Zooming Out:
The Trade Effect of the Euro in Historical Perspective

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Abstract

In this paper, we put the trade effect of the euro in historical perspective. Using a data set that includes 22 industrial countries from 1948 to 2003, we find strong evidence of a gradual increase in trade intensity between European countries over time. Once we control for this trend in trade integration, the euro's impact on trade disappears. Moreover, a significant part of the trend in European trade integration is associated with measurable policy changes in areas such as exchange rate policy and institutional integration.

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1. Introduction

On January 1, 1999, eleven countries formed the European Economic and Monetary Union (EMU); they formally abandoned their national currencies and adopted a new currency, the euro.[1] A number of recent papers argue that the formation of the EMU has had a sizable effect on the member countries' pattern of international trade. Micco, Stein, and Ordoñez (2003, henceforth MSO), for instance, find that for pairs of countries that have adopted the euro, trade has increased by about 4-16 percent. Other papers, including Baldwin, Skudelny, and Taglioni (2005), Barr, Breedon, and Miles (2003), Bun and Klaassen (2002), De Nardis and Vicarelli (2003), De Sousa and Lochard (2004), Faruqee (2004), and Flam and Nordström (2003), report broadly similar, and often even larger, estimates. Baldwin (2006) provides an extensive summary of the literature.

While much of this work should be taken with caution (given that, at this early stage, only a few years of data from the EMU period are available)[2], the finding that the introduction of the euro has a positive and significant effect on intra-EMU trade has attracted considerable attention – for at least two reasons. For one thing, the result has important policy implications. If a common currency immediately benefits trade even among highly integrated economies, currency unions become more attractive. For instance, countries that are currently considering joining EMU may, as a result, opt for an early adoption of the euro.

[1] The countries are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. As twelfth member country, Greece joined EMU on January 1, 2001. All of our empirical results refer to the original eleven EMU members (with joint data for Belgium and Luxembourg); we get qualitatively similar results when we use EMU-12 instead.

[2] The sample period that is analyzed in these papers typically extends through the end of 2002. At that time, EMU had been in existence for four years. However, since the euro was not introduced as a physical currency before January 1, 2002, the sample period often covers only a single year of data from when the new currency was actually in circulation.

A more general implication is that a positive trade effect of the euro – even if initially moderate in magnitude – would appear to provide strong empirical support for Andrew Rose's (2000) finding that establishing a common currency significantly increases trade among union members.[3] Rose's original finding was met with great skepticism. Critics noted, for instance, that his conclusions were drawn from a sample of currency union members that mainly consists of extremely small, poor and highly dependent territories and therefore might not apply to other economies.[4] The formation of the EMU, then, allows addressing at least some of the objections: it presents one of those rare "natural experiments" that permits analyzing the impact of the introduction of a common currency on trade between large, developed and independent nations.[5]

In this paper, we take a fresh look at the evidence on the euro's effect on trade. In particular, we argue that the potential trade-creating effects of the EMU must be viewed – and analyzed – in the proper historical perspective. Rather than focusing on the formation of a monetary union as an isolated event, we emphasize that the creation of the EMU was a continuation, or perhaps a culmination, of an integration process that started almost half a century ago.[6] In fact, this process may go back (at least) as far as the Marshall plan of 1948, which, according to Berger and Ritschl (1995), helped to reestablish the traditional European division of labor in trade. The 1950s saw efforts to harmonize tariffs, regulations, and economic policies across European countries, leading up to the Treaty of Rome in 1957. After the removal of internal trade barriers, the integration process continued, eventually encompassing European monetary cooperation (after the end of the Bretton Woods system), a

[3] Previous results suggest that the trade effect of currency union entries/exits may be subject to extremely long lags. Glick and Rose (2002) estimate that it will take about three *decades* after a change in the currency regime for trade to double.
[4] Persson (2001) even argues that Rose's empirical specification is inappropriate since countries that belong to currency unions are systematically different from the rest of the sample.
[5] Other episodes of currency union formation and entry in the post-war period are analyzed in Nitsch (2005).
[6] Faruqee (2004, p. 4) makes a similar point, arguing that EMU is best viewed as an "ongoing process that, in many ways, preceded the euro".

gradual increase in EU membership (in the 1970s and 1980s), and the introduction of the single market framework (in 1987). Since all this set the table for the Maastricht Treaty of 1991 and, thus, ultimately the formation of the EMU, the question of interest to us is: What has been the euro's impact on trade above and beyond the impact of previous and ongoing steps toward economic integration in Europe?

Taking a long-run view of European integration, we find that the introduction of the euro has almost no measurable effect on trade. More specifically, there is strong evidence for a gradual increase (rather than a one-time jump) in trade intensity between countries that later join the EMU over a period of more than a half century. As soon as we control for this long-term trend, the introduction of the euro has no additional effect on trade. These results are robust across a number of model specifications and alternative data sets. Moreover, the longer-run developments in trade intensities among later EMU member countries are closely related to elements of European economic integration, in particular trade liberalization, economic harmonization, and low exchange rate volatility.

The remainder of the paper is organized as follows. In Section 2, we briefly review the existing evidence of the euro's effect on trade. Section 3 describes our estimation methodology and the data. Section 4 presents our benchmark results on the evolution of trade between current EMU members over a period of more than 50 years, followed by an exploration of some potential determinants of growing intra-EMU trade. Section 6 provides a short conclusion.

