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## Currency Unions in Prospect and Retrospect

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### Abstract

We critically review the recent literature on currency unions and discuss the methodological challenges posed by the empirical assessment of their costs and benefits. In the process, we provide evidence on the economic effects of the euro. In particular, and in contrast with estimates of the trade effect of other currency unions, we find that the euro's impact on trade has been close to zero. After reviewing the costs and benefits of joining a currency union, we conclude with some open questions on normative and positive aspects of the theory of currency unions, emphasizing the need for a unified welfare-based framework to weigh their costs and gains.

## 1. INTRODUCTION

What is the appropriate domain of a currency area? Mundell's (1961) seminal question is today as pertinent as ever. At the turn of the new millennium, 12 Western European countries instituted the euro as legal tender, delegating monetary policy to the European Central Bank. Cyprus, Malta, Slovakia, and Slovenia formally joined the euro area more recently, and a number of other states (including Andorra, Kosovo, Montenegro, Monaco, San Marino, and Vatican City) unilaterally adopted the euro as their sole currency.<sup>1</sup> Furthermore, a growing group (including Bulgaria, Hungary, and Romania) is currently negotiating accession, whereas others (among them Denmark, Iceland, and the United Kingdom) have maintained ongoing debates on the advisability of adopting the euro, particularly after the onset of the current financial crisis.

Moving south, six Gulf Cooperation Council countries originally planned to introduce a common currency, the Khaleeji, in 2010 but recently postponed its introduction, partly because of the financial crisis. Six members of the Economic Community of West African States have agreed to create a new common currency by the year 2015, and 11 members of the Southern African Development Community have agreed to adopt a common currency by 2018. Finally, and in a less tangible future, the East African Community plans to create a new common currency. (Details of the countries involved in these prospective currency unions are given in **Supplemental Table 1**; follow the Supplemental Material link from the Annual Reviews home page at <http://www.annualreviews.org>.)

This reshaping of the international monetary arrangement, actual or planned, has reinvigorated the theoretical and empirical debate over the wisdom of currency unions. The case for joining a currency union rests on two main benefits. The first is the elimination of currency conversion costs and the disturbances in relative prices coming from nominal exchange-rate fluctuations; lower transaction costs and greater predictability encourage deeper integration in goods and capital markets. This is the main benefit emphasized by Mundell (1961), as well as one of the main preoccupations of nineteenth-century economists, as famously expressed by John Stuart Mill (1848): "So much of barbarism, however, still remains in the transactions of the most civilized nations, that almost all independent countries choose to assert their nationality by having, to their own inconvenience and that of their neighbours, a peculiar currency of their own." Related to this point, Mundell (1961) also emphasized that a broader currency area reduces the scope for speculation and hence volatility in foreign exchange markets, as, in thicker markets, single speculators are less likely to affect exchange rates. This increases the value of money as a medium of exchange and likely leads to higher market integration.

The second benefit of joining a currency union is its potential to discipline policies, in particular to combat inflation, insofar as the anchor country (or the union's monetary authority) is better able to commit to monetary rules. The gain from commitment stemming from currency unions was recently emphasized by Alesina & Barro (2002).<sup>2</sup>

The main argument against currency unions, from the perspective of a member country, is the loss of independence to tailor monetary policy to local needs. There are, however,

<sup>1</sup>They differ from the formal members in that they do not have a vote in the European Central Bank.

<sup>2</sup>For earlier contributions, see Giavazzi & Giovannini (1989) and Alesina & Grilli (1992), who focused on the Barro & Gordon (1983) trade-off between the commitment and flexibility of fixed versus flexible exchange-rate regimes in the context of the European Monetary Union.

certain conditions under which this loss is relatively small, which are typically known as the optimum currency area (OCA) criteria.<sup>3</sup> Specifically, a currency union will tend to be less costly for countries that feature high comovement of economic variables vis-à-vis other countries in the union, as this increases the consensus over the direction of monetary policy (Mundell 1961).<sup>4</sup> Similarly, a currency union will be less costly if there is a high level of labor mobility within the union, and/or high degrees of wage and price flexibility, as both these conditions facilitate full employment, reducing the need for active policy, and, also, diminishing the effectiveness of monetary policy, and thus the value of monetary independence (Mundell 1961).

Furthermore, the cost of joining a union will tend to decrease with fiscal integration or, more generally, with the availability of public or private mechanisms to smooth out diverse shocks through regional transfers (Kenen 1969); in the same vein, capital market integration will tend to lower the cost of joining, insofar as it allows countries to smooth consumption in the face of idiosyncratic shocks (Mundell 1973, Buiter & Sibert 2008). A currency union will also tend to be less costly for a country with a high degree of sectoral diversification, as this will provide some insulation against a variety of shocks, avoiding the need for changes in exchange rates (Kenen 1969). On a different line, joining a currency union may also be less costly for small, open (price-taking) economies—for which the prices of tradeables (both imports and exports) are flexible—because nominal exchange rates in this case become ineffective as a mechanism to affect terms of trade, and hence to restore external balance (McKinnon 1963).

None of the OCA criteria in this nonexhaustive list is necessary or sufficient, and some may even seem mutually contradictory. For example, to achieve stabilization, Mundell (1961) emphasized the importance of the synchronization of shocks within a currency union, as it reduces the cost of relinquishing monetary policy independence; by contrast, Mundell (1973) and Buiter & Sibert (2008) argued that asynchronous shocks can be beneficial in a currency union with integrated capital markets as they increase the scope for risk diversification within the union. Similarly, whereas Kenen (1969) suggested that highly diversified (and presumably large) developed economies are better suited to form a currency union, McKinnon (1963) argued that small, commodity economies make ideal candidates. Furthermore, whereas Fleming (1971) argued that similarity in inflation rates is important, Alesina & Barro (2002) made the point that high-inflation countries may gain significantly from joining a currency union with committed low-inflation countries.

Moreover, the OCA criteria are likely to be affected once countries join the union, a point voiced by Mundell (1961) and Krugman (1993), among others. Frankel & Rose (1998) addressed this point empirically, finding that trade increases the synchronization of business cycles, and Alesina et al. (2002) and Barro & Tenreyro (2007) tested it directly, finding that indeed currency unions affect the degree of comovement of price and output shocks across countries.

Although the theoretical arguments for and against currency unions are intuitively appealing and fairly well understood, the first limitation of the literature is that, until

<sup>3</sup>An optimum currency area refers to the geographical area over which it is optimal (in terms of welfare) to have a single or common currency, rather than separate or national currencies. (A long tradition in the literature has equated optimality with the achievement of three goals: full employment, domestic price stability, and balance of payments equilibrium.)

<sup>4</sup>Others scholars, most notably Fleming (1971), have argued that ex ante similarity in inflation rates among union members is also important for the sustainability of the union.



recently, there has been little progress in the empirical assessment of the gains and (particularly) the costs of joining a currency union. The second, perhaps more important, limitation is the regrettable lack of a unifying framework to weigh the various gains and losses of forming a currency union. A demanding critic could argue that the OCA theory is still now little more than an enumeration of noncommensurable criteria.

