Asymmetric Information, Credit Rationing, and Investment[*]

Cornelia Neff

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1. Introduction: Adverse selection and moral hazard

EPITAPH. INTENDED FOR SIR ISAAC NEWTON, IN WESTMINSTER ABBEY
Nature, and Nature's laws, lay hid in night,
God said, "Let Newton be!" And all was light.
ALEXANDER POPE (1688 – 1744)

300 years after Newton, although we are "enlightened" to understand the laws of nature, our world is far from being deterministic. Instead, we have to make decisions under uncertainty: we buy goods whose quality is not exactly known, we hire workers before learning their actual productivity, or we insure drivers although we cannot observe their attitude towards risk. Some 20 years ago the subject of asymmetric information evolved as an area of active economic research. Incomplete and imperfect information affects economic contracting. Hereby, we usually distinguish between models of ex ante and ex post asymmetric information (cf. RASMUSEN 1994): In the ex-ante models, informational asymmetry occurs before the contract is signed. In the ex-post models an agent can make use of private information after the contract has been signed.

1.1 Asymmetric information ex ante

In this class of models, a certain characteristic of the agent is unknown to the principal, for example the level of a worker's computer knowledge, the health of a health insurance buyer, the quality of a used car. Incomplete information about the quality of a good or the type of the agent can lead to equilibria with adverse selection: only poor quality cars are sold, only sick people buy health insurance.

In the basic model of adverse selection, neither the principal nor the agent has any possibility to reduce the informational asymmetry. The time-line can be sketched as follows: Nature first assigns a characteristic type to the agent, which is known to the agent, but not to the principal. Then the principal offers the contract. The agent can accept or refuse this contract, and as a result we may get a pooling or a separating equilibrium.

$$\text{Nature} \Rightarrow \mathbf{A} \leftarrow \text{Contract} \rightarrow \mathbf{P} \rightarrow \mathbf{A} \; accepts \, / \, refuses \rightarrow \text{Result}$$

One extension of the basic model includes *signaling*: In order to reduce the informational asymmetry, the agent takes the initiative and sends a signal to the principal: The car seller provides a renewal of the TÜV-license, the worker presents her diploma, a firm signals her credit worthiness by the assessment of a rating agency.

Nature ⇒ **A** –Signal→ **P** ←Contract→ **A** *accepts / refuses* → Result

The other extension of the basic model is to introduce *screening*: here, the initiative to reduce informational asymmetry before the contract is offered is on the side of the principal. To learn more about the characteristics of the agent, the principal undertakes investigations: the car buyer test drives the car, firms set up assessment centers before hiring, banks will check the credit history of their loan applicants.

Nature ⇒ **A** ←Screening— **P** ←Contract→ **A** *accepts / refuses* → Result

1.2 Asymmetric information ex post

If uncertainty occurs only after the contract has been signed, the agent can take advantage of it for the principal cannot distinguish between the impact of nature and a change in the agent's behavior. This is the classical principal-agent relationship, where two different problems of moral hazard arise.

Moral hazard with hidden action occurs if the agent can take a private unobservable action after the contract has been signed but before the final market result is realized. Assume for example that a German bank has extended a loan to an Indonesian firm. If the firm is unable to repay her loan, the bank does not know whether the insolvency of the firm is due to the break-down of export markets in the course of the financial crisis since summer 1997 or whether corruptive managers have put money aside. The bank cannot tell whether a bad result is due to "Nature" or to the action of the agent.

P ←Contract→ **A** ⇒ Nature ⇒ **A** —Action→ Result

In the case of *moral hazard with hidden knowledge*, the agent receives private information after the contract has been signed. Since the final result depends on data that the agent has to convey to the principal, there is an incentive for the agent to change data into his favor. If for example a bank extends a loan for an innovation project, and only the firm but not the bank can learn the actual amount of profits at no cost, the firm has an incentive to report low profits in order to reduce repayments to the bank.

P ←Contract→ **A** ⇒ Nature ⇒ **A** —Knowledge→ Result

In order to reduce asymmetric information ex post, banks can engage in costly state verification (TOWNSEND 1979). This includes monitoring, supervising the actions of the agent, and verifying the information provided.

