Bank Lending During the Transition Period in Eastern Europe

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ABSTRACT. This paper develops a model for bank lending in economies in transition. Many loans in the bank's portfolio are non-performing as former state-owned companies are still to be restructured and therefore at least in the short-run short of cash-flow to service their loans. The bank now faces the following dilemma: should it terminate the loan irrespective of the future profitability thereby pushing the company into bankruptcy or should it extend its credit facilities thereby risking throwing good money after bad? This paper will argue that the bank should support a firm willing to undergo sufficient restructuring by extending existing credit facilities. On the other hand, the bank should initiate bankruptcy procedures against firms unwilling to undergo restructuring. The analysis is confined to small and medium-sized enterprises as large firms frequently get implicit or explicit government support.

I. Introduction

Much research has been carried out into the financial systems of economies in transition (Begg and Portes, 1992; van Wijnbergen, 1993; Coricelli and Thorne, 1992) and many proposals have been put forward concerning the reform of the banking system in Eastern Europe. The latter is widely regarded as a fundamental part of economic restructuring as banks – apart from managing the payment system act – as financial intermediaries. In developed economies, banks firstly collect savings and allocate them to projects expected to yield the highest rate of return (*screening role*). Secondly, they monitor spending to ensure that funds are used in the way agreed in the loan contract (*monitoring role*). Under central planning, however, banks neither selected investments nor monitored them. They simply accommodated the planner's output and investment decision. The question then arises as to what exactly should be done to reform the financial system and to foster economic development in Eastern Europe.

There is widespread agreement that credit has to be more effectively allocated to enable successful companies to thrive rather than to assist ailing firms to survive. Otherwise Eastern Europe will keep the legacy of an inefficient and uncompetitive industry. Banks must thus support firms willing and capable of undergoing drastic restructuring whereas firms unable to do so must be allowed to go bankrupt.

In the initial period of the transformation process, the banking sector was partly liberalised. Large banks were created out of the local branches of the former Central Bank when the latter shed its commercial banking activities transferring the loan business to those newly formed banks as well. In Hungary, a two-tier banking system was created in 1987 when the corporate banking business of the National Bank of Hungary was transferred to three newly formed commercial banks. In Poland, nine regional commercial banks were created out of the lending department of the National Bank of Poland, taking with them the doubtful loan portfolio of the state bank. A similar process took place in the then still existing Czechoslovakia, when the commercial branches of the Czechoslovak State Bank were transferred into three separate banks. Joint venture banks have been created and foreign banks have entered the market in all three countries.

As many enterprises are struggling to survive during the transition, often loans are not performing although debts inherited from the past bear little relation to real assets or future profitability, as they often originate from the central planner arbitrarily shifting funds between enter-

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prises. Governments in transition economies operate within closely defined political and economic constraints. It is necessary to distinguish between large former state owned enterprises (SOEs) and small to medium-sized former SOEs. The former frequently continue to receive direct budgetary transfers irrespective of their long-term viability. These direct state subsidies are deemed necessary as frequently the large SOEs are the biggest employer in any given sector or region and as such their failure would result in mass unemployment. Whilst small to medium-sized former SOEs receive financial concessions from the banking sector the criterion upon which these are provided is based upon the long-term viability of the firm; not on any socio-political grounds.

Banks thus face the following dilemma: as a large part of their loan portfolio is non-performing, should they roll over all credits irrespective of the future profitability of any given small to medium-sized company? Or should they initiate bankruptcy procedures whenever a firm is in arrears with its payments? Or should they decide case by case whether or not to terminate non-performing loans? This paper will argue that the bank should support small or medium-sized firms willing to undergo sufficient restructuring by extending existing credit facilities. On the other hand it should initiate bankruptcy procedures against firms unwilling or unable to adapt to the changing economic environment. The paper is structured as follows: section two outlines the model whereas in sections three and four the optimal lending policy towards a non-restructuring and a restructuring firm respectively is examined.

2. A theoretical model of bank lending

In this model a bank simply collects deposits, which it then uses for lending to firms. It pays its depositors an interest rate, i, whereas firms pay an interest rate r on their loans. The profit for the bank results from the interest rate spread h (thus $h = r - i$ and $h > 0$). Let $B(t)$ be the size of a loan. However, among those firms which are clients of the bank there are a number of small to medium-sized former SOEs which currently do not operate profitably and which continue to receive credit to be kept afloat although, taking economic considerations fully into account, these companies are not creditworthy. The optimal bank lending policy towards these firms is examined in this chapter.