2. Zooming In: Some Open Issues

Previous findings of a significant trade-enhancing effect of EMU, although generally consistent with Rose's (2000, 2004) observation that common currencies promote trade, invite a more detailed examination for a number of reasons. We focus here on results reported in MSO; other studies often present (qualitatively) similar results.[7]

A first notable observation from these papers is that the estimated trade effect of the euro appears to be surprisingly large relative to the trade effect of membership in the European Union (EU). According to MSO's benchmark cross-country regressions (reported in their Table 1), the point estimate of EMU membership on trade is 0.20, while the estimated coefficient of EU membership on trade is only marginally larger, at 0.27. These results imply that the adoption of the euro has almost the same impact on trade as the removal of trade barriers and the creation of a single market (i.e., further harmonization and integration) in the European Union.[8] Given the much shorter history of EMU and the large degree of monetary integration that was already achieved before the adoption of the euro (with low exchange rate volatility between countries that later join the EMU), this is a remarkable finding inviting further study.

Another interesting empirical observation is that trade between EMU members was obviously already disproportionately large in 1998, i.e., one year *before* the formation of the

[7] Gomes et al. (2004) discuss some of these points in more detail; they also provide an excellent review of the related literature.

[8] The total impact of EU membership is obtained by adding the coefficient of EU membership, the coefficient of the EU Trend multiplied by the mean of the trend, and the coefficient of membership in a Free Trade Arrangement; see footnote 2 in MSO. The coefficients imply that trade between EMU members is estimated to be 22 percent (=exp[0.20]-1) higher than the rest of the sample after 1999, while the trade-increasing effect of EU membership is estimated at 31 percent (=exp[0.27]-1).

monetary union and the irrevocable fixing of exchange rates (see Table 2 in MSO).[9] The decision about the final set of participating countries, however, was only made in early/mid-1998 and even then some uncertainties remained. For instance, the ultimate conversion rates were not specified until the very end of the convergence process, making a strong anticipation effect less likely.[10] These difficulties in dating the exact beginning of the EMU point towards other – somewhat more continuous – dimensions of the European integration process that are often neglected.

Indeed, reviewing the results on the evolution of trade intensity between EMU countries in MSO (Table 2) more generally, there appears to be gradual increase in trade integration over the (full) period (from 1992 through 2002) that is analyzed by MSO; the results indicate a surprisingly steady rise in the estimated intra-EMU trade intensities. The yearly EMU coefficients increase from a low of -0.02 (with a standard error of 0.03) in 1993 to 0.04 (0.03) in 1997 and, after rising both in terms of size and significance in 1998, the coefficients continue to grow over the EMU period from 0.12 (0.03) in 1999 to 0.15 (0.04) in 2002.[11]

Finally, MSO also present results on the trade effect of the euro disaggregated by country (and by country group). These estimates (reported in their Table 7) suggest that the EMU had the largest effect on trade for countries of the former Deutsche-Mark bloc. In fact, when the DM bloc is dropped from the sample, the estimated coefficient on EMU membership even becomes statistically insignificant. However, since the exchange rate links

[9] It should also be noted that, in principle, various dates could be identified as important for the introduction of the euro, each of which could be associated with a significant increase in trade. These dates include the signing of the Maastricht treaty in February 1992, the fixing of the final date for the beginning of the currency union at the end of 1997, the actual start of the EMU on January 1, 1999, or the introduction of the euro as physical currency on January 1, 2002.

[10] See Flam and Nordström (2003) for an alternative view.

[11] To illustrate, regressing MSO's EMU coefficients for the developed country sample and the period from 1993 through 2002 on a constant and a linear time trend yields a highly significant estimate of about 0.02 and an adjusted R^2 of 0.89.

between the DM bloc countries (including the non-EMU member Denmark) were, as a rule, already tight before the adoption of a common currency, it is striking to find that the introduction of the euro had the strongest effect on these countries. This invites further investigation of country-specific elements in the European integration process.

In the following, we argue that many of these results, in particular the finding of a sizable increase in trade after the introduction of the euro, are very sensitive to the analyzed time period and the regression specification. Extending the length of the sample to cover the entire post-war period and accounting for the underlying non-monetary integration dynamics within the European Union has a significant impact on estimation results.

3. Methodology and Data

We estimate variants of an augmented gravity model of the form:

$$(1) \qquad \ln\left(T_{ijt}\right) = \alpha + \sum_{k=1}^{n} \beta_k X_{ijkt} + \gamma EMU_t + \phi_{ij} + \eta_t + \varepsilon_{ijt}$$

where T_{ijt} is the volume of trade between country i and j at time t in real US dollars; X_t is a set of *n* conditioning variables that are typically found to affect bilateral trade flows (such as the size of and distance between the trading partners); EMU_t is a binary variable that takes the value of one if the two countries are members of the European Monetary Union; ϕ_{ij} and η_t are a comprehensive set of country pair- and time-specific fixed effects; and ε_t is a residual assumed to have standard characteristics. This set-up is standard and has been used, among others, by Rose (2000), Glick and Rose (2002) and MSO.

In early work on the common currency effect on trade, the above framework was mainly implemented in cross-section fashion; see, for instance, Rose (2000). In this specification, the data are typically pooled over time, but year dummies eliminate the time-series variation so that the currency union dummy captures the extent to which trade between members of a currency union differs from (or, more precisely, is larger than) trade between countries using separate currencies.

