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Does a currency union affect trade? The time-series evidence☆

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Abstract

Does leaving a currency union reduce international trade? We answer this question using a large annual panel data set covering 217 countries from 1948 through 1997. During this sample a large number of countries left currency unions; they experienced economically and statistically significant declines in bilateral trade, after accounting for other factors. Assuming symmetry, we estimate that a pair of countries that starts to use a common currency experiences a near doubling in bilateral trade.

JEL classification: F15; F33

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1. Introduction

In this short paper, we ask the question "What is the effect of currency union[1] membership on international trade?" Since an increase in trade prompted by currency union would be an unexpected benefit of European Monetary Union (EMU) or dollarization, this is an interesting question to both policy-makers and academics.

Rose (2000) estimated this effect using an essentially cross-sectional approach. He used data for a large number of countries between 1970 and 1990 and found that bilateral trade was higher for a pair of countries that used the same currency than for

☆ This paper was included in this issue, since it is directly related to the ISOM paper by Thom and Walsh. A current (PDF) version of this paper and the STATA data set used in the paper are available at http://haas.berkeley.edu/~arose.

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[1] We treat "common currencies", "currency unions", "monetary unions" and so forth synonymously.

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a pair of countries with their own sovereign monies. More precisely, the coefficient (denoted γ) on a currency union (CU) dummy in an empirical model of bilateral trade was found to be positive and significant in both economic and statistical terms. Its value rarely fell below 1.2, implying an effect of currency union on trade of around ($e^{1.2} \approx$) 300%. This was true even after controlling for a number of other factors, which might affect trade through the "gravity" model. The latter states that trade between a pair of countries is proportional to their combined incomes and inversely proportional to the distance between them.

There are a number of potential issues with the cross-sectional approach. Most importantly, the policy question of interest is the (time-series) question "What is the trade effect of a country joining (or leaving) a currency union?" and not the cross-sectional question "How much more do countries within currency unions trade than non-members?" Other possible problems are econometric; for instance, pair-specific "fixed effects" may obscure the econometric estimates.

In this paper, we estimate the effect of currency unions on trade exploiting time-series (as well as cross-sectional) variation. We use a data set that covers a large number of countries for 50 post-war years. During this sample, a large number of currency unions dissolved, allowing us to use both time-series and cross-sectional variation on currency union incidence. In particular, we use the fact that over 100 country-pairs dissolved common currency linkages during the sample. By comparing their trade before and after this regime change (holding other effects constant), we can estimate the effect of currency union membership on trade. Our panel approach, which exploits variation for a large number of countries, can be contrasted with the case-study methodology employed by Thom and Walsh (2002). Thom and Walsh focus on the dissolution of the currency union between Ireland and the UK in 1979, and interpret their results as showing few effects on Irish–British trade. The question we pose in this paper is: "Can the conclusions of Thom and Walsh be generalized beyond the Irish–British case?"

Reassuringly, we find that our results are basically consistent with those of Rose (2000). We find an economically and statistically significant effect of currency unions on trade using a number of different panel estimation techniques. Our estimate is that bilateral trade approximately doubles/halves as a pair of countries forms/dissolves a currency union, ceteris paribus.

In Section 2, we describe the data set and methodology that we use. Section 3 is the heart of the paper, and presents estimation results of the effect of currency union on trade. After some sensitivity analysis, the paper concludes with a brief summary.

2. Methodology and data

2.1. Gravity methodology

We are interested in estimating the effect of currency unions on international trade. Towards that end, we estimate a conventional gravity model of international trade.[2]

[2] Gravity models have been much discussed in the literature; Rose (2000) provides references.

We augment the model with a number of extra controls:

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

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

- X_{ijt} denotes the average value of real bilateral trade between i and j at time t,
- Y is real GDP,
- Pop is population,
- D is the distance between i and j,
- $Lang$ is a binary variable which is unity if i and j have a common language,
- $Cont$ is a binary variable which is unity if i and j share a land border,
- FTA is a binary variable which is unity if i and j belong to the same regional trade agreement,
- $Landl$ is the number of landlocked countries in the country-pair (0, 1, or 2),
- $Island$ is the number of island nations in the pair (0, 1, or 2),
- $Area$ is the land mass of the country,
- $ComCol$ is a binary variable which is unity if i and j were ever colonies after 1945 with the same colonizer,
- $CurCol$ is a binary variable which is unity if i and j are colonies at time t,
- $Colony$ is a binary variable which is unity if i ever colonized j or vice versa,
- $ComNat$ is a binary variable which is unity if i and j remained part of the same nation during the sample (e.g., France and Guadeloupe, or the UK and Bermuda),
- CU is a binary variable which is unity if i and j use the same currency at time t,
- β is a vector of nuisance coefficients, and
- ε represents the myriad of other influences on bilateral exports, assumed to be well behaved.

The coefficient of interest to us is γ, the effect of a currency union on trade. We estimate the model with a number of techniques below. We follow the norm in the literature by using ordinary least squares, albeit with standard errors which are robust to clustering (since pairs of countries are likely to be highly dependent across years). However, the force of the paper rests in employing a number of panel data techniques. We use both fixed and random effects estimators extensively below. We rely on the robust fixed effects "within" estimator, which essentially adds a set of country-pair specific intercepts to the equation, and thus exploits only the time-series dimension of the data set around country-pair averages.

2.2. The data set

Rose (2000) exploited a large data set originally developed by the United Nations, covering 186 countries from 1970 through 1990. In this paper we instead use the

CD-ROM "Direction of Trade" (DoT) data set developed by the International Monetary Fund (IMF).

The DoT data set covers bilateral trade between 217 IMF country codes between 1948 and 1997 (with many gaps). Not all of the areas covered are countries in the conventional sense of the word; colonies (e.g., Bermuda), territories (e.g., Guam), overseas departments (e.g., Guadeloupe), countries that gained their independence (e.g., Guinea-Bissau), and so forth are all included. We use the term "country" simply for convenience. (The countries are listed in Appendix A.) Bilateral trade on FOB exports and CIF imports is recorded in American dollars; we deflate trade by the American CPI.[3] We create an average value of bilateral trade between a pair of countries by averaging all of the four possible measures potentially available.[4]

To this data set, we add a number of other variables that are necessary to estimate the gravity model. We add population and real GDP data (in constant dollars) from three sources. Wherever possible, we use "World Development Indicators" (taken from the World Bank's WDI 2000 CD-ROM) data. When the data are unavailable from the World Bank, we fill in missing observations with comparables from the Penn World Table Mark 5.6, and (when all else fails), from the IMF's "International Financial Statistics".[5] The series have been checked and corrected for errors.

