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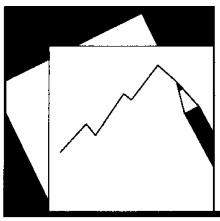

IMF Working Paper

Stylized Facts on Bilateral Trade and Currency Unions: Implications for Africa

Charalambos G. Tsangarides, Pierre Ewenczyk, and Michal Hulej

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African Department

Stylized Facts on Bilateral Trade and Currency Unions: Implications for Africa

Prepared by Charalambos G. Tsangarides, Pierre Ewenczyk, and Michal Hulej[1]

Authorized for distribution by Anne-Marie Gulde-Wolf

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Abstract

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This paper explores and quantifies several aspects of the performance of currency unions using an augmented version of the gravity model and focusing on two samples, the world and Africa. Our empirical findings suggest that, in principle, membership in a currency union should benefit Africa as much as it does the rest of the world. In addition, we find evidence from both samples that the effect of currency unions on trade is large, almost a doubling; currency unions are associated with trade creation, increase price co-movements among members, and make trade more stable; and longer duration of currency union membership brings about more benefits, although with some diminishing returns.

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Author(s) E-Mail Address: ctsangarides@imf.org; pewenczyk@imf.org;
mhulej@wne.uw.edu.pl

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I. INTRODUCTION

Analogues of Newton's theory of gravity have been applied in a number of different contexts in attempts to explain interactions with spatial dimensions such as trade or migration. Although gravity models to estimate bilateral trade were originally introduced by Pöyhönen (1963) and Tinbergen (1962) as atheoretical (albeit plausible) empirical models, subsequent work established micro foundations for the basic building blocks that appear in these gravity models.[2] Gravity models, shown to be fairly effective in modeling bilateral trading patterns, explain more than half of the variation in trade.

Recent work by Andrew Rose and a number of coauthors (for example, Rose, 2000; Frankel and Rose, 2002; Rose and van Wincoop, 2001; and Glick and Rose, 2002) has used gravity models to investigate, from an empirical point of view, the impact that currency arrangements have on bilateral trade. Frankel and Rose (2002) support the view that the important growth enhancing benefits of currency unions come only through increased trade and not through other channels (such as reduced inflation). Specifically, Frankel and Rose conclude that two countries that share the same currency trade roughly three times as much as they would if they used different currencies.[3]

From a theoretical standpoint, currency unions reduce transaction costs between trading partners and thus promote trade; they create a larger market in which there are potential gains from economies of scale and production efficiency (assuming factor mobility and flexible wages); they bring macroeconomic stability by signaling the central bank's commitment to reduce inflation; they enhance the credibility of the monetary authority; and they reduce uncertainty. Less uncertainty about prices can help allocate resources more efficiently in a region, while the absence of exchange rate risk in countries sharing a common currency encourages investment and facilitates capital mobility. These potential gains need to be compared with the potential losses from membership. Potential losses depend on the extent to which countries in the union face asymmetric shocks, and whether countries in the region are sufficiently flexible to absorb or mitigate such shocks, with factor mobility and transfers acting as shock absorbers.

This paper contributes to the ongoing debate about how currency unions affect trade by empirically investigating certain stylized facts of currency unions in Africa, and the world, in general. We choose to focus on Africa because it has had a rich experience with currency unions, although its integration in world trade has remained limited.[4] We begin by augmenting the gravity model of Glick and Rose (2002) to investigate some stylized facts about the impact of currency unions on trade, including possible trade diversion effects.

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[2] Deardorff (1998) argues that the basic regressors of gravity models – distance and income – are actually implied by a wide variety of theoretical models. Also, Feenstra, Markusen, and Rose (2001) argue that empirical gravity models can be used to discriminate between alternative trade theories.

[3] Rose (2000) conducts numerous robustness checks of his overall results and finds that the statistical significance of the estimated parameters is robust to the choice of estimation technique, sample period, and choice of subsamples of countries. Rose and van Wincoop (2001) reach similar conclusions.

[4] See Appendix A for a chart of African regional economic integration arrangements. See Masson and Pattillo (2004) for a detailed discussion of Africa's experience with currency unions.

Then, we examine the effect of the duration of currency union membership on bilateral trade, and the impact of currency unions on price and output co-movements and trade stability.

Our empirical findings suggest that African countries stand to benefit as much from currency union membership as countries in the rest of the world, and, therefore, currency union benefits are not region specific. Our findings, which are fairly robust to a variety of estimation techniques, can be summarized as follows. First, in investigating the effect of a currency union membership on trade, the results of both samples reveal that countries belonging to the same currency union trade about two times more with each other than do other comparable countries that do not share a currency. Second, for both samples, there is evidence that currency unions are associated with trade creation, trade stability, and increased co-movement of prices, but not with the co-movement of output among members. Third, we show that, for bilateral trade, it matters not only whether countries share a common currency but, if they do, for how long: the longer a country participates in a currency union, the greater the benefit is; however, the relationship is not linear, with some diminishing returns to membership in a currency union. Finally, while the main results hold true for both samples and the marginal effects and the mechanisms of transmission may vary across the regions, we find that currency unions can be an effective tool for stimulating trade. However, given the low trade base and the protracted period necessary following the establishment of a currency union to increase trade significantly, it can be inferred from the results that currency union membership could not be a primary tool to achieve high levels of trade in Africa.

The rest of the paper is organized as follows. Section II provides a short survey of the relevant literature. Section III describes the methodology, presenting the analytical framework, estimation issues, and the data sources. Section IV presents the results of the various estimations, including the benchmark results of the impact of currency unions on trade, the characteristics of Africa trade, the effects of the length of membership in a currency union, and the impact of currency unions on output and price synchronization. Section V provides concluding remarks.

II. Literature Review

Baldwin's (2005) survey of the evidence on how the volume of trade is affected by currency unions rightly places Andrew Rose's research at the center of this literature. Rose and his coauthors show that membership in a currency union promotes trade substantially. Rose (2000) shows that trade between countries belonging to the same currency union is over three times greater than trade between comparable countries that do not share the same currency. He also shows that the effect of the decrease in exchange rate volatility is positive, although the coefficient is much smaller than the one associated with the currency union. In fact, the increase in trade associated with a currency union is over an order of magnitude larger than that associated with decreasing exchange rate volatility to zero. In answering the question of why sharing a currency has such a big effect on trade, Rose presents several reasons, including that a common currency can induce financial integration with its subsequent effects

on trade and that, by entering a currency union, a government signals its commitment to long-term integration.[5]

Investigating further the trade generating effect of currency union membership, Rose and van Wincoop (2001) use a structural model developed by Anderson and van Wincoop (2003) to address country-specific idiosyncrasies. This approach, which was applied only to countries with complete bilateral data, reduces the effect of currency unions on trade to about two and a half. Exploring the time-series dimension of the data, Glick and Rose (2002) use a fixed-effects estimator to address the time-series element of the country-specific idiosyncrasies, namely, the pair-specific idiosyncrasies. They find a smaller, yet still large impact of currency unions on trade: joining a currency union almost doubles bilateral trade. In summary, while part of the recent debate (see Baldwin, 2005) has centered around the large magnitude of the estimated currency union effect, there seems to be an agreement in the literature that there is indeed a common-currency effect, which, as suggested by Frankel (2005), "is probably substantially smaller than a tripling."[6]

There is a growing literature describing the potential channels through which a currency union affects trade. Alesina and Barro (2002) show that, apart from country size and trade volume with a potential anchor, the characteristics that matter are co-movement of prices, co-movement of outputs, inflation, and the volatility of inflation. They conclude that countries that may gain the most from joining currency unions are those with a history of high and volatile inflation and those having the largest co-movements of outputs and prices with a potential anchor. The predictions of Alesina and Barro (2002) are also tested by Tenreyro (2001). Using a probit model, the determinants of currency union are investigated, taking into account geography, colonial past, and price and output co-movements. Controlling for distance, cultural links, and colonial past, it is shown that countries with higher co-movements of prices have a higher propensity to form a currency union, whereas co-movement of outputs has no effect on countries' decision.[7] Finally, Alesina, Barro, and Tenreyro (2002) and Tenreyro and Barro (2003) analyze the impact of currency union on co-movements of outputs and prices between trading partners and investigate how co-movements of outputs and prices would respond to the formation of a currency union.[8]

Africa presents an interesting area in which to assess the relative impact of currency unions and free trade agreements on intraregional trade as well as on trade with the rest of the

[5] However, he acknowledges that the effect may be smaller for modern industrial countries; most currency unions in Rose's (2000) sample comprise small or poor countries or both.

[6] Rose (2004) performs a "meta-analysis" of the currency union effect by combining estimates from 34 other studies. Treating all estimates as having been generated by the same process, Rose estimates a range of 30 to 90 percent for the currency union effect.

[7] Based on these results, Tenreyro constructs an instrumental variable for currency union that is used in a gravity model to account for the possible trade-currency union endogeneity. Persson (2001) uses a similar logit regression to find pairs of countries with a similar propensity to adopt a common currency but only one pair actually sharing the same currency. This matching procedure is then used in his nonparametric estimation of the gravity model.

[8] See Frankel and Rose (1998) and Frankel and Rose (1997) for a discussion of the endogeneity of optimum currency areas criteria.

world.[9] Currency unions and preferential regional trade agreements have been an important component of trade policy in African countries over the past few decades. However, despite these initiatives, the participation of African countries in world trade remains limited. Various explanations have been given for Africa's trade marginalization, including slow economic growth, unfavorable geographical and exogenous factors, poor infrastructure and transport policies, poor trade policies, and the poor effectiveness of currency unions restrained by barriers to intraregional trade, and constraints to factor mobility. In addition, the substantial savings on transaction costs and the trade benefits that would accrue from a monetary union may be limited in Africa because of lesser diversification and the asymmetric terms of trade shocks hitting the economies.[10] Furthermore, the loss of the nominal exchange rate instrument makes real adjustments to asymmetric shocks more difficult, especially in view of the poor systems of fiscal transfers and the limited development of the banking and financial sectors in Africa.

Looking at the empirical work on Africa, Debrun, Masson, and Pattillo (2005) show that gains from adopting a common currency depend, among other factors, on the correlation of terms of trade shocks. This, in turn, is connected to countries' dependence on primary commodity prices. In addition, they show how the existence of interest groups affects incentives to join a currency union or accept a new member in a multilateral union. This effect, especially important for Africa, is crucial for gains and losses from participating in a currency union because differences in government spending propensities may be more important than asymmetric shocks. Coe and Hoffmaister (1999) analyze North-South trade and show that, on average, Africa trades more than developing countries in other regions. Subramanian and Tamirisa (2003) highlight the importance of distinguishing between Anglophone and Francophone Africa in assessing the integration of countries in the region with global markets. Finally, Masson and Pattillo (2004) examine the impact of currency unions on trade in Africa using the Glick and Rose (2002) specification. They estimate that the effect of the currency union dummy on African bilateral trade (which includes African countries' trade with the rest of the world) is almost the same as in their world sample, with currency unions increasing trade by a factor of three for both Africa and the world.[11]

Our paper contributes to the existing empirical work in the literature in several ways. First, we separate the empirical analysis in two samples, the world and Africa, to investigate whether Africa's experience is different. Second, we add several modifications to the standard gravity model estimations, including variables for free trade area, trade diversion, and membership duration, as well as extend the sample of coverage and period compared with earlier empirical work. Third, we investigate and quantify a series of "stylized facts" relating to the trade and currency union nexus, including the trade-generating impact of

[9] Carrere (2004) provides an assessment of the trade impact of African regional agreements.
[10] See, among others, Collier (1995), Rodrik (1998), Yeats (1998), Collier and Gunning (1999), Limao and Venables (2001), and Subramanian and Tamirisa (2003).
[11] Masson and Pattillo (2004) analyze the impact of currency unions on trade in Africa using the Free Trade Area (FTA) definition from Glick and Rose (2002), which does not distinguish between FTA and currency union effects. As discussed in the results section, our data set permits this distinction and we explore this estimation.

currency union membership, the effect of currency unions on trade stability, and price and output co-movements.