Below we discuss in more detail the various benefits and costs stemming from currency unions and critically review recent empirical developments attempting to quantify them. In the process, we highlight some econometric problems in existing empirical work and propose solutions where possible. A spin-off of this work is to provide a different assessment of the effect of the euro on different economic outcomes. In particular, and in contrast with empirical estimates of the trade effect of other currency unions, we find that the euro's effect on trade has been close to zero. The differences can be potentially explained by the different characteristics of countries taking part in monetary unions other than the euro, typically very small and low-income economies. Our finding also stands in contrast with previous estimates of the euro's effect on trade. As we show, these estimates tend to reflect the fact that euro-zone (EZ) countries historically traded much more intensively than other groups, but there is little evidence that the introduction of the euro had a differential effect on trade among these countries when compared with other developed countries that are not in the EZ. We conclude with a discussion of some open issues and a possible way forward for the theory of currency unions. Given space constraints, we simply provide a few leading references for some important issues pertaining to the gains and costs of currency unions.

## 2. THE BENEFITS

### 2.1. Increased Trade

The main benefit of a currency area envisaged by Mundell (1961) was a trade increase stemming from the elimination of currency conversion costs and the possibly greater predictability of prices. Forty years later, Rose (2000) presented the first systematic attempt to quantify the effect of currency unions on trade.<sup>5</sup> Rose (2000) estimated that sharing a common currency increased bilateral trade between countries by over 200%. The result raised a not small amount of skepticism, and a large number of papers, including some by Rose, investigated the robustness of the initial finding. The literature spawned by Rose's (2000) paper is large, so we highlight the main issues that qualify the initial finding and discuss the conclusions generally drawn from this literature (for a thorough review, see Baldwin 2006).

**2.1.1. The results of Rose (2000) and subsequent studies.** The empirical work on the effects of currency unions on trade has been framed within the standard gravity equation model (for early references on the theoretical foundations of the gravity equation for trade,

<sup>5</sup>There were a number of attempts to estimate the effect of exchange-rate variability on trade, and the general consensus emerging from that literature is that there is only a small effect (e.g., see Frankel & Wei 1993, Eichengreen & Irwin 1995, Frankel 1997, Tenreyro 2007, and references therein). For a more general theoretical investigation of the effects of fixed versus flexible exchange-rate regimes, see Obstfeld & Rogoff (1996). Some scholars have argued, however, that currency unions go far beyond the elimination of exchange-rate variability and that there should be a large discontinuity going from small variability to the certain and committed absence of exchange-rate fluctuations (e.g., see Klein & Shambaugh 2006, Frankel & Rose 2002).

see Anderson 1979, Helpman 1981, Helpman & Krugman 1985). The model states that the bilateral trade flow from country  $i$  to country  $j$ , denoted by  $T_{ij}$ , increases with the size of the countries (typically, proxied by their GDP), denoted by  $Y_i$  and  $Y_j$ , and decreases with their distance, broadly construed to include all factors that create trade resistance, and collected in the vector  $x_{ij}$ .<sup>6</sup> The vector of costs  $x_{ij}$  is then augmented with a dummy variable,  $CU$ , indicating whether the countries share the same currency. To account for deviations from the theory, the model includes a multiplicative stochastic term  $\eta_{ij}$  with unit conditional mean,  $E(\eta_{ij}|Y_i, Y_j, x_{ij}, CU_{ij}) = 1$ , leading to

$$T_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} \exp(x_{ij}\beta + \gamma CU_{ij})\eta_{ij}, \quad (1)$$

where  $\alpha_0$ ,  $\alpha_1$ ,  $\alpha_2$ ,  $\beta$ , and  $\gamma$  are unknown parameters. The factor  $\exp(\gamma)$  is the enhancement effect from sharing a common currency and is the main parameter of interest. Following a long tradition in the trade literature, Rose (2000) log-linearized Equation 1 and estimated the parameters of interest by least squares using the equation

$$\ln(T_{ij}) = \ln(\alpha_0) + \alpha_1 \ln(Y_i Y_j) + x_{ij}\beta + \gamma CU_{ij} + \ln(\eta_{ij}), \quad (2)$$

which imposes  $\alpha_1 = \alpha_2$ , as in many theoretical formulations.<sup>7</sup>

To estimate the equation, Rose (2000) put together a large data set with bilateral trade data for 186 countries for five years, spanning 1970 through 1990. Subsequent work by Glick & Rose (2002) extended the coverage to 217 countries from 1948 through 1997.

This estimation procedure implicitly makes a number of assumptions that have been questioned by subsequent work and that we discuss in turn.

**Selection into currency unions.** There are basically two types of currency unions in Rose's data. One is a client-anchor arrangement in which typically small or low-income nations adopt the currency of a large, rich country (typical anchors are France, the United Kingdom, and the United States). The second type of currency union corresponds to multilateral unions, in which there is no clear anchor within the union (the multilateral unions in Rose's data set are the Central African CFA franc zone and the West African CFA franc zone, which are treated as a sole union in the data set, and the Eastern Caribbean Currency Area).

As pointed out by Persson (2001) and Tenreyro (2002), among others, these currency unions were not randomly formed. On the contrary, self-selection into currency unions is strongly hinted at by some distinctive features shared by countries that were part of common currency areas during the pre-euro period, and is included in Rose's data set. Because of this self-selection, in general, the ordinary least squares (OLS) estimates of  $\gamma$  in Equation 1 cannot be given a causal interpretation. Indeed, in data sets of this nature, there is ample margin for the existence of uncontrolled systematic differences in characteristics between members and nonmembers of currency unions, which will be picked up by the OLS estimate of  $\gamma$ .<sup>8</sup> For example, cultural and historical links may increase the propensity to

<sup>6</sup>We interpret  $x_{ij}$  broadly here to include (in a more complete specification) multilateral resistance terms, as in Anderson & van Wincoop (2003).

<sup>7</sup>The dependent variable used by Rose (2000) is the average of the two-way bilateral trade flows instead of the unidirectional trade flows.

<sup>8</sup>Rose (2000) also acknowledged this potential problem but rejected its quantitative relevance by resorting to an instrumental-variable approach whereby the currency-union indicator was instrumented with inflation rates. These estimates were "implausibly bigger," in his words, and the overall strategy was not compelling.

form a currency union, as well as strengthen trade links between two countries. Moreover, countries that decide to join a currency union might also be more likely to foster integration through other means, for example, by encouraging the harmonization of standards and by reducing regulatory barriers.<sup>9</sup>

To address this issue, Persson (2001) employed a matching technique that controls for self-selection (see also Kenen 2002). Using Rose's (2000) data, he found an increase in trade of between 13% and 66%, although the results are not statistically significant. In response to Persson's critique, Rose (2001) argued that the matching method implies a significant loss of information and showed that a similar technique applied to a broader data set yields statistically significant results, in the range of 21%–43%.

