

ISAE ISTITUTO DI STUDI E ANALISI ECONOMICA

**THE IMPACT OF EURO ON TRADE:
THE (EARLY) EFFECT IS NOT SO LARGE**

by

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ABSTRACT

We investigate the impact of the euro adoption on commercial transactions of EMU countries. We refer to the abundant gravity-model literature about the effect of Currency Unions on trade originated by Rose (2000). We adapt this kind of modelling to the specific case of the European Monetary Union drawing from former literature some guidelines that can be summed up as follows: distinction of “pure” common currency from exchange rate volatility effect; selection of sample of countries strictly focussed on EMU economies; consideration of time as well as space dimension; inclusion of other political factors promoting integration. We add to these provisions the observation that the panel estimation of the gravity equation must be dynamic, because EMU is a young phenomenon, where short run effects, like trade persistence, may play a crucial role.

Our main finding is that the euro adoption has had a positive but not exorbitant impact on bilateral trade of European countries (the estimated percentage increase ranges between 2.6 and 6.3%), much lower than that derivable from Rose’s estimates referred to a larger and heterogeneous set of countries (providing a trade increase following the adoption of a common currency by as much as 200%). Our results refer to short-run impacts; long-run effects could be stronger (but, in our opinion, they certainly are not by the order indicated in the existing literature), particularly if the structural change implied by the new currency regime (intra-EMU trade is potentially equivalent to domestic trade) becomes completely interiorised in the perception and the behaviours of Euroland citizens.

JEL Classification: F4; F15; C230.

Key words: Bilateral, Economic Integration, Dynamic Panel data.

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NON TECHNICAL SUMMARY

Many observers expect, as a side effect of the adoption of a common currency, a boost to the volume of trade among member countries. The argument generally goes as follows: transaction costs and, especially, currency risks constitute a barrier to trade by dampening the volume of exchanges of goods and services that would otherwise take place; hence zeroing these costs and the exchange-rate variability, with the introduction of a unique currency, produces an expansion of cross-border transactions and deeper integration in the monetary area.

This argument probably misses the most important point in the analysis of the trade effects of Currency Unions. The abatement of the variability of exchange rates is only part – and probably not the most relevant one – of the whole story. The same result could be equally obtained with a credible regime of fixed-exchange rates. A Currency Union is, qualitatively, a different thing. It entails a modification of perceptions and expectations of economic agents which end up dealing with an institutional arrangement whose degree of transparency (all prices across member countries are named in the same currency) and of irrevocability/commitment (breaking up a Currency Union is different from breaking up an exchange rate mechanism) is incommensurably larger than that of any fixed exchange rate regime.

This paper investigates the impact of the euro adoption on commercial transactions of EMU countries, trying to specifically disentangle the effects attributable to the annihilation of exchange rate volatility and to other policy factors acting in promoting integration from the influence properly related to the emergence of the European Currency Union.

From the recent literature about the effect of Currency Unions on trade, we extract four main guidelines for our work: 1) distinction must be made between euro adoption and exchange rate variability effects, since the former should entail different implications for the economic agents' behaviours; 2) the sample of countries has to be selected by focussing on the group of economies that entered EMU, so that this case is adequately weighted in the whole sample; 3) time as well as space dimensions must characterise the analysis to be able to address the most relevant policy issues, provided the time dimension includes enough years of the euro experience; 4) an explicit consideration must be made of the political and economic ties between Euroland economies that pre-existed or accompanied the formation of EMU and gave rise to an independent increase of the share of intra-area trade.

Moreover, we take in account the fact that countries that trade a lot with each other normally tend to keep on doing so. Such inertia mainly derives from the sunk costs exporters have to bear to set up distribution and service networks in the partner country, leading to the emergence of substantial entrance and exit barriers. This is largely a short-run effect, but EMU is a young phenomenon,

data refer only to a limited lapse of time and the analysis cannot be other than short-run focussed.

Our main finding is that the adoption of a common currency had a positive but not exorbitant impact on bilateral trade of European countries (which increases following the introduction of the euro by a percentage ranging between 2.6 and 6.3%). This probably because trade links were already tight for several reasons. Trade relationships within Europe, historically intense for cultural and neighbourhood factors, were reinforced during the past 20 years by several (partially overlapping) policy decisions such as the creation of the European Monetary System at the end of the seventies, the institution of the Single Market in the eighties, the adoption of the euro at the end of the nineties. Our quantification of the influence of the euro rank extremely low with respect to the general findings of the literature on Currency Unions (which provides estimates of trade increase up to 200%, following adoption of a common currency). We deem our estimates more plausible and appropriate for the EMU case.

L'IMPATTO DELL'EURO SUL COMMERCIO DEI PAESI UEM: L'EFFETTO NON E' COSI' AMPIO

SINTESI

In questo lavoro si analizza l'impatto dell'adozione dell'euro sulle transazioni commerciali dei paesi dell'UME. Il riferimento teorico è costituito dalla abbondante letteratura, basata sul modello di gravità, originata dal lavoro di Rose (2000), riguardante l'effetto delle unioni valutarie sul commercio. Questo tipo di modellistica viene adattata al caso specifico dell'UME, traendo alcune linee guida che possono essere così sintetizzate: distinzione tra un "puro" effetto unione valutaria e un effetto volatilità del cambio; selezione di un campione di paesi strettamente focalizzato sulle economie UME; considerazione della dimensione sia temporale che spaziale; inclusione di altri fattori politico-istituzionali in grado di promuovere l'integrazione. Si ritiene inoltre che la stima panel dell'equazione di gravità debba essere dinamica: l'adozione dell'euro è un fenomeno molto recente e deve quindi essere considerato nel breve periodo, così come un altro importante effetto, quale il fenomeno di persistenza nel commercio, che può giocare un ruolo importante.

