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Banking Deregulation and Credit Risk: Evidence from the EU*

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Abstract

This paper studies the effect of banking deregulation on credit risk. Its theoretical model shows that a bank is willing to invest more resources in screening borrowers when there is an entry threat, even though loan rates are driven lower. Thus, deregulation may result in improved loan quality and lower credit risk. This result is tested using bank-level balance sheet data and macroeconomic data for the European Union. The data reveal that competition intensified after the completion of the Second Banking Directive, while loan quality improved in most markets. Evidence is found that the loan quality improvement is associated with lower interest margin.

1. INTRODUCTION

Recent outbreaks of financial crises and the trend of financial liberalization have stimulated much interest in studying the link between the two. One unsettled issue is the impact of intensified competition that arises from removing bank entry restrictions. Most of the theoretical literature concludes that competition increases banks' credit risk.[1] A common argument is that competition drives down loan rates and bank profits, reducing banks' incentives to screen loan applicants (Chan et al., 1986; Manove et al., 2001;

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[1] The paper focuses on credit risk. Literature on other types of risk is not considered here.

and Gehrig, 1998), leading to eased lending criteria and increased bank failures (Bolt and Tieman, 2004). It is also argued that competition reduces banks' screening ability by worsening the pool of loan applicants (Marquez, 2002; Gehrig and Stenbacka, 2001). In contrast, Chen and Haller (2003) argue that loan screening helps alleviate competitive pressure, and thus intenser competition can stimulate screening activities. Likewise, Chen (2005) considers a bank's choice between loan screening and collateral requirements, and concludes that it is more likely to choose the former rather than rely on the latter when facing competitive pressure from a potential entrant.

Empirically, results in the related literature are no less mixed. Demirgüç-Kunt and Detragiache (1999) and Gruben et al. (2002) find evidence of a positive link between financial liberalization and financial crises. Gropp and Vesala (2004) conclude that financial liberalization tends to lower bank asset quality. However, Jayaratne and Strahan (1996), Rizvi (2001), and Isik and Hassan (2003) find improved bank performance after banking deregulation in the Untied States, Pakistan, and Turkey, respectively; and Caminal and Matutes (2002) do not find a clear relationship between market power and bank failures.

Despite the academic unsettlement on this issue, central bankers commonly believe that competition promotes efficiency and stability.[2] The European Union removed cross-border bank entry restrictions by enacting the Second Banking Directive in the mid-1990s. Competition is reported to be intensified as a result of the deregulation, according to a report by the European Commission (1997). Foreign bank presence has also substantially increased in Central Europe, Latin America, and Asia since the mid 1990s, thanks to the globalization of financial services and the removal of foreign entry barriers (IMF, 2000). Given the current trend of liberalizing the banking industry, more research is needed to better understand the consequences of increased competition in the banking market.

This paper will contribute both theoretically and empirically to the literature that is in favor of banking competition. It develops a simple theoretical model to show how removing entry restrictions increases banks' incentives to screen loan applicants while lending rates are driven lower, and finds empirical evidence supporting this result by analyzing the EU-15 banking markets. The theoretical findings run contrary to the papers that conclude that

[2] See, for example, Ciocca (2005).

lower bank profits reduce screening incentives. The modeling in those papers commonly uses the level of loan rates to represent the intensity of competition (Chan et al., 1986 and Gehrig, 1998), or a parameter to indicate banks' lending criteria (Bolt and Tieman, 2004). They consider how a lower lending rate and profit would affect a bank's screening effort, but not how screening intensity (or how much a bank knows about their borrowers) would in turn affect its loan rate decisions. A closer look at the strategies a bank may adopt when facing competition suggests that treating both screening intensity and lending rates as endogenous decisions may be important.

To simplify, suppose the pool of borrowers contains both good (low risk) and bad (high risk) borrowers. The bank's goal is then to lend to good borrowers and reject bad borrowers.[3] Good borrowers would not only prefer lower loan rates (as would bad borrowers), they would also appreciate being correctly recognized by the bank, so that they can be treated the way they deserve, such as having easier access to credit and being granted higher credit lines. In this sense, they would prefer banks to have better screening ability (unlike bad borrowers). Thus, to compete for good borrowers, a bank can either cut loan rates, or can develop an ability to identify good borrowers more accurately than other banks. The latter entails relying more on the screening of loan applicants. In other words, determining screening level is an additional competition strategy. It allows a bank to compete without exclusively relying on cutting loan rates. That is, the more a bank screens, the less it relies on cutting loan rates when facing competition. However, the modeling in the above-mentioned papers does not allow the benefit of knowing borrowers when competing with other banks. In contrast, this paper's theoretical model considers the interaction of both loan rate and screening decisions, and finds competition can increase a bank's screening effort, even if its loan rate is driven lower.

The theoretical results reinforce those of Chen (2005) and Chen and Haller (2003), but the models differ in the following aspects. Chen (2005)[4] considers banks' choice between two prudent measures: screening of loan borrowers and collateral requirements, with the latter being more vulnerable to asset price shocks. By assuming away collateral requirements, this paper presents a simpler model that applies to a more general case in

[3] Risk diversification is not considered here.

[4] Chen's paper has the same concern as Manove et al. (2001), who obtain opposite results. The difference between these two papers is not addressed here.

which banks issue non-collateralized loans. Further, this setting allows a better focus on the impact of credit risk (without consideration of market risk) on bank soundness. In addition, Chen (2005) assumes perfect screening technology, whereas imperfect screening technology is considered here, allowing differentiated intensity of screening effort. In Chen and Haller (2003), banks compete symmetrically, while an asymmetric case is considered in this paper, that is, the incumbent bank is considered to have an information advantage and therefore is assumed to have the technology for screening borrowers. While Chen and Haller (2003) is suitable for addressing the outcome of market structure changes due to mergers and acquisitions, this paper's setting applies to the common situation that follows a financial deregulation: new players enter a market with little local knowledge when entry restrictions are lifted, or engage in unfamiliar businesses when product-line restrictions are removed.

On the empirical side, current deregulation practices around the world provide a wide selection of subjects for study. However, in order to concentrate on the effects of banking deregulation on credit risk and to avoid getting entangled with other factors, it is preferable to study countries where regime changes have been smoother and the financial systems are relatively mature. As pointed out by Lindgren et al. (1996, p. 100) and Honohan (2000), regime shocks and incomplete reforms can all contribute to the weakness of a banking sector. Thus, reliable analysis of the impact of deregulation on banks' credit risk would be more difficult for emerging markets. Moreover, the lack of international accounting standards for bank-level data of these countries poses additional difficulties. In contrast, the banking market in the European Union during the 1990s provides a potentially promising arena. The relatively smooth deregulation process, coupled with the existence of relatively high quality data, makes the EU a good candidate for my purpose here. Applying bank balance sheet data from Bankscope and relevant macroeconomic data, the study finds evidence of loan quality improvement after the removal of cross-border bank entry restrictions, supporting the above theoretical results.

