DOES ENTERING OR LEAVING A CURRENCY UNION AFFECT BILATERAL TRADE?

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Economics, with its reliance on mathematics, has often considered itself the 'physics' of the social sciences. In this paper, Tony O'Connor goes one step further, using the theory of gravity to help explain international trade. Interestingly the evidence suggests that currency unions, between smaller and poorer countries at least, have little effect on bilateral trade.

1. Introduction

The objective of this paper is to examine how entering or leaving a currency union affects bilateral trade. This question is of interest to policymakers, some of whom were recently asking the question as to what the effects of a country leaving the eurozone would be.

Specifically, we seek to examine the claim of Glick and Rose (2001) and others, who state that there are large benefits to trade of entering a currency zone. In this task, we use the Poisson pseudo-maximum likelihood estimator, which Silva and Tenreyro (2006) demonstrated to be consistent when applied to the gravity model, while controlling for those biases identified by Anderson and Wincoop (2003) and Baldwin and Taglioni (2006).

Using these methods, the paper finds little evidence for the claim that entering or leaving a currency union affects trade in any way between two countries. This finding is robust to many econometric techniques.

1.1. Literature Review

This core finding of this paper, that entering or leaving a currency union has no impact upon bilateral trade, is in contrast to the findings of Glick and Rose (2001), who found that a pair of countries who began to use the same currency enjoyed a near doubling of bilateral trade. Likewise, they found that countries who left a currency zone, or ceased sharing a currency, suffered falls in bilateral trade, that were significant economically and statistically.

They support this finding with concrete evidence, using the example of countries

that departed from the pound sterling. Of this group, which included Ireland, New Zealand, The Gambia, Malawi, Sierra Leone, Tanzania, Uganda and Zambia, only Ireland did not experience long-term negative effects on bilateral trade (Glick and Rose, 2001). Frankel and Rose (2002) corroborate this finding with econometric evidence that when two countries begin to share a currency, trade increases by a factor of three to four. They further highlight a tendency for this effect to increase over time, specifically between the 1970's and the 1990's. However, both these findings are reliant upon currency unions featuring poor and small nations (Micco et al., 2003). There is thus doubt over whether it would apply to large advanced economies, such as those in the Eurozone.

In line with this, when Micco et al. (2003) use post-1999 data relating to European countries, they also find a small but positive statistically significant effect on bilateral trade, in the range four to sixteen percent.

Similarly, other researchers using matching techniques have found the effect of currency unions on trade to be 65 percent and 13 percent (Persson, 2001), while some such as Silva and Tenreyro (2010) even found them to be close to zero.

2 Empirical Approach

To estimate the determinants of bilateral trade, and thus the effect of currency unions, a gravity model for trade will be estimated. Such a model attempts to explain the volume of bilateral trade between two countries, as a function of the economic size of the two countries, their distance from each other, the size of their respective populations, and a range of other control variables. A crude interpretation of the model would be to say that two very small countries, on opposite sides of the world, will have little trade between each other; conversely, two large countries, quite close, would trade far more. The relationship is expressed in functional form as follows:

$$T_{ij}=G\ \frac{M_i M_j}{D_{ij}} \tag{1}$$

Where T_{ij} is the volume trade flow from country i to country j, M is the economic "mass", or GDP, of each country, D is the distance between them, and G is a constant. Variations of this model are used to explain the effects of economic integration agreements, currency unions, immigrant shocks and other measures of trade costs on bilateral trade flows, as can be seen in Baier and Bergstrand (2009) and Rose et al. (2000).

Of course, trade does not follow physical laws. For example, while the amount of gravitational force between two objects can never be zero, we see that trade between some very small and very distant countries, is literally zero (Silva and Tenreyro, 2006). In econometric applications, this stochastic model of trade thus adopts the form:

$$F_{ij}=G(\ \frac{M_i^{\beta_1} M_j^{\beta_2}}{D_{ij}^{\beta_3}})\eta_{ij} \tag{2}$$

Which in log-linearised form gives us:

$$ln(F_{ij})=\beta_0+\beta_1 ln(M_i)+\beta_2 ln(M_j)-\beta_3 ln(D_{ij})+\varepsilon_{ij} \quad (3)$$

Unfortunately, specification (3) suffers from a number of problems. Firstly, it suffers from heteroskedasticity. As the volume of trade between two nation's increases, we expect the variation in trade to also increase. Indeed, when we tested a naive OLS regression on (3), it failed both the Breusch-Pagan and White tests for heteroskedasticity. Thus, all of the regressions outlined in subsequent tables will report standard errors that are robust to heteroskedasticity.