III. METHODOLOGY

A. Analytical Framework

Gravity models represent trade between two economies as a function of their respective economic masses, the distance between the two economies, and a variety of other factors. In line with earlier literature, we begin by investigating the effect of currency unions on trade by defining the following augmented gravity model:

$$\log(X_{ij}) = \beta_0 + \sum_{k=1}^{N} \beta_k Z_k + \gamma CU_{ij}, \quad (1)$$

where i and j denote the exporting and importing countries, respectively; t denotes time; X_{ijt} denotes the value of bilateral trade between i and j; CU_{ij} is a binary variable that is unity if i and j share the same currency;[12] γ is the estimate of the currency union trade-generating effect; and Z_k is a vector consisting of gravity variables. The Z_k vector includes $\ln(Y_i Y_j)$, $\ln(\frac{Y_i Y_j}{Pop_i Pop_j})$, $\ln D_{ij}$, $Cont_{ij}$, $Lang_{ij}$, FTA_{ij}, $ComNat_{ij}$, $ComCol_{ij}$, Col_{ij}, and $\ln(Area_i Area_j)$, where 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 the part of the same nation; $ComCol_{ij}$ is a binary variable, which is unity if i and j were colonies after 1945 of the same colonizer; Col_{ij} is a binary variable, which is unity if i colonized j or vice versa; and $Area_n$ is the land area of country n with $n = i, j$.

Next, we investigate the possibility that the stimulus to trade among members of a currency union comes at the expense of trade with nonmembers' diversion. Following Frankel and Rose (2002), we define a dummy variable that is unity if the two countries are not in the same currency union but (at least) one is in a currency union with another country. A negative (and significant) coefficient of this variable would indicate the existence of potentially harmful trade diversion, and could be interpreted as implying that the increased trade among members inside the union comes at the expense of trade with nonmembers.

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[12] The definition of "currency union" (which follows from Glick and Rose, 2002) implies that money was interchangeable between the two countries at a 1:1 par for an extended period of time, so that there was no need to convert prices when trading between a pair of countries. Under this definition, hard fixes are not identified as currency unions. Further, the definition of currency union is transitive: if country pairs X, Y and X, Z are in a currency union, then Y and Z are in a currency union.

Then, we investigate the effects of membership duration. We construct another variable of interest – the number of years that a given pair of countries shares a common currency – and we modify equation (1) to include a variable to capture duration in a currency union as follows: [13]

$$\log(X_{ij}) = \beta_0 + \sum_{k=1}^{N} \beta_k Z_k + \upsilon\left(yearsCU\right)_{ij}. \tag{2}$$

In order to investigate the impact of currency unions on co-movements of output and prices, we construct the variables measuring co-movement of prices and output that are used as dependent variables in equation (1), following Alesina, Barro, and Tenreyro (2002). Specifically, the price co-movements are computed as follows: for every pair of countries, we use annual price data to compute residuals from second-order autoregression equation estimated for each pair of countries for which we have more than 20 observations:

$$\ln(\frac{P_{it}}{P_{jt}}) = b_0 + b_1 \ln(\frac{P_{i,t-1}}{P_{j,t-1}}) + b_2 \ln(\frac{P_{i,t-2}}{P_{j,t-2}}) + \varepsilon_{tij}. \tag{3}$$

Estimated residuals from equation (3) are then used to obtain a measure of co-movement of prices, with higher VP_{ij} representing greater synchronization of prices between countries i and j:

$$VP_{ij} = -\sqrt{\frac{1}{T-3}\sum_{t=1}^{T} \hat{\varepsilon}_{tij}^2}. \tag{4}$$

In a similar fashion, we construct a measure of co-movement of output, with $\hat{u}$ denoting estimated residuals from the following autoregressive process:

$$\ln(\frac{Y_{it}}{Y_{jt}}) = b_0 + b_1 \ln(\frac{Y_{i,t-1}}{Y_{j,t-1}}) + b_2 \ln(\frac{Y_{i,t-2}}{Y_{j,t-2}}) + u_{tij}, \tag{5}$$

and

$$VY_{ij} = -\sqrt{\frac{1}{T-3}\sum_{t=1}^{T} \hat{u}_{tij}^2}. \tag{6}$$

Finally, to assess the currency union impact on trade stability, we follow Rose (2005) and estimate an equation similar to the gravity equation with the coefficient of variation of log of real trade as dependent variable of equation (1). We calculate values for the dependent variable for the periods 1950-1976 and 1976-2003, so we have two observations per pair. In addition, as a robustness check of the dependent variable, we use (i) the maximal absolute value (during the 27-year sample period) of the difference between the log of real trade and the sample average of trade of every country, scaled by the sample average; (ii) the mean absolute value of the difference between exports and their sample average of every country (scaled by average exports); and (iii) the standard deviation of the residual from a

[13] Because our data begin in 1948, we ignore years spent in a currency union before that date. To be strict, we may define our variable as years spent in a currency union after 1948.

conventional gravity equation of exports in levels. All the explanatory variables are averaged over the corresponding time periods.

B. Other Estimation Issues

In this section we discuss several methodological issues before proceeding with the estimations. These issues are derived primarily from various critiques of the gravity equation analyses, including the three "classic gravity model mistakes" Baldwin (2005) labels as gold, silver and bronze medal mistakes.[14] To the extent that these critiques relate to our analysis, we discuss our attempts to address them through robustness checks of our results.

First, we begin with the issue of omitted variables and biases stemming from omitted variables that are pro-trade and correlated with the currency union dummy, labeled as the "gold medal mistake" in Baldwin's (2005) critique. Research following the initial Rose (2000) results attempts to control for the omitted variable bias by introducing country-specific idiosyncrasies in the model, both in the context of cross-section and panel estimations. First, in the context of cross section analysis, country fixed-effects are used to account for the Anderson and van Wincoop "multilateral resistance" factor, according to which trade between two countries does not depend only on the characteristics of those countries but also on the barriers between those countries and the rest of the world.[15] However, given that there is a time-series element to the potential bias that is not eliminated with the Anderson and van Wincoop (2003) procedure, a panel data fixed-effects procedure (robust fixed-effects "within" estimator) is employed that adds country-pair specific intercepts to the equation, and thus exploits the time-series dimension of the data around country-pair averages. To address the omitted variable bias issue, we first follow the literature in estimating the gravity equation using ordinary least squares; then we estimate the specifications with fixed-effects as in Glick and Rose (2002); and, finally, we use panel data techniques (the random effects and robust fixed-effects "within" estimator).[16]

Second, since forming a currency union (or continuing to stay in a currency union) may also be an endogenous choice, some of the large trade-creating effects of currency union may actually be a reflection of reverse causality. The use of instrumental variables could be a solution to the potential endogeneity problem. However, an appropriate instrument for a currency union is hard to find, which is further complicated by the fact that the currency union variable is a dummy variable. Nevertheless, attempts by Alesina, Barro, and Tenreyro (2002) to address the endogeneity problem using an instrumental variable based on client anchor relationship, have shown that the effect of currency union on trade still remains high even after accounting for this potential endogeneity. In addition, Rose and van Wincoop

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[14] For more details, see Baldwin (2005) and Frankel's comments on the Baldwin paper (Frankel, 2005).

[15] In Anderson and van Wincoop (2003) the national price indices (P_i and P_j) account for the "multilateral resistance" between countries i and j . They propose an iterative method to estimate P_i and P_j, but since the process is complex they propose an alternative method that is preferred in the empirical work: namely, estimating implicit prices by fixed-effects, i.e. country-specific dummy variables.

[16] In all regressions we include year effects and allow for clustering of the error terms within country pairs.

(2001) argue that: "reverse causality also does not explain away the findings; there is little evidence in the political science literature that countries join currency unions to increase trade, and instrumental variables only increase the impact of currency unions on trade." This political dimension is particularly important for the case of Africa. Masson and Pattillo (2004) underscore the political dimension of the decision to form or participate in a currency union and suggest that the experience of Africa shows that political objectives are important to the formation of monetary unions.[17] Based on the arguments above, and because the Alesina, Barro, and Tenreyro (2002) instrument is not designed for multilateral currency unions (which is of special interest to the Africa focus of our paper), in our analysis we choose to treat currency unions as an exogenous variable with respect to trade.

Finally, there are several issues relating to the model misspecification. Some of the criticisms in the literature relate to the aggregation of exports and imports in the estimation, inappropriate deflation of nominal trade values by the U.S. aggregate price index, possible nonlinear effects entering the gravity equation, and the use of zero-trade observations in the sample.[18] On the aggregation issue, some critics argue that while theory supports the use of bilateral exports as dependent variable, the use of bilateral trade as the dependent variable without properly aggregating imports and exports can seriously bias the results. In order to address this critique, we check the sensitivity of our results when the dependent variable used is the sum of the logarithm of exports and imports as well as the logarithm of the sums (the "silver medal of classic gravity model mistakes" as defined by Baldwin). Next, to account for the potential bias possibly arising from inappropriate deflation by the aggregate U.S. price index, we add time dummies. This procedure corrects for the global trends in inflation rates, as every bilateral trade flow is divided by the same price index adjusted for time effects (Baldwin's "bronze medal of classic gravity model mistakes"). Furthermore, in order to address the possibility of non-linear effects operating in the gravity equation estimations (as for example, due to sample non-homogeneity), similarly to Glick and Rose (2002), we add quadratic terms for both output and output per capita. Finally, the treatment of zero-trade observations is an issue, as the log-linear form of the gravity equation (1) requires using observations for which the dependent variable is positive.[19] Given that the value of trade flows between some pairs of countries–typically pairs of small countries–may be zero, a sample selection problem may arise, the severity of which depends on the particular characteristics of the sample and model used. In order to address this issue, we use a positive constant that allows the inclusion of the zero-trade observations, namely, using $\log(\text{constant} + X_{ij})$ as a dependent variable in order to avoid the truncation; and Tobit

[17] The CFA franc zone and the CMA were formed due, in large part, to the political self-interest of the major power (France in the former case, and South Africa in the latter).

[18] The first two in this list are what Baldwin (2005) calls the "silver and bronze medal mistakes." The issue of nonlinearities is also discussed in Baldwin. See also Frankel (2005) for a justification of using the "pooled" export-import specification.

[19] While, in many cases, zeros occur simply because some pairs of countries did not trade in a given period, zeros may be the result of rounding errors or missing observations that are wrongly recorded as zero. These problems are more likely to occur when small countries are considered. Dropping pairs of countries with zero-trade flows and estimating the log-linear form using ordinary least squares may create a truncation problem and result in inconsistent estimators. See Santos Silva and Tenreyro (2004) for a discussion of these issues.

estimation to appropriately account for the censored nature of the dependent variable of the model.[20]

C. Data

We extend Glick and Rose's data set (2002) to include 217 countries and other political units over the time period 1948-2002.[21] The full set of countries represents the world sample in our analysis. The Africa sample consists of 49 countries from the world sample where at least one in the ij pair is an African country. We also investigate intra-Africa and Africa trade with the rest of the world (Africa-ROW). The intra-Africa sample includes countries where both i and j in the pair come from Africa. The Africa-ROW sample includes exactly one country from Africa in each ij pair.[22]

The data sources for the first part of the paper include annual bilateral trade observations from the IMF's *Direction of Trade Statistics* (expressed in real U.S. dollars); GDP data from the University of Pennsylvania World Tables 6.1 and the World Bank's *World Development Report*; colonial past, distance, and language are variables from the CIA *World Factbook 2004*; data on currency unions for the period 1998-2002 are from the IMF's *Exchange Arrangements and Exchange Restrictions Annual Report*; and data on free trade agreements and currency unions are from Glick and Rose.[23] For the second part of the paper, we use data on prices (purchasing power parity of GDP) from Penn World Tables 6.1; and terms of trade data are from the IMF's *World Economic Outlook 2004*. Appendix B provides more details on the data construction and sources. Appendix C presents the countries, currency unions, and free trade agreements used in the study as well as summary statistics for the variables of interest.

