The Effect of Common Currencies on International Trade: A Meta-Analysis

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Comments Welcomed

Abstract

Nineteen recent studies have investigated the effect of currency union on trade, resulting in 383 point estimates of the effect. This paper is a quantitative attempt to summarize the current state of debate; meta-analysis is used to combine the disparate estimates. The chief findings are that: a) the hypothesis that there is no effect of currency union on trade can be rejected at standard significance levels; b) the combined estimate implies that currency union approximately doubles trade; and c) the estimates are heterogeneous and not consistently tied to features of the studies.

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The Effect of Common Currencies on International Trade: A Meta-Analysis

In this short paper, I briefly review the small recent literature that estimates the effect of common currencies on trade. I use meta-analysis to provide a quantitative summary of the literature.

The next section briefly reviews the literature qualitatively. Section II is the heart of the paper; it provides the quantitative meta-analysis that studies the preferred point estimates of the nineteen different studies collectively. Section III reviews the (almost four hundred) different point estimates tabulated in the literature, and the paper ends with a short conclusion.

I: A Short History of the Literature

In the summer of 1999, I began to circulate a paper that estimated the effect of currency union on trade; *Economic Policy* subsequently published this paper in 2000. I exploited a panel of cross-country data covering bilateral trade between 186 "countries" (really different trading partners) at five-year intervals between 1970 and 1990. The trade data was drawn from the *World Trade Data Bank* ("WTDB"), which contains data for a large number of country-pairs (thereby effectively rendering the analysis cross-sectional), though with many missing observations. In this data set, only a small number of the observations are currency unions; further, countries in currency unions tend to be either small or poor (or both).

The surprising and interesting finding was that currency union seemed to have a strong and robust effect on trade. Using a linear "gravity" model of bilateral trade to account for most variation in trade patterns, my point estimate was that the coefficient for a currency union dummy variable (which is unity when a pair of countries share a common currency and zero otherwise) has a point estimate of around γ=1.21. This implies that members of currency unions traded over three times as much as otherwise similar pairs of countries *ceteris paribus*, since exp(1.21)>3. While there was no benchmark from the literature, this estimate seemed implausibly large to me (and many others).[1] Almost all the subsequent research in this area has been motivated by the belief that currency union cannot reasonable be expected to triple trade.

There have been a number of different types of critique. Some are econometric. For instance, Thom and Walsh (2002) argue that broad panel studies are irrelevant to e.g., EMU, since most pre-EMU currency unions involve countries that are either small or poor. They adopt a case study approach, focusing on the 1979 dissolution of Ireland's sterling link; Glick and Rose (2002) provide related evidence.

Others have stressed the importance of relying on time-series rather than cross-sectional variation. The time-series approach has the advantage of addressing the relevant policy issue ("What happens to trade when a currency union is created or dissolved?" rather than "Is trade between members of currency unions larger than trade between countries with sovereign currencies?"). This can be done most obviously by using country-pair specific "dyadic fixed effects" with panel data. This is difficult to do sensibly using the WTDB because there is such little time-series variation in currency union membership after 1970 as recognized in my original paper and by e.g., Persson (2001); nevertheless, see Pakko and Wall (2001). However, Glick and Rose (2002) exploit the almost 150 cases of currency union exit and entry they find when the panel analysis is extended back to 1948 using the IMF's *Direction of Trade* data set.

In my original paper, I stressed that only about 1% of the sample involves pairs of countries in currency unions. Persson (2001) argues that this makes standard regression techniques inappropriate since currency unions are not created randomly, and advocates the use of matching techniques; see also Rose (2001) and Tenreyro (2001).

Nitsch (2002a, 2002b) is concerned with aggregation bias, and argues that combining different currency unions masks heterogeneous results. Along the same lines, Levy Yeyati (2001) divides currency unions into multilateral and unilateral currency unions (as did Fatás and Rose, 2002), while Melitz (2001) splits currency unions into those that are also members of either a political union or regional trade area, and others that are neither; see also Klein (2002).

