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On the Coexistence of Banks and Markets*

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Abstract

We examine the coexistence of banks and financial markets by studying a credit market where the qualities of investment projects are not observable and the investment decisions of entrepreneurs are not contractible. Standard banks can alleviate moral-hazard problems, while financial markets operated by investment banks can alleviate adverse-selection problems. In competition, standard banks are forced to increase repayments, since financial markets can attract the highest-quality borrowers. This, in turn, increases the share of shirkers and may make lending unprofitable for standard banks. The coexistence of financial markets and standard banks is socially inefficient. The same inefficiency may occur with the entrance of sophisticated banks, operating with a combination of rating and ongoing monitoring technologies.

Keywords: Debt contract; adverse selection; moral hazard; coexistence of financial intermediaries; regulation

JEL classification: *G*24; *G*28; *G*32; *G*38; *D*80; *D*92; *D*43

I. Introduction

We consider a credit market in which creditors can observe neither the quality of investment projects, nor whether entrepreneurs are investing and thus generating large enough returns to pay back their loans. Lenders therefore face a combined adverse-selection and moral-hazard problem. We examine how banks and financial markets compete in this credit market. The first type, called the standard commercial bank (henceforth standard bank), can act as a delegated monitor in the sense of the term used by Diamond (1984) and can reduce the private benefits of entrepreneurs who do not invest. Therefore standard banks can alleviate moral-hazard problems. Standard banks, however, face competition from financial markets, whereas

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investment banks and rating agencies are able to assess projects and can determine the quality of investment projects. We examine whether it is socially desirable for financial markets and standard banks to be present simultaneously.

Moreover, the current banking regulation in the Basel II Framework forces banks to become more sophisticated in the screening and rating of entrepreneurs. Hence, we also investigate the consequences for welfare when sophisticated banks that combine screening and monitoring technologies enter the scene.

Our conclusions are as follows. First, if the pool of entrepreneurs is good enough, standard banks that compete with other standard banks only will offer loans to all entrepreneurs. Second, if only financial markets are present and screening costs are not too high, only borrowers with the best projects will obtain credit. Third, in competition, standard banks are forced to increase repayments, since financial markets can attract the highest-quality borrowers. This, in turn, increases the share of shirkers, which is socially inefficient if social welfare is measured by aggregate production. If standard banks and financial markets coexist, social efficiency is always lower compared to a situation where only standard banks exist. Regulations prohibiting the coexistence of banks and specialized lenders might be beneficial.

Fourth, if the attractiveness of the remaining pool of entrepreneurs for standard banks decreases too much when financial markets are present, standard banks will drop out of the market. Entrepreneurs with intermediate qualities will not obtain loans, even if they have valuable projects. Since the presence of financial markets prevents intermediate-quality entrepreneurs from obtaining loans due to the exit of standard banks, the presence of financial markets can again create social inefficiencies.

To sum up, the presence of financial markets can create social inefficiencies, since the share of shirkers may increase or intermediate borrowers may not be able to obtain loans. We conclude by examining the issue of whether sophisticated banks with access to both types of monitoring technologies might obviate the social inefficiencies created by financial markets. Fostering the development of such banks is one of the main objectives of Basel II. We show that, depending on parameters, sophisticated banks either act as separate financial markets and standard banks, thus producing the same social inefficiencies, or they use both monitoring technologies, which definitively improves welfare.

Our paper is related to different strands in the literature. Its first topic is about competition between banks. Comprehensive surveys on bank competition can be found in Bhattacharya and Thakor (1993), Hellwig (1994), Allen and Santomero (1998) and Bhattacharya, Boot and Thakor (1998). We branch out from this literature by considering the coexistence of financial intermediaries with different specializations in the presence of

moral hazard and adverse selection. We show that the interaction of adverse selection and moral hazard creates social inefficiencies in credit markets when standard banks compete with financial markets or sophisticated banks.

Second, a wealth of research has addressed and enlarged upon the coexistence of bank lending and bond financing: Besanko and Kanatas (1993), Hoshi, Kashyap and Scharfstein (1993), Chemmanur and Fulghieri (1994), Boot and Thakor (1997), Holmström and Tirole (1997), von Thadden (1999), Bolton and Freixas (2000), Repullo and Suarez (2000) and Allen and Gale (2004). Our main contribution to this literature is to examine the coexistence of banks and financial markets when the pool of borrowers is plagued simultaneously by moral hazard and adverse selection. Further discussions of related literature can be found in Gersbach and Uhlig (2006b).

We can interpret standard banks as commercial banks that monitor borrowers to ensure promised investment activities and alleviate moral-hazard problems. In financial markets, investment banks and rating agencies specialize in screening entrepreneurs with creditworthiness tests. Investment banks and rating agencies do not engage in continuous monitoring of investment behavior. Thus financial markets with investment banks and rating agencies can mainly alleviate adverse-selection problems.[1] Accordingly, our analysis points up the potential negative feedback effects from banking regulation in the form of the new Accord Basel II that aims at increasing the sophistication of banks with respect to their screening and rating capabilities. As our model indicates, such attempts at banking regulation may not produce welfare gains if sophisticated banks tend to specialize in investment banking and threaten the economic role of standard commercial banks. Even if standard banks can survive, the proportion of shirkers in the economy will increase.

