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Emerging Currency Blocs

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EMERGING CURRENCY BLOCS

ABSTRACT

Using the gravity model to examine bilateral trade patterns throughout the world, we find clear evidence that trading blocs are emerging in some parts of the world. In Europe, it is the EC that operates as a bloc, not including EFTA. Two EC members trade an extra 55 per cent more with each other, beyond what can be explained by proximity, size, and GNP/capita.

Turning to the possibility of currency blocs, we find a degree of intra-regional stabilization of exchange rates, especially in Europe. Not surprisingly, the European currencies link to the DM, while Pacific currencies link to the dollar. We also find some cross-section evidence that bilateral exchange rate stability may have had a (small) role in promoting intra-bloc trade during the period 1965-1980. Even the small negative effects we estimate appear to have disappeared during the course of the 1980s, perhaps due to the proliferation of instruments to hedge exchange risk.

Finally, we consider the attributes and prospects of international currencies. We conclude that, notwithstanding recent gains by the yen and mark, the dollar will persist as the world's premier international currency.

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Emerging Currency Blocs

When countries in the 19th century joined the gold standard one-by-one, they were seeking to acquire more than just stability in the values of their currencies. They were moving toward closer integration, financially and economically, with the world economy. After World War I, the system fragmented into currency blocs and trading blocs: Sterling bloc, gold bloc, Central Europe bloc, and dollar bloc.¹ The allies who met at Bretton Woods in 1944 were determined not to repeat after World War II the fragmentation and instability that had characterized the interwar years. The ensuing period of world growth in trade and income indeed seemed to be closely associated with the common world monetary standard, the dollar standard.

The 1971-73 transition to floating exchange rates, among the dollar, yen, mark and pound, was only the beginning of a steady slide into currency entropy. The currencies of eighty smaller countries in the mid-1970s retained pegs to major currencies: the dollar, pound, French franc, or SDR [the IMF's unit that averages five major currencies]. Between 1975 and 1990, however, the number of countries pegging their currencies fell virtually monotonically. Exchange rate variability between most pairs of countries increased. Yet, despite fears that exchange rate uncertainty after 1973 would have an inhibiting effect, international trade continued to

grow.

Recently, a new trend has begun to emerge. Some countries have sought to re-establish stability in their exchange rates. When they have done so, they have not always chosen to peg to the major currency to which they were most closely linked in the past. Rather, the emerging pattern that many observers see is a division of the world into three great blocs, reminiscent of the 1930s but drawn more along regional lines: a European bloc centered on the DM, an Americas bloc centered on the dollar, and an East Asian bloc, centered on the yen.

Formal regional economic arrangements have progressed the furthest in Europe. Within the European Community (EC), the European Monetary System (EMS) had succeeded in stabilizing exchange rates well enough by December 1991 that the members agreed on ambitious plans for European Monetary Union (EMU). Those plans were soon proved overly ambitious, but the long-run trend toward integration is nevertheless clear. The next successful project of the EC will most likely be enlargement to include those of the other Western European countries (members of EFTA -- European Free Trade Association) who wish to join. There is also talk of eventually including countries from Central and even Eastern Europe.

In the Western Hemisphere, there are some regional

trading arrangements in place and others under discussion, such as the North American Free Trade Agreement (NAFTA). There are, however, no formal monetary or financial arrangements analogous to the EMS or prospective EMU. Nevertheless, when a Latin American country like Argentina decides to peg its currency, the dollar is the currency to which it pegs. Many countries are heavily dollarized *de facto*.

In East Asia and the Pacific, formal regional arrangements are almost altogether absent.

This paper concerns two key aspects of the possible regionalization of economic relations, and the interaction between the two. They are trade links and currency links. That the two may be closely intertwined is evident in that a major motivation behind recent attempts to strengthen currency links within Europe is to reduce the extent to which exchange rate risk discourages imports and exports, and thereby to promote stronger trade links. Other important aspects, such as financial links within regions or the extent to which countries within a region share common economic disturbances, are not considered here.

1. Introduction

There is more talk of regionalization, of whether the world is breaking up into three great trading blocs or currency blocs (Europe, Western Hemisphere, and East Asia; or mark, dollar, and yen blocs), than there are attempts at hard quantitative analysis. Often studies simply report measures of the relative size of the blocs, such as shares of world trade, and measures of the extent of intra-regional trade, such as the fraction of countries' trade conducted with others in the region. But these are not measures of intra-regional bias, the extent to which countries are concentrating their economic activity with others in the region.²

The paper looks econometrically at three questions: (1) Is trade biased toward intra-regional partners, within each of the three potential major blocs? (2) Are exchange rates more stable within each of the three potential blocs than across them? (3) To the extent exchange rates are stabilized within a bloc, does that contribute to intra-bloc trade?

Frankel (1993) applied to the trading bloc question the natural framework for studying bilateral trade, the gravity model. The gravity model assumes that trade between two countries is proportional to the product of their sizes and inversely related to the distance between them. These two

factors are presumably the source of the name, by analogy to the formula for gravitational attraction between two masses. It has a fairly long history.³ There are only a few recent applications to a large cross-section of countries throughout the world, however.⁴

Frankel (1993) and Frankel and Wei (1994) found that: (1) there are indeed intra-regional trade biases in the EC and the Western Hemisphere, and perhaps in East Asia; but (2) the greatest apparent intra-regional bias was in none of these three, but in the APEC grouping, which includes the U.S. and Canada with the Pacific countries; (3) the bias in the East Asia and Pacific groupings did not increase in the 1980s as it did in Europe and the Americas; and (4) bilateral exchange rate variability may have had a small negative effect on bilateral trade in 1980, but there is little evidence of an effect in 1985 or 1990.⁵

This paper begins by considering an extension of the original gravity model estimation, allowing a role for linguistic links in trade. At the same time, we extend the results back in history, to 1965. Next, we look more carefully at the possible role of stabilization of bilateral exchange rates in promoting intra-regional trade. We examine the extent to which exchange rates have been stabilized within regional groupings such as the EC and EFTA. Then we test

whether the stabilization of bilateral exchange rates promotes bilateral trade, on the entire data set, running from 1965 to 1990.

Besides these extensions, the paper focuses relatively more on Europe, including both the EC and EFTA, whereas the earlier papers focused relatively more on East Asia and the Pacific. In particular, a central motivating question is the extent to which stabilization of exchange rates within Europe has been a contributing factor to the increase in intra-regional trade there. One view, labelled "American" by Charles Wyplosz, is that stabilization of exchange rates within a region is not a prerequisite for trade integration, with the example of U.S.-Canadian integration frequently cited in support, whereas the "European" view is that it is a prerequisite.⁶ The set-back that European Monetary Union received in the Exchange Rate Mechanism crises of September 1992 and August 1993 means that a return to the higher levels of exchange rate variability that held in the past is a real possibility. To what extent would that reduce intra-European trade?

The final section of the paper discusses the future of the dollar, mark and yen as international currencies.