IV. Results

A. The Trade-Generating Effect in the World and Africa

We begin by investigating general aspects of bilateral trade with the extended sample and draw comparisons between the world and Africa samples. First, using the gravity equation (1) we establish some benchmark results by extending the results of Glick and Rose (2002) to allow the free trade agreement dummy to include agreements operating in Africa (which Glick and Rose neglect since these were not included in the World Trade Organization database they were using). Then, we estimate the characteristics of bilateral trade in Africa, trade creation, and address robustness issues.

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[20] The pseudo maximum likelihood approach developed by Santos Silva and Tenreyro (2004) also deals with potential heteroskedasticity and could be used as a robustness check.

[21] These include overseas territories, parts of kingdoms, possessions, self-governing territories in free association with another country, unincorporated territories, and crown dependencies.

[22] Hence, the number of observations the intra-Africa and Africa-rest-of-the-world samples sums to the total Africa sample.

[23] We added some free trade areas (FTAs) omitted in the Glick and Rose (2002) study, as well as FTAs operating in Africa (although not included in the World Trade Organization database).

Benchmark results

Table 1 shows the benchmark results of estimating equation (1) using our extended sample. Following the literature, we use simple cross-section estimation (columns 1-3) and then extend the results using panel fixed-effects estimation in order to account for the country-pair specific idiosyncratic effects and address the potential omitted-variable bias (columns 4-6). The specification in the first column uses the world sample and replicates the benchmark cross-section results of Glick and Rose (2002) very closely: countries sharing a common currency trade more than two and a half times more than countries not involved in a currency union. The coefficients on the standard determinants of the gravity models, such as income, population, and distance, have the correct sign, are statistically significant, and yield plausible elasticity estimates broadly in line with those obtained in the literature.[24] In column 2, we allow the free trade area dummy to include more agreements, especially those operating in Africa (which is an important point because a major part of currency union operates in this region). The coefficient of currency union decreases slightly to 2.3 compared with the original Glick and Rose specification. The third column presents the estimation of equation (1) for the Africa sample. Interestingly, the currency union trade-generating effect is larger than in the world sample, and the marginal impacts of the other determinants change.[25] In terms of the marginal impacts of the other determinants in the Africa sample compared with the world sample, the "common land border" variable becomes much more important, reflecting the poor transportation links between many African countries and the tendency to trade more with neighboring countries; "common language" is less important, since the currency unions in the sample are the Francophone countries of West and Central Africa and the South Africa Common Monetary Area; "ever colony" has a greater impact reflecting the colonial ties in Africa; and there is a reversal of the signs of "number of islands." Finally, we reestimate the specifications of columns 1-3 as a panel and add a set of country-pair-specific intercepts to the equation.[26] As expected, the results in columns 4-6 show that accounting for country fixed-effects does change the results significantly, suggesting that the idiosyncratic effect is important. For both the world and Africa samples (columns 5 and 6), the size of the currency union coefficient falls, with the currency union trade-generating effect now slightly smaller in Africa. With country effects taken into consideration, currency union membership is estimated to boost trade by a factor of 1.8 and 1.7 in the world and Africa, respectively.

Next, we investigate the characteristics of African trade in more detail. Table 2 presents the results of the relative trade performance of African countries by introducing dummies for intra-Africa trade, and trade between Africa and the rest of the world (ROW).[27] We introduce these trade dummies in the baseline specification (shown in column 2 of Table 1). Doing so changes the currency union coefficient only marginally, suggesting that the trade-generating

[24] Henceforth, and unless discussed otherwise, this statement will hold true for all specifications discussed.
[25] Although Masson and Pattillo (2004) have also estimated this, our results may not be directly comparable to theirs because free trade areas operating in Africa were not included in the Masson and Pattillo estimation.
[26] While we estimate both fixed and random effects, we rely on the robust fixed-effects "within" estimator.
[27] As discussed earlier, the dummy for intra-Africa trade is unity if both countries are in this region; the Africa-ROW trade is unity if only one country is located in Africa.

effect of a currency union is now 2.2 times greater than for countries not in a currency union. In addition, both the Africa-ROW and intra-Africa trade dummies are highly significant. In columns 5 and 6 the sample is restricted to examine the Africa-ROW and intra-Africa trade with country-specific effects taken into consideration. The results confirm that currency union participation in Africa has beneficial intraregional trade generating effects as well as Africa-ROW trade-generating effects: the trade-generating effect is 1.8 for intra-Africa and 1.7 for Africa-ROW trade. Finally, following Subramanian and Tamirisa (2003), we also examine the distinction between Anglophone and Francophone countries. We find that the trade-generating effect is still high but, contrary to Subramanian and Tamirisa, we do not find any distinction in the trade patterns of Francophone and Anglophone Africa, since we find no evidence of intra-Francophone and intra-Anglophone undertrading. However, we do find evidence of increasing integration of both Francophone and Anglophone Africa with the rest of the world because the coefficients of global overall trade with the ROW are positive and significant, suggesting that, in Francophone and Anglophone Africa, overall trade was about 22 and 25 percent more than the average, respectively.[28]

In Table 3, we investigate the possibility that the stimulus to trade among members of a currency union comes at the expense of trade with nonmembers by adding the trade diversion dummy to the specifications of Tables 1 and 2. All the specifications where country-pair specific fixed-effects are properly accounted for show that the coefficients associated with the trade diversion dummy are positive for both the world and Africa samples. This suggests that there is a significant trade creation effect (rather than trade diversion), with Africa's trade creation effect slightly smaller in magnitude than the world sample. In addition, while there is a significant trade creation effect for both the intra-Africa and Africa-ROW specifications, the intra-Africa trade creation effect is about five times higher, which reflects observed trade patterns in Africa's trade arrangements. Finally, the overall currency union trade-generating effect still remains about 2.1 and 2.0 for the world and Africa, respectively.

Sensitivity analysis

We check the robustness of our results presented in Tables 1 and 2, by changing our methodology in a number of ways (see discussion in Section III.B.) and reporting estimates of the coefficients of interest. In particular, we conduct sensitivity checks of the specification by estimating the dependent variable as the average of the logarithm of exports and imports (rather than the logarithm of the average); adding quadratic terms for output and output per capita to control for possible sample nonlinearities; adding time effects; modifying the dependent variable by adding a small constant to trade before taking logarithm to avoid the truncation issue, essentially estimating log(constant+X_{ij}) as the dependent variable;[29] and using Tobit estimation to account for the censored nature of the dependent variable.

[28] For brevity, results are not included, but are available from the authors.

[29] Indeed, not eliminating the zero observations increases the world and Africa samples by about 45 and 31 percent, respectively. Also, in order to compare our results with those obtained by Alesina, Barro, and Tenreyro (2002) we set this constant equal to 100. Therefore, the dependent variable becomes $\log(100 + X_{ij})$.

The results in Table 4 show that the estimates of the currency union trade-generating effect γ are reasonably insensitive to a number of sensitivity checks of our methodology. First, adding nonlinear terms, time effects, and changing the specification of the dependent variable to one of the average of the logs changes only marginally the magnitudes of the benchmark fixed-effects estimates. Second, adding the zero-trade values can make a difference in the results. It is important to acknowledge, however, that while excluding the zero values eliminates observations for which the currency union elasticity is low in absolute value may drive the overall elasticity upwards (Anderson and van Wincoop, 2003), at the same time, inclusion of the zero values may drive the overall elasticity downward.[30] The Tobit estimates, which overcome the bias that may result from the censored nature of the data, are sufficiently close to the cross-section benchmark results obtained in Table 1, but may, however, suffer from the omitted-variable bias resulting from not properly accounting for country-pair specific fixed-effects. In summary, the estimated γ from the fixed-effects estimates lies in the narrow range of about (1.17, 1.89) and (1.03, 1.85) for the world and Africa samples, respectively. When we include only statistically significant estimates and exclude the estimates resulting from corrections relating to zero-trade observations, the range becomes even more tight (1.59, 1.89) and (1.68, 1.85) for the world and Africa samples, respectively.

B. Years of Membership, Co-movements, and Trade Stability

We now turn our attention to three related (but different) issues. We investigate the impact of the duration of currency union membership on bilateral trade, the currency union impact on output and price co-movements, and the effect of currency union membership on trade stability. Finally, similarly to the previous section, we discuss robustness issues.

Benchmark results

Investigating the time-dimension aspect of a currency union, we follow Glick and Rose (2002) to estimate how the effects of leaving a currency union evolve over time. To do so, we define a dummy variable that is equal to unity for the observations associated with the year of a union's dissolution between a given pair of countries, and equal to zero otherwise.[31] More important, we also include lags of this dummy (we add a dummy variable for one year after dissolution, for two years after dissolution, and so on). Figures 1 and 2 plot the coefficients of subsequent lags to trace out the response of bilateral trade to the dissolution of a currency union.[32] Because our sample extends the time-dimension of the Glick and Rose data set, we show more convincingly that the exits from a currency union are associated with a decline in bilateral trade. For both samples of our analysis, the effect is not quite visible (and statistically significant) until about 21 years after the country exits the currency union,

[30] See Amemiya (1984) for a detailed discussion on this and the benefits of using Tobit estimation.
[31] See Appendix C for the number of identified currency union dissolutions for the world and Africa samples.
[32] The horizontal lines in Figures 1 and 2 correspond to the estimate of the coefficient of the currency union dummy (namely, the γ coefficient for the gravity equation (1) extended to include the vector of lagged variables described in the text) for the world and Africa samples, respectively. The 95 percent confidence intervals are also included.

and some negative effects in absolute terms can be identified only after 30 years.[33] For both the Africa and world samples, no statistically significant negative effects are identified in the years immediately after the dissolution of the currency union; statistically significant coefficients for the world and Africa samples, respectively, appear in the periods of 16-27 years and 16-21 years after leaving the currency union. In addition, the adverse effect of exiting from a currency union is smaller for the African sample in the first few years: after ten years of currency union exit, bilateral trade declines by about 35 percent for the Africa and 55 percent for the world. However, 10 years after the exit, the cumulative decline in bilateral trade is greater in Africa than in the world sample. Overall, the results suggest that the impact of leaving a currency union is far from linear, which motivates the inclusion of a quadratic term in the currency union duration effect analysis.

Next, since it is not possible to determine the effects of joining a currency union in a similar fashion (because there are too few currency union entries in the sample), we take the following approach: instead of measuring the trade effects that occur after a country enters a currency union, we ask how the trade effects of a currency union evolve over membership time. Specifically, we ask whether it matters for how long countries have been sharing the common currency. Table 5 presents the results of estimating equation (2). The length of a country's membership in a currency union is important, as in both the world and Africa samples, we estimate that one additional year of membership increases trade by 1.4 and 2.0 percent, respectively. Therefore, in the world sample, after a country has been in a currency union for 10 years, the impact on trade would be a 15 percent increase $[(1 + 0.014)^{10}]$, which implies that for a currency union to achieve the Glick and Rose (2002) results (namely, double trade) countries have to "wait" for about 67 years. (For the Africa sample, after 10 years of currency union membership trade increases by an estimated 22 percent, and trade is estimated to take 45 years to double.) Furthermore, as Figures 1 and 2 show, there may be a nonlinear impact of leaving a currency union. Therefore, we add a quadratic term, $\left(yearsCU\right)_{ij}^{2}$, to equation (2). Columns 2 and 4 (and 6 and 8) of Table 5 show a negative (and significant) quadratic term which suggests some diminishing returns of currency union membership.

