Capital Market Imperfections
and the Theory of Optimum Currency Areas

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Abstract

This paper studies how within- and cross-country capital market imperfections affect the welfare effects of forming a currency union. The analysis considers a bank-only world where intermediaries compete in Cournot fashion and monitoring and state verification are costly. The first part determines the credit market equilibrium and the optimal number of banks, prior to joining the union. The second part discusses the benefits from joining a currency union. A competition effect is identified and related to the added monitoring costs that banks may incur when operating outside their home country, through an argument akin to the Brander-Krugman “reciprocal dumping” model of bilateral trade. However, in our framework, whether joining a union raises welfare of the home country is ambiguous; it depends on the relative strength of “investment creation” and “intermediation diversion” effects.

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1 Introduction

Since the seminal contribution of Mundell (1961), the literature on optimum currency areas (OCAs) has proposed a variety of criteria for choosing if and when countries should elect to form or participate in a currency union. These criteria include similarity of inflation rates, the degree of factor mobility, the openness and size of the economy, the scope of production diversification, the degree of price and wage flexibility, the extent of integration in goods markets, the correlation between economic shocks across countries, the degree of fiscal integration, and the political will to integrate.1 Although much of the early literature on OCAs took these optimality criteria as given, recent research has emphasized that some of them may be endogenous, as a result of the very existence, and induced effects, of a currency union. It has been argued that similarity of inflation rates, for instance, may be promoted by participating in a currency union, and that a high degree of convergence (or low dispersion) should not necessarily be viewed as a pre-condition for forming one.2 Similarly, entry into a currency union may strengthen international trade linkages over time.3

By contrast, the present paper focuses instead on how within- and cross-country capital market imperfections may condition the welfare gains of joining a currency union. Somewhat surprisingly, there has been very little analytical research on this issue; most of the literature surveys referred to earlier do not even mention it as a relevant criterion for assessing the net benefits that countries might derive from forming or participating in a union.4 This paper is an attempt to fill this gap, using a simple stochastic model where financial intermediation services are provided only by banks. Our focus is on understanding how monitoring costs, and the degree of competition in banking, affect the welfare gains associated with (and thus the desirability of partici-

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2See Hoffman and Remsperger (2005), Beechey and Osterholm (2009), Maria Caporale and Krontonikas (2009), and Becker and Hall (2009).

3See Engel and Rose (2002), Barro and Tenreyro (2007), Gil-Pareja et al. (2008), and Gonçalves et al. (2009).

4Exceptions are Giovannetti and Marimon (2000) and Alves (2008). However, neither of these studies considers explicitly the role of credit market frictions, as we do here.
pating in) a currency union. A key step in doing so is a comparison between expected surpluses before and after joining the union. As a result, we are able to identify the reasons why the welfare effect of this decision is ambiguous.

The remainder of the paper is organized as follows. Section II provides a brief review of the current literature on capital market imperfections and OCAs. Section III presents the model and describes the functioning of the financial sector prior to joining a union. The model upon which our analysis is based extends the framework developed in Agénor and Aizenman (1998, 1999, 2005), which itself dwells on the costly state verification approach pioneered by Townsend (1979). However, in an important departure from these previous studies, we also endogenize the number of financial intermediaries. Section IV considers the case where the country under consideration joins a currency union, and analyzes a key channel through which financial factors may affect the welfare gains (calculated from the point of view of an individual member country) from joining the union: an enhanced bank competition effect. We draw an important analogy between the added monitoring costs that banks may incur when operating outside their home country, and transportation costs, in a manner similar to the “reciprocal dumping” model of Brander and Krugman (1983). However, we also show that our results differ in important ways from that paper, in the sense that welfare effects are now ambiguous. Section V further discusses some of the assumptions underlying our analysis, the distinction between financial integration and the financial effects of joining a currency union, and considers some possible extensions. Section VI summarizes our main results and offers some concluding remarks.

2 Capital Market Imperfections and OCAs

As noted earlier, there has been limited research on the role of capital market imperfections in the design and functioning of OCAs. In one of the few analytical studies available, Ching and Devereux (2003) examined the argument, first proposed by Mundell (1973), that a single currency area offers risk-sharing benefits when domestic

\[5\text{To save space, we limit our discussion to the case of the Euro area. The evidence for developing countries is discussed in the working paper of this article.}\]
capital markets are limited in their ability to provide consumption insurance. This argument goes against the “conventional” view, according to which a single currency area carries a welfare loss owing to the fact that the use of the nominal exchange rate to respond to country-specific shocks is precluded. They evaluate the costs and benefits of two monetary arrangements: a system of independent national currencies and a single currency area. They find that the presence of country-specific shocks may either reduce or enhance the benefits of a single currency area, depending on the importance of exchange rate adjustment relative to risk sharing. Thus, in practice, either regime may dominate, although welfare differences between the two regimes may not be large.

However, while the scope for risk sharing in the context of currency unions is clearly an important consideration, there are a number of additional issues associated with the functioning of capital markets that have not been addressed. For instance, what is the role of initial differences in the cost of intermediation for welfare? To what extent is an improvement in the efficiency of domestic financial intermediation necessary for a currency union to be welfare-improving? Are these welfare gains monotonic? Or is it only beyond a certain threshold of financial development that countries get to benefit from a currency union?

These issues are not mere analytical curiosities. Several observers have argued that the reason why the formation of the European Union (EU) in 1999 has not had yet a significant and lasting impact on growth in member countries is because much remains to be done to integrate highly imperfect national financial systems (Hochreiter, Schmidt-Hebbel, and Winckler (2002)). Although financial integration among Western European countries had started well before the introduction of the euro, the single currency was expected to accelerate that process, through several channels. First, by putting an end to exchange rate uncertainty on trading decisions among member countries. Second, by leading to reduced risk premia (and thus borrowing costs) and the elimination of conversion costs arising from the use of separate national currencies. And third, by increasing the degree of competition, not only in product markets

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6 According to data published by the European Commission, real GDP per capita grew at an average rate of 1.6 percent a year between 1999 and 2008, down from an average of 1.9 percent during 1989 and 1998 and well below the 2.2 percent recorded for Denmark, Sweden, and the United Kingdom, which have remained outside the Union.
but also in the provision of financial services. In turn, more integrated markets were expected to spur growth and employment.

