers precise reasonable income and distance elastiticities, and plausible estimates for other nuisance coefficients. These bolster my confidence in the three main findings. First, there is an intuitive but heretofore hidden (in time-series analysis) strong negative effect of exchange rate volatility on trade.[18,19] A more novel finding is the large positive effect of a common currency on trade. Third, I have found that the effect of a common currency is much larger than the hypothetical effect of reducing exchange rate volatility to zero.

5.2 Really?

Tables 2 through 7 present some of the sensitivity analysis I have performed. They are meant to confirm that my key results do not depend delicately on the exact way that my equation is specified or estimated. I continue to estimate the equations using the complete pooled data set on the default equation (with year controls), as in the extreme right-hand side of Table 1.[20]

Table 2 examines the sensitivity of the results with respect to the *sample* used in the estimation. (I add a row that tabulates the number of currency union observations for each perturbation.) One column excludes purely intra-LDC trade, thereby including only observations with at least one OECD country. This tests the idea that the currency union effect is a purely developing country phenomenon. Another excludes observations for Australia, France, New Zealand, the UK and the US, the five countries whose currencies are widely used by others. This tests the idea that northern "key currencies" are delivering the result, rather than a common currency effect *per* se. A third experiment excludes all African trade from the sample and therefore the many CFA-franc zone observations. A fourth excludes all observations involving Europe, the Antipodes and countries in the Pacific; a fifth excludes all observations involving countries from the Caribbean and North, Central and South America. Another perturbation throws out observations where bilateral trade accounts for more than ten percent of total trade for either country, to check if observations with highly concentrated trade account for the size of γ. There are also two perturbations that exclude observations where countries are very dis-similar in terms of either GDP (by more than a factor of four) or GDP per capita (by more than a factor of two). These test if my result relies on observations with enormous disparities in income or income per capita. Finally, there are two perturbations that exclude observations where one or

both countries are either very poor (defined as GDP per capita of less than $1000) or very small (defined as a population of less than one million). These check whether my result relies on observations for tiny or poor countries. Both γ and δ retain their economic and statistical significance throughout these perturbations.[21]

Table 3 analyses the sensitivity of the results with respect to the *measurement of the monetary regime*. Estimates without the monetary regime variables are also shown. It is comforting that the nuisance coefficients for the real regressors do not vary much.[22] Next, the common currency variable is changed in two ways. First, I use a stricter definition of currency unions, including only countries with territories or dependencies (Denmark, France, UK and US), the CFA zone, the ECCB zone, the Panama-US link, Australia's links (Kiribati and Tuvalu), and New Zealand's links (Cook Islands and Niue). Second, the currency union variable is split into two separate dummy variables, one for trade between countries and another for relationships between countries, dependencies, and territories. This checks if my results stem wholly from intra-national trade. In fact, the two coefficients are of similar size and both are statistically significant at standard levels. Finally, four different measures of exchange rate volatility are substituted for my default measure of exchange rate volatility. I use: a) the absolute value of the *maximal* monthly percentage change in the exchange rate during the preceding five years; b) the *ninetieth percentile* in the univariate distribution of the percentage change in the exchange rate during the preceding five years; c) the standard deviation of the *level* of the exchange rate during the preceding five years; and d) the standard deviation of the first-difference of the exchange rate during year t (rather than from t-5 through t-1). Throughout these perturbations the currency union coefficient retains its size and statistical significance. The exchange rate volatility coefficient is also robustly negative and significant, except when

exchange rate volatility is measured using levels. Given issues associated with non-stationarity stemming from inflation differentials or differing productivity growth, I do not place much confidence in this last measure of exchange rate volatility.

Table 4 examines the sensitivity of my results with respect to alternate measures of distance. In place of my measure of distance, two alternatives are used: the Hirschberg centroid measure, and the Fitzpatrick-Modlin great circle distance between most populous cities. I also replace my simple binary variable for a common language with the Boisso-Ferrantino (1997) continuous measure of linguistic similarity, which ranges from 0 (least similar) to 10,000 (identical linguistic patterns). However, none of my key results is affected.

Table 5 searches for *omitted variables* that may be responsible for my results. I add to the default specification ten different sets of additional regressors. The variables are: a) remoteness (defined as the inverse of GDP-weighted distance) and the *product* of the two countries' tariff rates; b) the *sum* of the two countries' tariff rates, and the square of the log of distance; c) the log of the *product* of the two countries' land areas and a dummy variable which is unity if at least one of the countries is landlocked; d) the log of the *sum* of the two countries' land areas, and separate dummies for one or both countries being landlocked; e) quadratic terms for both output and output per capita; f) dummy variables for current account controls and required surrender of export proceeds; g) dummy variables for one or both trading partners being islands; h) measures of the difference between the two countries' bureaucratic efficiency and political stability; i) a dummy variable for a common head of state; j) the sum of the two countries' "Economic Freedom" indices; and k) a dummy variable if one country is linked to the other via a currency board.[23] Once again, the currency union effect remains economically large and statistically significant throughout.

Table 5 also contains other kinds of specification analysis. In one column, interactions between the currency union and dummy and the three key regressors of the gravity model (distance, output, and output per capita) are added. Although the interaction terms are highly collinear with the currency union dummy, γ remains positive and significant. More importantly, γ and the three interaction coefficients are jointly extremely significant.[24] I also show that my results do not depend on the inclusion of the six regressors that are not part of the standard gravity model, by excluding them from the regression. Finally, I add a dummy variable which is unity if the two countries are not in a currency union with each other but (at least) one is in a currency union with another country. A significant negative coefficient on this variable would indicate the existence of potentially harmful trade diversion, and could be interpreted as implying that currency unions boost trade inside the union at the expense of trade with non-members. But the coefficient is positive and significant, indicating that currency unions seem to make countries more open without damaging trade diversion effects.

The possibility of an important omitted factor, which is highly correlated with the two monetary variables, can never be ruled out. If such a variable exists, it could, in principle, be dramatically influencing the size and significance of γ, δ, or both. Still, there appears to be no suspect smoking gun near the scene of this crime; my set of controls is virtually the union of those in the literature, and includes many regressors not tested heretofore.[25,26]

Further sensitivity checks are provided in Table 6, which focuses on sensitivity to different *estimation* techniques. Trade flows are censored in that they must be greater than zero to appear in the sample. A related concern is undue importance of trifling trade observations since my sample includes many small countries. Both problems can be handled by first setting (the log of) small trade values (defined as those <$50k) to zero, and second using Tobit. Tobit is

an appropriate estimator for gravity equations, though it has seldom been of more than academic import in the literature. A different way to address the issue of unimportant observations is to use weighted least squares; I use the product of real GDPs (i.e., $\ln(Y_iY_j)$) for my weights. Another concern is non-randomly missing observations (since many country-pairs do not engage in any trade at all): Heckit can be used to solve this problem.[27] High-tech estimates that exploit the panel nature of the data set are also presented. I use random effects, maximum likelihood, and a generalized linear Gaussian model estimator.[28] Finally, I tabulate both quantile (median) and robust (iterative Huber/biweight) regression results, which take potential outliers into greater account. The estimates of γ and δ do not vary much despite the use of this econometric artillery; both γ and δ remain correctly signed and economically and statistically significant.

