Is EMU Becoming an Optimum Currency Area? The Evidence on Trade and Business Cycle Synchronization

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Abstract

This short paper reviews the recent literature linking monetary union, international trade, and business cycle synchronization. I survey the literature using the quantitative technique of meta-analysis, which allows me to estimate the effects of EMU taking into account the entire extant literature. Twenty-six recent studies have investigated the effect of currency union on trade, using actual European data of relevance. Taking all these studies into account, EMU has raised trade inside the Eurozone by at least 8% and perhaps 23%. Twenty different studies have estimated the effect of trade on the synchronization of business cycles. Aggregating across these estimates, an increase of bilateral trade between two countries raises the synchronization of their business cycles by an economically and statistically significant effect. I estimate that a one percent increase in bilateral trade increases the correlation coefficient of detrended output by .02. Taken together, the estimates suggest that EMU has created a virtuous circle; by increasing trade and the synchronization of business cycles, EMU reduces the need for national monetary policy. That is, EMU seems along the path to becoming an optimum currency area.

Keywords: meta; analysis; monetary; currency; union; literature; test; study; estimate.

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Introduction

Fifteen European countries are currently involved in the world's largest and most interesting currency union, EMU. Yet most economists (especially those from the other side of the Atlantic) do not think that when EMU was created because it was an optimum currency area (hereafter "OCA"). At the birth of EMU in 1999, national business cycles appeared to be imperfectly synchronized across the members of EMU, and few thought that trade would rise substantially with monetary union. Together, these lead most to believe that EMU did not satisfy the requirements of an OCA, using either the classic model of Mundell (1961) or the more modern version of Alesina and Barro (2002). In this short paper, I wish to argue that even though EMU was not created as an OCA, it is moving in that direction.

My argument relies on two recent empirical literatures, which I survey briefly. The first estimates the effect of European Monetary Union (EMU) on trade; the second estimates the effect of trade on the cross-country synchronization of business cycles. I use meta-analysis to provide a quantitative summary of both literatures.

These literatures deal with important questions that are intrinsically important to the EMU/OCA nexus, and inter-related. Any reduction of the transactions costs associated with trade inside the Eurozone by EMU is of general interest. Indeed, one of the few undisputed benefits of EMU is its trade-promoting effect, so quantifying its size is an important exercise. The second linkage is also of interest. If increased trade raises the coherence of business cycles across countries, it thereby reduces the need for national monetary policy. If *both* links work in practice, then a currency union like EMU which does not look like an optimal currency area *ex ante* may become one *ex post*. This can occur if the trade increase stemming from currency union actually makes the currency union optimal, by reducing or eliminating the need for a

national monetary policy to reduce idiosyncratic business cycles. Frankel and Rose (1997, 1998) lay out the argument in detail.

A Brief 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. This paper exploited a panel of cross-country data covering bilateral trade between a large number of countries. Since most of the variation was across pairs of countries rather than time, I used a conventional "gravity" model of trade to account for factors that drive trade (other than monetary arrangements). This equation has now become the standard vehicle for the literature, and takes the form:

$$T_{ijt} = \beta_1 D_{ij} + \beta_2 (Y_i Y_j)_t + \Sigma_k \beta_k Z_{ijt} + \Sigma_t \delta_t T_t + \gamma CU_{ijt} + u_{ijt}, \quad (1)$$

where: T_{ijt} denotes the natural logarithm of trade between countries i and j at time t, $\{\beta\}$ is a set of nuisance coefficients, D_{ij} denotes the log of distance between i and j, Y denotes the log of real GDP, Z denotes other controls for bilateral trade, CU_{ijt} is a dummy variable that is one if countries i and j are in a currency union at t and zero otherwise, and u is a well-behaved disturbance term. The coefficient of interest is γ, which represents the partial effect of currency union on trade, *ceteris paribus.*

The surprising and interesting finding was that currency union seemed to have a strong and robust effect on trade. Even using the standard linear gravity model that accounts 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 =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 others). Almost all the subsequent research in this area has been motivated by the belief that currency union cannot reasonably be expected to triple trade. I provided a meta-analysis of the work as it existed in March 2004 in my 2005 paper with Stanley.

One of the problems with almost all the work that Stanley and I surveyed was that it estimated the effect of currency unions on trade using monetary unions that preceded EMU. This choice was made of necessity; since the euro only started to circulate in 2002, there was essentially no European data of relevance available. However, the currency unions that existed before the Eurozone involved countries that were either small or poor (or both). Clearly the relevance of such currency unions for EMU was unknown.

