Assessing the Euro's Trade Effects: Common Currency or Macroeconomic Stability?

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ABSTRACT

Do common currencies increase trade? The recent trade literature has fervently debated this issue. Lately, the introduction of the Euro has provided a natural experiment, but empirical tests have been ad-hoc and data are still few. We use Andrews' (2003) test for end-of-sample instability to rigorously test whether the introduction of the Euro has had trade effects. We also augment the traditional gravity equation to capture supply-side effects stemming from macro-economic policies accompanying the introduction of the Euro.

1 INTRODUCTION

In a seminal and controversial paper, Rose (2000) claimed that currency unions boost trade by over 200%. Micco, Stein and Ordoez (MSO, 2003), Nitsch and Berger (2005), and Flam and Nordstrm (2003) among others have used the recent introduction of the Euro as a natural experiment to test whether a common currency increases trade and by how much. The technique used to date has essentially been to test for the significance of coefficients on dummy variables taking the value of 1 from January 1999 onwards for Euro area countries. We propose a more rigorous approach by applying Andrews (2003) end-of-sample instability test. This test relies on few regularity assumptions and no distributional assumptions. Furthermore, it is tailored precisely to deal with few observations following the point of instability.

From a theoretical standpoint, macro-economic policies often accompanying the introduction of a common currency have been generally overlooked as a transmission channel affecting trade. We augment the traditionally demand-based gravity equation with a micro-founded supply-side. Specifically, we posit that interest rates play an crucial role in determining the number of firms engaged in trade. The paper is organised as follows. We first derive the augmented gravity equation, then we describe the Andrews (2003) test which we adapt for a panel data setting. Next, we discuss the data, methodology used and empirical results.

2 MICRO-FOUNDATIONS AND CHANNELS OF TRANSMISSION IN THE GRAVITY MODEL

Our work follows in the lineage of Anderson and van Wincoop (2003, 2001) and Rose and van Wincoop (2001) who were the first to provide rigorous microfoundations to the gravity equation of trade.[1]

While Anderson and van Wincoop's (2003) significantly modernized the gravity equation, most notably with the introduction of their "multilateral trade resistance" term (to capture relative, not absolute, trade costs), their gravity equation remains too simplified to accurately capture the effects of a common currency on trade.[2] It is widely acknowledged that this effect, if existent, works through three possible channels: elimination of (i) exchange rate volatility, and (ii) currency related transaction costs, and (iii) credible commitment to macro-economic policy coordination. Of the three channels, the second is likely to be the weakest, especially among the relatively well-functionning European capital markets, yet is arguably the only one captured by the gravity equation of Anderson and van Wincoop (2003), specifically by the trade cost term $\tau_{i,j}$.[3]

A large literature has developed around the first channel, that of currency volatility and trade. Bacchetta and van Wincoop (2000) offer the most complete and rigorous theoretical foundations in

[1]Baldwin (2005) offers a clear and concise overview of this literature, as well as helpful intuition for the various terms in the gravity equation.

[2]Their gravity equation is $v_{i,j} = \frac{y_i y_j}{y^w}\left(\frac{\tau_{i,j}}{P_i P_j}\right)^{1-\sigma}$ where $v_{i,j}$ is the value demanded of country i's goods in country j, y are domestic GDP, y^w is the sum of all countries' GDP, $\tau_{i,j}$ is the cost of trade, σ is the elasticity of substitution between goods and P is the CES price index.

[3]And even then, the argument is weak, as transaction costs due to the conversion and accounting of multiple currencies is likely to be a fixed cost, not a variable cost as is $\tau_{i,j}$.

a general equilibrium setting[4]. The main policy contribution of the paper, is that there is no clear answer as to how and if volatility should affect trade. Empirical results echo this finding.

2.1 Interest Rates: an Unexplored Channel of Transmission?

We concentrate on the last of the three transmission channels: newly crafted, credible macro-economic policies. Surprisingly, this channel has received little attention from trade economists working on the effects of a common currency on trade. Yet, with the introduction of a common currency, one stylized fact stands out: an almost contemporaneous structural break in interest rates, dictated in part by accession criteria and in part by the credibility of the new monetary institution. Starting around 1995, interest rates both converged and decreased across all Euroland countries, while variances came down drastically. A look at the data alone hints that this third channel of transmission, going from macro-economic policy to interest rates, is potentially highly influential at explaining changes in trade patterns and must be looked at more carefully.