As documented in a number of studies, including Mongelli (2002), Hartmann, Maddaloni, and Manganelli (2003), Baele et al. (2004), De Grauwe and Mongelli (2005), Schmiedel and Schönenberger (2005), Melnik and Nissim (2006), Haq and Heaney (2009), and Morelli (2010), the degree of financial integration in the Euro area appeared to have increased significantly following the launch of the common currency—particularly in the equity and corporate bond markets. Melnik and Nissim (2006) for instance found that the introduction of the Euro led to a significant reduction in the issuance cost of Euro-denominated bonds, compared with bonds denominated in the legacy currencies, whereas Haq and Heaney (2009) found that bank equity risk declined in almost all member countries following the formation of EMU.

Yet, there is also broad agreement that the degree of financial integration in the Euro area remains far from perfect. Infrastructure of the securities market remains highly fragmented, with a large number of providers for trading, clearing, and settlement that are not efficiently connected to one another. In addition, even though there appears to have been convergence in nominal interest rates among members after the formation of the Euro area, persistent differentials in inflation implies that real interest rates have continued to move apart—a phenomenon exacerbated by the recent sovereign debt crisis. More importantly for the purpose at hand, in banking markets, and corporate lending markets in particular, price differentials remain relatively high—even though there appears to have been some degree of convergence in cost efficiency of banks across European countries (see Weill (2009)). A key reason for that is differences in practices (in credit risk assessment, for instance), laws and regulations, and market fragmentation. Indeed, as noted in several of the studies mentioned above, particularly Mongelli (2002, p. 21) and De Grauwe and Mongelli (2005, p. 22), financial structures continue to differ significantly among European countries, particularly with respect to contract enforcement costs. There is still considerable persistence of “home bias” in lending to (and borrowing by) non-financial corporations. In a study of convergence across European banking markets, Koutsomanoli-Filippaki and Mamatzakis (2010) found that there remains considerable heterogeneity in terms
of the speed of adjustment of cost efficiency to equilibrium. In the same vein, Carbó et al. (2009) found that the degree of competition in banking markets in the Euro area varies considerably across countries.

The foregoing discussion suggests that there is some evidence supporting the view that differences in financial intermediation costs (including both monitoring costs and contract enforcement costs) may explain the persistence of large price differentials in banking across countries in a currency union. In what follows we present a model that captures these factors and examine their implication for the benefits—or lack thereof—of joining a currency union.

3 The Pre-Union Case

We begin by considering the behavior of a small open economy prior to joining a union. The country considered has access to an integrated world capital market, but borrowing occurs (at a premium) in different currencies. Risk-neutral banks provide intermediation services to entrepreneurs, who rely only on bank loans and demand credit to finance their investment projects. There is a large number of entrepreneurs, \( m \), each of whom is a price taker, and \( n \) banks. We assume that \( m/n \) is large, implying that each bank can diversify away its exposure to idiosyncratic risk.

The project’s future return is random. It depends on productivity shocks, whose realized values are revealed to banks only at a cost. If an entrepreneur chooses to default on his loan repayment obligations, the bank seizes any collateral set as part of the loan contract, plus a fraction \( \alpha \in (0, 1) \) of the project’s realized value. Seizing involves two types of costs: first, verifying the outcome of the project is costly; second, recourse to the legal system to enforce repayment is also costly.

Investment \( I_i \) at the beginning of the period by a representative entrepreneur \( i \) results in output of a single good

\[
Y_i = a\sqrt{I_i(1 + \varepsilon_m + \delta_i)},
\]

where \( \varepsilon_m \) is a macro shock, and \( \delta_i \) an idiosyncratic i.i.d. shock, uniformly distributed in the interval \([-\delta, \delta]\), where \( \delta > 0 \). The good produced is traded, and its price is therefore fixed on world markets.
To simplify, we will assume only two possible states, with equal probability, for the macro shock:
\[
\varepsilon_m = \begin{cases} 
\bar{\varepsilon} & \Pr = 0.5 \\
-\bar{\varepsilon} & \Pr = 0.5 
\end{cases},
\]
(2)
where \(\bar{\varepsilon} > 0\).

3.1 The Demand for Loans

Investment is bank financed, at a contractual interest rate of \(r_L\). Default triggers a penalty, equal to \(\alpha Y_i\). Hence, assuming zero collateral for simplicity, the entrepreneur’s debt service, \(S_i\), will follow the rule
\[
S_i = \min[(1 + r_L)I_i; \alpha Y_i].
\]
(3)

The macro shock is public information. By contrast, the producer-specific shock is revealed to the bank only at a cost, proportional to the level of investment, \(cI_i\), where \(c \in (0, 1)\).

To simplify, we assume parameter values that imply full repayment by all producers in the good state of the macro shock (\(\varepsilon = \bar{\varepsilon}\)). In the bad macro state of nature, the threshold value of the idiosyncratic shock leading to default, \(\delta^*_i\), is determined by
\[
(1 + r_L)I_i = \alpha a \sqrt{I_i}(1 - \bar{\varepsilon} + \delta^*_i).
\]
(4)

From (4), we can solve implicitly for \(\delta^*_i\):
\[
\delta^*_i = f[\sqrt{I_i}(1 + r_L); \alpha], \quad f'_1 > 0, \quad f'_2 < 0.
\]
(5)

Banks are risk neutral. All entrepreneurs are ex ante identical from the banks’ point of view. Banks therefore offer an identical contractual interest rate, \(r_L\), associated with the expected yield on their loans, \(r_B\), and finance the equilibrium investment level, denoted by \(I^*\).

Following the discussion and derivations in Agénor and Aizenman (1998, 1999) and the Appendix of Agénor, Aizenman, and Hoffmaister (2008), the link between the contractual lending interest rate and the bank’s expected yield on the contract is
\[
(1 + r_B)I_i = 0.5(1 + r_L)I_i
\]
(6)

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7The Appendix discusses in more detail the nature of the bank debt contract and monitoring costs.
+0.5 \left\{ (1 + r_L)I_i \int_{\delta_i}^{\delta} \frac{1}{2\delta} d\delta + \int_{-\delta}^{\delta} \left\{ \alpha a \sqrt{I_i} (1 - z + \delta_i) - c I_i \right\} \frac{1}{2\delta} d\delta \right\},

where \( r_B \) is determined later.