Some four years have now passed since I finished my 2005 survey (with Stanley), and much work has been done. I am now aware of 26 studies that estimate the currency union effect on trade – γ in equation (1) above – *using data directly relevant for EMU*. It seems appropriate to see what these studies say, taken as a whole.

Meta-Analysis: The Effect of Currency Union on Trade

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 an excellent 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 twenty-six papers that provide estimates of the effect of currency union on bilateral trade (γ) using data of relevance. These articles are tabulated in Table 1 (I note parenthetically that I am a co-author of none.) I also present the studies' preferred estimate of γ, along with its standard error. In each case, I present the estimate of γ that seems to be most preferred or representative (if a preferred estimate is not available) by the author(s) of the study. 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 twenty-six 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 (26) 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 785 is drawn from chi-squared (52).[1]

I tabulate meta-estimates of the currency effect on trade in Table 2. I provide both "fixed effect" and "random effect" meta-estimates that are common in the area. The former are based on the assumption that a single fixed effect underlies every study, so that, in principle, if every

study were infinitely large, every study would yield an identical result. This is the same as assuming there is no heterogeneity across studies. By way of contrast, the random effects estimator assumes that the studies are estimating different treatment effects, drawn from a distribution whose mean is of interest.[2]

Manifestly, there is considerable heterogeneity; the fixed and random effect estimators are not similar in magnitude. However, both estimates are both economically substantial; the smaller fixed effect estimate of γ indicate that currency union raises trade by about 8% (as ln(.08)-1=.08), while the random effect estimate indicates that the effect is more like 23%.

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 (fixed-effect) point estimates for γ tabulated in Table 3, along with a 95% confidence interval.

It seems that EMU has had a measurable effect already on trade. In the spirit of trying to stay modest, the few years since EMU began have already seen trade rise within the Eurozone by at least 8%. Since EMU is a relatively young institution, it seems likely (though uncertain) that this effect will grow with time. I also note that this conclusion is consistent with writers who have surveyed the literature in a more qualitative fashion. The best known of these is Baldwin (2006), who writes "The bottom line of this literature is that the euro probably did boost intra-Eurozone trade by something like five to ten percent on average, although the estimates size of this effect is likely to change as new years of data emerge."[3]

Increased Trade Enhances Business Cycle Synchronization

I now turn to the link between international trade and business cycle synchronization. It is now standard to use the following equation:

$$BCS_{ijt} = \alpha + \beta*\ln(trade_{ijt}) + controls + \varepsilon_{ijt} \quad (2)$$

where BCS a measure of business cycle synchronization between countries i and j during time period t. Countries might choose their monetary regime, such as a fixed exchange rate, to both simultaneously enhance trade and affects BCS, so β is almost always estimated with instrumental variables.

Frankel and Rose (1997, 1998) show that theoretically β is ambiguously signed; it depends on what kind of trade is spurred by integration, and what sorts of shocks hit the economy. However, *if* β is positive, then currency unions may endogenously become optimal. In particular, if currency raises trade significantly, then by indirectly raising BCS it reduces the need for a national monetary policy to offset idiosyncratic domestic shocks, thus making the currency union sustainable.

The chief measurement issue is determining an empirical analogue for business cycle synchronization (BCS). This is typically (though not always) measured as a correlation coefficient that is estimated between detrended levels of activity for countries i and j, over some reasonable period of time.[4] Since EMU has only existed for a short period of time, no study, to the best of my knowledge, creates BCS measures using only post-EMU data.

The coefficient of interest is β, which measures the effect of trade on BCS. This has been estimated by twenty different studies. These studies, along with their estimates of β (and its standard error) are tabulated in Table 4. While twenty studies are not enough to give one a truly large sample, it still seems worthwhile to use meta-analysis to aggregate their estimates quantitatively.

The hypothesis that β is statistically insignificantly different from zero is grossly rejected; under the null hypothesis of no effect, the test-statistic of 277 is drawn from chi-squared (40).[5] The meta-estimates of the effect of trade on BCS are presented in Table 5. As with the effect of currency union on trade, there is considerable heterogeneity and the fixed and random effect estimators are not close. I continue to be conservative, and focus on the lower, fixed-effect, estimate of $\beta \approx .02$. While this is considerably lower than I estimated in my 1998 paper with Frankel, it is still economically significant. If EMU has thus been associated with a trade increase of say 8% and each 1% increase in bilateral trade leads to an increase in BCS of .02, then EMU leads to an increase in the correlation coefficient of detrended outputs of (.02*8=) .16. Since the sample average of BCS is around .22, this represents an economically relevant increase in the synchronization of business cycles across the members of EMU. While this reduction in idiosyncratic national business cycles is substantial, whether it is enough to obviate the need for a national monetary policy is, of course, a different question.