From an intuitive standpoint, the link between interest rates and trade is straightforward. Trade is a commercial endeavor which, like all others, requires funding usually obtained in the form of loans. When a firm wants to begin selling abroad or plans to expand its foreign sales, it faces a significant cost. Typically, this cost is fixed and includes having to adapt one's products to foreign specifications, undertake market research abroad, negotiate greater insurance coverage or possibly hire a foreign workforce. The decision to trade (or increase trade) is akin to an investment decision - and is thus highly dependent on interest rates.

2.2 An Augmented Gravity Equation

We hypothesize that the interest rate will primarily affect the number of exporting firms. Lower interest rates favor investment in capacity expansion or entry into the export market, thus increasing trade. Because firms are heterogeneous and exporting requires a fixed cost (possibly spread over several years or required repeatedly to stay in business), lower interest rates will cause substantial entry into, and expansion of, the export sector. To greatly simplify the theoretical analysis, though, and still generate an estimation equation that links interest rates to trade, we instead assume that all firms are homogenous and engage in trade, but that because of fixed costs, interest rates determine the number of active firms. To do so, we follow Rebelo (Check reference!). This allows us to go one step beyond Anderson and van Wincoop (2003) in considering the supply side of trade dynamics.

[4]For a theoretical model in partial equilibrium, see, for instance, Obstfeld and Rogoff (1998)

On the demand side, we make only two slight adjustments to the Anderson and van Wincoop (2003) model. First, we drop the assumption that a country only exports one variety in favor of a model closer to those typical in the economic geography literature. Second, we consider trade volume, not value.

We begin with the usual CES consumption index, which, for simplicity, we present for the aggregate consumption of country i's varieties in country j:

$$C^i_{j,t} = \left(\int_0^{n_{i,t}} x_{i,t}^{1/\sigma} di \right)^{\sigma}$$

where σ is the elasticity of substitution between varieties and $n_{i,t}$ is the number of active firms in country i (equivalently the number of varieties). For simplicity, we drop the time subscripts in the derivations below.

This gives rise to the usual demand for each variety i in country j, given by

$$x_{i,j} = \left(\frac{p_{i,j}}{P_j} \right)^{\frac{\sigma}{1-\sigma}} C_j$$

where in equilibrium, aggregate consumption equals aggregate income, $C_j = Y_j/P_j$ and where P_j is the aggregate price index in country j (defined in greater detail below). Furthermore, we assume the standard full pass-through pricing condition as well as PPP: $p_{i,j} = p_i \tau_{i,j} \frac{1}{\epsilon_{i,j}}$, where $\epsilon_{i,j}$ is the nominal exchange rate between countries i and j specified as the price in i's currency of one unit of j's currency.

Thus, aggregate demand for country i's varieties is $n_i \cdot x_{i,j}$, giving rise to the following basic demand equation (or equation determining exports of country i's varieties to country j).

$$X_{i,j} = n_i \left(\frac{p_i \tau_{i,j} \frac{1}{\epsilon_{i,j}}}{P_j} \right)^{\frac{\sigma}{1-\sigma}} \frac{Y_j}{P_j} \quad (1)$$

The supply side of the model will mostly aim to determine n_i and in particular link n_i to R_i, the interest rate in country i. We model the supply side with some additional complexity, mainly in line with Rebelo (check ref). We assume that firms employ both capital and labor and need to pay a fixed cost in order to produce. Firms' production function can therefore be summarized by a Cobb-Douglas equation:

$$x_i = A(K_i - \bar{K})^{1-\gamma}(N_i - \bar{N})^{\gamma} \quad (2)$$

where $\bar{K}$ and $\bar{N}$ are the fixed costs needed to operate in terms of both capital and labor.

Straightforward cost minimization subject to the production of amount x_i, the wage rate w_i and the interest rate R_i, yields the optimal utilization of capital and labor, with the resulting cost function:

$$R_i\bar{K} + w_i\bar{N} + \frac{1}{A}\frac{R_i^{1-\gamma}w_i^{\gamma}}{(1-\gamma)^{1-\gamma}\gamma^{\gamma}}x_i \qquad (3)$$

We therefore see very clearly that costs can be separated into a fixed part $R_i\bar{K} + w_i\bar{N}$ and a remaining variable part. For simplicity, and following Rebelo's notation, we call the first a_0 and the second a_1. When choosing its optimal price, the firm therefore sets $p_i = \sigma a_1$, as is usual in the CES case, where σ is the elasticity of substitution between goods and in this case represents the fixed markup over the marginal cost a_1.