Another way to check my results is to see if the *growth* in trade is linked to currency union status. To do this, I examine the growth of trade between 1990 and 1970, taking into account the growth in real GDP, real GDP per capita and entry into a regional trade arrangement. Bilateral trade grew sixteen percent faster annually for currency union partners, holding other things equal:

$$\Delta\ln(X_{ij}) = .001 + .75\Delta(Y_iY_j) + .90\Delta\ln(Y_iY_j/Pop_iPop_j) + 1.44\Delta FTA_{ij} + .16CU_{ij} + \text{error}$$

$$\qquad\qquad (.002)\ (.02) \qquad\quad (.05) \qquad\qquad\qquad (.23) \qquad\quad (.03)$$

$$N = 2989 \qquad R^2 = .47 \qquad RMSE = .104$$

where: Δ denotes the difference between 1990 and 1970 values (divided by 20 to annualize the data), the equation is estimated with OLS, and robust standard errors are presented in

parentheses. Thus, currency unions are associated with trade growth which is significantly faster than non-currency unions in both economic and statistical terms.

To summarize: my results do not appear to be sensitive either to the exact specification of the gravity equation, to the precise sample, or to the particular estimation technique.

5.3 But ...

Exchange rate volatility appears to lower trade. But countries with extensive trade may have sought to lower exchange rate volatility deliberately in order to raise trade. Indeed, it is hard to understand European monetary relations of late without realizing that there is a potentially non-trivial simultaneity problem inherent in my estimates. The sign of this simultaneity bias is indeterminate since more exchange rate volatility should be bad for trade but more trade should reduce exchange rate volatility. Hence there is no reason why δ should be biased in one particular direction.

One way to resolve the simultaneity issue is to use the estimation technique of instrumental variables. Three terms involving inflation rates are used as instrumental variables. There is no obvious theoretical reason why inflation should affect international trade flows directly, but inflation differentials certainly affect international monetary relations.[29] I use a) the product of the two relevant inflation rates, b) their sum, and c) the absolute value of the difference between the two inflation rates, all calculated over the five years preceding the sample year (i.e., using the same timing as with exchange rate volatilities).[30] Thus, for the 1975 Algeria/Angola observation, the product of the Algerian and Angolan annual inflation rates calculated using annual data from 1970 through 1974 is used, as well as the sum of the two

inflation rates and the difference between the higher and lower inflation rates. The results are tabulated in Table 7, which again presents pooled results.

In the first (left) column of Table 7, I instrument for exchange rate volatility and confirm the previous results: γ is still estimated to be positive and significantly different from zero at conventional levels, while δ is still negative and significant. The coefficients on the nuisance terms and the fit remain essentially unchanged, though the sample has shrunk due to unavailable inflation data.

One can apply the same reasoning to conjecture that the currency union variable may be similarly affected by simultaneity bias. This is a more hypothetical argument than its counterpart for exchange rate volatility. Decisions to enroll in or depart from a currency union are infrequent; common currency arrangements are generally much longer-lived than exchange rate arrangements.[31] During my sample, two countries joined the CFA franc zone and trade does not appear to have played a role in either case. Ireland departed from its rigid 1:1 pound fix and joined the EMS as part of its general reorientation away from the UK and towards Europe. Countries which left currency unions before the sample began also appear to have been motivated by political rather than economic considerations; Cohen (1993).[32] Most would not say that deepening trade actually played a crucial role in the decision to create EMU. Succinctly: trade considerations seem irrelevant when a country decides whether to join or leave a common currency area. If they are irrelevant, the issue of reverse causality does not affect OLS estimates of γ.

Still, in the second column of table 7, CU as well as V(e) are treated as endogenous, using the same three instrumental variables. Though γ is now wildly and implausibly bigger, it remains positive and significant. Other results are unsatisfactory; δ is *positive* and of marginal

significance, and several nuisance coefficients switch sign.[33] Still, the hypotheses that either CU alone or both CU and V(e) jointly are exogenous cannot be rejected with standard Hausman tests at the 5% level, though the hypotheses are rejected at the 1% level.[34]

I treat these results with a grain of salt, given the difficulty of finding appropriate instrumental variables for the incidence of currency unions. The two middle columns in table 7 present the "first stage" regressions of V(e) and CU respectively on the instrumental variables. They show how much easier it is to find good instrumental variables for V(e) than CU. This is unsurprising, as many believe that the decision to join or leave a common currency arrangement is primarily a political decision, where economic considerations like international trade are unimportant.

Finally, three extra instrumental variables are added in the extreme right columns of Table 7. The instrumental variables are the product, sum, and absolute value of the difference between the two contemporaneous growth rates of M2. This robustness check leads to insignificantly different results.[35]

I conclude that allowing for the endogeneity of exchange rate volatility does not change my results. Though it is unclear whether they are needed, it is difficult to find good instrumental variables for common currency arrangements. Research on the determinants of currency unions remains an interesting research issue.

6. So?

6.1 What I Learned this Summer

In this paper, the gravity model was used to show that two countries with a common currency trade more. The effect is statistically significant and economically large. Two

countries which use the same currency trade much more than comparable countries with their own currencies; my point estimate is over three times as much. The impact of a common currency is an order of magnitude larger than the effect of reducing moderate exchange rate volatility to zero but retaining separate currencies. The effect takes into account a variety of other factors, and seems robust.[36]

6.2 Ignorance

It is clear that a common currency should encourage trade. The puzzle in this paper is that the effect seems to be so enormous. Why does sharing a currency have such a big effect on trade?[37] The short answer is: I don't know. A common currency represents a serious government commitment to long-term integration. This commitment could, in turn, induce the private sector to engage in greater international trade. Perhaps hedging exchange rate risk is much more difficult than commonly believed. Alternatively, a common currency could induce greater *financial* integration, which then leads to stronger trade in goods and services.[38] 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, while price transparency is clearly higher within a currency union, the question is "How much?" 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.[39]

Nevertheless, even if we don't know *why* a common currency makes a difference, it is plausible *that* it does. The evidence in this paper 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 intranational bias is clear; trade within countries is simply huge compared to trade between countries, even for 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 point estimates of γ too literally to agree with this reasoning.