Tenreyro (2001) argues that sampling the data every fifth year (as I did in my original paper) is dangerous, since trade between members of currency unions may not be large enough to be consistently positive. She advocates averaging trade data over time, and argues that this reduces the (otherwise biased) effect of currency union on trade. While this may be true with the *WTDB* data set employed by Tenreyro, it seems not to be true of the *DoT* data set, where no bias is apparent (see my website for details).

Rather than focusing on post-WWII data, some have extended the data set back to the classical gold standard era. Flandreau and Maurel (2001) and López-Córdova and Meissner (2001) use data sets that include monetary unions from the pre-WWI period. Estevadeoral, Frantz, and Taylor (2002) estimate a lower bound on the currency union effect by using membership in the gold standard; the inclusion of their estimates imparts a slight downward bias to the meta-analysis below.

A number of researchers have followed my original paper in worrying about reverse causality, including Flandreau and Maurel (2001), López-Córdova and Meissner (2001), and Tenreyro (2001). It is possible to also to take a more structural approach as I do in my work with van Wincoop (2001), which also takes account of country-specific effects.

Finally, some research takes a big effect of currency union on trade as given, and seeks to determine the implications of this estimate for e.g., output (Frankel and Rose, 2002) or business cycle co-ordination (Flandreau and Maurel, 2001). Other aspects of the behavior of currency union members are examined by Rose and Engel (2002) and Fatás and Rose (2002).

In all, a number of papers have provided estimates of the effect of currency union on international trade. Obviously many these estimates are highly dependent; they sometimes rely on the same data set, techniques, or authors. Still, there seem to be enough studies to warrant at least a preliminary meta-analysis.

II: Meta-Analysis

Meta-analysis is a set of quantitative techniques for evaluating and combining empirical results from different studies. Essentially one treats different point estimates of a given coefficient as individual observations. One can then use this vector of estimates to: estimate the underlying coefficient of interest, test the hypothesis that the coefficient is zero, and link the estimates to features of the underlying studies. Since there are currently a number of studies that have provided estimates of γ, the effect of currency union on trade, meta-analysis seems an appropriate way to summarize the current state of the literature. Stanley (2001) provides a recent review and further references.

One begins meta-analysis by collecting as many estimates of a common effect as possible. To my knowledge, there are nineteen papers that provide estimates of the effect of currency union on bilateral trade, which I denote γ. I tabulate these in the appendix, along with the associated estimates of γ (and its standard error) that seems to be most preferred or representative (if a preferred estimate is not available). While I have strong views about the value of some of these estimates (or lack thereof), I weigh each estimate equally, simply because there is no easily defensible alternative weighting scheme.

The most basic piece of meta-analysis is a test of the null hypothesis $\gamma=0$ when the nineteen point estimates (and their standard errors) are pooled across studies. This classic test is due originally to Fisher (1932) and uses the p-values from each of the (19) underlying γ estimates. Under the null hypothesis that each of the p-values is independently and randomly drawn from a normal [0,1] distribution, minus twice the sum of the logs of the p-values is drawn from a chi-square. The hypothesis can be rejected at any standard significance level, since under the null hypothesis; the test-statistic of 577 is drawn from $\chi^2(38)$.[2] While there is manifestly considerable heterogeneity between the different estimates, the fixed and random effect estimators are quantitatively similar, as I show in Table 1. They are also economically substantial; both pooled estimates of γ indicate that currency union more than doubles trade (as $\ln(2)\approx.69$). Also, none of these conclusions change if my six studies are dropped; the test-statistic rejects the hypothesis of no effect, as under the null of no effect, 203 is drawn from $\chi^2(26)$.