2. Is Europe a trade bloc?

2.1 The gravity model

One cannot meaningfully investigate the extent to which regional policy initiatives are influencing trade patterns without holding constant for natural economic determinants. A systematic framework for measuring what patterns of bilateral trade are normal around the world is offered by the gravity model. A dummy variable can then be added to represent when both countries in a given pair belong to the same regional grouping. One can check how the level and time trend in, for example, Europe compares with that in other groupings.

The variable to be determined is trade (exports plus imports), in log form, between pairs of countries in a given year. We have 63 countries in our data set, so that there are 1,953 data points ($=63 \times 62 / 2$) for a given year.⁷ The goal, again, is to see how much of the high level of trade within each region can be explained by simple economic factors common to bilateral trade throughout the world, and how much is left over to be attributed to a special regional effect.

One would expect the two most important factors in explaining bilateral trade flows to be the geographical distance between the two countries, and their economic size. These factors are the essence of the gravity model.

Despite the obvious importance of distance and transportation costs in determining the volume of trade, empirical studies surprisingly often neglect to measure this factor. Our measure is the log of distance between two major cities (usually the capital) of the respective countries. We also add a dummy "Adjacent" variable to indicate when two countries share a common land border.

Entering GNPs in product form is empirically well-established in bilateral trade regressions. It can be justified by the modern theory of trade under imperfect competition.⁸ In addition there is reason to believe that GNP per capita has a positive effect on trade, for a given size: as countries become more developed, they tend to specialize more and to trade more.

The equation to be estimated, in its most basic form, is:

$$(1) \quad \dots \quad 0.$$

The last four explanatory factors are dummy variables. *EC*, *WH*, and *EASIA* are three of the dummy variables we use when testing the effects of membership in a common regional grouping.

The results are reported in Tables 1, 2, and 3. These differ from the tables in Frankel (1993) principally by the explicit distinct consideration of (1) the EC, (2) EFTA, and

(3) Europe overall, and the inclusion of terms to capture any possible trade-diversion effects in Europe. We found all four standard gravity variables to be highly significant statistically (> 99% level).

The adjacency variable indicates that when two countries share a common border, they trade with each other approximately twice as much as they otherwise would [$\exp(.7)=2$]. The coefficient on the log of distance is about $-.56$, when the adjacency variable is included at the same time. This means that when the distance between two non-adjacent countries is higher by 1 per cent, the trade between them falls by about $.56$ per cent.

The estimated coefficient on GNP per capita is about $.29$ as of 1980, indicating that richer countries do indeed trade more, though this term declines during the 1980s, reaching $.11$ in 1990. The estimated coefficient for the log of the product of the two countries' GNPs is about $.75$, indicating that, though trade increases with size, it increases less-than-proportionately (holding GNP per capita constant). This presumably reflects the widely-known pattern that small economies tend to be more open to international trade than larger, more diversified, economies.

2.2 Estimation of trade-bloc effects

How high do intra-regional preferences appear to be in the data? If there were nothing to the notion of trading blocs, then the basic economic variables in our gravity regressions would soak up most of the explanatory power. There would be little left to attribute to a dummy variable representing whether two trading partners are both located in the same region. In this case the level and trend in intra-regional trade would be due solely to the proximity of the countries, and to their rate of overall economic growth.

But we found that dummy variables for intra-regional trade are highly significant statistically. If two countries are both located in the Western Hemisphere for example, in 1980 they traded with each other by an estimated 86 per cent more than they would have otherwise [$\exp(.62) = 1.86$], after taking into account distance and the other gravity variables.

The strongest bloc effect in our gravity estimates is not any of the three most often discussed, but is the Pacific bloc that includes the United States and Canada along with East Asia, Australia and New Zealand. (This dummy variable is labelled APEC, after the membership of the Asian Pacific Economic Cooperation forum.) The coefficient in 1980 suggests that two APEC members trade five times as much as a typical

pair of countries [$\exp(1.6)=5.06$]. The group of East Asian countries alone also constituted a significant distinct trade bloc, with a coefficient suggesting that it doubles trade between members [$\exp(.8) = 2.23$].

Both coefficients declined a bit during the decade, reflecting that the rapid growth in Asian/Pacific trade which many observers have remarked was entirely the result of economic growth among the individual countries. [Indeed, the East Asian bloc effect virtually loses significance in 1985 and 1990, if one allows for the greater openness of East Asia in general, and Hong Kong and Singapore in particular, simultaneously with the APEC bloc effect.⁹]

The blocs that strengthened in the 1980s lay elsewhere, in the Americas and Europe. The Western Hemisphere coefficient started the decade with an implied 1.86 multiplier, as noted above, and rose to 2.46 [$=\exp(.9)$]. The rise came entirely between 1985 and 1990. We turn now to Europe.

2.3 The European Community and EFTA

The results suggest that Europe may not even have been an operational trade bloc in 1980. The estimated coefficient on

the EC is only of borderline significance (The point estimate of the effect on trade is 26 per cent [$\exp(.23)=1.26$]). Furthermore, it diminishes when a dummy variable is added to capture the overall openness of European countries. This dummy variable is defined to equal one when either one of the two countries in a given pair is located in Europe, as opposed to both. The results indicate that, as of 1980, the high level of intra-regional trade in Europe can be mostly explained by a combination of proximity, high income, and openness (as compared to the average level of openness in the sample, which includes many LDCs).

By 1985 the EC dummy had become statistically significant. The coefficient implies that two EC members trade an extra 58 per cent with each other [$\exp(.46) = 1.58$].

It is clear that it is the European Community in particular that is having an influence, as terms for EFTA or for Europe overall are not significant.¹⁰ Furthermore, when the term is added to capture the greater openness of European countries, even though it is again significantly positive, the significance of the EC bloc effect rises a bit rather than falling.

Why did the EC strengthen in the early 1980s? One possibility is the accession of Spain, Portugal and Greece during this period, and of the United Kingdom, Ireland and

Denmark not long before. (For ease of comparison across time, these countries are included in the definition of the EC grouping throughout the sample.) Another possible contributing factor, considered below, is the stabilization of exchange rates under the European Monetary System.

The EC coefficient in 1990 is a little larger than in 1985. The effect is 68 per cent [$\exp(.52)=1.68$]. The EFTA and Europe effects are again insignificant. The major change relative to 1985 is that the coefficient on European openness, which was previously significantly greater than zero, is now less than zero, and borderline-significant. This finding bears on the famous distinction between trade-diversion and trade-creation in the literature on the welfare effects of customs unions.

The 1980 and 1985 results suggest that trade-diversion is not greater than zero, indeed that it is negative. One might wonder how the formation of a free-trade area like the EC could produce a negative "trade-diversion coefficient," or what we have called a positive openness coefficient. In theory, the reduction of trade barriers within the region should not encourage trade with other countries; if anything, it should discourage it. The answer is that countries in a given region may somewhat reduce barriers with respect to non-members, at the same time that they reduce or eliminate

barriers internally. Indeed, the two policy changes may be related in a political economy sense. Some have argued that the constellation of political forces that allows liberalization with respect to trade with regional neighbors may be similar to what is required to allow liberalization more generally. The best example is Mexico's decision to negotiate the NAFTA soon after undertaking unilateral liberalization and joining GATT (Lawrence, 1991).