6.3 Bliss

The most important consequence of increased trade is increased gains from trade. As the deadweight loss of using different currencies vanish, competitive pressures increase and consumers gain static 'Harberger' triangles. 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.[40] And if EMU causes radically increased intra-European trade and its benefits, other countries may well take the plunge, spreading these gains even further. Many countries both inside Europe and elsewhere are toeing the water at present. If the benefits of a common currency have been underestimated, more will consider relinquishing monetary sovereignty.

Still, a caveat is in order. The gravity model is a reduced form model of trade; it does not attempt to link common currencies to trade through a structural framework. As such, it cannot provide a quantitative estimate of the welfare gains from a common currency. I do not know

why the seemingly small costs associated with exchanging currencies seem to deter trade so much.[41] Thus to the question "How important are the welfare benefits of extra trade which stem from a common currency" I can only truthfully answer "Bigger than you thought."

6.4 Watch Out

A large increase in trade precipitated for whatever reason (including the introduction of a common currency) brings benefits but also tensions. Certainly there may be an increase in trade disputes. These will certainly occur inside Europe because of EMU, as competitive pressures lead special interests to cry for protectionism in the timeworn fashion. There may also be an increase in trade tensions between Europe and the rest of the world if the European market size increases dramatically. 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 there is no evidence of this in the historical data. As a result, there may be pressures to retain (or even increase) the social safety net both inside and outside Europe.

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. Frankel and Rose (1998) show that 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.

6.5 The Bottom Line

The decision to enter a currency union is based on many 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 now. Instead, economists have used the much smaller 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 weaker accordingly.

This paper contends 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.

Table 1: Benchmark Results

	1970	1975	1980	1985	1990	Pooled
Currency Union γ	.87	1.28	1.09	1.40	1.51	1.21
	(.43)	(.41)	(.26)	(.27)	(.27)	(.14)
Exchange Rate Volatility δ	-.062	.001	-.060	-.028	-.009	-.017
	(.012)	(.008)	(.010)	(.005)	(.002)	(.002)
Output β_1	.77	.81	.81	.80	.83	.80
	(.02)	(.01)	(.01)	(.01)	(.01)	(.01)
Output/Capita β_2	.65	.66	.61	.66	.73	.66
	(.03)	(.03)	(.02)	(.02)	(.02)	(.01)
Distance β_3	-1.09	-1.15	-1.03	-1.05	-1.12	-1.09
	(.05)	(.04)	(.04)	(.04)	(.04)	(.02)
Contiguity β_4	.48	.36	.73	.52	.63	.53
	(.21)	(.19)	(.18)	(.18)	(.18)	(.08)
Language β_5	.56	.36	.28	.36	.50	.40
	(.10)	(.10)	(.09)	(.08)	(.08)	(.04)
FTA β_6	.87	1.02	1.26	1.21	.67	.99
	(.16)	(.21)	(.16)	(.17)	(.14)	(.08)
Same Nation β_7	1.02	1.37	1.12	1.36	.88	1.29
	(.74)	(.59)	(.38)	(.64)	(.52)	(.26)
Same Colonizer β_8	.91	.73	.52	.48	.59	.63
	(.15)	(.14)	(.12)	(.12)	(.12)	(.06)
Colonial Relationship β_9	2.52	2.40	2.28	2.05	1.75	2.20
	(.23)	(.19)	(.14)	(.14)	(.15)	(.07)
Number of Observations	4052	4474	5092	5091	4239	22,948
$\mathbf{R^2}$	.57	.59	.62	.65	.72	.63
RMSE	2.18	2.18	2.03	1.94	1.75	2.02

Note: OLS estimation; robust standard errors in parentheses.

Constant term (and year controls for pooled regression) not reported.

Table 2a: Sample Sensitivity

Observations Excluded:	Intra-LDC	Australia, France, NZ, UK, and US	African	Europe, Australia, NZ and Pacific	The Americas and Caribb.
Currency Union γ	1.85	1.04	1.46	.96	1.23
	(.30)	(.15)	(.40)	(.15)	(.19)
Exchange Rate Volatility δ	-.014	-.016	-.013	-.018	-.037
	(.003)	(.002)	(.002)	(.003)	(.005)
Output β_1	.88	.78	.82	.78	.74
	(.01)	(.01)	(.01)	(.01)	(.01)
Output/Capita β_2	.50	.64	.80	.61	.68
	(.02)	(.01)	(.02)	(.02)	(.02)
Distance β_3	-1.01	-1.09	-1.03	-1.05	-.88
	(.02)	(.02)	(.02)	(.03)	(.03)
Contiguity β_4	-.50	.66	.24	1.04	.78
	(.10)	(.09)	(.09)	(.10)	(.12)
Language β_5	.52	.27	.59	.37	.33
	(.04)	(.05)	(.05)	(.06)	(.09)
FTA β_6	.53	1.10	1.00	1.41	.75
	(.07)	(.09)	(.09)	(.13)	(.09)
Same Nation β_7	1.37	1.20	1.45	1.06	3.56
	(.26)	(.35)	(.38)	(.48)	(.49)
Same Colonizer β_8	.39	.65	.74	.83	.53
	(.15)	(.06)	(.09)	(.07)	(.09)
Colonial Relationship β_9	1.60	2.95	1.74	1.67	1.65
	(.07)	(.30)	(.10)	(.28)	(.11)
Currency Unions Obs.	36	252	41	228	130
Number of Observations	10,977	20,084	12,677	11,354	7,352
R^2	.75	.58	.69	.51	.69
RMSE	1.50	2.09	1.87	2.29	1.89

Note: OLS estimation; robust standard errors in parentheses.

Intercept and year controls unreported.