Summary and Conclusion

The objective of this paper was to provide a brief quantitative survey of two related literatures. The effect of EMU on trade has now been examined by some 26 studies; I use meta-analysis to aggregate these together. If one weighs each of the studies equally, the literature has not yet come to a consensual view concerning the effect of EMU; a conservative estimate is that has already lead to an increase in trade of some 8%, but a more substantive effect of 23% is also plausible. The hypothesis that it has had had no effect at all can be easily rejected by the literature taken as a whole.

I also ask what can be learned from the twenty papers that estimate the effect of international trade on business cycle synchronization (BCS). The meta-estimates here are also heterogeneous, though again the idea that trade has no effect on BCS seems grossly inconsistent with the data. A conservative estimate is that each 1% increase in trade between a pair of countries seems to raise the correlation coefficient for their detrended outputs by around .02.

EMU seems to have had a combination of two effects: the direct consequence of increased trade, and an indirect benefit through the effect of this trade expansion on business cycle synchronization. This means that EMU may have created a virtuous circle that might make currency union closer to being sustainable. Whether the effect is big enough to make Europe an optimal currency area remains to be seen. A modern currency union between large rich countries like EMU has no historical precedent, and too little time has passed since the introduction of the euro for the trade and BCS effects to be clearly estimated. That said, EMU seems clearly to be moving along the path to becoming an optimum currency area.

I close with a caveat. EMU has had and is having an enormous number of economic consequences, and I have ignored almost all of them in this brief paper. Countries choosing whether or not to enter (or stay in) EMU have to consider its effect on the efficiency of capital and labor markets, the quality of monetary policy inside EMU, risk-sharing, and so forth. The non-economic issues associated with sovereignty and political influence within the EMU may be of equal or greater importance. Still, the two literatures I have surveyed provide some grounds for an optimistic, though early, view of EMU.

Table 1: Recent Studies of Currency Union and Trade

			Gamma	SE
1	**Bun and Klaassen**	**2002**	0.33	0.1
2	**de Souza**	**2002**	0.17	0.24
3	**de Nardis and Vicarelli**	**2003**	0.061	0.027
4	**Cabasson**	**2003**	0.63	0.24
5	**Micco, Stein, Ordonez**	**2004**	0.089	0.025
6	**Barr, Breedon and Miles**	**2004**	0.25	0.033
7	**Baldwin and Taglioni**	**2004**	0.034	0.015315
8	**Faruqee**	**2004**	0.082	0.018
9	**de Nardis and Vicarelli**	**2004**	0.093	0.039
10	**Clark, Tamirisa, and Wei**	**2004**	0.22	0.38
11	**Baldwin, Skudelny, and Taglioni**	**2005**	0.72	0.06
12	**Yamarik and Ghosh**	**2005**	1.8285	0.30475
13	**Adam and Cobham**	**2005**	1.029	0.039486
14	**Baxter and Koupritsas**	**2006**	0.47	0.22
15	**Flam and Nordstrom**	**2006b**	0.139	0.02
16	**Berger and Nitsch**	**2006**	-0.001	0.036
17	**Gomes, Graham, Helliwell, Kano, Murray and Schembri**	**2006**	0.069	0.011
18	**Baldwin and Taglioni**	**2006**	-0.02	0.03
19	**Baldwin and Di Nino**	**2006**	0.035	0.01
20	**Flam and Nordstrom**	**2006a**	0.232	0.024
21	**Tenreyro and Barro**	**2007**	1.899	0.351
22	**Bun and Klaassen**	**2007**	0.032	0.016
23	**de Nardis, De Santis and Vicarelli**	**2007**	0.04	0.01278
24	**Brouwer, Paap, and Viaene**	**2007**	0.067	0.025769
25	**Flam and Nordstrom**	**2007**	0.248	0.046
26	**de Nardis, De Santis and Vicarelli**	**2008**	0.09	0.033962

Table 2: Meta-Analysis of Impact of Currency Union on Trade

Estimation Technique	Pooled Estimate of γ	Lower Bound of 95%	Upper Bound of 95%
Fixed	.08	.07	.09
Random	.21	.15	.27