For our purposes, however, the cross-sectional approach has a severe drawback. More specifically, the estimated coefficient on EMU membership in a simple cross-section framework is not necessarily an indication of the trade effect of the euro. In fact, it is quite plausible that the EMU countries shared a disproportionately large amount of trade already before the adoption of a common currency. Therefore, to identify the *change* in trade intensity *after* the formation of EMU, adding country-pair fixed effects might be a useful strategy. By allowing for country-pair specific intercepts that account for any particularly strong (or weak) bilateral tendency to trade, the panel fixed effects estimator exploits the time series variation around country-pair averages and the EMU dummy captures the extent to which trade between EMU member countries differs before and after the adoption of the common currency (see Glick and Rose, 2002, among others). MSO (p. 327) argue that the use of country-pair dummies "provides the cleanest possible benchmark against which to assess the euro effect on trade." [12]

Therefore, we follow MSO and others, and use the regression specification with a comprehensive set of country-pair fixed effects, estimated by ordinary least squares (OLS), as our preferred specification. For the sake of completeness, we also continue reporting standard

[12] Klein and Shambaugh (2004) and Baldwin (2006) provide a more detailed discussion of the various estimation techniques.

pooled OLS results on the cross-sectional set-up of our preferred specification.[13] Finally, as another robustness check, we use the Poisson pseudo-maximum likelihood (PPML) estimator on a model with trade in levels as dependent variable, as proposed by Santos Silva and Tenreyro (2006).[14]

Benchmark estimation results are reported in Table 1. In a first exercise, we seek to replicate MSO's results which are derived from a relatively short sample period that begins in the early 1990s. We carefully follow MSO's original approach, using the same data sources and data definitions, but use an updated data set that incorporates the most recent data revisions and extends the sample period (by one year) to 2003.[15] Moreover, similar to MSO, we present two sets of estimation results, one based on the full sample of 22 industrial countries and another (analogous) one for a subset of European countries.[16]

[Insert Table 1 here]

The first column of Table 1 reports the baseline estimates for the full developed country sample, derived from a conventional pooled OLS estimator. As shown, the model delivers sensible results. For instance, the estimated coefficients on the standard gravity

[13] Parenthetically, we note that, in principle, it is possible to combine both approaches by adding a separate dummy variable to the cross-country set-up; this variable takes the value of one for the whole sample period if the two countries are – or eventually later become – EMU members (i.e., adding a pooled EMU country-pair fixed effect).

[14] Santos Silva and Tenreyro (2006) are concerned about two possible problems in the log-linear specification of the gravity model. Because of Jensen's inequality, log-linearization of the empirical model yields inconsistent estimates in the presence of heteroskedasticity – a problem that appears to be particularly relevant for the gravity model. Also, the logarithmic transformation of the dependent variable introduces the problem of how to deal when there is zero observed trade.

[15] The data set is described in more detail in Appendix 1. It should be noted that we slightly depart from MSO's regression specification by dropping two explanatory variables for which MSO report insignificant coefficients: the log product of land areas and an EU trend integration measure. As shown in the working paper version of this paper (Berger and Nitsch, 2005), this change hardly influences the results.

[16] Countries in the developed country sample are: Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The European sample is a subset of the above.

variables income and distance take on the expected sign, are of reasonable magnitude and statistically highly significant. Moreover, with an adjusted R^2 of 0.93, the model explains the data extremely well. Most notably, however, our estimation results strongly confirm MSO's key finding; the coefficient on the variable of interest, the dummy for joint EMU membership, is positive, economically large and statistically significantly different from zero. The point estimate of 0.31 implies that trade between EMU members is about 36 percent (=exp[0.31]-1) higher than trade between non-EMU members, holding other things constant. Restricting the sample to European countries yields even somewhat larger estimates (reported in column four of Table 1).

While cross-sectional pooled OLS results may be interesting in helping to describe patterns of trade, they do not capture the time-series variation in trade and therefore provide no insights about the actual trade effects of the euro. A useful approach to deal with this problem is to apply a panel fixed effects estimator that controls for average trade between a pair of countries over the sample period. Results are reported in the second column of Table 1. As expected, for this estimation technique, the coefficient on the EMU dummy falls considerably, suggesting that countries that later joined EMU had indeed strong trade relations already before the formation of the monetary union. Nonetheless, the coefficient on EMU membership remains positive and statistically highly significant. The estimate of about 0.14 implies that trade between EMU members has increased by about 15 percent (=exp[0.14]-1) after the adoption of the euro.

Column three of Table 1 deals with the potential problem of heteroskedasticity and reports results from a Poisson estimator. Similar to Santos Silva and Tenreyro (2006), we find that Poisson estimates of the key gravity variables are smaller in magnitude than those obtained using OLS. Also, since the number of observations is identical for both

specifications (i.e., there are no observations of zero trade in the sample), the difference in the results indicates that heteroskedasticity may be indeed a problem. Still, the estimated coefficient on the EMU dummy is only marginally affected.

In summary, we are able to replicate the MSO finding of a surge in intra-EMU trade after the adoption of a common currency. Using updated and extended data, we find even larger effects on trade so that data revisions seem to have a considerable impact on the estimation results.[17] For instance, for the developed country fixed effects specification, MSO report a point estimate of 0.04, implying a trade effect of about 4 percent (=exp[0.04]-1), a finding that is considerably smaller than our estimate of 15 percent. While it is surprisingly hard to identify country- or period-specific data revisions that explain these differences, revisions to GDP appear to have been particularly influential.

4. Zooming Out: Putting the Euro's Effect on Trade in Perspective

After having added another year of EMU data, we now extend our data set backwards. MSO explore a sample that covers the 10-year period from 1992 to 2002; we lengthen the sample to include the entire post-war period starting in the late 1940s. Estimation results are reported in Table 2. Turning directly to our variable of interest, the point estimates for EMU membership not only remain positive and statistically highly significant (with a t-statistic often close to 10), but also increase substantially in magnitude. The benchmark (country-pair fixed effects) estimate for the developed country sample (reported in the second column of Table 2) implies that trade between EMU members exceeds trade between countries using separate currencies by about 41 percent (=exp[0.34]-1), and even larger positive effects are

[17] Gomes et al. (2004) report similar findings. In Berger and Nitsch (2005), we show that this result is not due to adding data for 2003.

found when the country-pair-specific fixed effects are dropped or the sample is restricted to European economies.

[Insert Table 2 here]

A possible explanation for this dramatic increase in the estimated EMU effect is that the additional inclusion of trade observations before 1992 lowers the sample average of bilateral trade flows, thereby further highlighting the above-average tendency to trade between EMU member countries. In view of this obvious dependence of the estimated EMU effect on the sample period, it appears to be even more important to put the trade-creating effects of EMU in historical perspective.[18] We now turn to that task.