Table 2b: Sample Sensitivity

Observations Excluded:	(Bilateral /Total Trade) > .1	GDP per capita Disparity > 2	GDP Disparity > 4	GDP per capita < $1000	Population < 1 million
Currency Union γ	1.04	1.19	1.26	1.48	1.31
	(.19)	(.17)	(.19)	(.24)	(.17)
Exchange Rate Volatility δ	-.016	-.018	-.014	-.010	-.013
	(.002)	(.003)	(.003)	(.003)	(.002)
Output β_1	.79	.83	.84	.88	.84
	(.01)	(.01)	(.01)	(.01)	(.01)
Output/Capita β_2	.66	.70	.67	.83	.73
	(.01)	(.01)	(.01)	(.02)	(.01)
Distance β_3	-1.04	-1.12	-1.14	-1.07	-1.15
	(.02)	(.02)	(.02)	(.02)	(.02)
Contiguity β_4	.23	.63	.58	.25	.48
	(.11)	(.09)	(.09)	(.10)	(.09)
Language β_5	.30	.42	.42	.43	.40
	(.04)	(.05)	(.05)	(.05)	(.04)
FTA β_6	1.26	.73	.75	.80	.43
	(.10)	(.08)	(.08)	(.08)	(.08)
Same Nation β_7	1.31	1.46	1.63	1.25	3.93
	(.58)	(.43)	(.81)	(.43)	(.22)
Same Colonizer β_8	.58	.93	.80	.94	.78
	(.06)	(.07)	(.07)	(.09)	(.08)
Colonial Relationship β_9	1.32	2.22	1.90	2.01	1.91
	(.15)	(.05)	(.05)	(.09)	(.08)
Currency Unions Obs.	159	129	121	51	100
Number of Observations	20,419	16,035	16,865	13,969	16,848
R^2	.58	.65	.64	.68	.64
RMSE	2.02	2.01	2.02	1.88	1.95

Note: OLS estimation; robust standard errors in parentheses.

Intercept and year controls unreported.

Table 3: Monetary Regime Sensitivity

Currency Union γ				1.22 (.14)	1.26 (.14)	1.27 (.14)	1.27 (.18)
Stricter Currency Union Definition γ		1.17 (.14)					
Currency Unions between Countries			1.28 (.14)				
Dependency/Territory Currency Unions			1.11 (.47)				
Volatility: Maximal				-.0026 (.0003)			
Volatility: 90th percentile					-.006 (.002)		
Volatility: Level						10 e-15 (4 e-15)	
Volatility: Within Year							-.014 (.002)
Exchange Rate Volatility δ		-.017 (.002)	-.017 (.002)				
Output β_1	.80 (.01)	.80 (.01)	.80 (.01)	.80 (.01)	.80 (.01)	.80 (.01)	.81 (.01)
Output/Capita β_2	.67 (.01)	.66 (.01)	.66 (.01)	.65 (.01)	.67 (.01)	.67 (.01)	.67 (.01)
Distance β_3	-1.12 (.02)	-1.09 (.02)	-1.09 (.02)	-1.09 (.02)	-1.10 (.02)	-1.10 (.02)	-1.10 (.02)
Contiguity β_4	.50 (.09)	.54 (.08)	.53 (.08)	.53 (.08)	.53 (.08)	.52 (.08)	.52 (.09)
Language β_5	.42 (.04)	.41 (.04)	.40 (.04)	.40 (.04)	.40 (.04)	.39 (.04)	.35 (.04)
FTA β_6	1.07 (.08)	.98 (.08)	1.02 (.08)	1.00 (.08)	.99 (.08)	.98 (.08)	1.09 (.08)
Same Nation β_7	1.90 (.26)	1.63 (.27)	1.47 (.29)	1.30 (.26)	1.30 (.27)	1.29 (.27)	1.47 (.36)
Same Colonizer β_8	.71 (.06)	.63 (.06)	.63 (.06)	.64 (.06)	.65 (.06)	.66 (.06)	.59 (.06)
Colonial Relationship β_9	2.20 (.07)	2.19 (.07)	2.19 (.07)	2.20 (.07)	2.23 (.07)	2.24 (.07)	2.15 (.06)
Number of Observations	22,948	22,948	22,948	23,033	23,033	22,948	18,753
R^2	.63	.63	.63	.63	.63	.63	.64
RMSE	2.03	2.02	2.02	2.02	2.03	2.03	1.99

Note: OLS estimation; robust standard errors in parentheses.
All regressions pooled across years; intercept and year controls unreported.

Table 4: Distance Sensitivity

Currency Union γ	1.80 (.24)	1.79 (.24)	1.53 (.24)
Exchange Rate Volatility δ	-.010 (.002)	-.012 (.003)	-.011 (.002)
Output β_1	.83 (.01)	.83 (.01)	.84 (.01)
Output/Capita β_2	.71 (.01)	.69 (.01)	.69 (.01)
Hirschberg Centroid Distance β_3	-1.11 (.03)		
Fitzpatrick/Modlin Distance* β_3		-.02 (.0004)	
Distance β_3			-1.16 (.02)
Contiguity β_4	1.47 (.10)	1.48 (.10)	.54 (.11)
Language β_5	.59 (.05)	.58 (.05)	
Boisso-Ferrantino Measure of Linguistic Similarity* β_5			.005 (.0009)
FTA β_6	1.48 (.09)	1.54 (.09)	.78 (.09)
Same Nation β_7	1.06 (.42)	1.01 (.42)	1.14 (.44)
Same Colonizer β_8	.74 (.07)	.73 (.07)	.85 (.07)
Colonial Relationship β_9	2.00 (.08)	2.03 (.07)	2.34 (.08)
Number of Observations	16,028	16,263	16,263
$\mathbf{R^2}$	.62	.62	.63
RMSE	2.00	2.01	2.00

Note: OLS estimation; robust standard errors in parentheses.
All regressions pooled across years; intercept and year controls unreported.
* indicates statistics multiplied by 100.

Table 5a: Specification Sensitivity

Currency Union γ	1.83 (.26)	1.95 (.28)	1.33 (.14)	1.22 (.14)	.67 (.15)
Exchange Rate Volatility δ	-.019 (.003)	-.019 (.003)	-.014 (.002)	-.016 (.002)	-.014 (.002)
Output β_1	.85 (.01)	.85 (.01)	.93 (.01)	.87 (.01)	-.83 (.08)
Output/Capita β_2	.50 (.02)	.51 (.02)	.49 (.01)	.57 (.01)	-.72 (.18)
Distance β_3	-1.20 (.03)	.71 (.36)	-1.07 (.02)	-1.05 (.02)	-1.03 (.02)
Contiguity β_4	.59 (.13)	.82 (.13)	.75 (.09)	.70 (.09)	.56 (.09)
Language β_5	.53 (.06)	.55 (.06)	.50 (.04)	.52 (.04)	.41 (.04)
FTA β_6	.48 (.10)	.63 (.11)	.89 (.08)	.84 (.08)	.58 (.08)
Same Nation β_7	-.21 (.99)	-.28 (.99)	1.16 (.27)	1.17 (.27)	.73 (.28)
Same Colonizer β_8	.92 (.08)	.90 (.08)	.41 (.06)	.47 (.06)	.47 (.06)
Colonial Relationship β_9	1.89 (.09)	1.87 (.09)	2.01 (.08)	2.03 (.08)	2.32 (.08)
Remoteness	9.4 (12.)				
Tariff Rate Product	-.037 (.002)				
Tariff Rate Sum		-.041 (.002)			
Distance Squared		-.12 (.02)			
Product of Land Area			-.14 (.01)		
At least one Landlocked			-.35 (.03)		
Sum of Land Area				-.19 (.01)	
One Country Landlocked				-.40 (.04)	
Both Landlocked				-.62 (.13)	
Output Squared					.024 (.001)
Output /Capita Squared					.042 (.005)
Number of Observations	9008	9008	22,948	22,948	22,948
$\mathbf{R^2}$	.69	.69	.64	.64	.64
RMSE	1.84	1.84	2.00	2.01	2.00

Note: OLS estimation; robust standard errors in parentheses.
All regressions pooled across years; intercept and year controls unreported.