The sample selection approach in this paper differs from those in the related empirical literature, which seem to be less suited here. Gruben et al. (2002) choose data in periods when financial crises occurred; Demirgüç-Kunt and Detragiache (1999) use a cross-section comparison approach for a large number of developed and developing countries. They

both find evidence of a positive connection between financial liberalization and banks' risk taking. Claessens et al. (2001) apply bank level data for 80 countries and find foreign bank entry reduces domestic banks' profitability and operation costs, but do not see impact on their loan loss reserves. Gropp and Vesala (2004) study the relationship between deposit insurance and banks' risk taking with bank level data. They conclude that financial liberalization tends to lower bank asset quality, characterized by the share of problem loans in total assets. However, their analysis is constrained to 128 large commercial banks out of the thousands of available European Union banks in Bankscope. This paper derives empirical findings from a much larger data set, including banks in all sizes. The model is also subject to extensive misspecification tests and respecifications to ensure statistical validity.

The paper is organized as follows. Section 2 introduces the theoretical model and demonstrates that a bank's screening incentive is greater after the removal of entry restrictions. Section 3 reviews the process of the European Union's banking deregulation process. Sections 4 presents preliminary evidence of loan quality improvement associated with competition intensification. Section 5 carries out the statistical analysis. Finally, section 6 contains the conclusion. Quantitative results are reported in the appendix.

2. THE THEORETICAL MODEL

The simple model has a basic set-up similar to those in Chen (2005), Chen and Haller (2003), and Gehrig (1998), except for the differences discussed in the introduction. Consider a credit market where banks face two types of firms, with the total measure normalized to one. The portions of the good (low risk) type firms (g) and the bad (high risk) type firms (b) are one half each. Each firm is endowed with a project that needs 1 unit of investment and can only be funded by borrowing from a bank. A good firm's project generates a return z with probability π_g and a return 0 with probability $1-\pi_g$; a bad firm's project has the same return z with a lower probability π_b and a return 0 with probability $1-\pi_b$. Firms know about their own types while banks do not. However, banks can observe the results of projects and enforce repayments from borrowers of successful projects. If a project fails, the firm pays nothing to the bank.

Banks have unlimited funding with a fixed gross rate 1. Assume $\pi_g z - 1 > 0$, and $\pi_b z - 1 < 0$, so that funding a good project is beneficial for the economy, while funding a bad project is wasteful. Also assume

$$\frac{1}{2}(\pi_g z - 1) + \frac{1}{2}(\pi_b z - 1) = \frac{1}{2}(\pi_g + \pi_b) z - 1 > 0, \tag{1}$$

that is, overall the projects are worth funding.

A monopoly bank can acquire information about a firm's status by screening the firm. In the duopoly banking market, the model assumes that only one bank, bank 1, has the screening technology. This assumption is based on the consideration that collecting information is less costly for an incumbent bank because of its local knowledge. First, an incumbent understands the business culture unique to the local market. Second, it can acquire borrower-specific information (such as their risk management styles) through past lending experiences. This type of proprietary information is crucial to banks' credit risk management. With this local background, bank 1, the incumbent, has the advantage for gathering information at a lower cost in determining whether a project is worth lending to. One may interpret bank 1 in the model as a domestic bank, and bank 2 as a foreign bank. This assumption may also be generalized to apply to credit markets with incumbent banks and new entrants that are not familiar with the local market.

The screening technology has the following features. Screening a firm costs $c(s)$, where $s \in [0, 1]$ represents the screening level. Assume $c(0) = 0$, $c'(0) = 0$, $c'(s) > 0$ for $s > 0$, $c''(s) > 0$, and $c(1) > \frac{1}{2}(\pi_g z - 1)$, so that it is never optimal for banks to screen at the level $s = 1$. Based on the screening result, the bank assigns applicants to two categories: creditworthy (G) and uncreditworthy (B). Only those in category G can get a loan. The probability of a good firm (correctly) and a bad firm (mistakenly) being assigned to category G depends on the screening level s and is denoted as $p(G|g) = l_g(s)$ and $p(G|b) = l_b(s)$, respectively. Assume $l_g' > 0$, $l_g'' \leqslant 0$, $l_b' < 0$, $l_b'' \geqslant 0$; and $l_g(0) = l_b(0) = \frac{1}{2}$, $l_g(1) = 1$, $l_b(1) = 0$.

Let r_i be the loan rate that bank i charges when there are two banks.[5] For the bank without screening technology, bank 2, the expected profit of giving a loan at rate r_2 is

[5] In practice, good borrowers may get a lower loan rate. However, lending rate is also highly dependent

given by: $\Psi_2(r_2) = \frac{1}{2}(\pi_g r_2 - 1) + \frac{1}{2}(\pi_b r_2 - 1) = \frac{1}{2}(\pi_g + \pi_b) r_2 - 1$, provided that it expects the pool of its applicants to contain the same portion of both types of firms as the entire pool of firms. In some cases (as we will see later), bank 2 can infer for certain a loan applicant's type based on both banks' offers. In order to allow bank 2 to utilize this information, assume that bank 2 can reject applicants if it infers that only bad firms apply. A similar modelling approach has been taken by Hellwig (1987).

The timing of the borrowing procedure in the duopoly banking market is as follows:

- First, the bank with the screening technology (bank 1) announces screening levels and then both banks announce loan rates. Screening levels and loan rates are observable but screening results are not revealed to the potential entrant (bank 2).
- Second, firms make choices of going to bank 1 or bank 2, or staying out of the credit market based on their expected payoffs from dealing with the banks. Assume they go to bank 1 if they are indifferent.
- Third, bank 1 screens applicants.
- Finally, both banks issue loans to those who are considered worthy of receiving loans, that is: bank 1 gives loans to those assigned to category G; bank 2 either gives loans to every applicant or rejects all applicants depending on the offers of both banks.

The same procedure applies to the monopoly bank case, except that bank 2 is not present.

2.1 The Monopoly Case

A monopoly bank maximizes its profit with respect to the loan rate r it charges and the screening level s it chooses:

$$\Psi_m(r, s) = \frac{1}{2} l_g(s)(\pi_g r - 1) + \frac{1}{2} l_b(s)(\pi_b r - 1) - c(s) \tag{2}$$

on other factors, such as monetary policies. For simplicity, I consider the benefit of being recognized as good borrowers to be the success of obtaining a fixed loan, as in the literature, but not a lower loan rate or a larger loan than bad borrowers receive.

Notice that the loan rate r must not exceed z: when $r \leq z$, all firms that qualify will take a loan, otherwise no firm will take a loan. Obviously, a monopoly bank will choose the highest possible loan rate:

$$r_m^* = z$$

Since $\Psi_m(z, s)$ is strictly concave, the optimal screening level s^* is given by the first order condition:

$$l_g'(\pi_g z - 1) + l_b'(\pi_b z - 1) = 2c' \tag{3}$$

Notice that at the zero screening level, the monopoly bank earns a positive expected profit by simply giving a loan to every applicant. In order for the bank to apply a positive screening level, the screening technology should be efficient so that there exist $s > 0$, at which $\Psi_m(s)$ is greater than the profit the bank earns without screening. For this purpose, assume the set $S^0 = \{s \in (0,1) | \Psi_m(z,s) = \frac{1}{2}(\pi_g + \pi_b) z - 1\}$ is non-empty, and there exists $\hat{s} \in S^0$ such that $\Psi_m'(\hat{s}) > 0$[6]. With this condition, $\Psi_m(s^*) > \frac{1}{2}(\pi_g + \pi_b) z - 1$, and s^* is indeed its optimal screening level.