In order to investigate the effects of currency unions on the co-movements of prices and output we follow the approach of Alesina, Barro, and Tenreyro (2002), and Tenreyro and Barro (2003). We test whether their results hold in a bilateral approach to currency unions, especially in the context of Africa and estimate equation (1), sequentially substituting the dependent variable with VP_{ij}, and VY_{ij} as calculated in equations (4) and (6).[34] The results of the estimated impact on co-movements of output and prices are presented in Table 6, columns 1-4 and 5-8, respectively. For both the world and Africa samples, we find that currency unions tend to increase the co-movement of prices but that they are not systematically related to the co-movement of outputs. This also confirms the results of Alesina, Barro, and Tenreyro (2002) for the world sample. In addition, the marginal effect of

[33] This cannot be seen in the Glick and Rose data because plots of only 30 years after the dissolution of a currency union are used.

[34] We estimate the equations for the averages 1948-2003.

currency unions on the price co-movements is higher for Africa. This is an important observation, as co-movements are lower in Africa (see summary statistics in Appendix C). The coefficient of currency union for Africa (0.04 with country fixed-effects) is quite high because mean co-movements of prices are equal to –0.15 for that subsample. The fact that the estimated coefficients on the currency union dummy variable are not significantly different from zero in the output co-movement regressions may arise because the theoretical link between currency union and output co-movement is ambiguous, and largely depends on the extend to which trade is intra or inter-industry.[35] Also, the positive estimated effect of currency union on price co-movement may emerge because countries that are members of currency unions avoid the inflation and nominal exchange rate volatility that characterizes other regimes.

Finally, we examine whether participation in currency unions makes trade more stable by reducing exchange rate volatility. Table 7 shows estimations of the gravity model with the coefficient of variation of log of real trade as dependent variable. Columns 1 and 2 of Table 7 show that currency union does make trade more stable, with the marginal impact slightly higher in Africa than for in the world. However, once country-pair fixed-effects are taken into account (columns 3 and 4), for both the world and Africa samples the currency union coefficient falls and becomes statistically insignificant. Nevertheless, the currency union impact is high as the mean stability for Africa sample is 0.22 (compared to 0.18 for the world).

Sensitivity analysis

Similarly to the previous section, we check the robustness of the results presented in Tables 5, 6, and 7, by conducting sensitivity checks of the specification: estimating the dependent variable as average of the logarithm of exports and imports; adding quadratic terms for output and output per capita to control for possible sample nonlinearities; and adding time effects. Estimates in Table 5 are robust to all the above sensitivity checks: after a country in the world (Africa) has been in a currency union for 10 years, trade increases by 14-22 percent (20-29 percent), and the diminishing returns of currency union membership effect is always significant. The conclusions of Tables 6 and 7 are also insensitive to the perturbations. In particular, for Table 7, we estimate the specification with other techniques and measures of stability. The results are reasonably robust, except in the specifications with zero-trade observations included (which can be explained by the fact that zeros for the extended period of time bias the stability measure).[36]

[35] As also discussed in Alesina, Barro, and Tenreyro (2002) increased interindustry trade may stimulate sectoral specialization and lead to less co-movements (as increased specialization likely lowers the co-movements of outputs and prices with industry-specific shocks would become country specific shocks), while intraindustry trade likely leads to more co-movements.

[36] These other methods used (described in the methodology section) include the maximal absolute value, the mean absolute value, and the standard deviation of the residual from a conventional gravity equation of exports in levels.

V. CONCLUSIONS

This paper has provided some insights into several aspects of the performance of currency union using an augmented version of the gravity model and focusing on two samples, the world and Africa. First, we have confirmed the results that the impact of a currency union on trade is large: countries that belong to the same currency union trade about twice as much with each other compared with similar countries that do not share the same currency. Moreover, this increase in trade comes without trade diversion from non-currency-union members. Second, we have found that the duration of a country's membership in a currency union matters: the longer the duration the more the benefits, with some diminishing returns. Third, we have shown that currency union participation reduces trade volatility, increases price co-movements, but has no significant effect on output co-movements among members. Finally, these results are fairly robust to the estimation methodology employed and, although they hold true for both samples under investigation, the marginal effects and mechanisms of transmission may vary across the two samples.

Although this paper has concluded that several aspects of the performance of currency union operate more or less the same in Africa as elsewhere, the methodology herein does not constitute an explicit investigation into how trade and its underlying determinants are explicitly interconnected, or the extent to which currency unions can promote growth and poverty reduction. Identifying the similarities and some of the differences across the samples only begins to tackle the problem and may, in fact, raise more questions than it answers. More work is required in this direction. Perhaps one avenue might be to look for omitted factors that induce countries to join a currency union and to trade more, as suggested by Rose and van Wincoop (2001). Joining a currency union and opening up to the world are very often political decisions, so that such omitted factors may lie in a set of political and institutional variables. This is not a new realization: in recent papers on "deeper" determinants of economic growth, both institutions and trade openness determine a country's performance in the long run (see, for example, Acemoglu, Johnson, and Robinson, 2001; and Rodrik, Subramanian, and Trebbi, 2002). In the complicated web of relationships describing income, its determinants, and the linkages between the determinants, the interdependence of trade and institutions is a recurring theme that is difficult to handle, not least because of the issues of causality and construction of proper instruments.

Figure 1. Dissolution of Currency Union
World Sample

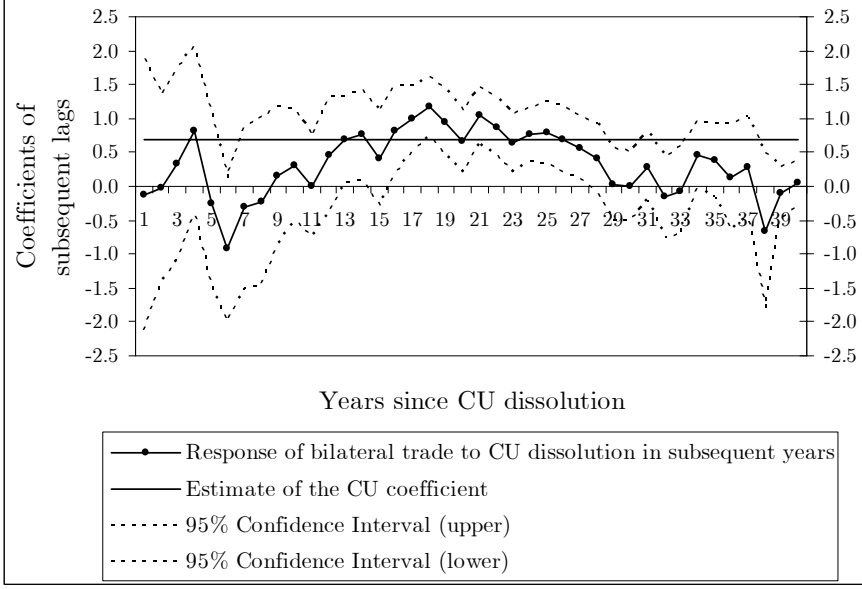
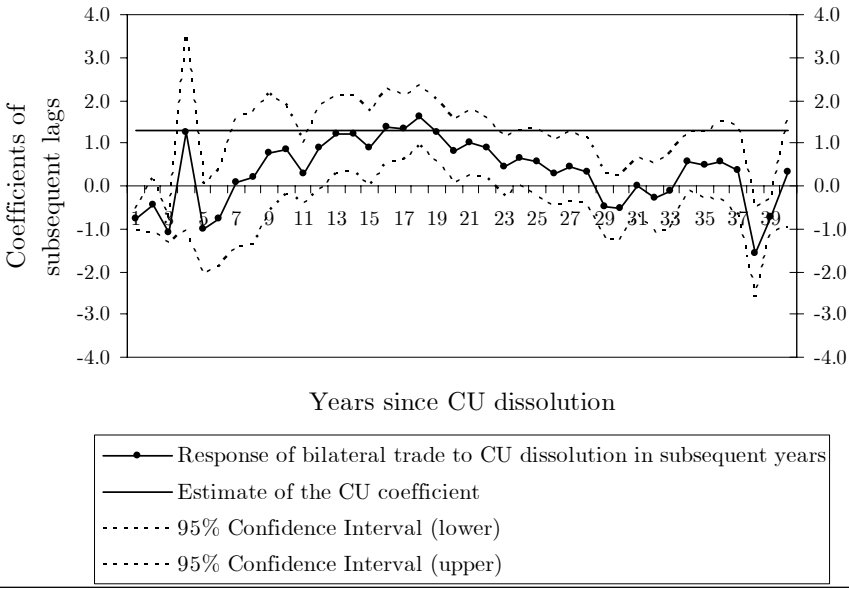


Figure 2. Dissolution of Currency Union
Africa Sample



Notes:
1. The horizontal lines in Figures 1 and 2 correspond to the estimate of the coefficient of the currency union dummy (the g coefficient for the gravity equation (1) extended to include the vector of lagged variables described in the text) for the World and Africa samples, respectively.
2. The corresponding lag of the dummy variable associated with CU dissolution is statistically significant if the corresponding error bands exclude zero.

Table 1: Benchmark Results
Dependent variable is log of real trade, log(Xij)

Sample:	World	World	Africa	World	World	Africa
Estimation:	OLS	OLS	OLS	Fixed effects	Fixed effects	Fixed effects
Specification:	(1)	(2)	(3)	(4)	(5)	(6)
Currency union	1.00 **	0.84 **	0.99 **	0.54 **	0.58 **	0.55 **
	(8.55)	(7.75)	(6.57)	(13.37)	(14.35)	(8.18)
Log distance	-1.08 **	-1.05 **	-1.06 **			
	(52.68)	(52.08)	(19.77)			
Log product real GDP	0.92 **	0.93 **	1.01 **	0.16 **	0.15 **	-0.10 **
	(104.20)	(105.38)	(61.62)	(24.28)	(22.52)	(8.66)
Log product real GDP/capita	0.42 **	0.44 **	0.34 **	0.55 **	0.57 **	0.66 **
	(32.28)	(33.80)	(14.77)	-(51.62)	(53.47)	(33.23)
Common language	0.36 **	0.35 **	0.29 **			
	(9.25)	(9.31)	(4.66)			
Common land border	0.52 **	0.40 **	1.22 **			
	(4.71)	(3.85)	(7.30)			
FTA	1.14 **			0.64 **		
	(10.40)			(18.75)		
FTA (with Africa)		1.19 **	0.92 **		0.30 **	0.20 **
		-14.32	-7.46		(12.08)	(4.61)
Number landlocked in the pair	-0.23 **	-0.25 **	-0.35 **			
	(8.17)	(8.82)	(8.86)			
Number islands in the pair	0.03	0.03	-0.31 **			
	(0.92)	(0.73)	(5.00)			
Log product of areas	-0.08 **	-0.08 **	-0.18 **			
	(10.75)	(11.26)	(14.70)			
Common colonizer	0.55 **	0.51 **	0.30 **			
	(8.78)	(8.27)	(3.48)			
Current colony	0.95 **	0.99 **	-0.39	0.43	0.41 **	-0.07
	(3.91)	(4.02)	(0.86)	(5.42)	(5.11)	(0.49)
Ever colony	1.31 **	1.32 **	2.14 **			
	(10.75)	(10.97)	(14.42)			
Same nation	-0.20	-0.23	1.63 **			
	(0.20)	(0.22)	(3.30)			
Observations	265,262	265,262	100,597	265,262	265,262	100,597
R-squared (within)				0.13	0.13	0.03
R-squared (between)				0.41	0.40	0.01
R-squared (overall)	0.68	0.68	0.52	0.38	0.36	0.01
Hausman test (p-value)				0.00	0.00	0.00