The 1990 result suggests a shift toward trade-diversion.

While a typical European country now trades 68 per cent more with other European countries than can be explained by natural factors, it trades an estimated 11 per cent less with non-European countries. Further results, not reported here, suggest that the trade diversion takes place among the EFTA countries, not the EC countries.

2.4 Common languages

The earlier results were incapable of distinguishing between regional biases reflecting discriminatory trade policies, and those that might derive from historical, political, cultural and linguistic ties. We now add a dummy variable to represent when both countries of a pair speak a common language or had colonial links earlier in the century. We allow for English, Spanish, Chinese, Arabic, French,

German, Japanese, Dutch, and Portuguese.¹¹ The results, reported in Table 4, show that two countries sharing linguistic/colonial links tended in 1965 or 1970 to trade roughly 65 per cent more than they would otherwise [$\exp(.5)=1.65$]. The bloc variables remain significant even when holding constant for these links.

We tested whether some of the major languages were more important than the others. Chinese is the only one to qualify, and its apparent effect is probably spurious.¹² French, Spanish, and Arabic, if anything, have less effect than other common languages, though the differences are not very significant statistically. When all nine linguistic/colonial links are constrained to have the same coefficient, it is significant at the 99 per cent level.¹³ The 1980 effect is again 65 per cent.

To summarize, allowing for the linguistic links has little effect on the statistical significance of the bloc coefficients, as was also true of earlier extensions.

3. Currency blocs

Does the stabilization of exchange rates within regions help promote trade within those regions? The question bears on the larger literature on the implications of fixed versus

floating exchange rate regimes.

3.1 Stabilization of exchange rates within the blocs

Table 5 reports statistics on the nominal variability of exchange rates among various groupings of countries. Worldwide, monthly exchange rate variability rose in the 1980s, from a standard deviation of .33 per cent in 1980 to .38 per cent in 1990. The latter figure suggests that for a typical pair of countries, approximately 5 per cent of monthly exchange rate changes are larger than .76 per cent (two standard deviations, under the simplifying assumption of a log-normal distribution).

There is a tendency for exchange rate variability to be lower within each of the groups than across groups, supporting the idea of currency blocs. The lowest variability occurs within Europe. The 1980 statistic is a standard deviation of .04 per cent, and it falls by half during the course of the decade.

Even though the members of the EC correspond roughly to the members of the European Monetary System,¹⁴ non-EC members in Europe show about as much stability in exchange rates (both vis-a-vis themselves and vis-a-vis other European countries) as EC members. The EC members show slightly more stability

than the EFTA members in 1990, but slightly less in 1980. These results no doubt in part reflect that the United Kingdom and the Mediterranean countries have not been consistent members of the Exchange Rate Mechanism, especially not with the narrow margins set by the others. It also reflects, however, that such EFTA countries as Austria are loyal members of the currency club de facto, even though they are not at all in de jure. We saw in the first part of the paper that the statistical significance of intra-European trade links applies only to the EC, not to EFTA. Observing that the EFTA members have stabilized bilateral exchange rates as much or more than EC members, one immediately suspects that the stabilization of exchange rates must not have been the dominant source of the intra-EC trade links.

The members of APEC also have a relatively low level of intra-regional exchange rate variability, especially considering the diversity of the countries involved. It too fell by half in the course of the 1980s. The level of exchange rate variability is a bit higher within East Asia considered alone. This reflects that the international currency of Asia is not the yen, but rather the dollar, as we will see below. Results on the determination of exchange rates for nine East Asian countries in Frankel and Wei (1994) show that all place very heavy weight on the dollar in their

implicit baskets.¹⁵

The Western Hemisphere considered alone in Table 5 shows much higher levels of exchange rate variability than any of the other groupings (in 1985 and 1990).

3.2 The influence of the dollar, yen, and DM on the values of smaller currencies

We now examine the influences which the most important international currencies have on the determination of the values of currencies of smaller countries. One way that countries in a given area could achieve the lower levels of intra-regional bilateral exchange rate variability observed in Table 5 is to link their currencies to the single most important currency in the region. In a simple version of the currency-bloc hypothesis, one would expect that the dollar has dominant influence in the Western Hemisphere, the yen in East Asia, and the mark (or ECU¹⁶) in Europe.

The equation to be estimated is

$$(2) \quad \Delta \ln(\text{value of currency } i) =$$

$$\beta_0 + \beta_1 \Delta \ln(\text{value of } \$) + \beta_2 \Delta \ln(\text{value of yen}) + \beta_3 \Delta \ln(\text{value of DM}) + \epsilon_t,$$

where the change in the value of each currency is computed

logarithmically. The goal is to see whether countries try to stabilize their currencies in terms of a particular major currency. Such an equation is exceptionally well-specified under a particular null hypothesis, namely that the value of the local currency is determined as a basket peg (perhaps a crawling peg, since we allow for a constant term). By "exceptionally well-specified", we mean that the coefficients should be highly significant and the α_0 should be close to 1.

In 1988, for example, there were 31 countries that were officially classified by the IMF as following a basket peg of their own design (plus another eight pegged to the SDR). They included Austria, Finland, Norway, Sweden, Iceland, and Thailand. [Some who claimed to define the value of their currency in terms of a basket, in fact followed an extremely loose link.] Most basket-peggers keep the weights in the basket secret, so that one can only infer the weight statistically from observed exchange rate movements. Previous tests have suggested that countries that are officially classified as basket-peggers in practice often exhibit a sufficiently wide range of variation around the basket index, or else alter the parity or weights sufficiently often, that they are difficult to distinguish empirically from countries classified as managed floaters.¹⁷

In applying equation (2) to a wide variety of countries, we realize that most do not even purport to follow a basket peg. Policy-makers in some countries monitor an index that is a weighted average of their trading partners, even though they allow the exchange rate to undergo large deviations from the index depending on current macroeconomic considerations or speculative sentiments. We can still meaningfully estimate the coefficients in the equation under the (restrictive) assumption that these local deviations -- the error term -- are uncorrelated with the values of the major currencies.

There is a methodological question of what numeraire should be used to measure the value of the currencies. Here we use the SDR as numeraire. Under the basket-peg null hypothesis, the choice of numeraire makes no difference in the estimation of the weights (though more generally it does make some difference).¹⁸

Table 6 reports estimates for nine EC currencies. The sample period is 1979-90, broken into three sub-samples. We also allow for the possibility of some effect of a fourth major currency, pound sterling, in memory of the role it once played as the world's international currency. We impose the constraint that the weights on the four currencies sum to 1 (by subtracting the change in the value of the pound from each of the other variables).

The EC countries, as expected, give heavy weight to the DM. In the case of Belgium, the other three major currencies get no weight, and the weight on the DM is insignificantly different from 1 during most of the period. France, Denmark and the Netherlands show some sign of a small weight on the dollar. For Italy the weight on the dollar is statistically significant, and estimated at just over 0.1; the weight on the mark is around 0.8. Greece gave heavy weight to the dollar during the sub-period 1979-82, but this diminished thereafter.

