The Determinants of Loan Contracts to Business Firms
Empirical Evidence from a Private Bank in Vietnam

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While various theories used to explain the debt contract design, however, do not give unambiguous answers as to the relationships between the different loan terms specified in a debt contract, we focus on the possible interdependency of different loan contracting tools and hence estimate a simultaneous equation model. We also try to determine the relevant firm characteristics for the loan contracts, and to answer how they affect the different contract features. The experience is from the Asia Commercial Bank (ACB).

I. THE SPECIFICATION OF THE MODEL AND HYPOTHESES

1. The structure of the model in general terms

We follow Dennis et al. (2000) by specifying a system of equations that simultaneously explains a set of focused contract features: the loan maturity, collateral requirements and the loan interest rate. Our model takes the following form,

(1) Collat $=\alpha_1$Lmat + α_2Loanr + β_1X1 + ε_2

(2) Lmat $=\alpha_3$Collat α_4Loanr + $\beta_2 X_2$ + ε_2

(3)Loanr $=\alpha_5$Lmat α_6Collat + $\beta_3 X_3$ + ε_3

where *Collat* is a dummy with a one if collateral is asked, and a zero if not, *Lmat* refers to the loan maturity, and *Loanr* refers to the interest rate of loans denominated in Vietnamese currency, VND. X_K for *K=1 to 3* are vectors of other explanatory variables. are the residuals.

We allow for a bi-directional relationship between the *Loanr* and *Mat* and *Collat* since, at forehand, there is no reason to assume why one of these relations should be uni-directional. At the least, the bi-directional relationships between all of the contract terms is a testable assumption.

2. Interdependencies between the loan interest rate, collateral requirement and maturity

About the normalization: Equation (1) is normalized with respect to *Collat*, equation (2) is normalized with respect to *Lmat* and equation (3) is normalized with respect to *Loanr*. By definition, *Collat, Lmat* and *Loanr* are jointly determined, so that, strictly speaking, we can not talk about dependent variables in one or another equation. The system of normalization we have chosen is based on loan policies of the ACB. We see equations (1) and (3) as primarily determined by loan policies of the ACB, whereas equation (2) is primarily reflecting demand policies of the firm. Below, it will become clear that this affects our choice of exogenous variables, i.e. the modelling of X_1, X_2 and X_3.

Collateral or the secured status of a loan vis-à-vis the loan interest rate

The signalling theory argues that collateral can be used as a screening device to identify credit applicants (Bester 1985) and a negative relationship between collateral and the loan rate is expected according to this theory.

The contrasting view by Pozzolo (2002) predicts that banks simultaneously require collateral and charge higher interest rates to ex-ante riskier borrowers. Probability of success is jointly determined by the level of borrower riskiness and the level of effort. The model shows that for a given probability of success, banks face a trade-off between higher interest rates and lower collateral. However, when the probability of success decreases, banks cover the higher credit risk both by augmenting the degree of loan security and by charging higher interest rates.

Collateral or the secured status of a loan vis-à-vis the loan maturity

The agency cost theory (for example, Myers 1977) predicts that collateral and loan maturity are positively related. The reason is that both collateral and loan maturity are tools for coping with the asset substitution and underinvestment problems. According to the trade-off theory, this positive relationship is also expected if the loan contracting choice is primarily determined by borrowers' actions.

On the other hand, Boot et al. (1991) derive a theoretical model in which collateral and maturity are negatively related. Assuming that banks incur a dissipative cost in taking possession of and liquidating collateral, they argue that the dissipative costs of collateral are lower for longer maturity loans. The reason is that for a longer maturity loan a bank has more timing flexibility in terms of when to force default on the loan and take possession of collateral. In such a situation, the bank can make use its flexibility and then cut its collateral costs by lowering collateral for longer maturity loans.

Loan maturity vis-à-vis the loan rate

Also, the relationship between the interest rate and loan maturity is ambiguous. According to the trade-off hypothesis, loans of a longer maturity bear higher interest rates to offset the higher risk-premium that results from longer maturity loans. So, the loan maturity and the loan rate are positively related.

Other authors, however, argue that there may be a negative relationship. High-risk borrowers may be forced to accept higher interest rates and low maturity if credit risk is very high. Also, Merton's option pricing model predicts a negative relationship conditional on a certain range of the debt-to-firm value ratios with debt valued at the riskless rate.

3. Effects of exogenous variables on the endogenous loan contract items

Firm quality hypothesis

In our estimation, firm quality is represented by *fsize, turno, areceive,* and *inventc* with following justifications. First, measured by the book value of total assets since the

market value is lacking, size of firm (*fsize*) may influence contract terms through risk diversification and reputation effects (Diamond 1989, 1991). A larger firm is considered to be well-established and hence less risky than its smaller counterparts. Second, a high asset turnover (*turno*) indicates that the firm is efficient in generating revenues, which is a source of debt service. Third, a low inventory period *(inventc)* and a low accounts receivable period *(areceive)* reflect the firm's efficiency in asset management. Given that credit quality is considered as one aspect of firm quality, in our analysis we proxy firm credit quality by firm leverage and firm liquidity. First, firm leverage is measured by the debt-to-total assets ratio (*debta*) and the debt-to-equity ratio (*debte*). Reasonably, a high-levered firm may face a higher likelihood of a future insolvency. Second, firm liquidity (*liquidr*) measures the extent to which a firm can liquidate assets and cover short-term debts, implying that a highly liquid firm is less prone to default risk.