The paper proceeds as follows. In the next section we outline the model. Then we separately examine standard banks in Section III and financial markets in Section IV. Section V focuses on the coexistence of standard banks and financial markets. In Section VI we examine sophisticated banks. Section VII concludes.

II. The Model

There are two periods, *this period* and the *next period*. We consider a finite number k of entrepreneurs who have access to a project but do not have the funds to finance it. Entrepreneurs are of different types $j = 1, \ldots, n$.

[1] The informational role of underwriters is shown, for example, in Beatty and Ritter (1986), Booth and Smith (1986) and Carter and Manaster (1990). It is clear that commercial banks also invest resources in screening potential borrowers. Accordingly, when we examine sophisticated banks we also take their screening role into account.

Entrepreneurs of type j have a quality of $q_j \geq 0$. The probability that an entrepreneur is of type q_j is denoted by γ_j. To simplify notation we present our results normalized by the number of entrepreneurs, i.e., we set $k = 1$.

Qualities are labeled so that $0 \leq q_1 < q_2 < \cdots < q_n$, i.e., qualities q_j are strictly increasing in j. All projects are of equal size. Suppose that the initial costs for each project are $I + z$, but the entrepreneur's initial wealth is only z. Hence, an entrepreneur must borrow at least I for the project.

Given additional resources $I > 0$, he can choose to invest ($\delta_j = 1$) or not ($\delta_j = 0$). If he invests in this period, he receives the output

$$(I + z) \cdot q_j \tag{1}$$

in the next period. If the entrepreneur does not invest, the available funds are simply $I + z$. Entrepreneurs cannot have negative wealth in the next period.

Entrepreneurs can borrow additional funds from standard banks or from financial markets operated by investment banks. Lenders face the following informational asymmetries if they decide not to invest in monitoring. The quality q_j is known to the entrepreneur but not to lenders. Moreover, lenders cannot observe *a priori* whether or not an entrepreneur invests. Thus creditors face a fixed pool of seemingly identical borrowers. Lenders, however, can only observe and verify realized cash flows in the next period if the entrepreneur invests. If the entrepreneur does not invest but simply consumes the funds granted to him, lenders cannot expect any repayment.

It is useful to discuss the main assumptions of our model. The nonverifiability of the investment decision is a standard scenario. Projects often require specific human capital, or they may need the design of blueprints for machinery, buildings or logistics. In the case of an inventor, considerable time may be devoted to reading and designing. Whether these efforts are directed toward the project and whether blueprints are competently drafted is unlikely to be observable for a standard bank. Even if it becomes clear to the standard bank *ex post* whether or not the entrepreneur has invested, investment decisions are not verifiable in court.

The second assumption of our model is that the verification of output conditional on investment is possible at low or zero costs, while entrepreneurs have large private benefits if they do not invest. This assumption is justified by the possibilities available to standard banks of securing the repayments if entrepreneurs invest. Monitoring to secure repayments takes many forms: inspection of firms' cash flow when customers pay, and efforts to collateralize assets if they have been created in the process of investing and selling products to customers. If the final products of an entrepreneur's project are physical goods, such as houses or machines, standard banks can secure repayment conditional on investment at very low costs. For

simplicity, we assume that the costs of verifying cash flow are zero if the entrepreneur has invested.

Our assumption—non-verifiability of investments, but verifiability of project output—is a simple way of modeling moral hazard. Two remarks are in order. An arbitrarily small probability $\varepsilon(\varepsilon > 0)$ could be introduced such that investment returns are 0 with probability ε and $q_j(I + z)$ with probability $1 - \varepsilon$. This would strengthen the non-verifiability of investment assumptions.[2] Second, as documented in the empirical banking literature, monitoring activities to ensure promised investment activities by borrowers and to prevent funds from being diverted is an important aspect of the activities of commercial banks; see e.g. James (1987), Lummer and McConnell (1989), Berger and Udell (2002) and Petersen (2004). The assumption that entrepreneurs who do not invest consume their funds does not need to be taken literally. For instance, entrepreneurs may want to build empires and may misuse funds for such purposes, which creates a similar moral-hazard problem as in the current model.

Standard banks and financial markets specialize in certain monitoring technologies to alleviate informational asymmetries. Standard commercial banks act as delegated monitors and alleviate the moral-hazard problem to some extent by securing non-zero repayment if entrepreneurs do not invest.

Investment banks and rating agencies that operate in financial markets specialize in alleviating adverse-selection problems. They can screen entrepreneurs by creditworthiness tests, as in Bröcker (1990), and then decide whether or not to issue debt on behalf of entrepreneurs. In contrast to standard banks, investment banks in financial markets only interact with entrepreneurs at the stage when debt contracts are issued and do not engage in continuous monitoring of investment behavior.