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Table 2: Africa Trade Details
Dependent variable is log of real trade, log(Xij)

Sample:	World	Africa-ROW	Intra-Africa	World	Africa-ROW	Intra-Africa
Estimation:	OLS	OLS	OLS	Fixed effects	Fixed effects	Fixed effects
Specification:	(1)	(2)	(3)	(4)	(5)	(6)
Currency union	0.79 **	0.53	0.55 **	0.58 **	0.62 **	0.53 **
	(7.03)	(1.18)	(2.69)	(14.35)	(4.56)	(6.35)
Africa-ROW	0.27 **					
	(7.90)					
Intra Africa	0.42 **					
	(4.58)					
Log distance	-1.06 **	-0.96 **	-1.29 **			
	(52.00)	(15.64)	(9.92)			
Log product real GDP	0.94 **	1.06 **	0.62 **	0.15 **	-0.13 **	-0.07 *
	(104.26)	(64.47)	(9.83)	(22.52)	(10.37)	(2.56)
Log product real GDP/capita	0.48 **	0.33 **	0.50 **	0.57 **	0.75 **	0.37 **
	(35.94)	(13.95)	(5.80)	(53.47)	(32.71)	(8.34)
Common language	0.33 **	0.27 **	0.40 *			
	(8.76)	(4.26)	(2.01)			
Common land border	0.43 **	1.10 **	0.98 **			
	(4.17)	(3.21)	(4.27)			
FTA (with Africa)	1.15 **		0.78 **	0.30 **		0.18 **
	(13.08)		(5.24)	(12.08)		(3.39)
Number landlocked in the pair	-0.28 **	-0.37 **	-0.33 **			
	(9.97)	(8.82)	(3.07)			
Number islands in the pair	0.04	-0.39 **	0.17			
	(1.09)	(6.07)	(0.83)			
Log product of areas	-0.09 **	-0.20 **	-0.01			
	(12.35)	(16.14)	(0.15)			
Common colonizer	0.49 **	0.32 **	0.25			
	(7.91)	(3.46)	(1.09)			
Current colony	0.98 **	-0.03		0.41 **	-0.10	
	(3.92)	(0.06)		(5.11)	(0.65)	
Ever colony	1.30 **	2.12 **				
	(11.25)	(14.08)				
Same nation	-0.31	1.47 **				
	(0.31)	(2.62)				
Observations	265,262	85,759	14,838	265,262	85,759	14,838
R-squared (within)				0.13	0.03	0.01
R-squared (between)				0.40	0.00	0.01
R-squared (overall)	0.68	0.54	0.40	0.36	0.00	0.01
Hausman test (p-value)				0.00	0.00	0.00

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Table 3: Trade Creation or Diversion?
Dependent variable is log of real trade, log(Xij)

Sample:	World	Africa	Africa-ROW	Intra-Africa	World	Africa	Africa-ROW	Intra-Africa
Estimation:	OLS	OLS	OLS	OLS	Fixed effects	Fixed effects	Fixed effects	Fixed effects
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Currency union	0.97 **	1.05 **	0.61	0.59 **	0.73 **	0.70 **	0.73 **	1.03 **
	(8.77)	(6.81)	(1.38)	(2.58)	(17.74)	(10.29)	(5.35)	(10.80)
Trade diversion	0.23 **	0.10 *	0.09	0.09	0.21 **	0.18 **	0.12 **	0.58 **
	(8.66)	(2.35)	(1.92)	(0.55)	(21.18)	(10.24)	(6.71)	(10.75)
Log distance	-1.05 **	-1.05 **	-0.96 **	-1.29 **				
	(52.02)	(19.62)	(15.61)	(9.86)				
Log product real GDP	0.93 **	1.01 **	1.06 **	0.63 **	0.18 **	-0.06 **	-0.11 **	0.00
	(105.28)	(61.82)	(64.45)	(9.89)	(26.35)	(5.35)	(8.01)	(0.09)
Log product real GDP/capita	0.44 **	0.33 **	0.32 **	0.50 **	0.56 **	0.64 **	0.73 **	0.31 **
	(33.56)	(14.46)	(13.64)	(5.61)	(52.34)	(31.95)	(31.74)	(6.94)
Common language	0.33 **	0.28 **	0.27 **	0.40 *				
	(8.80)	(4.57)	(4.20)	(2.00)				
Common land border	0.42 **	1.22 **	1.11 **	0.98 **				
	(4.04)	(7.29)	(3.19)	(4.26)				
FTA (with Africa)	1.17 **	0.93 **		0.80 **	0.32 **	0.22 **		0.31 **
	(14.03)	(7.55)		(5.13)	(12.74)	(5.19)		(5.61)
Number landlocked in the pair	-0.24 **	-0.35 **	-0.36 **	-0.33 **				
	(8.38)	(8.71)	(8.70)	(3.03)				
Number islands in the pair	0.01	-0.31 **	-0.39 **	0.17				
	(0.24)	(5.01)	(6.07)	(0.86)				
Log product of areas	-0.08 **	-0.18 **	-0.20 **	-0.01				
	(11.48)	(14.82)	(16.19)	(0.20)				
Common colonizer	0.52 **	0.31 **	0.33 **	0.26				
	(8.42)	(3.60)	(3.51)	(1.15)				
Current colony	1.03 **	-0.35	-0.02		0.44 **	-0.08	-0.11	
	(4.17)	(0.77)	(0.03)		(5.52)	(0.53)	(0.67)	
Ever colony	1.25 **	2.10 **	2.09 **					
	(10.57)	(13.94)	(13.65)					
Same nation	-0.25	1.60 **	1.46 **					
	(0.24)	(3.22)	(2.59)					
Observations	265,262	100,597	85,759	14,838	265,262	100,597	85,759	14,838
R-squared (within)					0.13	0.03	0.03	0.02
R-squared (between)					0.13	0.02	0.03	0.02
R-squared (overall)	0.68	0.52	0.54	0.40	0.43	0.03	0.00	0.04
Hausman test (p-value)					0.39	0.00	0.00	0.04

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Table 4: Sensitivity Analysis of Currency Union Effect
Various estimation methods

Sample:	World		Africa	
	γ	*Effect*	γ	*Effect*
Ordinary Least squares	0.84 **	*2.3*	0.99 **	*2.7*
	(7.75)		(6.57)	
Dependent variable is log(100+Xij)	0.57 **	*1.8*	0.58 **	*1.8*
	(4.85)		(4.05)	
Fixed Effects	0.58 **	*1.8*	0.55 **	*1.7*
	(14.35)		(8.18)	
Fixed effects AND dependent variable calculated as average of logs	0.64 **	*1.9*	0.62 **	*1.9*
	(15.33)		(9.15)	
Fixed effects AND non-linearities added	0.46 **	*1.6*	0.52 **	*1.7*
	(11.46)		(7.82)	
Fixed effects AND time effects added	0.60 **	*1.8*	0.54 **	*1.7*
	(14.84)		(8.13)	
Fixed effects AND dependent variable is log(100+X_{ij})	0.16 **	*1.2*	0.03	*1.0*
	(4.55)		(0.59)	
Tobit estimation	0.79 **	*2.2*	0.86 **	*2.4*
	(20.30)		(16.09)	
County-fixed effects	0.85 **	*2.4*	1.14 **	*3.1*
	(7.86)		(7.82)	

Notes:
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.
Controls not reported are those listed in the other tables.

Table 5: Duration of Currency Union Memebership
Dependent variable is log of real trade, log(Xij)

Sample:	World	World	Africa	Africa	World	World	Africa	Africa
Estimation:	OLS	OLS	OLS	OLS	Fixed effects	Fixed effects	Fixed effects	Fixed effects
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years in currency union	0.03 **	0.07 **	0.03 **	0.06 **	0.01 **	0.05 **	0.02 **	0.04 **
	(7.47)	(7.49)	(5.99)	(5.58)	(8.35)	(13.67)	(8.71)	(8.05)
(Years in currency union)^2		-0.001 **		-0.001 **		-0.001 **		-0.001 **
		(4.86)		(3.26)		(11.00)		(4.58)
Log distance	-1.05 **	-1.05 **	-1.06 **	-1.06 **				
	(52.02)	(52.00)	(19.88)	(19.82)				
Log product real GDP	0.93 **	0.93 **	1.01 **	1.01 **	0.15 **	0.15 **	-0.11 **	-0.10 **
	(105.60)	(105.64)	(61.60)	(61.70)	(21.23)	(22.31)	(9.91)	(9.01)
Log product real GDP/capita	0.44 **	0.44 **	0.34 **	0.34 **	0.58 **	0.57 **	0.68 **	0.67 **
	(33.88)	(33.87)	(14.77)	(14.72)	(54.57)	(53.23)	(34.18)	(33.07)
Common language	0.35 **	0.35 **	0.29 **	0.29 **				
	(9.26)	(9.22)	(4.74)	(4.67)				
Common land border	0.41 **	0.40 **	1.23 **	1.23 **				
	(3.94)	(3.89)	(7.29)	(7.29)				
FTA (with Africa)	1.19 **	1.19 **	0.91 **	0.92 **	0.30 **	0.32 **	0.17 **	0.18 **
	(14.35)	(14.41)	(7.36)	(7.42)	(12.13)	(12.66)	(4.00)	(4.18)
Number landlocked in the pair	-0.25 **	-0.25 **	-0.36 **	-0.36 **				
	(8.82)	(8.82)	(8.90)	(8.88)				
Number islands in the pair	0.02	0.02	-0.31 **	-0.31 **				
	(0.67)	(0.68)	(5.00)	(5.02)				
Log product of areas	-0.08 **	-0.08 **	-0.18 **	-0.18 **				
	(11.30)	(11.38)	(14.67)	(14.74)				
Common colonizer	0.51 **	0.50 **	0.31 **	0.30 **				
	(8.24)	(8.06)	(3.53)	(3.41)				
Current colony	1.17 **	1.06 **	-0.04	-0.21	0.58 **	0.48 **	0.11	0.00
	(4.80)	(4.49)	(0.09)	(0.47)	(7.46)	(6.10)	(0.81)	(0.01)
Ever colony	1.34 **	1.33 **	2.15 **	2.14 **				
	(11.10)	(11.04)	(14.69)	(14.60)				
Same nation	-0.24	-0.22	1.62 **	1.73 **				
	(0.21)	(0.19)	(3.23)	(3.60)				
Observations	265,262	265,262	100,597	100,597	265,262	265,262	100,597	100,597
R-squared (within)					0.13	0.13	0.03	0.03
R-squared (between)					0.38	0.40	0.00	0.01
R-squared (overall)	0.68	0.68	0.52	0.52	0.35	0.36	0.01	0.01
Hausman test (p-value)					0.00	0.00	0.00	0.00

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Table 6: Currency Union Impact on Comovements of Outputs and Prices
Dependent variables: comovement of outputs (Vyij) for (1)-(4); and comovement of prices (Vpij) for (5)-(8)

