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ECB-CFS RESEARCH NETWORK ON CAPITAL MARKETS AND FINANCIAL INTEGRATION IN EUROPE

FINANCIAL MARKET INTEGRATION AND LOAN COMPETITION

WHEN IS ENTRY DEREGULATION SOCIALLY BENEFICIAL?

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In 2004 all publications will carry a motif taken from the €100 banknote.

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[2] *Department of Economics, University of Vienna, Hohenstaufengasse 9, 1010 Vienna, Austria; e-mail: leo.kaas@univie.ac.at*

ECB-CFS Research Network on "Capital Markets and Financial Integration in Europe"

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Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.int

Fax
+49 69 1344 6000

Telex
411 144 ecb d

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CONTENTS

Abstract

The paper analyzes how the removal of barriers to entry in banking affect loan competition, bank stability and economic welfare. We consider a model of spatial loan competition where a market that is served by less efficient banks is opened to entry by banks that are more efficient in screening borrowers. It is shown that there is typically too little entry and that market shares of entrant banks are too small relative to their socially optimal level. This is because efficient banks internalize only the private but not the public benefits of their better credit assessments. Only when bank failure is very likely or very costly, socially harmful entry can occur.

JEL classification: D43; D82; G21
Keywords: Entry deregulation; Bank competition

Non–technical summary

Despite various policy initiatives promoting financial integration in the European Union over the past decades, the scope of cross–border bank entry remains so far rather limited. Does this observation reflect the presence of any remaining barriers to entry, or do banks decide optimally not to enter foreign markets, even in the absence of entry barriers? Further, if banks decide against entry, is the outcome socially optimal?

This paper develops a theoretical model demonstrating that there may indeed be too little entry of banks into foreign markets for bank loans. Even in the absence of regulatory barriers hampering banking integration, banks may decide not to enter a foreign market, although entry would be in the interest of society. Furthermore, when foreign banks enter, their market shares remain too small relative to domestic banks. Consequently, additional initiatives enhancing private incentives for entry can be socially beneficial.

The model considers two countries (A and B) which differ only in the degree of efficiency of their banks' credit assessments. Each country has borrowers of different creditworthiness, and banks run informative credit tests on these borrowers before they lend out funds. Banks in country A are more efficient in conducting these tests than banks in country B. In the presence of entry barriers, banks can only operate in their home country. Hence, in country A the banks' loan portfolio is of better quality and the risk of bank failure is lower than in country B. When barriers are lifted, however, banks from country A may want to enter country B. Clearly, entry of banks with better credit assessment always improves the overall quality of loans, but it may also increase the risk of bank failure because competition becomes fiercer, lowering each bank's buffer against unfavorable return shocks.

The main finding of this paper is that there tends to be too little entry relative to the social optimum provided that there is no bank failure after entry. Furthermore, whenever the more efficient banks from country A enter the market for bank loans of country B, their market shares remain too small.

The reason of these inefficiencies is that entrants do not account for all welfare gains that are associated with their better credit scoring. The most creditworthy borrowers benefit from a better quality of credit tests because they are more likely to be accepted. These borrowers, in the aggregate, make thus higher profits, but only a fraction of these profits accrues to the lending bank. As a result, the more efficient banks from country A do not take into account all marginal welfare gains that are associated with a loan rate cut attempting to win market shares in country B. At the margin, their loan rates are too high and their market shares are too

small. Similarly, banks from country A may dismiss an entry decision, contrary to the welfare of society.

On the other hand, when bank failure after entry is possible, there may also be too much entry of foreign banks. Incumbent banks in country B, expecting insolvency after entry, tend to behave less competitively than without entry, thereby attracting banks from country A, although it would be better for society if they stayed out of the market.

1 Introduction

The removal of entry barriers in banking is one of the main aspects of the integration of financial markets that is taking place in many countries. In the European Union, the First and Second Banking Directives (1977, 1988), and recently the Financial Services Action Plan (1999) consisted of large sets of initiatives to ensure the full integration of European banking markets; also various deregulations at the national level have helped to foster banking integration. Although most of the cross–border and cross–regional activities in Europe are taking place via mergers and acquisitions, there has been substantial de–novo entry in Portugal, Southern Italy, and in many of the Central and Eastern European accession countries (Barros (1995), Bonaccorsi di Patti and Gobbi (2001), Caviglia, Krause, and Thimann (2002)). In the United States, the removal of bank branch restrictions in the 1980s has led to significant entry by new banks and to improvements in the quality of loans (Jayaratne and Strahan (1996)), but also a greater number of bank failures (Keeley (1990)). However, the extent of de–novo entry in developed economies is regarded as quite limited, whereas developing economies (most notably Latin America and Eastern Europe) have attracted the most foreign bank entry (see Clarke, Cull, Martinez Peria, and Sanchez (2003)).

The purpose of this paper is to analyze the effects of entry deregulation on loan competition, bank stability and economic welfare. We consider a situation where a market that is served by banks with weak credit assessment is opened to entry by banks with better credit assessment facilities. Such entry, as expected, produces a better allocation of funds to borrowers, but it also increases banks' exposures to insolvency risk. The paper addresses the questions (i) whether there is too much or too little entry relative to the social optimum, and (ii) how regulatory authorities can respond so as to guarantee bank stability after entry deregulation and to remove potential inefficiencies.

We consider a model of two markets (countries, states) that are identical in all respects except the degree of efficiency of their banks' credit assessments. Each of these markets is populated by two types of borrowers ("good" and "bad"), and banks can be set up to conduct informative tests so as to single out good borrowers. Because there is both idiosyncratic and aggregate credit risk, banks with weak credit assessment ability fail with positive probability, whereas capital requirement regulation may be imposed to avoid bank failure. Banks possess market power because of a cost advantage in screening certain groups of borrowers due to geographical or technological specialization.[1]

The central assumption of our model is that banks in one country have better facilities to screen and to evaluate borrowers than banks in the other country; thus their loan portfolio is of better quality and the risk of bank failure is lower. When there are entry restrictions, banks are allowed to operate only in their country of origin, so that the country with less efficient banks is characterized by lower quality of loans and by a higher risk of bank failure. When entry barriers are lifted, however, efficient banks may enter the market that was previously served only by the less efficient banks. Thus, in this model banks are attracted to another market because they are more efficient than the incumbents; this idea is best suited to describe foreign bank entry in developing economies, whereas in developed economies other motives may play a greater role.[2] Obviously, entry of banks with better credit assessment always improves the overall quality of loans, but it may also increase the risk of bank failure because competition becomes fiercer, lowering each bank's buffer against bad return shocks.[3]

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[1] Our modelling strategy uses a Salop location model, following related models of loan competition by Almazan (2002), Hauswald and Marquez (2002), Sussman and Zeira (1995) and Wong and Chan (1993).

[2] In developed economies, foreign–bank entry is often attributed to the "follow the customer" motive, rather than efficiency differentials between entrants and incumbents. Quite the contrary, DeYoung and Nolle (1996) find that foreign–owned banks in the US are less profitable than domestic–owned banks, although they attribute this to differences in input efficiency whereas output efficiency is nearly equal. On the other hand, Claessens, Demirgüc-Kunt, and Huizinga (2001) find that foreign banks are more profitable than domestic banks in developing economies, whereas the opposite is true in developed economies. Using data on 260 banks in OECD countries, Focarelli and Pozzolo (2003) find that there is greater foreign presence when local banks are relatively less efficient. Comparing the performance of foreign and domestic banks in Columbia, Barajas, Steiner, and Salazar (2000) find that foreign banks have fewer non–performing loans and higher productivity.

[3] For simplicity and for the purpose of this paper, our model completely abstracts from established borrower–bank relationships that are crucial in many of the literature on entry in banking (see e.g. Bouckaert and Degryse (2003), Dell'Ariccia (2001) and Dell'Ariccia, Friedman, and Marquez (1999)). Unlike this literature, there are no switching costs or other hurdles to entry in our model. This assumption is justified on the grounds that in catching–up economies where de–

The main conclusion of this paper is that whenever banks enter and banks do not fail, entry is socially beneficial, but not vice versa. That is, entry of efficient banks may not take place even though it would be socially optimal. In other words, when bank stability is guaranteed, entry is always in the interest of a social planner, but there may be too little entry in equilibrium, and this is so even in the absence of any exogenous borrower switching costs or other obstacles to entry. As a result, policies promoting entry can be welfare–enhancing. Moreover, even when efficient banks enter, their market share remains too small relative to the socially optimal level.

