Capital Market Imperfections and the Theory of Optimum Currency Areas

Pierre-Richard Agénor* and Joshua Aizenman**

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Abstract

This paper studies how 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. Whether joining a union raises welfare of the home country is shown to depend on the relative strength of "investment creation" and "intermediation diversion" effects.

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*School of Social Studies, University of Manchester, and Centre for Growth and Business Cycle Research; **Department of Economics, University of California at Santa Cruz, and National Bureau of Economic Research. We are grateful to Martin Bohl, Pierre Siklos, and other participants at the conference on *The First Decade of European Monetary Union*, held in Munster, Germany, May 28-29, 2008, for their useful comments.

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.[1] 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. Bayoumi (1994) developed a formal OCA model that captures some of the key insights (expressed informally in some previous papers) regarding the role of openness, diversification, labor mobility, and the degree of correlation of economic shocks. Aizenman and Flood (1993) provided a more detailed discussion of the role of labor mobility as a criterion for an OCA.[2]

Much of the early literature on OCAs took optimality criteria as given. Recent research, however, has emphasized that some of these criteria may be endogenous, as a result of the very existence, and induced effects, of a currency union. For instance, it has been argued that similarity of inflation rates 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. Hoffman and Remsperger (2005) have indeed found that, for the Euro area, the degree of persistence in inflation differentials fell significantly following the adoption of the common currency

[1] Ishiyama (1975) provides an early review of the literature. Subsequent discussions include Masson and Taylor (1992), Tavlas (1993), Lafrance and St-Amant (1999), De Grauwe (2000), and Mongelli (2002).

[2] See also Calmfors (2001) and Cukierman and Lippi (2001) for a further discussion of the role of labor market structure in the performance of monetary unions.

in 1999. Fiscal discipline may also be a *consequence* of joining a union—as suggested for instance by Fielding (2002) and as implied by the analysis in Sun (2003)—whereas the degree of labor mobility and wage-price flexibility may respond endogenously to the elimination of currency fluctuations.

Similarly, entry into a currency union may strengthen international trade linkages over time. Whether increased trade integration raises the benefits of joining the arrangement depends on whether it leads to greater diversification of production or instead to increased specialization, which would make countries more dissimilar. In theory, closer trade ties could result in national business cycles becoming more idiosyncratic, if they result in countries becoming more specialized in goods in which they have a comparative advantage. Countries would then become more sensitive to industry-specific shocks. However, if common shocks (domestic or external) tend to predominate, or if intra-industry trade accounts for most of the trade, then business cycles may indeed become more similar across countries experiencing greater trade integration.[3] This prediction appears to be supported by several recent empirical studies on the endogenous effects of currency unions on trade flows and business cycle synchronization. Alesina and Barro (2002), Alesina, Barro, and Tenreyro (2002), and Barro and Tenreyro (2007), for instance, found that if trading costs are large, countries that trade more with each other would benefit more from adopting a common currency. In addition, tighter international trade ties appear also affect the nature of national business cycles; countries with closer trade links appear to have more tightly correlated business cycles. This is in part a reflection of the adoption of a common monetary policy, but also the result of closer intra-union trade links.

[3]In addition, if business cycles become more synchronous as a result of greater trade within the union, there may be less need for counter-cyclical movements in interest rates. This, in turn, may improve the welfare gains from the union.

Frankel and Rose (1998, 2002), Engel and Rose (2002), and Glick and Rose (2002), all found that closer trade links lead to more trade and more closely correlated business cycles across industrial countries.[4]

The present paper follows a very different line of investigation than the recent literature on OCAs. It focuses on how capital market imperfections may affect 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.[5] 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 participating in) a currency union. A key step in doing so is a comparison between expected surpluses before and after joining the union.