2. Asymmetric Information in the Credit Market – the Individual Firm - Bank Relationship

We now analyze the effects of asymmetrically distributed information in the credit market. The credit market is part of the financial markets where firms and banks exchange demand and supply of loans. When the credit market is incomplete due to asymmetric information the interest rate does not have any longer the neoclassical market clearing function. Instead, the interest rate acts as a screening device: changing the interest rate has an impact on the selection of loan applicants which can induce adverse selection. Moreover, the interest rate acts as an incentive mechanism when it induces a change in economic behavior of the agent. This can lead to problems of moral hazard. Therefore the interest rate includes – besides the price for the lending of capital – a risk premium and a compensation for information costs such as screening, supervision, and control. Again we will distinguish between models with adverse selection (= ex ante asymmetric information) and moral hazard (= ex post asymmetric information).

2.1 Credit Market and Adverse Selection

2.1.1 The STIGLITZ-WEISS (1981) – Model

In this model, credit rationing occurs as a consequence of the adverse selection problem. A risk-neutral, competitive bank faces credit demand from firms. Each firm applies for loan D for an investment project. The loan size may be normalized $D=1$. The investment project can either be successful or a failure: [1] With probability p^i the project return will be high (π_i^{max}) and with probability $1-p^i$ it will be low (π_i^{min}). π_i^{min} equals zero for all investment projects. The expected returns of all projects are identical (mean preserving spread), but the projects have different degrees of risk, such that higher returns can only be received with lower probability:

$$p^1 \pi_1^{max} = p^2 \pi_2^{max} = ... = p^n \pi_n^{max}$$
$$with \ \ p^1 > p^2 > ...p^n \ \ \ \ and \ \ \ \ \pi_1^{max} < \pi_2^{max} < ... \pi_n^{max}$$

The bank is informed about the returns and the success probabilities p^i of each risk class, $i = 1, ...n$, and its distribution $\varphi(p^i)$ among the firm population, but the bank cannot identify the risk-class of an individual firm.

The firms are subject to limited liability. The expected return of a firm net of loan repayments $(1+r)D$ equals:

$$EV^i = p^i[\pi^i – (1+r)D].$$

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[1] Here and in the following models we simplify the analysis in the way that we assume only two possible project outcomes instead of a continuous profit distribution.

The expected return of the bank is non-monotonic: If the bank asks for higher interest rates, i.e. higher repayments $(1+r)D$, at first her profits increase. But for repayments above $(1+r)D = \pi_1^{max}$, a firm with the relatively safe p_1-project will drop out of the market, because firm profits EV^1 will become negative. If the bank further increases the level of repayments, she will extend loans to a more and more risky pool of firms. This phenomenon is illustrated in the following figure for the case of two different risk-classes $(i=1,2)$:

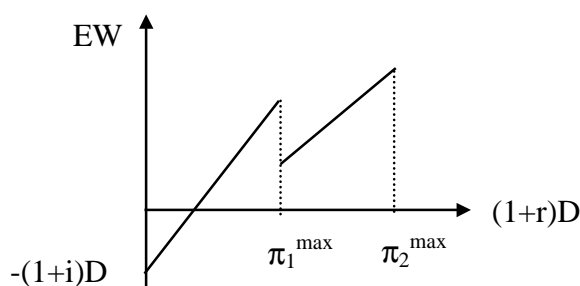Figure 1

Expected profits of the bank EW depending on the interest rate r (=repayments), 2 firms $(i=1,2)$

Starting from the intersection of the horizontal and vertical axes, we see that at repayments of zero the bank makes losses depending on the level of the deposit rate i. Expected bank returns increase with higher repayments as long as the bank supplies loans to both risk types of firms. At π_1^{max} all low risk firms withdraw, and expected bank returns fall due to the reduced success probability of the second risk group. Bank returns increase again and reach the highest point where repayments equal π_2^{max}.

If we allow for more risk classes we get a concave function for the expected bank return: An increase in repayments has the direct effect of increasing bank returns. But it also has an indirect, adverse-selection effect acting in the opposite direction. From a certain level of individual repayments onwards this adverse-selection effect becomes dominating and bank returns will decrease due to the higher bankruptcy risk of the remaining pool of credit demanding firms.