Sample:	World	Africa	World	Africa	World	Africa	World	Africa
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Currency union	-0.002	0.002	0.000	0.000	0.06 **	0.07 **	0.03 **	0.04 **
	(0.61)	(0.55)	(0.12)	(0.25)	(9.07)	(9.35)	(11.19)	(11.19)
Log distance	0.002 **	0.008 **	-0.001 **	-0.001	-0.003	0.001	-0.004 **	-0.003 *
	(3.56)	(7.58)	(3.56)	(0.96)	(1.79)	(0.26)	(5.33)	(2.23)
Log product real GDP	0.005 **	0.005 **	0.003 **	0.000	0.002 **	-0.003 **	0.007 **	-0.008 **
	(22.10)	(14.19)	(5.21)	(0.30)	(4.18)	(3.96)	(3.34)	(3.57)
Log product real GDP/capita	0.005 **	0.001	-0.004 **	0.001	0.012 **	0.016 **	-0.004	0.011 **
	(16.98)	(1.63)	(4.39)	(0.56)	(14.76)	(16.61)	(1.17)	(3.47)
Common language	0.001	-0.002	0.001 *	0.000	0.001	0.000	0.002	0.001
	(0.65)	(1.54)	(2.05)	(0.13)	(0.42)	(0.09)	(1.43)	(1.15)
Common land border	0.006 *	0.005	0.003 **	0.001	-0.005	-0.007	0.004	0.004
	(2.52)	(1.44)	(3.65)	(0.82)	(0.66)	(0.77)	(1.46)	(1.24)
FTA (with Africa)	0.012 **	0.010 **	0.003 *	-0.001	0.018 **	0.015	0.007 *	-0.007 *
	(4.59)	(2.65)	(2.35)	(0.60)	(2.84)	(1.89)	(2.50)	(2.21)
Number landlocked in the pair	0.005 **	0.007 **			0.007 **	0.014 **		
	(8.19)	(8.65)			(3.88)	(7.30)		
Number islands in the pair	0.005 **	0.010 **			0.012 **	0.012 **		
	(7.14)	(8.08)			(6.77)	(5.45)		
Log product of areas	0.000 **	0.000			-0.004 **	-0.001		
	(3.07)	(0.66)			(9.62)	(1.94)		
Common colonizer	0.004 **	0.009 **	0.002 **	0.001	0.010 **	0.002	0.005 **	0.006 **
	(3.14)	(5.45)	(3.49)	(0.98)	(3.35)	(0.50)	(4.06)	(4.48)
Current colony	-0.018	-0.044	-0.007 *	-0.002	0.049	-0.040	0.025 *	-0.020
	(1.70)	(1.47)	(2.03)	(0.23)	(1.90)	(0.68)	(2.15)	(0.70)
Ever colony	0.004	0.018 *	0.000	0.001	0.007	0.034	-0.006	0.005
	(1.70)	(2.01)	(0.03)	(0.55)	(0.72)	(1.77)	(1.40)	(0.70)
Same nation								
Country fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Observations	6,992	3,793	6,992	3,793	7,000	3,796	7,000	3,796
R-squared	0.25	0.15	0.92	0.92	0.12	0.13	0.87	0.91

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Table 7: Currency Union Impact on Trade Stability

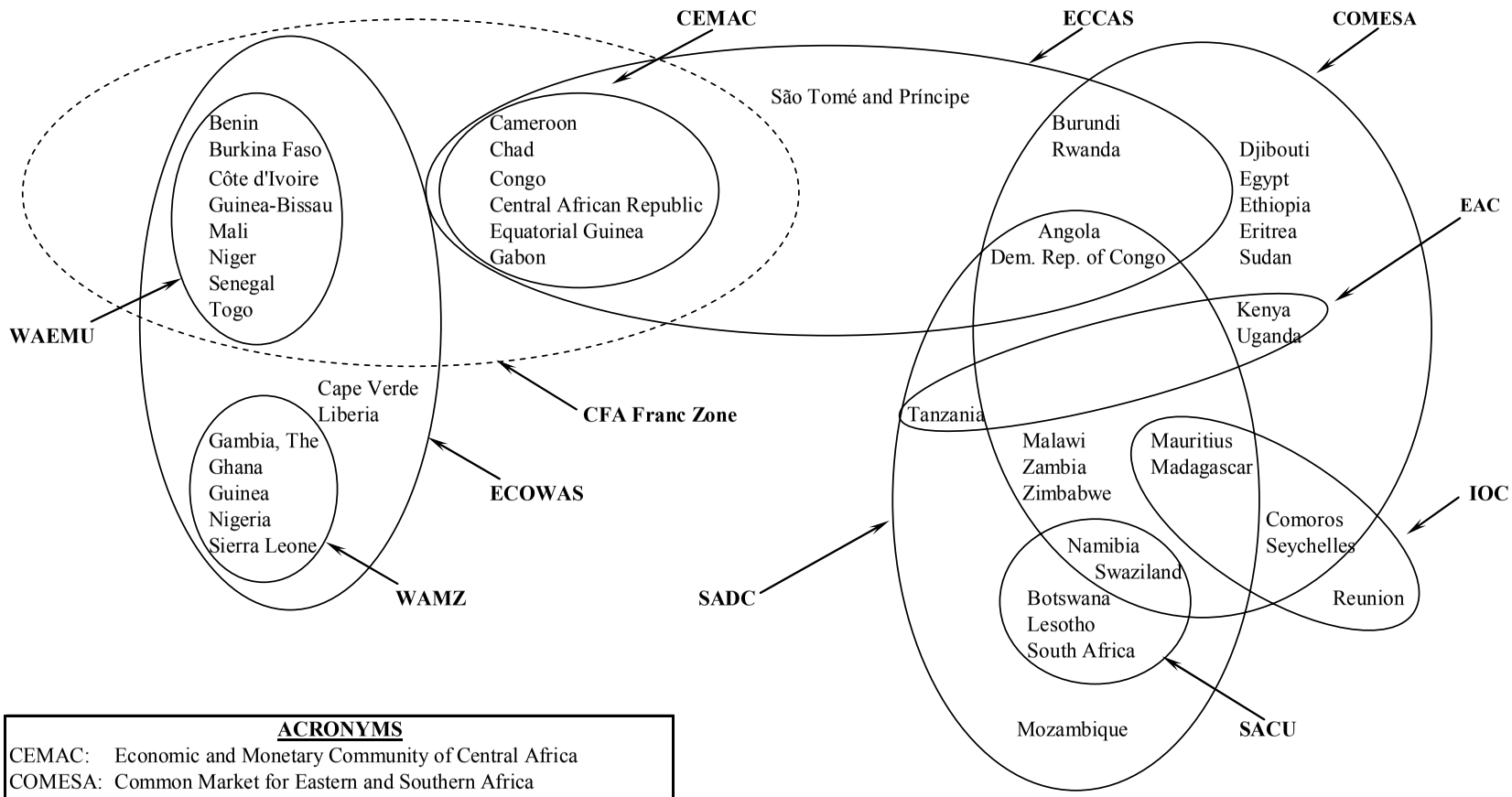
Dependent variable is trade variability, the coefficient of variation of log(Xij)

Sample:	World	Africa	World	Africa
Estimation:	OLS	OLS	Panel fixed	Panel fixed
Specification:	(1)	(2)	(3)	(4)
Currency union	-0.05 **	-0.06 **	-0.02	-0.02
	(4.36)	(4.40)	(0.95)	(0.64)
Log distance	0.05 **	0.07 **		
	(22.53)	(13.09)		
Log product real GDP	-0.03 **	-0.05 **	-0.01 *	0.03 **
	(30.40)	(19.77)	(2.00)	(2.63)
Log product real GDP/capita	-0.02 **	-0.02 **	-0.04 **	-0.08 **
	(9.86)	(4.08)	(6.11)	(6.85)
Common language	-0.02 **	-0.03 **		
	(5.46)	(3.55)		
Common land border	0.02 *	-0.03 *		
	(2.01)	(2.41)		
FTA (with Africa)	-0.06 **	-0.07 **	-0.02	-0.04 *
	(6.30)	(4.97)	(1.46)	(2.31)
Number landlocked in the pair	0.01	0.02 *		
	(1.83)	(2.46)		
Number islands in the pair	0.01 *	0.04 **		
	(2.51)	(4.90)		
Log product of areas	0.00 **	0.01 **		
	(2.77)	(5.58)		
Common colonizer	-0.02 *	0.00		
	(2.15)	(0.21)		
Current colony	-0.01	0.11 **	0.04	0.06
	(0.47)	(3.44)	(1.29)	(1.24)
Ever colony	-0.02 *	-0.04 **		
	(2.55)	(2.65)		
Same nation	-0.03	-0.12 **		
	(1.00)	(4.10)		
Observations	18,156	7,845	18,156	7,845
R-squared (within)			0.05	0.10
R-squared (between)			0.06	0.11
R-squared (overall)	0.18	0.17	0.11	0.01
Hausman test (p-value)			0.11	0.00

Notes:
The table reports robust t-statistics in parentheses.
One asterisk (*) denotes significance at the 5 percent level; two asterisks (**) denote significance at the 1 percent level.

Appendix A

Main African Regional and Sub-Regional Economic Integration Arrangements (as of August 2005)



ACRONYMS

CEMAC:	Economic and Monetary Community of Central Africa
COMESA:	Common Market for Eastern and Southern Africa
EAC:	East African Community
ECCAS:	Economic Community of Central African States
ECOWAS:	Economic Community of Western African States
IOC:	Indian Ocean Commission
SACU:	Southern African Customs Union
SADC:	Southern African Development Community
WAEMU:	West African Economic and Monetary Union
WAMZ:	West Africa Monetary Zone

Appendix B

Sample Data:
Variable Definitions and Sources

Variable	Description	Source
Dependent variable		
X_{ijt}	The average value of real bilateral trade between i and j at time t,	IMF s *Direction of Trade (DoT)*; Average of available values for export from a to b export from b to a, import into a from b, imports into b from a. Deflated by U.S. Consumer Price Index.
Explanatory variables		
Y_i	Real GDP	World Bank s *World Development Indicators*
Pop_i	Population	World Bank s *World Development Indicators*, *Penn World Tables 6.1*; Glick and Rose (2002) data used for 1948-1950
D_{ij}	The distance between i and j	CIA's *World Factbook*; Great Circle Method used to calculate distance
$Lang_{ij}$	A binary variable which is unity if i and j have a common language	CIA's *World Factbook*
$Cont_{ij}$	A binary variable which is unity if i and j share a land border	CIA's *World Factbook*
Landl	The number of landlocked countries in the country-pair (0, 1, or 2)	CIA's *World Factbook*
Island	The number of island nations in the country-pair (0, 1, or 2)	CIA's *World Factbook*
Area	A land area of country n, n=i,j	CIA's *World Factbook*
$ComCol_{ij}$	Binary variable which is unity if i and j were colonies after 1945 with the same colonizer	CIA's *World Factbook*
$CurCol_{ij}$	Binary variable which is unity if i and j are colonies at time t	CIA's *World Factbook*
$Colony_{ij}$	Binary variable which is unity if i colonized j or vice versa	CIA's *World Factbook*
$ComNat_{ij}$	Binary variable which is unity if i and j remained part of the same nation during the sample	CIA's *World Factbook*
FTA_{ij}	Binary variable which is unity if i and j belong to the same regional trade agreement	WTO publication [http://www.wto.org/english/tratop_e/region_e/region_e.htm]
CU_{ij}	Binary variable which is unity if i and j use the same currency at time t	Glick and Rose (2002). For 1998-2002: IMF s *Annual Report on Exchange Arrangements and Exchange Restrictions*
P_i	PPP of GDP	Penn World Tables 6.1; price level of GDP (P) is the PPP over GDP divided by the exchange rate and multiplied by 100
Tot_i	Terms of trade	IMF s *World Economic Outlook* 2004

Appendix C

Table C1: Summary Statistics

	World sample (265,262 observations)		Africa sample (100,597 observations)	
Variable	Mean	Std. Deviation	Mean	Std. Deviation
Log of real trade	10.020	3.246	8.813	2.951
Currency union	0.014	0.119	0.027	0.161
Log distance	8.167	0.809	8.175	0.661
Log product real GDP	47.974	2.662	47.075	2.193
Log product real GDP/capita	16.106	1.470	15.180	1.259
Common language	0.216	0.411	0.266	0.442
Common land border	0.030	0.170	0.029	0.169
FTA (with Africa)	0.034	0.180	0.045	0.207
Number landlocked in the pair	0.262	0.479	0.402	0.553
Number islands in the pair	0.338	0.537	0.250	0.470
Log product of areas	24.139	3.299	24.670	2.904
Common colonizer	0.099	0.298	0.155	0.362
Current colony	0.002	0.041	0.002	0.043
Ever colony	0.020	0.139	0.017	0.129
Same nation	0.000	0.016	0.000	0.017
Years in currency union	0.359	3.481	0.705	4.840
Comovements of outputs[1]	-0.075	0.030	-0.087	0.031
Comovements of prices[1]	-0.155	0.080	-0.163	0.070
Trade volatility[2]	0.181	0.258	0.224	0.294

Notes:

[1] One value for country pair (6992/7000 observations for the world for co-movements of outputs/prices and 3,793/3,796 for Africa samples, respectively).