2.2 The Case with an Entrant

As specified before, bank 1 is endowed with the screening technology, while bank 2 is not. Since no firm will take a loan if $r > z$, only the case $r_i \leq z$ is considered.

A good and a bad firm's expected profits from bank 1 are $l_g(s)\pi_g(z - r_1)$, and $l_b(s)\pi_b(z - r_1)$, respectively. If bank 2 accepts applicants at the final stage, a good firm will come to bank 2 when

$$\pi_g(z - r_2) > l_g(s)\pi_g(z - r_1), \tag{4}$$

[6] The following is a numerical example where there is s such that $\Psi_m(z,s) > \frac{1}{2}(\pi_g + \pi_b)z - 1$. Given $\pi_g = \frac{1}{2}$, $\pi_b = \frac{1}{8}$, $z = 4$, $l_g(s) = \frac{1}{2} + \frac{s}{1+s}$, $l_b(s) = \frac{1}{2} - \frac{s}{1+s}$ and $c(s) = s^4$, $\Psi_m(z, \frac{1}{2}) = \frac{5}{16} > \frac{1}{2}(\pi_g + \pi_b)z - 1 = \frac{1}{4}$.

i.e.,

$$r_2 < z - l_g(s)(z - r_1) \equiv \widetilde{r}_2.$$

Let $\widetilde{r}_2 \equiv z - l_g(s)(z - r_1)$.

A bad firm will come to bank 2 when

$$\pi_b(z - r_2) > l_b(s)\pi_b(z - r_1), \tag{5}$$

i.e.,

$$r_2 < z - l_b(s)(z - r_1).$$

Notice that if bank 1's screening level is positive, good firms will require a lower loan rate than will bad firms for them to choose bank 2. The reason is that when bank 1 screens, a good firm is more likely to get a loan from bank 1 than is a bad firm. Thus, it is more difficult for bank 2 to attract good firms than to attract bad firms. When it undercuts bank 1 by setting r_2 lower than the threshold for good firms to come, i.e., when (4) and (5) are both satisfied, bank 2's expected profit for accepting applicants is: $\Psi_2(r_2) = \frac{1}{2}(\pi_g + \pi_b)\, r_2 - 1$. When (4) is satisfied but (5) is not, only bad firms will come if bank 2 accepts applicants. In this situation, bank 2 should reject applicants at the final stage.

Next let us specify bank 2's belief about an applicant's status that determines its optimal strategy at the final stage. Three situations are possible, depending on s, r_1, and r_2:

1) $l_g(z - r_1) < (z - r_2)$, which implies $l_b(z - r_1) < (z - r_2)$. In this case, both types of firms prefer bank 2 if bank 2 accepts applicants. Accordingly, bank 2 would have the belief that the probability of an applicant's type being good is 1/2;

2) $l_b(z - r_1) \geqslant (z - r_2)$, which implies $l_g(z - r_1) \geqslant (z - r_2)$. In this case, both types of firms prefer to go to bank 1 whatever bank 2 does at the final stage. Bank 2's belief about the probability of an applicant being good could be anything between 0 and 1, and would be irrelevant in equilibrium. Let us assume it is 1/2;

3) $l_g(z-r_1) \geqslant (z-r_2)$, but $l_b(z-r_1) < (z-r_2)$. In this case, going to bank 2 is a strictly dominated strategy for good firms (recall the assumption that good firms prefer bank 1 when the payoffs from both banks are the same), but bad firms would strictly prefer to go to bank 2 if it accepts applicants. Thus, bank 2 would not hold a belief that an applicant's type is good with a positive probability. In other words, bank 2 would believe that an applicant belongs to the bad type with probability 1.

Based on these beliefs, bank 2's optimal strategy at the final stage is to accept in cases (1) or (2), provided $\Psi_2(r_2) \geqslant 0$, and to reject otherwise.

Given s and r_1, if $\Psi_2(\tilde{r}_2) > 0$, bank 2 can always undercut bank 1 by setting $r_2 = \tilde{r}_2 - \varepsilon$ and thus attracting all firms, and bank 1 should either cut its loan rate or raise its screening level to keep the market share. Thus, an equilibrium would occur only when bank 1 drives bank 2's profit to be non-positive at $\tilde{r}_2$. In this case, s and r_1 are determined by

$$\left.\begin{array}{c} \underset{s,r_1}{Max} \;\; \Psi_1 = \frac{1}{2} l_g(s)(\pi_g r_1 - 1) + \frac{1}{2} l_b(s)(\pi_b r_1 - 1) - c(s) \\ s.t., \; \Psi_2(\widetilde{r}_2) = \frac{1}{2}(\pi_g + \pi_b)\widetilde{r}_2 - 1 \leqslant 0 \end{array}\right\} \tag{6}$$

where $\widetilde{r}_2 \equiv z - l_g(s)(z - r_1)$.

After simplifying the constraint to

$$r_1 \leqslant z - \frac{1}{l_g(s)}(z - \frac{2}{\pi_g + \pi_b}),$$

one can easily see that the constraint is always binding, since otherwise bank 1 can raise r_1 to improve its profit. Thus, (6) is equivalent to

$$\left.\begin{array}{c} \underset{s\in[0,1]}{Max} \;\; \Psi_1 = \frac{1}{2}(l_g(s)\pi_g + l_b(s)\pi_b) r_1 - \frac{1}{2}(l_g(s) + l_b(s)) - c(s) \\ = \frac{1}{2}(l_g(s)\pi_g + l_b(s)\pi_b)[z - \frac{1}{l_g(s)}(z - \frac{2}{\pi_g + \pi_b})] \\ - \frac{1}{2}(l_g(s) + l_b(s)) - c(s) \end{array}\right\} \tag{7}$$

Lemma 1 *In the banking market described above, a pure strategy (perfect Bayesian) equilibrium has the following features:*

- Bank 1 announces s^* that solves (7) and sets

$$r_1^* = z - \frac{1}{l_g(s^*)}(z - \frac{2}{\pi_g + \pi_b});$$

- *Bank 2 announces* $r_2^* = \widetilde{r}_2^* \equiv z - l_g(s^*)(z - r_1^*) = \frac{2}{\pi_g + \pi_b}$, *and rejects applicants at the final stage;*

- *Firms go to bank 1.*

The proof is in the Appendix.

Because $s \in [0, 1]$, a solution to (7) exists. As in the monopoly case, assume the screening technology is efficient enough so that at r_1^*, the set $S_1^0 = \{s \in (0, 1) | \Psi_1(s) = 0\}$ is non-empty, and there exists $\hat{s} \in S_1^0$, such that $\Psi_1'(\hat{s}) > 0$. With this assumption, an equilibrium with the features stated in lemma 1 exists.[7]

At equilibrium, the effective loan rate in the market is bank 1's loan rate: $r_1^* = z - \frac{1}{l_g(s^*)}(z - \frac{2}{\pi_g + \pi_b})$, which is lower than the monopoly loan rate z since $z > \frac{2}{\pi_g + \pi_b}$ by (1). Also notice that $r_1^*(s)$ is an increasing function of s. That is, a higher screening level eases the pressure of cutting the loan rate, for bank 1.