Table 5b: Specification Sensitivity

Currency Union γ	1.71 (.13)	1.11 (.15)	1.18 (.14)	2.51 (1.18)	1.33 (.53)
Exchange Rate Volatility δ	-.044 (.002)	-.007 (.002)	-.017 (.002)	-.017 (.002)	-.048 (.012)
Output β_1	.77 (.01)	.85 (.01)	.82 (.01)	.80 (.01)	.84 (.02)
Output/Capita β_2	.58 (.01)	.52 (.01)	.64 (.01)	.66 (.01)	.81 (.04)
Distance β_3	-1.21 (.02)	-1.21 (.02)	-1.10 (.02)	-1.10 (.02)	-1.08 (.06)
Contiguity β_4		.40 (.09)	.56 (.09)	.52 (.09)	-.16 (.23)
Language β_5		.28 (.04)	.39 (.04)	.40 (.04)	.34 (.14)
FTA β_6		.89 (.09)	.88 (.08)	1.05 (.08)	.45 (.17)
Same Nation β_7		1.00 (.32)	1.19 (.27)	1.21 (.29)	3.82 (.30)
Same Colonizer β_8		.82 (.06)	.59 (.06)	.63 (.06)	.49 (.30)
Colonial Relationship β_9		2.15 (.08)	2.09 (.08)	2.20 (.07)	1.66 (.27)
Current Account Controls		-.43 (.03)			
Surrender of Export Proceeds		-.34 (.03)			
One Island Nation			.03 (.03)		
Two Island Nations			.59 (.07)		
Currency Union*Output				-.06 (.04)	
Currency Union* Output/Capita				-.16 (.07)	
Currency Union*Distance				.44 (.14)	
Absolute Difference in Bureaucratic Efficiency					.13 (.04)
Absolute Difference in Political Stability					.11 (.04)
Number of Observations	22,948	19,581	22,948	22,948	1852
R^2	.59	.66	.63	.63	.66
RMSE	2.13	1.93	2.02	2.02	1.81

Note: OLS estimation; robust standard errors in parentheses.
First four regressions pooled across years; intercept and year controls unreported. Last regression is only for 1980.

Table 5c: Specification Sensitivity

Currency Union γ	1.18 (.14)	1.34 (.20)	1.21 (.14)	1.35 (.14)
Exchange Rate Volatility δ	-.017 (.002)	.005 (.002)	-.017 (.002)	-.015 (.002)
Output β_1	.81 (.01)	.91 (.01)	.80 (.01)	.81 (.01)
Output/Capita β_2	.65 (.01)	.62 (.01)	.66 (.01)	.65 (.01)
Distance β_3	-1.10 (.02)	-1.27 (.02)	-1.09 (.02)	-1.11 (.02)
Contiguity β_4	.54 (.08)	.33 (.11)	.53 (.08)	.54 (.08)
Language β_5	.37 (.04)	.19 (.05)	.40 (.04)	.38 (.04)
FTA β_6	.92 (.08)	.41 (.08)	.99 (.08)	.97 (.08)
Same Nation β_7	.53 (.28)	n/a	1.30 (.26)	1.36 (.26)
Same Colonizer β_8	.61 (.06)	.81 (.07)	.63 (.06)	.63 (.06)
Colonial Relationship β_9	2.13 (.08)	1.98 (.09)	2.19 (.07)	2.05 (.08)
Common Head of State	.87 (.11)			
Sum of Economic Freedom Indices		.22 (.01)		
Currency Board Control			1.14 (.36)	
Currency Union/Non-Currency Union Control				.29 (.03)
Number of Observations	22,948	13,104	22,948	22,948
R^2	.63	.70	.63	.63
RMSE	2.02	1.77	2.02	2.02

Note: OLS estimation; robust standard errors in parentheses.
All regressions pooled across years; intercept and year controls unreported.

Table 6: Estimation Sensitivity

	Tobit	WLS	Heckit	Random Effects	MLE	GLM	Quantile	Robust
Currency Union γ	1.57	1.30	1.52	1.23	1.23	1.25	1.45	1.29
	(.18)	(.14)	(.14)	(.20)	(.20)	(.19)	(.15)	(.13)
Exchange Rate	-.018	-.017	-.021	-.005	-.006	-.007	-.015	-.017
Volatility δ	(.003)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Output β_1	.89	.81	.82	.80	.80	.79	.83	.84
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Output/Capita β_2	.71	.67	.67	.60	.60	.62	.66	.66
	(.01)	(.01)	(.01)	(.02)	(.02)	(.02)	(.01)	(.01)
Distance β_3	-1.21	-1.10	-1.13	-1.16	-1.16	-1.15	-.99	-1.05
	(.02)	(.02)	(.02)	(.03)	(.03)	(.03)	(.02)	(.02)
Contiguity β_4	.52	.47	.41	.69	.68	.67	.45	.48
	(.12)	(.08)	(.09)	(.17)	(.16)	(.14)	(.10)	(.09)
Language β_5	.48	.40	.75	.39	.39	.39	.44	.41
	(.05)	(.04)	(.04)	(.07)	(.07)	(.06)	(.04)	(.04)
FTA β_6	1.06	.91	1.11	.41	.43	.56	.76	.94
	(.13)	(.07)	(.10)	(.11)	(.11)	(.11)	(.11)	(.09)
Same Nation β_7	1.50	1.35		1.15	1.16	1.22	1.28	1.39
	(.34)	(.25)		(.28)	(.28)	(.29)	(.27)	(.25)
Same Colonizer β_8	.65	.64		.55	.55	.57	.72	.75
	(.07)	(.06)		(.09)	(.08)	(.08)	(.05)	(.05)
Colonial	2.28	2.15		2.41	2.40	2.37	1.98	2.01
Relationship β_9	(.14)	(.07)		(.21)	(.21)	(.19)	(.12)	(.11)
R^2	.15	.64		.63			.44	

Note: All regressions pooled across years; intercept and year controls unreported.