Il principale risultato della verifica empirica è il seguente: l'adozione dell'euro ha avuto un impatto positivo ma non di enorme entità sul commercio bilaterale dei paesi europei (il campo di variazione dell'incremento percentuale stimato varia tra il 2,6 e il 6,3%), molto inferiore rispetto a quello desumibile dalle stime di Rose riferite ad un più ampio ed eterogeneo gruppo di paesi (che indica un incremento di commercio dovuto alla adozione di una moneta comune di circa il 200%). I nostri risultati, riferiti al breve periodo, sembrano più plausibili; gli effetti di lungo periodo potrebbero essere più forti (ma a nostro avviso non dell'ordine di un effetto doppio o triplo indicato nella recente letteratura sulle unioni valutarie), in particolare qualora i cambiamenti strutturali impliciti nel nuovo regime valutario (una parte del commercio estero è potenzialmente equivalente al commercio interno) vengano completamente interiorizzati nella percezione e nel comportamento dei cittadini europei.

Classificazione JEL: F4; F15; C230.

Parole chiave: scambi bilaterali; integrazione economica; panel dinamici.

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1. INTRODUCTION

As widely discussed in the literature on monetary unions, the elimination of national currencies and their replacement with a single (international) currency cause both benefits and costs to countries that give up their monies and their independent monetary policies. The degree of optimality of currency areas depends on the structural characteristics of member economies that make benefits prevail on costs or not. While costs are essentially related to the loss of an important instrument of macroeconomic policy to adjust to asymmetric shocks, benefits mainly deal with potential gains in economic efficiency, several of which deriving from the elimination of both transaction costs, associated with the use of different monies, and uncertainty deriving from fluctuations of exchange rates.

As a side effect of the adoption of a common currency, many observers also expect a boost to the volume of trade among member countries. The argument generally goes as follows: transaction costs and, especially, currency risks constitute a barrier to trade by dampening the volume of exchanges of goods and services that would otherwise take place. Hence, zeroing these costs and the exchange-rate variability with the introduction of a unique currency, produces an expansion of cross-border transactions and a deeper integration in the monetary area.

This vision, although widespread, is not at all undisputed among scholars of monetary unions. Particularly, sceptics underline that, even in a turbulent currency environment, there exist several financial instruments that allow exporters and importers to hedge against exchange risks, so that the potential increase in trade coming from the elimination on national currencies, is at best small. The counterargument, is that hedging against exchange rate risks cannot be complete and it is, at any rate, costly, especially for small-size exporting firms that typically do not have sufficiently developed financial branches able to efficiently manage the risk in currency markets.

These disputes, focused exclusively on the abatement of the variability of exchange rates, may miss the most relevant point in the analysis of the trade effects of Currency Unions. As a matter of fact, the elimination of uncertainty is only part – and probably not the most relevant one – of the whole story. The same result could be equally obtained through a credible regime of fixed exchange rates. A Currency Union is, qualitatively, a different thing. It entails a modification of perceptions and expectations of economic agents which end up dealing with an institutional arrangement whose degree of transparency (all prices across member countries are named in the same currency) and of

irrevocability/commitment (breaking up a Currency Union is different from breaking up an exchange rate mechanism) is incommensurably larger than that of any fixed-exchange-rate regime. As a consequence of these important peculiarities, a significant fraction of foreign trade of the countries adopting a common currency may become, to the eyes of economic agents, equivalent to domestic trade. In this perspective discussions of the repercussions of monetary unions on trade acquire quite a different qualification.

This paper investigates the impact of the euro adoption on commercial transactions of EMU countries, trying to specifically disentangle the effects attributable to the annihilation of exchange rate volatility, and to other policy factors acting in promoting integration, from the influence properly related to the emergence of the European Currency Union. Section 2 surveys the empirical literature on Currency Unions and trade, largely developed over the past few years, in which our paper is inserted and from which the main general indications and methodological instruments for the analysis are drawn. Sections 3 and 4 expose the characteristics of the model adopted. Illustration and discussion of the results of the estimates are made in Section 5. Conclusions are reported in Section 6.

2. CURRENCY UNION AND TRADE: A SURVEY OF THE EMPIRICAL LITERATURE WITH AN EYE TO THE EMU

Despite widespread convictions that exchange rate volatility dampens trade, scant empirical evidence has been produced to support this view until the mid-nineties. The results of these older studies generally showed a relation between exchange rate and trade either with the “wrong” sign (e.g. Brada and Mendez, 1988), or statistically insignificant (e.g. Belanger et alii, 1992) or at best weak (e.g. Frankel and Wei, 1993).

Given the rather inconclusive state of the literature, great attention was paid at the beginning of this decade to the seminal work of Rose (2000) who - explicitly considering in a gravity model the effect of common currency distinct from that of exchange rate variability - found an extremely large positive impact of Currency Union on trade: according to his estimates, two countries sharing a common currency trade three times as much as they would with different currencies. Such a striking result remained substantially unchallenged in a conspicuous set of subsequent sensitive analysis aimed at checking the robustness of the finding to different specifications and methods of estimation of the basic equation (Rose 2001; Frankel and Rose 2001; Rose and Engel 2000).