Agency cost hypothesis

We pick up the effect of agency costs by four variables. First, firm profitability (*profitbt)* suggests that a profitable firm is strong and therefore more likely to expand. Second, asset maturity (*amat)* reflects the time pattern of cash flows generated from a firm's fixed assets. The last term in this variable aims to support the idea that longer maturity assets will be depreciated at a slower rate (Guedes et al. 1996). Firms match the maturity of debt payments with the maturity of assets. Firms with longer-lived assets in place are able to have longer maturity debt without increasing the agency costs of debt (Myers, 1977). Agency costs may be mitigated by matching debt maturity with asset maturity, suggesting a direct relationship between asset maturity *amat* and loan maturity. Third, firm leverage is admittedly relevant based on the argument that agency costs may be limited by reducing leverage as well as shortening maturity or requiring collateral. Accordingly, the debt- total assets ratio *(debta)* and the debt- total equity ratio *(debte)* are also taken into account to reflect an inverse relationship between firm leverage and loan maturity and a positive relationship between firm leverage and collateral.

Tax hypothesis

We also include tax considerations in our analysis, measured by *taxa.* Dennis et al. (2000) hypothesize a negative relationship between the marginal effective tax rate and borrowing duration. However, Guedes et al. (1996) argue that duration is positively related to the marginal tax rate. Borrowers try to accelerate interest payments to maximize the present value of interest tax shields. Maturity structure that accelerates tax payments is more costly to borrowers than a maturity structure that lowers tax payments since an additional premium has to be paid to the lender (see Guedes et al., 1996, p. 1814).

Relationship lending hypothesis

In our analysis, we use two relationship proxies, frequency of the relationship (*numberlc)* and loan concentration (*loanc*). In short, we hypothesize that *numberlc* and *loanc* both have a negative relationship with collateral and the sign of the relationship with loan interest rate is uncertain.

We follow Boot et al. (1991), Harhoff et al. (1998) by considering loan size *(lsize)* as an exogenous variable in the system. Harhoff et al. (1998) finds that a higher incidence of securitization on larger loans, but Boot et al. (1991) discover that loan size is inversely related to the probability that a loan is secured. Concerning the loan size- loan interest rate relationship, it is commonly argued that loans of a larger size carry lower interest rates, given that larger loans incur lower transaction costs in lending. In contrast, the Midle et al. (1988) predict a positive relationship between loan size and loan interest rates.

The final exogenous variable is *dummyus* for some of the contracts that were originally denominated in US dollars. In order to make these contracts comparable with the contracts denominated in Vietnamese ñoàng, we have converted the loan contracts denominated in USA dollars into loan contracts denominated in ñoàng.

We specified the X_K vectors of the relationship between the exogenous variables and the endogenous variables as follows:

$$(4)\ X_1 = \begin{bmatrix} liquidr,\ debta,\ inventc,\ profibt,\ areceive \\ turno, numberlc,\ loanc,\ debte,\ fsize,\ lsize, c \end{bmatrix}$$

$$(5)\ X_2 = \begin{bmatrix} liquidr,\ debta,\ inventc,\ profibt,\ areceive \\ turno, taxa,\ amat,\ fsize,\ lsize, c \end{bmatrix}$$

$$(6)\ X_3 = \begin{bmatrix} liquidr,\ debta,\ inventc,\ profibt,\ areceive \\ turno,\ numberlc, loanc, dummyus, fsize,\ lsize, c \end{bmatrix}$$

Where: *liquidr* = current assets/ current liabilities; *debta* = debt/ total assets; *inventc* = inventories/ cost of goods sold; *profitbt* = profit before tax/ total assets; *areceive* = accounts receivable/ net sales; *turno* = net sales/ total assets; *taxa* = taxes/ total assets; *amat* = (fixed assets/ total assets)*(fixed assets/ depreciation); *fsize* = ln(total assets); *lsize* = ln(loan size); *numberlc* = number of loan contracts a firm has with the ACB bank on July 2003; *loanc* = cumulative loan outstanding of a firm/ the sum of total debt of the firm plus the cumulative loan outstanding; *dummyus* = dummy with a one if the loan contract originally refers to a loan denominated in US dollars, and a zero if the loan contract was originally denominated in Vietnamese ñoàng; *debte* = debt/ equity and *c* = constant.

By using the rank condition, it can be seen that all equations are now identified. The order condition shows that the three equations are over-identified.

II. THE ESTIMATION RESULTS AND DISCUSSION

We have information on 277 loan contracts of the ACB (as of July 2003) from the bank's database system. After leaving out all contracts with missing data on any contract terms, we end up with a smaller data set of 152 contracts with complete information on all variables we use in our equations.