Given that entrepreneurs are risk neutral, applying (1), (3) and (5) yields the entrepreneur’s expected profit, \( \Pi_E \), as

\[
\Pi_E = a \sqrt{I_i} - 0.5(1 + r_L)I_i \\
-0.5 \left\{ (1 + r_L)I_i \int_{\delta_i}^{\delta} \frac{1}{2\delta} d\delta + \alpha a \sqrt{I_i} \int_{-\delta}^{\delta} (1 - \varepsilon_m + \delta_i) d\delta \right\}.
\]

Substituting the bank’s expected profits (as given in (6)) in this expression yields

\[
\Pi_E = a \sqrt{I_i} - (1 + r_B + 0.5c \int_{-\delta}^{\delta} \frac{1}{2\delta} d\delta)I_i,
\]

which shows that, in equilibrium, the borrower in effect “pays” the cost of state verification.

From (7), the first-order condition determining optimal investment (which is the same across entrepreneurs) can be written as

\[
\frac{a}{2\sqrt{I}} - (1 + r_B + 0.5c \int_{-\delta}^{\delta} \frac{1}{2\delta} d\delta) - 0.5c \frac{1}{2\delta} \frac{df}{dI} = 0.
\]

Equivalently, this equation can be rewritten to show that optimal investment is determined by equating the marginal product of capital, \( a/2\sqrt{I} \), to the expected cost of borrowing funds, which is the sum of banks’ gross expected yield, \( 1 + r_B \), plus the expected marginal cost of monitoring and enforcement:

\[
\frac{a}{2\sqrt{I^*}} = 1 + r_B + \psi c,
\]

where \( \psi \) is the sum of the probability of default, given by \( 0.5 \int_{-\delta}^{\delta} (1/2\delta) d\delta \), plus the marginal impact of investment on that probability (see equation (5)); thus

\[
\psi = \frac{1}{4\delta} \left\{ (\delta + \delta^*) + \frac{df}{dI} \right\}.
\]

Equations (5), (6) and (8) characterize the equilibrium triplet \((I^*, r_L, \delta^*)\) corresponding to a given \( r_B \). It implies a downward-sloping demand for credit, \( I^* \), and an expected producer’s surplus, \( \Pi^*_E \), equal to

\[
I^* = I^*(r_B; \bar{c}), \quad \Pi^*_E = \Pi^*_E(r_B; \bar{c}).
\]
These results lead to the following proposition:

**Proposition 1.** An increase in the expected rate of return on loans, or a rise in monitoring costs, reduce both investment and the expected producer’s surplus.

### 3.2 Equilibrium Loan Supply

The \( n \) domestic banks in the economy differ only in the cost of running the bank (that is, the cost of operating the business). We assume that this “administration” cost is fixed and denote it by \( \mu_j \), for \( j = 1, \ldots n \). Banks are ordered according to their cost efficiency, \( \mu_{j+1} \geq \mu_j \).

With \( m \) entrepreneurs and \( n \) banks, the credit market equilibrium condition is given by

\[
      mI^*(r_B; c) = nL_r, \tag{12}
\]

where \( L_r \) is the supply of loans offered by the representative bank.

Banks compete in Cournot fashion. Let \( \bar{L}_{-r} \) denote the aggregate supply of all the other \( n - 1 \) banks, and let \( r_B(\bar{L}_{-r}, L_r) \) denote the market-clearing interest rate determined by (12), for the case where bank \( r \) lends \( L_r \), whereas the remaining banks lend \( \bar{L}_{-r} \).

Let \( r_0 \) denote the bank’s expected cost of funds, or the expected yield on depositors’ money needed to attract savers. Cournot competition implies that the representative bank determines its loan supply by solving the following problem

\[
      \max_{L_r} \left[ L_r \{ 1 + r_B(\bar{L}_{-r}, L_r) \} - L_r (1 + r_0) - \mu_r \right], \tag{13}
\]

taking \( \bar{L}_{-r} \) as exogenously given. The quantity \( r_B(\bar{L}_{-r}, L_r) \) is the expected bank’s yield.

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8We consider a fixed cost for simplicity only. Introducing heterogeneity in the marginal cost of making loans would complicate the analysis without affecting much the qualitative features of our analysis. The added complication is that the efficiency ordering of the banks would depend both on the fixed and marginal cost of each bank; this makes the efficiency ordering less obvious.

9Our choice of Cournot competition is motivated by the fact that several empirical studies have shown its relevance in analyzing competition issues in banking, especially for the EU and other industrial countries; see Angelini and Cetorelli (2000) for Italy, Corvoisier and Gropp (2002) and van Leuvensteijn et al. (2007) for the Euro Area, Bos (2003) for Holland, and Uchidaa and Tsutsui (2005) for Japan. It has also been used in a number of theoretical studies of bank behavior (see for instance Yafeh and Oved Yosha (2001)).
on loans, which is determined by the market-clearing condition

$$mI^*(r_B; c) = \bar{L}_r + L_r.$$  \hfill (14)

The resulting first-order condition from (13) is

$$1 + r_B + L_r r'_B = 1 + r_0.$$  \hfill (15)

In a symmetric equilibrium, with \( n \) banks, offering aggregate supply of \( L = nL_r \), the first-order condition reduces to

$$(1 + r_B)(1 - \frac{1}{nn_{I/r_B}}) = 1 + r_0,$$  \hfill (16)

where \( \eta_{I/r_B} \) is the elasticity of the demand for loans with respect to \( r_B \), defined as

$$\eta_{I/r_B} \equiv -d \ln I^*(r_B; c)/d \ln(r_B).$$

Rearranging equation (16) yields the following proposition:

**Proposition 2.** The (gross) expected yield on loans is equal to the (gross) cost of funds, times a mark-up that depends negatively on the number of banks and the elasticity of the demand for loans:

$$1 + r_B = (1 + r_0)\frac{nn_{I/r_B}}{nn_{I/r_B} - 1},$$  \hfill (17)

where \( nn_{I/r_B}/(nn_{I/r_B} - 1) > 1 \).