An alternative strategy used in many studies, including Glick & Rose (2002), is to include country-pair fixed effects in the gravity equation; this inclusion reduced the currency-union effect to approximately 100%.<sup>10</sup> These controls, however, may not completely eliminate the problem because a shift in trade volumes at some point in time may be related to a change in the propensity to use a common currency. For example, countries that historically broke with a currency union often saw their trade collapse due to independence wars followed by the deliberate adoption of protectionist policies (Thom & Walsh 2002). To the extent that these unmeasured (or hard to measure) characteristics affect, or are correlated with, both the propensity to share a common currency and the volume of bilateral trade, OLS estimates of  $\gamma$  will not identify the causal effect of currency unions on trade. Indeed, Thom & Walsh (2002) found no effect in Anglo-Irish trade when Ireland abandoned the sterling peg in 1979; they stress that the Anglo-Irish case is a rare example of a long-established currency union breaking up in otherwise stable circumstances (see, however, Glick & Rose 2002 for a different perspective).<sup>11</sup>

Different ways of tackling the problems caused by self-selection into the currency unions were explored in Tenreyro (2002), who employed a standard Heckman (1979) selection model that controls for selection on unobservables, and in Alesina et al. (2002) and Barro & Tenreyro (2007), who used a three-step instrumental-variable (IV) approach. The first step estimates the propensity that a country will enter a currency union with a main anchor; these results are interesting in their own right, as they elucidate part of the reason why countries adopt a foreign currency or join currency unions. The IV is then obtained by computing the joint probability that two countries, independently, adopt the same currency. The underlying assumption in the analysis is that there exist factors driving the decision to adopt a third country's currency that are independent of the bilateral links between any two potential clients. In other words, the basic idea is to isolate the motive that relates to the third countries' currencies and use this motivation as an IV for whether

<sup>9</sup>Other unobservable variables, such as market power, may have the opposite effect on the OLS estimates: Higher levels of monopoly distortion in the economy may lead to higher inflation rates under discretion and thereby increase the need to join a currency union as a commitment device to reduce inflation (see Alesina & Barro 2002).

<sup>10</sup>Pakko & Wall (2001) also controlled for fixed effects in Rose's (2000) data set, finding no significant trade effect. As mentioned above, Glick & Rose (2002) used a broader data set. Estimates of the same order of magnitude of Glick & Rose were found by Rose & van Wincoop (2001), who controlled for (time-invariant) country-specific effects (see more below). Nitsch (2002) argued that most of the effect in Glick & Rose came from trade collapses after currency separations, whereas the effect of joining a currency union on trade was approximately 8%.

<sup>11</sup>Fidrmuc & Fidrmuc (2003) found that the recent breakups of currency unions in Central and Eastern Europe were followed by dramatic drops in bilateral trade, although they warn that the currency separation cannot be disentangled from the political disintegration, unlike the Anglo-Irish case. Nonetheless, de Sousa & Lamotte (2007) challenged their result and argued that the fall in trade was rather smooth.

two countries share a common currency. The general message from these regressions is that a currency union is more likely when countries speak the same language, are geographically close, and share former colonial links. In terms of client-anchor arrangements, a union is more likely when the client is poorer and smaller and the anchor is richer. The IV approach generated large estimates of the effect of currency unions on trade, comparable and in some cases even bigger than Rose's (2000), whereas the Heckman approach produced estimates on the order of 50%, although imprecisely estimated, more in line with Persson (2001).

One criticism to all these studies, however, is that they do not appropriately control for possibly time-varying multilateral resistance terms in the gravity equation, a concept introduced by Anderson & van Wincoop (2003) and emphasized by Baldwin (2006), who argued that properly controlling for time-varying fixed effects significantly reduces the currency-union effect on trade. Another criticism is that most of these studies averaged two-way bilateral trade flows instead of using the unidirectional trade flows suggested by theoretical models, thus ignoring bilateral trade imbalances, although it is not obvious in which direction this may affect the results.

**Heteroskedasticity and zeroes in trade data.** Most of the studies mentioned above resort to the common practice of taking logarithms to linearize the gravity equation as in Equation 2 and estimate its parameters by OLS. Even in the absence of other problems, this procedure can generate substantial biases for two reasons.

First, in trade data sets, it is unlikely that the variance of  $\eta_{ij}$  in Equation 1 will be independent of the countries' sizes and of the various measures of distance,  $x_{ij}$ . Because the expected value of the logarithm of a random variable depends both on its mean and on higher-order moments of its distribution, whenever the variance of the error term  $\eta_{ij}$  in Equation 1 depends on the regressors, the conditional expectation of  $\ln(\eta_{ij})$  will also depend on the regressors, violating the condition for consistency of OLS. Santos Silva & Tenreyro (2006) found this to be a serious source of bias in practical applications of the gravity equation.

Second, as a result of the logarithmic transformation, pairs of countries for which bilateral exports are zero have to be dropped from the sample. In a typical data set, this leads to a loss of over 30% of the data points. This massive sample selection, which is particularly problematic when one considers small or poor countries (such as the ones that have been clients in or part of multilateral currency unions in Rose's data), can cause additional biases in the estimation.

These two problems can be addressed by estimating the gravity equation in its multiplicative form. Specifically, Santos Silva & Tenreyro (2006) proposed a pseudo-maximum likelihood technique (see Gourieroux et al. 1984) that is particularly well suited to the estimation of gravity equations, although it has not been applied to estimate the effect of currency unions.<sup>12</sup>

**2.1.2. Trade effects of currency unions and the case of the euro.** Despite the empirical issues raised in reaction to Rose's (2000) original estimates, subsequent work by Rose and other scholars still found far from negligible effects on trade from pre-euro common

<sup>12</sup>Helpman et al. (2008) offer an alternative way to deal with the presence of zeros. Their method, however, is heavily dependent on incidental distributional assumptions.

currency areas, and a consensus grew that currency unions indeed enhance trade, even if by less than initially estimated. Projections for the euro area were, however, hard to make because the EZ involved relatively richer countries that were already fairly integrated. Therefore, time was needed to gauge the euro effect.

In a first attempt, Micco et al. (2003) concluded that the euro increased trade among EZ members by 8% to 16% when compared with other European Union (EU) members not using the euro, and by 4% to 10% when compared with a broader sample of developed countries. The authors used the gravity equation framework, estimating their models with data from 1992 through 2002, and including country-pair fixed effects in some specifications. Subsequent work on the euro effect addressed various specification issues in Micco et al. (2003) (e.g., using unidirectional trade flows, post-1993 data, as changes in statistical procedures introduce a break in the series in 1993), generally confirming the positive effects of the euro on trade (e.g., Bun & Klaassen 2002, 2007; Flam & Nordström 2003, 2006; Baldwin et al. 2005; Baldwin 2006; Baldwin & Taglioni 2006). The estimates for the euro effect range from 2% in Baldwin (2006) to more than 70% in Gil-Pareja et al. (2008) (for a comprehensive survey, see Baldwin 2006).<sup>13</sup> A notable exception to this trend is the work of Berger & Nitsch (2008), who found no significant effect.

Given the disparity of results, we think it is useful to provide our own estimates of the euro effect. For that, we use a simple differences-in-differences specification, comparing trade flows among the so-called Euro-12 (Austria, Belgium-Luxembourg, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain) with those of similar groups of trading partners. In particular, we consider the following three control groups.

The first group includes only the countries that were part of the EU in 1999 but so far have not adopted the euro: Denmark, Sweden, and the United Kingdom. Throughout, we refer to this control group as EU15. This group is interesting because the three countries it includes are similar to those of Euro-12, but it has the drawback of being quite small.

In the second group, the set of countries is expanded by adding three other members of the European Economic Area (EEA): Iceland, Norway, and Switzerland. This control group, which we refer to as EEA, represents perhaps the best compromise between comparability with the treatment group and sample size.

The final control group sacrifices the degree of homogeneity to allow the use of an even larger sample. This is achieved by including five additional countries that were members of the Organization for Economic Co-operation and Development (OECD) in 1993: Australia, Canada, Japan, New Zealand, and the United States. We label this group OECD93.