Table 3: Checking for Influential Studies in the Meta-Estimate of γ

	Study Omitted	Gamma	Lower Bound of 95%	Upper Bound of 95%
1	**Bun and Klaassen**	.08	.07	.09
2	**de Souza**	.08	.07	.09
3	**de Nardis and Vicarelli**	.08	.07	.09
4	**Cabasson**	.08	.07	.09
5	**Micco, Stein, Ordonez**	.08	.07	.09
6	**Barr, Breedon and Miles**	.08	.07	.09
7	**Baldwin and Taglioni**	.09	.08	.10
8	**Faruqee**	.08	.07	.09
9	**de Nardis and Vicarelli**	.08	.07	.09
10	**Clark, Tamirisa, and Wei**	.08	.07	.09
11	**Baldwin, Skudelny, and Taglioni**	.08	.07	.09
12	**Yamarik and Ghosh**	.08	.07	.09
13	**Adam and Cobham**	.07	.06	.08
14	**Baxter and Koupritsas**	.08	.07	.09
15	**Flam and Nordstrom**	.08	.07	.09
16	**Berger and Nitsch**	.08	.08	.09
17	**Gomes, et al**	.09	.08	.10
18	**Baldwin and Taglioni**	.09	.08	.09
19	**Baldwin and Di Nino**	.10	.09	.10
20	**Flam and Nordstrom**	.08	.07	.09
21	**Tenreyro and Barro**	.08	.07	.09
22	**Bun and Klaassen**	.09	.08	.10
23	**de Nardis, De Santis and Vicarelli**	.09	.08	.10
24	**Brouwer, Paap, and Viaene**	.08	.07	.09
25	**Flam and Nordstrom**	.08	.07	.09
26	**de Nardis, De Santis and Vicarelli**	.08	.07	.09

Table 4: Recent Studies of Trade and Business Cycle Synchronization

			Beta	SE
1	**Baxter and Kouparitsas**	**2005**	0.134	0.032
2	**Bower and Guillenmineau**	**2006**	0.02055	0.00528
3	**Calder**	**2007**	0.013	0.004
4	**Calderon Chong and Stein**	**2007**	0.015	0.003055
5	**Choe**	**2001**	0.027	0.008333
6	**Clark and van Wincoop**	**2001**	0.09	0.03
7	**Crosby**	**2003**	0.048	0.063
8	**Fidrmuc**	**2004**	0.021	0.044872
9	**Fiess**	**2007**	0.123	0.062
10	**Frankel and Rose**	**1998**	0.086	0.015
11	**Gruben, Koo and Mills**	**2002**	0.059	0.017206
12	**Imbs**	**2003**	0.03089	0.020058
13	**Imbs**	**2004**	0.074	0.022289
14	**Inklaar, Jong-a-Pin and de Haan**	**2005**	0.115	0.041071
15	**Kose and Yi**	**2005**	0.091	0.022
16	**Kose, Prasad and Terrones**	**2003**	0.0107	0.0045
17	**Kumakura**	**2006**	0.0575	0.0354
18	**Kumakura**	**2007**	0.05555	0.01232
19	**Otto, Voss and Willard**	**2001**	0.0461	0.090999
20	**Shin and Wang**	**2004**	0.07665	0.07665

Table 5: Meta-Analysis of Impact of Trade on Business Cycle Synchronization

Estimation Technique	Pooled Estimate of γ	Lower Bound of 95%	Upper Bound of 95%
Fixed	.020	.016	.023
Random	.043	.031	.054

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Endnotes

[1] Edgington's small sample correction leads to the same conclusion.

[2] http://www.cochrane-net.org/openlearning/HTML/mod13.htm. To elaborate: the fixed effect assumption is that differences across studies are only due to within-study variation. By way of contrast, random effects models consider both between-study and within-study variability and assume that the studies are a random sample from the universe of all possible studies.

[3] Probably the most relevant is Frankel (2008), who writes "If one estimates the effects of the euro versus other monetary unions in a large sample that includes all countries and all years, thereby bringing to bear as much information as possible on questions such as the proper coefficients on common border and common language in a gravity model, then the effect of the euro in the first eight years is seen to be large, and comparable with the effect of the other non-euro monetary unions."

[4] Different measures of real activity are available (real GDP; the unemployment rate; industrial production …), as are detrending techniques (HP-filtering; Baxter-King filtering; first-differencing; linear detrending …). These do not seem to have an appreciable difference on the results in practice.

[5] Again, Edgington's technique changes nothing.