### 3.3 Equilibrium Number of Banks

The equilibrium number of banks, \( n^* \), is determined by the break-even condition of the marginal bank. That is, for \( j = n^* \) (given our ordering assumption), expected net profits are zero if and only if \( (r_B - r_0)L_r = \mu_{n^*} \). Using (17) yields

$$(r_B - r_0) L_r = \mu_{n^*} \iff \frac{1 + r_0}{nn_{I/r_B} - 1} L_r = \mu_{n^*}.$$  \hfill (18)

Combining (14), (17), and (18) yields the optimal administration cost as

$$\mu_{n^*} = (\frac{mI^*}{n})(\frac{1 + r_0}{nn_{I/r_B} - 1}).$$  \hfill (19)

In what follows we assume that \( \eta_{I/r_B} > 1/n \), to ensure an equilibrium with positive interest rates and a positive number of banks. This condition is actually not very
restrictive. Using (16), equation (19) can be written also as
\[ \mu_{n^*} = m(1 + r_B)I^*/n^2\eta_{I/r_B}, \]
where \( dI^* / dr_B < 0 \) (see Proposition 1). Applying the implicit function theorem, it then follows that
\[ \frac{dn^*}{dr_B} = mI^*(1 - \eta_{I/r_B})/\left[\frac{d\mu_n}{dn} + 2m \frac{(1 + r_B)I^*}{n^2\eta_{I/r_B}}\right]. \]

Hence, a higher expected yield (resulting from a higher cost of funds) reduces the number of banks when the demand for loans is sufficiently elastic (\( \eta_{I/r_B} > 1 \)). It is easy to confirm that \( \eta_{I/r_B} \to 2 \) when \( c \to 0 \). The assumption of a relatively elastic demand for funds is thus a reasonable benchmark, which allows us to evaluate the impact of changes in the cost of financial intermediation.

Using (11) and (17), it follows that the equilibrium number of banks, \( n^* \), is given by
\[ n^* = n^*(\bar{r}; c), \]
which yields the following proposition:

**Proposition 3.** An increase in the banks’ cost of funds (resulting from either an increase in the risk-free rate or a rise in the risk premium), or an increase in monitoring costs, lower the equilibrium number of banks, \( n^* \), and increases the banks’ expected yield and the lending rate, \( r_B \) and \( r_L \).

Banks’ aggregate expected surplus is
\[ \Pi_B^* = \sum_{i=1}^{n^*} [(r_B - r_0)L_r - \mu_i]. \]

Substituting (18) in (21) yields
\[ \Pi_B^* = n^*(\mu_{n^*} - \bar{\mu}), \]
where \( \bar{\mu} = \sum_{i=1}^{n^*} \mu_i / n^* \) is the average fixed cost.

The equilibrium is illustrated in Figure 1. The downward-sloping curve is the demand for investment facing the representative bank as a function of the banks’ expected yield, \( r_B \), where \( r_0 \) is the cost of funds. The markup condition (17) determines the gap between the two, resulting in each bank financing \( I^{au} \) in the initial equilibrium, yielding expected gross rent given by the dotted rectangle \( (r_B - r_0)I^{au} \). The equilibrium number of banks is determined by the free entry condition, where the marginal bank
earns zero net rent: the expected gross rent, \((r_B - r_0)I^{au}\), equals the fixed cost of the marginal bank, \(\mu_{n^*}\).

### 3.4 Welfare

Our measure of welfare prior to joining the union, \(W\), is the sum of the expected net income of domestic producers and domestic banks, as in Agénor and Aizenman (1999).\(^{10}\) Specifically, welfare prior to joining can be evaluated by the sum of the producers’ expected surplus, obtained by aggregating \(\Pi_E^*\) in (11) across all \(m\) producers, and the domestic banks’ aggregate expected surplus given in (22):

\[
W = m\Pi_E^* + \Pi_B^*.
\] (23)

We turn now to an evaluation of the welfare impact of changes in the cost of monitoring, \(c\). Recall that, \textit{ex ante}, borrowers “pay” monitoring costs in the form of a higher expected real cost of borrowing (see equation (7)). A higher \(c\) implies therefore a direct reduction in investment and a lower producers’ surplus, thereby reducing the equilibrium number of banks (see (11) and (20)). In addition, because the exit of marginal banks raises the banks’ equilibrium lending rate, \(r_B\), the higher cost of borrowing triggers a secondary round of adverse effects, by further reducing equilibrium investment, \(I^*\) (see (11)). Thus, the net welfare effect is therefore\(^{11}\)

\[
\frac{dW}{dc} = m \left\{ \frac{d\Pi_E^*}{dc} + \frac{d\Pi_E^*}{dr_B} \frac{dr_B}{dc} \right\} < 0.
\]

Hence, if domestic financial intermediation costs fall upon joining a union, domestic welfare would improve. However, as discussed next, the outcome is a lot more complex if domestic banks have a comparative advantage in providing financial intermediation services to domestic entrepreneurs, in the sense that they incur lower monitoring costs than foreign banks.

\(^{10}\)The analysis could easily be extended to account for endogenous (labor) income, by introducing labor in the production function (11) and assuming fixed wages (see, for instance, Agénor and Aizenman (1998, 1999). However, this would complicate the analysis without adding much insight.

\(^{11}\)The marginal impact of banks’ exit on \(\Pi_B^*\) is of a second-order magnitude, reflecting the break-even condition of the marginal bank; hence its surplus is zero.
4 Gains from Joining a Union: The Bank Competition Effect

Consider two countries (home or domestic, denoted $H$, and foreign, denoted $F$) operating initially with each other a floating exchange rate or a fixed exchange rate subject to occasional realignments. They then choose to form a currency union, which involves the irrevocable adoption of a common currency. In what follows, we discuss what is in our view the key channel through which this decision will affect each country individually: a bank competition effect.\textsuperscript{12} We examine the impact on welfare, as defined in (23). In order to simplify notations and avoid working systematically with a two-country framework, we focus on the case where the countries considered are identical in all respects, except possibly for the monitoring costs associated with financial intermediation.