We exploit the CIA's "World Factbook" for a number of country-specific variables. These include: latitude and longitude, land area, landlocked and island status, physically contiguous neighbors, language, colonizers, and dates of independence.[6] .We use these to create great-circle distance and our other controls. We obtain data from the World Trade Organization to create an indicator of regional trade agreements, and include: EEC/EC/EU; US–Israel FTA; NAFTA; CARICOM; PATCRA; ANZCERTA; and Mercosur.[7]

Finally, we add information on whether the pair of countries was involved in a currency union. By "currency union" we mean essentially 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. Hard fixes (such as those of Hong Kong, Estonia, or Denmark) do not qualify as currency unions under our definition.[8] Our basic source for currency union data is the IMF's *Schedule of Par Values* and issues of the IMF's *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*. We supplement this with information from annual

[3] As a result, fluctuations in the American dollar may affect our results. We know of no way to correct this systematically. Still, we are not worried since the majority of currency union switches took place before 1970 when exchange rates were fixed (typically to the dollar). Also, there are a few instances where only FOB imports are available; we then use them instead of CIF imports.

[4] Since both exports and imports are measured by both countries, there are potentially four measured bilateral trade flows: exports from *a* to *b*, exports from *b* to *a*, imports into *a* from *b*, and imports into *b* from *a*.

[5] The IFS-based series are calculated by converting national currency GDP figures into dollars at the current dollar exchange rate, and then dividing by the US GDP deflator.

[6] The website is: (http://www.odci.gov/cia/publications/factbook)

[7] Since we are not primarily interested in estimating the FTA effect, we treat all FTAs as being equal.

[8] Though there is nothing in principle to preclude one from following Rose (2000) in adding exchange rate volatility to the model.

Table 1
Descriptive statistics[a]

	Non-unions	Currency unions
Observations	422,715	4,077
Log real trade	10.7	10.6
	(3.7)	(3.1)
Log distance	8.2	7.1
	(0.8)	(1.0)
Log product GDP	47.9	44.7
	(2.6)	(3.1)
Log product GDP/capita	16.1	14.5
	(1.4)	(1.6)
Common language dummy	0.15	0.85
	(0.35)	(0.36)
Land border dummy	0.02	0.16
	(0.14)	(0.36)
Regional trade agreement	0.01	0.07
	(0.08)	(0.26)
Number landlocked	0.23	0.31
	(0.45)	(0.54)
Number islands	0.35	0.44
	(0.54)	(0.71)
Log product land areas	23.8	23.2
	(3.6)	(4.3)
Common colonizer	0.06	0.66
	(0.24)	(0.47)
Current colony	0.002	0.16
	(0.04)	(0.37)
Ever colony	0.01	0.23
	(0.11)	(0.42)
Same nation	0.001	0.09
	(0.02)	(0.28)

[a]Means with standard deviations are reported in parentheses.

copies of *The Statesman's Yearbook*. Our definition of currency union is transitive; if country-pairs x–y, and x–z are in currency unions, then y–z is a currency union. In the data set, about 1% of the sample covers currency unions, a proportion comparable to that in Rose (2000). The currency unions in our data set are tabulated in Appendix B. A number of currency unions are sufficiently integrated that trade data are unavailable; this will tend to bias our estimate of γ downwards.[9]

During the sample there were 16 switches into and 130 switches out of currency unions (for which we have data). There are a number of foibles with these regime switches. First, since we do not have many observations on currency union entries, we are forced to treat exits from and entries into currency unions symmetrically. Second, some of the transitions were related (e.g., Bermuda's switch from the pound sterling

[9] These include Andorra–Spain/France; Belgium–Luxembourg; Switzerland–Liechtenstein; France–Morocco; Italy–Vatican; and South Africa–Lesotho/Swaziland/Namibia.

to the American dollar), and a number are cross-sectionally dependent (e.g., Equatorial Guinea entered the CFA-Franc zone and so joined a currency union vis-à-vis many countries simultaneously). But while we do not have 146 independent observations on regime transitions, the number is still substantive. Our techniques exploit this time-series feature of the data.[10]

Descriptive statistics for the data set are tabulated in Table 1 for both currency unions and non-unions. Sample means for the key gravity regressors are broadly similar for currency unions and non-unions, the exception being the common language and colonial variables.

3. Gravity-based estimates of the effect of currency unions on trade

3.1. OLS estimates

We begin by estimating our gravity equation using conventional OLS (with a full set of year-specific intercepts added). Results are presented in Table 2.

The gravity model works well in a number of different dimensions. The model fits the data well, explaining almost two-thirds of the variation in bilateral trade flows. The gravity coefficients are economically and statistically significant with sensible interpretations. For instance, economically larger and richer countries trade more; more distant countries trade less. A common language, land border and membership in a regional trade agreement encourage trade, as does a common colonial history. The same nation coefficient is not intuitively signed but is statistically indistinguishable from zero.

The model delivers a γ estimate of 1.3, an estimate that is comparable to and slightly *higher* (in both economic and statistical significance) than that of Rose (2000). The estimate implies that a pair of countries that are joined by a common currency trade over three times as much with each other ($e^{1.3} \approx 3.7$), holding other things constant.

It is possible to perform extensive robustness analysis for gravity estimates like those in Table 2. For instance, we have estimated the model using only the cross-sectional aspects of the model, ignoring the time-series features of our panel data set. When we do this, we find that γ remains economically and statistically large when estimated on individual years, though it does vary somewhat; results are in Table 3. However, instead of pursuing that tack, we now make the most of the time-series variation in our panel data set.

3.2. Fixed effects estimates

The fixed effect "within" estimator is the most appropriate way to exploit the panel nature of the data set without making heroic assumptions. It estimates γ by comparing trade for a pair of countries before CU creation/dissolution to trade for the same pair of countries after CU creation/dissolution. There are only two possible drawbacks to

[10] These regime switches almost always occur before 1970, so that a time-series technique was essentially not feasible for Rose's UN data set.