Having the goal to test the effect on trade of the most ambitious experiment of Currency Union ever tried – since such is the EMU experiment – the obvious question is to what extent these findings are relevant to infer on the consequences of the euro on the transactions between Euroland economies. Quite disappointingly, the answer is "not much". Although there is no benchmark from this literature, the magnitude of the effect proposed in this new vintage of studies (a tripling impact!) seems implausibly large in general and, in particular, for the peculiar experience of EMU countries.

Starting from the general implausibility of the effect, several authors have criticised under different points of view these original findings¹ and tried to obtain (among them, Rose himself) lower estimates. We go through this literature with a special eye to the EMU case, picking up the contributions that seem most promising in shedding light on how to proceed to detect the impact of the euro which is a more limited case (and a special case as we will see) than the common currency effect considered in Rose's universe². In what follows, we try to single out some major directions of route that prove useful for subsequent analysis.

Heterogeneity of the sample countries

The sample of countries in the dataset of Rose (2000) was extremely heterogeneous. It included 186 countries, dependencies, territories, overseas departments, colonies and so forth: there was a number of Currency Unions comprising one large and developed country with a number of much smaller countries or territories. It is a world completely different from that represented by the subset of European countries that gave rise to the European Monetary Union. As stressed by Lockwood (2000) and Rose (2000), it is not possible to extrapolate relevant information about the trade repercussions of the euro from this kind of sample³. We derive from these observations that, to infer the impact of the euro on the transactions of EMU countries it is necessary to refer to a sample somewhat narrowly defined around a core consisting of the Euroland economies.

¹ SEE, for example, Lockwood (2000) and Quah (2000), the report of the general discussion on Rose (2000) and Persson (2001)

² Limiting the field of observation to the euro area only, we avoid some of the criticism to Rose's works, like those concerning the aggregation bias (see Levy Yeyati, 2001). For a recent survey of the empirical works on the topic of monetary union, see Rose (2002).

³ This is for example a criticism carried out by Lockwood (discussion on Rose, 2000), but Rose himself said that "In 330 observations two countries trade and use the same currency. Many of the countries involved are small, poor, or both, unlike most of the EMU-11. Thus, any extrapolation of my results to EMU may be inappropriate since most currency union observations are taken from countries unlike those inside Euroland", see Rose (2000), p. 15.

Time versus spatial dimension

Rose (2000) exclusively focused on a spatial dimension. He estimated a gravity equation on a very ample cross-section of countries; the large estimate of the common-currency parameter measures the variation of trade between member countries of a Currency Union with respect to trade between countries that maintain their national monies. But, as underlined by Rose (2002), a time-series rather than a cross- cross-section approach would allow to address the more relevant policy issue of the measurement of the variation of trade of countries before and after the creation (or the destruction) of a monetary union, As a matter of fact, this is precisely the issue we want to deal with when testing the consequences of that very specific and (up to now) short-lived Currency Union which is the EMU. However, not to loose the equally important information conveyed by the spatial dimension, the best strategy to follow seems to be, even in the case of EMU, resorting to panel estimations.

Working with panel estimates generally allows to treat properly all the time-invariant (but space-variant) factors. Rose (2000), working on cross-section data, considers a set of space (geographical, cultural and historical) factors that are actually independent of time. Yet, in spite of the many time-invariant variables one adds to the regressors, there always remains the possibility to omit some, which are difficult to proxy, thus seriously running the risk of a spurious regression. Conversely, in the case of panel estimation, a fixed-effect method allows to control for all the possible time-invariant factors specifically affecting bilateral trade of each pair of countries, including those factors for which it would be impossible to find an explicit approximation⁴.

Rose (2000)⁵ noted that a fixed-effect estimation would in many ways be preferable to estimation techniques based on cross-sectional evidence; the very

⁴ Besides, the fixed-effect estimation also allows to avoid a number of problems of misspecification created by the measure of geographical distance. This problem is well known in empirical works adopting gravity equation. Distance can be a poor measure of transport costs. Usually, it is measured by miles or kilometres between two single points, i.e. the capital cities, under the implicit assumption that all citizens concentrate in the capital; trading costs are quite different if people are spatially distributed within the country. Recently, Melitz (2001) has demonstrated that a measure of distance can reflect comparative advantages. The latter depends on differences in climate and seasons, factors that are simply reflected in differences in latitude between countries. If this holds true, it is not clear which sign is expected for this variable: an increase in distance might raise, not diminish, trade, if differences in comparative advantage prevail. A fixed-effect estimation allows to bypass this kind of problems, including distance in bilateral constant term.

⁵ See Rose (2000).

few regime changes in his data (countries entering or leaving common currencies) did not enable him to adopt this method⁶.

Resorting to a different dataset – a panel whose time series go back to 1948 – and to a modified specification of the gravity equation, Glick and Rose (2002) obtain, with a fixed-effect method, the reduction by about one third of the original threefold-trade-increase estimation.

Distinguishing common currency from other “political” effects

Lower and more plausible estimates of the trade effect of common currency require a keen separation of the Currency Union from other political factors, whose influence on trade may get improperly confused with that of the single-currency. Melitz (2001), using the heterogeneous dataset of Rose (2000) and making a distinction between the different political effects, came to a lower quantification of the impact of Currency Union that would raise trade by a factor of 2 (rather than 3). This result was basically obtained distinguishing Political Union and Free Trade area from the currency-union effect. The rationale for this differentiation is apparent: in general, countries that tend to form a monetary union already enjoy particularly close trade or political ties. When not controlling for these links, (most) part of the coefficient of a Currency Union variable is likely to catch the influences attributable to other political factors.

