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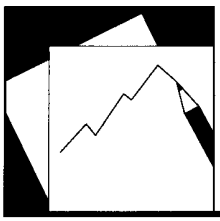

IMF Working Paper

The Euro's Effect on Trade Imbalances

Helge Berger and Volker Nitsch

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The Euro's Effect on Trade Imbalances

Prepared by Helge Berger and Volker Nitsch [1]

Authorized for distribution by Luc Everaert

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Abstract

When does trade become a one-way relationship? We study bilateral trade balances for a sample of 18 European countries over the period from 1948 through 2008. We find that, with the introduction of the euro, trade imbalances among euro area members widened considerably, even after allowing for permanent asymmetries in trade competitiveness within pairs of countries or in the overall trade competitiveness of individual countries. This is consistent with indications that pair-wise trade tends to be more balanced when nominal exchange rates are flexible. Intra-euro area imbalances also seem to have become more persistent with the introduction of the euro, some of which is linked to labor market inflexibility. Reviewing the direction of imbalances, we find that bilateral trade surpluses are decreasing in the real exchange rate, decreasing in growth differentials, and increasing in the relative volatility of national business cycles. Finally, countries with relatively higher fiscal deficits and less flexible labor and product markets exhibit systematically lower trade surpluses than others.

JEL Classification Numbers: F15; F16; F32; F36; F42

Keywords: imbalances, trade balance, trade surplus, trade deficit, euro, EMU, European integration

Author's E-Mail Address: hberger@imf.org; nitsch@vwl.tu-darmstadt.de

[1] The authors are respectively with the International Monetary Fund, and the Technische Universität Darmstadt, Germany. They thank Luc Everaert, Thierry Tressel, Edouard Vidon, and participants at presentations in Kiel and Portland for helpful comments and suggestions.

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I. INTRODUCTION

Imbalances in bilateral trade relationships have recently raised considerable interest. For many countries, the difference between the value of shipments to and from a particular partner has risen sizably in recent years. More notably, large bilateral imbalances appear to increasingly dominate some countries' overall trade balance. A prominent example is the trade deficit between the United States and China, which increased from virtually zero in the mid 1980s to more than 225 billion US dollars in 2009, accounting for almost one half of the U.S. total trade deficit. For Italy, the trade deficit with Germany has risen by a factor of 5 within a decade, now even exceeding the country's overall deficit in external trade.

While there is no economic reason to assume that a bilateral trade relationship should necessarily be balanced, the emergence of large and persistent trade imbalances is often interpreted as prima facie evidence of underlying rigidities or distortions. For example, protectionist measures can bias trade in favor of a particular country. Similarly, distortionary policies could delay a country's external adjustment to shocks. Also, fixed or managed exchange rates may slow corrections of the real exchange rate.

The lack of an adjustable nominal exchange rate supposedly poses a particular problem within a currency union that also operates a single and unrestricted market for goods and services, such as the euro area. In this case, the permanently fixed nominal exchange rate forces real exchange rate adjustment through relative price levels alone, which can be difficult in the presence of rigidities in national goods and labor markets. Surprisingly however, the empirical evidence on the link between trade imbalances on the one hand and exchange rate flexibility and structural rigidities on the other appears to be generally mixed.

In this paper, we identify several new stylized facts on intra-European trade that can add to this discussion. Specifically, we examine the patterns of trade between a sample of 18 European countries, some of which have adopted the euro as their common currency, over the period from 1948 through 2008. Previewing our main results, we find that trade imbalances—measured as the fraction of deficits and surpluses in total bilateral trade—have indeed widened considerably between euro area member countries after the introduction of the euro. Moreover, since we control for various sets of country-specific and pair-wise fixed effects, our analysis indicates that the larger imbalances are not (only) the result of enduring asymmetries in trade competitiveness between a given pair of countries or the consequence of changes in the institutional framework, financing conditions, or trends in the competitiveness of specific countries against all others. Finally, we establish that intra-euro area imbalances have become more persistent, which can be partially linked to labor market inflexibility.

Reviewing the direction of pair-wise trade imbalances, we find that bilateral trade surpluses are decreasing in the real exchange rate, decreasing in growth differentials, and increasing in the relative volatility of national business cycles. Also, countries with relatively higher fiscal

deficits and less flexible labor and product markets exhibit systematically lower trade surpluses than others. Finally, it seems reassuring to note that many of these effects are particularly developed among euro area member countries. In summary, these findings entail, in our view, both bad and good news for policymakers in the euro area. On the negative side, permanently fixed nominal exchange rates do come at the cost of large and lasting trade imbalances. On the plus side, these imbalances can be addressed through structural and macroeconomic policies.

The remainder of the paper is organized as follows. In Section 2, we briefly review the relevant literature. Section 3 describes the empirical methodology and the data. We begin our analysis by examining the association between the exchange rate regime and trade imbalances (Section 4). We then explore various determinants of bilateral trade surpluses and deficits (Section 5). Finally, we analyze the persistence in trade patterns (Section 6). Our findings are summarized in a brief concluding section which also provides some policy conclusions.

II. RELATED LITERATURE

The question whether exchange rate variability affects the speed of current account adjustment is hardly a new one. Friedman (1953) famously claimed that flexible exchange rates allow for prompt and continuous change of relative prices and thereby facilitate rapid external adjustment. Despite its strong intuitive appeal, however, the empirical support for this idea appears to be mixed. Chinn and Wei (2008), for instance, find no robust evidence that current account persistence depends upon the exchange rate regime, declaring Friedman's claim a matter of "faith". Ghosh, Terrones and Zettelmeyer (2008), in contrast, side with Friedman, referring to results that the flexibility of nominal exchange rates facilitates the adjustment of real rates and trade flows, albeit perhaps in a nonlinear fashion. A related (and equally controversial) issue is whether the real exchange rate is a significant driver of trade—a relationship questioned, for example, by Rose (1990), but supported by Debelle and Faruqee (1990) and Lane and Milesi-Ferretti (2002).[2]

The absence of "closure" to the debate has aroused considerable interest in the natural experiment on exchange rate regime change provided by the introduction of the euro. Again, however, results appear to be generally inconclusive. While the early literature on the trade effects of the euro suggests that the abolition of nominal exchange rate volatility has promoted intra-euro area trade (Rose, 2000; Faruqee, 2004; Baldwin, 2006), the picture is complicated by the historically high propensity of euro area members to trade amongst each other. In fact, Berger and Nitsch (2008) argue that the common currency added little or

[2] See also Ghosh, Gulde and Wolf (2003), Wolf, Ghosh, Berger and Gulde (2008), as well as the broadly related work by Mendoza (1995), Freund (2005), and Gruber and Kamin (2007). The papers in Clarida (2007) provide a more comprehensive summary of the literature on current account adjustments.

nothing to the pre-existing trend of increasing trade intensity among euro area member countries. In another set of papers, Ahearne, Schmitz and von Hagen (2007) and Schmitz and von Hagen (2009) find an increase in the heterogeneity of intra-euro area current account and trade balances since 1999. There is also evidence that the euro area members' bilateral trade balances with other member countries became more dispersed than their extra-area balances; these differences seem to have been on an upward trend already prior to the introduction of the euro. For instance, the European Commission (2009, 2010) notes that current account dispersion has steadily increased since the early 1990s, reaching an "all-time high" in 2008. Similarly, Decressin and Stavrev (2009) observe a growing persistence of current account surpluses and deficits of euro area countries in excess to that of other advanced economies, again predating the euro. In sum, the absence of flexible exchange rates may not be the only factor at play.