Number of observations = 22,948, except for Heckit (35,998). Quasi-R^2 reported for Tobit and quantile regression.

Table 7: Instrumental Variables

	IV for δ	IV for δ and γ	V(e): 1st Stage	CU: 1st Stage	IV for δ	IV for δ and γ
Instrumental Variables	Inflation	Inflation			Inflation, M2 growth	Inflation, M2 growth
Currency Union γ	1.69 (.21)	83. (20.)			1.58 (.21)	52. (14.)
Exchange Rate Volatility δ	-.009 (.003)	.014 (.006)			-.007 (.003)	.008 (.005)
Output β_1	.85 (.01)	1.00 (.04)	.09 (.02)	-.002 (.0002)	.85 (.01)	.96 (.03)
Output/Capita β_2	.74 (.01)	.84 (.04)	-.62 (.03)	-.001 (.0005)	.77 (.01)	.87 (.04)
Distance β_3	-1.19 (.02)	-.52 (.17)	.36 (.05)	-.008 (.001)	-1.21 (.02)	-.71 (.14)
Contiguity β_4	.27 (.10)	.14 (.78)	-.25 (.25)	.003 (.004)	.35 (.11)	.53 (.58)
Language β_5	.33 (.04)	-1.26 (.42)	.42 (.10)	.020 (.002)	.29 (.05)	-.57 (.27)
FTA β_6	.79 (.08)	-.97 (.96)	-.54 (.24)	.022 (.004)	.93 (.09)	-.38 (.80)
Same Nation β_7	.85 (.36)	1.24 (.41)	-.77 (1.34)	-.004 (.022)	1.05 (.49)	1.25 (.50)
Same Colonizer β_8	.65 (.07)	-1.98 (.71)	-.56 (.14)	.032 (.002)	.71 (.08)	-1.20 (.58)
Colonial Relationship β_9	2.14 (.08)	3.07 (.26)	-1.10 (.29)	-.011 (.005)	2.26 (.14)	2.90 (.24)
Inflation Difference			-.059 (.002)	.0001 (.00003)		
Inflation Product			-.00003 (1 e-6)	5 e-8 (2 e-8)		
Inflation Sum			.078 (.002)	-.0001 (.00003)		
R^2	.67		.60	.06	.67	
RMSE	1.91	6.11	4.41	.071	1.89	4.19
Number of Observations	16,855	16,855	16,855	16,855	12,468	12,468

Note: IV estimation; robust standard errors in parentheses.

Intercept and year controls unreported.

Table A1: Currency Unions, 1970-1990

Australia
Christmas Island (territory)
Cocos (Keeling) Islands (territory)
Norfolk Island (territory)
Kiribati
Nauru
Tuvalu
Tonga (pre '75)

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

ECCA
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

Belgium
Luxembourg

CFA
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)
British Virgin Islands (territory of UK)
Turks and Caicos islands (territory of UK)
Bahamas
Bermuda (colony of UK)
Liberia
Marshall Islands
Micronesia
Palau
Panama
Barbados (? 2:1)
Belize (? 2:1)

Singapore
Brunei

Table A2: Countries

Antigua and Barbuda	Afghanistan	Albania	Algeria
American Samoa	Angola	Anguilla	Argentina
Aruba	Australia	Austria	Bahamas
Bahrain	Bangladesh	Barbados	Belgium/Luxembourg
Belize	Benin	Bermuda	Bhutan
Bolivia	Brazil	Brit. Ind. Oc. Terr.	British Virgin Islands
Brunei Darussalam	Bulgaria	Burkina Faso	Burundi
Cambodia	Cameroon	Canada	Cayman Islands
C.A.R.	Chad	Chile	China
Colombia	Comoros	Congo	Cook Islands
Costa Rica	Cuba	Cyprus	Czechoslovakia
Denmark	Djibouti	Dominica	Dominican Republic.
Ecuador	Egypt	El Salvador	Eq. Guinea
Ethiopia	Falkland Islands	Fiji	Finland
Fr. Guiana	France	Gabon	Gambia
Germany, East	Germany, West	Ghana	Gibraltar
Greece	Greenland	Grenada	Guadeloupe
Guam	Guatemala	Guinea	Guinea-Bissau
Guyana	Haiti	Honduras	Hong Kong
Hungary	Iceland	India	Indonesia
Iran	Iraq	Ireland	Israel
Italy	Ivory Coast	Jamaica	Japan
Jordan	Kenya	Kiribati	Korea, Rep.
Kuwait	Laos	Lebanon	Liberia
Libya	Madagascar	Malawi	Malaysia
Maldives	Mali	Malta	Martinique
Mauritania	Mauritius	Mexico	Mongolia
Montserrat	Morocco	Mozambique	Myanmar
North Korea	Nauru	Nepal	Netherlands
Netherlands Antilles	New Caledonia	New Zealand	Nicaragua
Niger	Nigeria	Niue	Norway
Oman	Pacific Isl.	Pakistan	Panama
Papua New Guinea	Paraguay	Peru	Philippines
Poland	Portugal	Qatar	Reunion
Romania	Rwanda	S Yemen	Saudi Arabia
Senegal	Seychelles	Sierra Leone	Singapore
Solomon Islands	Somalia	South Africa	St. Pierre & Miquelon
Spain	Sri Lanka	St. Helena	St. Kitts & Nevis
St. Lucia	St. Vinc. & Grenadines	Sudan	Suriname
Sweden	Switzerland	Syria	Taiwan
Tanzania	Thailand	Togo	Tonga
Trinidad & Tobago	Tunisia	Turkey	Turks & Caicos Islands
Tuvalu	U.K.	U.S.A.	U.S.S.R.
Uganda	United Arab Emirates	Uruguay	US Virgin Islands
Venezuela	Vietnam	(Western) Samoa	Western Sahara
Yemen	Former N. Yemen	Yugoslavia	Zaire
Zambia	Zimbabwe		

Table A3: Descriptive Statistics

	Obs.	Mean	Std. Dev.	Min	Max
Trade	33,903	9.10	3.33	.13	19.37
Currency Union	33,903	.009	.098	0	1
Exchange Rate Volatility	27,628	4.72	6.90	0	93.57
Output	26,608	34.4	2.7	20.0	43.5
Output/Capita	26,635	16.2	1.4	11.7	20.8
Distance	30,515	8.18	.82	2.97	9.42
Contiguity	33,903	.02	.15	0	1
Language	33,903	.12	.33	0	1
FTA	33,903	.02	.13	0	1
Same Nation	33,903	.003	.06	0	1
Same Colonizer	33,903	.08	.26	0	1
Colonial Relationship	33,903	.01	.11	0	1

