



Do loan interest rate margins and loan fees move in the same direction and are they jointly determined?

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ABSTRACT

A standard UK debt contract has two price components, the interest rate margin which is paid *ex post* and the up-front fee which is paid *ex ante*. The interest rate margin reflects risk, whilst the up-front fee is a mechanism for banks to price contract options and to screen borrowers, thus we cannot treat the fee as exogenous in interest rate margins as interest rate margins and fees may be jointly determined. Our empirical evidence shows that the two are indeed jointly determined, but that interest rate margins have a stronger (positive) effect on loan fees than vice-versa.

1. Introduction

Theory points to the fact that loan contract terms are jointly determined and indeed many can be seen as options embedded in a contract which are designed to improve screening in the presence of private information (Berg et al., 2016; Cowling, 2021). It is not always the case, however, that empirical modelling of loan contract parameters has allowed for loan contract terms to be jointly determined and not exogenously predetermined. Indeed, a recent empirical study of credit lines from a major Italian bank, which examined the relationship between loan interest rates and collateral, found that addressing this problem of joint determination is particularly important in dealing with the endogenous nature of loan contract terms to avoid misspecification (Bellucci et al., 2021).

In this paper, we take a holistic approach and estimate a variety of methods of establishing the empirical relationship between the interest rate margin and loan fee in bank loan contracts. Importantly, we do not impose any directional constraints on the relationship between the two which generated important new insights in the Italian study of bank loan interest rates and collateral (Bellucci et al., 2021). Our study is novel in several ways. Firstly, it uses a data set of 76,437 individual loan contracts issued by UK lending institutions. Secondly, it covers to the Covid-19 pandemic period. Thirdly, it relates to the UK government backed Coronavirus Business Interruption Loan Scheme (CBILS). Finally, it contains detailed information on the loan fee, loan interest rate margins, and a rich array of firm and loan characteristics, thus avoiding the problems often associated with survey-based data.

2. Empirical models and data

We estimate different model specifications of the following equations:

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$$\text{InterestRateMargin}_{i,t} = \alpha_r + \beta_r \text{Fee}_{i,t} + \gamma_r W_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\text{LoanFee}_{i,t} = \alpha_f + \beta_f \text{InterestRateMargin}_{i,t} + \gamma_f Z_{i,t} + \varepsilon_{i,t} \quad (2)$$

Here, i denotes the borrower and t the time the loan was issued. The loan fee depends on the loan interest rate margin and vice-versa, as well as a rich vector of control variables that relate to the borrower firm and other elements of the loan. The interest rate equation has the vector W and the loan fee equation the vector Z . Coefficients with a subscript r refer to the interest rate margin and coefficients with a subscript f refer to the loan fee.

The starting analysis estimates two basic ordinary least squares (OLS) models. This is followed by a seemingly unrelated regression (SUR) model which allows for cross-equation correlation in the error terms. The final set of analysis allows for endogenous loan contract terms using a 2-stage least squares (2-SLS) approach.

3. Data and outcome variables

We estimate a variety of models of loan fees and interest rate margins using a large data set of 76,437 CBILS loans between March 2020 and July 2021 for the UK. The data set is broad in its coverage of the UK business population, and contains a rich array of firm and loan related variables, including firm size, age, industry, and geography, the type of lending institution that issued the loan, and the purpose of the loan.

Our focus is on two outcome variables that relate to the overall price of the loan to the borrower firm, the interest rate margin and the fee. The interest rate margin is the annual interest rate charged by the lending institution adjusted for the Bank of England base lending rate of 0.1 % and is expressed as a %. The loan fee is expressed in cash terms and is paid up front at the point of issue. Table 1 reports the summary statistics for the core variables used for analysis.

From Table 1, we note that the average loan interest rate margin is 5.99 % and the average loan fee is £2096, for an average loan size of £264,496 over a term of 59 months. In total, 74.0 % of CBILS loans are for working capital during the Covid-19 pandemic, and 52.8 % are issued by one of the big multinational high street banks operating in the UK. The average firm taking out a CBILS loan is 17 years old and has annual sales of £3.8 m. In total, 72.8 % of loans were issued in the peak pandemic year of 2020.