Table 2
Pooled panel OLS gravity estimates*

Currency union	1.30
	(0.13)
Log distance	−1.11
	(0.02)
Log product real GDPs	0.93
	(0.01)
Log product real GDP/capita	0.46
	(0.02)
Common language	0.32
	(0.04)
Common land border	0.43
	(0.12)
Regional trade agreement	0.99
	(0.13)
Number landlocked	−0.14
	(0.03)
Number islands	0.05
	(0.04)
Log product land areas	−0.09
	(0.01)
Common colonizer	0.45
	(0.07)
Current colony	0.82
	(0.25)
Ever colony	1.31
	(0.13)
Same nation	−0.23
	(1.05)
Observations	219,558
R^2	0.64
RMSE	2.02

*Intercept and year controls not recorded.
Standard errors robust to country-pair clustering recorded in parentheses.
Annual data for 217 countries, 1948–1997.

the estimator: the impossibility of estimating time-invariant factors, and a potential lack of efficiency. Since our data set is large, we are prepared to ignore the latter problem. Since γ can manifestly (as will be shown below) be estimated from the time-series variation in currency union incidence, the former problem does not arise.

Above and beyond econometric robustness, the fixed effect estimator has one enormous advantage. Since the within estimator exploits variation over time, *it answers the policy question of interest*, namely the (time-series) question "What is the trade effect of a country joining (or leaving) a currency union?" This can be contrasted with the cross-sectional question "How much more do countries within currency unions trade than non-members?" which was answered by Rose (2000).

Estimation results are in Table 4. We present the fixed effects estimates of γ and a few of the key gravity coefficients in the left-hand column. For comparison, we also

Table 3
Cross-sectional OLS gravity estimates of the currency union effect[a]

Year	γ
1950	0.98
	(0.32)
1955	1.04
	(0.26)
1960	0.71
	(0.17)
1965	0.84
	(0.15)
1970	1.40
	(0.21)
1975	1.23
	(0.23)
1980	1.13
	(0.24)
1985	1.81
	(0.23)
1990	2.39
	(0.25)
1995	1.49
	(0.23)

[a]Controls not reported: distance, output, output per capita, language, land border, FTA, landlocked, islands, land area, common colonizer, current colony, ever colony, same nation and constant.
Standard errors recorded in parentheses.
Annual data for 217 countries.

tabulate random effects estimates, using a generalized least-squares estimator assuming Gaussian disturbances that are uncorrelated with the random (country-pair specific) effects. The "between" estimator (which essentially runs a regression on group averages) and a normal maximum likelihood estimator are also shown at the right-hand side of the table.

The fixed effects estimate of γ is smaller than the OLS estimates of Tables 2 and 3. Since $e^{0.65} \approx 1.9$, the estimate implies that joining a currency union leads bilateral trade to rise by about 90%, i.e., almost double. This effect is economically large, and statistically significant at conventional levels; the t-statistic is 13. The other estimators generate even bigger estimates of γ, though we prefer to be conservative. And while the nuisance (β) coefficients vary between fixed and random effects, the estimate of γ is reasonably robust.

3.3. Sensitivity analysis

In Table 5, we provide some sensitivity analysis. We perturb our basic methodology in a number of different ways, and tabulate estimates of γ using both fixed and random effects estimators. In particular: (1) we add a comprehensive set of year-specific controls; (2) instead of using all years of the sample, we use only the data from every

Table 4
Pooled panel gravity estimates[a]

	Fixed effects ("within")	Random effects GLS	Between estimator	Maximum likelihood
Currency union	0.65	0.70	1.52	0.69
	(0.05)	(0.05)	(0.25)	(0.05)
Log distance		−1.35	−1.42	−1.35
		(0.03)	(0.03)	(0.04)
Log product real	0.05	0.27	0.98	0.23
GDPs	(0.01)	(0.01)	(0.01)	(0.01)
Log product real	0.79	0.52	0.46	0.57
GDP/capita	(0.01)	(0.01)	(0.02)	(0.01)
Common language		0.18	0.38	0.16
		(0.06)	(0.06)	(0.07)
Common land		0.53	0.50	0.54
border		(0.16)	(0.17)	(0.19)
R^2: within	0.12	0.12	0.11	
R^2: between	0.23	0.52	0.63	
R^2: overall	0.22	0.47	0.58	
Hausman test (p-value)		0.00		

[a]219,558 observations in 11,178 country-pair groups. Obs per group within [1, 50], mean = 19.6.
Intercepts not recorded. Other controls not recorded: (a) regional FTA membership, (b) # landlocked; (c) # islands; (d) area; (e) common colonizer; (f) current colony/colonizer; (g) ever colony/colonizer; (h) common country.
Standard errors in parentheses.
Annual data for 217 countries, 1948–1997.

fifth year; (3) we add quadratics of both output and output per capita; (4) we throw out all industrial country observations (those with IFS country codes under 200); (5) we throw out all small country observations (those with GDP < \$1 billion); (6) we throw out all poor countries (those with real GDP per capita < \$1,000); (7) we retain only similarly sized country-pairs (i.e., those with GDPs which differ by less than a factor of five); (8) we retain only country-pairs where bilateral trade is a small fraction (< 10%) of total trade for both countries; (9) we retain only observations after 1960; (10) we throw out all CFA-Franc observations; and (11) we throw out all ECCB observations, as well as those which involve the American dollar, the British pound sterling, or the French franc.[11]

The results of Table 5 show that γ is reasonably insensitive to a number of different perturbations in our methodology. Our fixed effects estimates lie in the relatively narrow range of (0.59, 0.80) and are consistent economically and statistically significant throughout. They are also consistently close to the random effect estimates of γ. Other

[11] We have also used different measures of exchange rate stability (e.g., not requiring that the exchange rate between the countries be 1:1 so long as it is extremely stable) without altering our conclusion that extreme monetary stability encourages trade.