In the already-mentioned study, Glick and Rose (2002) separated a “*within*” from a “*between*” estimate for the impact of common currency: the former relates to the effect of entry into (or exit from) Currency Union for a specific country pairs; the latter concerns cross-section or different pairs. While the former does not mix a Currency Union effect up with political-ties or close-trade effects, the latter can be supposed to do so. The results of the “*within*” estimate showed a smaller influence of currency (a twofold increase of trade), in line with the findings of Melitz (2001).

On a rather different ground, Rose and Van Wincoop (2001) considered the cases of new Currency Unions between countries that already trade a lot with each other, as it in the case of EMU economies. Introducing a multilateral-trade-

⁶ Probably for this reason, the results addressed by Pakko and Wall (2001) might be biased. In fact, they start from the original dataset adopted in Rose (2000); using trading pair specific fixed effects to control for time-invariant factors, they show an opposite result: a common currency may lead to significant reductions in trade; indeed, this result is statistically insignificant. The authors point out that “..the pooled cross section estimates are not reliable because they are biased by the exclusion or mis-measurement of trading pair-specific variables”. This is probably true, but the original Rose’s dataset shouldn’t permit to apply this estimation method.

resistance index, drawn from Anderson and Van Wincoop (2001), which varies positively with the intensity of trade barriers between each country and with all its trading partners, the authors estimate an increase by “only” 59% in trade between Euroland members: a significantly smaller impact than previous estimates, but, still, a large effect.

3. SHORT TERM DYNAMICS IN EUROLAND TRADE: THE “PERSISTENCE EFFECT”

From the former discussion we extract four main guidelines for our work:

- 1) distinction must be made between euro adoption and exchange rate variability effects, since the former should entail different implications for the economic agents' behaviours;
- 2) the sample of countries has to be selected by focusing on the group of economies that entered EMU, so that this case is adequately weighted in the whole sample;
- 3) time as well as space dimensions must characterise the analysis to be able to address the most relevant policy issues, provided the time dimension includes enough years of the euro experience;
- 4) an explicit consideration must be made on the political and economic ties between Euroland economies that pre-existed or accompanied the formation of EMU and gave rise to an independent increase of the share of intra-area trade.

Before facing estimation issues, a further observation should be added to the former guidelines in order to better adapt the findings of the literature to the special monetary union we are dealing with. When considering the time dimension, one should not forget that EMU is quite a young phenomenon. The European common currency replaced the member countries' national currencies on January 1, 1999, even though only in a “virtual” form⁷. Taking into consideration that “irrevocable” decisions concerning the “euro club” founding members, their exchange rates and their macroeconomic policies were taken in 1997, at best it is possible to scale the beginning of the influence of the (future) new common currency back to 1998. Given the novelty of EMU, traditional static gravity models, that generally deal with long-run relationships, do not fit well to interpret the repercussions of the euro. To this aim, we need to make the gravity equation more short-run oriented, by explicitly introducing dynamics, controlling for the lagged effects of the dependent variable and detecting the

⁷ The single currency was officially introduced on January 1, 2002.

short-term influences of the euro and of all other variables affecting bilateral trade in Euroland.

Indeed, “short run” can be generally very relevant in trade analyses, since countries that trade a lot with each other normally tend to keep on doing so. Such inertia mainly derives from the sunk costs exporters have to bear to set up distribution and service networks in the partner country, leading to the emergence of substantial entrance and exit barriers (see Eichengreen and Irwin, 1996). This sticky behaviour seems all the more important in the EMU case, where trade relationships are affected not only by past investments in export-oriented infrastructures, but also by the accumulation of invisible assets such as political, cultural and geographical factors characterising the area and influencing the commercial transactions taking place within it. It is worth noticing that, notwithstanding the general importance of the “persistence effects”, quite few studies, based on a panel estimation of gravity equations, have considered the possibility to control for them (among the few, see Egger, 2000, De Grauwe and Skudelny, 2000; Bun and Klaassen, 2002)

4. MODEL AND DATASET

The estimation methodology adopted is hence a dynamic panel data approach. We consider 11 exporter countries (European countries now joining the euro, data for Belgium and Luxembourg aggregated) and 30 importer countries (the 11 euro countries plus 19 other countries⁸). The estimate refers to the period 1980-2000.

The introduction of dynamics in a panel data model raises an econometric problem. If trade is a static process, the “*within*” estimator (fixed-effect estimator) is consistent for a finite time dimension T and an infinite number of country-pairs N . But if trade is a dynamic process, the estimate of a dynamic panel such as our model (a static one with the lagged dependent variable) is more difficult. The reason is that the transformation needed to wipe out the country-pair fixed effects⁹ leads to correlation between lagged dependent variable and the transformed error term that (for a finite T and an infinite N) renders least square estimator biased and inconsistent.

⁸ They are: Argentina, Australia, Brazil, Canada, China, Czech Republic, Korea, Hong Kong, Japan, Mexico, Norway, Poland, Romania, Russia, Sweden, Switzerland, Turkey, United Kingdom, United States.

⁹ The “*within*” estimator consists of removing the country-pair effects by taking deviations from country-pair means and then applying least squares on the centered variables.