Crucial for our analysis is the fact that agents in financial markets may tend to specialize in alleviating moral-hazard or adverse-selection problems. For instance, a rating agency or an investment bank acquires knowledge about industries in which borrowers are engaged and can therefore perform reliable creditworthiness tests. Other financial institutions, such as commercial banks, acquire knowledge about inspecting the firms' cash flow when customers pay, or invest in efforts to collateralize assets if they are created in the process of investing or selling products. We explore the exact nature of these different specializations by financial institutions in subsequent sections.

There are potentially H standard banks indexed by i or h with $i, h = 1, \ldots, H$ that can enter the credit market, and financial markets are

[2] Since entrepreneurs can consume their funds when they do not invest, there is no way for banks to punish non-investing entrepreneurs because they can always claim that their investments were unsuccessful.

operated by investment banks. Standard banks and investors in capital markets are assumed to be risk-neutral. For simplicity of presentation, the opportunity cost of funds is normalized to zero. We summarize the game as follows:

(1) Standard banks and investment banks that operate financial markets simultaneously decide whether or not to enter and which contract to offer to investors upon entering.
(2) Entrepreneurs simultaneously choose standard banks or choose to borrow from financial markets via investment banks.
(3) Banks finance themselves at the opportunity cost of funds. Funded entrepreneurs make a decision on whether to invest.
(4) Payoffs are realized and repayments occur.

An equilibrium of this game is a pure-strategy, perfect Bayesian Nash equilibrium. It is a self-selection model where standard sorting devices, such as collateral, cannot be used to separate bad from good entrepreneurs; see Bester (1985, 1987).

We additionally assume four tie-breakers in the case of indifference on the part of the entrepreneurs. We describe them briefly here and in greater detail in the analysis below. First, entrepreneurs who are indifferent between investing and not investing always choose to invest. Second, investing entrepreneurs who are indifferent between several standard banks or between several contracts issued by investment banks on behalf of entrepreneurs will choose between standard banks or investment banks with equal probability. Third, entrepreneurs who are indifferent between standard banks and financial markets will go to financial markets. Fourth, entrepreneurs who choose not to invest will randomize across their preferred standard banks in order to mimic the investing entrepreneurs.[3] The first three tie-breaker rules are standard and innocuous, while the fourth tie-breaker rule is critical to the analysis.

We conclude the description of the game by deriving the first-best allocation. For that purpose, we assume that there is a fixed pool of savings, denoted by S. We assume that savings exceed the volume of loans if all entrepreneurs have obtained a credit. Since we have normalized the number of entrepreneurs, k, to 1, the condition amounts to $S > I$.[4] All savings not channeled to entrepreneurs are assumed to be invested in a

[3] Since investment banks that operate financial markets can screen projects, they will be able to avoid and reject shirkers who apply for credit contracts.
[4] Note that banks are assumed to have unlimited access to funds at a zero interest rate. As credit decisions are taken before banks finance themselves, the condition $S > I$ ensures that no bank will be rationed by deposits.

frictionless technology that generates the opportunity costs of funds. Then welfare is defined as the value of aggregate resources in stage 4. Let $j^* = \min\{j \mid q_j \geq 1\}$. Hence j^* is the first index value for which the return of the investment project is greater than, or equal to, the opportunity costs of funds. The first-best solution is characterized by the absence of informational functions and by a social planner that grants loans and enforces investment decisions in order to maximize aggregate output.

Proposition 1. *The first-best solution is characterized as follows. An entrepreneur obtains a loan and has to invest if, and only if*, $q_j \geq 1$, *i.e., iff* $j \geq j^*$.

In other words, the social planner dictates that there should be investment in all projects that at least meet the opportunity costs. The proposition is obvious. Welfare in the first-best allocation, denoted by W^{FB}, is given by

$$W^{FB} = \sum_{j \geq j^*} \gamma_j q_j (I + z) + \left(S - \left(\sum_{j \geq j^*} \gamma_j \right) I \right) + \left(\sum_{j < j^*} \gamma_j \right) z. \quad (2)$$

The first term in W^{FB} represents the output of entrepreneurs who have received loans and have invested. The last two terms capture the output from investing the remaining funds in the frictionless technology.

III. Standard Banks Only

We now study competition between standard banks. We assume that these banks offer debt contracts. A theoretical justification is given in Gersbach and Uhlig (2006a), which can easily be extended to standard banks with monitoring technologies, such as those considered here.

A debt contract offered by bank i ($i = 1, \ldots, H$), denoted by $D(R_i)$, is characterized by a repayment R_i that is independent of the type j. Moreover, under a debt contract the standard bank i obtains $q_j(I + z)$ if the entrepreneur has invested but cannot pay back R_i since control will shift to the creditor.