Table 5
Sensitivity analysis of the panel currency union effect[a]

	Fixed effects ("within")	Random effects GLS
Year controls	0.59	0.58
	(0.05)	(0.05)
Data at five-year intervals	0.80	0.88
	(0.11)	(0.10)
Quadratic output terms	0.61	0.64
added	(0.05)	(0.05)
No industrial countries	0.65	0.68
	(0.08)	(0.08)
No small countries	0.68	0.73
	(0.06)	(0.06)
No poor countries	0.67	0.72
	(0.08)	(0.08)
Similar sized countries	0.69	0.71
	(0.08)	(0.08)
Countries with unimportant	0.65	0.69
bilateral trade	(0.06)	(0.06)
No pre-1960 observations	0.62	0.68
	(0.05)	(0.05)
No CFA observations	0.69	0.79
	(0.06)	(0.06)
No ECCB/American	0.71	0.74
dollar/French franc/British	(0.06)	(0.06)
pound observations		

[a]Controls not reported: distance, output, output per capita, language, land border, FTA, landlocked, islands, land area, common colonizer, current colony, ever colony, same nation, and constant.
Standard errors in parentheses.
Annual data, 1948–1997.

estimators (such as the panel estimator tabulated in Table 2, the between and maximum likelihood estimators tabulated in Table 4) show even higher estimates.[12]

We have examined the symmetry of entries into and exits from currency unions, but are stymied by the paucity of observations on currency union entries (which are outnumbered by exits by a ratio of over 8 : 1). When we do separate currency union exits from entries, we find that the exit effect on trade is bigger than the entry effect, though our fixed effects and OLS estimates (but not the random effects estimate) do not reject equality of entry and exit coefficients at reasonable significance levels. Nevertheless, it should be noted that exits tended to take place early in the sample while entries occurred late, so the effects of lags (as well as the number of data points) might bias the effect of entry downwards compared to the effect of exits. It would be interesting to pursue this issue using a methodology that accounts for the "interrupted spell" nature

[12] Also, a random effects estimator corrected for AR(1) disturbances delivers an estimate of $\gamma = 0.73$ with a standard error of 0.08.

of the data, as well as the issues of (possibly non-randomly) missing data and repeated entries/exits from currency unions.

To summarize: a number of different panel estimators all deliver the conclusion that currency union has a strong positive effect on trade. We rely most on the fixed effects estimator since by essentially exploiting the time-series variation in currency union arrangements, it is least demanding in terms of heroic econometric assumptions. Our fixed effects estimates indicate that entry into/departure from a currency union leads bilateral trade to approximately double/half, holding a host of other features constant. This result is not only economically and statistically significant, but seems relatively robust.

3.4. Case studies: Ireland, the UK and more

The fact that currency union dissolution typically has a substantial depressing effect on bilateral trade means that the conclusions of Thom and Walsh (2002) cannot be reasonably generalized. Focusing on Ireland's departure from its sterling link in 1979, Thom and Walsh find mixed evidence of a substantial decline in Irish–British trade and conclude that currency union has only a negligible effect on trade. Our data set reproduces their finding. More precisely, the residuals from a gravity equation (which obviously excludes the currency union variable) show no structural break for Irish–British trade at or around 1979. Nevertheless, our results show that the case of Ireland–UK is atypical in not showing the decline in trade that is generally observed. That is, our use of a broad data set with many currency union transitions, rather than our methodology, account for the differences between our results and Thom and Walsh.

This point can be made effectively by simply graphing trade around the time of currency union dissolution. Fig. 1 presents 16 time-series plots of bilateral trade (measured, as always, by the natural logarithm of real trade in American dollars) against time. Few countries joined currency unions during the sample, so we only provide one example of a currency union creation (all remaining 15 graphs depict trade before and after currency union dissolutions). Still, the top-left graph shows that when Equatorial Guinea joined the CFA in 1985 (an event marked with a vertical line), it experienced a surge in its trade with Cameroon, a CFA member.

The Irish departure from the pound sterling is portrayed immediately to the right. Immediately after Ireland's departure from sterling in 1979, its trade with Britain fell discretely for a period of years. Thom and Walsh tend to see a pig's ear in this decline, attributing it mostly to the business cycle, measurement error, and ad hoc effects. We tend to see a silk purse, but readily admit that since the growth in bilateral trade eventually resumed, no persistent negative effect is apparent. Thus our data reproduces the negative effect found by Thom and Walsh.

Still, the Irish–British case was the exception, not the rule. A number of other countries also left sterling; we portray data for New Zealand (another OECD country), the Gambia, Malawi, Sierra Leone, Tanzania, Uganda, and Zambia. All experienced declines in their trade with the UK. This is also true of a number of other countries that dissolved currency union links after WW2, as Fig. 1 clearly shows.

Of course, the raw data portrayed in Fig. 1 does not take into account the effects of output, free trade areas, independence, and the like. Further, it might be objected that

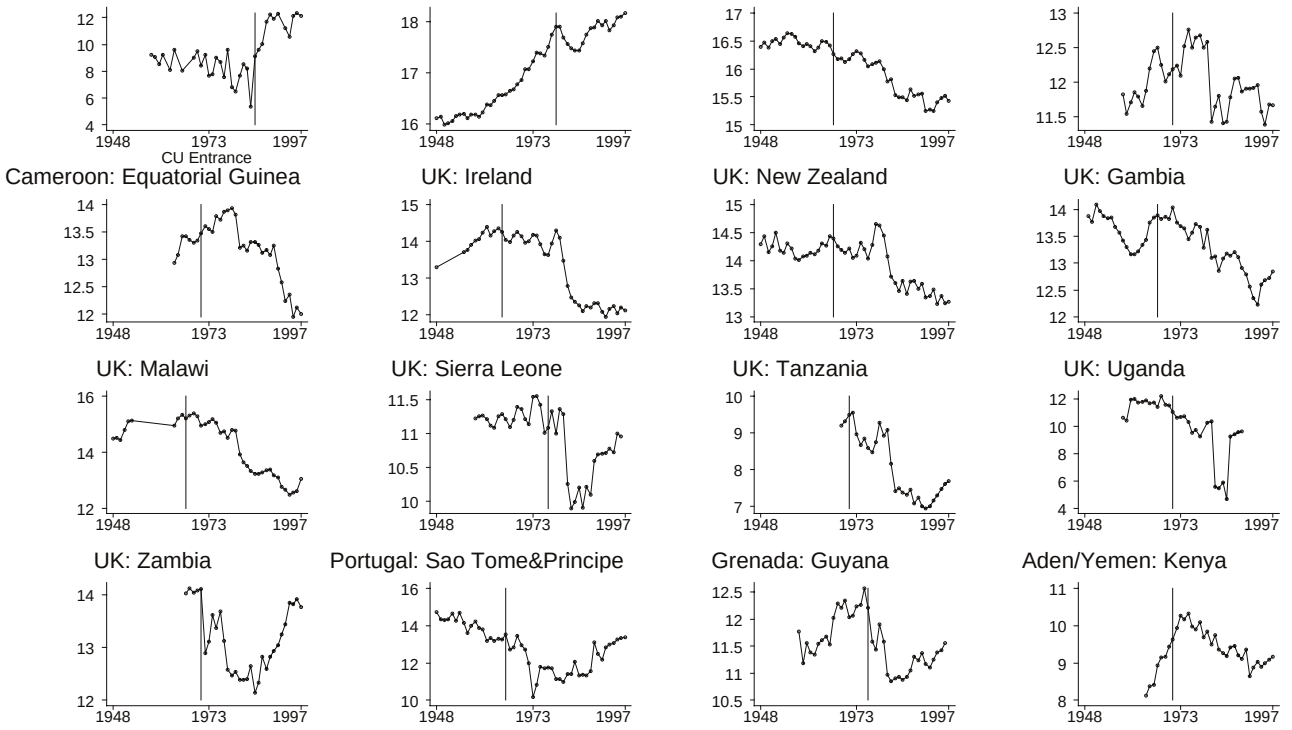

Fig. 1. The impact of currency union dissolution on trade over time: Case studies.