By showing that entry may be socially, but not privately optimal, the paper also provides an explanation why various policy initiatives promoting the integration of banking markets have resulted in little entry activity. Generally, markets are said to be integrated when the law of one price holds. Complementary measures of financial market integration are based on the amount of cross–border penetration and cross–border activity of banks and other financial institutions. This paper argues that, even in the absence of any regulatory frictions hampering banking integration, there can be too little entry activity. Therefore, additional initiatives enhancing private incentives for entry can be socially beneficial.

The explanation for these inefficiencies is that entrant banks do not internalize all marginal welfare gains that are associated with their better credit assessment. Even when banks are able to price discriminate among borrowers of different types, they are unable to extract all marginal rents that are due to better lending quality. The reason is that good borrowers benefit from better credit assessment because fewer of them are rejected. These borrowers, in the aggregate, make thus higher profits, but only a fraction of these profits accrues to the lender. As a result, efficient lenders do not take into account all welfare gains that are associated with a loan rate cut attempting to win market shares. At the margin, their loan rates are too high and their market shares too small. By a similar argument, efficient lenders may dismiss an entry decision even when it would be socially beneficial. These conclusions, however, may not be true when bank failure becomes a problem, and this is even

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novo entry is of most importance, relationship lending is of relatively minor importance. Also, if banks plan to operate over longer horizons, established borrower–bank relationships become less significant for entry decisions.

so when there are no social costs of bank failure (as is the case in our model). The reason is that banks who expect to fail with some probability, may behave less competitively (because they charge higher risk–premia), drawing efficient banks into the market even in such situations where it is socially not desirable.

The paper is organized as follows. Sections 2 describes the economic environment and Section 3 discusses the equilibrium in the regulated economy. Sections 4 analyzes the potential equilibrium configurations after entry deregulation, and Section 5 discusses the welfare effects of entry. Section 6 concludes.

2 The economic environment

Consider an economy consisting of two markets (countries), each comprising borrowers, depositors, and banks. The markets are identical except for their characteristics of banks. Each market is described by a Salop circle of unit circumference that is populated by two types of uniformly distributed borrowers, each type of a unit mass. There are two periods, "today" and "tomorrow". All borrowers have an investment need of unit size today to yield tomorrow a payoff A if they are successful and zero if they are unsuccessful. "Good" borrowers succeed idiosyncratically with probability λ^G and "bad" borrowers succeed idiosyncratically with probability $\tilde{\lambda}^B$. $\tilde{\lambda}^B$ itself depends on tomorrow's aggregate state; in a "high–income" state of the world (that occurs with probability α), bad borrowers' success probability is $\tilde{\lambda}^B = \lambda^B/\alpha$, and in a "low–income" state of the world, bad borrowers succeed with probability zero. Thus, λ^B is the unconditional expected repayment probability of bad borrowers. We assume that, in both states of the world, bad borrowers' success probability is below the success probability of good borrowers:

$$\lambda^G > \lambda^B/\alpha \; . \tag{A0}$$

Without this assumption, a lender who expects to be insolvent in the low–income state would prefer lending to the risky bad borrowers. Thus (A0) excludes gambling by lenders of limited liability.

There is a perfectly elastic supply of funds from depositors at rate ρ. We assume that it is efficient to lend to good borrowers but inefficient to lend to borrowers of unknown type, i.e.

$$\lambda^G A > \rho > \frac{1}{2}(\lambda^G + \lambda^B)A \; . \tag{A1}$$

Because of assumption (A1) there is a role for banks that have access to a screening technology to single out good borrowers. To screen borrowers, banks can be set up at arbitrary positions on the circle at cost f. We assume that each bank can open at most one such branch; an extension to the multi–branching case is straightforward as long as no bank is allowed to open two branches next to each other. Screening costs are increasing in distance of the borrower from the bank. Specifically, we assume that banks pay $tx/2$ to screen a borrower located at distance x from the bank, so that the bank pays tx to screen all borrowers at distance x.[4] With this assumption, banks possess local market power because of a cost advantage over the nearest competing bank.[5] As we show below, because of local market power banks charge higher interest rates on borrowers located closer to them, so that loan rates are decreasing in borrower–bank distance.[6]

Borrower screening leads to a credit assessment that provides banks with a noisy signal $s \in \{G, B\}$ about the borrower's type. Let $\varphi = \text{Prob}(s = G|G) = \text{Prob}(s = B|B) > 1/2$ be the probability that the signal is correct. Under (A0) and (A1) and provided that the signal is informative enough (i.e. φ is big enough), banks lend only to borrowers that are assessed positively. Because both borrower types are of unit mass and because credit assessment signals are symmetric, each bank that screens all borrowers at distance x wants to lend to a unit mass of them which is composed of φ good borrowers and $1 - \varphi$ bad borrowers. The credit repayment probability, conditional on the aggregate state, is

$$\tilde{\lambda} \equiv \varphi\lambda^G + (1 - \varphi)\tilde{\lambda}^B \; .$$

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[4] This location model has a geographical and a technological interpretation; if x is geographical distance, banks pay travel costs to screen the borrower; in the technological interpretation, the bank's financial analysts are specialized in a particular industry, and credit assessments are the cheaper the more similar the producer is to the core specialization of the bank.

[5] Other theoretical contributions with similar implications are Sussman and Zeira (1995) and Hauswald and Marquez (2002). Sussman and Zeira assume that banks' monitoring costs increase in distance in a costly–state–verification model. Hauswald and Marquez assume that the quality (not the cost) of credit assessment is falling (not increasing) in distance. See also Almazan (2002) and Wong and Chan (1993) for related contributions.

[6] Empirical evidence of a negative relationship between loan rates and the borrower–lender distance has been documented by Degryse and Ongena (2003).

The parameter φ measures the quality of credit assessment. Banks in the two markets differ only with respect to this parameter. In one market only "efficient" banks with quality parameter φ^E operate, whereas in the other market only "inefficient" banks with quality parameter $\varphi^I < \varphi^E$ operate.[7] For convenience of the exposition, we suppress the superscripts E and I for the rest of this and the following section.

Finally, in each market a banking regulator imposes a *capital requirement* on banks in order to protect depositors from credit risks. This regulation requires banks to finance a fraction k of their loans by equity capital. Equity capital is more costly than bank deposits, and we assume that there is a perfectly elastic supply of equity capital at rate $\rho' > \rho$. ρ' can also be interpreted as the opportunity cost of equity capital. To simplify the exposition and to concentrate on the interaction between banks in the loans market, both ρ and ρ' are given to the bank in the market.[8] The cost of funds per unit of loan are

$$\bar{\rho} \equiv \rho(1-k) + \rho' k \ .$$

A *bank failure* occurs if the bank is unable to meet its deposit obligations from its loan revenues; in that case the bank is closed down by the regulator, all bank capital is liquidated, and depositors are paid only a fraction of their promised repayment.

Suppose now that a bank screens all borrowers located at distance $x \leq d$, and lends to all borrowers that are assessed positively at loan rate r_x. Then the expected profit of the bank, conditional on the aggregate state, is

$$\tilde{\pi} = 2 \max\Big(\int_0^d \tilde{\lambda} r_x - (1-k)\rho \, dx, 0 \Big) - 2 \int_0^d k\rho' + tx \, dx \ .$$

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[7] An advantage in credit assessment quality is only one possibility to model incentives for entry. An alternative would be cost advantages in t or f, or the entry of new borrowers at a second stage (as in Bouckaert and Degryse (2003)). We interpret credit assessment quality not as bank expertise (which should arguably be higher for local banks, at least for a limited time period) but as a measure of the bank's available tools to assess borrowers such as computation facilities and the skills of its financial analysts.

[8] These assumptions are not innocuous when banks may fail in the low–income state, because depositors and equity holders alike would ask the banks to pay a risk–premium (see e.g. Matutes and Vives (2000) for a model where depositors form beliefs about the probability of bank failure). However, when the probability of the low–income state is small (α is large), the assumption of given ρ and ρ' seems appropriate. On the other hand, the assumption of a perfectly elastic supply of equity capital can be relaxed following a similar approach as Hellmann, Murdock, and Stiglitz (2000).

If the expression in the max operator is positive, the bank does not fail and it pays out depositors and equity holders. On the other hand, if the expression in the max operator is negative, deposit obligations cannot be met by loan revenues, the bank is shut down, screening costs are lost, as are the opportunity costs of equity capital. If the bank does not fail, the (unconditional) expected bank profit is

$$\bar{\pi} = E\tilde{\pi} = 2\int_0^d \bar{\lambda} r_x - \bar{\rho} - tx \; dx \; , \tag{1}$$

where $\bar{\lambda} \equiv \varphi\lambda^G + (1-\varphi)\lambda^B$ is the expected repayment probability, and $\bar{\rho}$ are the costs of funds defined above. If the bank fails in the low–income state, the expected bank profit is

$$\bar{\pi} = E\tilde{\pi} = 2\int_0^d \bar{\lambda}_\alpha r_x - \bar{\rho}_\alpha - tx \; dx \; , \tag{2}$$

where $\bar{\lambda}_\alpha \equiv \alpha\varphi\lambda^G + (1-\varphi)\lambda^B$ is the effective repayment probability, and $\bar{\rho}_\alpha \equiv \alpha\rho(1-k) + \rho' k$ are the effective costs of funds. Note that $\bar{\rho}_\alpha < \bar{\rho}$ and $\bar{\lambda}_\alpha < \bar{\lambda}$, reflecting the fact that a failing bank is shut down, so that both its expected loan revenues and its expected costs of funds are lower.