Standard banks are assumed to have access to a monitoring technology. If a bank offers a loan contract to an entrepreneur and pays a resource cost m, $m \geq 0$, it can secure a repayment of αI ($0 < \alpha \leq 1$) from the entrepreneur if he does not invest. Hence, a non-investing entrepreneur only obtains $z + (1 - \alpha)I$. If the entrepreneur invests, the bank obtains $\min\{R_i, q_j(I + z)\}$. Note that the resource cost m has to be paid before the bank observes shirking on the part of entrepreneurs. We assume throughout the

paper that m is small enough for standard banks always to decide to monitor when they grant loans. A necessary condition is $m < \alpha I$.[5]

Consider an entrepreneur of type j. If there is at least one contract for which investing is weakly better than not investing, we assume that the entrepreneur will always choose to invest (this is the first tie-breaker mentioned above) and will select any of the standard banks at which the payoff is maximized with equal probability (the second tie-breaker).

All entrepreneurs for whom not investing is strictly better than investing are *shirkers* and will not invest. Shirkers will choose the standard bank that offers the highest payoff. Hence they prefer standard banks that do not monitor to standard banks that invest in monitoring. They are indifferent among the set of standard banks if, as we have assumed, all standard banks invest in monitoring.

To break that indifference we apply our fourth tie-breaker rule. We assume that shirkers distribute themselves across the standard banks in exactly the same way as investors do. A justification for this assumption is given in Gersbach and Uhlig (2006a).[6]

Bertrand competition will ensure that in any equilibrium, standard banks will demand the same repayment, which is denoted by R^b. The entrepreneur who is indifferent between investing and not investing when applying for a standard bank credit is denoted by q^{SB} and given by

$$q^{SB}(I+z) - R^b = (1-\alpha)\cdot I + z \tag{3}$$

$$q^{SB} = 1 + \frac{R^b - \alpha I}{I+z}. \tag{4}$$

Note that q^{SB} increases with the repayment because a higher repayment will increase the incentive to shirk. The expected profits for standard banks are denoted by $G^b(R^b)$ and are given by

$$G^b(R^b) = \sum_{q_j < q^{SB}(R^b)} \gamma_j(\alpha I - I - m) + \sum_{q_j \geq q^{SB}(R^b)} \gamma_j(R^b - I - m). \tag{5}$$

Let R^* be the interest rate standard banks will charge under Bertrand competition. The standard Bertrand undercutting argument implies that

$$R^* = \min\{R \mid G^b(R) \geq 0\}. \tag{6}$$

Equation (5) implies that R^* exists if the pool of investors is of sufficiently high quality and/or the monitoring technology in terms of the pair

[5] If we use $F(q)$ to denote the proportion of entrepreneurs with $q_j > q$, a sufficient condition is $m < \alpha I F(1)$, since the proportion of shirkers standard banks face is at least $F(1)$.

[6] If all entrepreneurs are shirkers, we assume that shirkers distribute themselves arbitrarily across standard banks. Since this case does not occur in equilibrium or in any relevant deviation strategies, the assumption is harmless.

(α, m) is sufficiently effective, i.e., if α is sufficiently high and m comparatively low. We summarize our observations in the following proposition:

Proposition 2. *Suppose that R^* exists and that only standard banks are present. Then there exists a unique equilibrium in which standard banks offer debt contracts at repayment R^*.*

In the following we assume that R^* exists. Otherwise, there would be no economic role for standard banks.

IV. Financial Markets Only

Let us assume that there is a finite number of investment banks that operate financial markets. An investment bank has access to a creditworthiness test. If an investment bank invests $c > 0$ per credit, it can detect the quality of the project when the entrepreneur applies for a debt contract and has the option of issuing debt on behalf of the entrepreneur. We interpret c as the overall cost of a creditworthiness test and placement and settlement of one debt contract. Different levels of c may be associated with different levels of financial development. A high level of c corresponds to financial institutions where direct financing operated by investment banks is less highly developed. There are two options for investment banks entering into an agreement with a borrower. First, they can decide to undertake a creditworthiness test and then decide whether to issue debt contracts on behalf of the entrepreneurs by pledging the entrepreneurs' capacity to pay back consumers. Second, they can issue debt contracts themselves and then decide whether to undertake a creditworthiness test and to offer debt contracts to a borrower. We work here with the first variant because it is closer to the actual behavior of financial markets.

We assume that investment banks either perform a creditworthiness test before issuing debt on behalf of investors, or they do not enter the market.[7] Obviously, an investment bank will only issue debt on behalf of investors if the project is of sufficiently high quality. Let q^{FM} denote the critical quality level above which entrepreneurs receive credit. A credit contract offered by an investment bank on behalf of investors is denoted by $C^v(R^v_{q_j}, q_j \geq q^{FM})$. $R^v_{q_j}$ is the repayment demanded from an entrepreneur who turns out to be of quality $q_j \geq q^{FM}$ when screened by an investment bank. The expected profit of a bank from a loan to an entrepreneur with quality level q_j who invests is given by $G^v_{q_j} = R^v_{q_j} - I - c$.

[7] The screening condition requires that the screening costs c be below some critical level that can be determined by using the subsequent propositions.