we have chosen the case studies of Fig. 1 carefully, as indeed we have. *But that is the quintessence of the case study approach.* It is also the reason we prefer to trust our panel study with a broad representative sample. The objective of the statistical work in Tables 2–5 is to show that currency union dissolution *typically* has a depressing effect on trade, even accounting for a host of other factors. This is true for the data sample as a whole, and also for many subsets of the data (though perhaps not for the Irish–British case).

3.5. Caveats

There are issues associated with the applicability of our results. Since our sample ends before EMU, most of the currency unions involved countries that were either small, poor, or both; our results may therefore be inapplicable to EMU. Of course that is true of all work on currency unions. Ireland in 1979 was also small and poor compared to the EMU countries in 1998.[13] Thus, extrapolating from the single case considered by Thom and Walsh (2002) seems at least as dangerous as extrapolating from our many cases (which include the Ireland–UK case). In any case, our results may be highly relevant to the many small and/or poor countries considering "dollarization." Further, there is no evidence that our results are very sensitive to the income or size of the countries involved, and López-Córdova and Meissner (2001) find similar results on gold-standard data. Nevertheless, Rose and van Wincoop (2001) attack these issues using a more structural approach that allows for trade diversion and multilateral spillover effects, and still find economically and statistically significant impacts of currency union on trade and welfare.

In addition, we treat currency unions as exogenous with respect to trade. There are a number of reasons to believe this assumption, since there is little evidence that countries have joined currency unions to increase trade. Nevertheless, some of the apparently large trade-creating effects of currency union may actually be a reflection of reverse causality. Rose (2000) and López-Córdova and Meissner (2001) provide evidence that the effect of monetary union on trade seems high even after accounting for potential endogeneity; Persson (2001) provides counter-arguments (but see Rose, 2001). But while we doubt the importance of this in practice, we have been unable to devise a convincing set of instrumental variables for bilateral currency union incidence that would allow us to quantify this effect.

Finally, the impact of currency union departure/entry on trade may be subject to extremely long lags. If we add a comprehensive set of dummy variables for years after currency union exit to our default OLS gravity specification (tabulated in Table 2), we can trace out the response of bilateral trade to currency union dissolution.[14]

[13] The World Bank estimates real Irish GDP per capita in world prices at $6,801 in 1979. By 1998 (start of EMU), Portugal, the poorest member of the initial EMU-11 had a comparable GDP per capita of $9,017, and most EMU countries like France, Germany, and Italy had figures exceeding $14,000.

[14] That is, we add a dummy that is one for observations that occur precisely a year after currency union dissolution and zero otherwise, another that is one for observations 2 years after currency union exit, and so forth. We focus on currency union exits since there are few entries in the data set.

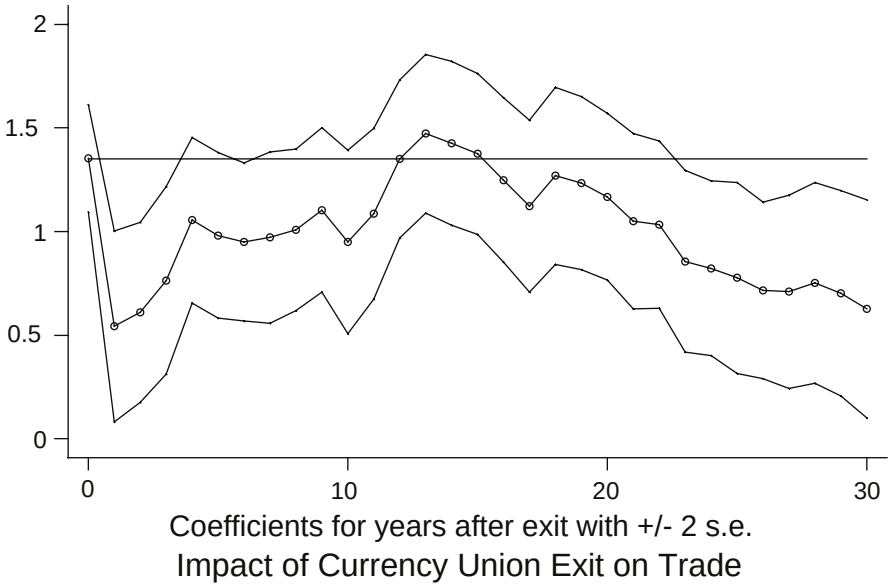

Fig. 2. Estimated typical impact of currency union dissolution on trade over time.

Fig. 2 provides a graph of these coefficients plotted against years since currency union departure; that is, it provides an estimate of the typical impact of currency union dissolution on trade. Trade is almost always lower after currency union dissolution (except for a blip which appears after about a decade) than during currency union (the latter effect is marked with a horizontal line), usually substantially so. Thirty years after currency union exit, bilateral trade has fallen by more than half. However, the data do not speak very loudly on the issue; the graph shows that even 30 years after a pair of countries has dissolved a currency union, they seem to share a disproportionate amount of trade, ceteris paribus. Since the lags are long compared with the span of our data set, we may even have under-estimated the eventual impact of currency union on trade.

4. Conclusion

In this paper we used a large panel data set to estimate the time-series effect of currency union on trade. Our data set includes annual bilateral trade among over 200 countries from 1948 through 1997. During this period of time, a large number of countries joined or (mostly) left currency unions. Controlling for a host of other influences through an augmented gravity model, we find that a pair of countries which joined/left a currency union experienced a near-doubling/halving of bilateral trade. This result is economically large, statistically significant, and seems insensitive to a number of perturbations in our methodology.