In this respect, a related strand of the literature may be of importance that discusses the influence of structural factors on the level and persistence of the current account. Conceptually, Blanchard (2007) shows that structural characteristics of goods, labor, and financial markets affect a country's current account. Indeed, there is some empirical evidence pointing in this direction. Schmitz and von Hagen (2009), for instance, show that the integration of euro area financial markets reached a new level with the introduction of the common currency, paving the way for higher current account and trade imbalances.[3] They show that the elasticity of within-area trade balances (which is their proxy for within-area net capital flows) to per capita GDP has significantly increased with the introduction of the euro. In a related paper, Ca'Zirzi and Rubaszek (2008) argue that expectations of real income convergence and consumption smoothing well explain the pattern of current account balances of euro area countries. According to Ju and Wei (2007), labor market rigidities are another structural factor shaping current accounts across countries. They argue that the less flexible labor markets are, the more protracted the adjustment of current accounts to shocks toward their longer run equilibrium is, since market rigidities slow the needed adjustment in the production structure between the tradables and the nontradables sector. Kennedy and Sløk (2005) highlight the connection between the persistence of current account imbalances and market rigidities more generally, warning that it often remains difficult to robustly establish a link between specific structural conditions and current account positions that is independent of idiosyncratic country conditions. Zemanek, Belke and Schnabl (2010) discuss links between various proxies of structural reforms and competitiveness within the euro area. And Biroli, Mouree, and Turrini (2010) provide evidence that regulation affecting price and nominal wage flexibility and employment protection influence the adjustment of real exchange rates in the euro area.

[3] Lane (2006) and Lane and Milesi-Ferretti (2007) document that bilateral bond and equity holdings within the euro area are significantly higher than similar holdings between other countries.

Finally, some papers look at the relationship between macroeconomic variables and the external account. For example, the standard import demand model links the trade balance to the real exchange rate and income differences across countries (e.g., Goldstein and Khan, 1985). Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso (2010), among others, show that fiscal adjustments affect the current account, in particular in emerging economies. Mody and Ohnesorge (2010) and Fogli and Perri (2010) discuss the impact of business cycle volatility on savings and current account balances.

In what follows, we add to the literature on exchange rate variability and external account adjustment along various dimensions. For one thing, we make use of the natural experiment provided by European monetary integration. That is, we focus exclusively on a sample of European countries, some of which have deliberately adopted a common currency, the euro. In addition, we take a detailed look at bilateral trade relations.[4] This allows for a more comprehensive analysis of the effects of exchange rate conditions on trade than the study of overall trade (or current account) balances, which reflect a multitude of bilateral exchange rate constellations. Finally, we use a comparatively long sample and a wide variety of empirical settings to examine various potential determinants of trade imbalances.

III. METHODOLOGY AND DATA

Our variable of interest is the bilateral trade balance between a reporter country r and a partner country p, defined as the difference between r's exports to p and r's imports from p in a given year t. To account for differences in the importance of a trade relationship both across partners and over time, we normalize the trade surplus or deficit by the total value of bilateral trade:[5]

$$(1) \qquad TradeBalance_{rpt} = (Exports_{rpt} - Imports_{rpt}) / (Exports_{rpt} + Imports_{rpt}) .$$

Initially, we are interested in the effect of Economic and Monetary Union (EMU) or euro area membership on bilateral trade imbalances. To that end, we estimate variants of the regression:

$$(2) \qquad |TradeBalance_{rpt}| =$$

$$\alpha + \beta\, EMU_{rpt} \{+ \Sigma_t \phi_t T_t\} \{+ \Sigma_{rp} \phi_{rp} RP_{rp}\} \{+ \Sigma_{rt} \phi_{rt} R_{rt}\} \{+ \Sigma_{pt} \phi_{pt} P_{pt}\} + \varepsilon_{rpt} ,$$

[4] See Dekle, Eaton, and Kortum (2007) for a recent discussion of the link between current account balances and bilateral trade relations.

[5] Given our interest in the symmetry of trade relations, normalizing by total trade is the natural choice (rather than, for instance, normalizing by country size). Larger magnitudes of the variable of interest indicate greater imbalances in bilateral trade.

where the regressand is the absolute value of the normalized trade balance, EMU is a dummy variable that takes the value of one if both trade partners are members of the euro area at time t and zero otherwise, and ε is the disturbance term. We also include various combinations of fixed effects. In our baseline specification, we use common time fixed effects {T} to control for joint variations in trade imbalances over time. We also allow pair-wise imbalances to consistently deviate from the sample average by adding pair-specific fixed effects {RP}. Finally, we replace the common time effects by country time fixed effects for both reporter {R} and partner {P} countries to capture any dynamic country-specific features that could affect the countries' overall trade position, including changes in the institutional environment, trends in country-specific competitiveness, or changes in the ease with which trade imbalances can be financed.[6] Given the comprehensiveness of the set of fixed effects, this constitutes a fairly strong test of the hypothesis that euro area membership will influence the level of trade imbalances.

In a second exercise, we examine country-specific determinants of trade imbalances in more detail. In particular, we aim to identify country features that help explaining the occurrence of a surplus or deficit in bilateral trade. Our regressions take the following general form:

(3) $\text{TradeBalance}_{rpt} =$

$$\alpha + \beta\, Z_{rpt} + \gamma\, Z_{rpt} \times EMU_{rpt} \{+ \Sigma_t\, \phi_t\, T_t\} \{+ \Sigma_{rp}\, \phi_{rp}\, RP_{rp}\} \{+ \Sigma_{rt}\, \phi_{rt}\, R_{rt}\} \{+ \Sigma_{pt}\, \phi_{pt}\, P_{pt}\} + \varepsilon_{rpt}\,,$$

where Z is the variable of interest which is typically entered as the pair-wise difference in values between the reporter and partner country, thereby allowing the inclusion of an EMU interaction term that captures possible changes in the effect after the introduction of the euro as common currency.

In line with previous work on the effects of EMU on trade (Berger and Nitsch, 2008), our analysis focuses on a homogeneous set of 18 European countries. The approach has the advantage of including countries which either share the European Union's (EU) institutional framework or are closely associated with it. The sample comprises the 15 countries which were member of the EU at the time of the introduction of the euro (eleven of which adopted the currency from the beginning, followed by Greece in 2001) plus Iceland, Norway and Switzerland. We analyze the period from 1948 to 2008.