Ireland and Portugal also give some weight to the dollar in 1987-90, but, as with the others, give dominant weight to the DM throughout. No European country gives significant weight to the yen.

The implicit coefficient on the pound is equal to 1 minus the sum of the three coefficients reported. For Ireland, for example, the implicit coefficient on the pound ranges between .1 and .2. The pound is not generally significant, however. Multicollinearity between the pound and DM is very high, as one would expect. When all four major currencies are entered on the righthand side without imposing the constraint that their coefficients sum to 1, the pound loses out to the mark, and is not significantly greater than zero for any of the EMS countries. (These results are not reported here, to save space.)

The DM also dominates among the six EFTA countries, shown in Table 7. Austria exhibits a very tight peg to the DM, as expected. (The β is .98 or .99.) Switzerland also gives heavy weight to the DM. It, like some Nordics, appears to give significant weight to the yen as well at times. The four Nordic countries have a weight on the dollar which is highly significant statistically, though still less than the DM. The weight on the pound is seen also sometimes to be statistically significant for the Nordics, in the unconstrained estimation (not reported). But the pound gets less weight than either the DM or the dollar. Overall, the DM dominates.

Similar tests among five major Western Hemisphere currencies show the dollar dominant. [Colombia is close to a dollar peg (though with a large significant trend depreciation). Canada, Chile, and Mexico also have dollar weights in the neighborhood of 1.0. Argentina is the only country that consistently appears to show a weight on another currency (.5 on the DM) that is significant and larger than the dollar weight (.2). Its estimated weight on the pound is similar (.2). However the pound is not significant for any of the Latin American countries.]¹⁹

In each region considered thus far, Europe and the Western Hemisphere, almost all countries give dominant weight to the major currency of the region. This pattern is broken

in East Asia, however.²⁰ The weight on the dollar is very high in most countries. Only in Indonesia, and to a lesser extent Singapore, is there significant evidence of a yen weight exceeding 10 per cent. Each of the Asian countries is more properly classed in a dollar bloc than in a yen bloc. It is not a coincidence that many Asian/Pacific countries call their currencies "dollar." Nor, given the economies of scale in the use of an international currency, is it surprising that the dollar is the choice of Asia, as the rest of the world. [International currencies are discussed further in section 5 below.²¹]

We have also tried regression tests that do not impose the constraint that the weights on the major currencies sum to one (and that also exclude the pound). The results are similar: the DM reigns supreme in Europe, the dollar in the Western Hemisphere, and the dollar -- not the yen -- is also dominant in East Asia. A t-test does not reject the constraint that the sum of the three coefficients is 1 for the Western Hemisphere and Asian countries, but often does reject this constraint for the European countries, perhaps reflecting the absence of the pound and French franc.²²

3.3. An attempt to estimate the effect of exchange rate variability on trade

One rationale for a country to assign high weight to a particular currency in determining its exchange rate is the assumption that a more stable bilateral exchange rate will help promote bilateral trade with the partner in question. This is a major motivation for exchange rate stabilization in Europe. There have been quite a few time-series studies of the effect of exchange rate uncertainty on trade overall,²³ but fewer cross-section studies of bilateral trade.

One exception is De Grauwe (1988), which looks at ten industrialized countries. Two others are Abrams (1980) and Brada and Mendez (1988). We will re-examine the question here using a data set that is more recent as well as broader, covering 63 countries. The updating of the data set turns out to be qualitatively important. A problem of simultaneous causality should be noted at the outset: if exchange rate variability shows up with an apparent negative effect on the volume of bilateral trade, the correlation could be due to the government's deliberate efforts to stabilize the currency vis-a-vis a valued trading partner, as easily as to the effects of stabilization on trade. Therefore we will also use the method of instrumental variable estimation to tackle the possible simultaneity bias.

Volatility is defined to be the standard deviation of the

first difference of the logarithmic exchange rate. We start with the volatility of nominal exchange rates and embed this term in our gravity equation (1) for 1980, 1985 and 1990. The results are reported in Table 8, which does not include the trade bloc dummies. Most of the standard gravity coefficients are similar to those reported in the earlier results without exchange rate variability (Tables 1-4). Nominal exchange rate variability appears to have a statistically significant negative effect on the volume of trade in 1980; but the negative effect disappears in 1985 if we hold constant for distance and adjacency, and also in 1990 [whether we hold constant for the two geographic variables or not].

A presumably more relevant measure of exchange rate uncertainty is the volatility of the real exchange rate, which takes into account the differential inflation rates in the two countries in addition to movements in the nominal exchange rate. Table 8 also reports the gravity equation with real exchange rate volatility included. It has a statistically significant negative effect in every year, even when holding constant for the geographic variables. From these results, it would appear that the conventionally hypothesized effect of exchange rate uncertainty on trade is borne out.

We know that stabilization of bilateral exchange rates is correlated, not only with whether countries are neighbors, but

also with whether they are located in the same continental area. When we add the bloc variables back into the equation, the statistical significance of the exchange rate variability term falls somewhat. OLS regressions are presented in Table 9. In addition to adding variables for the major continental groupings, this table extends the results by adding the EFTA bloc variable, and by measuring volatility as the level of the standard deviation rather than its log. The latter change allows the experiment of asking how much trade would go up if exchange rate variabilities like those reported in Table 5 were reduced to zero. The magnitude of the coefficients on the variability in level form is not, of course, to be compared with the magnitude in log form.²⁴

In 1980, the coefficient[s] for the volatility term are still negative and statistically significant at the 99% level.

In comparison to the earlier gravity results that did not include a role for exchange rate volatilities, the EC and Western Hemisphere bloc dummy variables appear with lower coefficients, suggesting that a bit of the bloc effect may have been attributable to exchange rate links. In 1985, the volatility parameter[s] are no longer significant (with the point estimate turning slightly positive). Clearly, much of the apparently significant effect of exchange rate variability in Table 9 was a spurious stand-in for the effect of regional

trading arrangements like the EC. In 1990, the coefficient on real volatility returns to a negative sign, and is statistically significant, but only at the 90 per cent level.** (Henceforth we concentrate our discussions on the regressions involving the real exchange rates.)

By way of illustration, these point estimates can be used for some sample calculations. They suggest that if the level of EC real exchange rate variability that prevailed in 1980, a standard deviation of 0.050 per cent in Table 5, had been eliminated altogether, the volume of intra-EC trade would have increased by 14.18 per cent ($=6.97 \times 2.04$). This OLS estimate should be regarded very much as an upper bound; for one thing, the 1980 point estimate of the effect of exchange rate volatility is the largest of all the years.

Worldwide, the average level of exchange rate variability in 1980 was still 3.22 per cent. The OLS-estimated effect on trade of adopting fixed exchange rates worldwide was thus 22.44 per cent ($=6.97 \times 3.22$).