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, and their potential importance for assessing the optimality of existing (and future) currency unions. Section III presents the model and describes

[4]Some of these studies may overestimate the impact of currency unions on trade due to sample selection bias and nonlinearities (Persson (2001)), as well as the endogeneity of the decision to join a union, which is influenced by geography and distance. The latter issue is addressed in Barro and Tenreyro (2007); they also find, however, that currency unions decrease comovements in output, possibly as a consequence of greater specialization. Moreover, Calderón, Chong and Stein (2007) found that the impact of trade integration on business cycle synchronization is much lower for developing countries than it is for industrial countries.

[5]Exceptions are Giovannetti and Marimon (2000) and Alves (2008). However, neither of these studies considers explicitly the existence and implications of *credit* market frictions, as we do here.

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, in the present setting we also endogenize the number of financial intermediaries, under the assumption of Cournot competition. Section IV considers the case where the country under consideration joins a currency union, and analyzes the various channels through which financial factors may affect the welfare gains (calculated from the point of view of an individual member country) from joining the union. These channels include changes in transactions costs, a diversification-risk premium effect, and enhanced bank competition. Regarding the latter, 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). A graphical illustration of this effect is also provided. Section VI summarizes the main results of the analysis 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) examine the argument, first proposed by Mundell (1973), that a single currency area offers risk-sharing benefits when domestic capital markets are limited in their ability to provide consumption insurance. This argument goes against the "conven-

tional" 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, there are a number of additional issues associated with the functioning of capital markets that have not been addressed. For instance, 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 major (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)).[6] Although financial integration among Western European countries had started well before the introduction of the euro, the single currency was expected to accelerate the process, most notably by putting an end to exchange rate uncertainty on trading decisions among member countries. This would have

[6]According to data recently 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.

also led to reduced risk premia, and thus borrowing costs. Furthermore, conversion costs arising from the use of separate national currencies would be eliminated. More integrated financial markets would spur growth and employment. Finally, the introduction of a single currency was expected to increase the degree of competition not only in product markets but also in the provision of financial services.

Yet, as documented by Mongelli (2002), Hartmann, Maddaloni, and Manganelli (2003), De Grauwe and Mongelli (2005), Baele et al. (2004), and Schmiedel and Schönenberger (2005), although the degree of financial integration in the Euro area has increased significantly since the launch of the common currency (particularly in the corporate bond and equity markets), it 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 banking markets, and corporate lending markets in particular, price differentials remain relatively high. 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.

The role of capital market imperfections in the viability and functioning of a currency union is also an important consideration for developing countries, many of which are currently considering either an enlargement of an existing union, or the creation of new ones. In January 2008, for instance, members

of the East African Community (consisting of Kenya, Tanzania, Uganda, as well as Burundi and Rwanda since July 2007) announced their intention to bring forward, to 2012 from 2015, the formation of a monetary union.[7] In a review of the performance of the Common Monetary Area between Lesotho, Namibia, Swaziland, and South Africa, created in 1986, Wang et al. (2007) note that an important issue (and source of concern) is the large disparities among the financial systems of the countries involved, and their low degree of efficiency. Banks in countries other than South Africa are saddled with large portfolios of non-performing loans and suffer from high operating costs. Although there has been convergence in prime lending rates, interest rate spreads remain large. Indeed, the World Bank (2004) found that lending rate spreads between Lesotho and South Africa can be explained largely by the higher default risks and weaker legal and judicial protection for lenders in Lesotho. Moreover, they argue that the anticipation of a bailout of ailing banks in one country by a future common central bank may keep union-wide inflation expectations high and slow the speed of convergence in inflation rates across members. Such expectations may also translate into higher interest rates, with adverse effects on fiscal deficits, investment, and growth. Alternatively, large differences in monitoring costs across countries may prevent the flow of capital within the union and constrain lenders' capacity to respond to greater borrowing needs (induced by improved prospects for greater trade integration), and therefore limit the growth benefits of the union.