Before presenting estimates of the euro effect, it is interesting to graphically study the evolution of trade among the Euro-12 countries and compare it with that of the countries in the control groups defined above. The data on exports used to construct these graphs are from the International Monetary Fund's Direction of Trade Statistics, and the data on GDP are from the OECD STAT database. Given the break mentioned above, our sample runs from 1993 to 2007.

<sup>13</sup>Baldwin & Di Nino (2006), Flam & Nordström (2006), and Berthou & Fontagné (2008) investigated in particular the hypothesis that the euro has increased the number of goods that are traded (extensive margin), finding ample confirmation for this hypothesis.

**Figure 1** (see color insert) shows the evolution of the exports of the Euro-12 countries to trading partners in the same group and to OECD93 countries, both relative to the total GDP of the Euro-12. For completeness, the figure also displays the exports from the 11 OECD93 countries to the members of this group and to the Euro-12 countries, both relative to the total GDP of the OECD countries. Similar plots for EEA and EU15 are presented in **Supplemental Figures 1 and 2**, respectively.

These figures suggest that, if there were a euro effect on trade, it would almost certainly be small. Yet, if we apply the same estimation approach followed by Micco et al. (2003) to these data, we get a strong and statistically significant effect of the euro,<sup>14</sup> a finding that at first is hard to reconcile with the graphical evidence.

With this conflicting evidence as a background, we approach the estimation of the euro's effect on trade by considering an augmented gravity equation as in Equation 1. However, we depart from previous studies on this topic by including a dummy in the model, labeled Euro-12 dummy, which identifies the treatment group. That is, irrespective of the year, the Euro-12 dummy is equal to 1 for the pairs for which both countries are part of the Euro-12 group. This dummy is included to control for possible unobservable systematic differences in characteristics between pairs of members of the Euro-12 and other pairs.

As in previous studies, the euro effect is measured by a dummy that is equal to 1 when, in the relevant year, both partners share the euro as their official currency. As above, this dummy is labeled *CU*, and it is the main regressor of interest.

Finally, the model also contains a standard set of dummies capturing sources of trade resistance. Specifically, the model includes dummies indicating contiguity, common language, and colonial ties, as in Santos Silva & Tenreyro (2006); a dummy for the existence of a free trade agreement between the countries in the pair, constructed using information provided by the World Trade Organization website,<sup>15</sup> and time-varying importer and exporter fixed effects, as suggested by Anderson & van Wincoop (2003). We also control for bilateral distance [computed using the great circle distance algorithm provided by Gray (2004)]. However, rather than just including the log of the distance as a regressor, we allow the distance to have a more flexible effect by dividing it into its four quartiles and interacting the log of distance with dummies for each quartile.

**Table 1** presents the main estimation results for the three samples defined by the different control groups. All estimates were obtained using the Poisson pseudo-maximum likelihood estimator of Santos Silva & Tenreyro (2006). The results for the standard gravity variables are as expected, and the only remark to add is that indeed we find that the effect of log distance is not linear. More interestingly, we find the effect of the Euro-12 dummy, the regressor identifying the treatment group, to be strong and statistically significant. This indicates that, even before the euro's creation, the trade between countries in the Euro-12 was already considerably stronger than between comparable countries, even those that were part of the EU.

As for the main regressor of interest, the estimates obtained for the coefficient of *CU* are small and not statistically significant at the usual 5% level. For the sample with the OECD93 control group, the coefficient of *CU* is only marginally insignificant, but the

<sup>14</sup>These results are available from the authors on request.

<sup>15</sup>When the comparison group is EU15 or EEA, the coefficient on this dummy is not identified because all countries are linked by free trade agreements during the period spanned by our sample.



**Table 1** Estimates of the euro's effect (*CU*) for three different control groups<sup>a</sup>

	OECD93	EEA	EU15
<i>CU</i>	-0.084	-0.006	0.065
	(1.958)	(0.107)	(0.578)
Euro-12 dummy	0.356	0.398	0.227
	(3.385)	(2.929)	(1.207)
Free trade agreement	0.886	–	–
	(7.123)	–	–
Log distance (first quartile)	-0.494	-0.639	-0.696
	(4.537)	(7.039)	(5.962)
Log distance (second quartile)	-0.513	-0.642	-0.709
	(5.008)	(7.225)	(6.055)
Log distance (third quartile)	-0.552	-0.663	-0.723
	(5.654)	(7.986)	(6.717)
Log distance (fourth quartile)	-0.581	-0.714	-0.764
	(6.041)	(8.615)	(6.866)
Contiguity dummy	0.279	0.101	0.030
	(3.039)	(1.154)	(0.282)
Common-language dummy	0.468	0.621	0.630
	(4.888)	(8.402)	(6.961)
Colonial-tie dummy	-0.147	0.113	0.113
	(1.029)	(0.721)	(0.678)
Sample size	6930	4080	2730
$R^2$	0.979	0.978	0.981
RESET test p-values	0.264	0.990	0.407

<sup>a</sup>All regressions are performed by Poisson pseudo-maximum likelihood and include time-varying importer and exporter fixed effects; robust (clustered by country pair) t-ratios are in parentheses.

point estimate is actually negative, suggesting that bilateral trade between countries that adopted the euro has increased by less than trade among comparable countries not sharing the common currency. Taken as a whole, the low t-statistics for the coefficient of *CU*, coupled with the variability of its estimates across the different samples, strongly suggest that the effect of the euro on trade is negligible.

To check the adequacy of the specification used, we performed RESET tests (Ramsey 1969), as described in Santos Silva & Tenreyro (2006). Table 1 reports the p-values of the RESET tests for the three samples, none of which provides evidence against the null hypothesis of adequate model specification. Although departures from it would have only



minor consequences, we also checked the implicit assumption that the conditional variance of  $T_{ij}$  is proportional to the conditional mean, and again we were unable to reject the null for the three cases considered.

As a robustness check, we also estimated models excluding *CU* but with the Euro-12 dummy interacted with dummies for the different years. These models, which also passed the specification tests described above, lead to results that are remarkably close to those reported in **Table 1**. In particular, the new dummy variables are generally not statistically significant, therefore providing no significant evidence of a euro effect.

In view of these results we conclude that, after controlling for the fact that the Euro-12 countries already traded much more intensively in the past, there is little evidence that the creation of the euro has had an effect on trade. Although the methods used are quite different, our results reinforce those of Berger & Nitsch (2008), who also emphasized the need to account for the strong integration of the Euro-12 countries before the euro's creation.

## 2.2. Increased Capital Integration

The trade increase from a common currency area envisaged by Mundell (1961) also concerned trade in assets. As many advocates of currency unions have argued, a common currency should foster deeper and more liquid financial markets, and possibly higher levels of cross-border investment [through equities and foreign direct investment (FDI)], given lower transaction costs and the elimination of exchange-rate risks (e.g., see Martin & Rey 2004, Lane 2006, Papaioannou & Portes 2008). More integrated financial markets should, in turn, increase the allocative efficiency of capital and allow for higher diversification of shocks, mitigating their impact on consumption.

Measuring the effect of monetary unions on capital markets poses similar econometric challenges to those discussed in Section 2.1. There have been, however, several recent attempts in the literature, mostly trying to assess the change in the degree of capital market integration with the advent of the euro. For a thorough analysis, we refer the reader to Japelli & Pagano (2008) and the comprehensive survey by Lane (2006).<sup>16</sup> The consensual findings are (a) a swift integration of the EZ bond market following the euro's introduction, with a sharp fall in yield differentials across member countries, and (b) an increase in cross-border bond and equity holdings, as well as FDI activity among EZ countries. There is, nevertheless, a broad range of estimates of the euro effect. In the interest of space, we do not attempt to summarize the literature, but provide the reader with a set of plots as an indication of the magnitudes involved.