An *equilibrium in the regulated economy* is described by the following four–stage game. At stage I, banks decide to enter their home market at arbitrary locations, paying the sunk set–up cost f. At stage II, banks engage in price competition, potentially discriminating among borrowers at different locations. At stage III, borrowers apply at (potentially many) banks. At stage IV, banks decide whether they screen certain borrowers or not. After screening, they make offers to those borrowers that are assessed positively and borrowers accept the best offer. If there is a tie, borrowers split equally between the two offers. We assume that borrowers, as banks without screening, do not know their type. Banks know if certain borrowers are screened by other banks, but they do not know the outcome of their screening. We restrict the analysis to equilibria in which banks are always located symmetrically around the circle. This limitation can be justified on the grounds that the symmetric configuration is an equilibrium when banks decide freely about location (see, for instance, MacLeod et al. (1988)).

An *equilibrium in the deregulated economy* starts from an equilibrium location of the regulated economy but allows banks from each market to enter the other market. We assume that any relocation of incumbents incurs a payment of the setup cost f

again, implying that incumbents never relocate.[9] Clearly, only efficient banks would want to enter the market of inefficient banks, but not vice versa. Because the market with efficient banks is already blockaded to entry by efficient banks, inefficient banks cannot profitably enter their market either.[10] Therefore, at stage I, efficient banks decide about entry, given the locations of inefficient banks. The subsequent stages II, III and IV are as in the regulated economy. Throughout the analysis we restrict attention to such situations where at most one bank enters between two incumbents. This limitation is justified provided that the efficiency differential between incumbents and entrants is not too big. Whenever one efficient bank enters between two inefficient incumbents, it must locate symmetrically between the incumbents. This result is shown in Lemma 2 in the Appendix.

Before we compute equilibria in the regulated and in the deregulated economy, we solve the last three stages of the game. We consider competition between two banks, named 1 and 2, located distance ℓ apart, that have potentially different (effective) repayment probabilities and different (effective) costs of funds, labelled λ_i and ρ_i, $i = 1, 2$ (see (1) and (2)). This comprises in particular those scenarios where one bank is more efficient in screening than the other or where one or both banks fail in the low–income state. We consider competition between these banks for borrowers located between them, i.e. at distance $x \in [0, \ell]$ from bank 1 (distance $\ell - x$ from bank 2). Because of our above–mentioned restriction to symmetric locations, no other bank competes with banks 1 and 2 for these borrowers. The following Lemma shows that there is a pure–strategy equilibrium where bank 1 wins the market for all borrowers in its neighborhood by offering the Bertrand loan rate at which bank 2 would make zero profits. Moreover, each borrower is screened by exactly one bank.[11]

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[9] Instead of relocating, banks would open another branch at the same cost, yielding them higher profit. Because they do not open additional branches in their home market in the regulated economy, they also do not do so under deregulation. Hence relocation cannot be profitable either.

[10] One may wonder whether inefficient banks enter the other market and stop screening in an attempt to save screening costs in exchange for a poor selection of borrowers (as some US banks specialized in credit cards to high–risk consumers). However, such behavior is excluded by assumption (A1) in our model: lending without screening cannot be profitable.

[11] It is well–known that interest rate games with asymmetric information may have no pure–strategy equilibria (e.g. Broecker (1990), Dell'Ariccia, Friedman, and Marquez (1999), Hauswald and Marquez (2002)). The reason for our different outcome is that (i) marginal screening costs are positive (unlike the models of Broecker and Hauswald/Marquez); (ii) there are no established bank–borrower relationships (unlike Dell'Ariccia et al.); (iii) banks make interest rate offers before

Lemma 1: Let banks 1 and 2 be located distance ℓ apart, and assume that $\rho_i < \lambda_i A$, $i = 1, 2$, and that ℓ is not too large. Then, for all borrowers located at distance

$$x \leq \bar{x} = \frac{\lambda_1 \rho_2 - \lambda_2 \rho_1 + t\lambda_1 \ell}{t(\lambda_1 + \lambda_2)}$$

from bank 1, banks 1 and 2 set interest rates

$$r_{1x} = r_{2x} = \frac{\rho_2 + t(\ell - x)}{\lambda_2} \ (\leq A)$$

at stage II, borrowers apply at both banks at stage III, and only bank 1 screens these borrowers, making an offer only to those that are assessed positively. Bank 1's profit from screening all borrowers $x \leq \bar{x}$ is $\pi_1 = \frac{\lambda_1 + \lambda_2}{2\lambda_2} \bar{x}$.

If $x > \bar{x}$, the reverse result holds with banks 1 and 2 interchanged and with $\ell - x$ replaced by x. Moreover, if $\bar{x} \leq 0$ or if $\bar{x} \geq \ell$, one of the two banks wins the whole market $x \in [0, \ell]$.

Proof: Appendix.

3 The regulated economy

Consider the benchmark scenario of the regulated economy where banks of the same screening quality play the stage I location game. Since banks choose locations simultaneously, an equilibrium is a *contestable market equilibrium* in which the number of banks is generally indeterminate and is restricted by two features: (i) bank profits are non–negative; (ii) it is not profitable for another bank to enter the market. We confine the analysis to such cases where the loan market is covered and where banks do not have monopoly power over certain groups of borrowers (i.e. each borrower applies at two banks at least). As mentioned before, we also concentrate on symmetric equilibrium locations only. We consider first an equilibrium in which banks do not fail in the low–income state, and we turn then to equilibria where banks fail in the low–income state.

In an equilibrium without bank failure, suppose that n banks locate symmetrically around the circle so that the distance between any two banks is $\ell = 1/n$. From

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they screen (unlike Hauswald/Marquez). Assumption (iii) may be relaxed by allowing banks to undercut their initial offers after stage IV without changing the equilibrium stated in Lemma 1.

Lemma 1, two neighboring banks of identical efficiency share the market equally (i.e. $\bar{x} = 1/(2n)$), and each bank charges interest rates $r_x = (\bar{\rho} + t(1/n - x))/\bar{\lambda}$ on borrowers located at distance $x \leq 1/(2n)$. To guarantee that all these borrowers are willing to apply at this bank and at the neighboring bank, we must have that $r_x \leq A$ for all x or

$$\frac{t}{n} \leq \bar{\lambda} A - \bar{\rho} \; . \tag{3}$$

If that condition is satisfied, Lemma 1 applies and there is Bertrand competition between every two neighboring banks for all borrowers located between them. The nearest bank's expected profit from attracting and screening the borrower located at distance x is

$$\pi_x = \bar{\lambda} r_x - \bar{\rho} - tx = t(\ell - 2x) \; ,$$

and so the bank's expected profit is

$$\bar{\pi} = 2 \int_0^{\ell/2} \pi_x dx = \frac{t\ell^2}{2} \; .$$

Therefore, banks enter the market iff $\ell = 1/n \geq \sqrt{(2f)/t}$. On the other hand, it must not be profitable for any other bank to enter the market at stage I and to locate in the middle between two banks, i.e. at distance $\ell' = \ell/2$ from any of the two banks. By the above argument, such entry would pay off the profit $t(\ell')^2/2 = t\ell^2/8$. Hence, entry is unprofitable iff $\ell = 1/n < \sqrt{(8f)/t}$. Therefore the number n of banks satisfies

$$\sqrt{\frac{t}{2f}} \geq n > \sqrt{\frac{t}{8f}} \; . \tag{4}$$

To guarantee that all n satisfying the contestable–market conditions (4) are also compatible with the covered–markets condition (3), we impose the following assumption:

$$\sqrt{8ft} < \bar{\lambda} A - \bar{\rho} \; . \tag{A2}$$

To make sure that banks do not fail, loan revenues must exceed deposit liabilities in the low–income state. That is, we must have

$$\int_0^{\ell/2} \varphi \lambda^G r_x - (1-k)\rho \, dx \geq 0 \; ,$$

which turns out to be equivalent to

$$\varphi \lambda^G (k\rho' + \frac{3}{4}\frac{t}{n}) \geq (1-\varphi)\lambda^B (1-k)\rho \; . \tag{5}$$

As turns out below, this inequality is not only sufficient, but also necessary for solvency of banks in the regulated economy. The condition has a very intuitive interpretation. First, solvency is always guaranteed when the banks' credit assessment is good enough (high φ); in the limit $\varphi = 1$ banks do not lend to bad borrowers and they are therefore not hit by the low–income state. Second, a high enough capital requirement ratio also guarantees solvency. Third, strong market power (high t or low n) is also beneficial for solvency because loan rate margins serve as a buffer against bad return shocks. Conversely, in the limit of a perfectly competitive market ($t = 0$), (5) implies that some capital requirement is needed to avoid failure when credit assessment is not perfectly informative ($\varphi < 1$).