Now suppose that the elimination of currency risk and the greater scope for risk sharing commonly associated with the formation of a monetary union increase incentives for domestic banks to enter financial markets in the partner country. This is consistent with the evidence in Spiegel (2009) for instance, who found that accession to the EMU was accompanied by a change in Portuguese and Greek borrowing in favor of borrowing from their new EMU partner countries.\textsuperscript{13}

There are two potential effects of increased bank competition associated with entry: a) a change in the (equilibrium) number of banks; and b) a reduction in (marginal) administration costs. The simplest and most transparent way to understand the competition effect of a union in our setting is to consider first the case where the home economy $H$ forms a currency union with a foreign economy $F$ that is in all respects

\textsuperscript{12}In the working paper version of this article, we also discuss two other channels, namely a transactions costs effect and a diversification-risk premium effect. The latter, in particular, dwells on the idea that capital market integration implies that individual capital markets move in a similar way and as a result of this have high correlations, which in turn implies reduced benefits from international portfolio diversification. Because these are more standard, we omit them here to save space.

\textsuperscript{13}See also Petroulas (2007), Brouwer, Paap, and Viaene (2008), and Haselmann and Herwartz (2010) for the Euro area. The latter study found evidence of reduced home bias of German investors since the introduction of the Euro, as a result of two effects on portfolio reallocation: reduced exchange rate risk and transaction costs within the EMU, and higher diversification benefits induced by an increase of correlation of EMU returns. There is also evidence that MERCOSUR led to a substantial increase in capital flows from Brazil to Argentina.
identical—including monitoring and contract enforcement costs—with all banks, domestic and foreign, free to operate in either country. In these circumstances, the formation of the union entails also a transformation from “relative” financial autarky to a fully integrated financial equilibrium.\textsuperscript{14} The welfare consequences of this transformation can then be inferred by applying Brander and Krugman (1983)’s logic in their seminal paper on “reciprocal dumping,” which studies the impact of trade integration of two symmetric economies, each characterized by imperfect Cournot competition.

Specifically, suppose that banks’ monitoring costs, when operating in their own countries, $H$ and $F$, are $c^H$ and $c^F$, respectively. To simplify notation, we focus on the case where $c^H = c^F = c$. Domestic banks in each country have a cost advantage in their market relative to foreign banks. However, they are at a disadvantage when operating outside their own local market, which translates into an increase in monitoring and enforcement costs by the magnitude $t$. These costs may reflect the fact that, for instance, seizing a fraction $\alpha$ of the realized value of output—or, more generally, pledged collateral—in case of default may require recourse to a legal system that differs from the home country’s. Hence, the cost of $H$ ($F$) banks operating in country $F$ ($H$) is $c + t$. This “cost gap” leads to home bias in the provision of financial intermediation services, and is akin to the home bias in the consumption of goods due to transportation costs emphasized by Brander and Krugman (1983).

Recalling (6), and using (9) and (10), the expected cost of credit facing the entrepreneur prior to joining the union is $r_B + \psi c$, where $\psi > 0$. A domestic bank would be able to compete in the foreign country only if it is able to charge the same contractual interest rate as the foreign bank operating in their country, $r_L$. This in turn implies that the representative bank’s expected return on the first unit lent in the foreign market will be $r_B - t\psi$. The expected cost disadvantage of the foreign operator, $t\psi$, is akin to the transportation cost separating the two markets in Brander and Krugman’s “reciprocal dumping” model. If this cost disadvantage exceeds the gap between the expected return and the expected marginal cost of a loan prior to joining ($t\psi > r_B - r_0$), the formation of the union would not alter the degree of competition in the domestic

\textsuperscript{14}We refer to “relative” autarky because country $H$ could have maintained unrestricted financial flows with a third country, prior to forming the union with country $F$. 
market of either country. However, if \( t\psi > r_B - r_0 \), it would be in the self interest of local banks to supply credit to the foreign market—the first unit lent in the foreign market would increase each local bank’s profits by \( r_B - r_0 - t\psi \). This would lead to “reciprocal dumping,” with the net effect of increasing competition and reducing the cost of credit. The union-wide equilibrium would be established once the profit margin vanishes, that is, when

\[
MR^U_{L^*} - r_0^U = t\psi,
\]

where the index \( U \) stands for the integrated equilibrium, and \( MR^U_{L^*} \) is the expected increase in revenue associated with a unit lent by the representative local bank in the foreign country.

Banks’ market power implies that \( MR^U_{L^*} = r_B^U + (dr_B^U/dL^*)L^* \), where \( L^* \) stands for the loans of the representative local bank in the foreign country (note that for the first unit lent \( L^* = 0 \), hence \( MR^U_{L^*}|_{L^*=0} = r_B \)). The competition effect implies a lower cost of funds, which translates therefore into an increase in the equilibrium level of investment, \( I^* \).

Applying the logic of Brander and Krugman (1983), we can establish the following result:

**Proposition 4.** Following the formation of a currency union between two identical countries, the change in national welfare is positive if the cost of home bias is small, and ambiguous if the cost disadvantage is large.

This result follows from the observation that serving a local market by a foreign bank entails wasteful “cross hauling,” where some domestic loans are supplied by foreign banks that face a cost disadvantage of \( t\psi \) relative to the case where all domestic loans are supplied by local banks. If the extra cost of providing financial intermediation services to a foreign market, \( t\psi \), is low, the competition-induced welfare gain triggered by the entry of foreign banks would exceed the welfare cost of using a relatively inefficient provider of loans—thereby increasing welfare. But the reverse may apply for a high enough cost disadvantage: if the extra cost of providing intermediation services to the foreign market were to exceed the extra revenue generated by a reduction in banks’ cost of funds, banks’ profits would decline, inducing the exit of marginal banks—which in turn would lead to higher lending rates and lower investment.
The welfare effect of enhanced competition is illustrated also in Figure 1. Assuming that the cost disadvantage is not prohibitive, the increase in competition induced by the union reduces home banks’ equilibrium expected yield to $r_H^U$. This in turn would increase funding for investment supplied by the representative bank to $I^U$, with a portion $I_H$ of it supplied to domestic investors and a portion $I^U - I_H$ to foreign investors. Investors’ welfare improves, as the expected cost of borrowed funds declines. The vertical trapezoid is a welfare gain, associated with “investment creation.” More specifically, the welfare gain associated with investment creation is the shaded trapezoid, the base of which is the added investment, $\Delta I = I^U - I^{au}$, with its left and right sides given by $r_B - (r_0 + t\psi)$ and $r_H^U - (r_0 + t\psi)$, respectively.