Furthermore, firms enter the market freely, until profits are zero for all firms. This condition helps determine the number of firms that can remain active in the market. In particular, the free entry condition specifies that $\pi = 0$ at equilibrium, where π are profits per firm. We therefore write that at equilibrium

$$\pi = p_i x_i - a_0 - a_1 x_i = 0 \quad \rightarrow \quad (p_i - a_1)x_i = a_0$$

namely, profits per unit times the number of units equals the fixed costs. We thus conclude, by solving for x_i that

$$x_i = \frac{a_0}{(\sigma-1)a_1} = x \qquad (4)$$

thus, x_i, each firm's output, is fixed in equilibrium by the free entry condition.

To build intuition for this intermediate result, it is worth looking into greater detail at the mechanism linking the number of firms and profits: the aggregate price index. Indeed, the aggregate price depends negatively on n_i, the number of firms. As is usual in the CES setting, the price index is the power mean of prices of each variety over all trading partners $k \in K$. With the price p_i fixed for all firms,

$$P_j = n_i^{1-\sigma}\left(\int_0^K (p_i\tau_{i,j})^{\frac{1}{1-\sigma}}\,dk\right)^{1-\sigma}$$

We clearly see that the aggregate price decreases with n_i, the number of firms or varieties. Appropriately, this link is commonly referred to as the variety effect and is central to explaining the zero profit condition. As more firms enter the market, aggregate prices decrease. Since a firm's demand function is a negative function of aggregate prices (relative prices matter), each firm sells less. Operating profits, $(\sigma-1)a_1x_i$ thus decrease until they are equal to a_0, the fixed cost of operation, and firms stop entering.

At this point, finding the number of active firms in the market is straightforward. Intuitively, if firm output is fixed and total labor is given, the number of firms able to survive in the market is determined by total labor divided by the number of workers employed by each firm. For a given level of total employment, the number of firms (or varieties) is inversely proportional to the number of workers employed by each firm.

For our purposes, the essential relationships to extract from this model are those linking x_i and n_i to R_i. From the above, we see that as R_i decreases, a_1 decreases. Firms therefore produce more (x_i increases), but substitute capital for labor in their production function. Thus, N_i decreases. Consequently, the number of active firms (the number of varieties), n_i, increases. Stylistically, we can therefore write

$$n_i = n_i\left(\frac{E_i \cdot w_i}{R_i}\right) \qquad (5)$$

where E_i is the total number of workers available in country i.[5] To simplify the estimation procedure, circumvent unreliable employment data and especially minimize the divergence from more traditional gravity equations, we make a final simplification: we assume full employment and constant productivity (or at least a constant divergence in unemployment and productivity between european countries) and thus equate E_i to country i's real GDP, Y_i^R.

We now go back to the demand-side and substitute for n_i in equation (1), using the results in (5). Finally, we follow Baldwin (2005) who offers a theoretical interpretation of the work of Flam and Nordstrm (2003). In the CES context, price is a fixed markup over marginal cost: $p_i = \sigma a_1$. Furthermore, we divide top and bottom of (1) by P_j and define $\xi_{k,j}$ as the real exchange rate between country k and j, given by $\epsilon_{i,j}a_1/P_j$. This is a somewhat unconventional definition of the real exchange rate, which usually includes P_k in the numerator instead of a_1. Yet, to the extent that the aggregate price is a function of each domestic firm's price, which is itself a function of marginal costs a_1, our simplification does not introduce notable distortions to the model. This is especially true as we consider σ to be constant across time and countries.

Next, we separate the variable trade cost, $\tau_{k,j}$, into two parts: one dependent and one independent on time. We write

$$\tau_{k,j} = (\tau_{k,j}^{ind})^{1-\theta}(\tau_{k,j}^{dep})^{\theta}$$

where the sub-indexes ind and dep represent the time independent and dependent parts respectively, and θ are weights. $\tau_{k,j}^{ind}$ captures distance, common language, type and efficiency of the legal system and other such elements commonly found in traditional gravity equations. This will be estimated by a

[5] Note that w_i appears in the numerator for the exact same reason (but inverse relationship) as R_i appears in the denominator.

fixed, (time independent), pair-specific effect, which we call α_{i-j}. $\tau_{k,j}^{dep}$ instead captures integration between european countries, mainly at the legal and institutional level. This element is meant to control for the evolving european legislation, which, like the Single Market Act, is meant to reduce bureaucratic frictions between EU countries and thus foster trade.