There are alternative estimators to bypass this inconsistency problem¹⁰. We focus on that proposed by Arellano and Bond (1991). They suggest to transform the model in first differences and run it by using the Hansen two-step generalised method of moments (GMM) estimator. First differencing the equation removes the random effects that are independent and identically distributed over the individuals, and produces an equation that is estimable by instrumental variables¹¹.

We are interested in distinguishing the “pure” Currency Union effect on trade from other political effects (free trade area, exchange rate volatility) that are specific to the case of EMU. To this aim, two distinct monetary variables were considered: a measure of exchange rate volatility and a dummy variable for countries that adopted the euro¹². Our assumption is that countries sharing the same currency have an additional positive effect on trade with respect to countries sharing a fixed-exchange-rate regime. *De facto*, the assumption is that a common currency can affect trade by the elimination of exchange rate volatility and by another, different influence that we might call “Currency Union” effect, the latter including a structural change in the perception of agents due to the irreversible choice of adopting a common currency¹³. Since exchange rate volatility between Eurozone countries was reduced during the last decade thanks to the EMS and, lately, to the convergence process leading to the common currency, the distinction between the two effects seems important. Beside, the specific effect on trade deriving from bilateral free trade agreements is taken into account introducing a dummy variable to this scope.

The estimated equation is:

$$\Delta \ln(\text{Exp}_{ijt}) = b1 \ln(\text{Exp}_{ijt-n}) + b2 \Delta \text{EURO}_{ijt} + b3 \Delta \text{VOL}_{ijt} + b4 \Delta \text{FTA}_{ijt} + b5 \Delta \ln(\text{MASS}) + b6 \Delta \text{RFE} \quad (1)$$

where:

\ln is the natural logarithm, i is the exporter country, j is the importer country and t is the year, n is a lag structure for the dependent variable;

¹⁰ See Baltagi (2001).

¹¹ Arellano and Bond (1991) identified how many lags of the dependent variable and of the pre-determined variables were valid instruments and how to combine these lagged levels with first differences of the strictly exogenous variables into a potentially very large instrument matrix

¹² Considering that countries decided to join the single currency in May 1998, we consider that year as the start of the common currency period.

¹³ “Sharing a common currency rate is much more serious and durable commitment than a fixed rate”, see Rose (2000), pp. 10-11

Exp_{ijt} are the exports in volume from country i to country j ;

$EURO_{ijt}$ is a dummy variable describing the adoption of the same currency by the 11 European countries: it assumes value 0 for trade between all the pairs of countries in which at least one is not member of EMU, and value 1 for trade between Eurozone countries from 1998 to 2000; in doing so, we assume that the euro started to exert its influence in 1998, before its actual introduction, after decisions were taken (in 1997) about the countries entering the union and endorsing the commitments on exchange rates and macroeconomic policies.

VOL_{ijt} is the exchange rate volatility between countries i and j at time t ; it has been measured by the standard deviation of the first-difference of monthly natural logarithm of the bilateral nominal exchange rate at the current year t .

FTA_{ijt} is a dummy variable that assumes value 0 for absence of free trade agreement or custom unions, 1 if these agreements are present

MASS is the bilateral real GDP of a country pair, as in traditional gravity applications, where

$$MASS = \ln(GDP_{it} \times GDP_{jt})$$

GDP_{it} is the gross domestic product in volume of exporter country, GDP_{jt} is the gross domestic product in volume of importer country;

RFE is an index for relative factor endowments, proxied by *per capita* GDP (GDPPC). The index takes the following form:

$$RFE = \left| \ln(GDPPC_{it}) - \ln(GDPPC_{jt}) \right|$$

with $RFE \geq 0$; The index takes its minimum for countries with identical factor endowments.

The sources of these variables are showed in Table A1 in the Appendix.

Bilateral export flows were expected to be positively influenced by:

- a) the euro effect. We expect a positive effect of the euro adoption on trade: considering historical trade relationships between European countries, we expect a smaller impact compared to Rose's results.
- b) the product of GDPs of exporter and importer countries (i.e. the sum of their values expressed in logs); in gravity models, trade flows are positively influenced by the dimensions of the origin and destination countries ("mass effect"), proxied by GDP.

- c) the presence of custom unions or bilateral free trade agreements. Considering all the European countries joining the euro, the implementation of a Single Market should have caused an important effect on bilateral trade within the area. On the other hand, in the period under examination, European countries have signed regional trade agreements with most non-European countries of our dataset. We expect an economically large impact on trade from this variable.
- d) the lagged endogenous variable. Trade relationships between industrialised countries and, in particular, among European countries, have been characterised by very tight economic and political links. We expect that countries trading a lot with each other continue to do so, thus reflecting entrance and exit barriers due the sunk costs.

Bilateral export flows were expected to be negatively correlated

- e) with the exchange rate volatility indicator. We expect an increase in bilateral trade when uncertainty regarding bilateral exchange rate fluctuations diminishes¹⁴.
- f) with the RFE index. This index is a proxy of differences in factor endowments: a negative correlation with bilateral trade indicates that countries with similar levels of development (small value of the index), like those in our sample, trade a lot, reflecting the importance of intra-industry trade; the correlation could indeed be positive if the sample included economies characterised by very different levels of development and predominance of inter-industry trade.