The exchange rate disruptions of September 1992 and August 1993 may herald a return to the level of variability among the EMS countries that prevailed in 1980. Table 5 shows that this would represent an approximate doubling of the standard deviation of exchange rates, relative to the stability that had been achieved by 1990. What would be the

predicted effects on trade? The OLS estimate in Table 9 suggests that trade would fall by 5.85 per cent ($=6.97 \times (2.04 - 1.20)$). **

Even if the stabilization of exchange rates achieved in Europe in the 1980s indeed raised trade on the order of 6 per cent, that would be much less than the 1/3 increase in trade bias estimated in our gravity model of Section 2 during the decade [$1.68/1.26 = 1.34$]. The OLS-estimated exchange rate stabilization effect is only 1/5 of the increase in the bias, which is in turn only half the total estimated 68 per cent European intra-regional trade bias in 1990. [It is also only a fraction of the total increase in intra-regional trade; recall from the first part of the paper that changes in such variables as GNP explain much of the variation in intra-regional trade flows.]

Interpretations of the estimates in Table 9 are in any case complicated by the likelihood of simultaneity bias in the above regressions. Governments may choose deliberately to stabilize bilateral exchange rates with their major trading partners. This has certainly been the case in Europe. Hence, there could be a strong observed correlation between trade patterns and currency linkages even if exchange rate volatility does not depress trade.

To address this problem, we use the method of

instrumental variable estimation, with the standard deviation of relative money supply as our instrument for the volatility of exchange rates. The argument in favor of this choice of instrument is that relative money supplies and bilateral exchange rates are highly correlated in theory (they are directly linked under the monetary theory of exchange rate determination), and in our data as well,²⁵ but monetary policies are less likely than exchange rate policies to be set in response to bilateral trade patterns. The results are reported in Table 10.

In 1980, the volatility parameter is still negative and significant at the 95% level. But the magnitude is much smaller than without using the instrument, suggesting that part of the apparent depressing effect of the volatility was indeed due to the simultaneity bias. Strong confirmation comes from an examination of the trade bloc coefficients for the EC and the Western Hemisphere: when the simultaneity is corrected, the presence of the volatility variable no longer reduces the trade bloc coefficient.

In 1990, the volatility parameter in Table 10 turns again into a positive number. The results suggest that if exchange rate volatility has depressed bilateral trade in the past, its negative effect diminished sharply over the course of the 1980s. This sharp change is somewhat surprising.

Theoretical models of the behavior of the firm often produce the result that, because of convexity in the profit function, exports can be an increasing function of exchange rate variability. Only when the firm is sufficiently risk-averse does the intuitive negative effect on trade emerge. Several empirical studies have taken this possibility seriously, and perhaps we should as well.²⁶ Before we put too much weight on the econometric findings for 1985 and 1990, it would be desirable to look at more data. Our final tests, reported in Tables 11-13, extend the results 15 years further back in history. The OLS results show a negative trade effect of exchange rate volatility (whether nominal or real) that is highly significant in 1965, 1970, and 1975, as well as 1980. Only in 1985 and 1990 does it turn positive. The Instrumental Variables results, reported in Table 13, show the same sign pattern across the years (though the negative effect is only statistically significant in 1965). One possible explanation is the rapid development of exchange risk hedging instruments.

In short, these results, while less robust than most of the other gravity equation findings, are generally consistent with the hypothesis that real exchange rate volatility has depressed bilateral trade a bit in the past. More specifically, they would appear to be a piece of evidence that the stabilization of exchange rates within Europe helped to

promote intra-European trade from 1965 to 1980. But the evidence for a negative trade effect, which starts out relatively strong in 1965, diminishes steadily in the 1970s and 1980s. The proliferation of currency options, forward contracts, and other hedging instruments may explain why even the small effect that appears once to have been there has more recently disappeared.

4. Summary of conclusions regarding Europe

Trade within Europe was at a high level even before the 1980s, and increased rapidly during that decade. Much of the tendency to trade intra-regionally can be explained by natural economic factors: the size of the GNPs, the levels of GNP/capita, the proximity of the countries, the sharing of common borders and common languages, and the openness of the economies. Some of the increase in intra-regional trade in the 1970s and 1980s can be explained by an increase in GNP per capita (though to a lesser extent than in Pacific Asia).

There was also a highly significant increase in the degree of intra-regional trade bias in the course of the 1980s, most readily explained by deliberate policy initiatives of the European Community. (The same was true in the Western Hemisphere.) Our estimates in Table 3 suggest that a country

joining the EC would have experienced an increase in trade with other members of 68 per cent by 1990.²⁷ No such effect is observed for EFTA.

We have considered in this paper the possibility that the stabilization of exchange rates was a significant contributor to the increase in intra-regional trade. The standard deviation of exchange rates fell among EFTA countries by about half in the 1980s, and among EC countries by slightly more. Among both groups, the currencies in effect linked themselves to the mark, much as Western Hemisphere (and East Asia) currencies in effect link themselves to the dollar.

We have found some possible cross-section evidence that real exchange rate variability has had an effect on trade volume. There is much more evidence that this factor is statistically significant in the period 1965-1980 than in 1985 or 1990. A possible explanation is the spread of hedging instruments. Even when the estimated effect is at its peak, however, it explains only a very small fraction of the intra-regional trade bias. It does not appear that the stabilization of European exchange rates in the 1980s played a large role in the increase in intra-regional trade.

5. The future of the dollar, mark and yen as international currencies

The dollar remains easily the world's most important vehicle currency, reserve currency, and all-around international currency. It has, however, sustained some recent loss of position vis-a-vis other major currencies. In this section we briefly consider the extent to which the dollar, yen, mark, and other currencies are used as international currencies. We then proceed to consider what conditions are likely to determine the use of these currencies in the future.

5.1 Measures of the use of international currencies

The tables in Frankel (1992) offer statistics on the relative importance of the major currencies in a number of categories: invoicing foreign trade, denominating international financial flows, pegs for smaller countries' currencies, reserve holdings of central banks, and foreign exchange trading. The dollar is easily the leading currency by all measures, but its relative role declined during the course of the 1980s.²⁸ The estimated fraction of trade invoiced in dollars (for overall trade reported by the six largest market economies plus OPEC) declined from 32.8 per cent in 1980 to 25.7 per cent in 1987.²⁹ The frequency of dollar-denomination shrank from 83 per cent in the early 1980s

to 65 per cent in 1990 in the case of external bank loans, from 63 per cent to 52 per cent in external bond issues, and from 74 per cent to 53 per cent in eurocurrency deposits. Turning from private-sector use of international currencies to public-sector use, the proportion of fixed-rate currencies that pegged to the dollar declined from 54 per cent in 1980 to 50 per cent in 1990, while the share of central banks' holdings of foreign currency reserves allocated to dollars declined from 69 per cent in 1980 to 56 per cent in 1990.

Two other currencies are in a close contest for second place after the dollar: the yen has surpassed the mark by some measures, but is still behind by others. The question of fourth place also depends very much on the criterion used. The pound does rather well in foreign exchange trading and external bank loans, the Swiss franc in international bond issues, the French franc and SDR in the number of countries that peg their currency to them, and the ECU (European Currency Unit) in international reserve holdings among European central banks.