Lemma 2 *The monopoly bank's screening level increases when it faces an entry threat.*

Proof. Since

$$\frac{\partial \Psi_m}{\partial s} = \frac{1}{2}(l_g' \pi_g + l_b' \pi_b)z - \frac{1}{2}(l_g' + l_b') - c'$$

and

$$\frac{\partial \Psi_1}{\partial s} = \frac{1}{2}(l_g' \pi_g + l_b' \pi_b)[z - \frac{1}{l_g}(z - \frac{2}{\pi_g + \pi_b})] + \frac{1}{2}(l_g + l_b)\frac{l_g'}{l_g^2}(z - \frac{2}{\pi_g + \pi_b}) - \frac{1}{2}(l_g' + l_b') - c',$$

subtracting $\frac{\partial \Psi_m}{\partial s}$ from $\frac{\partial \Psi_1}{\partial s}$ yields:

$$\frac{\partial \Psi_1}{\partial s} - \frac{\partial \Psi_m}{\partial s} = \frac{\pi_b}{l_g^2}(z - \frac{2}{\pi_g + \pi_b})(l_g' l_b - l_b' l_g) > 0,$$

[7] In the numerical example shown in the previous footnote, there also exists s such that bank 1 earns positive profit: $r_1^*(\frac{1}{2}) = \frac{76}{5}$ and $\Psi_1(r_1^*(\frac{1}{2}), \frac{1}{2}) = \frac{41}{400} > 0$.

since $z - \frac{2}{\pi_g + \pi_b} > 0$ from (1), and $l'_g > 0$, $l'_b < 0$.

Thus, $\frac{\partial \Psi_1}{\partial s}$ is greater than $\frac{\partial \Psi_m}{\partial s}$ for all $s \in [0, 1]$.

Notice that Ψ_m is strictly concave. In particular, it first increases, then decreases with s. Hence, $\Psi'_m(s) > 0$ for $s < s^*_m$ and $\Psi'_m(s) = 0$ at $s = s^*_m$. Thus, $\Psi'_1(s) > \Psi'_m(s) > 0$ for $s \leqslant s^*_m$. Therefore, there exists $\hat{s} > s^*_m$, such that $\Psi_1(\hat{s}) > \Psi_1(s)$ for all $s \leqslant s^*_m$. In other words, $s^* > s^*_m$. That is, bank 1's optimal screening level s^* in the duopoly case is higher than that of a monopoly bank, s^*_m. ■

In the proof, it is shown that the derivative of the profit function with respect to the screening level is higher for bank 1 when it is threatened by entry than when it is a monopolist. The interpretation is apparent: the marginal value of information increases when competition is introduced. When increasing screening level can be used to reduce the need for cutting loan rates, a bank facing an entry threat would adopt a higher screening level than would a monopoly bank.

In the equilibrium, bank 2 (the new entrant) has zero market share, because of its disadvantageous position. This result coincides with difficulties foreign banks encounter when entering into other markets. Following the removal of entry barriers of a market, it is common for foreign banks to establish representative offices and focus on serving international companies and providing trade-related operations with insignificant total market shares. However, penetration into local and retail businesses is usually slow, because they are more information concentrated.[8] To expand into these areas, a common shortcut is to form "alliances or joint ventures with local partners" (IMF, 2000, p. 159). Starting with acquiring a minority stake in a local bank and with a low degree of involvement in operations, a foreign bank can eventually equip itself with local knowledge and gain full control of the bank. In the EU-15 countries, retail banking services have also lagged behind wholesale services in the integration progress (Cabral et al., 2002). Although foreign assets and liabilities of commercial banks increased rapidly in most markets after 1992, market shares of foreign banks have been relatively small and remain lower than the average of developed countries, according to Buch and Heinrich (2003), who concur

[8] In the emerging economies, the increase in foreign presence in recent years was largely a result of massive banking reconstruction and privatizing, usually following a financial crisis.

that one responsible factor is the low profitability for foreign banks in developed banking markets.

Does the slow foreign penetration indicate that domestic banks are shielded from foreign competition? The model suggests that even if the potential foreign entrant (bank 2) has no market share, its stand-by presence creates a non-negligible threat to the domestic bank (bank 1). Bank 1 is forced to lower loan rates and raise screening levels. Lower lending rates represent lower borrowing costs and more accessible credit for borrowers. They encourage investment and thus promote economic growth. A higher screening level results in better credit risk management and enhances the stability of the banking sector. To test these beneficial effects of banking competition on lending rate and credit risk, the paper selects the EU-15 banking system to study, for the reasons argued in the introduction section.

3. BANKING DEREGULATION IN THE EU

The purpose of banking deregulation in European Union countries was to transform the highly segmented national markets into a common single market. The First Banking Coordination Directive was introduced in 1977. It initiated measures to establish a common regulatory framework across member countries and enhance cooperation and supervision. However, for a long time, progress was limited and the banking systems continued to be highly regulated and segmented. Foreign bank entry had to be authorized by the host country, and thus was subject to the host country's discretion. Cross-border operations were regulated and supervised by both home and host countries. Capital controls and excessive capital requirements for branch establishment also created obstacles to foreign bank entry. Foreign bank presence, although increased, was limited and mainly constrained to operations for large and medium-sized corporate customers. (EC, 1997, pp. 12-18)

The most important step toward a single banking market was the adoption of the Second Banking Directive. It marked the removal of cross-border branching restrictions by eliminating the minimum capital requirement and the local banking charter requirement

of the host country. It also established the rule of home country control. As a result, banks were able to set up branches and provide financial services across all European Union countries with a single license (EC, 1997, pp. 19-25). Foreign bank entry became virtually free. The EU banking system achieved the highest degree of openness to foreign competition in the world (Buch and Heinrich, 2003).

In addition, anticipating the integration of the EU markets, substantial restructuring and re-regulation occurred within each market during the preparation and implementation process of the Second Directive. By the time the Second Directive was completed, each market had formed a new regulatory environment wherein competition was encouraged. All countries deregulated interest rates and removed capital controls.[9] Public ownership decreased substantially. Geographic and product-line restrictions were either reduced or removed.

The Second Banking Directive was passed in 1989, and all 15 European Union countries completed the implementation of the Second Directive between 1991 and 1994. Denmark finished the process in 1991, Luxemburg and the United Kingdom in 1993, Belgium, Spain, Austria, Finland and Sweden in 1994; all other countries completed at the end of 1992. Since major banking deregulation measures were completed as direct or indirect results of the Second Directive, this paper refers to the period after the completion of the Second Directive as the post-deregulation period.

The next two sections analyze evidence of the intensification of banking competition after deregulation and its impact on banks' ability to control credit risk, indicated by loan quality, as screening and monitoring efforts cannot be directly observed. The analyses employ bank-level balance sheet data from Fitch IBCA and Bureau van Dijk's Bankscope database. It includes yearly balance sheet data for 4997 banks in the EU-15 countries from 1990 to 1999. Specialized Governmental Credit Institutions are excluded from the analysis.[10] Suspicious data with the following problems are treated as missing values:

[9] Germany, the UK, Netherlands, and Denmark lifted capital controls and interest rate regulations prior to the introduction of the Second Banking Directive and were considered to be more liberal and open.

[10] The types of credit institutions included are commercial banks, cooperative banks, investment banks, medium and long term credit banks, non-banking credit institutions, real estate/mortgage banks, and savings banks. Commercial banks account for more than half of the observations.

negative loan quantity and non-performing loans, non-performing loans and loan loss provisions that are greater than the loan size, and net interest income (or loss) higher than total earning assets. Country-level economic data are from the International Financial Statistics (published by the International Monetary Fund), the OECD Economic Outlook, and the World Bank.