5. THE RESULTS

Arellano and Bond (1991) propose a test of the hypothesis that there is no second-order serial correlation in the disturbances of the first differenced equation. This is a necessary condition for a valid instrumentation; if it is confirmed, then the GMM estimator is consistent. A test for the hypothesis that there is no first order serial correlation is also reported: the rejection of the null hypothesis (i.e. the presence of first order serial correlation) indicates the inconsistency of the OLS estimator.

Table 1 reports the results of these tests and the estimates of the equation by the Arellano-Bond procedure. The tests show the consistency of the GMM estimator and the inconsistency of the OLS procedure. Hence, by introducing dynamics,

¹⁴Among more recent works, also De Grauwe and Skudelny (2000) find a negative relationship between the variance of nominal exchange rate and trade.

the proper estimation method is the former¹⁵. A test of over-identification (Sargan test) is also reported: the statistic shows that the hypothesis that all moment restrictions are satisfied for dynamic specification is not rejected at 5% significance level.

Table 1

Estimation results

Dependent variable: Total-EMU countries' bilateral exports

Time period: 1980-2000

Lnexp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
EXP _{IT-1}	.3791956	0.021174	17.91	0	0.337695	0.420697
EXP _{IT-2}	.059718	0.014563	4.1	0	0.031174	0.088262
EXP _{IT-3}	.0313784	0.012558	2.5	0.012	0.006765	0.055992
VOL _{IT}	-.2887072	0.043723	-6.6	0	-0.3744	-0.20301
MASS	.6711997	0.051214	13.11	0	0.570823	0.771577
RFE	-.1874568	0.094771	-1.98	0.048	-0.3732	-0.00171
FTA	.1577987	0.027919	5.65	0	0.103079	0.212519
EURO	.0610236	0.026971	2.26	0.024	0.008161	0.113886
_const	.0038835	0.003836	1.01	0.311	-0.00364	0.011402

Sargan test of over-identifying restrictions:

$$\chi^2(184) = 280.73 \quad \text{Prob} > \chi^2 = 0.0000$$

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:

$$H_0: \text{no autocorrelation} \quad z = -1.98 \quad \text{Pr} > z = 0.0473$$

Arellano-Bond test that average autocovariance in residuals of order 2 is 0:

$$H_0: \text{no autocorrelation} \quad z = -0.12 \quad \text{Pr} > z = 0.9063$$

¹⁵ Bun and Klaassen (2002) show that trade is a dynamic process and that panel gravity models should allow for that; they also show that, for a T large, the LSDV estimator is a better tool than the GMM one. In other words, there is a consistency problem but also a bias problem. For T large, the bias of the GMM estimator is higher than that of the OLS one. In their sample T=48, we have a T=21. It is well known that the bias increase when T becomes smaller. For a smaller T than in the Bun and Klaassen dataset, the bias will be higher for both estimators. We are interested to the relative bias. We know that finite sample bias of the GMM estimators increase as the number of momentum conditions gets larger, in other words, as T gets larger. It is reasonable to suppose than for a T smaller than the Bun and Klaassen dataset, the bias of the GMM will be lower than their figure and the bias of the OLS estimator is higher. To evaluate with more precision the accuracy of the estimators, a Monte Carlo experiment should be performed.

All the regressors are statistically significant and show the expected sign. In particular, the positive impact of the euro adoption is confirmed, as is the negative influence of bilateral exchange rate volatility and the positive effect of being part of a free trade agreement.

Let's have a closer look at the three different kinds of "political" influences (so defined because their values depend on political decisions). As currency variability, a hypothetical reduction of exchange rate volatility between Euroland countries and their partners by one standard deviation around its mean would increase total bilateral trade of Eurozone countries by around 4%.¹⁶ Belonging to a free trade area or to a custom union increases total exports of the Eurozone countries (on average) by 17%¹⁷. After controlling for these two factors, the "pure" effect on total EMU trade produced by the euro adoption is an increase of 6.3%¹⁸; since no other country in our sample is member of a monetary union, such an effect ends up coinciding with the increase of intra-EMU trade following the euro introduction. This result seems more reasonable than the previous ones obtained on the grounds of quite heterogeneous samples of nations.

On the whole, the estimated parameters seem to confirm our priors: the adoption of a common currency had a positive but not exorbitant impact on the bilateral trade of European countries. This probably because trade links were already tight for several reasons. Trade relationships within Europe, historically intense for cultural and neighbourhood factors, were reinforced during the past 20 years by several (partially overlapping) policy decisions as the creation of the

¹⁶ We perform the same simulation exercise proposed by Rose (2000). It consists of reducing VOL, the variable measuring the exchange rate volatility, by an amount equal to its standard deviation. Being the standard deviation of VOL 0.137295 (with a mean of 0.6435) and the estimate of its parameter -0.2887 , the increase of trade following the fall of VOL by its standard deviation, i.e. $[(\text{EXP}_{\text{reducing VOL by one standard deviation}}/\text{EXP})-1]\times 100$, is given, *coeteris paribus*, by $[(e^{-0.2887 \times (\text{VOL}-0.1372)}/e^{-0.2887 \times \text{VOL}})-1]\times 100$ and therefore by $[e^{(-0.2887)(-0.1372)}-1]\times 100$; since $e^{(-0.2887)(-0.1372)}=e^{0.03964}=1.0404$, the increase in bilateral trade following a reduction of volatility from one standard deviation to zero is around 4%.