2.1. First Bias: Omitted Variable Bias

2.1.1. Source

Aside from the heteroskedasticity issues mentioned, Anderson and Wincoop (2003) proved that the traditional gravity model suffers keenly from omitted variable bias, and does not have a theoretical foundation. As a result, comparative statics analysis is inappropriate. This occurs due to the omission of so-called multilateral resistance terms, which denotes the average barrier to trade between a given nation and its trade partners (Anderson and Wincoop, 2003). Omission of these terms causes numerous analytical inaccuracies; one example is that we are blind to the fact that a given increase in a given trade barrier reduces size-adjusted trade between small countries less than in larger countries (Anderson and Wincoop, 2003).

2.1.2. Consequences

Failure to control for this bias has pernicious effects on the currency prediction. Concretely, as we would expect trade barriers to be low between countries who share a currency, we can say that the omitted multilateral resistance term is correlated with the currency coefficient. Thus, failure to control for the unobserved, but time-invariant, trade barriers will result in us overestimating the impact of a common currency (Baldwin and Taglioni, 2006). This prediction is also verified in the below regressions.

2.1.3. Solution

As elucidated by Silva and Tenreyro (2006), we can augment the traditional gravity equation with fixed effects between the importer and exporter (using country-pairwise, time-invariant dummy variables), resulting in:

$$T_{ij}=\alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} e^{\theta_i} e^{\theta_j} \quad (4)$$

Where, according to the microfounded Anderson-van Wincoop Model, and represent

fixed effects. The Hausman test, which can test whether we should control for random or fixed effects (Wooldridge, 2009), verified the theoretical case that fixed effects is more appropriate. In addition, theory predicts that both the and terms equal one, leading to an overall elasticity on the product of GDP equal to one. This latter prediction will be useful when comparing the derived regressions to the theory.

2.2 Second Bias: Deflation Bias

A second bias arises when all trade values are deflated according to the U.S. aggregate price index (Baldwin and Taglioni, 2006). As Baldwin and Taglioni (2006) noted, there are global trends in inflation, and failing to control for this would lead to bias through spurious correlations. They suggest using a time dummy to correct this deflation procedure, resulting in each bilateral trade flow being deflated by the same amount.

2.3 Regression Models

To highlight and control for the above biases, all models will be estimated with robust errors. We will then include models which will control for the deflation bias (through the introduction of time dummies) and fixed effects, individually and together.

In addition, we will use OLS, Poisson and Negative Binomial regressions, all while controlling for the above biases. Both OLS and Poisson regressions of the gravity equation feature prominently in the literature. For example, Poisson regression was applied to cross-sectional data in a paper by Silva and Tenreyro (2006), and they found that it was consistent in the presence of heteroskedasticity, unlike OLS.

As can be seen in Figure 1, the absolute value of trade seems to follow a type of Poisson or Pareto distribution. However, tests reject the null hypothesis that a Poisson regression fits the data. This may arise from the fact that in a Poisson distribution, the mean is equal to the variance. However, if we examine the trade variable, we see that the variance is far greater than the mean, by a factor of nearly 38 million. Fortunately, as all that is needed for Poisson pseudo-maximum likelihood to be consistent is that the condition holds. Thus, the data need not be Poisson, and we can still estimate the Poisson regressions (Silva and Tenreyro, 2006). Out of interest though, we will control for this overdispersion in the data by estimating some negative binomial regressions.

3. Dataset

A large cross country panel data set will be used, which includes 33,903 bilateral trade observations from 186 countries for 5 years (1970, 1975, 1980, 1985, and 1990). A list of the variables that will be used is provided in Table 1. It was used in the paper One Money, One Market: The Effect of Common Currencies on Trade, by Rose et al. (2000). The data is available on www.cepr.org/data, and was primarily drawn from the World Trade Database.