Using the same groups as defined above, **Supplemental Figure 3** shows the holdings by Euro-12 countries of bonds issued by other Euro-12 countries, relative to the total GDP of Euro-12 countries. The series thus describes the holdings by the typical Euro-12 country of other Euro-12 countries' bonds relative to GDP. To provide a benchmark, the figure also shows the holdings by Euro-12 countries of bonds issued by the 11 countries in the OECD93 group, relative to the total GDP of Euro-12 countries. For completeness, it also displays the total holdings by the OECD93 countries of bonds issued by other countries of the same group, and by the Euro-12 countries, both relative to the total GDP of the

<sup>16</sup>For another excellent survey, see Mongelli & Wyplosz (2008), and for more specific studies on the channels, see Baele et al. (2004), Spiegel (2008), Kalemli-Ozcan et al. (2009).



OECD93 countries. All series are normalized to 1 for the first year of the sample. Similar plots for EEA and EU15 are presented in **Supplemental Figures 4** and **5**, respectively.

**Supplemental Figures 6–8** depict the corresponding holdings of equity, and **Supplemental Figures 9–11** depict the FDI outflows for the different bilateral combinations. The data are available in 1997 and then again annually from 2001 to 2007 both for bonds and equity, and they are from the International Monetary Fund's Coordinated Portfolio Investment Survey. The data on FDI are from the OECD STAT database.

The figures show a widening gap of cross-border holdings of bonds between pairs of countries in the Euro-12, vis-à-vis pairs of countries outside this group. There is a perhaps less striking, but still visible, increase in cross-border equity holdings among Euro-12 countries, as shown in **Supplemental Figures 6–8**. Finally, there seem to be relatively small changes in FDI activity among Euro-12 countries, when compared with other bilateral groups. The figures suggest that there have indeed been important changes in capital markets coinciding with the introduction of the euro. As pointed out by Japelli & Pagano (2008), these changes in financial markets cannot be fully attributed to the use of a common currency; the introduction of the euro has also triggered a parallel deregulation process that removed important barriers to trade in financial assets. The two effects are hard to disentangle empirically. Indeed, Alesina et al. (2010) argued more generally that common currencies are likely to pave the way for broader structural reforms that foster flexibility and deeper integration.

Somewhat surprisingly, however, the increased financial integration has not led to visible improvements in the diversification of risk, at least not when compared with other countries that are not part of the EZ (Caselli 2008). This is roughly the conclusion taken from **Supplemental Figure 12**, which shows the evolution of consumption volatility, measured as the standard deviation of consumption growth for Euro-12, EU15, EEA, and OECD93, relative to their corresponding values in 1993.<sup>17</sup> The general pattern is almost indistinguishable among these various groups. In terms of changes in allocative efficiency across countries, perhaps a good macroeconomic proxy is the level of GDP per capita. Gauged by this measure (see **Supplemental Figure 13**), there seems to be a slight jump in 1999 for Euro-12 countries, creating a gap with respect to EU15, but by 2006 the two groups are virtually back to the same relative position as in 1993. In other words, overall growth during 1993–2007 was almost identical for the countries in the Euro-12 and EU15 groups.<sup>18</sup> The numbers are only slightly more encouraging when compared with those in OECD93 or EEA. At least judged by these macroeconomic indicators, deeper integration does not seem to have materially affected consumption smoothing or labor productivity growth in EZ countries differently than in non-EZ countries.

One conjectural explanation for the apparent lack of response of the real economy is that there is little scope for diversification among EZ countries, as their business cycles are highly synchronized; thus, Ingram (1962), Mundell (1973), and Buitert & Sibert (2008) have hypothesized that, in terms of seizing the gains from deeper capital market integration, currency unions among highly unsynchronized countries may be more beneficial. A second conjecture is that, because nominal bonds issued by member countries can no longer vary with changes in nominal exchange rates, a common currency eliminates a

<sup>17</sup>The standard deviation of the quarterly growth rate of consumption is computed over a moving interval of seven quarters.

<sup>18</sup>Recall that the EU15 control group comprises three countries: Denmark, Sweden, and the United Kingdom.

potentially important source of risk sharing across borders (see Neumeyer 1998, Lane 2006). To the extent that consumption smoothing and GDP per capita are better indicators of welfare than the various measures of integration, the findings for the EZ do not seem to point to a clear improvement. However, it may still be too early to judge.

### 2.3. Commitment Gains

A potentially important benefit of joining a currency union is a reduction in inflation rates, which is particularly relevant for countries that lack internal discipline and institutions that ensure a low-inflationary environment. In the jargon of Alesina & Barro (2002), by joining a monetary union with a credible anchor country or set of countries, a client country eliminates the inflation bias arising from time inconsistency in monetary policy (Barro & Gordon 1983).<sup>19</sup> Countries with a history of high inflation, hence, *ceteris paribus*, have more to gain from joining a currency union, provided that low-inflation countries act as anchors.<sup>20</sup>

An earlier literature had stressed the need of similarity in inflation rates across countries in the union as one of the OCA conditions. In particular, Fleming (1971) argued that when inflation rates are stable and similar across countries, terms of trade will also remain stable, reducing the incidence of external imbalances and the need for nominal exchange-rate adjustment. Indeed, this preoccupation was reflected in one of the conditions for accession established in the Maastricht Treaty: A country could join the union if its inflation rate were no higher than 1.5 percentage points above the average of the three best-performing member states. This rule was supplemented with fiscal rules, given the obvious inflationary threats posed by large fiscal deficits and debts.

Given the Maastricht conditions, EZ countries therefore narrowed their inflation-rate differentials many years before the actual launching of the euro, with the exception of Greece, which had to wait two more years to meet the criteria to join. After the launching of the euro, however, inflation-rate differentials increased, with Germany at the lower bound of the inflation range and Ireland at the upper bound. This is not surprising and mostly reflects variation in the prices of less tradeable goods (particularly nonfinancial services). Differences in productivity growth (to some extent driven by catch-up effects), changes in competition leading to changes in markups, and different exposure to external shocks and international trade outside the EZ, for example, can in principle explain why some countries within the union experienced higher levels of inflation (with a Balassa-Samuelson effect usually acting as one of the underlying channels). In all, the EZ performed well. Some skeptics, however, have highlighted that its performance was not unusual for the period: The post-1993 era has witnessed very-low-inflation rates in all developed countries (Caselli 2008). This is illustrated in **Supplemental Figure 14**, which shows that average inflation rates in the three comparison groups (EU15, EEA, and OECD93) have been oscillating in a very narrow range since 1993. However, one cannot reject the alternative, and more positive, view that the overall good monetary performance in developed countries has been itself an unexpected by-product of the euro's introduction

<sup>19</sup>See also Alesina & Stella (2009), who discuss the rules versus discretion arguments, as well as other important institutional issues.

<sup>20</sup>Popular concerns in Germany about the loss of Bundesbank independence may suggest that the union could bring a loss of commitment to previously stable countries. However, at least the early evidence of the euro effect does not support these concerns.

and its commitment to stability, which left behind beggar-thy-neighbor inflationary policies.