At the same time, however, the diversion of banks’ lending from the domestic to the foreign source results in a welfare cost given by $(I^{au} - I_H) t\psi$, the small rectangle. This cost reflects the inefficiency of replacing domestic loans, associated with monitoring costs of $c$, with foreign loans, associated with monitoring costs of $c + t$. Thus, in the same spirit as Brander and Krugman (1983), the net welfare effect of the union is ambiguous. If the cost disadvantage of banks operating in foreign markets, $t$, is small enough, the formation of the union will increase welfare of both members. This the case illustrated in Figure 1. If the cost disadvantage is large enough, as would be the case if $t\psi$ approaches $r_B - r_0$, the “lending diversion” effect would dominate the “investment creation” effect, thereby reducing welfare. This is the case depicted in Figure 2.\(^{15}\)

Greater competition tends to reduce banks’ expected gross rent due to two effects: a) the entry of foreign banks induces a drop in home banks’ margin, inducing them to supply funds beyond the level where, prior to joining the union, the marginal cost of funds equaled marginal revenue; and b) market forces induce the bank to absorb its monitoring cost disadvantage in the foreign market, $(I^{au} - I_H) t\psi$. Note, however, that the drop in the banks’ cost of funds would work in the opposite direction. If the competition effect dominates, expected gross rents would decline, inducing the exit of marginal banks. This in turn would increase the demand facing infra-marginal banks.

\(^{15}\)Note that even in this case, if the cost disadvantage shrinks and disappears over time due to learning by doing, the formation of a currency union may still prove beneficial down the road. See the discussion in the concluding section.
A higher cost disadvantage in foreign markets, and a lower drop in home banks’ cost of funds, both increase the likelihood of this outcome.

Our model, and the results dealing with the welfare effect of integration, differ from those of Brander and Krugman (1983) in several important dimensions. To recall, their model implies that with free entry, integration leading to two-way trade is unambiguously beneficial; by contrast, our model provides ambiguous results. Beyond the difference in the context (trade in goods versus in financial intermediation), our model assumes heterogeneity of the fixed cost across producers, whereas Brander and Krugman (1983) assume that all domestic producers and identical. This in turn implies that in our model, most banks earn rents, whereas in Brander and Krugman, free entry dissipates producers’ rents. Hence, in Brander and Krugman, free entry implies lower prices, increased consumer’s surplus, and therefore higher welfare. In our setup, free entry works to reduce banks’ rents, leading to the possible ambiguity of the welfare results of integration.

Our model can readily be extended to allow for asymmetric features, including cost advantages for some banks (that is, the possibility of lower monitoring costs, \( c \)). To illustrate, suppose that the only difference between the two economies is that \( c^H > c^F \), which implies that home banks are less efficient in providing financial intermediation services than foreign banks. As before, we assume that offshore operations increase monitoring costs by \( t \). To simplify the analysis, suppose that prior to forming the union, the banks’ expected gross yield in both economies is the same, \( 1 + r_B \). Similar to our discussion before Proposition 4, a foreign bank that considers operating in the home economy \( H \) will find that its expected return on the first unit lent to firms in the home market is \( r_B - [t - (c^H - c^F)] \psi \). Similarly, a home bank attempting to operate in the foreign country \( F \) will find that its expected return on the first unit lent in the foreign market is \( r_B - [t + (c^H - c^F)] \psi \). Hence, the superior monitoring technology by country \( F \) banks relative to country \( H \) banks reduces the “cost gap” of foreign banks operating in the home country to \( t - (c^H - c^F) \), while at the same time increasing the “cost gap” of country \( H \) banks operating abroad to \( t + (c^H - c^F) \), relative to the case
of equal monitoring costs. If

\[ [t + (c^H - c^F)] \psi > r_H - r_0 > [t - (c^H - c^F)] \psi, \]

the cost disadvantage of home banks relative to foreign banks will be large enough to prevent them from operating in country \( F \), whereas the cost advantage of country \( F \) banks relative to home banks will induce country \( F \) banks to provide offshore banking services in country \( H \). This is the case where asymmetry in monitoring costs translates into “asymmetric dumping,” where only country \( F \) banks operate in both markets.

We also need to consider now the relationship between \( t \) and \( c^H - c^F \). If \( t > c^H - c^F \), the superior monitoring capacity of country \( F \) banks mitigates the cost gap associated with offshore operation by foreign banks in the home country. A modified version of Figure 1 can then be applied to describe the impact of country \( F \) banks on welfare in country \( H \): investors in the home country are better off due to the lower cost of funds induced by the entry of country \( F \) banks; country \( H \) banks are worse off, because their volume of intermediation drops to \( I_H \), without the gains of offshore operations in country \( F \); and country \( F \) banks are better off by the extra rents associated with their offshore banking activities in country \( H \), \( I^U - I_H \). By contrast, if \( t < c^H - c^F \), country \( F \) banks have an absolute cost advantage over country \( H \) banks—even after accounting for the offshore costs of operation. If mergers are allowed, in these circumstances one would expect, following the formation of the union, to observe mergers initiated by the more efficient banks, looking to “take over” the customer base of the less efficient ones. While the cost saving is an obvious welfare gain, such a process may ultimately reduce competition if it leads to a large drop in the number of banks, with a relatively small number of “mega-banks” ultimately dominating the market.

5 Further Discussion and Extensions

Before offering some concluding remarks, it is useful to discuss further some of the assumptions underlying our model, as well as some of the features of our analysis and its possible extensions.