Figure 2 illustrates a credit market equilibrium where rationing occurs due to asymmetric information. The non-monotonic relation between repayments and the expected return to the bank is depicted in the lower right quadrant of figure 2. In the competitive equilibrium of the banking sector, all returns are transferred to the depositors, so the expected rate of bank return is equal to the deposit rate. In the lower left quadrant we get the saving deposits as an increasing function of this deposit rate. If we assume that all saving deposits are used for the supply of loanable funds (45° line in the upper left quadrant), we can derive the non-monotonic credit supply curve. Credit supply and demand curves are shown in the upper right quadrant. The credit demand is a monotonically decreasing function of the repayment level. At the maximum of the credit supply curve, there will be excess demand for loanable funds, and credit rationing occurs. Credit rationing is of type I, if not all firms get a loan at the bank-optimal repayment level, i.e. if some of these otherwise

identical firms are denied a loan-contract. The bank does not consent to eliminate the excess demand (by increasing repayments up to the intersection of the L^S- and L^D-curves) because of the adverse selection effect. Credit rationing is of type II, if all of the firms get a loan, but of a smaller size than originally requested.
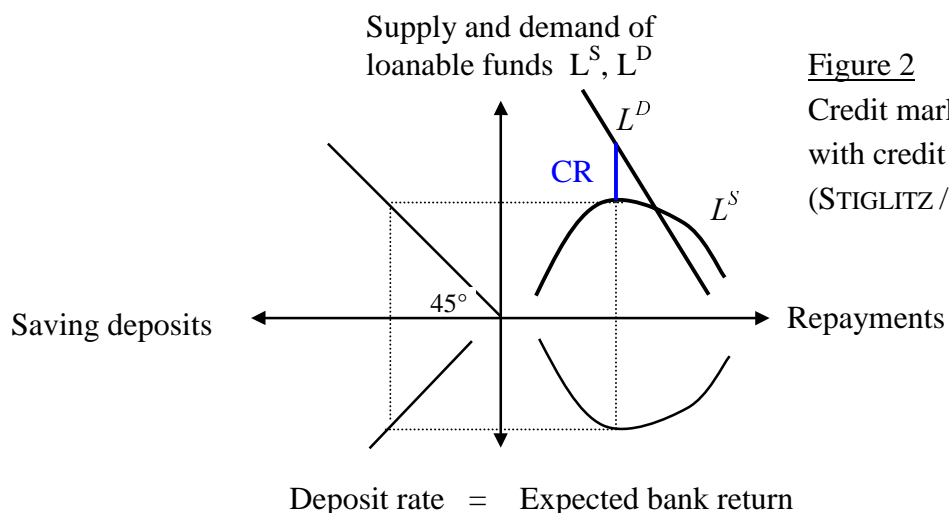

Supply and demand of loanable funds L^S, L^D

Figure 2
Credit market equilibrium with credit rationing (CR)
(STIGLITZ / WEISS 1981, 397)

2.1.2 Solutions to the adverse selection problem

Signaling via collateral (BESTER 1985a)

One possibility to overcome the adverse selection problem is to include a collateral into the credit contract. When the firm is unable to meet the repayment obligations, the collateral is transferred to the bank and gets liquidated to make up for the outstanding debt. Since the more risky types of firms will loose their collateral with higher probability, they are less willing to trade higher collateral for a reduction in repayments than the "safe" type of firms. The bank therefore offers two different credit contracts which induce auto-selection of the firms: In equilibrium, the "safe" group provides collateral in exchange for lower repayments. The risky group has higher repayment obligations but does not provide collateral at all. Credit rationing disappears when the liquidation of collateral is done at no cost.

Signaling via variable loan size (BESTER 1985b, MILDE / RILEY 1988)

Here again the bank offers different loan contracts that induce auto-selection of the firms. The crucial assumption is that firms of different risk classes will obtain different marginal profits from an additional unit of loan invested. Therefore, the marginal rate of substitution between the interest rate and loan size differs between both groups of firms. So again the bank can offer various loan contracts that lead to a separating equilibrium. Because of the signaling effect of the loan size ($D\uparrow$ means e.g. that the firm belongs to the safe group) the

investment level under asymmetric information can even be higher than under complete information.

Although the idea of the model is stringent, the empirical situation is opposite: loan contracts are either standardized, or the bank investigates the creditworthiness of the individual firm before extending higher amounts of loan.

Extension to a multi-period context

DIAMOND (1989, 1991) considers repeated credit-relationships instead of the one-shot lending presented above. Here, the population of risky firms is gradually reduced because of their higher bankruptcy probability (*1-p*). It is assumed that a firm, which is not able to pay back her loan, looses all her reputation and is not eligible for credit any more. So if a firm has been identified by bankruptcy once, no (other) bank will grant her a credit in the future.

WEBB (1991) shows that long-term contracts can be used to mitigate the adverse selection problem by separating entrepreneurs of different project risk. Firms that don't go bankrupt, are offered better terms of contract and make lower repayments in the following period, whereas risky firms will only get a loan to the old contract conditions.