Whether similarity in inflation rates was needed as a precondition to join the EZ is less clear; indeed, Alesina & Barro's (2002) argument suggests that a key reason for countries with high-inflation records to join a union with credible anchors is the prospect of low inflation after entering the union. In the interest of space, we do not discuss how the union's monetary authority's incentives for inflation change as the size of the union increases. We refer the reader to Rogoff (1985), Barro & Tenreyro (2006), and references therein.<sup>21</sup>

### 3. THE COSTS

The main cost of joining a currency union is the loss of monetary policy independence, with the consequent inability to react to shocks through exchange-rate adjustments. Quantitatively assessing this loss, however, is an extremely difficult task, as there are many factors affecting the need and effectiveness of monetary policy as an adjustment instrument.

Here we discuss the main factors emphasized in the literature. All these factors (or OCA criteria) are endogenous, and thus the conditions for optimality should not be the pre-currency-union conditions, but rather the ex post conditions, after the union is formed. We accordingly discuss the evidence on the effect of currency unions on the factors listed as OCA conditions, where available. In practice, even countries that could potentially let their exchange rates adjust to mitigate the impact of shocks (self-declared floaters) often display so-called fear of floating and thus do not exploit the automatic stabilization properties of floating exchange rates (Calvo & Reinhart 2002). This reluctance to use monetary policy in the face of shocks might be linked to its actual effectiveness (or the lack thereof), the need for it (other mechanisms may facilitate the adjustment and/or render monetary policy less effective), or possibly to wider considerations, such as fear that it may trigger beggar-thy-neighbor responses by trading partners, inducing excessive structural volatility in financial markets, or impair long-term credibility.

#### 3.1. Similarity of Shocks and Inflation

Mundell (1961) highlighted that the pattern of shocks was a critical determinant of the optimal size of a currency union. He defined the term optimal as achieving labor-market and external equilibrium and did away with the presumption that common currencies and national boundaries should coincide. He focused on a particular type of shock, a shift in demand away from the output of one region toward the output of another. (The term region, in this case, is an area subject to the same shocks.) If each region had its own currency, a currency depreciation in the region facing the adverse shock vis-à-vis the other currency would restore external balance and prevent unemployment in the first region. If, however, both regions were in a monetary union, then unemployment would emerge in one region and inflationary pressure in the other. In other words, monetary policy at the union level would be unable to solve both problems of unemployment and inflation, if capital

<sup>21</sup>We also refrain from discussing the vast literature on the conduct of monetary policy in a currency union (or, more generally, under cooperation). Obstfeld & Rogoff (1996) should be an obligatory starting point.



were mobile and regions were subject to asynchronous shocks. The conclusion thus followed that regions with synchronous shocks make ideal candidates to form currency unions, as there was no need for monetary policy autonomy: A common monetary policy can restore equilibrium in all regions. (There are, of course, many implicit assumptions in Mundell's analysis, e.g., nominal rigidity, which we discuss below.) The phrase similarity of shocks later became a broader term to capture the incidence of both supply and demand shocks, as well as the structure of the economy, which in turn may affect the nature and speed of adjustment of the economy to shocks.

An empirical literature pioneered by Bayoumi & Eichengreen (1993, 1997) has studied the patterns of correlations of shocks across countries, trying to identify OCA candidates, often using the patterns of correlations across U.S. states as a benchmark. The general finding is that European countries have historically faced less correlated shocks than U.S. states, and hence forming a union in Europe may be costly. Alesina et al. (2002) used an alternative sample and method to study the extent of the similarity of shocks across countries, focusing on the covariance of relative shocks (to also capture the relative size of shocks, which is relevant for the appropriateness of monetary policy). In particular, they studied the advisability of a dollar, euro, and yen blocs and reached optimistic conclusions about the prospect of a dollar- and euro-area bloc, possibly enlarged by unilateral fixers.

The findings from these exercises should not be viewed as conclusive tests of the OCA criteria. As stated above, in principle it is ex post synchronization of shocks that matters for optimality. To assess ex post optimality, Alesina et al. (2002) and Barro & Tenreyro (2007) also studied the effect of currency unions on the pattern of covariance of shocks, using a broad sample of developing and developed countries that includes existing currency unions. The main result is that, although a common currency increases the comovement of real relative price shocks, it tends to decrease the comovement of output shocks.

The decline in output comovement may reflect Krugman's (1993) conjecture that integration leads to more specialization and thus less synchronization of business cycles. Frankel & Rose (1998), conversely, found that trade significantly increases the cross-country synchronization of business cycles in a sample of 21 industrialized countries. If, indeed, currency unions lead to more trade, then the two sets of results contradict each other. To complete the taxonomy of possibilities, Giannone & Reichlin (2006) found that the euro has had no detectable effect on the synchronization of shocks among EZ countries. The contradictions between the conclusions of these studies may arise from differences in the period covered, samples of countries, and methods used, as well as differences in the actual measures of synchronization. The conclusion to draw is that there is ample scope for more work to shed light on the issue.

A second open question on this matter is whether synchronization (either ex ante or ex post) is indeed needed. Mundell (1973) argued that, because currency unions lead to deep integration in financial markets, countries with asynchronous shocks make ideal candidates, as there are further benefits of risk diversification. The argument has been more recently revived by Buitert & Sibert (2008) and formalized by Ching & Devereux (2003) in a model that encompasses both the advantages and disadvantages of the similarity of shocks in a currency union; the model finds that there are neither substantial nor unambiguous effects on welfare, as the diversification motive and the similarity argument for common policy tend to cancel each other. The results make intuitive sense, given the model.



In reality, however, adjustment costs are important, and the idea that financial diversification will be enough to smooth the shocks to consumption, and hence leave welfare unaltered, misses the potentially important losses in human capital from a spell of high unemployment, the costs in terms of work relations and information needed to transact in domestic and foreign markets, and the fixed costs of closing and reopening plants, for example. The consideration of adjustment costs may untie the results in favor of similarity. There is, of course, the question of whether monetary policy is used as an adjustment tool, the premise that Calvo & Reinhart (2002) questioned. We think these are extremely relevant questions that have not yet received compelling answers.

With regards to the need for ex ante similarity in inflation rates, often listed as an OCA criteria, we refer the reader to the discussion on inflation in Section 2.3.

### 3.2. Factor Mobility

Mundell (1961) pointed out that labor mobility can be an alternative adjustment mechanism to restore equilibrium in regions subject to asymmetric shocks. If labor were mobile across different regions, then the unemployed in the adversely affected regions could move to the boom regions without the need for active monetary policy. Although Mundell's labor mobility criterion has not gone without criticism,<sup>22</sup> it remains one of the key concepts of an undergraduate course in international economics.

There is no consensus as to whether labor mobility can effectively attenuate the cost of a multicountry monetary union. Many have argued that labor mobility is unlikely to operate at the high frequency with which demand shocks take place and is hence unlikely to be an effective substitute for active monetary policy. Furthermore, the high costs of migration may entail larger welfare losses.