There are essentially two approaches to analyze the evolution of trade (or, more precisely, the development of cross-country variation in bilateral trade) over time. A first approach is to run separate regressions for every single year in the sample. The coefficient on the currency union dummy then captures, year by year, the extent to which trade between (future) EMU member countries deviates from the sample average, after controlling for other factors. Alternatively, one can estimate a pooled regression for the full sample period, adding separate annual currency union dummies. In contrast to the previous approach, this specification requires the coefficients on the control variables to be constant over time. In practice, however, it turns out that the results for both models are largely identical. Figure 1 plots the coefficient estimates on the EMU dummy for both specifications; panel (a) shows the results for the full country sample and panel (b) the coefficient estimates for the subgroup of European countries. Accompanying estimation results for 10-year periods are reported in Table 3.

[18] Bun and Klaassen (2004) also note a positive association between the sample period and the estimated impact of the euro on trade.

[Insert Figure 1 here]

[Insert Table 3 here]

The most notable observation from Figure 1 (and also Table 3) is a strong positive long-term trend in the bilateral tendency to trade between the countries that later join EMU. Trade between future EMU members was significantly below the sample average in the wake of World War II. Since then, however, trade has increased over a span of more than five decades to levels clearly, and significantly, above average trade within the sample. Against this backdrop, the increase in intra-EMU trade that we (and others) observe after the formation of EMU is largely a continuation of a remarkable longer-term trend. Arguably, Figure 1 still hints at a euro effect, but the increase in trade is small when compared with the long-term trend driving intra-EMU trade long before the inception of a common currency at the end of the 1990s.

Whether the positive trend in intra-EMU trade vis-à-vis the rest of the sample is continuous over time partly depends on the country sample that is used as control group. Relative to trade between all developed countries in the sample, intra-EMU trade grew in spurts, with the 1950s and 1980s being exceptionally dynamic periods, while the late 1960s and the 1970s were periods of relative stagnation. This general pattern is still discernable when the control group is restricted to European countries. However, relative EMU trade growth appears to have been somewhat more stable in this sample.

The long-term upward trend in intra-EMU trade also remains intact after the introduction of country-pair fixed effects to control for any unobserved time-invariant determinants. Figure 2 illustrates that, with this modification, there is still clear evidence of a

gradual increase in bilateral trade among future EMU economies. Note that the estimated values for the time-variant EMU dummies are consistently positive in this specification, since the country-pair fixed effects control for the average deviation of intra-EMU trade from the mean of the sample. For completeness, Figure 3 plots the coefficients from cross-sectional Poisson estimates. Again, our observation of an increase in trade intensity over time is confirmed.

[Insert Figure 2 here]

[Insert Figure 3 here]

5. Explaining the Evolution of Intra-EMU Trade

What could explain this particular time pattern in the evolution of intra-EMU trade? The growth spurt in the immediate post-war period seems to reflect the rapid re-emergence of pre-war patterns in European trade, fostered by institutions that were established under the auspices of the Marshall plan, including the European Payments Union. These institutions helped to overcome problems of convertibility and alleviated the notorious European trade deficit with the US by re-integrating the German economy into the European network of trading partners; see, for instance, Berger and Ritschl (1995).

The reestablishment of trade patterns was accompanied by the formal harmonization of tariffs, regulation, and economic policies, efforts that finally led to the founding of the European Economic Community (EEC) in 1957 and of the European Free Trade Agreement (EFTA) in 1960; Appendix 2 provides a broad timeline of important steps towards European integration. While institutional integration slowed somewhat during the 1960s, it was

rejuvenated in the late 1970s when – in the aftermath of the demise of the Bretton Woods system – European monetary cooperation took shape.[19] After another period of low activity in the early 1980s (often denoted as 'euro-pessimism'), the integration process re-intensified again in the second half of the 1980s with the preparation and passing of the Single European Act (which set up the single market framework), a streamlining of the work of the European Commission, and the start of the political process that culminated in the Maastricht Treaty of 1991.

While there is no obvious link between the landmarks of institutional integration and the particular time pattern in the evolution of intra-EMU trade that we observe empirically, it seems likely that the two are related. In particular, it would seem that – from the institutional perspective – the establishment of the EMU in 1999 was just another step in the long-developing movement toward increased integration and greater convergence. As a result, trade relations between EMU members intensified after 1999 as they intensified over the previous several decades in response to earlier efforts to increase integration.

5.1 Estimation Results

To explore this idea in more detail, we add a time trend to the model, aiming to describe the development of intra-EMU trade over the post-World War II period. While admittedly simple, this approach helps us to disentangle any possible short-run impact the euro might have had on trade between EMU members from the underlying dynamics of intra-EMU trade during the post-war era.[20]

[19] The European Monetary System entered into force in March 1979. In the same year the European Parliament was, for the first time, elected directly by European voters.
[20] Bun and Klaassen (2004) propose a similar approach; they apply country-pair specific time trends for shorter sample periods.

Table 4 shows that the introduction of a simple linear trend completely eliminates the effect of the introduction of the euro on trade. As shown in column two, the point estimate on EMU membership is statistically indifferent from zero (when country-pair fixed effects are included) and even becomes marginally negative (when the full country sample is analyzed). Quantitatively similar results are obtained for the smaller European sample and the Poisson estimation technique. At the same time, the trend coefficient is positive and statistically highly significant across samples. Taken together, then, the results clearly indicate that there is no effect on trade from the introduction of the euro *in addition* to the post-war trend of increasing trade integration.

[Insert Table 4 here]

These results are fairly robust. Alternative specifications of the trend variable leave the estimation results basically unaffected. For instance, the EMU coefficient remains statistically indifferent from zero when we replace the linear trend by a quadratic trend; results are shown in panel (b) of Table 4.