We assume that the entrepreneur is charged for the costs of the creditworthiness test up front, which he must then pay for from his initial wealth z. If the test turns out to be positive, i.e., $q \geq q^{FM}$, the investment bank grants a credit of $I + c$. If the test yields $q < q^{FM}$, the entrepreneur bears the cost.

The assumption allows investment banks to deter entrepreneurs of lower quality than q^{FM} from applying for credit. Otherwise, investment banks would need to be concerned about the incentives of entrepreneurs with $q < q^{FM}$ for applying for creditworthiness tests. Once an investment bank performs the test, pays c, and discovers that $q < q^{FM}$, the entrepreneur could negotiate a lower repayment with the investment bank because c is sunk. We obtain:

Proposition 3. *Suppose that only financial markets operated by investment banks are present. Then there exists a unique equilibrium with*

$$R^v_{q_j} = R^{v*} = I + c \tag{7}$$

$$q^{FM*} = 1 + \frac{I + c}{I + z}. \tag{8}$$

The proof of Proposition 3 is given in the Appendix. Proposition 3 shows that only entrepreneurs with $q \geq q^{FM*}$ will have access to financial markets. Financial markets avoid shirkers but limit access to the market.

V. Standard Banks and Financial Markets

We now examine the coexistence of standard banks and financial markets. Since there is Bertrand competition between standard banks, we simplify the derivation by assuming that all standard banks offer the same interest rate, denoted by R^b. Obviously, we have to show that in the proposed equilibria no standard bank wants to deviate.

To determine the equilibria we proceed in two steps. First, we determine the profits of standard banks under the assumption that repayments to the said banks will always be higher than in financial markets. Hence all entrepreneurs contemplating investment would like to obtain credit from financial markets. Standard banks thus anticipate that they will not attract entrepreneurs above a certain quality level, denoted by $\bar{q}$. In the second step, we discuss whether this is indeed an equilibrium.

The expected profits for standard banks, depending on the quality level $\bar{q}$, are denoted by $G^b(\bar{q}, R^b)$ and are given by

$$G^b(\bar{q}, R^b) = \sum_{q_j < q^{SB}(R^b)} \gamma_j(\alpha I - I - m) + \sum_{\bar{q} \geq q_j \geq q^{SB}(R^b)} \gamma_j(R^b - I - m). \tag{9}$$

Let

$$R^{b*}(\bar{q}) = \min\{R^b \mid G^b(\bar{q}, R^b) \geq 0\}. \tag{10}$$

Obviously $R^{b*}(\bar{q})$ may not exist. In general, $R^{b*}(\bar{q})$ exists if the pool of investors below $\bar{q}$ is of sufficiently high quality and the monitoring technology in terms of the pair (α, m) is sufficiently effective. Note that

$$R^{b*}(q_n) = R^* = \min\{R \mid G^b(q_n, R) \geq 0\}. \tag{11}$$

We immediately obtain

Lemma 1. *Suppose that $R^{b*}(\bar{q}^1)$ exists for some $\bar{q}^1 < q_n$. Then $R^{b*}(\bar{q})$ exists for all $\bar{q} \in [\bar{q}^1, q_n]$ and is monotonically decreasing in $\bar{q}$.*[8]

The proof of Lemma 1 follows directly from equation (9). The preceding analysis allows us to establish equilibria when both standard banks and investment banks that operate in financial markets compete for borrowers.

Proposition 4. *Suppose that R^* exists.*

(*i*) *If $R^* < I + c$, there exists a unique equilibrium in which only standard banks are active and offer debt contracts at a repayment rate of R^*.*

(*ii*) *If $R^* \geq I + c$, investment banks will offer debt contracts on behalf of entrepreneurs at a repayment rate of $R^{v*} = I + c$ for all entrepreneurs with*

$$q_j \geq q^{FM*} = 1 + \frac{I + c}{I + z}.$$

(*a*) *If $R^{b*}(q^{FM*})$ exists, standard banks offer debt contracts at a repayment rate of*

$$R^{b*}(q^{FM*}) > R^{v*} = I + c$$

and attract all entrepreneurs with $q_j < q^{FM*}$.

(*b*) *If $R^{b*}(q^{FM*})$ does not exist, standard banks do not offer any contracts, and only entrepreneurs with $q_j \geq q^{FM*}$ receive credit contracts.*

The proof of Proposition 4 is given in the Appendix. The second part of Proposition 4 shows how financial markets and standard banks might coexist. Only entrepreneurs with $q_j \geq q^{FM*}$ are able to access financial markets. Entrepreneurs with $q_j < q^{FM*}$ face higher repayments but have no other

[8] Note that $R^{b*}(\bar{q})$ is a step function.

choice than to go to standard banks. As such entrepreneurs will be monitored by standard banks, some of them are willing to invest upon receiving a loan. If monitoring technology in terms of the pair (α, m) is sufficiently effective and the pool of entrepreneurs with $0 \leq q_j \leq q^{FM*}$ is sufficiently attractive, then $R^{b*}(q^{FM*})$ exists and standard banks and financial markets coexist.