[7]For some recent studies focusing on the performance of existing currency unions in developing countries, and the potential for creating new ones in Latin America, Africa, and South Asia, see Khamfula and Huizinga (2004), Masson and Pattillo (2005), Saxena (2005), Sturm and Siegfried (2005), Edwards (2006), Neves, Stocco, and Da Silva, (2007), Pattanaik (2007), Karras (2007), and Houssa (2008). None of these studies, however, discusses in any detail the role of capital market imperfections in this context.

What the foregoing discussion suggests is 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 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, enforcing repayment requires costly recourse to the legal system.

Investment I_i at the beginning of the period by a representative entre-

preneur i results in output of a single good

$$Y_i = a\sqrt{I_i}(1 + \varepsilon_m + \delta_i), \tag{1}$$

where ε_m is a macro shock, and δ_i an idiosyncratic i.i.d. shock, uniformly distributed in the interval $[-\bar{\delta}, \bar{\delta}]$, where $\bar{\delta} > 0$. 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:

$$\varepsilon_m = \begin{cases} \bar{\varepsilon} & \Pr = 0.5 \\ -\bar{\varepsilon} & \Pr = 0.5 \end{cases}, \tag{2}$$

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 αY_i. Hence, assuming zero collateral for simplicity, the entrepreneur's debt service, S_i, will follow the rule

$$S_i = \min[(1 + r_L)I_i; \alpha Y_i]. \tag{3}$$

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, δ_i^*, is determined by

$$(1 + r_L)I_i = \alpha a\sqrt{I_i}(1 - \bar{\varepsilon} + \delta_i^*). \tag{4}$$

From (4), we can solve implicitly for δ_i^*:

$$\delta_i^* = f[\sqrt{I_i}(1 + r_L); \alpha], \quad f_1' > 0, \ f_2' < 0. \tag{5}$$

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 banks' expected yield of r_B, and finance the equilibrium investment level, denoted by I^*.

As discussed in Agénor and Aizenman (1998, 1999), and as derived in 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

$$(1+r_B)I_i = 0.5(1+r_L)I_i \tag{6}$$
$$+0.5\left\{(1+r_L)I_i\int_{\delta_i^*}^{\bar{\delta}}\frac{1}{2\bar{\delta}}d\delta + \int_{-\bar{\delta}}^{\delta_i^*}\left\{\alpha a\sqrt{I_i}(1-\bar{\varepsilon}+\delta_i) - cI_i\right\}\frac{1}{2\bar{\delta}}d\delta\right\},$$

where r_B is the bank's expected yield on lending, determined later.

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

$$\Pi_E = a\sqrt{I_i} - 0.5(1+r_L)I_i$$
$$-0.5\left\{(1+r_L)I_i\int_{\delta_i^*}^{\bar{\delta}}\frac{1}{2\bar{\delta}}d\delta + \alpha a\sqrt{I_i}\int_{-\bar{\delta}}^{\delta_i^*}(1-\bar{\varepsilon}_m+\delta_i)d\delta\right\}.$$

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

$$\Pi_E = a\sqrt{I_i} - (1+r_B+0.5c\int_{-\bar{\delta}}^{\delta_i^*}\frac{1}{2\bar{\delta}}d\delta)I_i, \tag{7}$$

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

$$\frac{a}{2\sqrt{I}} - (1+r_B+0.5c\int_{-\bar{\delta}}^{\delta_i^*}\frac{1}{2\bar{\delta}}d\delta) - 0.5c\frac{1}{2\bar{\delta}}\frac{df}{dI} = 0. \tag{8}$$

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:

$$\frac{a}{2\sqrt{I^*}} = 1 + r_B + \psi c, \tag{9}$$

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

$$\psi = \frac{1}{4\bar{\delta}} \left\{ (\bar{\delta} + \delta^*) + \frac{df}{dI} \right\}. \tag{10}$$

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

$$I^* = I^*(\bar{r_B}; \bar{c}), \qquad \Pi_E^* = \Pi_E^*(\bar{r_B}; \bar{c}). \tag{11}$$