Let $F(t)$ denote the total probability over $[0, t]$ of the firm going bankrupt due to suboptimal adaption to the changing economic conditions. The probability of failure at any time is dependent on credit extension, μ (*soft budget constraint*)[1] and on a natural failure rate, $s(\Omega, t)$, which governs in the absence of bank support and which is determined by economic conditions. This is a situation which is encountered frequently in the transition economies in Eastern Europe. Banks continue to support their clients' liquidity by rolling over non-performing loans. Without bank backing many firms would have to file for bankruptcy (Perotti, 1994; Begg and Portes, 1992). Specifically, $F(t)$ satisfies the following differential equation:

$$\dot{F}(t) = (1 - \mu)s(1 - F(t)) \tag{1}$$

which can be interpreted as the instantaneous probability density of failure at time t which does not depend on past credit allocations but only on the current credit extension. However, survival up to t depends on past soft budget constraints. $\dot{F}$ is the product of the natural failure rate s and the extent to which a hard budget constraint is implemented $(1 - \mu)$ times the probability of non-bankruptcy $[1 - F(t)]$ over $[0, t]$.

If the firm is still operating at time t, then it has, based on its assets, a real or market value, $P(\Omega, t)$ which reflects the probability of the loan being paid back. The higher the value of the firm's assets, the higher the chances of a complete debt repayment. P therefore is an indicator of the long-run solvency of the debtor. If, for example, the firm operates with an outdated and run-down capital stock then its long-term chances of survival are slim. On the other hand, if the firm possesses a relatively modern and valuable capital stock, then its long-term survival chances and solvency are higher. Ω denotes the extent of restructuring undertaken by the company and is a decision variable determined outside the model and therefore exogenously given. In order to make restructuring successful, Ω must be of a certain magnitude and therefore cannot be infinitesimally small. Let β denote this threshold or minimum restructuring extent so that $0 \leq \beta \leq \Omega \leq \infty$. β can vary across firms, industries and sectors, e.g. β can be high for heavy manufacturing and arms companies. For small, specialised companies producing goods in great demand even after the collapse of the CMEA trade, β can be quite small. $\dot{P}$ can be greater or smaller than 0 depending on whether the firm improves its viability over time ($\Omega \geq \beta$) which in turn increases the probability of the loan being paid back ($\dot{P} \geq 0$) or not ($\dot{P} < 0$ if $\Omega < \beta$). The assets of a failed company are assumed worthless, $P = 0$ in case of bankruptcy.

$s(\Omega, t)$ is a known function satisfying $s(\Omega, t) \geq 0$; with $\dot{s} \geq 0$ for companies which do not restructure sufficiently ($\Omega < \beta$) and with $\dot{s} \leq 0$ for those which do adapt to the changing economic conditions ($\Omega \geq \beta$). Thus, the natural failure rate incrases (decreases) over time if the firm does not restructure sufficiently (does restructure sufficiently). In summary, $\dot{P} \geq 0$ if $\dot{s}(\Omega, t) \leq 0$ which in turn requires that $\Omega \geq \beta$. The opposite also holds true: $\dot{P} < 0$ if $\dot{s}(\Omega, t) > 0$ which is contingent upon $\Omega < \beta$.

Theoretically, a fundamentally loss-making company can restructure but in this case β would be so high ($\beta = \infty$) that successful restructuring would be almost impossible. The company would have to be liquidated or split into different parts. This implies that the bank must have not only the knowledge and the authority to decide about the viability of the company but also must possess truthful information about the condition of the loan taker. It is assumed that the bank knows the state of the company and therefore the probability functions of survival and failure. This is not an unrealistic assumption since in many cases the bank has been working closely together with the company already under central planning (OECD, 1993, 1994). Thus $s(\Omega, t)$ is known to firms and banks. The probability of bankruptcy at time t, given survival to t can be written as:

$$F(t) = 1 - e^{-\int_0^T (1 - \mu(t))s(\Omega,\, t)\mathrm{d}t} \qquad (2)$$

(2) expresses only the probability of bankruptcy, not the probability of the loan being paid back or the long-run solvency of the firm. The probability of bankruptcy can be zero (if $\mu = 1$) but the long-run solvency can still be very low if the bank decides to support an utterly unviable firm unwilling or unable to undergo restructuring. The credit support rate, $\mu(t)$, is bounded: $0 \leq \mu \leq 1$. To put it differently, μ denotes the fraction by which the probability of bankruptcy is reduced. If $\mu = 1$, then the instantaneous and total probability of failure will be zero (1, 2). If $\mu = 0$ is selected, then from (1) the failure rate assumes its natural failure value:

$$\frac{\dot{F}}{(1 - F)} = s(\Omega, t) \qquad (3)$$

The bank incurs costs $C(\mu)s$ of keeping the company afloat where $C(\mu)$ is a known function satisfying:

$$C(0) = 0,\ \ C'(\mu) > 0,\ \ C''(\mu) > 0, \quad \text{for} \quad 0 \leq \mu \leq 1 \qquad (4)$$

which says that the costs of credit extension increase at an increasing rate. $C(\mu)s$ denote the costs of reducing the probability of bankruptcy by μ given the natural failure rate s. Continuous time is being used as the whole restructuring process is not regarded as a single big bang decision but rather as a sequence of many small steps and decisions taken over time in line with the changing economic environment. Measures to increase productivity, the development of new products, access to hitherto closed markets and shedding of labour will evolve over time rather than be executed in two or three steps. The bank maximises its discounted profit from lending to a firm over a period T:

$$\begin{aligned} \text{Max} \int_0^T & e^{-rt}[hB(t) - C(\mu)s(\Omega, t)]\,[1 - F(t)]\mathrm{d}t \\ & + e^{-rT}P(\Omega, T)\,(1 - F(T)) \qquad (5) \\ \text{s.t.} \quad & \dot{F}(t) = (1 - \mu)s(1 - F(t)) \end{aligned}$$

and further subject to transversality conditions as explained below. The second term of the bank's objective function measures the discounted value of the firm's assets at terminal time T which is known as the scrap value function. Note that the return for the bank under the integral sign is contingent upon survival up to t $[1 - F(t)]$. If bankruptcy occurs, then the return to the bank is zero $[0F(t)]$. Bankruptcy probability $F(t)$ is the state variable and the credit extension variable $\mu(t)$ is the control variable. The latter implies that the bank can implement any degree of credit support it chooses at any point of time. As a constraint is involved the following current value Lagrangian expression has to be formed with both terminal time T and bankruptcy probability $F(T)$ free:

$$L = (hB - C(\mu)s)(1 - F) + \lambda(1 - \mu)s(1 - F) + \tau_1\mu + \tau_2(1 - \mu) \quad (6)$$

where the time argument is omitted for notational simplicity. λ(t) is the costate variable and τ_i (i = 1, 2) denotes the Lagrangian multiplier made dynamic as the constraint must be satisfied at every point of time.

Differentiating the Lagrangian in (6) with respect to the control variable μ yields the necessary conditions for a constrained maximum:

$$\frac{\partial L}{\partial \mu} = -(C'(\mu) + \lambda)s(1 - F) + \tau_1 - \tau_2 = 0; \quad (7)$$
$$\tau_1 \geq 0;\ \ \tau_2 \geq 0;\ \ \tau_1\mu \geq 0;\ \ \tau_2(1 - \mu) = 0$$

where the second part in (7) depicts the complementary slackness conditions. Differentiating (7) with respect to μ results in:

$$\frac{\partial L^2}{\partial^2 \mu} = -C''(\mu)s(1 - F) < 0; \quad (8)$$

where the negativity guarantees that the Lagrangian is indeed maximised rather than minimised. The equation of motion for the costate variable λ(t) is given by:

$$\dot{\lambda} = r\lambda - \frac{\partial L}{\partial \mu} = r\lambda + hB - C(\mu)s + \lambda(1 - \mu)s \quad (9)$$