	Pooled Estimate	Lower Bound	Upper Bound	P-value for test

	of γ	of 95% CI	of 95% CI	of no effect
Fixed	.77	.72	.83	.00
Random	.73	.58	.88	.00
Fixed without Rose	.80	.71	.90	.00
Random without Rose	.57	.32	.83	.00

Table 1: Meta-Analysis of Currency Union Effect on Trade (γ)

There is little indication that any single study is especially influential in driving these results. If the studies are omitted from the meta-analysis one by one, one finds the following point estimates for γ (tabulated along with a 95% confidence interval):

Study Omitted:	Coefficient	95% CI, lower	95% CI, upper
Rose	.75	.70	.81
Engel-Rose	.77	.72	.82
Frankel-Rose	.76	.70	.81
Rose-van Wincoop	.77	.71	.82
Glick-Rose	.82	.76	.89
Persson	.77	.72	.83
Rose	.78	.72	.85
Honohan	.77	.72	.82
Nitsch	.77	.72	.82
Pakko-Wall	.77	.72	.83
Walsh-Thom	.78	.73	.84
Melitz	.77	.72	.83
Lopez-Cordova and Meissner	.77	.72	.83
Tenreyro	.77	.72	.83
Levy Yeyati	.77	.72	.83
Nitsch	.78	.72	.83
Flandreau and Maurel	.70	.65	.76
Klein	.77	.72	.83
Estevadeoral, Frantz, and Taylor	.79	.73	.84
Combined	.77	.72	.82

Table 2: Sensitivity of Meta-Analysis of γ to Individual Studies (Fixed Effects)

While I tried to choose the preferred/representative estimates to match the intentions of the authors, I did … choose them. An alternative way to proceed is to use a more mechanical procedure to choose the underlying estimates of γ for the meta-analysis. This is easy, since each of the underlying studies provides a number of individual γ estimates. Thus, an alternative I now deploy is to use the (19) median estimates of γ from the 19 underlying studies to construct an alternative set of γ estimates (and associated standard errors) suitable for meta-analysis. I also use the estimates at the 25th, 10th, and 5th percentiles.[3] Table 3 repeats the meta-analysis using these four alternative data sets. The default "preferred" estimates from table 1 are tabulated at the top to facilitate comparison.

		Pooled γ Estimate	Lower Bound, 95% CI	Upper Bound, 95% CI	P-value for Ho: no effect
"Preferred"	**Fixed**	.77	.72	.83	.00
"Preferred"	**Random**	.73	.58	.88	.00
Median	**Fixed**	.61	.56	.67	.00
Median	**Random**	.85	.58	1.13	.00
25th-Percentile	**Fixed**	.30	.26	.35	.00
25th-Percentile	**Random**	.52	.30	.75	.00
10th-Percentile	**Fixed**	.21	.17	.25	.00
10th-Percentile	**Random**	.37	.16	.57	.00
5th-Percentile	**Fixed**	.15	.12	.18	.00
5th-Percentile	**Random**	.36	.18	.55	.00

Table 3: Sensitivity of Meta-Analysis of γ to Choice of "Preferred" Estimate

The pooled meta-estimate of γ falls as one moves away from the median estimate towards estimates that are lower within individual studies (by design). But it is interesting to note that even using the γ estimates taken from the 5th-percentile of each underlying study, the hypothesis of no effect of currency union on trade can be rejected at conventional significance level. Further, all the effects are economically substantive. The lower bound for the lowest estimate is .15, implying an effect of currency union on trade of some sixteen percent.

One might then ask which design features of the individual studies account for the differences across individual estimates of γ. It would be fun and interesting to explain the variation in γ estimates across studies with a large number of study characteristics.

Unfortunately, given the paucity of studies, it does not seem wise to use multivariate meta-regression techniques very intensively. Nevertheless, I report in Table 4 the results of a series of bivariate meta-regressions. Each row tabulates the intercept and slope coefficient from a different bivariate regression, where the regressand is the set of nineteen γ estimates, and the independent variable is listed at the left of the table.