As another sensitivity analysis, Table 5 presents the results of a first-difference specification of the gravity model, examining the annual growth of trade. Again, the estimates support our initial (non-)result: we find that neither the coefficients for entry into the euro area (ΔEMU) nor EMU membership in general (EMU) are significantly different from zero; there is no evidence that changes in intra-EMU trade when the euro becomes (or is) in existence are significantly different from earlier periods. Allowing for country-pair specific (rather than EMU-specific) linear time trends also leaves the EMU effect statistically

insignificant. Finally, the same holds, when we add a time-invariant constant to the linear trend variable for the EMU countries (results not shown).[21]

[Insert Table 5 here]

5.2 Identifying Underlying Factors

What could be behind the longer-run trend in trade intensities between later EMU members? While the introduction of the euro was clearly not the first attempt to foster integration between countries that later joined EMU through political measures, it will be interesting to see whether we can possibly identify policy changes that have helped intra-EMU trade along the path described above. In the following, we show that reductions in exchange rate volatility and steps towards greater institutional integration are closely associated with the secular increase in euro area trade intensities during the post-war period.[22]

We begin by examining the relationship between exchange rate volatility and the pattern of intra-EMU trade. Exchange rate volatility is measured by the standard deviation of the mean monthly bilateral exchange rate in the year of interest.[23] The exchange rate data were obtained from the IMF's International Financial Statistics and are available (only) from 1957 onwards.

Figure 4 portrays the evolution of exchange rate volatility over the sample period. The inverted U-shaped pattern for the volatility measure interestingly implies that variations in exchange rate fluctuations are broadly in line with observed changes in trade intensities (as

[21] Unreported results are available on request.
[22] Berger and Nitsch (2005) show that the measures of exchange rate volatility and market integration (discussed below) are significant determinants of trade intensities, explaining part of the longer-run trend in intra-EMU trade.
[23] Note that the construction of the exchange rate variable allows for bilateral differences in exchange rate volatility. Modifications of this measure, such as using lagged or average values, have no effect on our findings.

documented, for instance, in Figure 1). Periods for which we observe a rapid increase in trade integration in Europe, at the beginning and at the end of our sample period (the 1950s and 1960s under the Bretton Woods system and the late 1980s and early 1990s under the European Monetary System [EMS], respectively), are typically associated with low exchange rate volatility. As a result, exchange rate stability may have been one of the factors behind the longer-run increase in trade intensities among future EMU-members. Viewed from this perspective, the introduction of the euro is perhaps best interpreted as a continuation of a policy that aimed at fostering internal trade relations through a stabilization of internal exchange rates.

[Insert Figure 4 here]

Another potential factor behind the growing intensity of trade among (future) EMU members is institutional integration. To roughly describe the development of institutional market integration over time, we construct a simple index encompassing information on trade liberalization, tariffs, and other activities aimed at generating a "single market" among European countries. The index combines information from three different sources, each summarizing important elements of the integration process over a certain period. For each of these three measures, the index is defined to vary between 0 (no liberalization) and 10 (full liberalization) index points, so that the overall index ranges from 0 to 30 (=3*10). Figure 5 graphs the sample average of the index, along with minimum and maximum values.[24]

Specifically, the index is constructed as follows. For the 1950s, we obtain information on the percentage of intra-European trade that is freed from quantitative restrictions. The data are available from the Organization for European Economic Co-operation (OEEC) on a bi-

[24] Mongelli, Dorrucci and Agur (2005) discuss alternative approaches to measuring institutional integration.

annual basis for the period from 1950 through 1961 for 17 major European countries; we take mid-year figures from the OEEC's final (1961) Annual Economic Review (Table 35) and divide these percentages by 10. At the beginning of the period, about one-half of private imports among the member countries were free of quotas. In the following years, this figure rapidly increased and often reached values significantly above 90 percent by 1956.

Beginning in the late 1950s, trade liberalization was increasingly carried out within subgroups of countries – most prominently in the EEC and the EFTA; see Appendix 2. The gradual phase-out of tariffs within, and between, these groupings is captured by an average tariff index that we take from Table 2 in Ben-David (1993). This tariff index is set to 100 in 1958 and gradually falls to 0 in 1967 (for intra-EFTA trade), 1968 (for intra-EEC trade) and 1977 (for EEC-EFTA trade). In the actual implementation of this tariff measure, we obtain our overall index of European trade integration during this period by adding the difference between 100 and the actual tariff index, divided by 10, to the starting value of 10.

The late 1970s and early 1980s were characterized by less dynamic real economic integration and liberalization efforts than previous periods, with the exception of some political progress and the rise of the EMS (which helped providing stable exchange rates). Thus, with other variables available to capture exchange rate stability (see above), our measure of European economic integration remains unchanged during this period.

Finally, attempts to eliminate the remaining barriers to the free movement of goods, services, capital and workers within Europe re-intensified in the mid-1980s, culminating in the introduction of the single market framework in 1992. At this time, the European Commission began to track the integration policies of individual member states with the help of an Internal Market Index (among other measures). This index is a composite measure of 12

indicators, including various prices (e.g. for electricity and gas) and intra-EU trade and investment.[25] We use this index and normalize it so that it takes the value of 20 in the base year 1992 and that a doubling in the index equals 10 index points.

Figure 5 illustrates that the dynamics of institutional market integration are fairly closely related to the evolution of intra-EMU trade over time, similar to our findings for the post-war behavior of exchange rate stability. This holds true for the beginning and the end of the sample period, but also for the slowdown of institutional market integration in the 1980s. Therefore, policies aimed at fostering market integration are probably another potentially important determinant of the trade relations between later euro area member countries. We conclude that the trade effect of the euro should not be viewed in isolation but is best interpreted as part of a longer-run trend towards market integration and exchange rate stability.