$\lambda(t)$ measures the sensitivity of optimal total profit to the bankruptcy probability. Alternatively $\lambda(t)$ can be interpreted as the marginal effect on the maximum profit of a small increase in the bankruptcy probability. The discounted value of the firm's assets at time t can be described by the following scrap value function:

$$\Upsilon(F(T), T) = e^{-r(T-t)}P(\Omega, T)(1 - F(T)) \quad (10)$$

Differentiating (10) with respect to time T and failure probability F yields:

$$\frac{\partial \Upsilon(F, T)}{\partial F(T)} = -e^{-r(T-t)}P(\Omega, T); \quad (11)$$
$$\frac{\partial \Upsilon(F, T)}{\partial T} = e^{-r(T-t)}(\dot{P}(\Omega, T) - rP(\Omega, T))(1 - F(T))$$

As $F(T)$ and T are free, the following transversality conditions apply if $F(T)$ and T are chosen optimally:

$$\lambda(T) = \frac{\partial \Upsilon(F, T)}{\partial F(T)} = -P(\Omega, T) \quad (12)$$

$$L(T) + \frac{\partial \Upsilon}{\partial T} = 0; \quad (13)$$
$$L(T) = (rP(\Omega, T) - \dot{P}(\Omega, T))(1 - F(T))$$

The transversality condition in (12) equates the marginal benefit of a decrease in $F(T)$ through its impact on the salvage term to the marginal cost of such an decrease measured over the whole time horizon and represented by $\lambda(T)$ (Léonard and Van Long, 1992, p. 227). Here it simply states that at terminal time T the marginal increase in the probability of bankruptcy should equal the negative value of the firm at T. Negativity of $\lambda(T)$ reflects the fact that an incremental increase in the state variable F raises the probability of bankruptcy and therefore reduces the optimal expected profit. (13) states that if T is delayed by an infinitesimally small increment of T then the increase in overall profit, pertaining to T and represented by $L(T)$, must be balanced by an decrease in the salvage term, as more capital is used up (Chiang, 1992, p. 209). From (7) and (4) it can be concluded, since $s(1 - F) > 0$ by definition that:

if $C'(0) + \lambda(t) > 0$ then select
$\mu(t) = 0,\ \tau_2 = 0,\ \tau_1 > 0$
if $C'(1) + \lambda(t) < 0$ then select
$\mu(t) = 1,\ \tau_1 = 0,\ \tau_2 > 0$ (14)
otherwise select $\mu(t)$ so that it satisfies
$C'(\mu) + \lambda(t) = 0;\ \tau_1 = \tau_2 = 0$

The first two statements concern the boundary solutions. The first condition states that if at an infinitesimally small level of credit support the marginal costs of a soft budget constraint are higher than the marginal profit from a reduction in the bankruptcy probability then the bank should not support the firm at all. The opposite is stated by the second condition: if the marginal costs of credit support granted at the maximum level are lower than the shadow price of bankruptcy probability then credit extension should indeed be granted at the maximum level. This would make failure impossible even in adverse short run economic conditions. Thus the optimal policy for the bank depends upon the long-term viability of the firm, which in turn is contingent upon restructuring. Finally the third condition states that unless there is a boundary solution the marginal cost of credit extension should be tailored to the shadow price of the bankruptcy probability. The conditions imply that if a firm undergoes a drastic change in its structure to cope with changing economic conditions, thereby increasing its long-run profitability and the chances of paying back the loan, then the bank should support the firm in the short run through "soft credits", for example by rolling over existing credit obligations. On the other hand the bank should cease to support a firm unwilling or unable to restructure. Of course, the bank's optimal policy can change depending on the assessment of the firm. If the company is restructuring sufficiently ($\Omega \geq \beta$) then it is in the interest of the bank to support the firm to the extent necessary according to (14) as this increases the probability that the loan will be paid back. Let:

$$z(t) = C'(\mu(t)) + \lambda(t) \tag{15}$$

which is zero from (14) in a time interval $0 < \mu(t) < 1$ and non-zero at boundary points ($\mu(t) = 0, 1$). Differentiating (15) totally results in:

$$\dot{z}(t) = C''(\mu)\dot{\mu} + \dot{\lambda}(t) = 0 \tag{16}$$

as $z(t)$ is constant. Substituting (9) into (16) and then using $z(t) = 0$ in (15) to replace $\lambda(t)$ by $C'\mu$) yields:

$$C''(\mu)\dot{\mu} = C'(\mu)(r + (1 - \mu)s) - hB + \mathrm{C}(\mu)s \tag{17}$$

Since it is assumed that $C''(\mu) > 0$ from (4), the sign of $\dot{\mu}$ is the same as the sign of the right hand side. Let the latter be denoted as $G(\mu, s)$. Points (s, μ) where $\dot{\mu} = 0$ satisfy the following:

$$G(\mu, s) = C'(\mu)(r + s(1 - \mu)) - hB + C(\mu)s = 0 \tag{18}$$

The shape of this curve can be determined by differentiating (18) implicitly:

$$\left.\frac{\partial\mu}{\partial s}\right|_{G=0} = -\frac{\partial G/\partial s}{\partial G/\partial\mu} = -\left[\frac{C'(\mu)(1 - \mu) + C(\mu)}{C''(\mu)(r + (1 - \mu)s)}\right] < 0 \tag{19}$$

which is negative given the assumptions about the C terms. The intercepts of this trajectory can be obtained from (18) by substituting in zero values for μ and s.

3. Credit support policy for a non-restructuring firm

In this section, the movement of the trajectory through time is analysed where $s(\Omega, t)$ is a given function and μ is determined by (17). As the failure rate is supposed to increase for a non-restructuring firm, s is non-decreasing over time ($\dot{s} \geq 0$). Therefore the arrows must point rightwards. Furthermore, the right hand side of (17) is an increasing function of μ as $s(1 - \mu) > 0$ and $C'(\mu) > 0$. and $C''(\mu) > 0$. Therefore a path at a point above the $\dot{\mu} = 0$ locus will rise and a path below will fall (Figure 1):

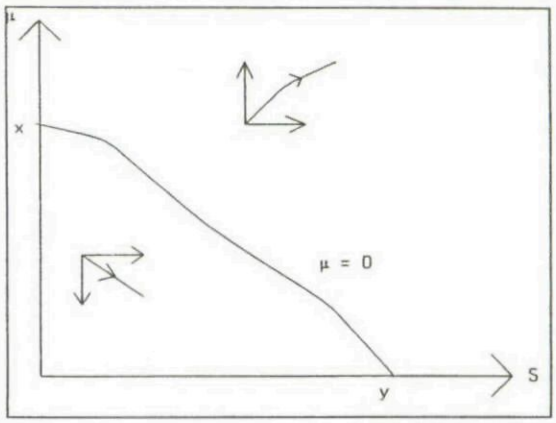

Fig. 1.

where x and y denote $\mu = C'^{-1}(hB/r)$ and $s = hB/C'(0) - r$ respectively. Now it is shown that the optimal lending policy involves non-increasing credit support ($\dot{\mu} \leq 0$) for those small to medium-sized companies which do not restructure where $0 \leq t \leq T$. Differentiating (12) with respect to time and substituting it into (9) yields:

$$hB - C(\mu)s - (r + (1 - \mu)s)P = -\dot{P} \geq 0 \tag{20}$$

which is positive since the market value of a non-restructuring firm will fall over time ($\dot{P} < 0$) as the long-run solvency of the firm decreases. However, actual credit extension costs $C(\mu)s$ might actually increase or decrease as the failure rate increases over time ($\dot{s} \geq 0$). If there is an interior solution with $0 < \mu(T) < 1$, then from (15) and (12), $z(T) = 0$, so $\lambda(T) = -C'(\mu(T)) = -P(\Omega, T)$. Substituting $-C'(\mu(T))$ for $-\mathrm{P}(\Omega, T)$ into (20) results in:

$$hB - C(\mu)s - (r + (1 - \mu)s)C'(\mu) = -C''(\mu)\dot{\mu}(T) \geq 0 \tag{21}$$

$\dot{\mu} \leq 0$ is required in order to render the equation positive, as from (4) $C''(\mu)$ is positive. From the phase diagram it can be seen that if $\dot{\mu}(T) \leq 0$, then μ must be non-increasing throughout $(0, T)$ as the dynamics of the system will push a μ-path below the $\dot{\mu} = 0$ curve downwards. The same holds true if $\mu(T) = 0$ as credit support cannot be increasing over time if the terminal value is zero $(0 \leq \mu \leq 1)$. Finally, let $\mu(T) = 1$ where t_1 is the first moment that $\mu = 1$. From (12) and (9) a first order differential equation with a constant term and a constant coefficient is obtained which, when integrated, yields:

$$\lambda(t) = -(1 - e^{-r(T-t)})\frac{hB - C(1)s(t)}{r} - e^{-r(T-t)}P(\Omega, T); \quad t_1 \leq t \leq T \tag{22}$$