Finally, following the literature which emerged from Anderson and van Wincoop (2003) we note that the term in the denominator of the equation for $X_{i,j}$ is time-varying, but should remain constant for country j over a given year. We will thus replace it with a time-varying import-country specific effect, $\lambda_{j,t}$.

These simplifications leave us with the following demand-for-exports equation:

$$X_{i,j} = \frac{Y_i^R \cdot w_i}{R_i} \left(\frac{\sigma(\alpha_{i-j})^{1-\theta}(\tau_{i,j}^{dep})^{\theta}\xi_{i,j}}{\lambda_{j,t}} \right)^{\frac{\sigma}{1-\sigma}} Y_j^R \tag{6}$$

For estimation purposes, we linearize this equation by taking logs of both sides. The straight (Sans Sheriff) fonts represent logs of variables. We also re-introduce time subscripts to emphasize the time-dependence of the model. We also write $\tau_{j,t}$ instead of $\tau_{i,j}^{dep}$ and redefine the constants such that we cancel the multiplicative terms coming from the exponents of the system above. The equation to estimate, for the imports of country j from country i, thus becomes:

$$\begin{aligned} \mathrm{X_{i,j,t}} = {} & \alpha_{\mathrm{i-j}} - \lambda_{\mathrm{j,t}} + \varphi_1 \mathrm{Y^R_{i,t}} + \varphi_2 \mathrm{w_{i,t-1}} - \varphi_3 \mathrm{R_{i,t-4}} \\ & + \varphi_4 \tau_{\mathrm{j,t}} + \varphi_5 \xi_{\mathrm{i,j,t}} + \varphi_6 \mathrm{Y^R_{j,t}} + \varepsilon_t \end{aligned} \tag{7}$$

where all variables are observable, the φ are reduced form coefficients, lags of $R_{i,t}$ have been introduced to capture the notion of time-to-build, inherent in the similarity drawn between exporting and investment, and finally ε_t is an estimation error term.

3 THE ANDREWS TEST: SETUP FOR A PANEL

The regression serving as the basis for tests of structural instability is:

$$Y_{it} = \begin{cases} X_{it}'\beta_0 + U_{it} & t = 1, \ldots, n \\ X_{it}'\beta_{1t} + U_{it} & t = n+1, \ldots, n+m \end{cases}$$

for individuals $i = 1, \ldots, k$. We work with two linear regressions, one including n observations, over $t = 1, \ldots, n$ which we call the estimation subsample (following the nomenclature in Dufour, Gysels, and Hall, 1994), and the other including m observations over $t = n+1, \ldots, n+m$ which we call the prediction subsample.

The Andrews test relies on few regularity conditions. Nonetheless it is important that $n \to \infty$ for the asymptotic critical values, but m can be as small as one observation. We also need to assume that the series $\{Y_{it}, X_{it}\}$ are stationary and ergodic. Apart from these assumptions, the test remains asymptotically valid under very weak conditions, such as non-normal, heteroskedastic, conditionally heteroskedastic and/or autocorrelated errors, non strictly exogenous regressors and cross sectional correlations.

Given the regression system above, the test naturally hinges on the following hypotheses:

$$H_0 : \beta_{1t} = \beta_0 \quad \text{vs.} \quad H_A : \beta_{1t} \neq \beta_0$$

which is equivalent to saying that the distribution of U_{it} for some $t = n+1, \ldots, n+m$ differs from the distribution of U_{it} for $t = 1, \ldots, n$.

3.1 The Test Statistic

As in DGH, if there is structural instability, the estimated residuals from the prediction subsample would differ from zero, and thus from those in the estimation subsample. Thus, the key variable is the predicted residual. As is usually done in F and Wald-type tests, the variable is squared and scaled by a measure of variance. Andrews (2003) shares this general approach to building his test statistic, called S, yet differs from DGH in the details. Notably, Andrews uses coefficients estimated from the full sample to build his predicted residuals. He then constructs his test statistic as the predicted residuals squared divided by the estimated variance-covariance matrix of the residuals over the full sample.

More formally, there are two cases to consider, one when there are more observations after the unstable point than there are regressors d, $(m \times k) \geq d$ and the other when there are fewer observations, $(m \times k) \leq d$. This latter case turns out to be a simplification of the first.