Proposition 1: Under assumptions (A0), (A1) and (A2), there is an equilibrium where banks do not fail, provided that (5) holds. The equilibrium number n of banks satisfies (4), and bank profits are $\dfrac{t}{2n^2}$.

We turn now to an analysis of equilibria with bank failure. The only difference to the previous analysis is that now the banks' effective repayment probability and the effective costs of funds are replaced by $\bar{\lambda}_\alpha$ and $\bar{\rho}_\alpha$. Therefore, markets are covered with n banks iff

$$\frac{t}{n} \leq \bar{\lambda}_\alpha A - \bar{\rho}_\alpha \ , \tag{3'}$$

and assumption (A2) becomes

$$\sqrt{8ft} < \bar{\lambda}_\alpha A - \bar{\rho}_\alpha \ . \tag{A2'}$$

Finally, the n banks fail indeed in the low–income state iff

$$\int_0^{\ell/2} \varphi \lambda^G r_x - (1-k)\rho \, dx < 0 \ ,$$

where $r_x = (\bar{\rho}_\alpha + t(\ell - x))/\bar{\lambda}_\alpha$ is now the Bertrand loan rate imposed on a borrower located distance x apart, provided that banks expect to fail in the low–income state. A straightforward calculation shows that this condition is satisfied if, and only if, condition (5) is violated. Hence, low capital requirement, poor credit assessment, or fierce competition can induce failure of banks. Paralleling Proposition 1 we have

Proposition 2: Under assumptions (A0), (A1) and (A2'), there is an equilibrium where banks fail with positive probability, provided that (5) does not hold. The equilibrium number n of banks satisfies (4), and bank profits are $\frac{t}{2n^2}$.

Propositions 1 and 2 characterize all equilibria in the regulated economy where banks do not have local monopoly power. The equilibrium number of banks in both cases is only restricted by the contestable markets condition (4). Banks do not fail whenever (5) holds, but failure occurs with positive probability otherwise.[12] Also, expected bank profits are the same in both cases, and they do neither depend on the quality of credit assessment, nor on the quality of borrowers, nor on capital requirements, but only the parameters determining market power (t and f). The reason is that in this symmetric market with equally effective credit assessment, all banks charge the same risk premium over the costs of funds, but margins (and bank profits) depend only on local screening advantages and on the distance to the nearest competitor.

It is also instructive to compute the social surplus that is generated by banks. Each bank generates an ex–ante surplus that is independent of whether the bank fails or not: because all agents are risk–neutral, a bank failure is simply an ex–ante transfer of surplus from depositors to bank owners, leaving total surplus unaffected. Unless there are spill–over effects or other costs of failure, the possibility of bank failure takes no impact on economic welfare in this model. The ex–ante surplus that each bank generates is equal to

$$s(n) = 2\int_0^{1/(2n)} \bar{\lambda}A - \bar{\rho} - tx \; dx - f \ .$$

Therefore, total surplus is

$$S(n) = ns(n) = \bar{\lambda}A - \bar{\rho} - \frac{t}{4n} - fn \ . \tag{6}$$

The socially optimal number of banks in the regulated economy is therefore $n^* = \sqrt{t/(4f)}$, a number that lies within the range (4) of free–entry equilibria (for a related result in a non–banking framework, see MacLeod et al. (1988, p. 442)).

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[12] Because the number of banks is generally indeterminate in the contestable markets equilibrium, there can be situations where banks fail in one equilibrium with many banks and low margins, but they do not fail in another equilibrium where fewer banks enter the market and margins are higher.

The maximum total surplus is $S(n^*) = \bar{\lambda}A - \bar{\rho} - \sqrt{tf}$ which is positive provided that (A2) holds. Therefore, the social optimum is also an equilibrium with free entry. Conversely, any free–entry equilibrium also leads to positive surplus: it is easy to show that $S(n) > 0$ for all n satisfying the contestable–markets condition (4), provided that (A2) holds. Hence we find

Proposition 3: Suppose that (A0), (A1), (A2) are satisfied. Then the social optimum is an equilibrium with free entry of banks. Conversely, any free–entry equilibrium is socially beneficial.

We will show in the next Section that this connection between socially and privately beneficial entry of banks breaks down after removal of entry barriers. When bank failure is not a problem, entry of efficient banks is always socially beneficial whenever it is privately beneficial, but not vice versa. That is, there are situations where entry does not take place even though it would be socially beneficial. Conversely, when inefficient banks fail after entry, there can also be situations where entry occurs even when it is socially not desirable, and this is true in spite of the absence of social costs of bank failures.

4 Financial market integration

Starting from an equilibrium in the regulated economy, suppose now that barriers to entry are lifted, so that all banks are allowed to operate in the markets of their choice. Locations of incumbent banks are given from the regulated economy, assuming implicitly that banks do not anticipate future entry deregulation. In particular, banks do not "deter entry" by opening more branches. Accounting for such entry deterrence would clearly make entry even less likely and would only reinforce our main conclusion.

For simplicity it is assumed that banks cannot adapt their screening technology in response to entry deregulation. When inefficient banks are permitted to improve their screening technology, they may decide to do so in order to deter entry. Moreover, when depositors and equity holders demand higher risk premia at riskier banks, less efficient banks will have additional incentives to adapt their technology. In any case, it is plausible that incumbents improve their screening technology in response to deregulation if such adjustments are not too costly.

Let $\varphi^I = \varphi$ be the quality parameter of "inefficient" banks in one market, and $\varphi^E > \varphi$ be the screening quality of "efficient" banks in the other market. Clearly, inefficient banks do not want to enter the market of efficient banks simply because entry is not even profitable for efficient banks, so it cannot be profitable for the less efficient ones either. On the other hand, efficient banks may want to enter the market of inefficient banks.

Our model completely abstracts from established borrower–bank relationships or from local expertise of incumbent banks that may serve as barriers to entry (see e.g. Bouckaert and Degryse (2003), Dell'Ariccia (2001) and Dell'Ariccia, Friedman, and Marquez (1999)); such effects could be easily incorporated in the form of switching costs for borrowers or differential costs of entry. To keep the model as simple as possible, we completely abstract from such effects and focus solely on differences in credit assessment quality between incumbents and entrants. This focus seems suited for a model of an emerging economy where established borrower–bank relationships are of relatively minor importance.

If efficient banks enter, they set up branches (at cost f again). To keep the analysis simple, we assume that the entrant branch operates under a single solvency constraint with the holding bank; that is, even if the entrant branch fails, the holding bank is committed to bail it out. Under the assumption that efficient banks never fail in their home market and that the home market is big enough, the joint company never fails either, and we can treat the entrant branch like a single bank operating under full liability; when local loan revenues fall short of local deposit obligations, the home bank intervenes to settle any imbalances.[13]

We start from an equilibrium location of inefficient banks in the regulated economy,

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[13] It is a striking feature of cross–border entry in the European Union that it often takes place via subsidiaries instead of branches (see Dermine (2003)). Unlike foreign branches, subsidiaries are subject to foreign solvency regulations. However, even with subsidiaries it is plausible to assume that the holding company interferes if the subsidiary is in financial distress. Failure of foreign subsidiaries may be particularly important in those scenarios where inefficient banks enter efficient markets, but such situations do not occur in this model.

assuming that these banks do not fail in the low–income state (i.e. starting from a configuration of Proposition 1). Then, after entry deregulation and entry of efficient banks, there can be one of the following three outcomes:

(A) Both banks operate and inefficient banks remain solvent.

(B) Both banks operate and inefficient banks fail in the low–income state.

(C) The efficient bank crowds out the inefficient bank.

Each of these cases may occur in equilibrium, depending on the economic fundamentals, particularly on the efficiency differential $\varphi^E - \varphi$ and on the capital requirement. We will start to examine the conditions leading to the type (B) equilibrium, discussing the type (A) and (C) equilibria afterward.