4. COMPETITION AND LOAN QUALITY AFTER DEREGULATION

In a few years after deregulation, banks faced increased competition both in the domestic and other EU markets. According to a bank survey published by the European Commission (EC, 1997, p.71), on average, competition increased to a large degree within domestic banking markets, and to a medium degree in other EU markets.[11]

Since the survey results reflect banks' perception of competition increase and have the flaw of subjectivity, the paper examines other indications of competition intensification. Consistent with the literature (e.g., Chan et al., 1986; Gehrig, 1998; and Chen, 2005), the theoretical model in this paper shows loan rates are lower after deregulation, implying a lower net interest margin (i.e., net interest income as a percent of total earning assets) when competition intensifies. Calculated from the Bankscope database, net interest margins declined on average (table 1) and in most individual markets (table 2-1) during the 1990s. The decline was witnessed most consistently, and to the largest degrees, in the countries with relatively high pre-deregulation interest margins, such as Portugal, Greece, and Spain. In a few markets where the pre-deregulation levels were low, the changes were either small or inconsistent across time (such as UK). Interest margins even trended upward for the countries with exceptionally low initial values (Luxemburg and Netherlands). The changes are generally consistent with the survey results of banks' perception of competition increase. The markets with above-average reported increases in competition also had above-average declines in net interest margins, except for Denmark.

Of course, competition intensity is not the only determinant of net interest margin.

[11] With a measure scale [-50, 50], where -50 is 'large decrease', -25 'small decrease', 0 'no change', 25 'small increase', and 50 'large increase', the average increase in competition is 38 and 37 in the domestic retail and corporate markets, and 26 and 31 in other EU retail and corporate markets, respectively.

Other factors, such as interest risk, credit risk, and cost efficiency also affect interest margin and may even outweigh the impact of market structure. According to Maudos and Fernández de Guevara (2004), the decline in interest margin in the EU may be mainly caused by improved cost efficiency. However, if the improvement in cost efficiency was a result of the restructuring and reforming of banks to deal with increased competition, it was indirectly associated with competition intensification. In addition, cost efficiency is affected by resources allocated to loan screening, which is again affected by competition intensity, as in the theoretical model of this paper. This setting coincides with the findings by Berger and DeYoung (1997) that increased cost efficiency reduces loan quality for some banks, probably due to skimping on loan underwriting and monitoring. In any case, even if net interest margin alone is not a direct measure of competition intensity, it provides an important indication regarding how banks' prudent behavior changes when profits decline. The argument that banking competition increases credit risk is mainly based on the reasoning that lower loan rates, and hence lower profits, reduce banks' incentives to invest resources in screening borrowers. In contrast, the model of this paper supports the counter argument as in Chen (2005) and Chen and Haller (2003). That is, a lower interest margin is accompanied by a decline in credit risk, or improved loan quality.

Bank concentration measures, such as the Herfindahl index and the 5-bank concentration ratio, are commonly used to indicate competition intensity. In general, a market with lower concentration, indicated by a lower Herfindahl index or five-firm concentration ratio, is regarded as more competitive. However, despite its popularity, such an index cannot fully capture the degree of competition in a market. It is well known that domestic mergers and acquisition activities increased substantially across the European Union in the late 1990s. As a result, the total number of banks declined and bank concentration increased in most markets (table 2-1). This trend continued in the 2000s; both indicators increased between 1999 and 2003 in most markets, according to ECB (2004). As noted by some commentators, such as Begg and Altunbas (2002), the increased concentration was the result of defensive strategies taken by large banks under competitive pressure in order to improve their efficiency. On the other hand, the national governments' willingness to sustain their domestic dominance may also be partly responsible for it (EC, 1997, p.120).

An alternative approach to the measure of intensity of competition used in recent lit-

erature, such as Bikker and Haaf (2002) and Claessens and Laeven (2004), is to estimate the H-statistic, a measure of the impact of a change in marginal cost on output price based on Panzar and Rosse (1987). Following Claessens and Laeven (2004), the interest income-to-asset ratio (proxy for output price) is regressed on a set of variables representing input costs and bank features: (i) the interest expense-to-deposit ratio (proxy for price of deposit), (ii) the personnel expense-to-asset ratio (proxy for labor price), (iii) the ratio of other operating expenses to fixed assets (proxy for price of fixed capital), and (iv) three variables representing other bank features, including the equity-to-asset ratio, loan-to-asset ratio, and total assets. All variables are log-transformed; fixed effects for bank types are also controlled for. The sum of the parameters on the variables (i)-(iii) is the H-statistic, with $H = 1$ indicating perfect competition, $0 < H < 1$ monopolistic competition, and $H \leq 0$ monopoly.[12] The H-statistic is estimated using the Bankscope data set for each country-year if there are at least 20 observations. The estimated H-statistics generally lie between zero and one, indicating that the EU markets were under monopolistic competition (table 2-2). In general, the change is small over time in the 1990s (figure 1).

One drawback of the H-statistic is that it is valid only when the market is in equilibrium. Again following Claessens and Laeven (2004), a test is conducted for each country to check whether the markets are at equilibrium. The logarithm of pre-tax profit-to-asset ratio is regressed on all variables (i)-(iv), as specified in the above paragraph. A time trend is also included. If the sum of the coefficients on variables (i)-(iii) is zero, it is accepted that the market is at equilibrium. The results show that the equilibrium hypothesis is rejected at the 10% significance level for all countries whose H-statistic can be estimated, except for Denmark and Netherlands. Thus, interpretation of the H-statistic should take this condition into account.

Finally, another indicator of competition intensity, the number of foreign banks or their market shares in the domestic markets, is also considered. In a paper by Claessens et al. (2001), it is concluded that foreign bank presence reduces domestic banks' profitability.

[12] Under perfect competition, firms earn zero profits. When there is an incrase in input price, output price would increase by the same amount. However, under monopoly, output and, hence, revenues would decline. Under monopolistic competition, both output and output price would increase.

However, measures of foreign bank presence can greatly understate the impact of deregulation and are not suitable for the sample considered here for the following reasons. First, this indicator does not account for competition pressure from domestic banks. Second, the theoretical model shows that when entry restrictions are removed, domestic banks are under competitive pressure and forced to make adjustments in loan rates and screening effort even if foreign entry does not actually occur. In other words, the competitive pressure from foreign banks can be significant when the number of foreign banks and their market shares remain low. Moreover, foreign banks may enter a market as an agency office or a representative office, which are not qualified as banks that engage in regular deposit and loan businesses. These initial entry attempts are not reflected by existing bank databases. Finally, in most EU-15 markets, the degree of foreign bank penetration remains low in the post-deregulation period even though there is clear evidence of competition intensification, indicated by other measures.

It is worth mentioning that the competition intensity measures do not correlate with each other perfectly, since the level of each indicator is also affected by many different factors. A market can be considered to be competitive by one measure, but not by another. For instance, in the post deregulation period, average interest margin is among the lowest in Finland and the Netherlands, although the two markets are highly concentrated (table 2-2). The H-statistic estimate is exceptionally low for Sweden, but its average interest margin level is moderate. Comparison by time also poses the same problem. Interest margin declined after deregulation in most countries while their concentration levels increased (table 2-1). The changes in the H-statistic and the concentration measures are also not consistent for a few countries. Thus, assessment of competition intensity should consider all indicators.