Figure 1: Distribution of Logged Trade and Trade in Dollars

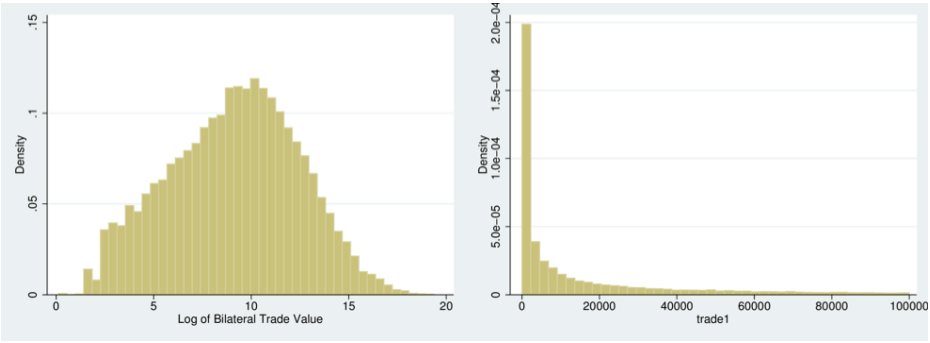

Table 1: A List of Independent Variables

Name	Label
trade	Real Value of Bilateral Trade in U.S. Dollars
lvalue	Log of Bilateral Trade Value
ldist	Log of Distance
lrgdp	Product of (log) Real GDP
lrgdppc	Product of (log) Real GDP per capitas
lpop	Product of (log) Population
cu	1 for Common Currency 0 otherwise
regional	1 for Regional TA Members 0 otherwise
colonial	1 if the two countries share(d) a colonial link 0 otherwise
comlang	1 for Common Language
border	1 for Common Land Border (Contiguity)
comcol	1 if a Common Colonizer shared 0 otherwise
gdpd	(Log of) GDP disparity

Interestingly, in Table 2 we see that 1 percent of the sample consists of bilateral trade flows in the presence of a shared currency. This implies that we have around 339 samples of common currency trade flows, with which we can estimate the impact of a common currency upon trade flows.

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
trade	594891.62	4745337.664	1.141	257499792	33903
lvalue	9.104	3.33	0.132	19.367	33903
ldist	8.177	0.817	2.967	9.422	30515
lrgdp	34.376	2.748	20.026	43.526	26608
lpop	17.979	2.692	5.841	27.593	28016
lrgdppc	16.228	1.372	11.728	20.805	26635
cu	0.01	0.098	0	1	33903
regional	0.017	0.128	0	1	33903
colonial	0.012	0.108	0	1	33903
comlang	0.121	0.326	0	1	33903
border	0.022	0.146	0	1	33903
comcol	0.076	0.265	0	1	33903
gdpd	1.175	0.152	1	2.322	26608
remote	0.001	0.001	0	0.052	26633
island	0.473	0.612	0	2	33903

4. Empirical Results

4.1. Testing the Model Specification

4.1.1. Heteroskedasticity

Firstly, the main problems faced by all gravity models are severe heteroskedasticity, as has been well noted by Silva and Tenreyro (2006). Indeed, when we tested our model for it, it failed both the Breusch-Pagan and White tests. All regression models one to ten are thus run, such that the errors are robust to hetroskedasticity. Due to the five-year gap between observations, autocorrelation was deemed not to be a problem.

4.1.2. Fixed Effects or Random Effects?

As mentioned earlier, the theory and literature indicates that gravity models should be run controlled for fixed effects. We tested this assumption on our data set, using the Hausman Specification Test. Under both OLS and Poisson regression, we rejected the null hypothesis that the difference on the error terms was not systematic, which implies that were we to estimate random effects, then the estimators would be inconsistent (Wooldridge, 2010). Thus, we control for fixed effects only.

4.1.3. Multicollinearity

We also tested for multicollinearity by analysing the variance inflation factors of the independent variables. We set a threshold of 10, implying that if the variance inflation factor of a variable exceeded 10, we would exclude that variable. However, all variables exhibited a variance inflation factor of less than 5. Thus, we concluded that multicollinearity is not a problem for these models.

4.1.4. Omitted Nonlinear Variables

We tested all our models with a heteroskedasticity-robust Ramsey RESET test. This test tells us if any non-linear combination of our variables, not presently in the model, have predictive power (Wooldridge, 2009). An example of a nonlinear combination would be or. A significant p-value thus implies that there are relevant explanatory variables omitted from our model. Of the 10 regressions we estimated, we found that three of them 'passed' the RESET test (p-values exceeded 0.05), indicating that we had not omitted relevant nonlinear variables. Of the models that passed, one was an OLS estimation controlled for the deflation bias (Model No. 2), one was a Robust Poisson (Model No. 4), and the last was a Poisson controlled for both the deflation bias and multilateral resistance (Model No. 6).

4.2. Are our regressions reliable?

It would certainly seem so. There are four pieces of evidence in favour of this series of regressions. Firstly, the GDP coefficient is usually quite close to unity, as is predicted by the literature (Baldwin and Taglioni, 2006). Secondly, we see that the coefficient on population is also correct; as can be seen in regressions seven and eight, a negative coefficient on population implies a positive coefficient on GDP per capita. The implication of a positive coefficient on GDP per capita implies that as the GDP per capita of a nation rises; it begins to demand more sophisticated goods, which can only be provided for from abroad. This finding is also present in the literature (Baldwin and Taglioni, 2006).