If $s(t)$ is replaced by its upper limit $s(T)$ for $t_1 \leq t \leq T$ then:

$$\lambda(t) \leq -\frac{(1 - e^{-r(T-t)})(hB - C(1)s(\Omega, T))}{r} - e^{-r(T-t)}P(\Omega, T) \tag{23}$$

where the inequality arises from the fact, that $\dot{s} \geq 0$ $(s(T) > s(t))$, so that the right hand side becomes bigger over time. Then, since from (15) $z(t) = C'(\mu(t)) + \lambda(t)$:

$$z(t) \leq C'(1) - \frac{(1 - e^{-r(T-t)})(hB - C(1)s(\Omega, T))}{r} - e^{-r(T-t)}P(\Omega, T) \tag{24}$$

Combining (14) and (12) yields:

$$C'(1) + \lambda(T) = C'(1) - P(\Omega, T) < 0 \tag{25}$$

which means:

$$C'(1) < P(\Omega, T) \tag{26}$$

Replacing $C'(1)$ by its upper limit $P(T)$ in (24) results in:

$$z(t) \leq \frac{(1 - e^{-r(T-t)})(rP(\Omega, T) - hB + C(1)s(\Omega, T))}{r} < 0; \quad \text{for} \quad t_1 \leq t \leq T$$

where the second inequality arises from (20). As the second term in brackets in (27) is the reverse of (20) which is positive, the former must be negative, which renders the whole fraction and therefore (27) negative. As $z(t) < 0$, it follows that $z(t_1) < 0$. Therefore there can be no period where $\mu < 1$ ends at t_1 as from (14) and (15) $z(t_1) = 0$ in that case. That implies that $\mu = 1$ throughout time if $\mu(T) = 1$. Thus μ is a non-increasing function over time if the company does not restructure.

4. Credit support policy for a restructuring firm

Now the case where the small to medium-sized company does restructure sufficiently is analysed. In this scenario the natural failure rate $s(t)$ decreases over time $(\dot{s} \leq 0)$ as the firm is now better equipped to adapt to the changing economic conditions. Restructuring means that the company is more likely to operate profitably in the near future and therefore more likely to repay its loan. That in turn implies that the market value of the firm rises $(\dot{P} \geq 0)$. (20) now changes to:

$$hB - C(\mu)s - (r + (1 - \mu)s)P = -\dot{P} \leq 0 \tag{28}$$

It is now demonstrated that under certain circumstances the optimal credit policy involves a non-decreasing credit support over time $(\dot{\mu} \geq 0, 0 \leq t \leq T)$. Again, the actual costs $C(\mu)s$ may either increase or decrease over time as the failure rate decreases $(\dot{s} \leq 0)$. The figure is similar to the first one with the difference that since $s(t)$ is not increasing, the dynamics of the system are partly reversed and thus the arrows in the phase diagram point leftwards instead of rightwards. The dynamics with respect to the μ values remain unchanged (Figure 2):

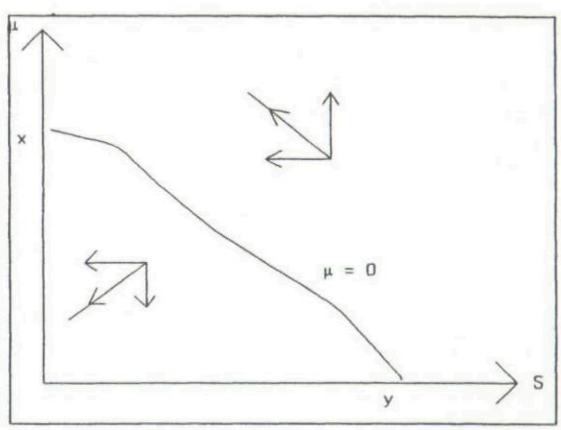

Fig. 2.

where x and y denote the same values as in Figure 1. First, the interior solution is examined where $0 > \mu(T) > 1$. From (15) and (12) $z(T) = 0$ and thus $\lambda(T) = -P(T)$. Substituting this into (28) results in:

$$hB - C(\mu)s - (r + (1 - \mu)s)C'(\mu) = -C''(\mu)\dot{\mu}(T) \leq 0 \tag{29}$$