Our key source of data is the International Monetary Fund's *Direction of Trade Statistics* from which we obtained nominal values of bilateral exports and imports on an annual basis.

[6] Example for changing institutional arrangements captured by time fixed effects include the country-specific effects of the "Single Market" initiative but also pre-EMU exchange rate arrangements. Arguably, the introduction of the euro has eased the financing of trade deficits through tighter financial integration and, for some countries, through the decline of real interest rates. Time fixed effects will also capture any systematic decline in (real) exchange rate volatility.

Since country r's trade balance with p is typically not identical to p's inversely-signed trade balance with r (e.g., because of different statistical valuation methods for exports and imports), we analyze the full sample of bilateral imbalances.[7] Our trade data set is augmented with macroeconomic variables from the IMF's *International Financial Statistics* and the World Bank's *World Development Indicators*. Institutional variables are taken from the OECD. Variables and sources are described in detail in an appendix.

Figure 1 graphs the evolution of absolute trade imbalances in our sample over time. Two observations stand out. First, the sample average trade imbalance consistently exceeds the median imbalance, indicating that the distribution could be dominated by a few disproportionately large imbalances between country pairs. Indeed, some bilateral trade relationships are characterized by one-directional trade flows and, thus, high imbalances, especially for small countries (such as Iceland, Ireland, and Greece).[8] Second, median and mean imbalances display the same U-shaped pattern over time. There have been relatively large bilateral trade imbalances in the Bretton Woods era, followed by a period of moderate imbalances in the 1970s and 1980s, and a renewed increase in imbalances since the mid-1990s. Taken at face value, this pattern is consistent with the hypothesis that a fixed exchange rate regime is associated with larger trade imbalances.

To analyze this issue in more detail, Figure 2 shows the trade balances of various groups of countries over the same period. Specifically, we distinguish between trade relationships for which exchange rates were fixed with the introduction of the euro (intra-EMU trade) and trade pairs for which nominal exchange rates remained flexible (i.e., trade between EMU countries and non-members as well as trade between non-members). Interestingly, the U-shaped pattern applies most strongly to trade between EMU member countries, while trade between non-members displays no clear tendency over time. Trade imbalances between EMU member countries and non-members show a similar but less pronounced U-shape. A possible explanation is that the external value of the euro, while flexible for the euro area as a whole, cannot adjust to individual (and possibly opposing) member country needs. Figure 3 contains corroborating graphical evidence for this hypothesis. The figure plots, separately for each EMU member country, the difference between the largest bilateral trade surplus and deficit with a non-member in our sample. For most countries, the spread between the most positive and the most negative trade imbalance has indeed been increasing over the last few years, possibly reflecting a growing divergence in trade competitiveness.

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[7] Restricting the sample to only one observation per country pair requires a decision on which observation to analyze and which to ignore. In our sensitivity analysis, we experimented with a number of approaches and found most results to be reasonably robust. For example, including only one observation per country pair while dropping any observations where pair-wise balances differ by more than 10 percentage points between the two reporting countries delivers results quite similar to those tabulated below.

[8] The introduction of fixed country-pair effects will limit the possible effect of outliers on our econometric results below.

IV. Trade Imbalances and Exchange Rate Regimes

Regression analysis confirms the association between the exchange rate regime and trade imbalances. Table 1 presents the benchmark estimation results. We begin with the most parsimonious specification of equation (2), a regression of the absolute value of bilateral trade imbalances on an EMU membership dummy and a comprehensive set of year fixed effects. As shown in the first column on the left of the table, the estimated β coefficient on the EMU variable is positive and, with a t-statistic of 2.1, significantly different from zero at the 5 percent level; the point estimate of about 0.018 implies that trade imbalances between euro area member countries are on average about 2 percentage points larger than for the rest of the sample. In the next column, we add a comprehensive set of pair-wise fixed effects to our specification so that the EMU coefficient now captures only the time variation in the trade imbalance for EMU member countries after the adoption of the euro. The estimated coefficient not only remains positive and significant, but almost doubles in magnitude to 0.033. This suggests that euro area member countries have experienced an increase in their bilateral trade imbalances with other euro area members by an average of more than 3 percentage points since the adoption of the common currency, which appears large compared to a sample mean of about 0.3. Controlling instead for time-variant country-specific features in the reporter and partner country leaves the estimation result basically unchanged. As shown in column 3, the estimated effect of euro area membership on trade imbalances remains positive, statistically highly significant, and economically sizable.

The final three columns on the right of Table 1 further generalize these results. The regressions add a dummy variable for the presence of a fixed (or unchanged) exchange rate between two countries other than euro area membership, along with the p-value of a t-test for similarity of the estimated coefficients. While the estimates of the EMU effect on trade imbalances are unaffected by this extension, the coefficients on the variable for other fixed exchange rates vary strongly across specifications. The estimated coefficient is positive and significant when only common time fixed effects are included, possibly reflecting some large imbalances in the immediate post-World War II period. After controlling for pair-wise fixed effects, however, the coefficient falls in magnitude and becomes statistically indistinguishable from zero; it even changes sign (but remains insignificant) for the specification with country time fixed effects.

To further investigate the role of exchange rate variability, Table 2 substitutes the simple binary measure of a fixed exchange rate by two alternative measures of exchange rate flexibility: the annual standard deviation of the monthly nominal exchange rate and a set of dummy variables indicating the degree of nominal exchange rate variability. For both measures, we report estimation results for the three benchmark regression specifications.

The first three columns of the table report the estimates when the measure of exchange rate volatility is added to our baseline specifications. As shown, the standard deviation of the nominal exchange rate appears to affect bilateral trade balances, but the exact result depends

on the specification that is used. Specifically, we find, somewhat counter-intuitively, that exchange rate volatility and trade imbalances are positively related in the regression with only year fixed effects (column 1). However, the relationship takes the expected negative sign for less parsimonious specifications. Once we introduce country fixed effects (column 3), bilateral imbalances are decreasing in nominal exchange rate variability. Overall, the findings suggest that controlling for time-variant country characteristics may be important for the identification of the exchange rate effect. Note, however, that the estimate of the euro's effect on trade imbalances remains largely unaffected by these perturbations.

A possible explanation for our inconclusive estimation results on the effect of exchange rate volatility on trade imbalances are potential nonlinearities. Adjustable exchange rates may imply lower imbalances, but greater exchange rate volatility does not necessarily imply a further reduction in bilateral trade imbalances. To examine this possibility, we differentiate across various degrees of exchange rate flexibility, making the omitted category a fixed exchange rate other than the use of the euro. The last three columns of Table 2 present the results. The estimates turn out to be generally in line with the hypothesis of a nonlinear effect of exchange rate variability on trade imbalances. The coefficients on moderate adjustments in the nominal exchange rate consistently take on the smallest values, while coefficients increase in magnitude for larger exchange rate changes.