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 The Cost of Funds and the Risk Premium

The bank's expected cost of funds, or the expected yield on depositors' money needed to attract savers, is denoted by r_0. Assuming risk-averse depositors, the cost of banks' funds is given by

$$r_0 = (1 + \tau) r_f + \rho, \tag{12}$$

where r_f is the risk-free interest rate on world capital markets (assumed exogenous), $\tau > 0$ a measure of transactions costs, and $\rho \geq 0$ the risk premium, which compensates depositors for the fact that banks may default on their repayment obligations. In general, one would expect ρ to be endogenous. For instance, in the absence of deposit insurance, recessions could be associated with a lower net yield on deposits, implying a higher risk premium (see Agénor and Aizenman (2006)). In what follows, we will assume first that ρ is exogenous, and will discuss later the impact of financial integration and diversification on the risk premium.

3.3 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 μ_j, for $j = 1, ...n$. Banks are ordered according to their cost efficiency, $\mu_{j+1} \geqslant \mu_j$.

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

$$mI^*(r_B; c) = nL_r, \tag{13}$$

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 (13), for the case where bank r lends L_r, whereas the remaining banks lend $\bar{L}_{-r}$.

Cournot competition implies that the representative bank determines its loan supply by solving the following problem

$$\max_{L_r} \left[L_r\{1 + r_B(\bar{L}_{-r}, L_r)\} - L_r(1 + r_0) - \mu_r \right], \tag{14}$$

taking $\bar{L}_{-r}$ as exogenously given. The quantity $r_B(\bar{L}_{-r}, L_r)$ is the expected bank's yield on loans, which is determined by the market-clearing condition

$$mI^*(r_B; c) = \bar{L}_{-r} + L_r. \tag{15}$$

The resulting first-order condition from (14) is

$$1 + r_B + L_r r'_B = 1 + r_0. \tag{16}$$

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

$$(1 + r_B)(1 - \frac{1}{n\eta_{I/r_B}}) = 1 + r_0, \tag{17}$$

where η_{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 (17) 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:*

$$1 + r_B = (1 + r_0)\frac{n\eta_{I/r_B}}{n\eta_{I/r_B} - 1}, \tag{18}$$

where $n\eta_{I/r_B}/(n\eta_{I/r_B} - 1) > 1$.

3.4 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 (18) yields

$$(r_B - r_0)L_r = \mu_{n^*} \quad \Leftrightarrow \quad \frac{1 + r_0}{n\eta_{I/r_B} - 1} L_r = \mu_{n^*}. \tag{19}$$

Combining (15), (18), and (19) yields the optimal administration cost as

$$\mu_{n^*} = (\frac{mI^*}{n})(\frac{1+r_0}{n\eta_{I/r_B}-1}). \tag{20}$$

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 (17), equation (20) 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

$$\frac{dn^*}{dr_B} = mI^*(1-\eta_{I/r_B})/[\frac{d\mu_n}{dn} + 2m\frac{(1+r_B)I^*}{n^2\eta_{I/r_B}}].$$

Hence, a higher borrowing rate will reduce the number of banks when the demand for borrowing is elastic. It is easy to confirm that in our model $\eta_{I/r_B} \to 2$ 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 (18), it follows that the equilibrium number of banks, n^*, is given by

$$n^* = n^*(\bar{r_0}; \bar{c}), \tag{21}$$

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' lending rate, r_B.*

Banks' aggregate expected surplus is

$$\Pi_B^* = \sum_{i=1}^{n^*}[(r_B - r_0)L_r - \mu_i]. \tag{22}$$

Substituting (19) in (22) yields

$$\Pi_B^* = n^*(\mu_{n^*} - \bar{\mu}), \tag{23}$$

where $\bar{\mu} = \sum_{i=1}^{n^*} \mu_i / n^*$ is the average fixed cost.