[2] Two values for country pair (18,156 observations for the world and 7,845 for the Africa sample)

Appendix C

Table C2: Free Trade Agreements in the Sample

Regional agreements	Members (date of entry)
Africa:	
ECOWAS: Economic Community of West African States	Benin (1975), Ghana (1975), Niger (1975), Burkina Faso (1975), Guinea (1975), Nigeria (1975), Cape Verde (1975), Liberia (1975), Senegal (1975), Côte d Ivoire (1975), Mali (1975), Sierra Leone (1975), Gambia, The (1975), Mauritania (1975), Togo (1975), Guinea-Bissau (1975)
COMESA: Common Market for Eastern and Southern Africa	Angola (1981), Malawi (1981), Tanzania (1981), Burundi (1981), Mauritius (1981), Uganda (1981), Comoros (1981), Mozambique (1981), Zambia (1981), Djibouti (1981), Rwanda (1981), Eritrea (1993), Namibia (1993), Zimbabwe (1981), Ethiopia (1981), Somalia (1981), Madagascar (1993), Kenya (1981), Sudan (1981), Seychelles (1993), Lesotho (1981), Swaziland (1981)
SADC: Southern African Development Community	Angola (1980), Lesotho (1980), Zimbabwe (1980), Botswana (1980), Swaziland (1980), Namibia (1990), Malawi (1980), Tanzania (1980), Mauritius (1995), Mozambique (1980), Zambia (1980), South Africa (1995)
CEMAC: Central African Economic and Monetary Community	Congo, Republic of the (1962), Central African Republic (1962), Gabon (1962), Chad (1962-1968, 1984), Cameroon (1962), Equatorial Guinea (1983)
WAEMU: West African Economic and Monetary Union	Benin (1984), Burkina Faso (1962), Côte d Ivoire (1962), Mali (1962), Niger (1962), Senegal (1962), Mauritania (1962 - 1994), Togo (1994)
Rest of the World:	
ASEAN	Brunei (1984), Cambodia (1999), Indonesia (1967), Lao PDR (1997), Malaysia (1967), Myanmar (1997), Philippines (1967), Singapore (1967), Thailand (1967), Vietnam (1995)
EU	Austria (1995), Belgium (1958), Denmark (1973), Finland (1995), France (1958), Germany (1958), Greece (1981), Luxembourg (1958), Ireland (1973), Italy (1958), Netherlands (1958), Portugal (1986), Spain (1986), Sweden (1995), United Kingdom (1973)
US-Israel	United States (1985), Israel (1985)
NAFTA	Canada (1989), United States (1989), Mexico (1994)
CARICOM	Antigua and Barbuda (1974), Bahamas (1983), Barbados (1973), Belize (1974), Dominica (1974), Guyana (1973), Grenada (1974), Jamaica (1973), Montserrat (1974), Saint Kitts and Nevis (1974), Saint Lucia (1974), Saint Vincent and the Grenadines (1974), Suriname (1995), Trinidad and Tobago (1973), Haiti (2002)
PATCRA	Australia (1977), Papua New Guinea (1977)
ANZCERTA	Australia (1983), New Zealand (1983)
CACM	Costa Rica (1963), El Salvador (1961), Guatemala (1961), Honduras (1961), Nicaragua (1961)
SPARTECA	Australia (1981), New Zealand (1981), Cook Islands (1981), Micronesia, Federated States of (1986), Fiji (1981), Kiribati (1981), Marshall Islands (1981), Nauru (1981), Niue (1981), Papua New Guinea (1981), Solomon Islands (1981), Tonga (1981), Tuvalu (1981), Vanuatu (1981), Samoa (1981)
MERCOSUR	Argentina (1991), Brazil (1991), Paraguay (1991), Uruguay (1991), Chile (1996), Bolivia (1996)

Table C3: Currency Unions in the Sample

Currency union members		End	Currency union members		End
Antigua and Barbuda	Barbados	1975	Central African Republic	Congo, Republic of the	ongoing
Antigua and Barbuda	Dominica	ongoing	Central African Republic	Côte d Ivoire	ongoing
Antigua and Barbuda	Grenada	ongoing	Central African Republic	Equatorial Guinea	ongoing
Antigua and Barbuda	Guyana	1971	Central African Republic	Gabon	ongoing
Antigua and Barbuda	Montserrat	ongoing	Central African Republic	Guinea	1969
Antigua and Barbuda	Saint Kitts and Nevis	ongoing	Central African Republic	Guinea-Bissau	ongoing
Antigua and Barbuda	Saint Lucia	ongoing	Central African Republic	Madagascar	1982
Antigua and Barbuda	Saint Vincent and the Grenadines	ongoing	Central African Republic	Mali	ongoing
Antigua and Barbuda	Trinidad and Tobago	1976	Central African Republic	Mauritania	1974
Aruba	Netherlands Antilles	ongoing	Central African Republic	Niger	ongoing
Aruba	Suriname	1994	Central African Republic	Reunion	1976
Australia	Kiribati	ongoing	Central African Republic	Senegal	ongoing
Australia	Nauru	ongoing	Central African Republic	Togo	ongoing
Australia	Solomon Islands	1979	Chad	Benin	ongoing
Australia	Tonga	1991	Chad	Burkina Faso	ongoing
Australia	Tuvalu	ongoing	Chad	Comoros	1994
Bangladesh	India	1974	Chad	Congo, Republic of the	ongoing
Barbados	Dominica	1975	Chad	Côte d Ivoire	ongoing
Barbados	Grenada	1975	Chad	Equatorial Guinea	ongoing
Barbados	Guyana	1971	Chad	Gabon	ongoing
Barbados	Montserrat	1975	Chad	Guinea	1969
Barbados	Saint Kitts and Nevis	1975	Chad	Guinea-Bissau	ongoing
Barbados	Saint Lucia	1975	Chad	Madagascar	1982
Barbados	Saint Vincent and the Grenadines	1975	Chad	Mali	ongoing
Barbados	Trinidad and Tobago	1975	Chad	Mauritania	1974
Belgium	Burundi	1964	Chad	Niger	ongoing
Belgium	Congo, Democratic Republic of the	1961	Chad	Reunion	1976
Belgium	Rwanda	1966	Chad	Senegal	ongoing
Belgium-Luxembourg	Burundi	1964	Chad	Togo	ongoing
Belgium-Luxembourg	Congo, Democratic Republic of the	1961	Comoros	Benin	1994
Belgium-Luxembourg	Rwanda	1966	Comoros	Burkina Faso	1994
Benin	Burkina Faso	ongoing	Comoros	Congo, Republic of the	1994
Benin	Cote d Ivoire	ongoing	Comoros	Côte d Ivoire	1994
Benin	Equatorial Guinea	ongoing	Comoros	Equatorial Guinea	1994
Benin	Gabon	ongoing	Comoros	Gabon	1994
Benin	Guinea	1969	Comoros	Guinea	1969
Benin	Guinea-Bissau	ongoing	Comoros	Madagascar	1982
Benin	Madagascar	1982	Comoros	Mali	1994
Benin	Mali	ongoing	Comoros	Mauritania	1974
Benin	Mauritania	1974	Comoros	Niger	1994
Benin	Niger	ongoing	Comoros	Reunion	1976
Benin	Reunion	1976	Comoros	Senegal	1994
Benin	Senegal	ongoing	Comoros	Togo	1994
Benin	Togo	ongoing	Congo, Republic of the	Benin	ongoing
Bhutan	India	ongoing	Congo, Republic of the	Burkina Faso	ongoing
Bhutan	Pakistan	1966	Congo, Republic of the	Côte d Ivoire	ongoing
Botswana	Lesotho	1977	Congo, Republic of the	Equatorial Guinea	ongoing
Botswana	Swaziland	1977	Congo, Republic of the	Gabon	ongoing
Brunei	Malaysia	1971	Congo, Republic of the	Guinea	1969
Brunei	Singapore	ongoing	Congo, Republic of the	Guinea-Bissau	ongoing
Myanmar	India	1966	Congo, Republic of the	Madagascar	1982
Myanmar	Pakistan	1971	Congo, Republic of the	Mali	ongoing
Cameroon	Benin	ongoing	Congo, Republic of the	Mauritania	1974
Cameroon	Burkina Faso	ongoing	Congo, Republic of the	Niger	ongoing
Cameroon	Central African Republic	ongoing	Congo, Republic of the	Reunion	1976
Cameroon	Chad	ongoing	Congo, Republic of the	Senegal	ongoing
Cameroon	Comoros	1994	Congo, Republic of the	Togo	ongoing
Cameroon	Congo, Republic of the	ongoing	Côte d Ivoire	Burkina Faso	ongoing
Cameroon	Cote d Ivoire	ongoing	Côte d Ivoire	Madagascar	1982
Cameroon	Equatorial Guinea	ongoing	Côte d Ivoire	Mali	ongoing
Cameroon	Gabon	ongoing	Côte d Ivoire	Mauritania	1974
Cameroon	Guinea	1969	Côte d Ivoire	Niger	ongoing
Cameroon	Guinea-Bissau	ongoing	Côte d Ivoire	Reunion	1976
Cameroon	Madagascar	1982	Côte d Ivoire	Senegal	ongoing
Cameroon	Mali	ongoing	Côte d Ivoire	Togo	ongoing
Cameroon	Mauritania	1974	Denmark	Faroe Islands	ongoing
Cameroon	Niger	ongoing	Denmark	Greenland	ongoing
Cameroon	Reunion	1976	Djibouti	Benin	1949
Cameroon	Senegal	ongoing	Djibouti	Burkina Faso	1949
Cameroon	Togo	ongoing	Djibouti	Cameroon	1949
Central African Republic	Benin	ongoing	Djibouti	Central African Republic	1949
Central African Republic	Burkina Faso	ongoing	Djibouti	Chad	1949
Central African Republic	Chad	ongoing	Djibouti	Comoros	1949
Central African Republic	Comoros	1994	Djibouti	Congo, Republic of the	1949

Table C3 (continued)