Next, consider credit risk after deregulation. Table 1 compares the pre- and post-deregulation loan quality, measured by non-performing loans and loan loss provision for the pooled data. As predicted by the theoretical model, in an environment with increased competition, banks should act more prudently and are more capable of identifying good (low risk) and bad (high risk) lendings. Thus, without significant adverse shocks causing credit risk to increase, we should see improved loan quality for EU banks in the 1990s. Calculated from the Bankscope data set, average non-performing loans and loan loss

provisions as percentages of loans indeed declined after deregulation while interest margin also declined. When the sample is broken down by size[13], the data show that large banks have much lower post-deregulation interest margins than other banks, indicating a sharper increase in competition among them. In addition, their loan quality improvement is more significant after deregulation, demonstrated by the greater declines in non-performing loans and loan loss provisions.

For individual countries, table 2-1 shows that both non-performing loans and loan loss provision are significantly lower in most banking markets. However, the average loan quality declined in Italy, Greece, and France, and the Netherlands, while interest margins also declined (except for the Netherlands). As mentioned above, interest margin is not the only measure of competition intensity, which is not the sole determinant of loan quality. In addition to the small sample size issue[14], these markets, especially France, have high standard deviations in one or all of the three indicators: interest margin, non-performing loan ratio and loan loss provision (table 2-2), possibly reflecting lower degrees of within-market integration. Moreover, except for France, they are either highly concentrated (Greece and the Netherlands) or experienced a sharp increase in concentration (Italy; table 2-1). Similar to Italy, Austria also had a sharp increase in concentration, and the decline in its loan loss provision is rather small and highly insignificant.. In contrast, the countries with improved loan quality in spite of higher interest margins (UK and Luxembourg) are among the least concentrated markets. The increase in market concentration in UK is also moderate compared to Italy and Austria. In addition, EC (1997, pp.116-123) reports that there are significant regulatory, fiscal, and structural impediments to cross- and within-border integration that are specific to the countries with declined loan quality a few years after deregulation (except for the Netherlands). Finally, average capital ratio declined after deregulation for Greece and the Netherlands,[15] while post-deregulation GDP growth rates were among the lowest for France and Italy (not listed in the tables).

[13] Following ECB (2003-2005), the thresholds between large and medium-sized banks and between medium-sized and small banks for each year are set to be 0.5% and 0.005% of total assets of all EU-15 credit institutions ($70-$100 billion and $0.7-$1 billion), respectively. Total EU-15 assets are found in various ECB publications.

[14] Observation numbers are particularly samll for Italy (in the pre-deregulation period) and Greece.

[15] Capital ratio increased for all other countries.

Figures 1 - 5 further present the link between loan quality and competition intensity. In figure 1, the averages of non-performing loan rates, loan loss provision rates, net interest margins, and the H-statistic for all countries are plotted. The figure demonstrates that loan quality improved during the decade while net interest margins declined. Figures 2-5 are scatter plots of average loan quality (non-performing loan and loan-loss provision rates) versus competition intensity measures (the Herfindahl index and the H-statistic) for each available country. All four graphs indicate that a higher loan quality (lower non-performing loan and loan-loss provision rates) is generally associated with a higher competition degree (lower Herfindahl index and higher H-statistic). The correlation coefficients for these variables are reported in table 3. Note that the relationship seems stronger between loan quality and competition intensity for the relatively more competitive markets, i.e., when the Herfindahl index is relatively low, or when the H-statistic is relatively high.

The above preliminary analyses show that in general, increased competition was associated with loan quality improvement for the EU banking system after deregulation. More formal regression analysis will be carried out in the next section.

5. REGRESSION ANALYSIS

5.1 Model Specification

The empirical model will analyze the impact of increased competition on loan quality after deregulation, measured by non-performing loans and loan loss provisions. Although non-performing loans may be a better measure than loan loss provisions in that they are less subjective, the sample size is greatly reduced when using non-performing loans (see table 1). Thus, both measures will be used. The model is constructed as follows:

$$\begin{aligned} loan\_quality &= \alpha_0 + \alpha_1 * interest\_margin_{t-1} + \alpha_2 * competition + \\ &+ \alpha_3 * loan + \sum_i \alpha_i * bank\_feature_{i,t-1} + \\ &+ \sum_j \alpha_j * country\_feature_j + \varepsilon \end{aligned} \tag{8}$$

In equation (8), *loan_quality* is log-transformed non-performing loans or loan loss provision; $interest\_margin_{t-1}$ is net interest margin in the previous year (to avoid simultaneity); *competition* represents competition intensity and includes the following variables, used separately or together: the H-statistic, a bank concentration indicator (the log of the Herfindahl index or the 5-firm concentration ratio), the survey outcome of competition increase (reported by EC, 1997; abbreviated as the survey indicator), and a deregulation dummy, d. The deregulation dummy takes the value of one after the completion of the Second Banking Directive and is zero otherwise for each country. The survey indicator is also zero for the pre-deregulation observations.[16] The variable *loan* is the current year log-transformed loan size; the variable set $bank\_feature_{t-1}$ includes capital ratio and non-interest operating income as a percent of total assets in the previous year; $country\_feature$ includes GDP growth, money market rate, and interest rate volatility for the country where the bank is located; ε is the error term. All data are bank-level data except for those representing competition intensity and country features.

The reasons to include *interest_margin* and *competition* as explanatory variables are explained in the previous section. The reasons for including the variables grouped in $bank\_feature$ are as follows. During the implementation process of the Second Banking Directive, two major prudential re-regulation directives, the Own Funds and Solvency Ratio Directives, were implemented to comply with the Basle Committee Capital Accord. Consequently, average total capital ratio increased from a pre-deregulation level of 13.6% to 17.1% after deregulation. The increase in capital may cause non-performing loans to decline due to lower moral hazard incentives to take on high risks, as shown in Berger and DeYoung (1997). In the meantime, many banks shifted their focus to non-interest income businesses, reflected by the increase of securitization, non-banking, and off-balance sheet activities (EC, 1997, p. 104). Loan quality could be adversely affected as resources devoted to traditional loan business are reduced. To capture the effect of the strengthening of capital adequacy and the shift of business emphasis toward non-interest income, total capital ratio and non-interest income as a percent of total assets in the previous year are

[16] Due to high correlation between the survey indicator and the deregulation dummy, these two variables are not used together. Also note that the survey indicator only reflects banks' perception of competition increase at the point when the survey was conducted. Austria, Luxembourg, Finland, and Sweden are excluded from the EC's survey report.

included as explanatory variables.

For the variables included in $country\_feature$, GDP growth, which reflects the overall economic situation, and lending rates both directly affect borrowers' repayment ability and therefore banks' loan quality. Moreover, higher lending rates tend to squeeze out low-risk borrowers and induce borrowers to engage in risky behavior because of the adverse selection problem and risk shifting effects.[17] However, lending rates also reflect the level of credit risk and thus induce the problem of simultaneity. As short-term loans between banks involve little credit risk, money market rates are used to substitute for lending rates. To control for interest rate volatility, standard deviation of 3-month interbank rates is also included,[18] following Maudos and Fernández de Guevara (2004).