The equilibrium is characterized in Figure 1. The downward-slopping curve is the demand for investment facing the representative bank as a function of banks' expected yield, r_B, where r_0 is the expected cost of funds. The markup condition (18) determines the gap between the two, resulting with 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, μ_{n^*}.

3.5 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), augmented by the consumers' surplus. Specifically, welfare prior to joining can be evaluated by the sum of the producers' expected surplus, obtained by aggregating Π_E^* in (11) across all producers, the domestic banks' aggregate expected surplus given in (23), and consumers' surplus, S_H:

$$W = m\Pi_E^* + \Pi_B^* + S_H. \tag{24}$$

To account for an adverse impact of income volatility, consumers' surplus could for instance be defined as

$$S_H = E(Q) - 0.5\theta V(Q), \tag{25}$$

where Q is income, E the expectations operator, V the variance operator, and $\theta > 0$. For simplicity, however, we will assume that income is exogenous.[8] Thus, changes in aggregate welfare will depend only on changes in the producers' and the banks' expected surplus.

We turn now to an evaluation of the welfare impact of changes in the cost of monitoring, c. Recall that, *ex ante*, borrowers pay the cost of monitoring in the form of 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 (21)). 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[9]

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

Hence, if financial intermediation costs fall upon joining a union, 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 at lower monitoring costs than foreign banks.

[8] 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, Agéor and Aizenman (1998, 1999). However, this would complicate the analysis without adding much insight.

[9] The marginal impact of banks' exit on Π_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

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 adopting the same currency and allowing full financial integration. In what follows, we discuss three channels through which this decision will affect each country individually: a transactions costs effect; a diversification-risk premium effect; and a bank competition effect. In each case, we examine the impact on welfare, as defined in (24) with $\Delta S_H = 0$. 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.

4.1 Reduction in Transactions Costs

The adoption of a single currency implies that transactions costs associated with conversion of foreign exchange, currency hedging, and the use of multiple currencies for trading purposes, are either reduced or disappear entirely for both countries. As noted by some observers, the reduction of these costs can be viewed as a proxy for the deadweight and efficiency losses in the foreign exchange market that are eliminated through the adoption of a single currency.[10]

A reduction in transactions costs can be formally captured in the model by assuming, that upon joining the currency union, τ falls.[11] From (21), the

[10] As noted by Grubel (2005, p. 512), joining a union also saves resources required to run institutions whose purpose is to evaluate exchange rate risk and operate forward and futures markets. This resource gain is not directly accounted for here.

[11] Assuming instead that τ drops to zero would lead to the same result as described next.

equilibrium number of banks goes up; there is therefore an indirect competition effect. From equation (18), and under the assumption $\eta_{I/r_B} > 1/n$ (as indicated earlier), we have

$$\frac{dr_B}{d\tau} = \frac{n\eta_{I/r_B}}{n\eta_{I/r_B} - 1} r_f - \frac{(1 + r_0)\eta_{I/r_B}}{(n\eta_{I/r_B} - 1)^2} (\frac{dn^*}{d\tau}) > 0,$$

implying that the cost of credit falls. This, in turn, stimulates private investment and increases the producers' expected surplus. Thus, a reduction in transactions costs improves welfare unambiguously.

4.2 Diversification-Risk Premium Effect

Suppose that, prior to forming the union, capital flows between the two countries are restricted to some degree by capital controls. Once the union is formed, all restrictions on capital movements are lifted. Thus, another channel through which the domestic country can benefit from forming a currency union is through a diversification or risk premium effect, which results from the fact that domestic banks (and consumers) are now able to diversify internationally their asset portfolios. In turn, the scope for greater diversification translates into a lower external risk premium.