Table A4: Simple Correlations

	Trade	Currency Union	Exchange Rate Volatility	Distance	Output	Output per Capita	Language	Contiguity	FTA	Same Colonizer	Same Country
Currency Union	-0.03										
Exchange Rate Volatility	-0.08	-0.07									
Distance	-0.17	-0.22	0.09								
Output	0.65	-0.21	0.09	0.20							
Output per Capita	0.46	-0.07	-0.07	0.05	0.36						
Language	0.02	0.19	-0.01	-0.19	-0.18	-0.04					
Contiguity	0.13	0.06	0.01	-0.37	0.01	-0.07	0.13				
FTA	0.09	0.20	-0.03	-0.31	-0.11	0.08	0.14	0.11			
Same Colonizer	-0.15	0.22	-0.06	-0.16	-0.33	-0.23	0.32	0.06	0.13		
Same Nation	-0.00	0.28	-0.03	-0.05	-0.11	0.00	0.08	-0.01	0.10	0.05	
Colonial Relationship	0.13	0.01	-0.03	-0.00	0.05	0.03	0.17	-0.01	-0.01	-0.04	.16

Number of observations = 22,804; standard error $\approx$ .007.

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Endnotes

[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 considerable currency substitution (also known as "dollarization") between two currencies with a long-term peg at 1:1 (to make price comparison trivial). I do not include countries that are informally or unofficially dollarized, German Unification in 1990, or the re-integration of Okinawa with Japan in 1972. Using the Australia dollar are Christmas Island (an Australian territory); Cocos (Keeling) Islands (territory); Norfolk Island (territory); Kiribati; Nauru; and Tuvalu (the Tuvaluan and Australian dollars are interchangeable). Tonga was pegged 1:1 to the Australian dollar through 1974. Belgium and Luxembourg are in an economic union, which includes a common currency (though there are both Belgian and Luxembourg francs, they circulate freely and exchange at par). The CFA Franc zone includes: Benin; Burkina Faso; Cote d'Ivoire; Guinea-Bissau; Mali; Niger; Sénégal; and Togo using the Franc of the Communauté Financiére Africaine, Cameroon; Central African Republic; Chad; (Republic of) Congo; Equatorial Guinea; and Gabon using the Franc of the Coopération Financiére Africaine, and Comoros uses the Comorian franc (Eq. Guinea and Mali joined in 1984). There are some technical issues of little interest: for instance, the BEAC of the central region issues currency with similar appearance and identical name identifiable by member, while the BCEAO of the Western region issues a single currency. Denmark has two external parts: the Faroe Islands and Greenland which all use the Danish kroner. The East Caribbean Currency Area (ECCA) includes: Anguilla (territory of UK); Antigua and Barbuda; Dominica; Grenada; Montserrat (territory of UK); St. Kitts and Nevis; St. Lucia; and St. Vincent and the Grenadines. France shares its currency with a number of other areas: French Guiana (an Overseas Department); French Polynesia (an Overseas Territory); Guadeloupe (OD); Martinique (OD); Mayotte (a Territorial Collectivity); New Caledonia (OT); Reunion (OD); Saint Pierre and Miquelon (TC); Wallis and Futuna Islands (OT); and Monaco. Andorra uses the currency of both France and Spain. The Italian lira is used in San Marino and the Vatican. The Moroccan dirham is used in Western Sahara. The New Zealand dollar is used in: Cook Islands; Niue; Pitcairn Island (territory of UK); and Tokelau (territory of NZ). Northern Cyprus uses the Turkish lira. Svalbard is a territory of Norway without its own currency. Brunei and Singapore are in a currency union (the Bruneian and Singaporean dollars are at par), as are South Africa, Lesotho, Namibia, and Swaziland (South African rand, Basotho loti, Namibian dollars and Swazi emalangeni are at par with each other). The Swiss franc is used in Liechtenstein. The UK is in a currency union with: Falkland Islands (territory); Gibraltar (territory); Guernsey (dependency); Jersey (dependency); Isle of Man (dependency); and Saint Helena (territory); one could in principle add the currency union between Scotland and England, since Scottish notes circulate. The US dollar is the official money in: American Samoa (territory); Guam (territory); US Virgin Islands (territory); Puerto Rico (commonwealth associated with US); Northern Mariana Islands (commonwealth in political union with US); British Virgin Islands (territory of UK); Turks and Caicos islands (territory of UK); Liberia (Liberian and American dollars are at par); Marshall Islands; Micronesia; Palau; and Panama (though Panama issues Balboa coins). The Bahamas and Bermuda remains tightly pegged at 1:1 with the US$, while Barbados and Belize are at 2:1. Similarly, a ninetieth country pairing stems from Ireland, which was pegged rigidly to the UK at 1:1 for over fifty years before its ERM entry in March 1979. I do not have data for most of these country-pair observations. A full listing of currency unions is included in the appendix.

[2] 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. They measure exchange-rate uncertainty in different ways. They were doe for different countries, for different time periods, and for different exchange-rate systems. They make varying assumptions on the time lags involved."

[3] The recent panel purchasing power parity (PPPP) literature is the most obvious example; Murray and Papell (1999) claim that panel methods allow one to verify the consensus view that half-lives of PPP deviations are three to five years long, but univariate time-series methods do not.

[4] I only exclude discrepancy observations such as "EEC, not elsewhere specified."

[5] The countries involved include (in alphabetical order): Anguilla; Antigua and Barbuda; Australia; Bahamas; Barbados; Belize; Benin; Bermuda; Bhutan; Brit. Virgin Islands; Burkina Faso; Cameroon; Central Afr. Rep.; Chad; Comoros; Congo; Cook Islands; Cote D'Ivoire; Denmark; Dominica; Falkland Isl.; Fr. So. Ant. Tr.; Fr. Guiana; France; Gabon; Gibraltar; Greenland; Grenada; Guadeloupe; Guinea-Bissau; India; Ireland; Kiribati; Liberia; Mali; Montserrat; Nauru; New Caledonia; New Zealand; Niger; Niue; Panama; Reunion; Senegal; St. Kitts & Nevis; St. Helena; St. Lucia; St. Pierre & Miquelon; St. Vincent & the Grenadines; Togo; Turks & Caicos. Isl.; Tuvalu; U.K.; U.S.A.; and US Virgin Islands. These 330 observations have positive amounts of trade, but the potential universe of

currency union observations is 1021 in my sample of countries, so that many currency union pairings have no trade (as do most bilateral pairings).

[6] The average values of the key gravity regressors for currency union observations are below but close to those for the rest of the sample.