The misspecification and respecification methodology follows McGuirk et al. (1993) and Spanos (1999). The assumptions to be tested for the pooled data include normality, functional form, independence, time trend, homoskedasticity, and variance shift. The joint conditional mean and variance tests are performed using auxiliary regressions, followed by individual misspecification tests when necessary. The test results suggest the model should be dynamic due to the strong temporal dependence of the dependent variables. The model is respecified by including the lagged dependent variables as explanatory variables. The first lag should be used when the dependent variable is non-performing loans, while the second lag and a time trend should also be included when the dependent variable is loan-loss provision. Further joint mean tests suggest that the respecifications are satisfactory. However, tests of normality reveal violations. The t-plots of the residuals suggest the rejection of normality is probably due to the existence of outliers for unknown reasons. Thus, the estimation results should be interpreted asymptotically. The joint variance tests also reveal violations of homoskedasticity. White's heteroskedasticity-consistent variances are then used and the corresponding p-values are reported for valid inferences. The results of joint mean and variance tests for the respecified models are reported in table 4. Regressions for each individual country follow the same specification. However, in order

[17] See Sounders (1999), pp. 8-9 for a summary.

[18] Based on daily (or monthly if daily data are not available) data; retrieved from the websites of each central bank or directly requested from them.

to increase observations, the second lag of loan loss provision is removed if its coefficient is not significant.

In line with the results of the theoretical model, the coefficients on net interest margin and bank concentration indicators (the Herfindahl Index and the five-firm concentration ratio) are expected to be positive, as lower interest margin and bank concentration imply intensified competition. The coefficients on the H-statistic (a higher H-statistic represents a more competitive market), the deregulation dummy, and the survey indicator are expected to be negative. For the variables representing bank and country features, the coefficients are expected to be negative for capital ratio and GDP growth, and positive for non-interest income, money market rate, and the standard deviation of money market rates.

5.2 Estimation Results

For a preliminary study, regressions with bank-type fixed effects are run for each country. Tables 5-1 to 5-4 present results for the four countries with enough observations to run regressions with all competition indicators: UK, France, Spain, and Portugal; table 5-5 is for the regressions with the deregulation dummy for other countries with sufficient observations[19]. The coefficients for the deregulation dummy and the H-statistic are mostly negative but insignificant, while the coefficient on the Herfindahl index is more inconsistent. The coefficient on net interest margin is positive in most regressions (including those for France and Italy, whose average non-performing loans or loan loss provisions increased after deregulation) and significant in more than half of them, providing evidence that the decline in interest margin is associated with higher loan quality. Notice that for the countries with wrong-signed or unstable estimates for interest margin (Finland and Sweden), the market concentration measures are very high, with a sharp increase in the 5-firm concentration ratio for Finland. This result confirms the preliminary analysis based on tables 2-1 and 2-2. That is, in a market with a high level of concentration or a sharp increase thereof, the association between lower interest margin and higher loan quality is less likely to be observed. As mentioned by Maudos and Fernández de Guevara

[19] Regression results with other competition indicators (the H-statistic and the concentration measures) are available on request.

(2004), the merger and acquisition activities that increased bank concentration since the late 1990s may have a negative effect on lending quality by creating obstacles to further integration of the markets.

To increase the power of estimation, regressions are run for the pooled data for all countries, controlling for country and bank type fixed effects. The results without considering interactions between competition and other variables are reported in tables 6-1 and 6-2. The coefficient for net interest margin is positive in all regressions and significant when the dependent variable is non-performing loans. This is strong evidence that the narrowing of interest margin is associated with loan quality improvement. The deregulation dummy coefficient indicates that non-performing loans would have been about 5 percent lower after the deregulation, and loan loss provisions about 18 percent lower, other things being equal. The coefficient on the time trend in the regressions on the right half of the tables reflects changes of loan-loss provisions caused by non-observable factors that cannot be captured by the explanatory variables.[20] In most regressions, the coefficient shows an approximate 4% growth per year in loan loss provisions without considering the deregulation effect. The negative coefficient for the deregulation dummy is then interpreted as a downward shift of this trend after the deregulation. The parameter for the survey indicator shows that problem loans declined to a larger degree in the markets where competition reportedly increased to a larger degree. The coefficient estimation for the H-statistic is insignificant, but mostly negative, as expected.

As discussed in the previous section, the measure of foreign bank presence can greatly understate competitive pressure caused by deregulation. Nevertheless, regression results are reported in table 6-2 with a foreign bank presence measure: the number of foreign banks as a percentage of total banks.[21] The coefficient for the log of foreign bank share has opposite signs in the two regressions and are both insignificant, while the coefficient on interest margin remains positive and mostly significant. Thus, unlike interest margin, foreign banks does not have much explanatory power of credit risk for the EU banking markets.

[20] The time trend for the regressions with non-performing loans as dependent variable is not included in the respecified model based on the misspecification test results (table 4), following McGuirk et al (1993).

[21] Data cover the period 1990-1997. Source: the World Bank.

Table 6-2 also displays the results for the regressions with bank concentration indicators from different sources. Note that the data published by the European Central Bank (2000) and the Group of Ten (2001) and those calculated from Bankscope exhibit large discrepancies and low correlations[22]. Due to inconsistency of the estimates across the two sets of the regressions with different dependent variables, no definite conclusion can be drawn on the impact of bank concentration. This result is not surprising, considering the inconsistency among different competition measures across country and time. Particularly, the increase in concentration in most markets in the 1990s is accompanied by competition intensification measured by other indicators.

As expected, the parameter on capital ratio is negative in all regressions, indicating that the strengthening of capital regulation caused banks to act more prudently, contributing to the improvement of loan quality. The coefficient on the non-interest income ratio is inconsistent and generally highly insignificant. Thus, the data do not show evidence that the shift toward non-interest income is at the expense of loan quality.

The coefficient for GDP growth has opposite signs across the regressions with different dependent variables, and is mostly significant. One possible reason why GDP growth is positively associated with non-performing loans and negatively associated with loan loss provision is that banks may be more optimistic during a period with high economic growth; thus, they may relax lending standards, and non-performing loans may increase. For the same reason, banks may also under-estimate the magnitude of problem loans, hence lower loan loss provisions. The coefficient on money market rate is significantly positive in all regressions, while the coefficient for standard deviation of interest rates is inconsistent and mostly insignificant. It seems that the level of interest rate has a stronger impact on credit risk than does interest rate volatility.

In order to further examine the impact of competition intensification on bank credit risk, regressions are run incorporating interactions of the competition indicators with

[22]The correlation is 0.58 for the 5-bank concentration ratios published by ECB and G-10, and is 0.65 for the Herfindahle indexes published by ECB and those calculated from Bankscope. Note that ECB (2000) does not cover the period 1991-1994, while G10 (2001) covers only eight of the EU-15 countries. The Bankscope data set includes only a fraction of the banks in the early 1990s with a dramatic increase in coverage in later years.

bank and country specific variables. The results are shown in table 6-3. The coefficient for interest margin turns negative in some regressions and is significant in two of them. In these regressions, the coefficients for the interaction terms between interest margin and the competition indicators (i.e., the deregulation dummy and the survey indicator) are significantly positive. It seems that the association between higher loan quality and lower interest margin only comes to exist after deregulation, and is stronger in the markets with greater reported increase in competition. There is also evidence that the engagement in non-interest income business and the level of interest rates have smaller effects on loan quality when competition intensifies, probably due to more prudent bank behavior.