When $(m \times k) \geq d$, Andrews (2003) defines the S statistics in the following way:

$$S = S_{n+1}(\hat{\beta}_{n+m}, \hat{\Sigma}_{n+m}) \tag{8}$$

We define an interval τ_j which spans from $[j, j+m-1]$.

$$S_j(\beta, \Sigma) = \hat{\mathbf{W}}_{i,\tau_j}' \hat{\Sigma}_{n+m}^{-\frac{1}{2}} \mathbf{P}_{\mathbf{X}_{i,\tau_j}} \hat{\Sigma}_{n+m}^{-\frac{1}{2}} \hat{\mathbf{W}}_{i,\tau_j} \tag{9}$$

with

$$\hat{\mathbf{W}}_{i,\tau_j} = (\mathbf{Y}_{i,\tau_j} - \mathbf{X}_{i,\tau_j}\beta)$$

where $\hat{\mathbf{W}}_{i,\tau_j}$ is the residual vector of the $(m \times k)$ observations starting at j, with $\beta = \hat{\beta}_{n+m}$. The S statistic is a positive definite quadratic form obtained from the transformed $(m \times k) \times 1$ vector of residuals by the $(m \times k) \times (m \times k)$ covariance matrix, $\hat{\Sigma}^{-\frac{1}{2}}$, projected onto the column space of the $(m \times k) \times d$ matrix of transformed post-instability regressors. The projection matrix can be written as:

$$\mathbf{P}_{\mathbf{X}_{i,\tau_j}} = \hat{\Sigma}_{1,n+m}^{-\frac{1}{2}} \mathbf{X}_{i,\tau_j} (\mathbf{X}_{i,\tau_j}^{'} \hat{\Sigma}_{n+m}^{-1} \mathbf{X}_{i,\tau_j})^{-1} \mathbf{X}_{i,\tau_j}^{'} \hat{\Sigma}_{1,n+m}^{-\frac{1}{2}} \quad (10)$$

The reasons for this projection matrix are elaborated below. Moreover, the variance-covariance matrix, $\hat{\Sigma}_{n+m}$, is:

$$\hat{\Sigma}_{n+m} = (n+1)^{-1} \sum_{j=1}^{n+1} \hat{\mathbf{U}}_{i,\tau_j} \hat{\mathbf{U}}_{i,\tau_j}^{'} \quad (11)$$

where the $(m \times k) \times 1$ residual vector, $\hat{\mathbf{U}}_{i,\tau_j}$, is:

$$\hat{\mathbf{U}}_{i,\tau_j} = (\mathbf{Y}_{i,\tau_j} - \mathbf{X}_{i,\tau_j} \hat{\beta}_{n+m})$$

Thus, the variance-covariance matrix covers the whole sample.

In the second case, when $(m \times k) \leq d$, there are less post-instability observations than regressors in the model. In this case, Andrews (2003) builds an equivalent test to the S statistic, $P = P_{n+1}(\hat{\beta}_{n+m}, \hat{\Sigma}_{n+m})$ where the weight matrix $\mathbf{P}_{\mathbf{X}_{i,\tau_j}}$ collapses to the identity matrix $I_{(m \times k)}$. (see Andrews (2003) for details).

3.2 Critical Values

We know that S is defined over the interval $[n+1, n+m]$, which is the prediction subsample of time-series dimension m. Since m is very small, we cannot derive an asympotitcally valid distribution for the S statistic. We can, however, reproduce similar test statistics in the estimation subsample, and compute their empirical distribution. Andrews calls these values S_j. The crux of the Andrews test is essentially to reject the Null of stability if S is "large" with respect to the S_j, or more rigorously, if S is greater than the $100(1-\alpha)\%$ of the S_j. We explain this methodology below.

To allow for a comparison of S to S_j, the latter must be estimated in a similar manner to the former. When $(m \times k) \geq d$ the S_j values can be written as:

$$S_j = S_j(\hat{\beta}_{2,(j)}, \hat{\Sigma}_{n+m}) \quad (12)$$

These are calculated according to the same methodology of the previous section, including the distinction between d being greater or smaller than the number of observations after instability. The S_j values also characterise m observations and S_j will exist for $\{S_j : j = 1, \ldots, n-m+1\}$, yielding $n-m+1$ different S_j values computed over the estimation subsample using a moving-window of m temporal observations over k individuals. Moreover, $\hat{\beta}_{2,(j)}$ is defined as:

$$\hat{\beta}_{2,(j)} = \beta$$

with $t = 1, \ldots, n$ but excluding observations $j, \ldots, j + \frac{m}{2} - 1$, i.e. the $\frac{m}{2}$ observations starting at j. We call these excluded observations the "gap", a term that is further explained in Andrews (2003).