[7] This has been augmented with data from the UN's *International Trade Statistics Yearbook.*

[8] Where both sources are missing, I occasionally found and filled in observations from the UN.

[9] The 1998 *World Factbook* available at http://www.odci.gov/cia/publications/factbook/index.html.

[10] Available at http://www.wto.org/wto/develop/webrtas.htm.

[11] One could, in principle, repeat the analysis using real exchange rates. I have not done so, since the absence of monthly or quarterly price data would reduce the sample size dramatically. Indeed, obtaining annual price series for most of the countries in my sample is difficult. In any case, the correlation between nominal and real exchange rates is high except for high-inflation countries, and my benchmark results do not change if hyper-inflationary observations are excluded from the sample.

[12] There is little evidence of heteroskedasticity; traditional and different varieties of robust standard errors are similar. Allowing for clustering to account for the dependent nature of the sample (a country-pair can enter the sample five times potentially) raises the standard error of γ in my default regression somewhat from .138 to .194.

[13] Standard variance inflation factors reveal informally that the regressors do not have much multicollinearity.

[14] The distance coefficients are somewhat higher than the Leamer-Levinsohn suggestion of .6, and the output per capita coefficients are somewhat higher than Frankel-Wei.

[15] The exception is the interesting and intuitive decline in the colonial effect. Most of the other coefficient variation is of negligible economic interest, though it is significant on purely statistical grounds.

[16] More formally, using the pooled estimates at the extreme right of Table 1, I can reject the null hypothesis of no effect of a currency union on trade at greater than the .000 confidence level (the t-statistic is 8.7). Similarly, the null hypothesis of no effect of exchange rate volatility has a t-statistic of -8.4.

[17] Even this calculation is biased down, since it ignores the fact that one can't enter a currency union without reducing bilateral exchange rate volatility, an effect that increases the size of the currency union effect. Of course, this *ceteris paribus* experiment has no counterpart in the real world. It is hard to reduce the volatility of a single bilateral exchange rate while maintaining the volatility of other rates.

[18] In contrast, the European Commission (1990, p 73) writes: "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."

[19] There is no evidence of any non-linearity in the relationship between trade and exchange rate volatility.

[20] There are 252 currency-union observations in my default regression. Also, my default equation assumes that β_1 and β_2 are identical for countries i and j; that is, that GDP and GDP per capita have the same coefficients for both countries. If one relaxes this restriction, γ rises to 1.37 (with a standard error of .17) and δ falls to -.015 (.002).

[21] Also, γ does not vary by an economically or statistically significant amount when CU is interacted with indicator variables for countries with large disparities of GDP or GDP per capita. Thus, the effect does not rely on trade between a center country and its periphery.

[22] It is also interesting to note that the coefficient on regional trade agreements, β_6 rises substantially when the monetary variables are omitted. This raises the possibility that inappropriate omission of the latter biases β_6 upwards, leading to an overstated impact of free trade agreements.

[23] Tariffs are defined as import duties as a percentage of imports and are extracted from the *WDI* CD-ROM. Land area is taken from the CIA's web site. The controls data are taken from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. Adding capital account controls does not substantively change the results. The measures for bureaucratic efficiency and political stability are taken from Mauro (1995) and are only available for 1980. Adding either the product or the sum of the two countries; bureaucratic efficiency and/or political stability leads to insignificantly different results. The economic freedom indices are available for 1975, through 1990 for around a hundred countries from the Fraser Institute at http://www.freetheworld.com. Using the product instead of the sum of the indices makes no substantive difference. The currency boards are taken from Table 1 of Ghosh, Gulde, and Wolf (1999).

[24] The hypothesis that the four coefficients are jointly zero is rejected at any reasonable significance level: $F(4,22929)=22$.

[25] I have not yet been able to control for the effects of tied bilateral aid, non-tariff barriers, or legal systems because of data inadequacies. It is hard to imagine that either of these controls would destroy the significance of γ.

[26] In unreported results, I have also added a number of other variables without changing my key results, including the Penn World Table measure of openness.

[27] I use ComNat, ComCol, and Colony to identify my selection equation and drop them from my primary equation; I also drop the year controls from my selection equation. A variety of different specifications for both the primary and selection equations all confirm the result.

[28] The paucity of countries that either join or leave currency unions means that a time-series "within" estimator (i.e., one that exploits only country-pair fixed effects) is untenable.

[29] Harry Flam's advice was instrumental in my choice of first-stage regressors.

[30] I use *IFS* line 64x as the inflation measure.

[31] Many common currency arrangements span the entire post-war period, and quite a few extend back to the nineteenth century. The Latin Monetary Union between France, Belgium, Switzerland and Italy lasted from 1865 through World War I, while the Scandinavian monetary union between Sweden, Denmark and Norway lasted from 1873 through World War I; Buiter (1999).

[32] Cohen states (p. 194): "Trade patterns are particularly unhelpful ..." and have "... no systematic relationship at all" in determining the sustainability of a common currency area. Most contemporary commentators believe that EMU was pursued at least in large part for non-economic factors. Barbados, Guyana and Trinidad-Tobago left the ECCB in the early/mid 1960s, primarily for non-economic reasons; Worrell, Marshall and Smith (1998). Trade is not mentioned among the economic forces.

[33] Very similar results obtain if hyper-inflationary observations are excluded from the sample.

[34] More precisely, when I estimate my equations on identical samples with IV and OLS, I can test (and verify) exogeneity for CU and V(e) jointly or CU alone. For the case of V(e) alone, the estimates do not satisfy the asymptotic assumptions of the Hausman test, as the chi-square test statistics are negative.

[35] I have also experimented with capital account restrictions and multiple exchange rate regimes dummies, and found similar results. In principle, Mundell's optimum currency area theory provides the appropriate instrumental variables: business cycle synchronization, price rigidities, labor mobility, and risk-sharing (e.g., through a tax/transfer structure). In practice, it is hard to measure the first two while the latter two are of negligible importance.

[36] Of the fifty-two estimates of γ provided in this paper, the smallest is .67, which implies a near-doubling of trade.

[37] Of course, the effects may be overstated for modern industrialised countries like those in EMU. Still, if my estimate of γ is over-stated by a factor of five, the growth of trade inside EMU would still be large.

[38] Richard Portes and Helene Rey have recently made progress along these lines using a gravity model which incorporates informational variables; it would be interesting to extend their work on the real side.

[39] There is a caveat here; derivative markets do not exist for most currencies, so that hedging exchange risk for most countries may be expensive.

[40] Baldwin (1991) summarizes both static and dynamic effects of EMU.

[41] Nor do I know if there are rents associated with foreign exchange trading that would be lost with a common currency.