It is important to stress that the coexistence of standard banks and financial markets does not depend on the fact that the cost of monitoring m for standard banks is much smaller than the cost of a creditworthiness test. Suppose, for instance, that $\alpha = 1$. Then the equilibrium condition for standard banks amounts to

$$G^b(q^{FM*}, R^b) = \sum_{q^{FM*} \geq q_j \geq q^{SB}(R^b)} \gamma_j (R^b - I) - m \left(\sum_{q_j \leq q^{FM*}} \gamma_j \right) \geq 0. \tag{12}$$

Now it is possible for $R^{b*}(q^{FM*})$ to exist even if $m \geq c$. For instance, if $m = c$ and the share of entrepreneurs in

$$\left[1 + \frac{2c}{I + z}, 1 + \frac{I + c}{I + z} \right]$$

is at least $\frac{1}{2}$, we have $G^b(q^{FM*}, I + 2c) \geq 0$, and hence R^{b*} exists.

Proposition 4 also implies that the presence of investment banks that operate in financial markets can lead to a breakdown of financing for the remaining borrowers. This occurs if standard banks face an unattractive pool of entrepreneurs in $[q_1, q^{FM*}]$ and monitoring technologies in terms of (m, α) are not highly effective.

To determine the social efficiency of the presence of financial markets, we recall that savings not channeled to entrepreneurs are invested at the opportunity costs of funds. We denote the welfare in the three different cases by W^{SB}, $W^{SB,FM}$ and W^{FM}, respectively. We then obtain

Proposition 5

(*i*) *If* $R^* < I + c$, *welfare is given by*

$$W^{SB} = \sum_{q_j \geq q^{SB}(R^*)} \gamma_j (q_j (I + z)) + \sum_{q_j < q^{SB}(R^*)} \gamma_j (I + z) + (S - I - m). \tag{13}$$

(*ii*) *If* $R^* \geq I + c$

(*a*) *If* $R^{b*}(q^{FM*})$ *exists, welfare is given by*

$$W^{SB,FM} = \sum_{q_j \geq q^{SB}(R^{b*}(q^{FM*}))} \gamma_j(q_j(I+z)) + \sum_{q_j < q^{SB}(R^{b*}(q^{FM*}))} \gamma_j(I+z) + S - I - c\sum_{q_j \geq q^{FM*}} \gamma_j - m\sum_{q_j < q^{FM*}} \gamma_j. \quad (14)$$

(*b*) *If* $R^{b*}(q^{FM*})$ *does not exist, welfare is given by*

$$W^{FM} = \sum_{q_j \geq q^{FM*}} \gamma_j(q_j(I+z)) + \left(S - (I+c)\sum_{q_j \geq q^{FM*}} \gamma_j\right) + \sum_{q_j < q^{FM*}} \gamma_j z. \quad (15)$$

The first term in W^{FM} is the value of production from investing entrepreneurs. The last two terms represent the investment of the remaining funds in the frictionless technology and the consumption of the entrepreneurs. The preceding proposition immediately allows us to characterize the constellations in which the joint presence of financial markets and standard banks is socially inefficient. For our main result, we assume for the moment that monitoring and screening costs are sufficiently low and can be disregarded.

Proposition 6. *Suppose that initially only standard banks are present. Then, the entrance of investment banks that operate financial markets is socially inefficient if, and only if,*

(*i*) – *entrepreneurs of high quality benefit from and obtain financing through capital markets* ($R^* \geq I + c$) *and*
– *standard banks make non-negative profits with the pool of entrepreneurs who do not have access to capital markets (*$R^{b*}(q^{FM*})$ *exists);*

or

(*ii*) – *entrepreneurs of high quality benefit from and obtain financing through capital markets* ($R^* \geq I + c$),
– *standard banks cannot make non-negative profits with the remaining pool of entrepreneurs who do not have access to capital markets and drop out* ($R^{b*}(q^{FM*})$ *does not exist), and*
– *entrepreneurs of higher quality than those investing with standard banks alone obtain capital market financing* ($R^* - \alpha I < I + c$).

The proof of Proposition 6 is given in the Appendix. We observe that the presence of investment banks that operate financial markets is socially inefficient in two cases. In particular, if standard banks and financial markets coexist, the outcome is necessarily socially inefficient.[9]

The presence of financial markets is irrelevant if screening costs are sufficiently high and socially efficient if screening costs are sufficiently low, such that standard banks drop out of the market and more intermediate quality borrowers will obtain credit than with standard banks alone, i.e., if $q^{FM*} < q^{SB}(R^*)$.