Note that if an efficient bank enters, it locates exactly between two inefficient banks (see Lemma 2 of the Appendix), so the distance to any competitor is $\ell/2 = 1/(2n)$ where n is the number of inefficient banks (and the number of entering efficient banks). Consider a borrower that is located at distance x from the efficient bank, so his distance to the inefficient bank is $\ell/2 - x$. The inefficient bank, expecting failure in the low–income state, operates with effective repayment probability $\bar{\lambda}^I_\alpha = \alpha\varphi^I\lambda^G + (1-\varphi^I)\lambda^B$ and costs of funds $\bar{\rho}_\alpha$ (see (2)).[14] Lemma 1 implies that the efficient bank bids down the inefficient bank to its break–even rate

$$r^I_x = (\bar{\rho}_\alpha + t(\ell/2 - x))/\bar{\lambda}^I_\alpha \tag{7}$$

and makes expected profit

$$\pi_x = \frac{\bar{\lambda}^E}{\bar{\lambda}^I_\alpha}\Big(\bar{\rho}_\alpha + t(\frac{\ell}{2} - x)\Big) - \bar{\rho} - tx \ .$$

Thus, in the type (B) equilibrium, the efficient bank screens all borrowers located at distance

$$\begin{aligned} x \leq \bar{x}^B \quad &\equiv \quad \frac{1}{t(\bar{\lambda}^E + \bar{\lambda}^I_\alpha)}\Big(t\frac{\ell}{2}\bar{\lambda}^E + \bar{\lambda}^E\bar{\rho}_\alpha - \bar{\rho}\bar{\lambda}^I_\alpha\Big) \\ &= \quad \frac{1}{t(\bar{\lambda}^E + \bar{\lambda}^I_\alpha)}\Big(t\frac{\ell}{2}\bar{\lambda}^E + (\bar{\lambda}^E - \bar{\lambda}^I_\alpha)k\rho' - (\bar{\lambda}^I_\alpha - \alpha\bar{\lambda}^E)(1-k)\rho\Big) \ . \end{aligned} \tag{8}$$

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[14] We define analogously the effective repayment probabilities for the non–failing inefficient and efficient banks as $\bar{\lambda}^I$ and $\bar{\lambda}^E$ (see (1)).

Without failure ($\alpha = 1$) and without efficiency differential ($\varphi^E = \varphi$), the banks split the market equally, i.e. $\bar{x}^B = \ell/4$. However, if the efficiency differential becomes bigger, the efficient bank's market share increases. The efficient bank's expected profit is

$$\bar{\pi}^A = 2\int_0^{\bar{x}^B} \pi_x \, dx = t\Big(1 + \frac{\bar{\lambda}^E}{\bar{\lambda}^I_\alpha}\Big)(\bar{x}^B)^2 \ .$$

Therefore, there is entry of efficient banks, and efficient banks do not crowd out inefficient banks if

$$\frac{\ell}{2} > \bar{x}^B \geq \sqrt{\frac{f}{t(1 + \bar{\lambda}^E/\bar{\lambda}^I_\alpha)}} \ . \tag{9}$$

To make sure that the entry equilibrium is in fact of type (B), we have to guarantee that inefficient banks fail in the recession state. This is the case iff

$$\int_0^{\ell/2-\bar{x}^B} \varphi^I \lambda^G r^E_x - (1-k)\rho \, dx < 0 \ ,$$

where $r^E_x = (\bar{\rho} + t(\ell/2 - x))/\bar{\lambda}^E$ is the break–even rate of efficient banks that is charged by inefficient banks in their market. This failure condition is equivalent to

$$\varphi\lambda^G(k\rho' + t\frac{\ell + 2\bar{x}^B}{4}) < (1-k)\rho\lambda^G(\varphi^E - \varphi) + (1-k)\rho(1-\varphi^E)\lambda^B \ . \tag{10}$$

Note that for $\varphi^E = \varphi$ this condition coincides with the negation of (5) when $(\ell + 2\bar{x}^B)/4$ is replaced by $3\ell/4$. It can be seen that both conditions for an equilibrium (B), the entry condition (9) and the failure condition (10) are favoured by more efficient entrants: better credit assessment makes entry more profitable, but it also makes failure of the incumbent banks more likely because the entrant charges lower risk premia, depressing margins for the incumbent banks, making them more vulnerable to bad return shocks.[15] We can summarize these findings as follows.

Proposition 4: Suppose that (9) and (10) are satisfied. Then the deregulated economy has an equilibrium where banks with efficiency φ^E enter the market of banks with efficiency $\varphi < \varphi^E$, and where inefficient banks fail in the low–income state.

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[15] There is also an opposite effect since the market share of incumbents $(\ell - 2\bar{x}^B)$ is decreasing in φ^E which makes incumbents less vulnerable to bad shocks because they pay lower screening costs on average. Numeric experiments suggest however that the other effect dominates.

Consider now an entry equilibrium of type (A) where all banks operate without failure. The analysis of this case parallels the above. The only difference is that now inefficient banks operate with the effective repayment probability $\bar{\lambda}^I$ and the costs of funds $\bar{\rho}$ (replacing $\bar{\lambda}^I_\alpha$ and $\bar{\rho}_\alpha$ above). Hence, entry without crowding–out occurs iff

$$\frac{\ell}{2} > \bar{x}^A \geq \sqrt{\frac{f}{t(1+\bar{\lambda}^E/\bar{\lambda}^I)}}\ , \tag{11}$$

where

$$\bar{x}^A \equiv \frac{1}{t(\bar{\lambda}^E+\bar{\lambda}^I)}\Big(t\frac{\ell}{2}\bar{\lambda}^E + (\bar{\lambda}^E - \bar{\lambda}^I)\bar{\rho}\Big)\ .$$

Analogous to (10), there is no failure iff

$$\varphi\lambda^G\Big(k\rho' + t\frac{\ell+2\bar{x}^A}{4}\Big) \geq (1-k)\rho\lambda^G(\varphi^E-\varphi) + (1-k)\rho(1-\varphi^E)\lambda^B. \tag{12}$$

Obviously, (12) is satisfied if the capital requirement ratio k is big enough. Also the entry condition (11) is favoured by a higher capital requirement ratio, as was the case before. Note, however, that (12) is not the negation of the failure condition (10). The reason is that the market sizes of efficient banks, $\bar{x}^B$ and $\bar{x}^A$, are different, depending on whether inefficient banks fail or not. Numeric experiments suggest that $\bar{x}^B < \bar{x}^A$; because inefficient banks that are subject to insolvency risk operate under lower effective costs of funds than non–failing banks, they also gain a bigger market share when they compete with efficient banks. This observation implies that both (10) and (12) can be satisfied simultaneously, implying the existence of multiple equilibria, some with bank failure and some without. However, numerical experiments also revealed that those regions in parameter space leading to multiple equilibria are very small (see the example below).

Proposition 5: Suppose that (11) and (12) are satisfied. Then the deregulated economy has an equilibrium where banks with efficiency φ^E enter the market of banks with efficiency $\varphi < \varphi^E$, and where banks do not fail.

Finally, an equilibrium of type (C) occurs if efficient banks completely crowd out inefficient banks, i.e. if either $\bar{x}^A \geq \ell/2$ or $\bar{x}^B \geq \ell/2$, depending on whether (10) or (12) holds. In such a case, inefficient banks may still stay in the market and compete with efficient banks (in the hope to win market shares later on after potential efficiency improvements), or they are shut down and leave the market. In the latter case, an equilibrium of the type of Proposition 1 would emerge again, with the only difference that credit assessment is overall of better quality than under entry regulation.

Proposition 6: Suppose that either (10) and $\bar{x}^B > \ell/2$, or (12) and $\bar{x}^A > \ell/2$. Then banks with efficiency φ^E enter the market of banks with efficiency $\varphi < \varphi^E$, and efficient banks win the whole market.

Because it is difficult to analyze the equilibrium conditions (9)-(12) in full generality, it is instructive to use a numerical example to illustrate graphically the role of the underlying parameters. Each of these equilibrium conditions defines an implicit relation between the efficiency of entrants, φ^E, and the capital requirement, k. We solved numerically for these curves, and plotted them in Figure 1 wherever they define a boundary between two of the four possible equilibrium regimes (no entry or entry of type A, B, or C).[16] The underlying parameter set was chosen such that, before deregulation, there is no failure in the market served by two inefficient banks with efficiency $\varphi = 0.7$ when the capital requirement ratio is at least 2.5%. That is, the requirements of Proposition 1 are satisfied for $n = 2$ and $k = 0.025$.[17]

It can be seen from the figure that entry occurs only for a sufficiently high efficiency differential $\varphi^E - \varphi$. For a low capital requirement ratio, inefficient banks fail after entry, whereas a high enough capital requirement ratio prevents entry (about 8% in our example). It turns out that a higher efficiency differential is required for entry when the capital requirement ratio is low and inefficient banks fail. When the efficiency differential becomes big enough, inefficient banks are crowded out of the market. Note also that the capital requirement ratio that is needed to prevent failure is *increasing in the efficiency of the entrant banks* (i.e. the boundary between type A and type B equilibrium regimes is increasing). As more efficient banks enter, incumbents must charge lower margins and are thus exposed to greater insolvency risk; therefore a higher capital requirement is needed to avoid failure. Note, however, that bank failures have no social costs in this model; the model is therefore ill–suited

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[16] As mentioned above, the failure conditions (10) and (12) are not identical, so that there is also a region of co–existing equilibria of types (A) and (B). Because this region is negligibly small, Figure 1 shows only one of the two (nearly coinciding) equilibrium curves.