2.1.3 Discussion

Imperfections in the credit market which induces a problem of adverse selection, affect the investment and financing decision of banks and firms in the following way:

First of all, young firms have difficulties to reduce the adverse selection problem and to become eligible for loan-financing, because they lack collateral and have had no time to build up reputation. Therefore, young firms are more financially restricted than the average firm.

Second, banks prefer firms with safe investment projects. Compared to the situation with a perfect capital market, there will be inefficient underinvestment. RUCKES (1997) shows, that when banks engage in costly screening activities, credit financing of investment projects is dominated by corporate conservatism. Thus we derive that firms are reluctant to invest in not-standardized, innovative projects because they fear not to get any financing at all due to the higher project risk. On the aggregate level, this will have a negative impact on innovation, economic growth and employment.

A third question is whether the choice of investment projects is influenced by house-bank relationships or share ownership by banks. The empirical analysis of ALBACH and ELSTON (1995) suggests that bank-affiliated firms are less liquidity constrained and that asymmetric information is reduced, but they find no general result for the investment decisions. Recent studies by ELSAS and CRANEN (1998) and LEHMANN and NEUBERGER (1998) support these findings. LEHMANN and NEUBERGER distinguish between specified loans for replacement or market expansion, and unspecified loans in the form of credit lines. Concerning the unspecified loans, housebanks engage in higher monitoring activities

and reject more risky loans. Therefore, a housebank-relationship could have a (conservative) influence on project choice.

2.2 Credit Market and Moral Hazard

Under informational asymmetry ex post it is assumed, that only the investing firm but not the credit extending bank can observe the actual amount of profit at no cost. This is the case of moral hazard with hidden knowledge. We concentrate on this situation because its analysis is equivalent to the moral hazard with hidden action case, in which the firm can put money aside before the bank knows which level of profits has been realized.

Again we assume that the project return is stochastic, and that there are only two possible outcomes, π^{min} and π^{max}, which occur with probabilities *(1-p)* and *p* respectively. We further assume that the repayment obligation R lays in between π^{min} and π^{max}, so that with positive probability the firm cannot pay back her loan. With the realization of π, the firm has private information which gives her an incentive not to reveal her profit realization truthfully and to declare low profits in either case. If the bank decides to verify the profit situation, she must bear monitoring costs *m,* which are assumed to be fixed. To minimize the moral hazard problem, the bank offers a loan-contract which is discussed below.

When costly state verification is required for numerous investment projects, a bank has advantages compared to an individual lender: She can realize higher economies of scale concerning the monitoring activities. This justifies the existence of a banking system (DIAMOND 1984).

2.2.1 The Standard Debt Contract

An incentive compatible credit contract is the standard debt contract which has three essential features (TOWNSEND 1979, GALE / HELLWIG 1985, WILLIAMSON 1987):

(i)   When the firm is solvent the contract involves a fixed repayment of $R = (1+r)D$ to the bank. The bank does not participate at investment profits above R.

(ii)   If the firm cannot meet her repayment obligations, she is declared bankrupt. In this case the bank engages in a costly state verification which implies monitoring costs of *m.*

(iii)   In the case of bankruptcy the firm has to transfer all profits to the bank.

Although the standard debt contract allows for an incentive-compatible credit relationship between the firm and the bank, a problem of time inconsistency arises: From the dynamic, game-theoretic point of view, an automatic verification by the bank in the case of bankruptcy is not a credible strategy-profile because the monitoring costs imply an additional loss to the bank. On the other hand, the firm -faced with the permanent threat of verification- will never lie. This means that both contracting parties could improve their

overall situation, if the bank does not verify automatically, but stochastically. However, mixed strategies of monitoring activities can be difficult to write down in the loan contract. Another way to solve the time inconsistency problem is to allow the bank to choose between monitoring and debt renegotiation for the case of bankruptcy.

2.2.2 Moral Hazard, Bankruptcy and Renegotiation – the Model of BESTER (1994)

BESTER (1994) discusses credit contracts with renegotiations. Here, in case of insolvency the firm does not go bankrupt if she agrees to transfer the minimum profit π^{min} plus some previously specified collateral C to the bank. Hereby the sum of collateral and minimum profit does not cover the total amount of loan extended ($\pi^{min}+C<D<R$). In this way the firm gets a partial debt relief whereas the bank is saving monitoring costs.