Study Characteristic	**Slope Coefficient** (|z-statistic|)	**Intercept** (|z-statistic|)
Number of Observations in study	.00 (0.0)	.72 (7.2)
Number of Countries in study	.00 (0.6)	.64 (3.9)
Number of Years in study	-.00 (0.4)	.78 (4.7)
Standard Error of γ	-.99 (1.2)	.91 (5.2)
Dummy for post-WWII study	-.03 (0.1)	.75 (3.8)
Dummy for cross-section or panel study	.24 (1.2)	.54 (3.0)
Dummy for Rose as Author	.38 (2.3)	.59 (5.8)

Table 4: Meta-Analysis: Bivariate Determination of γ Across Studies

There are two interesting positive results in Table 4, and one negative finding. First, there is not a positive relation between the number of observations and γ. The fact that there is no positive (let alone significant) relation between the sample size and the estimates of γ raises a seriously worrying question as to whether the underlying empirical phenomenon is authentic (Stanley, 2001). Second, papers that I have co-authored have consistently higher point estimates of γ (though other papers still have an economically and statistically significant effect of currency union on trade). Finally, there do not seem to be any other strong relationships between other characteristics of the studies (e.g., the span or nature of the data set) and point estimates of γ.

To summarize: the meta-analysis indicates two strong and one weak finding. First, the hypothesis that there is no effect of currency union on trade can be rejected at standard significance levels when the results from the individual studies are pooled.

Second, the pooled effect is not just positive but economically significant, consistent with the hypothesis that currency union approximately doubles trade. Third, the preferred estimates of γ from individual studies are not closely linked to the characteristics of the studies.

III: Different Estimates of γ and its Significance

Each of the nineteen studies provides a number of different estimates of γ. For instance, my original paper provided over fifty estimates of γ as a result of sensitivity analysis. In all, there are currently 383 estimates of γ (and accordingly, 383 associated t-statistics for the hypothesis of an insignificant γ). Simply averaging across these 383 different estimates of γ produces a mean of 1.4; the average t-ratio is 5.7.

I provide histograms of the 383 γ estimates and their t-statistics in Figure 1. I personally estimated some 134 of them, and the meta-analysis of Table 4 shows that I typically find higher results than others. Accordingly, I split the data into two: those I estimated, and those estimated by others. The top left graphic in figure 1 is a histogram of the 132 point estimates of γ I estimated that are less than 6.[4] Immediately below on a comparably scaled graph are the 249 estimates produced by others. The two graphics to the right of the figure are analogues that portray the corresponding t-statistics.[5]

What does the graphic show? The vast majority of the point estimates of γ are positive; only 30 of the 383 (<8%) are negative. Most are also economically large; 63% exceed .7 in magnitude, a number that implies that currency union is associated with a doubling of trade. It is interesting to note in passing that one cannot reject the hypothesis of equal means across my estimates and those of others, at even the ten percent level (the t-test for equality of means across the two sets of γ estimates is 1.56).

It is clear that many of the estimates are also statistically significant. The median t-statistic is 4; over three-quarters (290/383) exceed 2. My t-ratios tend to be larger than those of others, but over two-thirds of the t-statistics of others are at least two (the median is 2.8).

Finally, one can also combine the different estimates that exist within the nineteen studies, on a paper-by-paper basis. Table 5 provides nineteen rows (one for each study), which perform meta-analysis within the individual study to arrive at both fixed- and random-effect estimates of γ. I also tabulate the z-statistics which test the null hypothesis Ho: $\gamma=0$, and the associated p-values. The number of estimates provided by each study is also tabulated.

Table 5 clearly shows heterogeneity across γ estimates. While none are significantly negative and most are significantly positive, they vary considerably.