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Appendix A. Countries in sample

Afghanistan	Burundi	Kuwait
Albania	Cambodia	Kyrgyz Republic
Algeria	Cameroon	Lao People's Dem. Rep.
American Samoa	Canada	Latvia
Angola	Cape Verde	Lebanon
Anguilla	Cayman Islands	Lesotho
Antigua and Barbuda	Central African Rep.	Liberia
Argentina	Chad	Libya
Armenia	Chile	Lithuania
Aruba	China	Luxembourg
Australia	Colombia	Macao
Austria	Comoros	Macedonia
Azerbaijan	Congo, Dem. Rep. of (Zaire)	Madagascar
Bahamas	Congo, Rep. of	Malawi
Bahrain	Costa Rica	Malaysia
Bangladesh	Côte d'Ivoire (Ivory Coast)	Maldives
Barbados	Croatia	Mali
Belarus	Cuba	Malta
Belgium	Cyprus	Martinique
Belize	Czech Republic	Mauritania
Benin	Czechoslovakia	Mauritius
Bermuda	Denmark	Mexico
Bhutan	Djibouti	Moldova
Bolivia	Dominica	Mongolia
Bosnia & Herzegovina	Dominican Rep.	Montserrat
Botswana	Eastern Germany	Morocco
Brazil	Ecuador	Mozambique
Brunei Darussalam	Egypt	Namibia
Bulgaria	El Salvador	Nauru
Burkina Faso	Equatorial Guinea	Nepal
Burma (Myanmar)	Eritrea	Netherlands
Sao Tome & Principe	Estonia	Netherlands Antilles
Saudi Arabia	Ethiopia	New Caledonia

Senegal
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
Somalia
Somaliland, British
South Africa
Spain
Spanish Sahara
Sri Lanka
St. Helena
St. Kitts & Nevis
St. Pierre & Miquelon
St. Lucia
St. Vincent & Gren.
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syria
Tajikistan
Tanzania
Thailand
Timor
Togo
Tonga
Trinidad & Tobago
Tunisia
Turkey
Turkmenistan
Tuvalu
U.S.S.R.
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela
Faeroe Islands
Falkland Islands
Fiji
Finland
France
French Guiana
French Polynesia
Gabon
Gambia
Georgia
Germany
Ghana
Gibraltar
Greece
Greenland
Grenada
Guadeloupe
Guam
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kiribati
Korea, North
Korea, South (R)
New Zealand
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Panama
Papua N. Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Reunion
Romania
Russia
Rwanda
Samoa

Vietnam
Wake Islands
Wallis & Futuna
West Bank/Gaza Strip
Yemen Arab Rep.
Yemen, P.D.R.
Yemen, Republic of
Yugoslavia, Fr
(Serbia/Montenegro)
Yugoslavia, Socialist Fed. Rep.
Zambia
Zimbabwe

Appendix B. Currency unions in sample

Currency union members		End
Antigua and Barbuda	Barbados	1975
Antigua and Barbuda	Dominica	ongoing
Antigua and Barbuda	Grenada	ongoing
Antigua and Barbuda	Guyana	1971
Antigua and Barbuda	Montserrat	ongoing
Antigua and Barbuda	St. Kitts & Nevis	ongoing
Antigua and Barbuda	St. Lucia	ongoing
Antigua and Barbuda	St. Vincent & Gren.	ongoing
Antigua and Barbuda	Trinidad & Tobago	1976
Aruba	Netherlands Antilles	ongoing
Aruba	Suriname	1994
Australia	Kiribati	ongoing
Australia	Nauru	ongoing
Australia	Solomon Islands	1979
Australia	Tonga	1991
Australia	Tuvalu	ongoing
Bangladesh	India	1974
Barbados	Dominica	1975
Barbados	Grenada	1975
Barbados	Guyana	1971
Barbados	Montserrat	1975
Barbados	St. Kitts & Nevis	1975
Barbados	St. Lucia	1975
Barbados	St. Vincent & Gren.	1975
Barbados	Trinidad & Tobago	1975
Belgium	Burundi	1964
Belgium	Congo, Dem. Rep. of (Zaire)	1961

Belgium	Rwanda	1966
Belgium-Luxembourg	Burundi	1964
Belgium-Luxembourg	Congo, Dem. Rep. of (Zaire)	1961
Belgium-Luxembourg	Rwanda	1966
Benin	Burkina Faso	ongoing
Benin	Côte d'Ivoire (Ivory Coast)	ongoing
Benin	Equatorial Guinea	ongoing
Benin	Gabon	ongoing
Benin	Guinea	1969
Benin	Guinea-Bissau	ongoing
Benin	Madagascar	1982
Benin	Mali	ongoing
Benin	Mauritania	1974
Benin	Niger	ongoing
Benin	Reunion	1976
Benin	Senegal	ongoing
Benin	Togo	ongoing
Bhutan	India	ongoing
Bhutan	Pakistan	1966
Botswana	Lesotho	1977
Botswana	Swaziland	1977
Brunei Darussalam	Malaysia	1971
Brunei Darussalam	Singapore	ongoing
Burma (Myanmar)	India	1966
Burma (Myanmar)	Pakistan	1971
Cameroon	Benin	ongoing
Cameroon	Burkina Faso	ongoing
Cameroon	Central African Rep.	ongoing
Cameroon	Chad	ongoing
Cameroon	Comoros	1994
Cameroon	Congo, Rep. of	ongoing
Cameroon	Côte d'Ivoire (Ivory Coast)	ongoing
Cameroon	Equatorial Guinea	ongoing
Cameroon	Gabon	ongoing
Cameroon	Guinea	1969
Cameroon	Guinea-Bissau	ongoing
Cameroon	Madagascar	1982
Cameroon	Mali	ongoing
Cameroon	Mauritania	1974
Cameroon	Niger	ongoing
Cameroon	Reunion	1976
Cameroon	Senegal	ongoing