The repayment-game between firm and bank is formulated in three-steps:
1. The firm learns her actual profits.
2. The firm decides upon repayments: In case of investment failure she has no choice and must declare herself insolvent. In case of success she can choose between truthful repayment or strategic default (=cheating by declaring that low profits have been realized).
3. In case the firm does not meet her repayment obligations the bank must decide whether to verify the project outcome or whether she should engage in renegotiation to avoid the bankruptcy case. Renegotiation implies that the firm has to transfer the minimum profits π^{min} as well as the collateral C to the bank.

Figure 3 illustrates the game tree and the returns to the firm and the bank respectively:
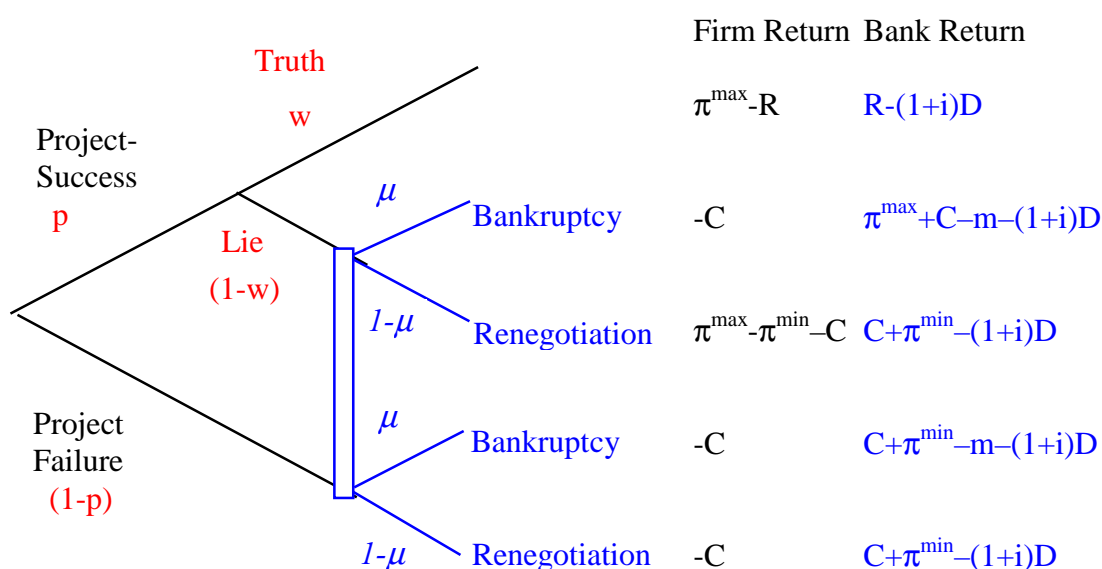

Figure 3:
Moral Hazard and Renegotiation (cf. BESTER 1994, 77)

If the firm makes the repayments, then ex post there is full information. If there is a perfect Bayesian equilibrium in the game, the expectations of the bank and the firms must be consistent. An equilibrium in mixed strategies implies that the bank is indifferent between monitoring and subsequent liquidation of the firm on the one side, and renegotiation and partial debt relief on the other side. Furthermore the firm must be indifferent between cheating and reporting profits truthfully. Then, costly state verification does not take place automatically, but only with a certain probability. The bank avoids information and transaction costs, and the firm receives higher expected profits because of the reduced bankruptcy probability.

Again, an extension to a multi-period framework reduces the problems of asymmetric information: With repeated bank–firm relationships, there is an incentive for the firm to acquire the reputation of being a reliable debtor and to avoid cheating. DIAMOND (1989) shows that when there is a long-term relationship between the firm and the bank, from a certain point of time on, the firms chose safe investment projects in order to keep their good reputation of non-default and to be eligible for lower interest rates in subsequent periods.

2.3 Discussion

We have seen that the different forms of ex-post asymmetrically distributed information between borrower and lender require a complex design of the loan contracts.

Moreover, asymmetric information in the credit market and other financial markets leads to a discrepancy of internal and external financing of investment projects. This is expressed by the pecking-order-hypothesis of MYERS and MAJLUF (1984): A firm will prefer to finance new investments from internally generated funds because these costs are immune to informational asymmetry. If the firm needs external financing however, it prefers external debt to external equity. Hereby it is assumed that the informational asymmetry between the management of the firm on one side and outside-investors on the other side is two-dimensional and concerns the return of the investment project as well as the value of the assets in place. The investment opportunity has a positive net present value. It must be financed completely by external funds. The return of the investment project and the market-value of the assets are high in good states and low in bad states of nature. If the firm decides to finance the investment project by issuing new shares, the price of the new shares will equal the sum of the expected values of assets in place and of investment return. The management knows one period prior to the outside-investors which state of nature will occur. If the management acts in the old shareholders' interest (who do not buy new shares), new shares are issued only when the state of nature is bad, i.e. when the *expected* value of assets plus the return of the investment is higher than their *actual* value