In this case $\dot{\mu}(T) \geq 0$ is required in order to render the whole equation non-positive as $C''(\mu)$ is positive. Again, the phase diagram shows that if $\dot{\mu}(T) \geq 0$, then $\dot{\mu}$ must be non-decreasing throughout time as the dynamics of the system will keep such a time path above the $\dot{\mu} = 0$ curve. The same holds true if $\mu(T) = 1$ by definition. Now let $\mu(T) = 0$ where t_1 is the first moment where $\mu = 0$. (9) now reduces to the following differential equation:

$$\dot{\lambda} = \lambda(r + s) + hB \tag{30}$$

which when integrated yields together with (12):

$$\lambda(t) = -\frac{1 - e^{-(r + s(t))(T - t)}hB}{r + s} - e^{-(r + s)(T - t)}P(\Omega, T) \tag{31}$$

Replacing $s(t)$ by its lower limit $s(T)$ for $t_1 \leq t \leq T$ yields the following inequality since $\dot{s} \leq 0$:

$$\lambda(t) \geq -\frac{(1 - e^{-(r + s(t))(T - t)}hB}{r + s(T)} - e^{-(r + s)(T - t)}P(\Omega, T) \tag{32}$$

Then, since $z(t) = C'(\mu) + \lambda$ and $C'(0) = 0$:

$$z(t) \geq -\frac{(1 - e^{-(r + s(T))(T - t)})hB}{r + s(T)} - e^{-(r + s)(T - t)}P(\Omega, T) < 0; \tag{33}$$

$$t_1 \leq t \leq T$$

where the second inequality results from the fact that both terms on the right hand side are negative. Now two cases have to be distinguished: firstly, if $z(t) < 0$ in an interval $t_1 \leq t \leq T$ then $z(t_1) < 0$ as well. Therefore again there cannot be a period ending at t_1 where $\mu(t) > 0$ since in this case $z(t_1) = 0$; this is why $\mu(t) = 0$ throughout time if $\mu(T) = 0$. Here μ is a non-decreasing function of time throughout the reform process if the company undergoes restructuring. Thus the bank's optimal lending policy suggests to support the firm by extending its credits. Secondly, if $z(t) \geq 0$ then the possibility of $z(t_1) = 0$ cannot be excluded. $z(t_1) = 0$ would imply $0 < \mu_1 < 1$ from (15) and in this scenario credit support could be decreasing if the firm undergoes restructuring. This could be the case if the firm has successfully restructured to such an extent that credit support is no longer necessary. A hard budget constraint can be implemented.

5. Conclusion

This model suggests that the bank's optimal lending policy depends on whether a former state owned firm is willing to undergo sufficient restructuring in order to cope with the changing economic conditions or not. The bank should support the former by extending existing credit obligations to enable the firm to survive in the restructuring period but not the latter. Only a reorganised firm can hope to operate profitably and to repay its loan. In turn, a company which can be viable after restructuring will have every incentive to restructure as only this guarantees continuous credit-support from the bank. Thus credit will be allocated more efficiently thereby supporting potentially successful firms to thrive. On an aggregate level, this will foster growth and help to increase overall economic welfare.

Notation

h = interest rate spread: $r - i$ with $h > 0$
i = interest rate paid on deposits by the bank
r = interest rate paid on loans by the firm
s = natural failure rate of a firm
z = dummy parameter
$B(t)$ = size of the loan at time t
$C(\mu)$ = cost as a function of credit extension
$F(t)$ = bankruptcy probability at time t, state variable
L = Lagrangian function
$P(\Omega, t)$ = value of a firm contingent on the extent of restructuring undertaken and time t
β = threshold or minimum restructuring necessary for the firm to become viable
$\lambda(t)$ = costate variable to the state variable $F(t)$
μ = extent of the soft budget constraint made available to the firm where $0 \leq \mu \leq 1$, control variable

$\tau_{1,2}$ = Lagrangian multipliers, connected to the complimentary slackness conditions as μ is constrained

$\Upsilon(F(T), T)$ = salvage or scrap value term of the firm at time T

Ω = degree of restructuring undertaken by the firm

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Note

[1] If an enterprise can persuade the central authorities to alter the plan's objectives in terms of taxes, subsidies, loan conditions and output prices it is said to face a soft budget constraint (Kornai, 1992).

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