Cameroon	Togo	ongoing
Central African Rep.	Benin	ongoing
Central African Rep.	Burkina Faso	ongoing
Central African Rep.	Chad	ongoing
Central African Rep.	Comoros	1994
Central African Rep.	Congo, Rep. of	ongoing
Central African Rep.	Côte d'Ivoire (Ivory Coast)	ongoing
Central African Rep.	Equatorial Guinea	ongoing
Central African Rep.	Gabon	ongoing
Central African Rep.	Guinea	1969
Central African Rep.	Guinea-Bissau	ongoing
Central African Rep.	Madagascar	1982
Central African Rep.	Mali	ongoing
Central African Rep.	Mauritania	1974
Central African Rep.	Niger	ongoing
Central African Rep.	Reunion	1976
Central African Rep.	Senegal	ongoing
Central African Rep.	Togo	ongoing
Chad	Benin	ongoing
Chad	Burkina Faso	ongoing
Chad	Comoros	1994
Chad	Congo, Rep. of	ongoing
Chad	Côte d'Ivoire (Ivory Coast)	ongoing
Chad	Equatorial Guinea	ongoing
Chad	Gabon	ongoing
Chad	Guinea	1969
Chad	Guinea-Bissau	ongoing
Chad	Madagascar	1982
Chad	Mali	ongoing
Chad	Mauritania	1974
Chad	Niger	ongoing
Chad	Reunion	1976
Chad	Senegal	ongoing
Chad	Togo	ongoing
Comoros	Benin	1994
Comoros	Burkina Faso	1994
Comoros	Congo, Rep. of	1994
Comoros	Côte d'Ivoire (Ivory Coast)	1994
Comoros	Equatorial Guinea	1994
Comoros	Gabon	1994
Comoros	Guinea	1969
Comoros	Madagascar	1982
Comoros	Mali	1994
Comoros	Mauritania	1974
Comoros	Niger	1994

Comoros	Reunion	1976
Comoros	Senegal	1994
Comoros	Togo	1994
Congo, Rep. of	Benin	ongoing
Congo, Rep. of	Burkina Faso	ongoing
Congo, Rep. of	Côte d'Ivoire (Ivory Coast)	ongoing
Congo, Rep. of	Equatorial Guinea	ongoing
Congo, Rep. of	Gabon	ongoing
Congo, Rep. of	Guinea	1969
Congo, Rep. of	Guinea-Bissau	ongoing
Congo, Rep. of	Madagascar	1982
Congo, Rep. of	Mali	ongoing
Congo, Rep. of	Mauritania	1974
Congo, Rep. of	Niger	ongoing
Congo, Rep. of	Reunion	1976
Congo, Rep. of	Senegal	ongoing
Congo, Rep. of	Togo	ongoing
Côte d'Ivoire (Ivory Coast)	Burkina Faso	ongoing
Côte d'Ivoire (Ivory Coast)	Madagascar	1982
Côte d'Ivoire (Ivory Coast)	Mali	ongoing
Côte d'Ivoire (Ivory Coast)	Mauritania	1974
Côte d'Ivoire (Ivory Coast)	Niger	ongoing
Côte d'Ivoire (Ivory Coast)	Reunion	1976
Côte d'Ivoire (Ivory Coast)	Senegal	ongoing
Côte d'Ivoire (Ivory Coast)	Togo	ongoing
Denmark	Faeroe Islands	ongoing
Denmark	Greenland	ongoing
Djibouti	Benin	1949
Djibouti	Burkina Faso	1949
Djibouti	Cameroon	1949
Djibouti	Central African Rep.	1949
Djibouti	Chad	1949
Djibouti	Comoros	1949
Djibouti	Congo, Rep. of	1949
Djibouti	Côte d'Ivoire (Ivory Coast)	1949

Djibouti	Gabon	1949
Djibouti	Guinea	1949
Djibouti	Madagascar	1949
Djibouti	Mali	1949
Djibouti	Mauritania	1949
Djibouti	Niger	1949
Djibouti	Reunion	1949
Djibouti	Senegal	1949
Djibouti	Togo	1949
Dominica	Grenada	ongoing
Dominica	Guyana	1971
Dominica	Montserrat	ongoing
Dominica	St. Kitts & Nevis	ongoing
Dominica	St. Lucia	ongoing
Dominica	St. Vincent & Gren.	ongoing
Dominica	Trinidad & Tobago	1976
Equatorial Guinea	Burkina Faso	ongoing
Equatorial Guinea	Côte d'Ivoire (Ivory Coast)	ongoing
Equatorial Guinea	Gabon	ongoing
Equatorial Guinea	Guinea-Bissau	ongoing
Equatorial Guinea	Mali	ongoing
Equatorial Guinea	Niger	ongoing
Equatorial Guinea	Senegal	ongoing
Equatorial Guinea	Togo	ongoing
France	Algeria	1969
France	French Guiana	ongoing
France	Guadeloupe	ongoing
France	Martinique	ongoing
France	Morocco	1959
France	Reunion	ongoing
France	St. Pierre & Miquelon	ongoing
France	Tunisia	1958
Gabon	Burkina Faso	ongoing
Gabon	Côte d'Ivoire (Ivory Coast)	ongoing
Gabon	Guinea	1969
Gabon	Guinea-Bissau	ongoing
Gabon	Madagascar	1982
Gabon	Mali	ongoing
Gabon	Mauritania	1974
Gabon	Niger	ongoing
Gabon	Reunion	1976
Gabon	Senegal	ongoing
Gabon	Togo	ongoing
Gambia	Ghana	1965
Gambia	Nigeria	1967

Gambia	Sierra Leone	1965
Ghana	Nigeria	1965
Ghana	Sierra Leone	1965
Grenada	Guyana	1971
Grenada	Montserrat	ongoing
Grenada	St. Kitts & Nevis	ongoing
Grenada	St. Lucia	ongoing
Grenada	St. Vincent & Gren.	ongoing
Grenada	Trinidad & Tobago	1976
Guinea	Burkina Faso	1969
Guinea	Côte d'Ivoire (Ivory Coast)	1969
Guinea	Madagascar	1969
Guinea	Mali	1969
Guinea	Mauritania	1969
Guinea	Niger	1969
Guinea	Reunion	1969
Guinea	Senegal	1969
Guinea	Togo	1969
Guinea-Bissau	Burkina Faso	ongoing
Guinea-Bissau	Côte d'Ivoire (Ivory Coast)	ongoing
Guinea-Bissau	Mali	ongoing
Guinea-Bissau	Niger	ongoing
Guinea-Bissau	Senegal	ongoing
Guinea-Bissau	Togo	ongoing
Guyana	Montserrat	1971
Guyana	St. Kitts & Nevis	1971
Guyana	St. Lucia	1971
Guyana	St. Vincent & Gren.	1971
Guyana	Trinidad & Tobago	1971
India	Maldives	1966
India	Mauritius	1966
India	Pakistan	1966
India	Seychelles	1966
Kenya	Somalia	1971
Kenya	Tanzania	1978
Kenya	Uganda	1978
Kuwait	India	1961
Lesotho	Swaziland	ongoing
Madagascar	Burkina Faso	1982
Madagascar	Mali	1982
Madagascar	Mauritania	1974
Madagascar	Niger	1982
Madagascar	Reunion	1976
Madagascar	Senegal	1982
Madagascar	Togo	1982