Our model contains three simultaneous equations of contract terms. The variables *lmat* and *loanr* are continuous variables, whereas *collat* is a discrete choice variable. We use Nelson et al.'s (1978) two-stage estimation procedure of a simultaneous equation model with limited dependent variables. The difference is that one of the equations is estimated by Logit and not by OLS since one of the dependent variables is a dichotomous variable.

Table 1 gives the second stage results. In Table 2 we present a cross-tabulation of actual and predicted results of *Collat* (based on a cut–off value of 0.5). This table shows that almost in all cases our model predicts collateral requirements correctly. However, in seven of the 18 cases the model predicts collateral requirements whereas collateral was not asked. Of the seven –wrongly – predicted cases, three cases entail the predicted probabilities in excess of 0.6. Generally speaking, the resulting collateral equation seems appropriate in explaining whether a loan is securitized or not.

Table 1: Structural equation results

	Collat	Lmat	Loanr	Collat	Lmat	Loanr
Collat^f		16.997**	0.027		16.566**	0.049
Lmat^f	-0.212**		0.012	-0.103**		0.011**
Loanr^f	-9.824**	-13.302***		-4.914***	-14.735***	
C	175.410**	22.120	15.259***	125.847***	44.314	15.242***
liquidr	1.448	-0.071**	0.001		-0.069**	0.001**
debta	-47.695**	2.884	-1.531***	-72.822**		-1.611***
inventc	-1.718	23.402**	0.143		23.735**	
profbt	106.462***	-29.293**	-0.152	83.571***	-31.188***	
areceive	-3.464	7.544	-0.070	1.561		
turno	-0.281	0.170	-0.011			-0.012
taxa		338.439			331.489	
amat		1.215***			1.109***	
fsize	-3.282*	1.773	-0.238***	-2.631***	1.334**	-0.258***
lsize	0.123	4.944**	-0.032	0.555**	5.206*	
numberlc	0.729***		0.028***			0.033***
loanc	-35.306**		-2.335***	-30.380***		-2.541***
debte	6.796**			9.866*		
dummyus			0.697***			0.692***
R-squared		0.335	0.397		0.332	0.393
Adjusted R-squared		0.277	0.341		0.290	0.354
McFadden R-squared	0.570			0.497		
S.E. of regression	0.222	17.387	0.430	0.221	17.232	
Sum squared resid	6.810	42021.33	25.530	6.924	42167.19	
Log likelihood	-23.795	-642.955	-80.093	-27.831	-643.218	
Mean dependent var	0.882	15.704	10.006	0.882	15.704	
S.D. Dependent var	0.324	20.453	0.530	0.324	20.453	
Restr. Log likelihood	-55.293			-55.293		
LR statistic (13 df)	62.995			54.924		
Probability(LR stat)	1.52E-08			1.26E-08		

Note: The number of observations in all equations is 152. * Coefficient is significant at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 2: Cross-tabulation of actual and predicted outcomes for the logit model

(based on estimated where insignificant variables are ignored)

		Collat (predicted)		
Collat (actual)		**0**	**1**	**Total**
	0	11	7	18
	1	2	132	134
	Total	13	139	152

1. Interdependencies between the endogenous contract terms

From Table 1, we find significant bi-directional relationships between collateral (*Collat*) and loan maturity (*Lmat*), and between loan rate (*Loanr*) and loan maturity (*Lmat*), and a uni-directional relationship between loan rate (*Loanr*) and collateral (*Collat*). These results provide support for the underlying premise of our study that these three key contract terms are interrelated and simultaneously determined in the loan contract designing process.

2. Effects of exogenous variables

Also from Table 1, we find evidence for the effects of exogenous variables on the three endogenous contract terms as formulated in section 1. The collateral equation shows significant positive direct effects of *lsize, debte* and *profitbt* and significant negative effects of *debta, loanc, fsize.* The loan maturity equation proves that *inventc, amat, fsize, lsize* have a positive impact while *liquidr, profitbt* have a negative impact on loan maturity. Finally, the loan rate equation brings us a positive effect of *liquidr, numberlc* and *dummyus* and a negative effect of *debta, fsize and loanc* on loan interest rate.It should be noted that our results support most of above-mentioned hypotheses on the loan contract design, i.e. agency cost and relationship lending, firm quality. However, there is little support for the tax hypothesis. This differs from the study of Dennis et al. (2000), where they find no evidence for the relationship lending hypothesis, but a strong evidence of the influence of tax considerations.

III. FUTURE RESEARCH SUGGESTED

More studies are needed to provide additional evidence for the hypothesis that the choice for certain loan maturity is primarily determined by borrower's behaviors, whereas the loan rate and the collateral requirements are primarily determined by banks policies. Therefore, future studies of loan contract design should be conducted using a theoretical framework that simultaneously governs behaviors of banks and borrowers to examine under which conditions and to which extent bank behaviors and borrower behaviors derive the outcomes.

One more thing, our final dataset only comprises 152 loan contracts covering 47 different firms that borrow from the private bank ACB as of July 2003. This may induce small sample problems that bias our interpretations. These issues suggest the need for future empirical studies based on a more comprehensive database. ■

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