[17] The other parameters are $\lambda^G = 1$, $\lambda^B = 0.3$, $\alpha = 0.5$, $\rho = 1.3$, $\rho' = 2$, $t = 0.3$, $f = 0.02$, $A = 2$.

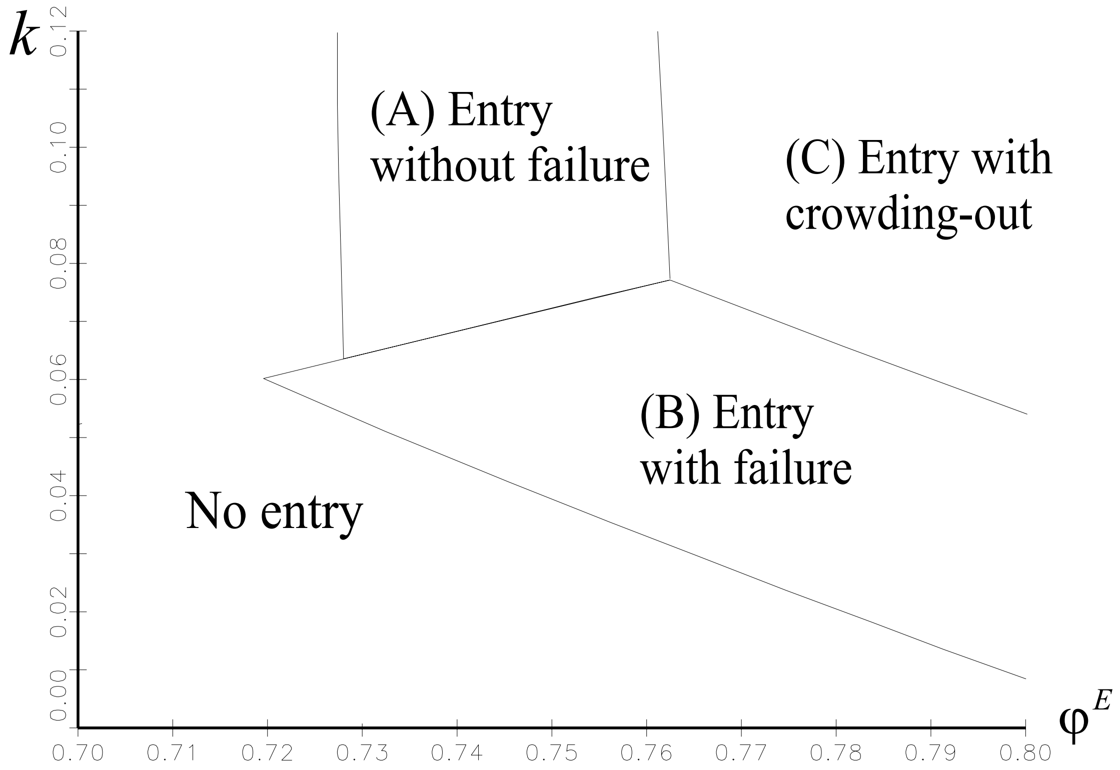

Figure 1: Equilibrium regimes after entry deregulation.

to discuss policy from a normative viewpoint. As we discuss in Section 6 below, there may even be positive welfare effects of bank failure in the longer run.

To conclude this section, entry of banks with better credit assessment facilities may lead to a higher risk of bank failure. This is despite the fact that the average quality of loans improves after entry; as borrowers are screened by more efficient banks, more bad borrowers are rejected and more good borrowers are accepted. The next section explores the welfare consequences of entry deregulation.

5 The welfare effects of integration

We have seen that, in the regulated economy, free entry does not conflict with the objective of a central planner interested in maximizing social surplus (Proposition 3). This finding does not extend to an economy that is already served by inefficient banks and that is opened to entry by more efficient banks. There are two reasons why free entry does not lead to the first–best solution that would be chosen by a social planner who can decide about entry of banks and who is able to control their pricing policies. The first reason is a "pricing inefficiency", the second is an "entry inefficiency". Both inefficiencies have to do with the fact that efficient banks do not internalize all welfare gains from their better credit assessment. The pricing inefficiency says that efficient banks win only a too small market share relative to the social optimum; first–best efficiency could be achieved by loan rate controls allowing efficient banks to win a larger market. Because such rate controls are difficult to implement in practice and problematic on its own, we then focus on the *second–best solution* where the central planner decides about entry, leaving pricing decisions to banks. We ask then whether the second–best solution coincides with the free–entry equilibrium. Because of an "entry inefficiency" the answer is negative; provided that the risk of bank failure is low enough, entry is always socially beneficial, but not vice versa. That is, there are situations where entry does not occur even though it would be socially beneficial. The reason is again that efficient banks do not internalize all surplus they are generating. Policies promoting entry would be socially beneficial. On the other hand, with bank failure it can also be the case that socially suboptimal entry occurs, and this is even possible when there are no social costs of bank failure. The reason for this curious outcome is that incumbent banks, expecting failure after entry, behave less competitively than before entry deregulation. This draws efficient banks into the market even when it would be better not to have them entering.

If there is *no entry*, the surplus that the n inefficient banks generate is (see (6))

$$S^{NE} = \bar{\lambda}^I A - \bar{\rho} - \frac{t}{4n} - nf \ . \tag{13}$$

If there is *entry* of n efficient banks, each locating symmetrically and serving the market $\bar{x} \in [0, 1/(2n)]$, the surplus is

$$\begin{aligned} S^E &= 2n\Big(\int_0^{\bar{x}} \bar{\lambda}^E A - \bar{\rho} - tx \ dx + \int_0^{1/(2n)-\bar{x}} \bar{\lambda}^I A - \bar{\rho} - tx \ dx\Big) - 2nf \\ &= S^{NE} + 2n\bar{x}(\bar{\lambda}^E - \bar{\lambda}^I)A + 2nt\bar{x}\Big(\frac{1}{2n} - \bar{x}\Big) - nf \ . \end{aligned} \tag{14}$$

Note again that the possibility of bank failure does not affect social surplus. From (13) and (14), the welfare gain (or loss) from entry is

$$2n\bar{x}A(\bar{\lambda}^E - \bar{\lambda}^I) + 2nt\bar{x}\Big(\frac{1}{2n} - \bar{x}\Big) - nf \ . \tag{15}$$

From that expression we obtain the socially optimal market size of efficient banks,

$$\bar{x}^S = \frac{1}{4n} + \frac{(\bar{\lambda}^E - \bar{\lambda}^I)A}{2t} ,$$

provided that $\bar{x}^S < 1/(2n)$ (otherwise $\bar{x}^S = 1/(2n)$). The market size of efficient banks increases in the efficiency differential, and when this differential is zero, it is optimal to split the market equally. We find, however, that the socially optimal market size is bigger than the market size that obtains with free pricing and without bank failures.[18]

Proposition 7: The market share of efficient banks in the free–entry equilibrium without bank failure is smaller than their socially optimal market share.

Proof: Appendix.

The conclusion of Proposition 7 appears to be at odds with the conventional wisdom that perfect price discrimination results in efficiency (see e.g. Spence (1976)). The intuitive explanation for our divergent result is that, in spite of discriminatory pricing, there is additional surplus accruing to borrowers that is not reflected in the efficient banks' profits. Therefore efficient banks operate in a market that is too small relative to the social optimum.[19]

To remove the inefficiency of Proposition 7, a regulator could impose some form of loan rate control (e.g. forcing inefficient banks to charge higher rates so as to help efficient banks gain market share), but such rate controls are not very appealing and particularly difficult to implement in practice. An alternative measure helping to increase the market share of banks with better credit assessment is the imposition of risk–adjusted capital requirements, as promoted in the "Basel II" regulatory

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[18] The result clearly extends also to the case with bank failure when the probability of the low–income state is small enough.