In Proposition 6, we have neglected monitoring and screening costs. We now discuss how our results need to be modified in the presence of such costs. Clearly, the first point in Proposition 6 holds under the stated assumptions if $m \leq c$, since the presence of financial markets would increase resource costs for banking activities. The second part holds as long as investment gains under standard banks outweigh the potential savings of screening costs when only investment banks that operate in financial markets are present.[10]

The last two propositions illustrate that there is a non-monotonical relationship between the efficiency of the monitoring technology of investment banks that operate in financial markets and social welfare. Suppose that, for investment banks, the cost c of judging investment projects is sufficiently high, so that $R^* < I + c$. Standard banks will then offer credit to all entrepreneurs. If c declines to a level that permits the coexistence of standard banks and financial markets or drives standard banks out of the market, the resulting allocation is less efficient. If, however, c shrinks even more, investment banks will reduce repayments to entrepreneurs for whom they issue debt contracts, thus allowing more entrepreneurs to obtain credit, which is socially more beneficial.

There have been many debates about the historical absence in continental Europe of certain types of financial intermediaries, such as venture capitalists or highly developed markets for investment banks. This is often ascribed to regulations rather than to a lack of entrepreneurial spirit. One interpretation in the light of the arguments set out above is that such a situation may protect standard banks. If financial markets were to develop for the same borrower classes, this could destroy existing credit markets. Clearly, other arguments need to be added in order to obtain a balanced perspective on such policy issues. However, our theoretical predictions show that the introduction of banks which specialize in creditworthiness tests may

[9] If the opportunity cost of funds is positive, we obtain a countervailing effect since shirkers no longer generate the opportunity cost of funds. However, the presence of financial markets is still inefficient if the share of intermediate quality borrowers is sufficiently large.

[10] Savings of screening costs occur if $c < m$ or $c > m$ and $m > c \sum_{q_j \geq q^{FM*}} \gamma_j$.

hamper the functioning of credit markets, even if the monitoring technologies available to financial intermediaries improve.

VI. Sophisticated Banks

Finally, let us consider a sophisticated financial intermediary that has access to both types of monitoring technologies. The development of such banks is the objective of the new Basel II Framework for banking regulation. Consider a situation where initially only standard banks are present. How sophisticated banks behave in competition with standard banks depends crucially on parameter comparisons. Let us consider this in more detail.

Suppose sophisticated banks can use both monitoring technologies. Bertrand competition ensures that repayments are $I+c+m$. A sophisticated bank will be able to finance all entrepreneurs of a quality above a critical level, denoted by q^{soph}, and given by

$$q^{soph}(I+z)-(I+c+m)=(1-\alpha)\cdot I+z \tag{16}$$

$$q^{soph}=1+\frac{I+c+m-\alpha I}{I+z}. \tag{17}$$

Hence a sophisticated bank can offer credit contracts such that all entrepreneurs who turn out to have a quality above q^{soph} in the creditworthiness test will obtain loans. Bertrand competition ensures that the repayment sophisticated banks offer to such entrepreneurs is equal to $I+c+m$.

We now characterize the equilibrium behavior of sophisticated banks. Since sophisticated banks can behave as investment banks, standard banks, or genuinely sophisticated banks, we can directly formulate the coexistence result in the following proposition, which is proved in the Appendix.

Proposition 7. *Suppose that R^* exists:*

(*i*) *If $R^* < I+c$, only standard banks and sophisticated banks acting as standard banks are active and offer debt contracts at R^*.*

(*ii*) *If $R^* \geq I+c$, investment banks and sophisticated banks acting as investment banks offer debt contracts at $R^{v*}=I+c$ for all entrepreneurs with $q_j \geq q^{FM*}$.*

  (*a*) *If $R^{b*}(q^{FM*})$ exists and if $R^{b*}(q^{FM*}) < I+c+m$, standard banks and sophisticated banks behaving as standard banks offer debt contracts at $R^{b*}(q^{FM*})$.*

  (*b*) *If $R^{b*}(q^{FM*})$ does not exist or if $R^{b*}(q^{FM*}) \geq I+c+m$, sophisticated banks offer debt contracts at repayment $R^{soph*}=I+c+m$ for entrepreneurs with $q^{soph} \leq q_j < q^{FM*}$. Standard banks are not active.*

The proof of Proposition 7 is given in the Appendix. The preceding proposition shows that standard banks and sophisticated banks can never coexist. If $R^* \geq I + c$, sophisticated banks may act as investment banks that operate financial markets and as standard banks for the remaining entrepreneurs. Hence, in this case, they would produce the same social inefficiencies as discussed earlier. Alternatively, they apply both types of monitoring technologies, which may be socially efficient.[11] The former case indicates that regulations such as Basel II, aimed at increasing the sophistication of banks, may lead to welfare losses if monitoring technologies are not efficient enough.

VII. Conclusion

In this paper we have identified a potential problem when capital markets operated by investment banks and standard commercial banks compete. If standard banks face competition from financial markets in which investment banks perform creditworthiness tests, welfare may decrease. Since financial markets can attract the highest quality borrowers, standard banks are forced to increase repayments. This, in turn, leads to less productive investments. We have outlined potential applications of the coexistence problem of financial intermediaries and financial markets when regulations aim to increase the sophistication of financial institutions.