In the context of the European Monetary Union (EMU), Bayoumi & Prasad (1997) found that cross-country labor mobility is significantly lower than that across comparable U.S. regions, where labor mobility tends to be an important equilibrating force in the face of disturbances (Blanchard & Katz 1992; see also Eichengreen 1990, Obstfeld & Peri 1998). In Europe, the main equilibrating mechanism instead appears to be changes in labor-force participation (Decressin & Fatás 1995). The lack of mobility may partly reflect the vast heterogeneity in languages and other cultural characteristics, as well as various other institutional or policy constraints, including the lack of integration in pension systems and in educational and qualification standards, the higher contractual costs of hiring and firing, and the generous unemployment benefits in many European countries. Alesina et al. (2010) argued, however, that many of these constraints may be affected by the introduction of the euro, as countries find ways to substitute for the lack of exchange-rate mechanism of adjustment. They found that the euro's introduction has indeed affected labor markets, although in complex ways. In particular, although there is no indication that the euro's adoption has accelerated labor-market reforms in the primary labor markets, in several countries a secondary market has emerged, with temporary and much more flexible contracts. The authors also found smaller, second-round inflationary effects, that is, a smaller adjustment of nominal wages to past inflation, and, accordingly, more

<sup>22</sup>Kenen (1969) suggested that it is only under very special circumstances that labor mobility solves both labor-market and trade balance. Moreover, interregional labor mobility requires occupational mobility, which is rare (see also Ingram 1962).

real-wage flexibility in various countries. Furthermore, Alesina et al. (2010) found significant reforms in product markets, which as Blanchard & Giavazzi (2003) argued, may be an important precondition to trigger labor-market reforms that foster flexibility.<sup>23</sup>

In terms of capital mobility, we refer the reader to the discussion in Sections 2.1 and 2.2; in the interest of space, we do not attempt to distinguish between trade in capital and noncapital goods, nor the extent to which trade in product markets itself substitutes for the relative lack of mobility in factor markets. These are important empirical matters that need further investigation.

### 3.3. Openness

McKinnon (1963) suggested that the size and openness of an economy were key determinants of the decision to join a currency union. He argued that, rather than involving a loss of policy autonomy, irrevocably fixing the nominal exchange rate could be a benefit for small, open economies. This is because in a small, open economy, a large portion of consumption and intermediate goods is imported, and prices are given by international markets [perhaps we should add here, following Engel's (2000) insight, that in McKinnon's analysis, which is pertinent for small, open economies, prices are set in the producer—or at least not local—currency]. In the limit—when all goods are tradable—a small economy is unable to influence its real exchange rate by intervening in the foreign exchange market, and hence it cannot use its nominal exchange rate to influence competitiveness (purchasing power parity holds). In other words, fluctuations in the nominal exchange rate merely result in fluctuations in the domestic price level for small, open economies via the effect on import prices. Because the currencies of small, open economies inherently suffer from shocks (due to specialization and currency speculation), domestic prices would fluctuate in accordance. Therefore, giving up monetary policy autonomy is no big loss.

McKinnon's openness criterion has been criticized because his analysis is valid only when the foreign price level is stable (Ishiyama 1975). This is why having a credibly stable anchor is critical, as stressed by Alesina & Barro (2002). A perhaps repetitive point at this stage is that if the degree of openness increases with the formation of the currency union, as generally found by the literature started by Rose (2000)—whether due to the elimination of exchange risk, transaction costs, or more generally because of other parallel reforms triggered by the union—then the *ex ante* OCA criterion is not the right metric and any cost-benefit analysis should be based on the post-unification degree of openness.

### 3.4. Economic Diversification

Kenen (1969) proposed product diversification (in domestic production and exports) as an OCA criterion. His argument rested on two reasons. First, the likelihood of asymmetric shocks and their impact in the economy are small when exports are diversified. Second, export diversity will help to stabilize investment, thereby requiring a smaller adjustment in prices and employment than would otherwise be required after an industry-specific export shock. Kenen acknowledged the conflict to which his first point gives rise. Product diversification is not sufficient to guarantee internal stability, even when external shocks tend to average out. To achieve labor-market equilibrium, there needs to be sufficient occupational

<sup>23</sup>Obligatory references on this topic are Saint-Paul (2000) and Saint Paul & Bentolila (2000).



mobility so that the unemployed resources in the adversely hit sectors are re-employed in the growing sectors. At the empirical level, and in the context of the EMU, Bayoumi & Prasad (1997) provided a comparative study of industrial diversification in European countries and U.S. regions. The main finding is that there do not seem to be significant differences between Europe and the United States on this criterion.

Because more developed and bigger economies tend to be more diversified (Koren & Tenreyro 2007), Kenen's (1969) OCA criterion points to a completely different set of ideal candidates for unification than McKinnon's (1963). In other words, the list of countries that do not satisfy either of these two criteria for OCA (or the list of countries that satisfy both) is nearly empty. To our knowledge, there is no work trying to clearly assess the comparative welfare or output losses from relinquishing monetary policy independence in diversified economies vis-à-vis small, open (and typically specialized) economies, and hence the relevance of these two opposing OCA criteria. We think this deserves further study.

### 3.5. Price and Wage Flexibility

In a seminal paper, Friedman (1953) made the case for flexible exchange rates given the intrinsic nominal rigidity that impairs the adjustment of the economy in the face of shocks. The case depends critically on the extent of nominal rigidity. In the extreme of perfect nominal flexibility, monetary policy is neutral, and hence the choice of exchange-rate regime becomes irrelevant. This was also pointed out by Mundell (1961) and is one important OCA criterion—and to some extent underpins McKinnon's (1963) criterion, as small, open economies face, from their perspective, flexible prices.

A more recent literature, largely inspired by Devereux & Engel (1998) and Engel (2000), has argued that price rigidity is not sufficient to advocate a flexible exchange-rate regime, all else equal. In particular, this literature shows that if there is pricing to market and prices are rigid in the local (destination) currency, there is low pass-through from exchange-rate changes. In this case, exchange-rate changes do not affect export prices in destination countries and hence do not induce changes in the demand for exports. Various empirical studies by Engel and coauthors also present empirical evidence on the low extent of pass-through, supporting his case. The argument is challenged, to some extent, by the usual surges in political pressure for depreciation amid recessions, which typically invoke the need to increase firms' competitiveness in foreign markets. The issue has spawned a large and growing literature exploring the extent of pass-through and its determinants. Given space constraints, we refrain from reviewing this work (for a different perspective, see, for example, Imbs et al. 2005, and the references therein).

### 3.6. Fiscal Transfers

Kenen (1969) also argued that the provision of fiscal transfers can significantly mitigate the cost of relinquishing monetary policy autonomy, as it can cushion the effects of economic disturbances. For the U.S. economy, a number of papers empirically studied this mechanism and its quantitative relevance (e.g., Sala-i-Martin & Sachs 1992, von Hagen 1992, Bayoumi & Masson 1995). Whether cross-country fiscal transfers are needed and, in particular, whether financial integration can be a substitute for them (either through well-diversified sovereign funds held by national governments or directly through private capital markets) are part of an ongoing debate.



Fiscal transfers, and, more generally, fiscal policy under monetary unions are part of a vast literature that we do not attempt to review in this short survey. A nonexhaustive list of references that can serve as guidance are von Hagen & Eichengreen (1996), Beetsma & Uhlig (1999), Dixit & Lambertini (2001), Uhlig (2003), Cooper & Kempf (2004), Chari & Kehoe (2007, 2008), and Gali & Monacelli (2008).<sup>24</sup>

#### 4. SUMMARY AND OPEN ISSUES ON NORMATIVE AND POSITIVE ASPECTS OF CURRENCY UNIONS

Before Mundell's (1961) pathbreaking contribution, currency areas were inextricably bounded by country borders. Unsurprisingly, then, previous work had concentrated on the pros and cons of flexible versus fixed exchange-rate regimes across countries. Mundell broke the conceptual constraint and used insights from the early literature to build the theory of optimum currency unions.<sup>25</sup> Mundell (1961) pointed out that monetary unification could lead to increased integration in goods and capital markets and that this gain should be weighed against the loss of monetary policy independence. He also noted that three conditions—similarity of shocks, nominal flexibility, and factor mobility—would reduce the cost of relinquishing monetary policy independence and hence balance the choice of regime in favor of monetary unification. Mundell's contribution inspired a vast normative literature establishing additional conditions under which relinquishing monetary policy independence would be less disadvantageous; these additional conditions—together with Mundell's—are known as the OCA criteria.