[Insert Figure 5 here]

[25] See http://europa.eu.int/comm/internal_market/score/index_en.htm for a more detailed description.

6. Concluding Remarks

Recent research suggests that the introduction of the euro has a sizable and statistically significant effect on trade among EMU members. Some estimates imply that EMU has increased trade by about 10 percent in its first four years of existence. This finding, if robust, has important policy implications for countries that are considering joining EMU.

In this paper, we put the adoption of the euro by EMU members in historical perspective. We argue that the creation of the EMU is best interpreted as a continuation, or culmination, of a series of policy changes that have led over the last five decades to greater economic integration among the countries that now constitute the EMU. Using a data set that includes 22 industrial countries from 1948 to 2003, we find strong evidence of a gradual increase in trade intensity between European countries. Once we control for this trend in trade integration, the effect of the formation of the EMU disappears. A significant part of this trend can be explained by measures of economic integration preceding the introduction of the euro.

These results caution against an unqualified application of the Rose (2000) result that establishing a common currency significantly increases trade among union members to the case of the EMU. While it might well be true that – as some have argued – the advent of the euro was as necessary condition for the European integration process to continue beyond the "single market" agenda in the early 1990s, the euro's repercussions on trade are difficult to understand without taking proper account of the dynamics of the underlying European institutions. An obvious policy implication is that countries considering joining the euro area (or, for that matter, any currency union) should be wary regarding promises of an imminent acceleration of intra-area trade.

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Appendix

A1. Data

a) Sources

When compiling the data set, we aim to follow MSO as closely as possible. However, since we employ historical data reaching back to 1948, we sometimes had to use other sources. For instance, we often replace World Bank data (which are typically only available beginning in 1960) with IMF data. To make sure that data issues do not affect our results, we re-estimated all our regressions with data from MSO's original sources (for shorter sample periods).

Our data set consists of annual observations for 22 industrialized countries between 1948 and 2003.

Trade. The trade data are taken in current US dollars from the International Monetary Fund's Direction of Trade Statistics. Bilateral trade is defined as the arithmetic average of the (two) export and (two) import values reported for a pair of countries. The nominal values are deflated by the US CPI.

GDP. GDP figures are derived in current local currency from the IMF's International Financial Statistics and converted into US dollars using current exchange rates (year averages). The nominal values are deflated by the US CPI.

Population. Population data are taken from the IMF's International Financial Statistics.

Distance. The distances are calculated as the Great Circle distance between the countries' geographic centers; the geographic coordinates are taken from the CIA World Factbook. Information for other gravity variables (common land border, common language) is also obtained from the CIA World Factbook.

FTA. The FTA dummy takes the value of one when the two countries in the pair belong to the same free trade area (FTA). The following FTAs are covered: Canada-US, ANZCER, EC, EFTA.

Exchange rates. The exchange rates are taken from the IMF's International Financial Statistics.

b) Descriptive statistics

	Non-EMU countries	EMU members
Observations	10,416	2,520
Trade	1.071 (2.241)	1.853 (2.209)
Real GDP	14.601 (2.637	14.723 (2.135)
Real GDP per capita	9.606 (1.292)	9.169 (1.400)
Distance	8.241 (1.112)	7.052 (0.620)
Common Language	0.124 (0.329)	0.067 (0.249)
Common Border	0.054 (0.226)	0.222 (0.416)
Free Trade Agreement	0.188 (0.390)	0.442 (0.497)
European Union	0.083 (0.276)	0.402 (0.490)
Landlocked	0.177 (0.356)	0.200 (0.400)
Island	0.452 (0.559)	0.000 (0.000)
Exchange rate volatility	0.030 (0.032)	0.017 (0.026)
Index of European integration	6.719 (8.924)	17.726 (5.150)

The table reports means with standard deviations in parentheses.

A2. Integration timeline

Year	Major European Events
1951	**Marshall plan** institutions (i.e., the **European Payments Union**) help solve the German balance of payments crisis and, thus allow restitution of European division of labor; Treaty of Paris signed; European High Authority set up (to become EU Commission later).
1954	**European Community of Coal and Steel** comes into force (France, Germany, Italy, Belgium, Luxembourg, The Netherlands).
1957	**Treaty of Rome** establishes, among other things, the **European Economic Community** (EEC).
1960	**European Free Trade Agreement** (EFTA) is established (Austria, Denmark, Norway, Portugal, Sweden, Switzerland, UK).
1961	EFTA expansion: Finland
1962	**Common Agricultural Policy** is launched.
1965	**European Community** (EC): Merger of the three European "unions" (EEC, Coal & steel, and Atomic Energy) in a treaty; single **Council** of Ministers and European Commission established to head the new institution.
1973	EC expansion: Denmark, Ireland, UK.
1974	EFTA expansion: Iceland
1979	First direct Europe-wide election to **European Parliament**; **European Monetary System** established.
1981	EC expansion: Greece
1986	EC expansion: Spain, Portugal.
1987	**Single European Act** comes into force, setting up "Single Market" framework and streamlines Commission's work.
1991	**Maastricht Treaty** establishes **European Union** (EU), sets up timetable for the **Economic and Monetary Union** (EMU), defines European citizenship, and initiates **EU enlargement** process.
1993	**Single Market** takes effect.
1995	EU expansion: Austria, Finland, Sweden; **Schengen** treaty takes effect (some countries).
1997	The **Treaty of Amsterdam**, among other things, updates Maastricht and further prepares eastward expansion.
1999	**Euro** introduced (physically in 2002).

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Figure 1: Evolution of trade intensity between EMU11 countries over time

a) Developed countries

Notes: Line with circles (crosses) reports estimated coefficients derived from pooled (yearly) regressions. A circle/cross indicates that the coefficient is significant at the 5% level.

b) European countries

Notes: Line with circles (crosses) reports estimated coefficients derived from pooled (yearly) regressions. A circle/cross indicates that the coefficient is significant at the 5% level.