V. Determinants of Bilateral Trade Surpluses/Deficits

In a next step, we focus not only on the magnitude of the bilateral trade imbalance, but also take its direction into account. In order to examine the effect of the euro on trade surpluses and deficits, we estimate variants of equation (3). Again, we use varying sets of fixed effects, reporting results for the most demanding regression specification, depending on the economic variable introduced.

We begin by exploring macroeconomic variables that are typically associated with the emergence of bilateral trade imbalances. According to standard models of import demand and supply, for instance, the trade balance is a function of relative prices as well as domestic and foreign expenditure. We proxy for these variables with (i) a bilateral index of the real exchange rate, computed as $RER_{rpt} = ER_{prt} \times CPI_{rt} / CPI_{pt}$, where ER denotes the nominal exchange rate and CPI is the consumer price index, and (ii) the difference in real GDP growth rates. Larger values of the (lagged) exchange rate index, implying a real appreciation of the reporter's currency, should then be associated with a deterioration of the trade balance. The impact of relative growth depends on the demand and supply elasticities, but we generally expect that a positive growth differential is associated with a lower bilateral trade surplus or higher deficit.

Table 3 tabulates the results. In columns 1 to 5 of the table, we present estimates for the full sample period as well as various sub-periods. As shown, bilateral trade surpluses and deficits indeed tend to deteriorate with real appreciations, in particular in the presence of fixed

nominal exchange rates. The estimated coefficient for the (log of the) real exchange rate takes the expected negative sign and is highly significant for periods with mostly fixed exchange rates, namely under the Bretton Woods system from 1949 to 1973 and the period 1999 to 2009 that covers the euro's reign in our sample. We find a similar result for the period from 1973 to the mid-1980s, when the so-called "currency snake" arrangement kept nominal exchange rate swings in check among many European countries. Moreover, the estimated impact is broadly similar in magnitude and economically sizable across these sub-periods, suggesting that a one-percent increase in the real exchange rate leads to a reduction in the trade balance of about 4 to 5 percentage points. Only for the period from 1984 to 1998, which roughly centers around the 1992 European Exchange Rate Mechanism (ERM) crisis, the coefficient on the real exchange rate takes an unexpectedly positive sign, which also seems to affect the estimation result for the full period. In another perturbation, we replace the time-varying country-specific fixed effects by real effective exchange rate indices for both the exporting and the importing country (available only for a shorter time period). Reassuringly, there is again strong evidence that a decline in price competitiveness due to a real exchange rate appreciation is associated with a worsening of the trade balance.

The regression results in the final two columns on the extreme right of Table 3 support the hypothesis that higher relative output growth is typically associated with lower bilateral trade surpluses or higher deficits. Column 7 tabulates results for the full sample, along with an interaction term for growth differentials among countries that use the euro as national currency; column 8 presents analogous results for a reduced sample of EMU member countries after the introduction of the euro. While results are generally weak for the full sample, the estimates consistently suggest that euro area member countries growing faster than their trade partners suffer, on average, a deterioration of their bilateral trade balance. Both the coefficient on the interaction term and the coefficient on the growth differential in the EMU-only sample take a negative sign; for the euro area sample, the estimate is -0.05 so that an increase in a country's growth advantage by one percent is associated with a decrease in its bilateral trade balance by about 5 percentage points. This likely reflects the large trade deficits of some of the faster growing member states after the introduction of the euro.

Table 4 provides evidence that trade surpluses tend to increase in (a measure of) business cycle volatility. Mody and Ohnesorge (2010) suggest that greater business cycle volatility is associated with higher precautionary household savings, which, by extension, should lead to higher trade balance surpluses or lower trade balance deficits. We explore this hypothesis by using the standard deviation of annual real GDP growth rates over a centered 9-year period as a proxy for business cycle volatility. Results are tabulated in the first two columns of Table 4. The positive coefficient estimates indeed imply that countries with relatively lower growth volatility tend to exhibit lower trade surpluses or higher deficits, an effect that is further amplified by euro area membership. The effect is nonnegligible in magnitude, with an increase in the difference in standard deviations by one being associated with an increase in the trade balance by about 9 percentage points.

We also find evidence for the hypothesis that trade deficits often emerge in conjunction with large fiscal deficits (e.g., Abbas, Bouhga-Hagbe, Fatás, Mauro, and Velloso, 2010). The results reported in columns 3 and 4 of Table 4 provide strong support for the "twin deficit" argument. All of our estimates suggest that higher deficits are associated with a more negative external position at statistically and economically significant levels. More notably, the effect is again particularly pronounced for trade pairs in which both partner countries use the euro. Among euro area members, a one percentage point increase in the (relative) fiscal balance is associated with an improvement in the bilateral trade balance by about two percentage points.

Finally, we examine the relationship between market flexibility and the trade balance—a link emphasized by Blanchard (2007) and others. In our analysis, we make use of OECD indicators that proxy the intensity of various aspects of product and labor market regulation; the indices range from 0 (least restrictions) to 6 (most restrictions). We start with a simple graphical approach for the two aggregate regulation measures. Figure 4 is a set of scatter plots of the trade balance against both cross-country differences in employment protection and product market regulation for individual years, covering the period of available data. The graphs clearly illustrate that higher relative levels of labor or product market flexibility are associated with higher bilateral trade surpluses (or lower deficits). Also, the association has apparently become stronger over time, especially for country pairs in which both partner countries adopted the euro (marked with a filled circle).

For a more rigorous analysis, Table 5 presents, for each regulation measure, estimation results from two separate regressions. As before, we show results for the full country sample, in which the variable of interest is interacted with the EMU dummy, as well as a sample that is reduced to cover only EMU countries during the euro years. In addition to results for the two aggregate regulation measures, we also report estimates for the individual sub-indices. Note that the availability of the institutional regulation measures severely limits the number of observations in a number of cases.

Reviewing the results, the bulk of the econometric evidence consistently shows that higher relative levels of regulation are indeed associated with lower trade balance surpluses or higher deficits. Specifically, we find that bilateral trade balances tend to be significantly lower when the relative levels of overall labor market and product market rigidity in a country are higher than in the partner country, an effect that is particularly strong among euro area members. Not surprisingly, the link is somewhat weaker for the sub-indices that focus on particular aspects of labor and product market regulation. Still, for the majority of sub-indices, we also find a significantly negative effect of regulation, especially for euro area member countries.[9]

[9] Of 30 estimated coefficients for ten regulatory indicators, 24 coefficients take a negative sign, 16 of which are statistically different from zero, at least at the 5 percent level.

VI. Persistence of Bilateral Trade Imbalances

In a final set of exercises, we ask whether the rate of persistence in trade account imbalances—that is, the speed with which imbalances revert to equilibrium after a shock— is affected by the degree of exchange rate stability.