A first wave of empirical work tried to quantitatively assess the various OCA conditions, particularly in the context of EMU countries, using comparable regions in the United States as a benchmark. The results of these exercises were qualified by the likely possibility that once countries entered or formed the union, many of the original conditions (e.g., synchronization of business cycles, openness) might change. It was not until Rose (2000), however, that the empirical literature really surged. Rose's provocative paper (and his novel data set) stimulated a large and growing literature trying to empirically assess the economic effects of currency unions. The advent of the euro, in turn, provided yet another ground to test the impact of a common currency. Although the jury is still out on the actual magnitudes, some consensus is emerging.

With regard to trade gains, for the small and relatively less developed economies in Rose's historical data, currency unions are associated with large increases in the volume of international trade. For countries in the EZ, the effect appears more elusive: In particular, we could not find statistically significant effects on trade among EZ members following the introduction of the euro, although previous work has found positive, yet generally small, effects. In terms of financial integration, important changes in trends are observed with the euro's introduction, particularly for cross-border holdings of bonds and equity. Concerning inflation, variability of consumption, and output growth, changes stemming from the introduction of the euro are less visible, particularly when compared with other developed countries in the EU.

<sup>24</sup>See also earlier work by Canzoneri & Diba (1991), Aizenman (1992), Sibert (1992), Buiters et al. (1993), and de Grauwe (1994).

<sup>25</sup>In particular, Mundell's work has been greatly influenced by his advisor James Meade (e.g., see Meade 1957).



There are, in general, less conclusive results on the costs of currency unions (that is, the various OCA criteria) and the extent to which they endogenously change with the use of a common currency. Empirical work exploiting the timing of the euro will shed more light on the question. Notably, Alesina et al. (2010) and Bugamelli et al. (2010) found evidence that the euro has forced significant structural reforms and firm restructuring; this should facilitate the response of national economies to shocks, thus substituting at least partly for the traditional exchange-rate mechanism of adjustment. There is also a growing branch of the literature studying both theoretically and empirically fiscal aspects of currency unions, as well as the causes and the extent of price and wage rigidity, currency choice, labor-market frictions, and diversification patterns, the results of which may affect the current view on the relevant OCA criteria.

Although significant progress on the empirical assessment of the various gains and costs is under way, the theory of currency unions begs for a unified framework that can incorporate the various relevant factors determining optimality. Important starting points are Alesina & Barro (2002) and Ching & Devereux (2003).<sup>26</sup> The former weighs trade and credibility gains against the cost of asynchronous shocks, in the absence of financial markets. The latter, by contrast, stresses the gain from integration in financial markets facilitated by currency unions. Not surprisingly, the extent of dissimilarity of shocks weighs differently in the two analyses. In Alesina & Barro (2002), the dissimilarity of shocks is a key determinant of the cost of joining a currency union, as in Mundell (1961); in Ching & Devereux (2003), dissimilarity can act rather as a benefit, fostering the diversification of shocks and a smoother path for consumption, as suggested by Mundell (1973).

A unified welfare-based framework should resolve the seeming contradiction in the roles played by these and the various other criteria we discuss above and thus help move the theory of optimum currency unions beyond a narrative enumeration of gains and costs. It should also clarify the implicit assumptions about the economy underlying the various OCA criteria. Guidance from recent empirical developments, in turn, should help operationalize the theoretical framework and turn it into a quantitative model for policy evaluation.

## DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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<sup>26</sup>See Carre & Collard (2003), Faia (2007), and Christoffel et al. (2009), who also analyze specific gains and costs from a monetary union. More broadly, on welfare-based analysis of different aspects of monetary interdependence, see Benigno & Benigno (2003), Benigno (2004), Bacchetta & van Wincoop (2000), Corsetti & Pesenti (2001), and Obstfeld & Rogoff (1995, 1996).



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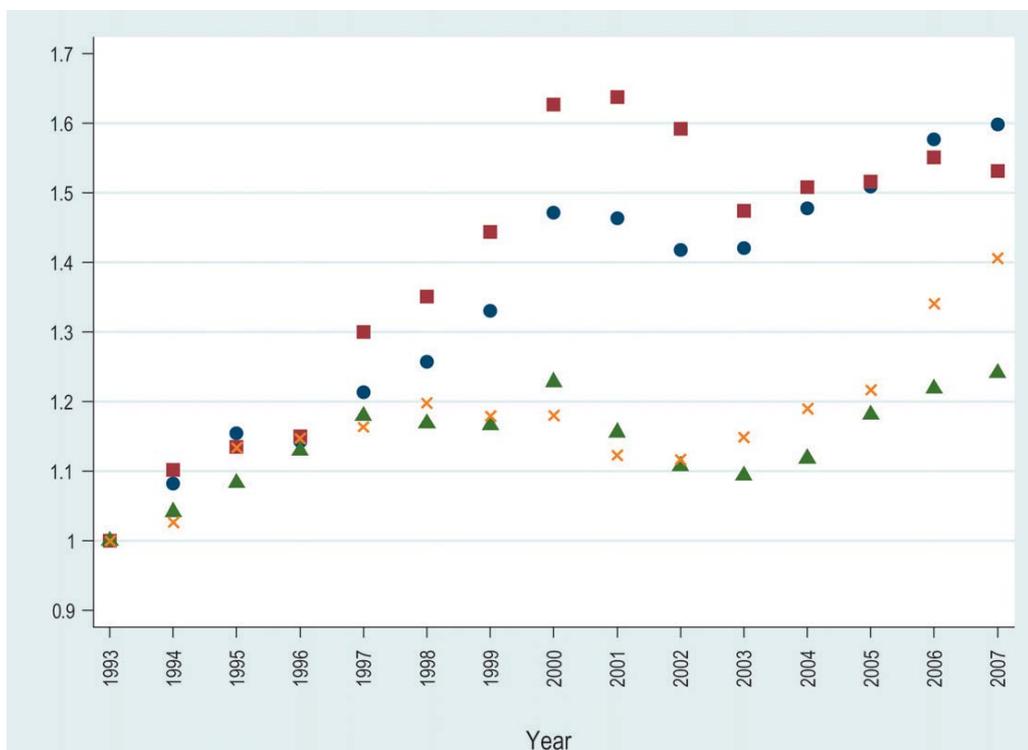
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**Figure 1**

Bilateral trade relative to GDP for different bilateral groups (OECD93): exports of the Euro-12 countries to trading partners of the same group (*circles*) and to OECD93 countries (*squares*), both relative to the total GDP of the Euro-12, and exports from the 11 OECD93 countries to the members of this group (*triangles*) and to the Euro-12 countries (*crosses*), both relative to the total GDP of the OECD93 countries. All series are normalized to 1 in 1993.