Figure 2: Evolution of trade intensity between EMU11 countries over time (with country-pair fixed effects)

a) Developed countries

Notes: Line reports estimated coefficients derived from pooled regressions. A circle indicates that the coefficient is significant at the 5% level.

b) European countries

Notes: Line reports estimated coefficients derived from pooled regressions. A circle indicates that the coefficient is significant at the 5% level.

Figure 3: Evolution of trade intensity between EMU11 countries over time (with Poisson estimation)

a) Developed countries

Notes: Line reports estimated coefficients derived from yearly regressions. A circle indicates that the coefficient is significant at the 5% level.

b) European countries

Notes: Line reports estimated coefficients derived from yearly regressions. A circle indicates that the coefficient is significant at the 5% level.

Figure 4: Exchange rate volatility

Notes: The graph shows the average yearly standard deviation in bilateral exchange rates.

Figure 5: Index of European integration

Table 1: The trade effect of the euro – the short run view

Sample	Developed	Developed	Developed	Europe	Europe	Europe
Period	1992-2003	1992-2003	1992-2003	1992-2003	1992-2003	1992-2003
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
EMU2	**0.305**** **(0.032)**	**0.143**** **(0.013)**	**0.139**** **(0.015)**	**0.362**** **(0.032)**	**0.143**** **(0.014)**	**0.110**** **(0.011)**
Real GDP	0.801** (0.007)	0.562** (0.027)	0.568** (0.034)	0.723** (0.008)	0.515** (0.036)	0.482** (0.031)
Real GDP per capita	0.273** (0.032)			0.282** (0.032)		
Distance	-0.789** (0.021)		-0.726** (0.030)	-1.040** (0.026)		-0.723** (0.032)
Common Language	0.715** (0.039)		1.712** (0.109)	0.391** (0.047)		1.026** (0.082)
Common Border	0.159** (0.045)		0.605** (0.037)	0.003 (0.040)		0.897** (0.044)
Free Trade Agreement	0.142** (0.054)	0.021 (0.023)	0.017 (0.040)	-0.174** (0.051)	0.028 (0.023)	0.032 (0.024)
European Union	0.220** (0.046)	0.015 (0.020)	0.030 (0.021)	0.142** (0.044)	0.022 (0.021)	0.026 (0.019)
Landlocked	-0.448** (0.029)		-1.039** (0.055)	-0.734** (0.030)		-0.674** (0.038)
Island	0.221** (0.040)		0.360** (0.102)	-0.352** (0.060)		-1.681** (0.129)
Country pair effects?	No	Yes	Yes	No	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	2,772	2,772	2,772	1,632	1,632	1,632
R^2	0.93	0.44		0.95	0.49	
Pseudo-R^2			0.97			0.95

Notes:
Dependent variable is bilateral trade in real US dollars either in log form (OLS) or in absolute terms (PPML).
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.

Table 2: The trade effect of the euro – the long run view

Sample	Developed	Developed	Developed	Europe	Europe	Europe
Period	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
EMU2	**0.376** (0.031)**	**0.343** (0.028)**	**0.148** (0.021)**	**0.462** (0.033)**	**0.437** (0.032)**	**0.185** (0.021)**
Real GDP	0.824** (0.004)	0.899** (0.017)	0.625** (0.017)	0.746** (0.006)	0.815** (0.026)	0.662** (0.023)
Real GDP per capita	0.187** (0.013)			0.316** (0.016)		
Distance	-0.817** (0.010)		-0.717** (0.017)	-0.921** (0.018)		-0.811** (0.029)
Common Language	0.763** (0.024)		1.618** (0.069)	0.724** (0.028)		0.526** (0.067)
Common Border	0.009 (0.022)		0.367** (0.049)	-0.099** (0.024)		0.444** (0.036)
Free Trade Agreement	0.543** (0.023)	0.194** (0.019)	0.313** (0.029)	0.462** (0.022)	0.182** (0.019)	0.169** (0.019)
European Union	-0.167** (0.025)	0.203** (0.022)	0.014 (0.030)	-0.198** (0.027)	0.240** (0.024)	0.159** (0.022)
Landlocked	-0.399** (0.015)		-0.784** (0.032)	-0.600** (0.017)		-0.375** (0.032)
Island	0.313** (0.020)		0.386** (0.051)	-0.327** (0.037)		-1.463** (0.074)
Country pair effects?	No	Yes	Yes	No	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	12,150	12,157	12,196	7,124	7,128	7,128
R^2	0.91	0.85		0.93	0.88	
Pseudo-R^2			0.95			0.91

Notes:
Dependent variable is bilateral trade in real US dollars either in log form (OLS) or in absolute terms (PPML).
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.

Table 3: Trade intensities between EMU members over time

Sample	Developed			Europe		
	EMU11	# Obs.	R2	**EMU11**	# Obs.	R2
Period						
1950-59	**-0.220**** **(0.057)**	1,933	0.80	**-0.348**** **(0.060)**	1,120	0.85
1960-69	**0.030** **(0.045)**	2,298	0.88	**-0.045** **(0.046)**	1,360	0.91
1970-79	**0.000** **(0.030)**	2,310	0.91	**-0.012** **(0.029)**	1,360	0.93
1980-89	**0.103**** **(0.025)**	2,310	0.93	**0.089**** **(0.024)**	1,360	0.94
1990-98	**0.248**** **(0.024)**	2,079	0.93	**0.243**** **(0.023)**	1,224	0.95
1999-2003	**0.324**** **(0.038)**	1,155	0.93	**0.400**** **(0.036)**	680	0.95
Country pair effects?	No			No		
Year effects?	Yes			Yes		

Notes:
OLS estimation. Dependent variable is the log of bilateral trade in real US dollars.
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.
The following variables are included in the regressions, but coefficients are not reported: real GDP, real GDP per capita, distance, common language, common border, free trade agreement, European Union dummy, landlocked, and island.