Table 6 reports estimates for augmented versions of the baseline model of Table 1 when lagged values of the dependent variable as well as an interaction term that captures the effect of lagged imbalances in the euro area are added to the specification. We find strong evidence of persistence; the autoregressive coefficient is about 0.68 and highly statistically significant.[10] More importantly, the degree of persistence is much higher for EMU countries. When the lagged dependent variable is interacted with EMU membership, the estimated coefficient is positive, statistically highly significant, and economically large. Taken at face value, the degree of persistence in intra-euro area imbalances is about 25 percent higher than elsewhere, implying an autoregressive coefficient of about 0.83 for EMU members. With this extension, however, the coefficient on the non-interacted EMU dummy becomes significantly negative, suggesting that the disproportionately large bilateral trade imbalances under EMU are linked to a greater persistence of these imbalances between euro area member countries.[11] Column 2 shows that the result does not extend to other fixed exchange rates. Finally, the remainder of the table reports analogous estimation results for regressions in which the absolute value of the trade imbalance is replaced by the trade surplus and deficit as dependent variable.

Interestingly, some of the greater persistence of trade imbalances for euro area member countries can be linked to market institutions. In the first three columns of Table 7, we tabulate results for augmented regression specifications that also include the average level of employment protection for a given pair of countries as explanatory variable (along with appropriate interaction terms); the remaining three columns of the table present analogous results for the average level of product market regulation. The key finding of these regressions is that higher levels of employment protection tend to be associated with greater persistence of trade imbalances among euro area countries; the relevant coefficient estimates are reported in row 4. Based on the results from the fully specified model in column 3, the autoregressive coefficient increases by about 0.09 for each unit increase in the pair-wise average of the OECD employment regulation measure (that ranges from 1 to 6). In summary, our results indicate that, after adoption of the euro, euro area member countries with more rigid labor market institutions exhibited statistically and economically significantly lower

[10] The inclusion of higher order autoregressive terms provides no further insights.

[11] Higher persistence means that trade balance shocks will linger longer and can accumulate, for example. In a regression with only a lagged endogenous variable and the EMU dummy, the latter is rendered insignificant (not reported).

rates of reversion in their trade account imbalances. For instance, a reduction of employment protection levels from the sample mean of 2.4 to the sample low of 0.8 would reduce persistence by about 0.15, all other things equal. This difference is equivalent to the deviation of the degree of persistence among EMU countries from the sample average.

VII. CONCLUSION

In this paper, we provide consistent evidence that imbalances in trade among euro area member countries have widened markedly after the introduction of the common currency. This increase went along with a higher degree of persistence, which appears to lengthen the impact of shocks on external accounts. These findings are in line with additional observations that imbalances tend to be lower among trade partners with a flexible nominal exchange rate and that bilateral trade surpluses are decreasing in the real exchange rate, which will move more slowly in the absence of nominal exchange rate flexibility.

Although bilateral trade relationships need not necessarily be balanced, the emergence of large and persistent trade imbalances between a pair of countries may reflect underlying policy tensions or rigidities. Indeed, our results strongly confirm that policy and market institutions affect external balances. Countries with relatively less flexible labor and product markets tend to display larger trade deficits; some of the higher intra-euro area persistence in trade imbalances is explained by higher average levels of employment protection. Moreover, trade surpluses tend to be higher (and deficits lower) in countries that have relatively volatile economies (and, thus high buffer savings) and prudent fiscal policies.

Our findings imply both bad and good news for policymakers. The bad news is that irrevocably fixed nominal exchange rates do come at the cost of larger and more permanent trade imbalances, just as Friedman (1953) claimed more than half a century ago. The good news is that these imbalances are not completely unavoidable. With a fixed exchange rate, trade imbalances are all the smaller and their adjustment to shocks all the faster, the more flexible the national labor and product markets are. Similarly, structural reforms that smooth the business cycle (e.g., by increasing growth contributions from domestic sources in very open trade surplus economies) can help reduce precautionary savings and thereby lower trade surpluses. Finally, measures to improve the fiscal balance are likely to aid efforts to reduce large deficits in international trade.

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Table 1. Trade Imbalances under Fixed Exchange Rate Regimes

EMU	0.018 (0.009)	0.033 (0.007)	0.034 (0.015)	0.020 (0.009)	0.033 (0.007)	0.035 (0.016)
Other fixed exchange rate				0.090 (0.009)	0.010 (0.006)	-0.004 (0.010)
Common time fixed effects?	Yes	Yes	No	Yes	Yes	No
Pair-wise fixed effects?	No	Yes	Yes	No	Yes	Yes
Country time fixed effects?	No	No	Yes	No	No	Yes
Number of observations	16,491	16,491	16,491	15,939	15,939	15,939
Adj. R^2	0.02	0.53	0.63	0.02	0.53	0.64
P-value: EMU=Other fixed				0.000	0.015	0.039

Notes: OLS regression. Dependent variable is the absolute trade imbalance as a fraction of total bilateral trade. Robust standard errors are reported in parentheses.

Table 2. Trade Imbalances and Exchange Rate Variability

EMU	0.046 (0.009)	0.037 (0.007)	0.024 (0.015)	-0.031 (0.013)	0.028 (0.010)	0.041 (0.019)
Exchange rate volatility	0.015 (0.002)	0.001 (0.001)	-0.008 (0.004)			
Exchange rate change >0, <2.5%				-0.099 (0.009)	-0.013 (0.006)	0.004 (0.010)
Exchange rate change >2.5, <15%				-0.041 (0.010)	-0.002 (0.007)	0.009 (0.011)
Exchange rate change >15%				-0.014 (0.011)	0.015 (0.008)	0.006 (0.013)
Common time fixed effects?	Yes	Yes	No	Yes	Yes	No
Pair-wise fixed effects?	No	Yes	Yes	No	Yes	Yes
Country time fixed effects?	No	No	Yes	No	No	Yes
Number of observations	14,073	14,073	14,073	15,965	15,965	15,965
Adj. R^2	0.03	0.56	0.65	0.04	0.53	0.64

Notes: OLS regression. Dependent variable is the absolute trade imbalance as a fraction of total bilateral trade. Robust standard errors are reported in parentheses.

Table 3. Economic Determinants of Bilateral Trade Surpluses/Deficits

Sample	Full	1948-1973	1974-1983	1984-1998	1999-2008	Full	Full	EMU
Log real exchange rate	0.025	-0.048	-0.044	0.053	-0.037	-0.005		
	(0.010)	(0.013)	(0.008)	(0.003)	(0.012)	(0.005)		
Log real effective exch. rate reporter						-0.115		
						(0.026)		
Log real effective exch. rate partner						0.190		
						(0.027)		
De-meaned real GDP growth differential							0.001	-0.052
							(0.004)	(0.004)
De-meaned real GDP growth differential × EMU							-0.008	
							(0.006)	
Common time fixed effects?	No	No	No	No	No	Yes	No	No
Pair-wise fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country time fixed effects?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Number of observations	16,060	6,587	2,716	3,766	2,720	8,555	12,026	1,060
Adj. R^2	0.76	0.84	0.89	0.93	0.95	0.77	0.80	0.98

Notes: OLS regression. Dependent variable is the trade imbalance (surplus +, deficit –) as a fraction of total bilateral trade. Robust standard errors are reported in parentheses.