The first issue relates to the decision to frame our analysis in the context of a single-country framework. Although we did refer in the previous section to a two-country
union, possibly different with respect to monitoring costs associated with financial intermediation, we did not—in contrast to much of the recent literature on currency unions—adopt an explicit two-country model, with an account of exchange rates and exchange rate risk. The key reason is that the focus of our analysis is the financial consequences of forming a union, which we view as applying after the transition to a currency union (that is, after exchange rates are fixed). Accounting explicitly for exchange rates is not necessary for that purpose. Our single-country setting simplifies notations; and by introducing two-country aspects only when relevant, our analysis is a lot more transparent.

The second issue relates to the distinction between the effects of financial integration (broadly defined) and the specific financial effects of joining a currency union. Specifically, is the bank competition effect identified earlier as a possible gain from joining a union represents also potential gains from financial integration? In principle, of course, greater financial integration can also lead to and increased competition among banks. In that sense, our analysis could be viewed as equally useful to understanding the extent to which financial liberalization may benefit a small open economy with imperfect capital markets.

However, although analyzing the effects of financial integration and currency unions may look similar on the surface, there are in our view important differences between the two. The first is in the nature of the benefits. The formation of a currency union is a systematic, multilateral process compared to a unilateral process of financial liberalization; consequently, the adoption of a common currency is likely to provide market participants with greater confidence in the irreversibility of financial liberalization. By reducing uncertainty about policy reversals, the formation of a currency union may therefore exert an independent effect on cross-border capital flows and banking activity. By implication, its effects on competition may be considerably magnified compared to unilateral measures, which may be perceived as easier to reverse. Thus,

17 From that perspective, a more general title to the paper could be “Capital Market Imperfections, Financial Integration, and Optimum Currency Areas.”
18 The same point can be made when comparing the effects of trade liberalization vs. the formation of a common market.
although our analysis of competition could be relevant to understanding the effects of unilateral financial liberalization—notwithstanding the fact that our discussion is in terms of a reduction in exchange rate risk, currency conversion costs, etc., rather than other measures that would characterize financial liberalization in a non-union context—it does not necessarily apply with equal force.

The third issue relates to the possible extensions of our analysis. Although our model was deliberately kept as simple as possible, it can fruitfully be extended in a number of directions. First, in the model, banks lend only to firms; a currency union brings therefore no direct welfare gain to consumers or households, whose income was taken to be exogenous. This is obviously not the case in practice; the formation of a union could bring direct benefits to consumers as well, most importantly in the form of enhanced opportunities for portfolio diversification and changes in the rate of return on saving. Second, the formation of a currency union may lead to important dynamic effects on the financial system, such as a reduction of intermediation costs over time, and changes in the distribution of credit, to the extent that firms themselves relocate within the union. In particular, greater foreign bank penetration may lead to improvement in monitoring efficiency of domestic banks, which may translate into lower enforcement and verification costs. In turn, greater heterogeneity in these costs may affect the present-value benefits from joining the union in the first place. Alternatively, in a dynamic setting, greater financial integration between union members may lead to an increase in the symmetry of business cycles. In turn, greater synchronization of business cycles would reduce macroeconomic volatility, which would encourage savings and investment. However, it is also possible, as argued by Ozcan, Sorensen, and Yoshia (2003), that precisely because better financial integration enhances risk-sharing opportunities (or income insurance), it may make specialization in production more attractive, thereby rendering macroeconomic fluctuations less, rather than more, symmetric. Exploring these issues in a full-blown two-country setting would add much to our understanding.

The working paper version of this article provides a more detailed list of possible extensions.

Bris, Koskinen, and Nilsson (2002), using corporate-level data from ten countries that adopted the euro, found that the introduction of the common currency lowered the cost of capital for firms inside the union relative to that of firms outside it.
6 Summary and Concluding Remarks

This paper examined the role of capital market imperfections in assessing the welfare effects of forming a currency union—a topic that has received surprisingly little attention among researchers. Following a brief review of the literature, we presented an analytical framework that we believe is a useful starting point for addressing some of the core issues involved. Our model considers a bank-only world where monitoring and state verification are costly and banks compete in Cournot fashion.

The first part of the paper determined the credit market equilibrium and the optimal number of banks, prior to joining the union. The second part identified a key channel through which financial factors may affect the welfare gains that each country may derive from joining a currency union, characterized by the elimination of foreign exchange risk, the complete liberalization of capital movements, and the removal of restrictions on the operation of foreign banks in each economy. Upon the formation of the union, foreign banks have access to the domestic capital market and may lend to domestic firms; there is therefore enhanced bank competition. We drew an important parallel between the added monitoring costs that banks may incur when operating outside their home country and trade-related transportation costs, and derived a “reciprocal lending” equilibrium akin to the “reciprocal dumping” equilibrium derived by Brander and Krugman (1983) in their seminal model of trade under a Cournot duopoly. However, our analysis differs from the Brander-Krugman trade model because welfare effects are now ambiguous. In particular, our analysis showed that joining a currency union brings a welfare gain to a country only if the cost disadvantage that banks face when operating outside their own local market is sufficiently small.

Empirical evidence on the relative importance of the investment creation and investment diversion effects identified in our analysis, perhaps focusing on a particular country or episode, would be useful. In addition, as noted in the previous section, there are a number of ways in which our formal analysis can be extended. However, many of these extensions would not alter the main thrust of our analysis, which is that, in the presence of credit market imperfections, there are a number of effects, operating through the financial system, that are associated with joining a currency union; the net
impact of these different effects on aggregate welfare of each individual country is in general ambiguous. Whether the competition effect generates a welfare gain depends on how strong the “investment creation” effect is relative to the “intermediation diversion” effect.\textsuperscript{21} By implication, incentives to participate in a currency union will differ across countries, depending on their degree of financial development. The benefits, from the perspective of a single country, of forming a currency union with another are not necessarily symmetric across countries. Those with more efficient financial systems have more to gain—as long as the cost that their banks must incur to access foreign markets are not excessive.