Next, Andrews (2003) constructs the empirical cummulative density function (CDF) of the S_j values, which he calls $\hat{F}_{S,n}(x)$. In a standard way, the CDF then allows for the calculation of critical value to evaluate the Null. For a test of significance level α, Andrews defines the critical value for S_d as the $1-\alpha$ sample quantile, $\hat{q}_{S,1-\alpha}$ of $\hat{F}_{S,n}(x)$:

$$\hat{q}_{S,1-\alpha} = inf\{x \in \Re : \hat{F}_{S,n}(x) \geq 1-\alpha\}$$

This expression can be summarised as $Pr(S < x) \geq 1-\alpha$, or for the actual critical value, $Pr(S < x) = 1-\alpha$. This is equivalent to rejecting the Null if $S > \hat{q}_{S,1-\alpha}$ or if S exceeds $100(1-\alpha)\%$ of the values of S_j. This equivalence is expressed in Andrews (2003), giving the following alternative rule for rejecting the Null:

$$(n-m+1)^{-1} \sum_{j=1}^{n-m+1} 1(S > S_j) \geq 1-\alpha$$

where $1(\cdot)$ is an indicator function.

4 DATA DESCRIPTION

Most of the trade literature tend to use annual data, often featuring a small time dimension. We instead use quarterly data from 1980 Q1 to 2004 Q4, as out estimation method requires a large time dimension. Our sample is composed of the EU-15 countries, subdivided into four trading groups: imports of the Euro Area (EA) from Euro Area, of the Non-Euro Area (NEA) from Non-Euro Area, of the NEA from the EA and of the EA from the NEA. We exclude Greece from the EA, since it joined the Euro only in January 2001. As is commonly done, we also group Luxembourg and Belgium as their trade data is confounded over most of our sample period.

The data was obtained from Eurostat, IMF DOTS and IFS. We use Nitsch and Berger (2005) index of european integration instead of dummies for the signing of major treaties. We use the unilateral import volumes as trade data, since our gravity equation is really a demand equation from one country to another. On the other hand, the disadvantage with unilateral trade is that the precision of the estimates will decrease, since two observations of trade volumes will share most of the same regressors. Lastly, we adjusted the data for seasonality when necessary.

5 ESTIMATION METHODOLOGY

Equation (7) flows directly from theory. In order to estimate it, though, we must make some concessions and further simplifications, such that the equation ends up exhibiting the properties assumed by econometric theory. First, it is useful to make some assumptions explicit. To start, we impose the fact that the slope coefficients are equal for all country pairs and over time. Thus, we use a coefficient vector β, instead of what could be a more general $\beta_{i,j,t}$. Second, we have purposefully kept a pair-specific, but time independent effect, $\alpha_{i,j}$ to control for the variables of type common border, common language, common history, similar legal system, distance and others typically included in gravity equations. The advantage of this "agnostic" specification with a pair-dummy (as in Flam and Nordstrm, 2003) is that we cannot leave out a regressor, nor mis-measure it, as is otherwise common with variables such as distance.

The last question to address is whether to incorporate the Anderson and vanWincoop multilateral trade resistance term (labeled $\lambda_{j,t}$ in our specification) which begs a country specific, time varying dummy. We choose to use a pair fixed effects instead of country specific time varying effects (both cannot be used together) for several reasons. First, most of the literature does so[6]. At least, adopting a similar methodology makes our results more comparable. Note that even Rose and van Wincoop (2001) who re-estimate the original Rose (2000) data in light of the Anderson-van Wincoop (2003) work on multilateral trade resistance, use "country-fixed effects in place of the country-specific multilateral resistance terms" (Rose and van Wincoop, 2001, p.6).

Second, the multilateral trade resistance term in fact accounts for the importance of relative trade barriers between countries. When considering just intra-European trade, the adjustment for relative trade barriers is far less important. Third, if a country undertakes actions such as loosening monetary policy and thereby affecting exchange rate volatility with all trading partners for instance, a time varying effect would over-correct the influence of exchange rate volatility on trade. This point is made explicitly in the IMF (2004) survey as one of the criticisms of using country-specific time varying effects.