The ECU has been put forward by the EC as a rival to the others. If and when Europe's individual central banks disappear into monetary union, their holdings of ECUs will disappear, while today's holdings by other central banks of marks, francs and pounds will presumably be replaced by

holdings of ECUs that are at least as large. The prospects for the ECU as an international currency, however, suffered at least as sharp a setback in September 1992 as did the EMS and the prospects for eventual EMU. The Euromarket in ECU bonds all but dried up. It seems unlikely that the ECU will be widely used outside Europe until after EMU is achieved, whenever that is.

5.2 Conditions for an international currency

What are the conditions for a currency to become an international currency? One can think of four major sorts of factors.

(1) History. There is much inertia in the system, and for good reason. An individual (exporter, importer, borrower, lender, or currency trader) is more likely to use a given currency in his or her transactions if everyone else is doing so. For this reason, the world's choice of vehicle currency is characterized by multiple stable equilibria. Krugman (1984) showed how there can be multiple equilibria in use of an international currency, developing some less formal ideas of earlier authors such as Kindleberger (1981), McKinnon (1979), and Swoboda (1969). The pound remained the world's leading international currency somewhat longer than purely contemporaneous economic factors might have dictated. In the

present context, this favors the continued central role of the dollar.

(2) Patterns of trade and finance. The currency of a country that has a large share in international trade and finance has a natural advantage. By such measures, Japan should clearly be number 2, after the U.S. and before Germany, in light of the large size of the Japanese economy. If the measure of being a vehicle currency is how often it is used in the invoicing and financing of international trade, then other aspects of the pattern of trade may also be relevant. [The fact that much of Japan's imports are raw materials and that much of its exports go to the Western Hemisphere, for example, helps explain why a disproportionately small share of trade is invoiced in yen as opposed to dollars.]

(3) Financial markets that are not only free of controls, but also deep and well-developed. The large financial marketplaces of New York and London benefit the dollar and pound relative, for example, to the deutschemark.

(4) Confidence in the value of the currency. Even if an international currency were used only as a unit of account, a necessary criterion would be that its value not fluctuate erratically. An international currency is also used as a form in which to hold assets: (i) firms hold working balances of

the currencies in which they invoice, (ii) investors hold bonds issued internationally, (iii) central banks hold currency reserves, and (iv) households and small businesses in hyperinflation-prone countries may hold foreign cash. (Even though relatively few Latin American countries are literally pegged to the dollar, dollar currency circulates throughout the region, and many countries offer dollarized bank accounts.) Here confidence that the value of the currency will be stable, and particularly that it will not be inflated away in the future, is critical.

The dollar lost 47 per cent of its purchasing power between 1973 and 1990, as compared to a 24 per cent loss during the time period 1948-72 (calculated from the CPI, logarithmically). The monetary authorities in Japan, Germany, and Switzerland, established good track records of price stability in the 1970s and 1980s, though Germany's has deteriorated a bit since unification in 1990, and the U.S. record has begun to look better.

A negative for the dollar is the fact that the United States began to acquire large and growing international debts in the 1980s. It is sometimes said that net creditor status is a necessary requirement for a country to have an international currency. Even if the Federal Reserve does not succumb to the temptations or pressures to inflate away the

U.S. debt, the continuing U.S. current account deficit could induce a further depreciation of the dollar. Such fears work to make dollars unattractive. The loss of key currency status and the loss of international creditor status have sometimes been associated -- along with such non-economic factors as political prestige and military power -- in discussions of the historical decline of great powers.

5.3 Advantages of having an international currency

One can think of four advantages to a country of having its currency play a large role in the world.

(1) Convenience for the country's residents. It is certainly more convenient for a country's exporters, importers, borrowers and lenders to be able to deal in its own currency than foreign currencies. The global use of the dollar, as with the global use of the English language, is a natural advantage that American businessmen tend to take for granted.

(2) More business for the country's banks and other financial institutions. There need be no firm connection from the currency in which banking is conducted to the nationality of the banks (nor from the nationalities of the savers and borrowers to the nationality of the intermediating bank). Nevertheless, it stands to reason that U.S. banks have a

comparative advantage at dealing in dollars, Japanese banks at dealing in yen, etc.

(3) Seignorage. This is perhaps the most important advantage of having other countries hold one's currency. They must give up real goods and services, or ownership of the real capital stock, in order to add to the currency balances that they use. This was the basis of European resentment against the U.S. basic balance deficit in the 1960s, and against the dollar standard to the extent that the European need to acquire dollars was the fundamental origin of the deficit.

(4) Political power and prestige. Britain's gradual loss of key currency status was simultaneous with its gradual loss of political and military pre-eminence. As with most of the other benefits and conditions mentioned above, causality here flows in both directions. The benefits of "power and prestige" are decidedly nebulous. Nevertheless, the "responsibilities commensurate with Japan's new status as a great economic power" that many Americans have urged on Japan in the abstract, will -- when realized in the concrete -- increasingly be seen as Japanese gains at U.S. expense.

5.4 Disadvantages of having an international currency

One can think of two disadvantages from the viewpoint of a

key-currency country. They explain why Japan and Germany have in the past been reluctant to have their currencies held and used widely.

(1) Larger fluctuations in demand for the currency. It is not automatically clear that having one's currency held by a wide variety of people around the world will result in greater variability of demand. Perhaps such instability is more likely to follow from the increase in the degree of capital mobility described under condition (3) above, than from key currency status per se. In any case, central banks are particularly concerned that internationalization will make it more difficult to control the money stock. This problem need not arise if they do not intervene in the foreign exchange market; but the central bank may view letting fluctuations in demand for the currency be reflected in the exchange rate as being just as undesirable as letting them be reflected in the money supply.

(2) An increase in the average demand for the currency. This is the other side of seignorage. In the 1960s and 1970s, the Japanese and German governments were particularly worried about the possibility that if assets were made available to foreign residents, an inflow of capital would cause the currency to appreciate and render exporters uncompetitive on world markets. While Japan has become much more confident

about its ability to export (it could hardly think otherwise!), talk of further substantial appreciation is not always welcome.

5.5 Conclusion: the future of the dollar

From a microeconomic perspective, it is clear that there are large economies of scale with respect to transactions costs in the choice of vehicle currency. As McKinnon (1979), Kindleberger (1981) and Krugman (1984), among others, have pointed out, an implication is that it is more efficient for the world economy to have a single vehicle currency. Assuming that world trade and finance continue to become more highly integrated, the importance of international transactions costs and the need to economize on them should grow.

Regardless whether or not U.S. economic performance in the future lags behind Japan's, the dollar -- not the yen -- will remain the premier currency of the Pacific. Regardless whether European monetary integration in the future regains the momentum of the late 1980s (which to an American seems unlikely), Europe's lot is as a smaller economic bloc than the vast Pacific. European firms will not be able, with the rest of the world using dollars, to insist on using the mark or the ECU in most of their overseas dealings. Thus the dollar will almost certainly persist as the world's unit of account in the

twenty-first century. And, as well, English as the world's language.