At a more practical level, our model suggests also that the deeper financial integration of European countries promoted by the formation of the Euro area set in motion powerful competition effects due to reciprocal lending by banks that used to operate domestically, shielded from foreign competition. The competition effect is stronger the lower is the cost disadvantage of banks operating in foreign markets, and the weaker was competition in the domestic market prior to the union. For a low enough cost disadvantage of foreign banks, the formation of the union would be welfare improving. The competition effect tends to induce the exit of marginal banks. It may also lead to banking consolidation, in an attempt to exploit scale economies and to reduce the exposure to risk by means of geographical diversification. These results are in line with the empirical evaluation of Méon and Weill (2005) who, using data for all EU countries for the period 1960-95, found the existence of potential gains from inter-country pair mergers that would provide a better hedge against macroeconomic risk.\textsuperscript{22} In fact, and in relation to the ongoing sovereign debt crisis in Europe, it is possible that there has been an overexpansion of financial intermediation across borders if banks entered markets with underinvestment in monitoring. Such underinvestment may have resulted

\textsuperscript{21}Neumeyer (1998) offers a different perspective as to why the welfare effects of a currency union can be ambiguous: while a currency union may reduce some non-fundamental volatility in foreign exchange markets, it also reduces the number of assets available to hedge fundamental risks.

\textsuperscript{22}See also Lensink and Maslennikova (2008) for an analysis of cross-border bank mergers and acquisitions in Europe during the period 1996-2004. At the same time, it is also important to implement reforms to ensure that financial integration and cross-border activity do not remain constrained by cultural, linguistic and legal differences (for instance, in company law and accounting systems) across member countries.
from a moral hazard problem associated with the belief that German or French taxpayers would bail out their most active banks at the level of the union in case of a bad macro shock. This issue, which can be addressed with an extension of our model, is left for future research.
This Appendix outlines the economic considerations explaining the bank debt contract and the monitoring costs applied in the paper. We start with a brief overview of the literature on “standard bank debt-contract” that followed Townsend (1979), and conclude with the way that our specification relates to this literature. The background of our discussion is Townsend’s (1979) pioneering work on costly state verification, and the follow-up analysis by Diamond (1984), Boyd and Smith (1994), and others.

Townsend (1979) considered an environment with risk-neutral agents, where *ex post* the state of nature is observed by the borrower, but revealed to the lender only after costly state verification. He showed that the optimal financial contract incorporates a rich set of state contingencies, and should allow for resources to be transferred on the basis of “extraneous randomization,” determining whether or not to verify the borrower’s announcements regarding the project outcome. Townsend’s contract may be contrasted to the “standard debt contract,” which calls for noncontingent repayment of principal plus interest. When this repayment does not occur, bankruptcy proceedings are initiated with probability one, and all resources are transferred to the creditors.

Diamond (1984) showed that when agents are risk neutral and state verification is done nonstochastically following underpayment, the optimal contract is a standard debt contract. Specifically, the borrower either repays principal plus interest fully, in which case no state verification is required, or defaults and turns all proceeds of the project over to the lender. In this case the lender must monitor to verify that everything has been turned over to him. Default is associated with bankruptcy, and a standard debt contract minimizes expected verification costs if monitoring is done nonstochastically.

Boyd and Smith (1994) provide a powerful interpretation as to why observed contracts are akin to Diamond’s “standard bank-debt,” and not Townsend’s contingent contracts. Specifically, a “standard bank debt contract” contains relatively limited state contingencies, and relatively little provision for extraneous randomization, even though the theory outlined by Townsend suggests that this is a suboptimal outcome. To gain further insight about this issue, Boyd and Smith contrasted two extreme contracts. The first is the *ex ante* efficient contract in an environment in which implementation is costless, where standard debt contracts will typically be non-optimal. They show that optimal contracts may involve defaults, even in states in which the borrower is fully able to repay. The second contract is the restricted, standard debt contract. They showed that for realistic values, the welfare loss from exogenously imposing the restrictions associated with the standard debt contract is extremely small.²³

Thus, if implementation costs are actually nontrivial, standard debt contracts will be very close to optimal. Accordingly, when full repayment does not occur, bankruptcy

²³They estimate the welfare loss from suboptimally imposing nonstochastic monitoring to be about 0.003-0.03 percent of beginning-of-period firm’s assets. They assume a “best guess” value of monitoring costs of 3.5 percent of assets and a “conservative estimate” of 10 percent of assets, in line with studies focusing on the United States.
proceedings are initiated with probability one, and all resources are transferred to the holders of claims on the debtor. In their model, lenders supply funds to borrowers who must make repayments contingently, depending on the success of the projects that are funded by their loans. Lenders can observe the outcomes of these projects only at some cost. In evaluating the welfare cost associated with exogenously and suboptimally prohibiting the use of stochastic verification, they find that standard debt contracts are quite likely to be nearly optimal in practice, when one takes account of the difficulties associated with implementing and enforcing contracts that contain explicit provisions for randomization.

Following Boyd and Smith, we consider an economy where monitoring occurs in order to reveal the truthful announcement of the state by the borrower. To make this problem meaningful in a macro context, where the state of the macro economy is public information, we assume that each investor is impacted both by the publicly observable macro shock, and an i.i.d., investor-specific shock. The i.i.d. shock is unobservable to the creditors in the absence of monitoring. Costly state verification models along the lines of Diamond (1984) and Boyd and Smith (1994) are a way of deriving bankruptcy costs from more primitive assumptions. In our model, banks may differ in terms of their monitoring costs, \( c \). Consequently, the expected verification cost, \( E(c) \), may be viewed as the friction inducing “deadweight loss” associated with bankruptcy, measuring the efficiency of financial intermediation provided by the bank. The case where \( \alpha = 1 \) corresponds strictly to Boyd and Smith’s (1994) standard debt contract in a macro model, where in bankruptcy all borrower’s resources are transferred to the holders of claims on the debtor. A value of \( \alpha < 1 \) corresponds to lax enforcement of bankruptcy, allowing the debtor to “shield” a fraction \( 1 - \alpha \) of his assets. Lower \( \alpha \) reflects weaker enforcement of creditor’s rights, and probably weaker institutions.
References


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Figure 1

The Reciprocal Lending Equilibrium: Win-Win Outcome
Figure 2
The Reciprocal Lending Equilibrium: Lower Welfare

Investment creation, +

Bank intermediation diversion, -