The above regressions use money market rates as a substitute for lending rates to avoid simultaneity. An alternative approach is to perform a two-stage least squares estimation. Lending rates are affected by monetary policy (proxied by money market rate), interest rate volatility (standard deviation of money market rate), competition intensity, input costs (including deposit rates, labor cost, and capital cost), and credit risk (measured by loan quality). The model to estimate lending rates is specified as

$$\begin{aligned} lending\_rate &= \beta_0 + \beta_1 * money\_market\_rate + \beta_2 * interest\_rate\_volatility \\ &\quad + \beta_3 * competition + \beta_4 * deposit\_rate + \beta_5 * labor\_cost + \\ &\quad + \beta_6 * capital\_cost + \beta_7 * loan\_quality + u \end{aligned} \tag{9}$$

Again following Claessens and Laeven (2004), the interest expense-to-deposit ratio is used as a proxy for *deposit_rate*, personnel expense to asset ratio for *labor_cost*, and the ratio of other operating expenses to fixed assets for *capital_cost*. The variables *competition* and *loan_quality* are defined as in equation (8); u is the error term. Misspecification tests indicate that the above model should be dynamic and the lagged lending rates should be included as an explanatory variable. Note that deposit rates are also affected by money market rates and competition. Thus, lending rate, deposit rate, and loan quality are the three endogenous variables in the system. Also note that equation (9) is overidentified. Using the two-stage least squares approach, the first stage is to regress lending rate on the variables of the right-hand sides of equations (8) and (9) except for the endogenous variables *deposit_rate* and *loan_quality*. Country-level lending rates from International

Financial Statistics are used since data are not available at the bank level.[23] Correspondingly, averages are used for bank-level data. The second stage is to use the fitted values of lending rates to estimate equation (8). The results of the regressions with all competition intensity indicators are reported in table 7. The coefficient on lending rate remains positive and significant, but the magnitude is smaller. The magnitudes and p-values of the coefficients for all competition indicators are generally similar to, and thus confirm, the results obtained previously.

The final study is to test if the impact of deregulation differs across banks of different sizes. As confirmed by the preliminary analysis in table 1, the literature (e.g. Bikker and Haaf, 2002) agrees that competition is intenser and increases more dramatically among large banks after deregulation, due to the fact that large banks mainly specialize in wholesale banking services, which are integrated to a much greater degree than is retail banking (Cabral et al., 2002). However, wholesale loans in general involve lower credit risk arising from information asymmetry, implying that a given increase in competition intensity may have a smaller impact on larger banks' loan screening practices. Also, the merger and acquisition activities that caused a significant increase in bank concentration since the second half of the 1990s mainly occurred among large banks (ECB, 2004), and may have affected their overall management, including credit risk management. The overall impact of the deregulation on large banks depends on all of the above factors.

Separate regressions are run for the three subsamples (small, medium-sized, and large banks). The results are reported in tables 8-1 to 8-2.[24] For all three groups, the parameters for the deregulation dummy (not presented in the tables) and the survey indicator are inconsistent with different dependent variables, but are significant when the signs are "correct". As before, the coefficient estimates for the concentration measures from various sources are inconsistent (only the Herfindahl index calculated from the Bankscope data set is reported).

Small banks and medium-sized banks seem to behave in a similar way. The coefficient

[23] Alternatively, interest income-to-loan ratio can be used to represent bank-level lending rate. The second stage results are similar.

[24] The H-statistic cannot be estimated by year and country for the large bank group due to insufficient observations. Regressions incorporating interactions between the competition indicators and other variables are also run, where none of the interaction terms is significant.

on interest margin for both groups is consistently positive and mostly significant. This is clear evidence that lower credit risk is associated with intensified competition for these banks. Even though smaller banks mainly focus on retail and domestic banking services and the markets are more segregated, the nature of retail banking, such as traditional loans to consumers and small to medium-sized businesses, likely enables banks to have more scope to improve credit quality through prudent lending practices. In contrast, the coefficient is inconsistent and insignificant for the large bank group across the regressions with different dependent variables. Thus, even though the large bank group have the greatest declines in interest margin, non-performing loans, and loan loss provision (table 1), after accounting for other factors, there is no evidence of connection between interest margin decline and loan quality improvement, probably because mergers and acquisitions mainly occurred among these banks. Further, the parameter signs for the concentration measures are generally consistent and "correct" for large banks, indicating the increased concentration after deregulation may have negative impact on their loan quality. This result is consistent with Gropp and Vesala (2004). However, note that here, the cause of the possible negative impact of deregulation is not increased competition, but increased market concentration.

6. CONCLUDING REMARKS

This paper studies the effect of banking deregulation, characterized by removing entry restrictions, on banks' credit risk. The theoretical model shows that when entry restrictions are removed, an incumbent bank screens loan applicants more intensively, resulting in a lower credit risk. The strengthened screening is accompanied by a lower lending rate, implying that the commonly believed trade-offs between credit risk and lower prices of banking services do not necessarily exist.

The empirical study using bank-level balance sheet data and macroeconomic data for the EU-15 countries supports this theoretical result. Competition intensified after the completion of the Second Banking Directive, indicated by the removal of cross-border entry restrictions and the restructuring and re-regulation measures taken within each market in promoting domestic competition. The data reveal that after the deregulation,

net interest margin declined in most countries along with non-performing loans and loan-loss provisions. Applying dynamic linear regressions after comprehensive misspecification tests, strong evidence is found that the decline in interest margin is associated with loan quality improvement for the pooled data and for most individual countries. Further, the improvement in loan quality seems more evident for small and medium-sized banks and in the countries where competition was reported to have larger increases. However, a high market concentration or a sharp increase thereof may weaken or remove the connection between loan quality improvement and lower interest margin, as seen in the regressions by country. This result indicates that the continued increase in market concentration caused by merger and acquisition activities since the late 1990s is likely to decelerate the process for the EU to reap the benefits from enhanced competition.

Since the implementation of the Second Banking Directive, new bank establishment and cross-border entry have not been intense across the EU-15 countries, causing doubts about the effects of deregulation and the contestability of the banking market. However, one should not look just at these activities in assessing the effect of deregulation on enhancing competition. The results of this paper suggest potential entry could produce competition pressure great enough to change domestic banks' behavior. This effect is positive and stabilizing in that it promotes information gathering and processing, or "knowing the customers". In this regard, this paper is pertinent to the literature on relationship banking. As noted in Petersen and Rajan (1995), competition lowers the value of, and hence may harm, the relationship between borrowers and lenders, and make it more difficult for young firms to acquire credits. Here, competition pressure induced by deregulation not only does not destroy, but promotes the exploration of, the lending relationship. In the European Union, the anticipation of competition intensification also prompted domestic reforms in each market, further strengthening the benefit.

Issues related to this study can be further explored. The data set used in the empirical study covers only a small portion of the banks in the early 1990s, but has a better coverage for the later period. A data set with more even coverages should serve the purpose better. Also, the study does not cover the period beyond 1999. Although this has the benefit of avoiding being entangled with the shock caused by the introduction of the single currency, some issues may be better studied using an extended data set. For example, no significant

evidence is found here that banks' shift of business focuses toward non-interest income has an impact on loan quality. However, as loan securitization accelerates after the creation of the euro, evidence may emerge later.

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