Malawi	Zambia	1967
Malawi	Zimbabwe	1967
Malaysia	Singapore	1971
Maldives	Mauritius	1967
Maldives	Pakistan	1971
Mali	Burkina Faso	ongoing
Mali	Mauritania	1974
Mali	Niger	ongoing
Mali	Reunion	1976
Mali	Senegal	ongoing
Mali	Togo	ongoing
Mauritania	Burkina Faso	1974
Mauritania	Niger	1974
Mauritania	Reunion	1974
Mauritania	Senegal	1974
Mauritania	Togo	1974
Mauritius	Seychelles	1976
Montserrat	St. Kitts & Nevis	ongoing
Montserrat	St. Lucia	ongoing
Montserrat	St. Vincent & Gren.	ongoing
Montserrat	Trinidad & Tobago	1976
Netherlands Antilles	Suriname	1994
New Caledonia	French Polynesia	ongoing
New Caledonia	Vanuatu	1971
New Caledonia	Wallis & Futuna	ongoing
New Zealand	Samoa	1967
Niger	Burkina Faso	ongoing
Niger	Reunion	1976
Niger	Senegal	ongoing
Niger	Togo	ongoing
Nigeria	Sierra Leone	1965
Oman	India	1970
Pakistan	Mauritius	1967
Pakistan	Seychelles	1967
Portugal	Angola	1976
Portugal	Cape Verde	1977
Portugal	Guinea-Bissau	1977
Portugal	Mozambique	1977
Portugal	Sao Tome & Principe	1977
Qatar	India	1966
Qatar	United Arab Emirates	ongoing
Reunion	Burkina Faso	1976
Reunion	Senegal	1976
Reunion	Togo	1976
Senegal	Burkina Faso	ongoing

Senegal	Togo	ongoing
Somalia	Tanzania	1971
Somalia	Uganda	1971
South Africa	Botswana	1977
South Africa	Lesotho	ongoing
South Africa	Swaziland	ongoing
Spain	Equatorial Guinea	1969
Sri Lanka	India	1966
Sri Lanka	Pakistan	1967
St. Kitts & Nevis	St. Lucia	ongoing
St. Kitts & Nevis	St. Vincent & Gren.	ongoing
St. Kitts & Nevis	Trinidad & Tobago	1976
St. Pierre & Miquelon	Benin	1976
St. Pierre & Miquelon	Burkina Faso	1976
St. Pierre & Miquelon	Cameroon	1976
St. Pierre & Miquelon	Central African Rep.	1976
St. Pierre & Miquelon	Chad	1976
St. Pierre & Miquelon	Comoros	1976
St. Pierre & Miquelon	Congo, Rep. of	1976
St. Pierre & Miquelon	Côte d'Ivoire (Ivory Coast)	1976
St. Pierre & Miquelon	Djibouti	1949
St. Pierre & Miquelon	Gabon	1976
St. Pierre & Miquelon	Guinea	1969
St. Pierre & Miquelon	Madagascar	1976
St. Pierre & Miquelon	Mali	1976
St. Pierre & Miquelon	Mauritania	1974
St. Pierre & Miquelon	Niger	1976
St. Pierre & Miquelon	Reunion	1976
St. Pierre & Miquelon	Senegal	1976
St. Pierre & Miquelon	Togo	1976
St. Lucia	St. Vincent & Gren.	ongoing
St. Lucia	Trinidad & Tobago	1976
St. Vincent & Gren.	Trinidad & 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	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	St. Helena	ongoing
United Kingdom	Tanzania	1967
United Kingdom	Uganda	1967
United Kingdom	Yemen, P.D.R.	1972
United Kingdom	Yemen, Republic of	1972
United Kingdom	Zambia	1967
United Kingdom	Zimbabwe	1967
United States	American Samoa	ongoing
United States	Bahamas	ongoing
United States	Belize	1949
United States	Bermuda	ongoing
United States	Dominican Rep.	1985
United States	Guam	ongoing
United States	Guatemala	1986
United States	Liberia	ongoing
United States	Panama	ongoing
Vanuatu	French Polynesia	1971
Vanuatu	Wallis & Futuna	1971
Wallis & Futuna	French Polynesia	ongoing
Yemen, P.D.R.	India	1951
Yemen, P.D.R.	Kenya	1972
Yemen, P.D.R.	Somalia	1971
Yemen, P.D.R.	Tanzania	1972
Yemen, P.D.R.	Uganda	1972
Yemen, Republic of	India	1951
Yemen, Republic of	Kenya	1972
Yemen, Republic of	Somalia	1971
Yemen, Republic of	Tanzania	1972
Yemen, Republic Of	Uganda	1972
Zimbabwe	Zambia	1967

Table 6
Simple bivariative correlations[a]

	Trade	Curr. union	Distance	GDP	GDP p/c	Lang.	Border	Regional	Landlck.	Island	Area	Com. col.	Cur. col	Ever col.
Curr. union	0.00													
Distance	−0.17	−0.18												
GDP	0.67	−0.14	0.18											
GDP p/c	0.41	−0.13	0.11	0.38										
Language	−0.01	0.19	−0.13	−0.18	−0.05									
Border	0.11	0.12	−0.42	−0.02	−0.12	0.12								
FTA	0.08	0.08	−0.25	−0.06	0.08	0.10	0.08							
Landlocked	−0.15	0.04	−0.09	−0.12	−0.21	−0.01	0.08	−0.05						
Island	−0.17	0.00	0.15	−0.30	0.20	0.10	−0.11	0.08	−0.19					
Area	0.27	−0.01	0.10	0.57	−0.22	−0.11	0.10	−0.13	0.04	−0.51				
Com. colonizer	−0.16	0.26	−0.15	−0.32	−0.18	0.37	0.06	0.12	0.02	0.19	−0.26			
Cur. colony	0.05	0.15	0.01	−0.01	0.01	0.07	−0.01	−0.01	−0.02	0.01	−0.03	−0.02		
Ever colony	0.15	0.08	−0.02	0.08	0.06	0.19	0.03	0.00	−0.03	−0.03	0.01	−0.05	0.31	
Same nation	0.02	0.05	0.00	−0.00	0.02	0.03	−0.00	−0.00	−0.01	0.02	−0.03	−0.01	0.39	0.12

[a]Number of observations $= 219,558 \Rightarrow$ standard error ≈ 0.002.

Appendix C. Simple bivariate correlations

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