Alternatively, suppose that the risk premium on domestic bonds depends positively on the volatility of inflation—possibly because all assets and liabilities are fixed in nominal terms. If the volatility of inflation drops following the formation of a successful currency union (because the risk associated with an unexpected devaluation disappears, for instance), the risk premium demanded by debt holders would fall. As in the case of the transactions cost effect described earlier, this would reduce the cost of credit, increasing thereby optimal investment, as well as the equilibrium number of banks. The

net welfare effect is again be unambiguously positive.[12]

To characterize the first effect, suppose that countries have the same degree of volatility of idiosyncratic shocks; that is, δ_i has the same distribution across countries. In general, the distribution of δ_i could affect ρ. However, given that the δ_i's are diversifiable domestically, its effect on ρ does not change as a result of joining a union; the issue is the relation between the two distributions of the macro shock in the two countries, ε_m^H and ε_m^F. Suppose then that the correlation of the business cycle between the two countries is zero, that is, $cov(\varepsilon_m^H, \varepsilon_m^F) = 0$.[13] If the distribution of each shock is characterized by (2), full diversification of banks' portfolios between the two countries has the effect of reducing lenders' exposure to recession, reducing thereby the risk premium needed to compensate depositors (see Agénor and Aizenman (2006)). In turn, the reduction in the risk premium lowers the cost of funds and increases producers' profits and banks' surplus. There is also an indirect competition effect, to the extent that the lower premium leads to an increase in the number of domestic banks. Although in (24) we do not account explicitly for the welfare of depositors, the net overall effect is thus an increase in domestic welfare.

[12] Note that here we have focused only on the direct effect of the currency union, which is to reduce transaction costs *within* union members. There may also be an indirect effect (or stability gain), which may result from a reduction in the risk premium between the union as a whole and the rest of the world.

[13] This assumption may not be warranted if increased trade among union members leads to greater syncrhonization of business cycles. However, as noted earlier, some studies do find that increased trade leads to less, rather than more, syncrhonization (Barro and Tenreyro (2007)). Assuming that $cov(\varepsilon_m^H, \varepsilon_m^F) = 0$ corresponds therefore to a neutral position.

4.3 Enhanced Competition

Now suppose that, upon forming the union, restrictions on entry of banks from the partner country into the domestic economy are lifted at the same time. 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.

A useful way to understand the competition effect of a union is to consider the case where the home economy H forms a currency union with a foreign economy F that is in all respects identical–including monitoring and contract enforcement costs—with the formation of the union entailing the removal of all restrictions on the operation of foreign banks in each economy. In these circumstances, the formation of the union entails also a transformation from "relative" financial autarky to an integrated financial equilibrium.[14] The welfare consequences of financial integration 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 α of the realized value of output—or, more generally, pledged

[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.

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 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

$$MR^U_{L^*} - r^U_0 = t\psi,$$

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 $MR^U_{L^*} = r^U_B + (dr^U_B/dL^*)L^*$, 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 $MR^U_{L^*}\big|_{L^*=0} = r_B$). 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_B^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 $r_B^U - (r_0 + t\psi)$, 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 if 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 bank's 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

[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.

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. 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 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 in 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 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 to 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

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

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 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 various channels 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. Thus, upon forming the union, foreign banks have access to the domestic capital market and may lend to domestic firms. These channels include changes in transactions costs, a diversification-risk premium effect, and enhanced bank competition. Regarding the latter, 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. 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.

The thrust of our analysis therefore 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, in particular, generates a welfare gain depends on how strong the "investment creation" effect is relative to the "intermediation diversion" effect. 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 costs 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 and 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.[16]

Our analysis can 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, 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.[17] However, it is also possible, as argued by Ozcan, Sorensen, and Yosha (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.

[16] See Lensink and Maslennikova (2008) for an analysis of cross-border bank mergers and acquisitions in Europe during the period 1996-2004.

[17] 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.

Third, fiscal and monetary policy considerations could be added to the analysis. If joining a union leads to an enhanced commitment to low inflation, there may be a credibility gain that translates into a further reduction in the risk premium that member countries face on international capital markets.[18] However, this gain may be diluted if incentives for fiscal policy coordination are perceived to be weakened by the loss of monetary autonomy. Indeed, if the risk of default on government debt increases as a result, the drop in the risk premium associated with a reduction in transactions costs may be more than offset, making the welfare gains of joining a union ambiguous.