¹⁷ Since the parameter of the dummy FTA is 0.1577, the variation of trade induced by being part of a trade agreement (FTA=1) with respect to the case of not being part of any agreement (FTA=0), i.e. $[(\text{EXP}_{\text{being part of a trade agreement}}/\text{EXP}_{\text{not being part of any trade agreement}})-1]\times 100$, is given, *coeteris paribus*, by $[(e^{0.1577 \times 1}/e^{0.1577 \times 0})-1]\times 100=17.09\%$

¹⁸ Since the parameter of the euro dummy is 0.061, the variation of trade induced by being part of EMU (EURO=1) with respect to the case of not being part of EMU (EURO=0), i.e. $[(\text{EXP}_{\text{being part of EMU}}/\text{EXP}_{\text{not being part of EMU}})-1]\times 100$, is given, other things being equal, by $[(e^{0.061 \times 1}/e^{0.061 \times 0})-1]\times 100=6.29\%$. This coincides with the average increase of intra-EMU trade both with respect to all countries that are not part of EMU and with respect to the trade of the EMU countries themselves considered before the creation of the monetary union.

European Monetary System at the end of the seventies, the institution of the Single Market in the eighties, the euro adoption at the end of the nineties. Taking the estimates of the policy parameters at their “face value”, one is led to attribute the largest impact on EMU transactions to the implementation of the Single Market (though the estimated effect also includes the influence of minor bilateral trade agreements with third countries outside Europe concluded in that period): the impact of the FTA dummy on trade is significantly higher than that of the EURO dummy and that of the exchange rate volatility.¹⁹

The lagged dependent variable is statistically significant until a 3-period lag; the value of the coefficient shows the importance of the “persistence effect”.

The other “gravity” variables are generally in line with the expectations and the “tradition” of this kind of modelling. Trade directly varies with the size of importers and exporters and indirectly with the differences in *per capita* GDP of trading economies; the latter evidence seems to confirm the prevalence of intra-industry trade between industrialised countries.

The impact of the euro on the EMU trade, obtained in this estimation, measures the variation of transactions of EMU economies with respect to:

- 1) transactions with non-member countries;
- 2) transactions of EMU countries themselves before they entered the “euro club”. Such a variation has hence both a spatial and a time dimension, with the complication that the latter includes a comparison with both EMU economies (for which there is a change in the currency regime in 1998) and non-EMU countries (for which there is no change in currency regime during the relevant time interval).

To have an evaluation of the effects of the euro on intra-EMU trade before and after the adoption of the single currency, we have re-estimated equation (1) considering a sub-panel only comprising EMU variables; hence, the dependent variable in this estimation is represented by intra-EMU exports. Results are shown in Table 2. Attention is drawn on the differences, compared with the estimation made on the whole panel, of the dimension of the so-called policy parameters (euro, Exchange rate volatility, FTA) and of the parameter of the lagged dependent variable. Starting from the latter, the lagged dependent variable shows a higher coefficient than in the complete-panel regression. This probably reflects the structurally tighter intra-area trade links that are mirrored in a higher degree of inertia in trade flows.

¹⁹ It is worth noticing that the dimension of the exchange rate volatility parameter is in line with that found by De Grauwe and Skudelny (2000) in their first difference estimation.

Table 2

Estimation results

Dependent variable: Intra-EMU countries' bilateral exports

Time period: 1980-2000

LnexpEU	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
EXP _{IT-1}	0.638625	0.013505	47.29	0	0.612155	0.665095
VOL _{IT}	-0.6832	0.102555	-6.66	0	-0.88421	-0.4822
MASS	0.521753	0.022367	23.33	0	0.477915	0.565591
RFE	-0.10094	0.025637	-3.94	0	-0.15119	-0.0507
FTA	0.059221	0.007416	7.99	0	0.044687	0.073755
EURO	0.025713	0.005209	4.94	0	0.015503	0.035922
_const	0.000895	0.000273	3.27	0.001	0.000359	0.001431

Sargan test of over-identifying restrictions:

$$\chi^2(189) = 1840.22 \quad \text{Prob} > \chi^2 = 0.0000$$

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:

$$H_0: \text{no autocorrelation} \quad z = -6.29 \quad \text{Pr} > z = 0.0000$$

Arellano-Bond test that average autocovariance in residuals of order 2 is 0:

$$H_0: \text{no autocorrelation} \quad z = -0.46 \quad \text{Pr} > z = 0.6439$$

Conversely, coefficients of the policy parameters favouring integration generally lead to estimate smaller impacts than in the complete-panel-regression case: this may be explained by the fact that variations are measured with respect to a “base” already characterised by a significant degree of commercial integration, higher than that denoting the larger panel. As for exchange rate volatility, the larger dimension of the parameter than in the previous estimate is more than offset by the lower variability of the variable, so that the impact of a currency volatility reduction gives rise to a very modest gain in intra-area trade: a volatility fall by one standard deviation around its mean would have increased on average intra-EMU trade by 0.8%²⁰. In evaluating this figure one has to consider that this kind of exercise is counterfactual: it gives an indication of

²⁰ The standard deviation is 0.01168 (with simple mean 0.00452) and the estimate of the coefficient is -0.6832 . Replicating the former exercise the increase of bilateral trade following the reduction of VOL by its standard deviation, i.e. $[(\text{EXP}_{\text{zeroing the standard deviation of VOL}}/\text{EXP}) - 1] \times 100$, is given, *coeteris paribus*, by $[(e^{-0.6832 \times (\text{VOL} - 0.01168)} / e^{-0.6832 \times \text{VOL}}) - 1]$ and hence by $[e^{(-0.6832)(-0.01168)} - 1]$; since $e^{(-0.6832)(-0.01168)} = e^{0.00798} = 1.0080$, the increase in bilateral trade produced by a fall of volatility from one standard deviation to zero is around 0.8%.