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References

Abrams, Richard, 1980. "International Trade Flows Under Flexible Exchange Rates," Economic Review, Federal Reserve Bank of Kansas City, March, 3-10.

Akhtar, M. Akbar, and Spence Hilton, 1984, "Effects of Exchange Rate Uncertainty on German and U.S. Trade," Federal Reserve Bank of New York Quarterly Review 9, no.1 (Spring), 7-16.

Alogoskoufis, George, and Richard Portes. 1992. "European Monetary Union and International Currencies in a Tripolar World," in Establishing a Central Bank: Issues in Europe and Lessons from the US, M.Canzoneri, V.Grilli and P. Masson, eds, Cambridge University Press, 273-300.

Anderson, Kym, and Hege Norheim. 1992. "History, Geography and Regional Economic Integration," GATT Secretariat Conference, Geneva, Oct.; forthcoming in Regionalism and the Global Trading System, K.Anderson and R.Blackhurst, eds., London: Harvester Wheatsheaf, 1993.

Bayoumi, Tamim, and Barry Eichengreen. 1992. "One Money or Many? On Analyzing the Prospects for Monetary Unification in Europe and Other Parts of the World," International Monetary Fund and University of California at Berkeley, August.

Brada, Josef, and Jose Mendez. 1988. "Exchange Rate Risk, Exchange Rate Regimes and the Level of International Trade," Kyklos 41, no.2, p.198.

Caballero, Ricardo, and Vittorio Corbo. 1989. "The Effect of Real Exchange Rate Uncertainty on Exports: Empirical Evidence," The World Bank Economic Review, 3, no.2, May, 263-278.

Cushman, David. 1986. "Has Exchange Risk Depressed International Trade? The Impact of Third-Country Exchange Risk" Journal of International Money and Finance, 5,

September, 361-379.

Deardorff, Alan. 1984. "Testing Trade Theories and Predicting Trade Flows," in R.Jones and P.Kenen, eds., Handbook of International Economics vol. I. Amsterdam, Elsevier Science Publishers. Ch.10: 467-517.

De Grauwe, Paul. 1988. "Exchange Rate Variability and the Slowdown in Growth of International Trade." IMF Staff Papers 35, pp.63-84.

Edison, Hali, and Michael Melvin. 1990 "The Determinants and Implications of the Choice of an Exchange Rate System," in William Haraf and Thomas Willett, Monetary Policy for a Volatile Global Economy, AEI Press, Washington.

Eichengreen, Barry. 1990. "One Money for Europe? Lessons from the US Currency Union, Economic Policy, April, 117-189.

Eichengreen, Barry, and Douglas Irwin, 1993, "Trade Blocs, Currency Blocs and the Disintegration of World Trade in the 1930s," U.C. Berkeley, June.

Eichengreen, Barry, and Charles Wyplosz, 1993, "The Unstable EMS," Brookings Papers on Economic Activity 1, 51-143.

Foroutan, Faezeh and Lant Pritchett. 1992. "Intra-Sub-Saharan African Trade: Is It Too Little?" World Bank, December.

Frankel, Jeffrey. 1991. "Is a Yen Bloc Forming in Pacific Asia?" in Finance and the International Economy, The AMEX Bank Review Prize Essays, edited by R.O'Brien, Oxford University Press, UK.

Frankel, Jeffrey. 1992. "On the Dollar," Pacific Basin Working Paper No. PB91-04, Federal Reserve Bank of San Francisco. In The New Palgrave Dictionary of Money and Finance, MacMillan Press Reference Books, London.

Frankel, Jeffrey. 1993. "Is Japan Creating a Yen Bloc in East Asia and the Pacific?" NBER working paper no. 4050. In Regionalism and Rivalry: Japan and the U.S. in Pacific Asia, edited by Jeffrey Frankel and Miles Kahler, University of Chicago Press, Chicago, forthcoming, September.

Frankel, Jeffrey, and Shang-Jin Wei. 1993 "Is There A Currency Bloc in the Pacific?" July 12-13, Kirribilli, Australia; in Exchange Rates, International Trade and Monetary Policy, edited by A.Blundell-Wignall and S.Grenville, Reserve Bank of

Australia, Sydney.

Frankel, Jeffrey, and Shang-Jin Wei. 1994. "Yen Bloc or Dollar Bloc? Exchange Rate Policies of the East Asian Economies", *Third Annual NBER - East Asia Seminar on Economics*, held in Sapporo, Japan, June 17-19, 1992; forthcoming in Macroeconomic Linkage, Takatoshi Ito and Anne Krueger, editors, University of Chicago Press, Chicago.

Gagnon, Joseph, 1989, "Exchange Rate Variability and the Level of International Trade," *International Finance Discussion Papers No. 369*, Federal Reserve Board, Dec.

Grant, Richard, Maria Papadakis, and J. David Richardson, 1992, "Global Trade Flows: Old Structures, New Issues, Empirical Evidence," *Twentieth Pacific Trade and Development Conference*, Washington, D.C. September 10-12.

Gros, Daniel, 1987, "Exchange Rate Variability and Foreign Trade in the Presence of Adjustment Costs," draft.

Hamilton, Carl, and L. Alan Winters. 1992. "Opening Up International Trade in Eastern Europe," Economic Policy (April).

Havrylyshyn, Oleg, and Lant Pritchett. 1991. "European Trade Patterns After the Transition." *Policy, Research and External Affairs Working Paper Series No. 748*, August, World Bank.

Helpman, Elhanan. 1987. "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries," Journal of the Japanese and International Economies 1: 62-81.

Helpman, Elhanan and Paul Krugman. 1985. Market Structure and Foreign Trade, Cambridge, MA, MIT Press.

Hooper, Peter, and Steven Kohlhagen. 1978. "The Effect of Exchange Rate Uncertainty on Prices and Volume of International Trade." Journal of International Economics 8, Nov., pp.483-511.

International Monetary Fund, 1983, "Exchange Rate Volatility and Trade," Research Department, Dec. 9.

Kenen, Peter, 1983, The Role of the Dollar as an International Currency, Occasional Papers No. 13, Group of Thirty, New York.

Kenen, Peter, and Dani Rodrik, 1986, "Measuring and Analyzing

the Effects of Short-term Volatility in Real Exchange Rates," Review of Economics and Statistics, 311-315.

Kindleberger, Charles P., 1981, International Money, George Allen & Unwin, London.

Krugman, Paul, 1984, "The International Role of the Dollar: Theory and Prospect," in Exchange Rate Theory and Practice, edited by John Bilson and Richard Marston, Chicago: University of Chicago Press, 261-78.

Lawrence, Robert. 1991c. "Emerging Regional Arrangements: Building Blocks or Stumbling Blocks?" in Finance and the International Economy, The AMEX Bank Review Prize Essays, edited by R.O'Brien. United Kingdom: Oxford University Press.