In addition, we see that when we control for the deflation bias and the multilateral resistance terms, the coefficients change in the correct pattern. For example, having stated that nations in a common currency zone tend to experience less multilateral re-

sistance, Baldwin and Taglioni (2006) hypothesised that controlling for multilateral resistance would reduce the coefficient on the currency zone dummy. This is exactly the effect we see in our three sets of regressions, where the coefficient on currency sharing declines as we control for variables which should, in theory, be correlated with it. This verifies Anderson-van Wincoop's hypothesis that failing to control for these terms introduces omitted variable bias.

Finally, we validate Silva and Tenreyro (2006)'s findings that OLS overestimates the impact of colonial ties, and bilateral trade agreements. These effects can be seen as we move from the OLS estimates, to the Poisson estimates, to the negative binomial estimates. The point estimates are not usually directly comparable, but as the models in this case are log-log for the OLS and level-log for the Poisson, we can meaningfully compare them after exponentiating them). The coefficient drops from 2.138 under OLS (implying a trade boost of having a colonial link in the order of 848 percent), to 0.687 under Poisson (implying a 198 percent increase 'only').

Lastly, we see that the coefficients on the common language and island variables are positive and significant across most regressions, which again accords well with logic. Island nations tend to trade more as they would usually be quite small, and thus would need varied supplies from overseas. Their smaller nature also implies that they will be more open, as there exists a negative relationship between a country's GDP and its level of openness, measured by total trade divided by total GDP (Silva and Tenreyro, 2006).

4.3. Inference

All three of the models that pass the RESET test imply that the effect of entering or leaving a currency zone on bilateral trade is insignificant from zero at the 1 percent significance level.

Furthermore, of the models that are fully controlled for the biases outlined in Section Three, we see that two of them pass the RESET test, with the fully controlled negative binomial regression (Model No. 10) failing said test. Although the latter regression fails the RESET test, it implies no significant impact of a shared currency on bilateral trade at the 1 percent level. This is in line with the finding of Silva and Tenreyro (2010). At the 5 percent level, however, Model No. 10 predicts a significant impact of trade, although it is relatively small, as it implies leaving a currency zone would result in an eventual 19.8 percent fall in bilateral trade. It should also be noted that the relatively small effect it predicts on trade is similar to that identified by researchers such as Micco et al. (2003).

4.4. Can we conclude that common currencies have no impact upon trade?

From all of the above regressions, it is clear that a common currency has an insignificant impact upon trade. However, our regressions are only as good as the data they are run

upon. As we use the same dataset as that used by Rose, over the same time period, the regressions are subject to the flaw that the currency union effect, proved on our regressions, only applies to small and poor countries. For example, a Probit probability model executed by the author implies that the probability of two countries forming a currency union was negatively related to both GDP and total bilateral trade. This implication that smaller countries are more likely to form currency unions verifies the criticism of the dataset. Thus, one should be very hesitant to use the findings of these regressions to judge the impact upon a large, wealthy country of leaving a currency zone.

5. Possible Extensions

Firstly, all the country pairs for which bilateral trade approximates zero have been excluded from this dataset. In some cases, this could lead to inconsistency of the estimators, as 'rounding down errors' are more likely to happen for smaller, distant countries, thereby resulting in the probability of this rounding down depending on the value of the covariates (Silva and Tenreyro, 2006). Thus, to enhance the accuracy of the estimators and reduce bias, it may be wise to leave the zeros in the dataset. Such zeros pose no problem for Poisson regression, at any rate.

Secondly, we could reconstitute the lvalue variable. It may be the case that this variable is simply the log of the average of the bilateral trade flows, rather than the average of the logs. As Baldwin and Taglioni (2006) proved, this leads to serious bias, especially so in the case where bilateral trade is greatly imbalanced, as is the case with North-South trade flows.

Thirdly, to expand our predictions to larger, wealthier countries, we could try to include recent data regarding the expansion of the eurozone, and its effects upon bilateral trade. This would allow us to extend our predictions to such countries.

Lastly, it may be the case that some of the variables included in the above regressions were endogenous. For example, regional trade agreements may be endogenous as countries would only opt into trade agreements with countries they already trade extensively with, or with those whom they forecast increasing trade into the future (Baier and Bergstrand, 2007). In this case, one could use instrumental variables, and reevaluate the model.

6. Conclusion

In this paper, we sought to quantify the impact upon a nation of leaving a currency zone. We found the impact to be insignificantly different from zero, implying that there would be no adverse impact on bilateral trade should a country leave a currency zone, such as the Eurozone. However, our assessment is constrained by the small country nature of the dataset, and thus one should take any policy recommendations with a healthy dose of skepticism.

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