after nature has drawn. This means that the management will only issue shares if the firm is overvalued and when there will be a sure capital loss. In this case it is favorable to the existing shareholders that the losses are spread also to the new shareholders. In good states of nature however, the firm is undervalued: the price for new shares is lower than their true value. If the firm issues new shares, the old stockholders must share these capital gains with the new stockholders. If the share of increment of total firm value obtained by old stockholders is less than the asset value increase (due to the good state of nature) without investment, it is better for the management to give up the positive net-present-value investment opportunity. Unless the project return is not really high, the management will issue and invest only in bad states of nature, whereas in good states of nature, it will forego the investment opportunity. Rational outside investors will anticipate these investment and financing decisions. Since they perceive equity issues as bad news, outside investors will ask for a lemons-discount in stock price. This in turn makes equity an expensive source of financing.

If the firm decides to issue debt instead, the problem is only alleviated. Of course, if the firm can issue default-risk-free debt, she will invest in every positive net present value project. But if she can only issue risky debt, the asset value is affected as well and the firm will also pass up some positive –NPV investment projects: The firm invests if the return of the project is higher than the fraction of capital gains that go to bondholders (especially if the capital gains are zero or negative). From option pricing theory we know that the capital gains of bondholders will be less in absolute value than the capital gains of the new shareholders. The firm would consequently prefer to finance new investments by issuing debt rather than by issuing equity.

To sum it up, the information asymmetry between management and outside investors concerning the investment project as well as the asset value imply the hierarchy of internal funds being preferred to debt, and debt (loan or bonds) being preferred to the issue of new shares for the financing of investment projects.

So far we have focused on the bilateral relationship between a firm and a bank (or some outside investor). In real economic life, firms are not isolated units but stand in interaction with other firms of their industry. In the next section we therefore analyze the impact of informational asymmetry on investment decisions when firms compete with each other.

3.   Credit Market Imperfections and Investment Competition – the View from Industrial Organization

The interaction between financial and product markets is one of the main research topics of the DFG long-term program on "Industrial economics and input markets". The basic question hereby is, which impact the financial decisions of firms have on their investment behavior and the competition in the product market. The aim is to integrate financial (and labor) markets into models of industrial organization.

The notion of investment shall be understood in a broad sense. In his empirical article on "Capital-Market Imperfections and Investment", HUBBARD (1998) describes the influence of capital market imperfections on such different activities as investment in pricing strategies, investment in research and development, investment in business formation and survival in competition, investment in inventory and investment into human capital of the working force. Hence, we define investment very comprehensively as investment in projects with stochastic return and different grades of risk.

3.1 Capital structure and competition

In their pioneering article BRANDER and LEWIS (1986) elaborate that firms, which take up debt, behave more aggressively in COURNOT-competition. This (strategic) investment in quantities is due to the limited liability of debt-financed firms, when project returns are stochastic. Since equilibrium quantities sold are higher, the profits of leveraged firms are lower than in the self-financing equilibrium. Therefore the single firm would never choose to issue debt. Only if strategic interaction between firms are taken into account, borrowing is optimal. We see that the influence is mutual: competition in the product market alters the financial decision of the individual firm, and the financial structure of the firms determines the outcome in the product market.

The impact of the capital structure on product market and investment decisions in oligopoly is further developed by SHOWALTER (1995) for the case of price competition; and by GLAZER (1994) and DASGUPTA and TITMAN (1996) for the competition over two periods.

3.2 Loan contracts and competition

A more concrete integration of the problems of asymmetric information in the credit market is the approach of BOLTON and SCHARFSTEIN (1990). In their model they assume that the bank cannot observe the profit realization by the firm. In order to avoid the problem of moral hazard that exists in the one-period case (cf. section 2.2 above), the bank and the firm sign a long-term credit contract. Here, the access to liquid funds in the following production period depends on the project result of the present period. When the firm reports low realized profits to the bank, the refinancing probability for the following investment period is correspondingly lower. The loan contract is incentive-compatible in the way that the firm truthfully reveals her realized profits to the bank.

These BOLTON-SCHARFSTEIN credit-contracts which intend to mitigate the moral hazard problem find application in several models of industrial organization.