Linneman, Hans. 1966. An Econometric Study of International Trade Flows, North-Holland, Amsterdam.

Lowell, Julia. 1992. "Do Governments Do What They Say (And Do We Believe Them?): Two Essays on National Debt and Exchange Regime Policies," Ph.D. Thesis, Department of Economics, University of California, Berkeley.

McKinnon, Ronald, 1969, Private and Official International Money: The Case for the Dollar, Essays in International Finance, No. 74, Princeton University, April

Peree, Eric, and Alfred Steinherr, 1989, "Exchange Rate Uncertainty and Foreign Trade," European Economic Review 33: 1241-1264.

Saxonhouse, Gary, 1989, "Differentiated Products, Economies of Scale, and Access to the Japanese Market," in R. Feenstra (ed.), Trade Policies for International Competitiveness, University of Chicago Press: Chicago, 145-174.

Swoboda, Alexander, 1969, "Vehicle Currencies in the Foreign Exchange Market: The Case of the Dollar," in R. Aliber, ed., The International Market for Foreign Exchange, Praeger, New York.

Thomas, S.H. and M.R. Wickens, 1991, "Currency Substitution and Vehicle Currencies: Tests of Alternative Hypotheses for the Dollar, DM and Yen," Discussion Paper No. 507, Centre for Economic Policy Research, London, Jan.

Tinbergen, Jan, 1962, Shaping the World Economy, The Twentieth Century Fund: New York.

Wang, Zhen Kun, and L.Alan Winters, 1991, "The Trading Potential of Eastern Europe," Centre for Economic Policy Research Discussion Paper No. 610, November, London, UK.

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Notes

- . The country membership in the four currency blocs did not coincide perfectly with the membership in four sets of preferential trading arrangements. Eichengreen and Irwin (1993), using an approach similar to that of the present paper, find that exchange rate variability had a significant effect on trade in the 1930s, but that in the case of the British Commonwealth countries, for example, preferential trading arrangements were a more important source of intra-bloc trade than was the adoption of a common sterling standard.
- . Frankel (1991) presented a back-of-the-envelope measure of intra-regional trade as: the ratio of the intra-regional trade share to the share of world trade. Anderson and Norheim (1992) use similar calculations of "intensity of trade indexes."
- . The results of one extensive early project along these lines were reported by Bergsten (1962, Appendix VI, pp.262-293) and Linneman (1967). Foundations for the gravity model are offered in papers surveyed by Deardorff (1984, pp.503-504) and Wang and Winters (1992).
- . Three others are Wang and Winters (1991), Hamilton and Winters (1992), and Havrylyshyn and Pritchett (1991). The focus of these papers was on potential Eastern European trade patterns.
- . NBER Working Paper No. 4335 considered some econometric extensions of the original gravity model estimation -- allowing for heteroscedasticity and zero-valued observations -- to see how that the basic results held up.
- . Eichengreen and Wyplosz (1993, p.136-37).
- . The list of countries, and regional groupings, is given in an Appendix [e.g. Frankel (1993)].
- . The specification implies that trade between two equal-sized countries (say, size .5) will be greater than trade between a large and small country (say, size .9 and .1). This property of models with imperfect competition is not a property of the classical Heckscher-Ohlin theory of comparative advantage. Helpman (1987) and Helpman and Krugman (1985, section 1.5). We have also tried to capture classic Heckscher-Ohlin effects, first by including bilateral absolute differences in GNP/capita figures, and then by including some factor endowment variables with data (for a subset of 656 of our 1,953 pairs of countries generously supplied by Gary Saxonhouse (1989). There is a bit of support for these terms [reported in the conference version of this paper]. The other coefficients are little affected.
- . Table 5 in Frankel (1993).
- .. This is the same result found by Hamilton and Winters (a significant coefficient of .7 on the EC and zero on EFTA). But it is the opposite of the conclusion one might draw from simple statistics on the magnitudes of intra-regional trade in the EC 12 and Western Europe as a whole, if one did not hold constant for proximity. Grant, Papadakis and Richardson (1992, p.48).
- .. Havrylyshyn and Pritchett (1991) found that three languages are significant in the gravity model -- Portuguese, Spanish and English, in decreasing order of magnitude. In a study of poor countries, Foroutan and Pritchett (1992) found that French, Spanish and English are statistically significant.
- .. Most of the burgeoning trade between Taiwan and China shows up in the statistics twice, because it is recorded as passing through Hong Kong.

.. attempt to correct the data for the effect of the ban on direct trade results in the Chinese language term becoming no stronger than the other languages. Frankel and Wei (1993).
 .. Reported *ibid.* The coefficients are .50, .54, and .32, in 1980, 1985 and 1990, respectively.
 .. Of the EC 12, only Greece had not joined the Exchange Rate Mechanism by early 1992 (though Italy and the United Kingdom dropped out soon thereafter).
 .. Only Singapore and Indonesia, and at times Malaysia and Thailand, appear to have significant weight on the yen, and the weight is usually less than .1, compared to .9 to 1.0 on the dollar.
 .. We have made the decision in this paper to focus on the mark rather than the Japanese Yen. One reason for this decision is that the ECU appears to have suffered a major set-back as an international currency subsequent to the foreign exchange crisis of September 1992. The ECU bond market, for example, largely dried up.
 .. Why do countries keep the weights secret? It allows the governments to devalue their currencies secretly when they so desire. But secret weights undermine the governments' ability to commit credibly to a low inflationary monetary policy. (Lowell, 1992.)
 .. The earlier tests on Asian currencies tried the Swiss franc and purchasing power over local goods as numeraires, in addition to the SDR [Frankel and Wei (1994) and Frankel (1993), respectively].
 .. Table 7 in the NBER Working Paper 4335, or Table 6 in Frankel and Wei (1993).
 .. The results in Table 8 in the NBER Working Paper 4335, or Table 7 in Frankel and Wei (1993), correspond to those reported here for the other regions. They confirm those in Frankel (1993) and Frankel and Wei (1994), which were produced with different numeraires.
 .. See also Alogoskoufis and Portes (1992) and Frankel (1992).
 .. Reported in NBER Working Paper 4335, Appendix tables 4-7.
 .. For example, Hooper and Kohlhagen (1978), Kenen and Rodrik (1986), Akhter and Hilton (1984), Cushman (1986) and Pereg and Steinherr (1989). The literature surveyed in Edison and Melvin (1990).
 .. The regressions with the volatilities measured in log form are available in Table 13 of Frankel and Wei (1994). There the coefficient on real exchange rate volatility again loses significance in 1985, although remaining negative in significance.
 .. "First-stage" regressions of exchange rate variability against our measure of exchange rate variability in relative money supply changes are usually significant statistically [reported in Appendix Table 4 of the conference draft of this paper.]
 .. For example, Gros (1987) or Caballero and Corbo (1989).
 .. This figure does not even take into account the outcome of more recent measures toward greater integration associated with 1992.
 .. This pattern continued a trend begun in the 1970s; see Kenen (1983).
 .. This computation is based on Thomas and Wickens, 1991, p.14.