“what it would be like” compared to “what it actually is”. In the case of EMU countries, bilateral exchange rate variability has been much lower than general volatility (in our panel it has been lower by a factor of 12), mainly because of the EMS functioning and, more recently, the process of macroeconomic convergence to meet the criteria to enter the monetary union. Given this evolution, the extra gain in trade from a further fall of exchange rate variability is necessarily limited.

As far as the FTA dummy variable is concerned, in the EMU sub-panel it basically reflects the progressive enlargement of the European Union to new countries. Compared with the large- panel regression, the parameter dimension shows a smaller impact (by a factor slightly less than 3): according to this estimate, the effect on intra-area trade is 6.1%²¹.

Finally, the coefficient for the EURO dummy is positive and statistically significant. Also in this case, the magnitude of the parameter is lower than in the estimate conducted on the complete panel. The adoption of the common currency, controlling for all the other factors, would have induced an intra-area trade increase by 2.6% with respect to the previous period²². This figure compares with the one obtained in the estimate conducted on the large panel (6.3%) which included both the time-dimension impact referred to the only intra-EMU trade and the space-and-time-dimension effect relative to trade with non-EMU countries.

²¹ The parameter of the dummy FTA is 0,059221, the variation of intra-EMU trade induced by the single, i.e. $[(\text{EXP}_{\text{after single market}} / \text{EXP}_{\text{before single market}}) - 1] \times 100$, is given, *coeteris paribus*, by $[(e^{0.059221 \times 1} / e^{0.059221 \times 0}) - 1] \times 100 = 6.1\%$.

²² Given the parameter of the dummy euro whose value is 0.025713 the variation of intra-area trade induced by the creation of EMU – i.e. $[(\text{EXP}_{\text{after EMU}} / \text{EXP}_{\text{before EMU}}) - 1] \times 100$ – is given by $[(e^{0.025713 \times 1} / e^{0.025713 \times 0}) - 1] \times 100 = 2.6\%$. This represents the increase of intra-EMU trade with respect to the situation of intra-area transactions before the adoption of the common currency.

6. CONCLUDING REMARKS

The goal of the paper is to estimate the impact of the euro adoption on trade of EMU countries. To this aim we referred to the abundant gravity-model literature originated by Rose (2000) which has provided estimates of the rise of trade due to the emergence of a Currency Union by a factor varying between 1.6 (i.e. 60%-increase) and 3 (i.e. 200%-increase). These figures seem to us implausibly large, even considering the lower end of the range, for the EMU case.

To adapt the gravity model to the specific case of the European Monetary Union, we draw some general guidelines from the literature that can be summed up as follows:

- distinction of “pure” common currency from exchange rate volatility effect;
- sample of countries strictly focussed on EMU economies;
- time as well as space dimension;
- consideration of other political factors promoting integration.

We add to these provisions the observation that the panel estimation of the gravity equation must be dynamic, because EMU is quite a young phenomenon, where short run effects, like trade persistence, may play a crucial role; this is particularly the case for European economies where persistence in commercial transactions is not only induced by physical investments in distribution and service networks, but also favoured by such “intangible” factors as policy, history, culture.

We performed two kinds of estimations to quantify the euro effect on the EMU trade. In the former, we calculate the variation of EMU trade with respect to both the intra-EMU trade before the introduction of the common currency and the EMU trade with other economies that do not share the European currency. Other things being equal, the euro causes an EMU trade increase by 6,3%; since the sample only includes the EMU case as monetary union, this rise coincides with an increase of intra-EMU trade. With the latter estimation we aim at exclusively detecting the variation of intra EMU-trade before and after the euro adoption. Not surprisingly, the more limited scope of the exercise leads to a lower impact estimate: this mainly depends on the fact that the trade variation is measured with respect to a “base” characterised by an already high degree of trade integration (i.e. intra-EMU commercial transactions). According to this latter estimate - other things being equal - the euro has induced an increase of intra-EMU trade by 2,6% with respect to the behaviour of this kind of trade in the period before the euro adoption.

In conclusion, the order of magnitude of the positive euro effect on the EMU trade we have obtained seems more plausible than the (very large) measures proposed in a literature not specifically focusing on the EMU experience. One has to consider that, since we deal with dynamic panel estimation, our results mainly refer to short-run impacts; long-run effects might be stronger (but in our opinion they certainly are not by the order indicated in the existing literature), particularly if the structural change implied by the new currency regime (intra-EMU trade is potentially equivalent to domestic trade) becomes completely interiorised in the perceptions and the behaviours of Euroland citizens.

ANNEX 1

Table. A1

Variables	Source	Available years
Bilateral exports flows (US million \$)	International Monetary Found, Direction of trade statistic database	1980-2000
Export deflator	Economist Intelligence Unit	1980-2001
GDP at costant price (billion US \$ at 1996 prices)	Economist Intelligence Unit	1980-2001
Free Trade Agreement	WTO, Mapping of regional Trade Agreement, available at http://www.wto.org/english/tratop_e/region_e/region_e.htm	1980-2001
Bilateral exchange rate	International Monetary Found, International Financial Statistic database	1980-2001
GDP per head (US \$ at PPP)	Economist Intelligence Unit	1980-2001

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