3.3 Applications

3.3.1 Credit Market Imperfections and Investment in Market Shares

CHEVALIER and SCHARFSTEIN (1996) combine capital market imperfections with two-period product market competition. Two firms compete two periods in prices for market shares for their heterogeneous products. The consumers are confronted with so-called consumer-switching-costs: they face high information- and transaction costs if they want to buy the product from another firm in the second period. This means that firms have to build up a clientele in the first period of competition by choosing an adequate pricing strategy. The aggregate demand level can be either high (= boom) or low (= recession).

In the reference case of two self-financed firms the first-period prices are strategically low because the firms have to invest into the acquisition of market shares. The second-period prices on the other hand are set close to the monopoly prices.

If the two firms do not have sufficient internal funds, the financing has to be done externally via a loan contract in the design of BOLTON and SCHARFSTEIN. It is further assumed that only if first-period demand is high, the profits are high enough to cover the repayment obligation. If first-period demand is low, the firm becomes insolvent and gets liquidated by the bank. The aggregate demand therefore determines the success of the pricing policy and the investment in market shares strategies. It is shown that debt-financed firms do not reduce their first-period prices as much as self-financed firms in order to conquer market shares. The reason for this is that with a certain probability the credit-financed firm will be liquidated at the end of period one and cannot enjoy the high return of the second competition period. A debt-financed firm therefore is less interested in gaining market shares and consequently will invest less in a first-period price reduction.

We keep the following results:
- External financing via an imperfect credit market leads to higher product prices in the first period, so there will be less investment in price reduction.
- The uncertainty of aggregate demand has an impact on market structure and investment dynamics: the aggregate demand influences the return of the investment project and determines via the loan contract the survival or the bankruptcy of the firm and the resulting the market structure.
- Moreover, CHEVALIER and SCHARFSTEIN show in a further step, that if firms are loan-financed, the actual demand situation has a countercyclical impact on the profit margin: In a boom phase price-cost-margins are low, whereas in a recession, price-cost-margins are high. Both influences investment dynamics and industry growth.

3.3.2 Credit market imperfection and R&D investment

MAURER (1996) and NEFF (1998) consider innovation and competition of two firms under financial restrictions. Investment is made in research and development activities which in case of success lead to a reduction of production costs. The firms in need of external funds are financed via an incentive-compatible BOLTON-SCHARFSTEIN-credit contract. This implies that the refinancing probability in the second period of production depends on the innovation success of the first period. If only the competitor successfully innovates, the own first-period profits are not enough to cover repayment obligations. In spite of positive profit expectations for the second period the respective firms has to leave the market.

The models show that innovative activities of financially restricted firms are considerably reduced. Especially in the asymmetric case where only one firm needs credit-financing whereas the other firm has sufficient internal funds, innovative activities of both firms are dramatically reduced, because a large share of the potential gains from innovation is transferred to the bank via the loan contract. (We have assumed that the bargaining power is on the side of the bank).

As a consequence product prices remain on a relatively high level: without innovation, there is no cost reduction that can be passed on to the consumers. Moreover, the firm that remains in the market will ask for a price close to the monopoly price. Therefore, the imperfections in the credit market lead to product market inefficiency and a welfare-loss.

3.3.3 Credit market imperfection and investment in entry deterrence and predation

SNYDER (1996) and STADLER (1997) investigate investments in strategic market deterrence when the market entrant needs external financing. These approaches stand in the tradition of the long purse story (TELSER (1966) in TIROLE, 1988, 377): the firm with better access to liquid funds can survive longer in predatory product market competition. The idea is that when the loan contract specifies a refinancing probability of less than one, the credit-financed firm is in danger of being attacked by the self-financed rival: this firm tries via price dumping or strategic capacity investment to reduce the profits of the financially restricted firm in order to increase her bankruptcy probability and to drive her out of the market.

In this case, imperfections in the capital market lead to a higher concentration within the industry. The market result improves slightly if the bargaining power in the credit business is on the side of the firm, because the refinancing probabilities of the second period are all increased.

3.4 Summary

As we have seen, investment financing via these two-period, incentive-compatible credit contracts has the following impact on competition in oligopolies:

- Market efficiency in the product market is reduced: there will be too little investment and too little innovation.
- Market power of the firm with sufficient internal resources increases. The likelihood of monopoly rises, and the intensity of competition is reduced.
- The result on the industry level is subject to the influence of macroeconomic variables.