[19] In a non–bank framework where Salop firms i with profit functions $\pi_i = p_{ix} - c_i - tx$ compete under discriminatory pricing p_{ix}, the allocation of consumers to firms is socially optimal (see Bhaskar and To (2003)), and this is even true when there are asymmetries in costs c_i. However, the analogy to our set–up are firms with profit functions $\lambda_i p_{ix} - c - tx$ where all firms pay *the same cost per customer* c, but once these costs are paid, they *produce different amounts* of an output good λ_i. This feature makes the allocation of customers inefficient, surprisingly even under discriminatory pricing.

framework. Provided that the banks' portfolios of borrowers can be observed by supervisory authorities, inefficient banks would have to raise more equity capital per unit of loans than efficient banks. Because equity capital is costly, inefficient banks lose market share in favor of more efficient banks. However, even this measure could not implement the first–best allocation, because higher capital requirements come at welfare losses since total surplus falls when total costs of funds go up.

For these reasons, we now turn to the second–best analysis, assuming that market shares are those obtained in the stage II pricing game. We ask under what condition entry is socially beneficial. Again we assume that we are in a regime without bank failure (or that the probability of bank failure is small enough), discussing the other case below. From (15), the type (A) equilibrium is socially beneficial iff

$$2\bar{x}^A A(\bar{\lambda}^E - \bar{\lambda}^I) + 2t\bar{x}^A\Big(\frac{1}{2n} - \bar{x}^A\Big) \geq f \ , \tag{16}$$

whereas the type (C) equilibrium is socially beneficial iff

$$\frac{1}{n}(\bar{\lambda}^E - \bar{\lambda}^I)A \geq f \ . \tag{17}$$

On the other hand, from (11) we know that a free–entry equilibrium of type (A) or type (C) occurs iff

$$t\Big(1 + \frac{\bar{\lambda}^E}{\bar{\lambda}^I}\Big)(\bar{x}^A)^2 \geq f \ . \tag{18}$$

The following proposition shows that free entry is always socially beneficial (i.e. (18) implies (16) or (17)), but not vice versa. The intuition for that result is similar to the above: efficient banks' profits do not reflect all welfare gains from better credit assessment. Thus, policies promoting entry can be welfare–enhancing.

Proposition 8: A free–entry equilibrium without failure of inefficient banks (type (A) or type (C)) is socially beneficial. Conversely, there are situations where entry is socially beneficial, but where efficient banks stay out of the market.

Proof: Appendix.

Proposition 8 does not generalize to the cases of bank failures. First of all, and as mentioned in Section 3, our model completely abstracts from any social costs of bank failures. When there are such costs, the above conclusions can only remain valid as long as the probability of failure is not too high and failure costs are not too large. But even in the absence of social costs to bank failures, the conclusion of Proposition 8 does not extend to type (B) equilibria with failure of inefficient banks. The reason is that inefficient banks which are not exposed to failure risk before deregulation, may fail after entry of efficient banks. This exposure to failure risk can make inefficient banks less competitive because they charge higher margins on their lending costs, which draws efficient banks into the market, even when it is not socially beneficial.[20] This can be seen from the break–even rate of the inefficient bank in (7). If this bank expects to fail, it faces both lower ex–ante funding costs $\bar{\rho}_\alpha < \overline{\rho}$ (because it only pays out depositors under solvency) and a lower loan repayment probability $\bar{\lambda}_\alpha < \overline{\lambda}$. These two effects on the break–even interest rate go in opposite directions, but because monitoring costs are sunk, the positive effect can dominate; hence a bank exposed to failure risk may charge higher interest rates than a solvent bank.

To give a numerical example, we use the parameter values of Figure 1 again to compare the curves leading to entry in the free–entry equilibrium (from Figure 1) with the second–best entry condition (16) above (replacing $\bar{x}^A$ by $\bar{x}^B$ when necessary). Figure 2 shows that, without bank failure, the socially optimal entry curve is always to the left of the free–entry equilibrium curve (implying that entry is always beneficial). With bank failure, however, the two curves intersect, so that there is a (small) region in parameter space, where entry occurs even though it is socially inefficient.[21] Note that this last conclusion holds even in the absence of any social costs of bank failure.

6 Conclusions

The focus of this paper is a specific aspect of financial market integration: the removal of barriers to entry of foreign banks with better credit assessment. There are two main conclusions. First, provided that solvency of banks after entry is

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[20] One may suspect that banks with limited liability behave more competitively because they have incentives to gamble. In this model, however, gambling is excluded by assumption (A0).

[21] Note that the Figures are based on a relatively large failure risk ($\alpha = 0.5$). When failure risk becomes smaller ($\alpha \geq 0.8$), the region of socially inefficient entry disappears.

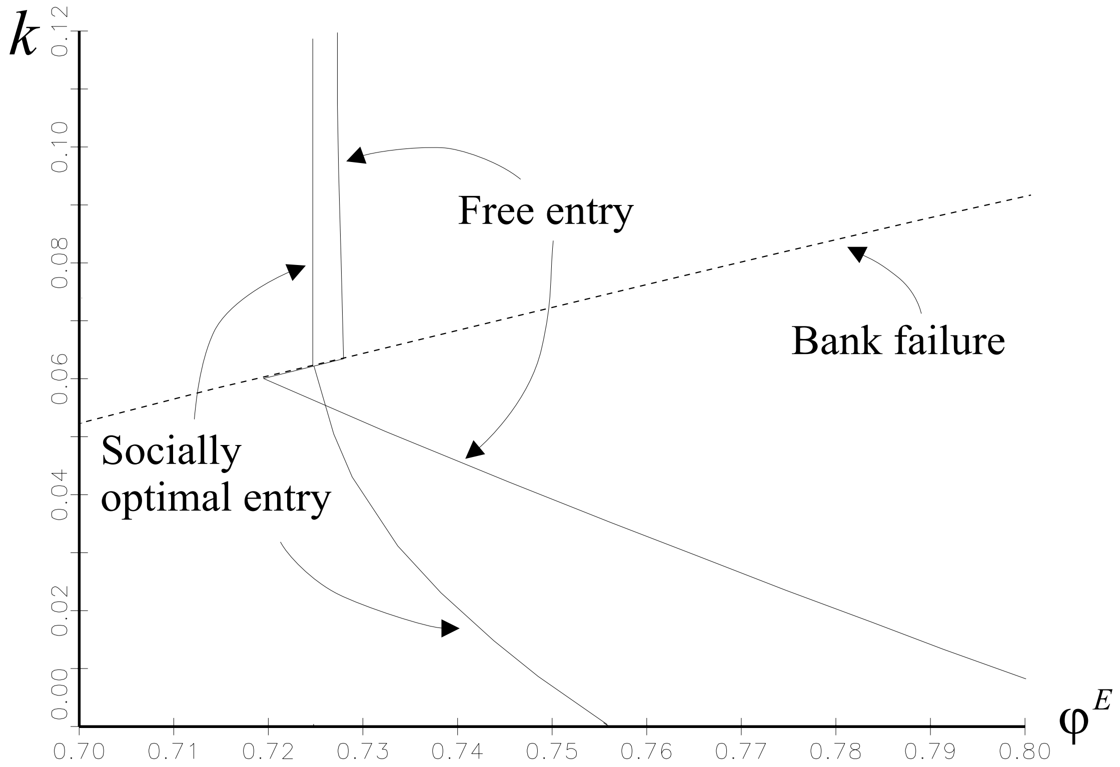

Figure 2: Conditions leading to free entry and to socially optimal entry.

guaranteed, there is *too little entry* relative to the socially optimal level and *market shares of entrant banks are too small.* The reason is that entrants do not account for all welfare gains that are associated with their better credit scoring. Thus they do not price aggressively enough and they may stay out of the market even when entry would be better for society. Second, when solvency of banks cannot be guaranteed, there may be *too much entry* of foreign banks. Incumbent banks which expect failure after entry behave less competitively than without entry, thus inducing foreign banks to enter although it would be better if they stayed out of the market.

There are several directions in which this model could be extended in order to account for other important aspects of banking integration. Important, yet missing features are the role of established borrower–bank relationships (as an implicit obstacle to entry) and potential social costs of bank failures (from which this one–period model with risk–neutral agents abstracts away). Regarding established relationships, it is not clear in what direction borrower switching costs would drive the main result, as such costs would both reduce the private and the social gains of entry. Regarding costs of bank failure, an interesting model extension would be a multi–period scenario that takes into account the long–run consequences of banking integration. If entry occurs in the beginning, with banks playing the pricing game repeatedly in all future periods, failure of inefficient banks would have social costs and social benefits in all future periods. On the cost side, average screening costs go up because there are fewer banks in the market after failure of some incumbent banks. On the benefit side, average screening quality improves and more bad borrowers get rejected. Which of the two effects dominates and determines the welfare effect is a topic for future research.