4. Determinants of contract terms

The control variables shown in Table 1 can be classified into four groups all of which could potentially impact on the determination of the loan interest rate margin and the loan fee. The first group relates to loan characteristics *per se*, and includes the size of loan expressed in £s, the loan term expressed in months, and the year in which the loan was issued, either in 2020 or 2021. The second group relates to the purpose of the loan in terms of what the firm is seeking to do and includes dummy variables for eight different loan purposes. The third group relates to the type of lending institution that issued the loan and includes dummy variables for big and small banks, asset finance houses, invoice financiers, responsible finance providers (not for profit community lenders), and other which

Table 1
Summary statistics.

Contract terms	Mean	Std Dev	Min	Median	Max
Interest Margin %	5.989	3.265	1.67	4.65	14.90
Loan Fees £s	2095.80	4090.69	0	0	30,000
Control Variables					
Loan Size £s	264,495.80	459,552.30	7500	150,000	5000,000
Loan Term months	58.64	16.41	12	60	72
Loan Purpose					
Asset finance	13.97		0		1
CapExp	0.51		0		1
External refinance	1.22		0		1
Growth	5.67		0		1
Internal refinance	3.39		0		1
Refinance internal facility	1.16		0		1
Start-up	0.04		0		1
Working Capital	74.04		0		1
Total	100.00				
Year Issued					
2020	72.76		0		1
2021	27.24		0		1
Total	100.00				
Firm Characteristics					
Age (years)	16.970	14.280	0	13	121
Sales £m	3.795	5.759	0.048	1.700	45.000
Instruments					
Limited Liability Status	97.764	14.785	0	1	1
High Street Bank	52.84	0.499	0	1	1

includes P2P lenders and alternative finance. The final group relates to the firm itself and includes firm age expressed in years from foundation, annual sales in the last accounting year expressed in £m. We also have a geographic identifier which contains 44 local enterprise partnership (LEP) regions, and an industry sector identifier which contains 22 individual industry codes.

5. Instruments

To instrument the interest rate, and in order to identify the interest rate in equation [1], we refer to whether or not the loan is issued by a major multinational high street bank operating in the UK. Major high street banks have a UK small business customer and loan share of around 70 %–80 % and are efficient processors of lending applications as evidenced by their ability to advance around 1 million very small loans under the Bounce Back Loan (BBL) scheme during the Covid-19 pandemic (Cowling et al., 2022, 2023). It is also the case that they have a lower cost of capital than all types of smaller lender. Here, loans issued by a major high street bank are coded 1 and by all other types of lender 0.

To instrument loan fees in equation [2], we use legal form of the business as this defines the limit of liability in the event of loan default which triggers a process of legal pursuit of the outstanding and unrepaid loan initially by the lending institution and subsequently, *in extremis*, by the UK government. Firms without limited liability legal status do not have the protection that is conferred by limited liability status which limits legal action to the firms' assets. This is important in the interest rate decision taken by lending institutions and the expected returns to lending. Unlimited firms are also more informationally opaque which adds to the general small firm lending issue of asymmetric information (Peltoniemi, and Vieru, 2013). However, limited liability firms are also more complex than sole proprietorships and due diligence may be more complicated due to the ownership structure and thus fees may be higher to reflect this.

Table 2
OLS estimates.