Currency union members		End	Currency union members		End
Djibouti	Côte d Ivoire	1949	Guyana	Trinidad and Tobago	1971
Djibouti	Gabon	1949	India	Maldives	1966
Djibouti	Guinea	1949	India	Mauritius	1966
Djibouti	Madagascar	1949	India	Pakistan	1966
Djibouti	Mali	1949	India	Seychelles	1966
Djibouti	Mauritania	1949	Kenya	Somalia	1971
Djibouti	Niger	1949	Kenya	Tanzania	1978
Djibouti	Reunion	1949	Kenya	Uganda	1978
Djibouti	Senegal	1949	Kuwait	India	1961
Djibouti	Togo	1949	Lesotho	Swaziland	ongoing
Dominica	Grenada	ongoing	Madagascar	Burkina Faso	1982
Dominica	Guyana	1971	Madagascar	Mali	1960
Dominica	Montserrat	ongoing	Madagascar	Mauritania	1974
Dominica	Saint Kitts and Nevis	ongoing	Madagascar	Niger	1982
Dominica	Saint Lucia	ongoing	Madagascar	Reunion	1976
Dominica	Saint Vincent and the Grenadines	ongoing	Madagascar	Senegal	1982
Dominica	Trinidad and Tobago	1976	Madagascar	Togo	1982
Equatorial Guinea	Burkina Faso	ongoing	Malawi	Zambia	1967
Equatorial Guinea	Cote d Ivoire	ongoing	Malawi	Zimbabwe	1967
Equatorial Guinea	Gabon	ongoing	Malaysia	Singapore	1971
Equatorial Guinea	Guinea-Bissau	ongoing	Maldives	Mauritius	1967
Equatorial Guinea	Mali	ongoing	Maldives	Pakistan	1971
Equatorial Guinea	Niger	ongoing	Mali	Burkina Faso	ongoing
Equatorial Guinea	Senegal	ongoing	Mali	Mauritania	1974
Equatorial Guinea	Togo	ongoing	Mali	Niger	ongoing
France	Algeria	1969	Mali	Reunion	1976
France	French Guiana	ongoing	Mali	Senegal	ongoing
France	Guadeloupe	ongoing	Mali	Togo	ongoing
France	Martinique	ongoing	Mauritania	Burkina Faso	1974
France	Morocco	1959	Mauritania	Niger	1974
France	Reunion	ongoing	Mauritania	Reunion	1974
France	Saint Pierre and Miquelon	ongoing	Mauritania	Senegal	1974
France	Tunisia	1958	Mauritania	Togo	1974
Gabon	Burkina Faso	ongoing	Mauritius	Seychelles	1976
Gabon	Côte d Ivoire	ongoing	Montserrat	Saint Kitts and Nevis	ongoing
Gabon	Guinea	1969	Montserrat	Saint Lucia	ongoing
Gabon	Guinea-Bissau	ongoing	Montserrat	Saint Vincent and the Grenadines	ongoing
Gabon	Madagascar	1982	Montserrat	Trinidad and Tobago	1976
Gabon	Mali	ongoing	Netherlands Antilles	Suriname	1994
Gabon	Mauritania	1974	New Caledonia	French Polynesia	ongoing
Gabon	Niger	ongoing	New Caledonia	Vanuatu	1971
Gabon	Reunion	1976	New Caledonia	Wallis and Futuna	ongoing
Gabon	Senegal	ongoing	New Zealand	Samoa	1967
Gabon	Togo	ongoing	Niger	Burkina Faso	ongoing
Gambia, The	Ghana	1965	Niger	Reunion	1976
Gambia, The	Nigeria	1967	Niger	Senegal	ongoing
Gambia, The	Sierra Leone	1965	Niger	Togo	ongoing
Ghana	Nigeria	1965	Nigeria	Sierra Leone	1965
Ghana	Sierra Leone	1965	Oman	India	1970
Grenada	Guyana	1971	Pakistan	Mauritius	1967
Grenada	Montserrat	ongoing	Pakistan	Seychelles	1967
Grenada	Saint Kitts and Nevis	ongoing	Portugal	Angola	1976
Grenada	Saint Lucia	ongoing	Portugal	Cape Verde	1977
Grenada	Saint Vincent and the Grenadines	ongoing	Portugal	Guinea-Bissau	1977
Grenada	Trinidad and Tobago	1976	Portugal	Mozambique	1977
Guinea	Burkina Faso	1969	Portugal	São Tomé and Príncipe	1977
Guinea	Côte d Ivoire	1969	Qatar	India	1966
Guinea	Madagascar	1969	Qatar	United Arab Emirates	ongoing
Guinea	Mali	1969	Reunion	Burkina Faso	1976
Guinea	Mauritania	1969	Reunion	Senegal	1976
Guinea	Niger	1969	Reunion	Togo	1976
Guinea	Reunion	1969	Senegal	Burkina Faso	ongoing
Guinea	Senegal	1969	Senegal	Togo	ongoing
Guinea	Togo	1969	Somalia	Tanzania	1971
Guinea-Bissau	Burkina Faso	ongoing	Somalia	Uganda	1971
Guinea-Bissau	Côte d Ivoire	ongoing	South Africa	Botswana	1977
Guinea-Bissau	Mali	ongoing	South Africa	Lesotho	ongoing
Guinea-Bissau	Niger	ongoing	South Africa	Swaziland	ongoing
Guinea-Bissau	Senegal	ongoing	Spain	Equatorial Guinea	1969
Guinea-Bissau	Togo	ongoing	Sri Lanka	India	1966
Guyana	Montserrat	1971	Sri Lanka	Pakistan	1967
Guyana	Saint Kitts and Nevis	1971	Saint Kitts and Nevis	Saint Lucia	ongoing
Guyana	Saint Lucia	1971	Saint Kitts and Nevis	Saint Vincent and the Grenadines	ongoing
Guyana	Saint Vincent and the Grenadines	1971	Saint Kitts and Nevis	Trinidad and Tobago	1976

Table C3 (concluded)

Currency union members		End
Saint Pierre and Miquelon	Benin	1976
Saint Pierre and Miquelon	Burkina Faso	1976
Saint Pierre and Miquelon	Cameroon	1976
Saint Pierre and Miquelon	Central African Republic	1976
Saint Pierre and Miquelon	Chad	1976
Saint Pierre and Miquelon	Comoros	1976
Saint Pierre and Miquelon	Congo, Republic of the	1976
Saint Pierre and Miquelon	Côte d Ivoire	1976
Saint Pierre and Miquelon	Djibouti	1949
Saint Pierre and Miquelon	Gabon	1976
Saint Pierre and Miquelon	Guinea	1969
Saint Pierre and Miquelon	Madagascar	1976
Saint Pierre and Miquelon	Mali	1960
Saint Pierre and Miquelon	Mauritania	1974
Saint Pierre and Miquelon	Niger	1976
Saint Pierre and Miquelon	Reunion	1976
Saint Pierre and Miquelon	Senegal	1976
Saint Pierre and Miquelon	Togo	1976
Saint Lucia	Saint Vincent and the Grenadines	ongoing
Saint Lucia	Trinidad and Tobago	1976
Saint Vincent and the Grenadines	Trinidad and Tobago	1976
Tanzania	Uganda	1978
Togo	Burkina Faso	ongoing
United Kingdom	Bahamas	1966
United Kingdom	Bermuda	1970
United Kingdom	Cyprus	1972
United Kingdom	Falkland Islands	ongoing
United Kingdom	Gambia, The	1971
United Kingdom	Ghana	1965
United Kingdom	Gibraltar	ongoing
United Kingdom	Iraq	1967
United Kingdom	Ireland	1979
United Kingdom	Israel	1954
United Kingdom	Jamaica	1969
United Kingdom	Jordan	1967
United Kingdom	Kenya	1967
United Kingdom	Kuwait	1967
United Kingdom	Libya	1967
United Kingdom	Malawi	1971
United Kingdom	Malta	1971
United Kingdom	New Zealand	1967
United Kingdom	Nigeria	1967
United Kingdom	Oman	1971
United Kingdom	Samoa	1967
United Kingdom	Sierra Leone	1965
United Kingdom	Somalia	1967
United Kingdom	South Africa	1961
United Kingdom	Saint Helena	ongoing
United Kingdom	Tanzania	1967
United Kingdom	Uganda	1967
United Kingdom	Yemen, P.D. Rep.	1972
United Kingdom	Yemen	1972
United Kingdom	Zambia	1967
United Kingdom	Zimbabwe	1967
United States	American Samoa	ongoing
United States	Bahamas, The	ongoing
United States	Belize	1949
United States	Bermuda	ongoing
United States	Dominican Republic	1985
United States	Guam	ongoing
United States	Guatemala	1986
United States	Liberia	ongoing
United States	Panama	ongoing
Vanuatu	French Polynesia	1971
Vanuatu	Wallis and Futuna	1971
Wallis and Futuna	French Polynesia	ongoing
Yemen, P.D. Rep.	India	1951
Yemen, P.D. Rep.	Kenya	1972
Yemen, P.D. Rep.	Somalia	1971
Yemen, P.D. Rep.	Tanzania	1972
Yemen, P.D. Rep.	Uganda	1972
Yemen	India	1951
Yemen	Kenya	1972
Yemen	Somalia	1971
Yemen	Tanzania	1972
Yemen	Uganda	1972
Zimbabwe	Zambia	1967
Currency unions not covered in Glick and Rose (2002) sample		
United States	Ecuador	ongoing
United States	El Salvador	ongoing
Austria	Belgium	ongoing
Austria	France	ongoing
Austria	Germany	ongoing
Austria	Italy	ongoing
Austria	Luxembourg	ongoing
Austria	Netherlands	ongoing
Austria	Finland	ongoing
Austria	Greece	ongoing
Austria	Ireland	ongoing
Austria	Portugal	ongoing
Austria	Spain	ongoing
Belgium	France	ongoing
Belgium	Germany	ongoing
Belgium	Italy	ongoing
Belgium	Luxembourg	ongoing
Belgium	Netherlands	ongoing
Belgium	Finland	ongoing
Belgium	Greece	ongoing
Belgium	Ireland	ongoing
Belgium	Portugal	ongoing
Belgium	Spain	ongoing
France	Germany	ongoing
France	Italy	ongoing
France	Luxembourg	ongoing
France	Netherlands	ongoing
France	Finland	ongoing
France	Greece	ongoing
France	Ireland	ongoing
France	Portugal	ongoing
France	Spain	ongoing
Germany	Italy	ongoing
Germany	Luxembourg	ongoing
Germany	Netherlands	ongoing
Germany	Finland	ongoing
Germany	Greece	ongoing
Germany	Ireland	ongoing
Germany	Portugal	ongoing
Germany	Spain	ongoing
Italy	Luxembourg	ongoing
Italy	Netherlands	ongoing
Italy	Finland	ongoing
Italy	Greece	ongoing
Italy	Ireland	ongoing
Italy	Portugal	ongoing
Italy	Spain	ongoing
Luxembourg	Netherlands	ongoing
Luxembourg	Finland	ongoing
Luxembourg	Greece	ongoing
Luxembourg	Ireland	ongoing
Luxembourg	Portugal	ongoing
Luxembourg	Spain	ongoing
Netherlands	Finland	ongoing
Netherlands	Greece	ongoing
Netherlands	Ireland	ongoing
Netherlands	Portugal	ongoing
Netherlands	Spain	ongoing
Finland	Greece	ongoing
Finland	Ireland	ongoing
Finland	Portugal	ongoing
Finland	Spain	ongoing
Greece	Ireland	ongoing
Greece	Portugal	ongoing
Greece	Spain	ongoing
Ireland	Portugal	ongoing
Ireland	Spain	ongoing
Portugal	Spain	ongoing

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