Finally, while our analysis focused essentially on the various channels through which forming a union may affect domestic welfare, and the role of intermediation costs in that context, it could be useful to analyze the implications of these costs for the formulation of a union-wide welfare function. A similar issue was examined elsewhere in the literature on currency unions (see Benigno (2004) and Lombardo (2006)). Benigno (2004), for instance, using a two-country model where labor is immobile and money is not neutral due to price rigidities, found that the union-wide welfare function (which is based on deadweight losses) should provide higher weight to the inflation rate in the country with a higher degree of nominal rigidity. In the present context, the question that could be addressed is whether the union-wide welfare function should provide higher weight to expected loss in the country with a higher degree of capital market imperfections.

[18] Grubel (2005) for instance argued that in a curreny union, countries may enjoy better monetary policy. This arises partly because the large institutions to which they surrender their monetary sovereignty are more likely to be free from political influences, and partly because they have more financial and human resources to design and implement policy decisions.

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Figure 1

The Reciprocal Lending Equilibrium: Win-Win Outcome

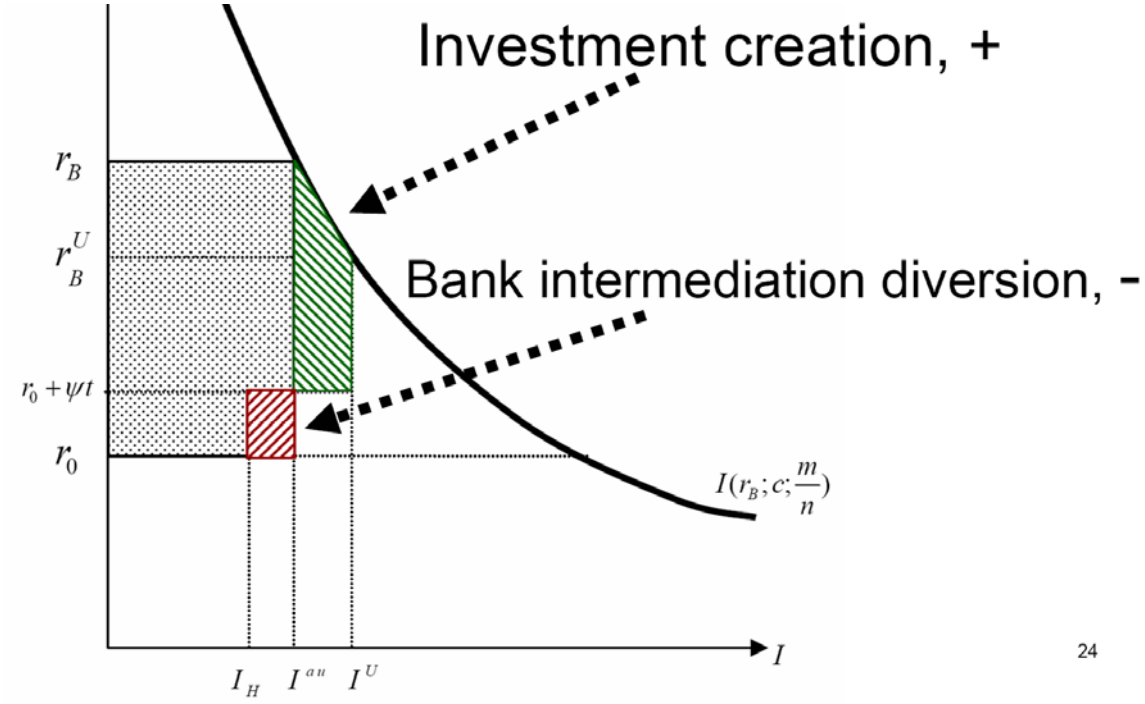

Figure 2
The Reciprocal Lending Equilibrium: Lower Welfare