Finally, in our estimation methodology, we adopt the fixed effects estimator for ease of computation, to maximize the degrees of freedom in our regression and because we are not particularly interested in the coefficients on the country-pair fixed effects (our goal being to detect a break in the main parameters of the model). In addition, using differences from sample mean, as is prescribed by fixed effects estimation, is to our advantage, as it helps stationarize our series.

[6] See, for instance, MSO (2003), Nitsch and Berger (2005), Flam and Nordstrm (2003), Cheng and Wall (2004), Glick and Rose (2001)

6 EMPIRICAL RESULTS

We test whether the introduction of the Euro in 1999 Q1 had a trade effect. We use two model specifications: (G) the gravity model without supply-side (no wages nor interest rates) and (AG) the augmented gravity model exposed in equation (7). All of the results were generated using RATS 6.0. We encountered problems with the inversion of the variance-covariance matrix $\hat{\Sigma}_{n+m}$ (equation (11)). For simplification, we restricted $\hat{\Sigma}_{n+m}$ to be equal to the inner product of the sampled error vectors (i.e. homoskedasticity, no serial nor cross-sectional correlations).

Table 1 shows the different S-statistic values for the different sub-groups which can be compared to the empirical critical values, S_j, at the 5 % and 25 % significance level. Overall the tests results tend to indicate the introduction of the Euro did not create trade effects at the 5 % level for either specification. It is interesting to notice, however, that if the S statistics are generally low, EA - EA and the NEA - EA groups (imports of group j from i) shows an S statistic significant at the 25 % level when using the traditional gravity equation (G) and the significance level drops when augmenting the gravity equation with the interest rates. This suggests that the demand-based only gravity model is mis-specified to explain unilateral trade within the Euro Area, and more importantly that the break in interest rates explains much of the break in trade after the adoption of the Euro.

Table 1. Instability Tests (Break date: 1999 Q1)

Group	Spec.	S	S_j: 5%	S_j: 25%
EA, EA	G	16.3	30.9	16.1
	AG	14.6	27.8	17.2
NEA, NEA	G	0.09	10.3	1.7
	AG	0.4	12.4	4.3
NEA, EA	G	4.7	10	5.8
	AG	3.2	5	11
EA, NEA	G	5.9	11.9	5.3
	AG	4.2	6.3	14.1

Table 2 shows the regression results of the augmented gravity model for the diverse trading sub-groups (imports of group j from i). Both the interest rates (φ_3) and the wages (φ_2) have a qualitatively and statistically important role in the augmented gravity equation, except when analysing the imports of the NEA from the EA. The signs of the interests rates are negative as expected for all 4 regressions. Wages are positive as expected for the EA - EA and NEA - NEA group but negative for the two other. The statistical significance and signs of the European Integration Index (φ_4) and the real exchange rate (φ_5) varies across trading group.

7 FURTHER RESEARCH

We have shown and micro-founded the theoretical importance of the supply-side in the gravity equation. There seems to be evidence in favour of augmenting the traditional demand-based gravity equation with the interest rates and wages. Moreover, we only find weak evidence of a trade effect with the introduction of the Euro, which is dimmed down when augmenting the gravity model with macro-economic considerations. We are currently working on the better adaptation of the Andrews test on panel data, specifically on the variance-covariance matrix $\hat{\Sigma}_{n+m}$, to get more consistent results. Furthermore, we intend to further divide our EA-EA dataset, to see if the trade effect is greater among a set of DM-core European countries. Finally, we may do further tests with export data.

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Table 2. Results for Equation (7)

Group	φ_1	φ_2	φ_3	φ_4	φ_5	φ_6
EA, EA	1.4	0.32	-0.09	0.28	-0.02	0.88
	(42)	(9.3)	(-8.9)	(6.2)	(-1.3)	(31.1)
NEA, NEA	0.14	-0.55	-0.08	2.35	-0.005	1.66
	(0.7)	(-4.3)	(-3)	(11.6)	(-0.1)	(8.4)
NEA, EA	0.86	-0.06	-0.001	0.5	-0.26	1.84
	(21)	(-1.7)	(-0.08)	(4.8)	(-10)	(21.9)
EA, NEA	1.35	0.57	-0.05	-0.08	0.03	0.78
	(14)	(8.8)	(-3.2)	(-1.3)	(3.9)	(18.5)