Study		**Coefficients**	**Asymptotic z-statistics**	**p-values**	**No. of Estimates**
Rose	Fixed	1.29	50.6	.00	52
	Random	1.31	32.9	.00	
Engel-Rose	Fixed	1.35	7.4	.00	5
	Random	1.35	7.4	.00	
Frankel-Rose	Fixed	1.63	19.8	.00	5
	Random	1.63	11.8	.00	
Rose-van Wincoop	Fixed	0.23	13.8	.00	18
	Random	0.65	7.7	.00	
Glick-Rose	Fixed	0.70	59.3	.00	37
	Random	0.77	27.8	.00	
Persson	Fixed	0.65	7.7	.00	6
	Random	0.59	4.8	.00	
Rose	Fixed	0.82	43.5	.00	17
	Random	1.06	8.9	.00	
Honohan	Fixed	0.35	3.7	.00	12
	Random	0.36	1.9	.05	
Nitsch	Fixed	3.00	111.4	.00	83

	Random	1.55	6.8	.00	
Pakko-Wall	Fixed Random	0.87 0.33	8.5 0.9	.00 .35	6
Walsh-Thom	Fixed Random	-0.01 0.02	-0.6 0.6	.57 .54	7
Melitz	Fixed Random	1.89 1.91	21.7 10.8	.00 .00	6
Lopez-Cordova and Meissner	Fixed Random	0.72 0.72	21.6 20.7	.00 .00	47
Silvana Tenreyro	Fixed Random	0.80 0.71	9.5 4.2	.00 .00	4
Levy Yeyati	Fixed Random	1.01 1.06	16.4 11.4	.00 .00	19
Nitsch	Fixed Random	0.46 0.43	5.6 2.6	.00 .01	8
Flandreau and Maurel	Fixed Random	0.94 0.90	35.9 7.3	.00 .00	8
Klein	Fixed Random	0.09 0.37	2.5 2.0	.01 .05	25
Estevadeoral, Frantz, and Taylor	Fixed Random	0.43 0.45	0.37 0.35	0.50 0.55	18

Table 5: Within-Study meta-estimation of γ

IV: Conclusion

It is too early to claim much for a meta-analysis like this. Nineteen studies sounds like a lot. But one would prefer thirty observations before starting to appeal to the large of law numbers. Further, the extant studies are dependent and not all of equal interest, two features that I have ignored above. The different estimates of this effect are heterogeneous and cannot be linked to study features such as the sample size. Thus it would be unreasonable for anyone to have too much confidence in the meta-analytic estimate of the effect of currency union on trade.

That said, a quantitative survey of the literature shows substantial evidence that currency union has a positive effect on trade. When the estimates are examined collectively, this effect is large in terms of both economic and statistical significance, implying that currency union is associated with a doubling of trade.