Appendix

Proof of Proposition 3

It is obvious that Bertrand competition ensures $R_{q_j} = I + c$ for all investing entrepreneurs if the investment is riskless. Repayments in this case must cover the opportunity cost of funds and the resources needed to perform creditworthiness tests. Given the repayment $R^{v*} = I + c$, the lowest quality entrepreneur who still invests is determined by $q^{FM*}(I + z) - R^{v*} = I + z$, which implies

$$q^{FM*} = 1 + \frac{I + c}{I + z}.$$

Hence, for $q \geq q^{FM*}$ the investment is indeed riskless. ■

Proof of Proposition 4

(i) The first point follows directly, since financial markets could not attract any entrepreneurs. In turn, if investment banks offer $R^{v*} = I + c$ in financial markets,

[11] The condition is $q^{SB}(R^*) > q^{soph}$.

standard banks can successfully undercut them in terms of repayments and attract all investors.

(ii) If $R^* \geq I + c$, competition between investment banks in financial markets requires that $R^{v*} = I + c$. Since $R^{b*}(q_n) = R^* > R^{v*}$ and R^{b*} is monotonically decreasing in q, standard banks can never successfully undercut investment banks operating in financial markets. Hence all entrepreneurs with $q_j \geq q^{FM*}$ will be attracted by financial markets. Standard banks will enter and offer credit contracts to the remaining population of entrepreneurs if, and only if, they can make non-negative profits and hence if, and only if, $R^{b*}(q^{FM*})$ exists. This implies (ii)(a) and (ii)(b). If $R^{b*}(q^{FM*})$ exists, the competition of standard banks will induce each standard bank to charge $R^{b*}(q^{FM*})$ in equilibrium, as discussed earlier in the paper. ■

Proof of Proposition 6

There are two cases where the entrance of investment banks that operate financial markets is socially inefficient. The first case is characterized as follows:

- High-quality entrepreneurs benefit from, and obtain financing through, capital markets ($R^* \geq I + c$).
- Standard banks can make positive or zero profits with the pool of entrepreneurs who do not have access to capital markets. The relevant condition is that $R^{b*}(q^{FM*})$ exists.

Since standard banks need to offer higher repayments to the remaining pool of borrowers ($R^{b*}(q^{FM*}) > R^*$), entrepreneurs using standard banks have less incentive to invest. As high-quality entrepreneurs lured away by investment banks would have also invested if standard banks were present on their own, the entrance of investment banks decreases the overall share of investing entrepreneurs and is therefore inefficient. This proves the first case. The second case is characterized as follows:

- High-quality entrepreneurs with high quality benefit from, and obtain financing through, capital markets ($R^* \geq I + c$).
- Standard banks cannot make non-negative profits with the remaining pool of entrepreneurs and drop out ($R^{b*}(q^{FM*})$ does not exist).
- Only entrepreneurs of higher quality than those investing with the standard bank alone obtain financing through capital markets. The relevant condition is $q^{SB}(R^*) < q^{FM*}$, which translates into $R^* - \alpha I < I + c$.

In the second case, financial markets cause the exit of standard banks. As only high-quality entrepreneurs have access to financial markets, the share of investing entrepreneurs decreases, as intermediate entrepreneurs who would invest with standard banks alone do not have access to credit. ■

Proof of Proposition 7

The first point (i) is clear. For (ii) we observe that sophisticated banks have no incentive to monitor entrepreneurs with $q_j \geq q^{FM*}$, as standard banks do, as such

entrepreneurs will invest anyway. Hence for such entrepreneurs, sophisticated banks imitate investment banks and require a repayment of $R^{o*} = I + c$. Next, we note that our general assumption $\alpha I > m$ implies that $q^{soph} < q^{FM*}$. Hence for the range of quality levels $[q^{soph}, q^{FM*})$, sophisticated banks apply both monitoring technologies to an individual entrepreneur, as otherwise such entrepreneurs would shirk. If, however, $R^{b*}(q^{FM*}) < I + c + m$, standard banks that perform no creditworthiness test can offer better terms for the whole pool of entrepreneurs. Therefore sophisticated banks imitate standard banks for the pool of investors who do not apply for creditworthiness tests.

If $R^{b*}(q^{FM*})$ does not exist, standard banks are not active, and sophisticated banks offer a second type of debt contract to entrepreneurs with $q^{soph} \leq q_j < q^{FM*}$ at repayment $R^{soph*} = I + c + m$. Such entrepreneurs are screened and monitored to avoid shirking. Sophisticated banks act like truly sophisticated banks.

Finally, we discuss the case where $R^{b*}(q^{FM*})$ exists and is larger than $I + c + m$. We note that

$$q^{SB}(R^{b*}(q^{FM*})) = 1 + \frac{R^{b*}(q^{FM*}) - \alpha I}{I + z} \geq 1 + \frac{I + c + m - \alpha I}{I + z} = q^{soph}. \tag{A1}$$

Hence standard banks would only have shirkers in the remaining pool of entrepreneurs $[q_1, q^{soph}]$ and accordingly drop out of the market. ■

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