Table 4. Other Economic Determinants of Bilateral Trade Surpluses/Deficits

Sample	Full	EMU	Full	EMU
Difference in real GDP growth volatility	0.045 (0.011)	0.085 (0.011)		
Difference in real GDP growth volatility × EMU	0.055 (0.015)			
Budget balance (% GDP)			0.006 (0.003)	0.020 (0.003)
Budget balance (% GDP) × EMU			0.012 (0.003)	
Number of observations	13,117	1,060	7,407	864
Adj. R^2	0.79	0.98	0.85	0.98

Notes: OLS regression. Dependent variable is the trade imbalance (surplus +, deficit –) as a fraction of total bilateral trade. Robust standard errors are reported in parentheses. Country specific time and country-pair fixed effects are included but not reported.

Table 5. Institutional Determinants of Bilateral Trade Surpluses/Deficits

Sample	Full				EMU		
Variable	Coeff.	EMU Intera'n	Numb. of obs.	Adj. R^2	Coeff.	Numb. of obs.	Adj. R^2
Employment protection	-0.303 (0.014)	-0.022 (0.008)	5,060	0.91	-0.230 (0.012)	864	0.98
Regular employment	-0.006 (0.013)	0.025 (0.008)	5,060	0.91	-0.147 (0.011)	864	0.98
Temporary employment	-0.006 (0.007)	-0.029 (0.005)	5,060	0.91	-0.101 (0.007)	864	0.98
Collective dismissal	0.408 (0.006)	0.004 (0.013)	2,340	0.96	0.015 (0.005)	864	0.98
Product market regulation	-0.699 (0.097)	-0.065 (0.040)	720	0.95	-0.477 (0.076)	180	0.99
Administrative regulation	-0.118 (0.125)	-0.057 (0.037)	720	0.95	-0.626 (0.073)	180	0.99
Domestic economic regulation	-0.179 (0.072)	-0.051 (0.027)	720	0.95	-0.349 (0.020)	180	0.99
State control	0.137 (0.050)	-0.035 (0.021)	720	0.95	-0.430 (0.027)	180	0.99
Barriers to entrepreneurship	-0.236 (0.048)	-0.100 (0.048)	720	0.95	-0.600 (0.056)	180	0.99
Barriers to trade & investment	0.048 (0.194)	-0.006 (0.049)	720	0.95	-1.081 (0.094)	180	0.99

Notes: OLS regression. Dependent variable is the trade imbalance (surplus +, deficit –) as a fraction of total bilateral trade. Robust standard errors are reported in parentheses. Country specific time and country-pair fixed effects are included but not reported.

Table 6. Persistence of Trade Imbalances

	Imbalance		Surplus/Deficit	
Lagged trade imbalance	0.675 (0.009)	0.677 (0.010)	0.734 (0.013)	0.735 (0.013)
Lagged trade imbalance × EMU	0.159 (0.018)	0.171 (0.019)	0.076 (0.017)	0.077 (0.017)
EMU	-0.040 (0.010)	-0.044 (0.010)		
Lagged trade imbalance × Other fixed exch. Rate		-0.020 (0.016)		-0.017 (0.014)
Other fixed exch. rate		0.012 (0.006)		
Number of observations	16,194	15,932	16,194	15,932
Adj. R^2	0.81	0.81	0.89	0.89

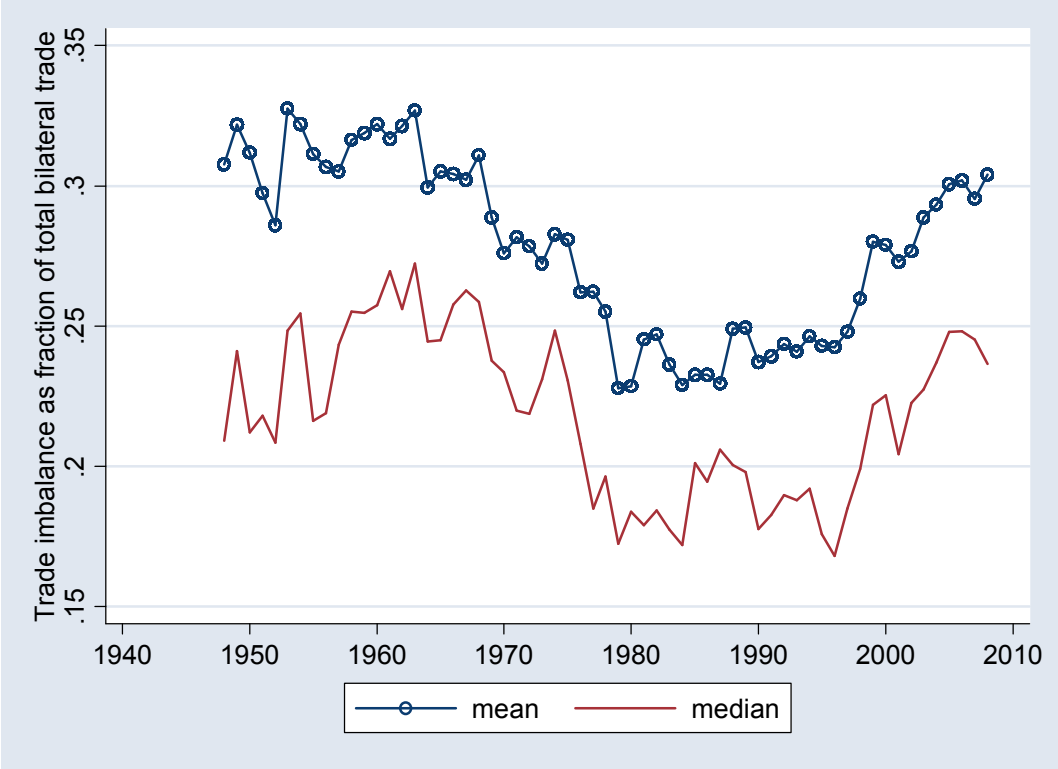
Notes: OLS regression. Dependent variable is listed on the top of each column. Robust standard errors are reported in parentheses. Country specific time and country-pair fixed effects are included but not reported.