Appendix

Proof of Lemma 1: We proceed by backward induction, starting at stage IV. We show first that bank 2 does not screen borrowers $x \leq \bar{x}$ when bank 1 screens them. The argument is similar to a finding by Broecker (1990): multiple screening lowers the average quality of borrowers, and because bank 2 breaks even when it screens alone, it must incur losses when both banks screen. To show this formally in this model, let φ_1 and φ_2 be the credit assessment qualities of the two banks, so that the credit repayment probability of bank 2, if it screens alone, is $\lambda_2 = \varphi_2 \lambda^G + (1-\varphi_2)\lambda^B$ (assuming that bank 2 does not fail in the low–income state; the other case is analogous). If bank 2 screens borrower x who is also screened by bank 1, bank 2 attracts all borrowers that are assessed positively by 2 and negatively by 1 plus half of all borrowers that are assessed positively by both banks (because there is a tie at stage II). Hence, bank 2 attracts $\varphi_2(1-\varphi_1/2)$ good borrowers and $(1-\varphi_2)(1+\varphi_1/2)$ bad borrowers located at x, a total less than one. Therefore, $\hat{\lambda}_2 = \varphi_2(1-\varphi_1/2)\lambda^G + (1-\varphi_2)(1+\varphi_1/2)\lambda^B$ borrowers repay their loan and the costs of funds are $\hat{\rho}_2 = (\varphi_2(1-\varphi_1/2)+(1-\varphi_2)(1+\varphi_1/2))\rho_2$. Hence, at $r_2 = (\rho_2 + t(\ell - x))/\lambda_2$, bank 2's expected payoff from screening borrowers at x is

$$\frac{\hat{\lambda}_2}{\lambda_2}(\rho_2 + t(\ell - x)) - \hat{\rho}_2 - t(\ell - x) \ .$$

But because

$$\frac{\hat{\lambda}_2}{\lambda_2} < \frac{\hat{\rho}_2}{\rho_2} < 1 \ ,$$

this payoff is negative. Therefore, it does not pay for bank 2 to screen the borrowers at x. On the other hand, bank 1 clearly prefers to screen the borrower at x if bank 2 does not screen because this guarantees non–negative profits, whereas non–screening and lending must incur losses because of (A1). This completes stage IV.

Because of the assumptions of the Lemma, $r_i \leq A$ for $i = 1, 2$. Therefore, all borrowers would make non–negative expected profit from a loan at any of the two banks, and so they apply at both banks at stage III.

Finally, at stage II, it does not pay for bank 2 to undercut. Although it could thereby attract all borrowers that it assesses positively (avoiding the above adverse selection problem), it would still incur losses because r_2 is the interest rate where bank 2 makes zero profits by screening alone. It also does not pay for bank 2 to raise the interest rate at stage II and to screen at stage IV since it would again end up with an adverse selection of borrowers implying losses. On the other hand, bank 1 will not lower the interest rate because this would only lower loan revenues without altering the quality of its borrowers. Bank 1 will also not raise the interest rate, because then bank 2 will start screening at stage IV (making zero profits though) so that bank 1 ends up with an adverse selection of borrowers and a loss because of (A1).

It remains to compute equilibrium profit for bank 1. A straightforward calculation shows that

$$\pi_1 = \int_0^{\bar{x}} \lambda_1 r_{1x} - \rho_1 - tx dx = \frac{\lambda_1 + \lambda_2}{2\lambda_2} \bar{x}^2 \ .$$

This completes the proof. □

Lemma 2: Suppose that two inefficient banks (0 and 1) are located distance ℓ apart and that an efficient bank decides about entry at distance y from bank 0 (distance $\ell - y$ from bank 1). Then it is optimal for the efficient bank to locate in the middle, i.e. $y = \ell/2$.

Proof: Suppose that the two existing inefficient banks have the effective repayment probability λ_1 and the effective cost of funds ρ_1, whereas the efficient entrant's repayment probability is λ_2 and the cost of funds are ρ_2 (this notation, following Lemma 1, captures all possible scenarios allowing also for failure of some of the banks). If the entrant locates at distance y from bank 0, Lemma 1 implies that it wins all borrowers located distance $x \leq \bar{x}_0$ into the direction of bank 0 and all borrowers located distance $x \leq \bar{x}_1$ into the direction of bank 1, where

$$\begin{aligned}\bar{x}_0 &= \frac{\lambda_2\rho_1 - \lambda_1\rho_2 + t\lambda_2 y}{t(\lambda_1+\lambda_2)} \ , \\ \bar{x}_1 &= \frac{\lambda_2\rho_1 - \lambda_1\rho_2 + t\lambda_2(\ell - y)}{t(\lambda_1+\lambda_2)} \ .\end{aligned}$$

Also according to Lemma 1, the total profit of the entrant bank is $\pi_1 = \frac{\lambda_1+\lambda_2}{2\lambda_1}(\bar{x}_0^2 + \bar{x}_1^2)$. Maximizing this expression with respect to y, one obtains easily $y = \ell/2$. That is, the entrant bank locates in the middle between the two incumbents. □

Proof of Proposition 7: We have to show that $\bar{x}^S > \bar{x}^A$, i.e.

$$\frac{(\bar{\lambda}^E - \bar{\lambda}^I)A}{2t} + \frac{1}{4n} > \frac{1}{2n}\frac{\bar{\lambda}^E}{\bar{\lambda}^E + \bar{\lambda}^I} + \frac{\bar{\rho}}{t}\frac{\bar{\lambda}^E - \bar{\lambda}^I}{\bar{\lambda}^E + \bar{\lambda}^I} \ .$$

Rewriting this inequality gives

$$A(\bar{\lambda}^E + \bar{\lambda}^I) - 2\bar{\rho} > \frac{t}{2n} \ .$$

Because $\bar{\lambda}^E > \bar{\lambda}^I$, this holds if

$$A\bar{\lambda}^I - \bar{\rho} > \frac{t}{4n} \ .$$

But this condition merely states that inefficient banks alone create positive surplus which follows from (A2) and the contestable market condition (4). □

Proof of Proposition 8: It is to show that (18) is strictly stronger than (16) when $\bar{x}^A < 1/(2n)$ and that (18) implies (17) when $\bar{x}^A \geq 1/(2n)$. Suppose first $\bar{x}^A < 1/(2n)$. (18) is sufficient, but not necessary for (16), if

$$2A(\bar{\lambda}^E - \bar{\lambda}^I) + 2t(\frac{1}{2n} - \bar{x}^A) > t\Big(1 + \frac{\bar{\lambda}^E}{\bar{\lambda}^I}\Big)\bar{x}^A \ . \qquad (19)$$

From (3) (which follows from assumption (A2)), $A \geq (t/n + \bar{\rho})/\bar{\lambda}^I$, so that (19) holds if

$$2(\bar{\rho} + \frac{t}{n})(\xi - 1) + 2t(\frac{1}{2n} - \bar{x}^A) > t(1+\xi)\bar{x}^A$$

is satisfied, where $\xi \equiv \bar{\lambda}^E/\bar{\lambda}^I > 1$. Plugging in the definition of $\bar{x}^A$ yields

$$2(\bar{\rho} + \frac{t}{n})(\xi - 1) + \frac{t}{n} > \frac{3+\xi}{1+\xi}\Big(\frac{t}{2n}\xi + (\xi-1)\bar{\rho}\Big) \ ,$$

and rearranging leads to

$$(\bar{\rho} + \frac{3t}{2n})\xi^2 - (2\bar{\rho} + \frac{t}{2n})\xi + \bar{\rho} - \frac{t}{n} > 0 \ . \tag{20}$$

The left–hand side is a quadratic in ξ which has a zero at $\xi = 1$ and whose minimum is at $\xi = (\bar{\rho} + t/(4n))/(\bar{\rho} + 3t/(2n)) < 1$. Therefore, (20) holds for all $\xi > 1$ (and so (19) holds for all $\bar{\lambda}^E > \bar{\lambda}^I$).

Suppose now that $\bar{x}^A > 1/(2n)$ (so that also (18) holds). We must show that also (17) is satisfied. $\bar{x}^A > 1/(2n)$ is equivalent to

$$(\bar{\lambda}^E - \bar{\lambda}^I) > \frac{t\bar{\lambda}I}{2n\rho} \ .$$

This inequality is sufficient for (17) if

$$\frac{t\bar{\lambda}^I}{2\bar{\rho}n} > \frac{nf}{A} \ .$$

Using $n^2 < t/(2f)$ (from (4)), this condition follows from $\bar{\lambda}^I A - \bar{\rho} > 0$ (see (A2)).□

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