These theoretical findings are supported by empirical studies: CHEVALIER (1995) shows that supermarkets charge higher product prices after a leveraged-buy-out: in this case, the debt level of a supermarket has risen from 40 % to 80 % on average.

Another branch of literature analyzes the interaction of the credit market and the product market, when the financial decisions have no commitment value for the strategies in the output market: ZECHNER, STOMPER and MAKSIMOVIC (1995) concentrate on the information sharing and acquisition for a given credit market- and product market-equilibrium. Since they do not focus on specific borrower-lender relationships, we will not discuss this topic further.

4 Credit Market Imperfections and Growth – Macroeconomic Linkages

In this last section we point out some aspects of macroeconomic consequences of imperfect capital markets. The approach stands in the tradition of the New Keynesian Macroeconomics. We therefore present the transmission mechanism through which monetary policy affects the financial markets and influences the output level of the entire economy. Three versions of the so-called credit channel theory exist (MISHKIN 1995, 7-9):

(a) The conventional approach: transmission via bank deposits:

Hereby it is assumed that banks play a special role for small and medium firms, which do not have direct access to financial markets. Tight monetary policy decreases bank deposits and therefore reduces bank lending, which in turn results in a decline of aggregate investment:

Money supply ↓ - bank deposits ↓ - bank lending ↓ - investment spending ↓ - output ↓.

However, this approach has lost some empirical relevance, because increased competition in the banking sector lead to financial innovations, which make bank deposits not the only source for lending activities. Moreover, investment spending does not rely solely on bank

loans any more since firms have gained better access to national and international capital markets.

(b) The information economics approach (I): transmission via the firm value

This approach focuses on the net worth of firms that are listed on the stock market. When money supply is reduced, the public has less money to spend on shares. Equity prices will fall, and the value of the firms will decline. Therefore, the firms can provide less collateral, which in turn leads to an increase of the adverse selection problem. Moreover, since the equity stake of the firms is reduced, incentives to engage in risky investment projects are higher. Thus the moral hazard problem is increased. Because of these information problems, bank lending is reduced, which finally results in a decline of investment spending:

Money supply ↓ - equity prices ↓ - adverse selection & moral hazard ↑ - investment spending↓ - output ↓.

(c) The information economics approach (II): transmission via the cash flow

If contractionary monetary policy raises the interest rate, the cash flow of firms gets reduced. The firms have less liquidity, provide less collateral, and their equity stake is lowered. Again, this leads to an increase of moral hazard- and adverse selection problems. Lending, and consequently investment spending are thus reduced:

Money supply ↓ - interest rate ↑ - cash flow ↓ - adverse selection & moral hazard ↑ - lending↓ - investment spending↓ - output ↓.

For conclusion we want to point out some recent work that investigates the macroeconomic consequences of capital market imperfections:

For an excellent theoretical treatment and an extensive literature survey on this part see the dissertation of SCHUBERT (1998): She presents a model in which product market, labor- and capital markets are all characterized by imperfections. She analyzes the consequences of credit market rationing on the business cycle as well as on endogenous economic growth.

CLEMENZ (1986) demonstrates that in booms firms are not able to communicate their positive profit expectations fast enough to banks, therefore credit rationing occurs and economic growth is reduced.

GRÖßL-GSCHWENDTNER (1993) argues that credit rationing leads to business-cycle-overshooting and to a slow-down of economic growth.

Empirical evidence is provided by WINKER (1996) that young, innovative firms under credit rationing reduce their R&D activities and their innovation expenditures. This in turn leads to a reduction in sales growth, and has a negative impact on technological progress, employment and economic growth.

5 Conclusion

In this paper we first have shown how problems of asymmetric information affect the borrower-lender-relationship between a firm and her bank: Credit rationing occurs due to adverse selection- and moral hazard problems. This induces under-investment or a "conservative" project choice of firms. However, credit rationing can be mitigated by signaling- and screening activities, or the formulation of incentive-compatible loan contracts. In a second step, we have analyzed which impact the imperfections in the credit market have on competition and on strategic interaction of firms in the product market. Our main results are that firms, which have to rely on credit-financing, invest less in price-reduction and in the acquisition of market shares, and spend less on research and development. On the other side, incentives for self-financed rivals to engage in predation and entry deterrence increase. As for the macroeconomic aspects, we have shown how monetary policy is transmitted via credit channels on aggregate investment and output. Moreover, recent theoretical and empirical macroeconomic studies suggest, that capital market imperfections have a negative impact on technological progress, employment, and growth.

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