Table 7. Regulatory Environment and Persistence of Trade Imbalances

Lagged trade imbalance	0.756	0.746	0.761	0.643	0.658	0.606
	(0.046)	(0.046)	(0.046)	(0.100)	(0.103)	(0.114)
Average employment protection	0.100	0.100	0.054			
	(0.017)	(0.013)	(0.013)			
Lagged trade imbalance × Average employment protection	-0.029	-0.027	-0.034			
	(0.018)	(0.017)	(0.018)			
Lagged trade imbalance × Average employment protection × EMU		0.012	0.088			
		(0.007)	(0.024)			
Average product market regulation				-0.127	0.227	0.319
				(0.144)	(0.082)	(0.125)
Lagged trade imbalance × Average product market regulation				0.000	-0.004	0.020
				(0.057)	(0.057)	(0.061)
Lagged trade imbalance × Average product market regulation × EMU					-0.020	-0.115
					(0.028)	(0.101)
Lagged trade imbalance × EMU			-0.171			0.199
			(0.060)			(0.180)
EMU			-0.021			-0.028
			(0.011)			(0.031)
Number of observations	5,059	5,059	5,059	720	720	720
Adj. R^2	0.9	0.9	0.91	0.94	0.94	0.95

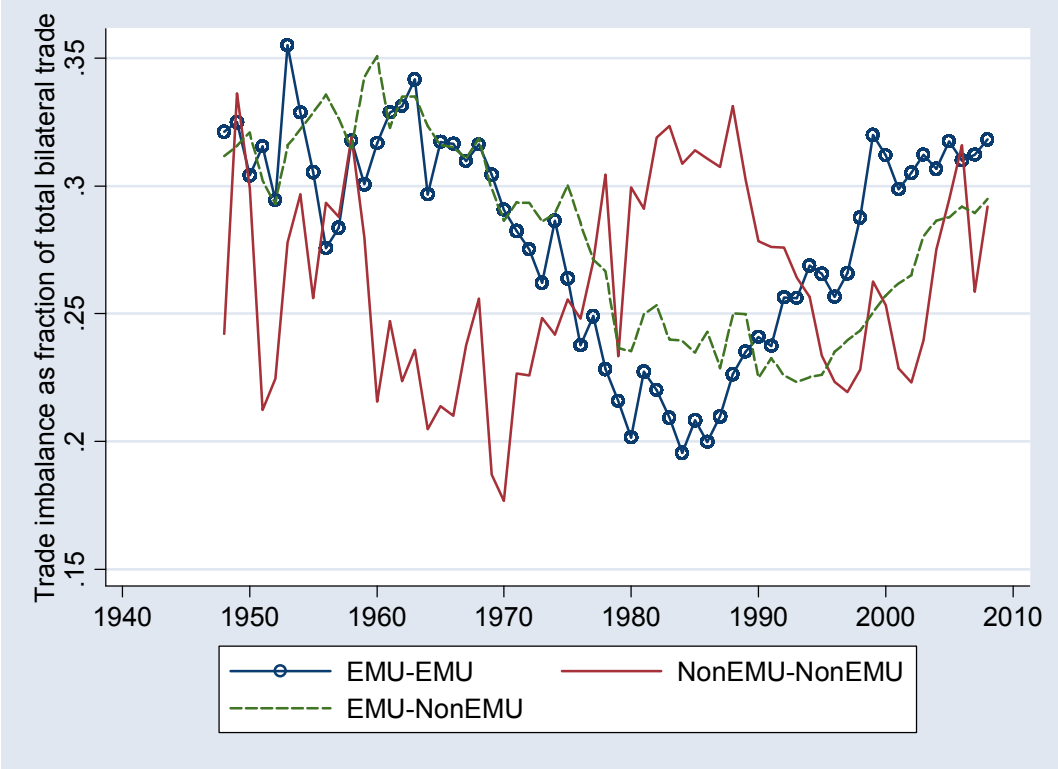
Notes: OLS regression. Dependent variable is the absolute trade imbalance as a fraction of total bilateral trade. Robust standard errors are reported in parentheses. Year-specific reporter and partner fixed effects and time-invariant pair-wise fixed effects are always included, but not reported.

Figure 1. Bilateral Trade Imbalances over Time



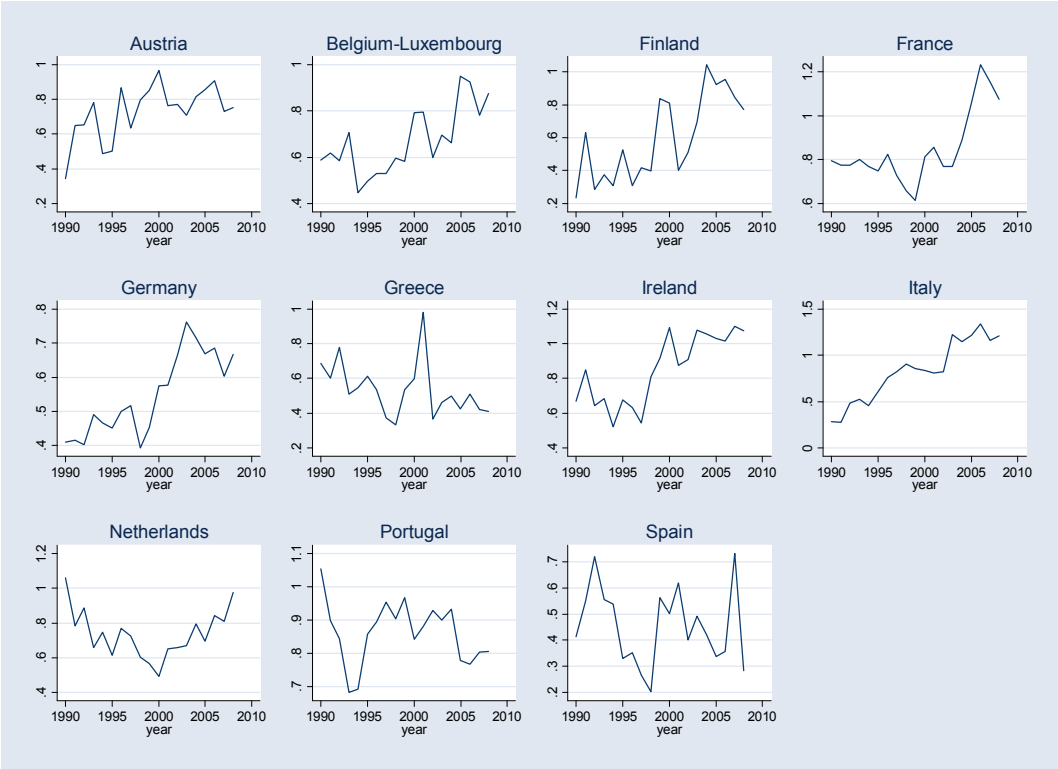
Notes: The figure graphs the absolute difference between a country's exports and imports with a partner as a fraction of total bilateral trade (exports plus imports) for a sample of 18 European countries. Data are taken from the IMF's Direction of Trade Statistics.

Figure 2. Bilateral Trade Imbalances by Group of Country Pairs



Notes: The figure graphs the average absolute difference between a country's exports and imports with a partner as a fraction of total bilateral trade (exports plus imports) for various groups of country pairs. Data are taken from the IMF's Direction of Trade Statistics.