Table 4: Controlling for the long-term trend in EMU trade intensities

a) Linear trend

Sample	Developed	Developed	Developed	Europe	Europe	Europe
Period	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
EMU2	**0.209** (0.059)**	**-0.001 (0.036)**	**0.069 (0.046)**	**0.327** (0.055)**	**0.019 (0.035)**	**0.030 (0.045)**
Common time trend for EMU11 countries	0.004** (0.001)	0.015** (0.001)	0.018* (0.009)	0.003** (0.001)	0.017** (0.001)	0.034** (0.009)
Country pair effects?	No	Yes	Yes	No	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	12,150	12,157	12,196	7,124	7,128	7,132
R^2	0.91	0.86	0.95	0.93	0.89	0.94

Notes:
Dependent variable is bilateral trade in real US dollars either in log form (OLS) or in absolute terms (PPML).
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.
The following variables are included in the regressions, but coefficients are not reported: real GDP, real GDP per capita, distance, common language, common border, free trade agreement, European Union dummy, landlocked, and island.
For the Poisson estimator, an exponential time trend is used; coefficients and standard errors are multiplied by 10^4.

b) Quadratic trend

Sample	Developed	Developed	Developed	Europe	Europe	Europe
Period	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
EMU2	**-0.070 (0.073)**	**0.087# (0.045)**	**0.070 (0.045)**	**-0.104 (0.068)**	**0.053 (0.044)**	**0.029 (0.046)**
Common time trend for EMU11 countries	-0.010** (0.002)	0.025** (0.003)	0.007 (0.013)	-0.018** (0.002)	0.021** (0.003)	0.520** (0.143)
(Common time trend for EMU11 countries)^2	0.035** (0.006)	-0.018** (0.006)	0.175 (0.192)	0.054** (0.005)	-0.007 (0.006)	-0.292 (0.208)
Country pair effects?	No	Yes	Yes	No	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	12,150	12,157	12,196	7,124	7,128	7,132
R^2	0.91	0.86	0.95	0.93	0.89	0.94

Notes:
Dependent variable is the log of bilateral trade in real US dollars.
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.
The following variables are included in the regressions, but coefficients are not reported: real GDP, real GDP per capita, distance, common language, common border, free trade agreement, European Union dummy, landlocked, and island.
Coefficients and standard errors for the quadratic time trend in the OLS specification are multiplied by 10^2. A Wald test shows that the coefficients on the linear trend and the quadratic trend are jointly significant.
For the Poisson estimator, an exponential time trend is used; coefficients and standard errors for the trend and the quadratic trend are multiplied by 10^5 and by 10^{10}, respectively.

Table 5: First differences

a) Developed countries

Sample	Developed	Developed	Developed	Developed	Developed	Developed
Period	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003
Δ EMU2	**0.052 (0.032)**			**0.034 (0.033)**		
EMU2		**0.020 (0.014)**	**0.010 (0.015)**		**0.003 (0.015)**	**-0.003 (0.016)**
Δ Real GDP	-0.075 (0.184)	-0.069 (0.184)	0.001 (0.188)	0.035 (0.228)	0.038 (0.228)	-0.014 (0.228)
Δ Real GDP per capita	0.554** (0.183)	0.547** (0.183)	0.476* (0.187)	0.430# (0.227)	0.426# (0.227)	0.475* (0.227)
Δ Free Trade Agreement	0.062** (0.018)	0.062** (0.018)		0.063** (0.018)	0.063** (0.018)	
Free Trade Agreement			0.004 (0.006)			0.019* (0.009)
Δ European Union	0.001 (0.024)	0.001 (0.024)		-0.004 (0.024)	-0.004 (0.024)	
European Union			0.011 (0.008)			-0.002 (0.011)
Country pair effects?	No	No	No	Yes	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	11,898	11,898	11,898	11,898	11,898	11,898
R^2	0.24	0.24	0.24	0.24	0.24	0.44

Notes:
OLS estimation. Dependent variable is the change in the log of bilateral trade in real US dollars.
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.

b) European countries

Sample	Europe	Europe	Europe	Europe	Europe	Europe
Period	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003	1948-2003
Δ EMU2	**0.048 (0.030)**			**0.027 (0.030)**		
EMU2		**0.020 (0.013)**	**0.013 (0.014)**		**-0.001 (0.014)**	**-0.003 (0.014)**
Δ Real GDP	0.260 (0.213)	0.268 (0.213)	0.332 (0.215)	0.322 (0.234)	0.326 (0.234)	0.305 (0.234)
Δ Real GDP per capita	0.163 (0.211)	0.155 (0.211)	0.091 (0.213)	0.090 (0.232)	0.085 (0.232)	0.103 (0.232)
Δ Free Trade Agreement	0.068** (0.016)	0.062** (0.016)		0.070** (0.016)	0.070** (0.016)	
Free Trade Agreement			0.006 (0.006)			0.021** (0.008)
Δ European Union	0.003 (0.022)	0.003 (0.022)		-0.004 (0.022)	-0.004 (0.022)	
European Union			0.014* (0.006)			0.000 (0.009)
Country pair effects?	No	No	No	Yes	Yes	Yes
Year effects?	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	6,974	6,974	6,974	6,974	6,974	6,974
R^2	0.31	0.31	0.31	0.32	0.32	0.32

Notes:
OLS estimation. Dependent variable is the change in the log of bilateral trade in real US dollars.
Robust standard errors are recorded in parentheses.
**, * and # denote significant at the 1, 5 and 10 percent levels, respectively.