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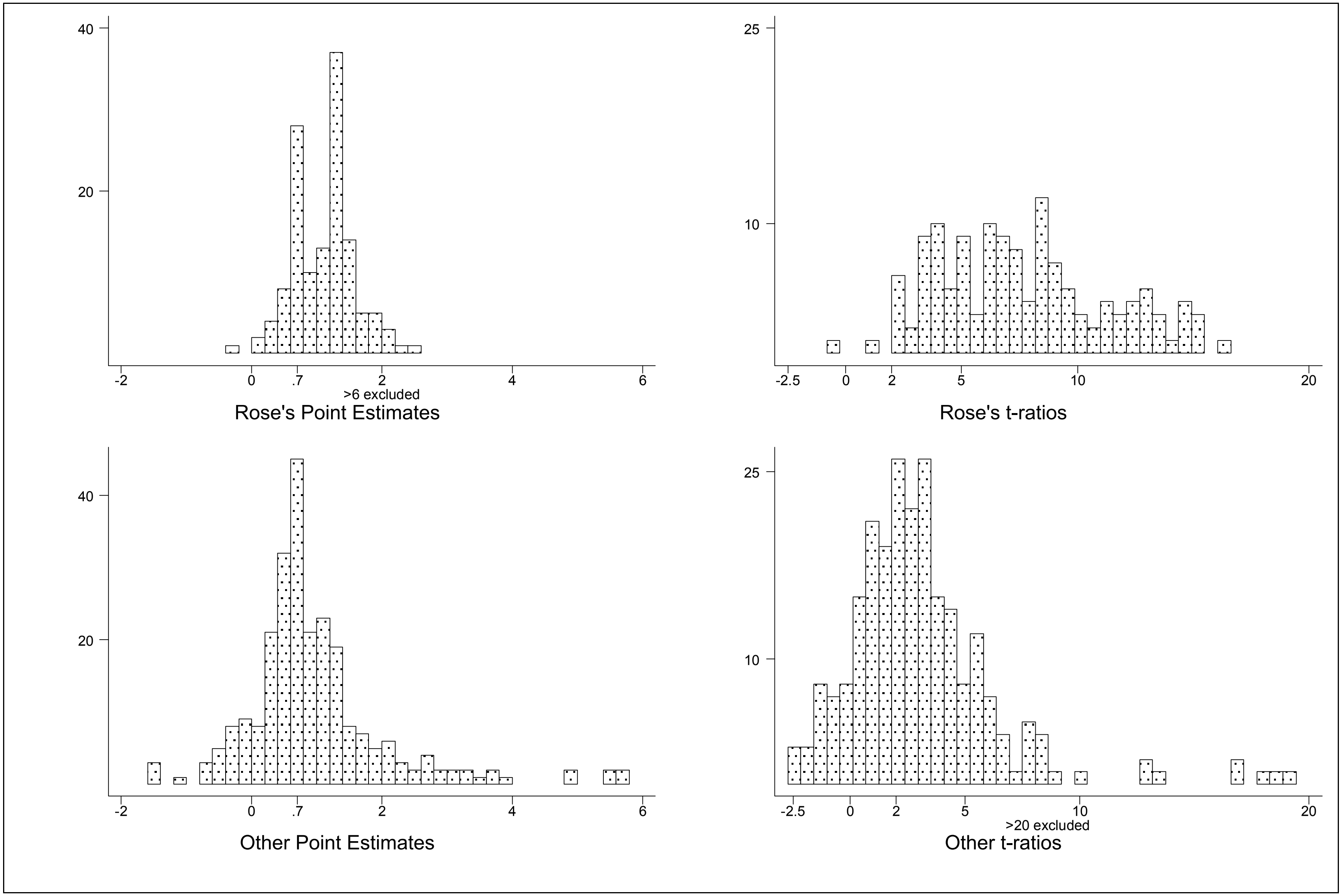

Figure 1: The Estimated Effect of Currency Union on Trade

Appendix: Estimates of the Effect of Currency Union on Trade

Author	Year	γ	s.e. of γ
Rose	2000	1.21	0.14
Engel-Rose	2002	1.21	0.37
Frankel-Rose	2002	1.36	0.18
Rose-van Wincoop	2001	0.91	0.18
Glick-Rose	2002	0.65	0.05
Persson	2001	0.506	0.257
Rose	2001	0.74	0.05
Honohan	2001	0.921	0.4
Nitsch	2002b	0.82	0.27
Pakko and Wall	2001	-0.378	0.529
Walsh and Thom	2002	0.098	0.2
Melitz	2001	0.7	0.23
López-Córdova and Meissner	2001	0.716	0.186
Tenreyro	2001	0.471	0.316
Levy Yeyati	2001	0.5	0.25
Nitsch	2002a	0.62	0.17
Flandreau and Maurel	2001	1.16	0.07
Klein	2002	0.50	0.27
Estevadeoral, Frantz, and Taylor	2002	0.293	0.145

Estimates of γ and standard error from $\ln(\text{Trade}) = \gamma \text{CurrencyUnion} + \text{controls} + \text{error}$

Endnotes

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1 Actually, make that many many others.

2 Edgington's (1972) small sample correction leads to the same conclusion.

3 Thus, my initial study contains 52 estimates of γ. The median of these is 1.285 (with standard error of .13). The 25th percentile estimate is 1.1 (.14); the 10th percentile is 1.09 (.26); and the 5th percentile estimate is .96 (.15). If there is an even number of estimates in the underlying study, I choose the higher estimate when e.g., the median lies between two estimates.

4 That is, two large outliers are not graphed; I estimated both.

5 This time, eleven t-statistics are dropped from the graph. All are larger than twenty, and I estimated none.