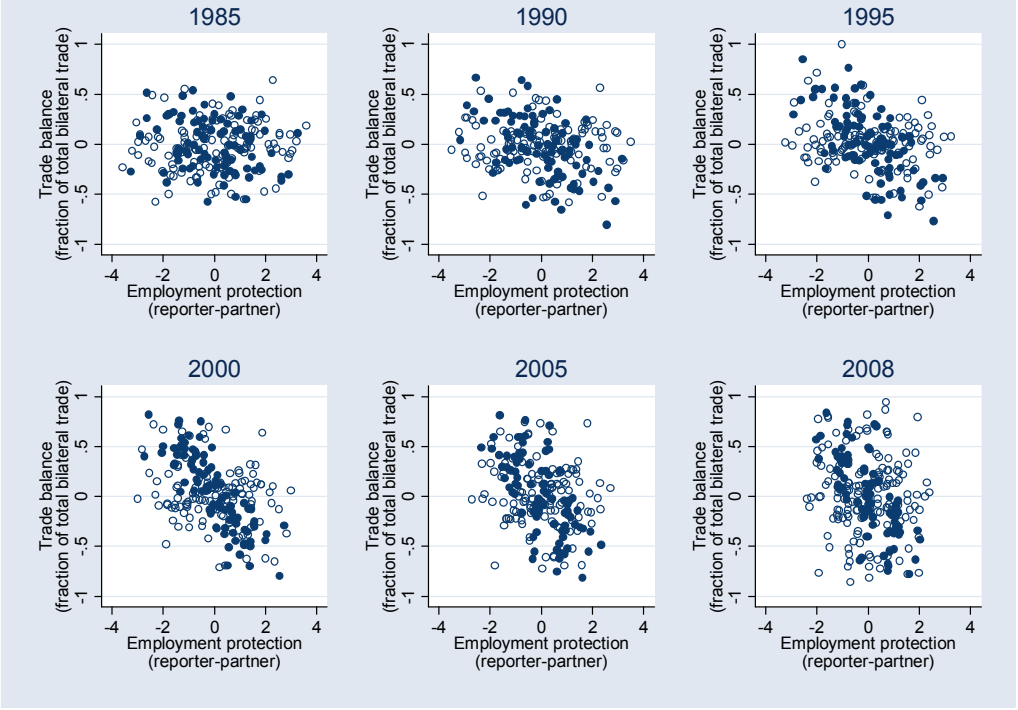
Figure 3. Spread of Trade Imbalances (Surplus/Deficit) of EMU Member Countries with Non-EMU Countries



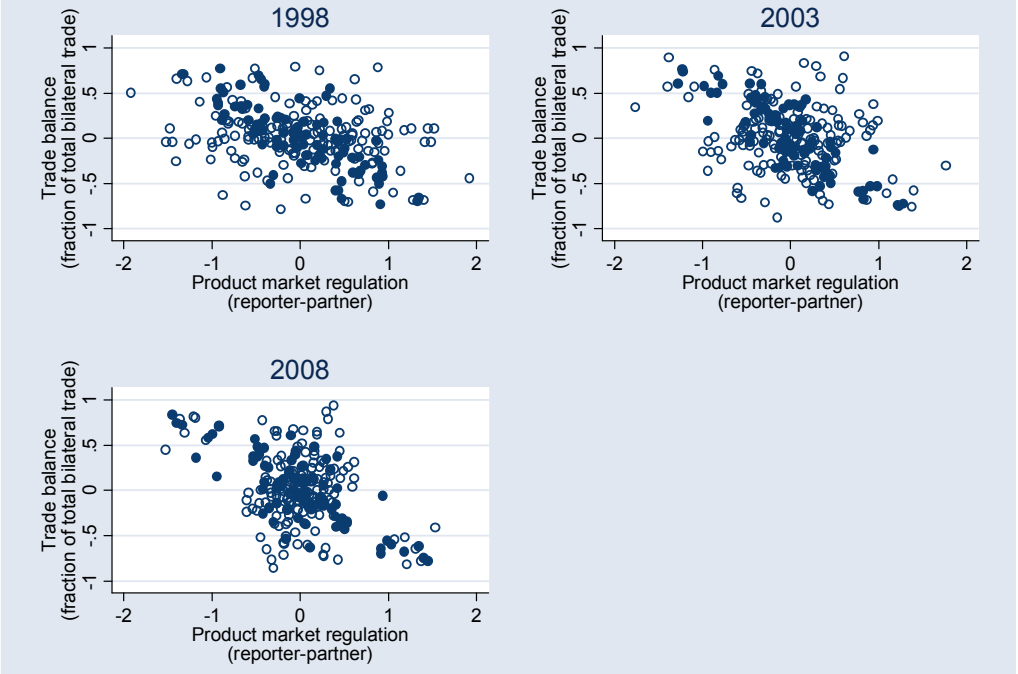
Notes: The figure graphs the difference between the maximum and the minimum trade imbalance (defined as a country's exports and imports with a partner as a fraction of total bilateral trade) of the EMU member country with one of the six non-EMU members in the sample (Denmark, Iceland, Norway, Sweden, Switzerland, the United Kingdom). Data are taken from the IMF's Direction of Trade Statistics.

Figure 4. Trade Imbalances and Regulation

Employment Protection



Product Market Regulation



Notes: Filled circles mark country pairs where both partners are/become EMU members.

APPENDIX: DATA DESCRIPTION

Variable	Description	Source	Period
Trade balance	(Exports-Imports)/ (Exports+Imports)	IMF Direction of Trade Statistics	1948-2008
Exchange rate volatility	Standard deviation of monthly bilateral nominal exchange rate	IMF International Financial Statistics	1948-2008
EMU	Dummy for common membership in euro area (time-variant)		1948-2008
Other fixed exchange rate	Dummy for exchange rate volatility < 0.1 in a given year		1948-2008
Real exchange rate	Nominal exchange rate$_{pr}$ × Consumer Price Index$_r$ / Consumer Price Index$_p$	IMF International Financial Statistics	1948-2008
Real effective exchange rate	Index (2005=100), based on relative consumer prices	IMF International Financial Statistics	1975-2008
De-meaned real GDP growth	Deviation of real GDP growth from average growth in previous 4 years	IMF International Financial Statistics	1948-2008
Real GDP growth volatility	Standard deviation of real GDP growth over period of 4 years before and after a given year	IMF International Financial Statistics	1948-2008
Budget balance (% GDP)	General government balance/GDP	IMF International Financial Statistics	1960-2008
Employment protection	Strictness of employment protection	OECD	1985-2008
Regular employment	Sub-indicator for dismissal of employees on regular contracts	OECD	1985-2008
Temporary employment	Sub-indicator for strictness of regulation on temporary contracts	OECD	1985-2008
Collective dismissal	Sub-indicator for additional regulation of collective dismissal	OECD	1998-2008
Product market regulation	Product market regulation	OECD	1998, 2003, 2008
Administrative regulation	Sub-indicator for administrative regulation	OECD	1998, 2003, 2008
Domestic economic regulation	Sub-indicator for domestic economic regulation	OECD	1998, 2003, 2008
State control	Sub-indicator for state control	OECD	1998, 2003, 2008
Barriers to entrepreneurship	Sub-indicator for barriers to entrepreneurship	OECD	1998, 2003, 2008
Barriers to trade & investment	Sub-indicator for barriers to trade and investment	OECD	1998, 2003, 2008