Dependent Variables:	(1) Interest Margin	(2) Interest Margin	(3) Loan Fees	(4) Loan Fees
<i>Contract Terms:</i>				
ln(Loan Fees)	0.003*** (0.001)	0.004*** (0.000)		
ln(Interest Margin)			0.146*** (0.027)	0.245*** (0.029)
<i>Control Variables:</i>				
ln(Loan Size)		−0.044*** (0.002)		0.051*** (0.015)
ln(Loan term months)		−0.033*** (0.003)		−0.276*** (0.024)
Loan to sales		−0.130*** (0.007)		0.330*** (0.051)
<i>Loan Purpose (base: Asset Finance):</i>				
CapExp		0.095*** (0.018)		3.712*** (0.138)
External refinance		−0.046*** (0.014)		5.166*** (0.102)
Growth		0.203*** (0.008)		4.357*** (0.058)
Internal refinance		0.250*** (0.009)		4.662*** (0.064)
Refinance internal facility		0.066*** (0.012)		0.887*** (0.091)
Start-up		0.043 (0.059)		2.070*** (0.455)
Working capital		0.172*** (0.006)		3.279*** (0.041)
<i>Firm Characteristics:</i>				
ln(Age)		−0.033*** (0.002)		−0.116*** (0.013)
ln(Sales)		−0.070*** (0.002)		0.097*** (0.013)
Constant	98.115*** (6.256)	56.915*** (5.811)	−957.780*** (44.427)	−919.223*** (44.570)
LEP Region FE	Yes	Yes	Yes	Yes
SIC sector FE	Yes	Yes	Yes	Yes
No. Obs	71,131	70,506	71,131	70,506
Adj. R-squared	0.651	0.704	0.637	0.639

Notes: *** indicates significance at 1 % level, ** indicates significance at 5 % level, and * indicates significance at 10 % level. Figures in parentheses are standard errors.

6. Empirical results

Table 2 reports the first OLS models estimated for loan interest margin (the premium over the base risk-free rate) and loan fees. These models do not account for potentially endogenous loan contract terms. For interest margin and fees, we estimate one model with no control variables in (columns 1 and 3) and another model with a full set of control variables (columns 2 and 4). In all models, there is a positive and highly significant association between interest margins and fees and also fees and interest margins. In both cases, it was also true that adding in a rich set of control variables increased the magnitude of the respective loan contract terms (for example from 0.003 to 0.004 for fees on interest margin and 0.146 to 0.245 for margin on fees). In terms of the implied marginal effects, and using the full model coefficients, suggests that a 1 % increase in the interest margin will increase fees by 0.25 % and a 1 % increase in fees will increase the interest margin by 0.004 %, when evaluated at the means. This would add 0.02 % to total loan interest rate margins and £524 to total fees charged.

Table 3 reports the SUR models which allows for cross-equation correlation in the error terms. Again, the base models (columns 1 and 3) show positive significance for interest margin on fees and vice-versa. In the richer full models (2 and 4) these results hold and we observe that the magnitudes of the respective interest margin and fees coefficients are quite robust as we identified for OLS. In both cases, the general magnitude of the coefficients is larger than in the OLS models. Importantly, in none of the SUR models can we reject the hypothesis that the correlation in the residuals for both equations is zero (the Breusch-Pagan tests for the two equations show correlations of -0.040^{***} and -0.475^{***} respectively).

Table 4 reports on our instrumental variables models which are estimated by 2 stage least squares (2SLS). Here, we predict each endogenous variable in the first stage using our LTD and High Street Bank instruments together with all other explanatory variables as controls. Columns (1) and (2) report the first stage estimates for the endogenous Fees and Interest Rate Margins respectively. Columns (3) and (4) report the second stage estimates.

The instruments are both significant determinants of loan contract terms. If a loan is issued by a high street bank, interest margins are significantly lower. In addition, if a loan is issued to a firm with limited liability legal status, then fees are, on average, higher supporting the complexity hypothesis. We note that the F test statistics show that both instruments are highly significant suggesting that they are strong instruments. For High Street Bank (LTD) to be a valid instrument in our IV estimations, it must be sufficiently correlated with the included endogenous regressor Interest margin (Loan Fees) but uncorrelated with the error term. Therefore, we also present the Cragg and Donald (1993) minimum eigenvalue statistic as a further test of weak instrument following Stock and Yogo (2005). All the tests statistics shows that our instruments are not weak.

The second stage analysis, using instrumental variables after endogenizing loan contract terms, show that the effect of (predicted) fees on the loan interest margin is positive and of different magnitude than in the SUR and OLS estimates. Further, we also find that the (predicted) interest margin effect on loan fees is positive and of larger magnitude than in our other model specifications which do not account for endogeneity in loan contract terms. In general, interest margins exert a much stronger influence on loan fees than loan fees do on interest margins. This suggests that the two price elements of a loan contract act in the same direction which is consistent with lenders (and firms) considering them as a pair which are jointly determined. When fees are higher (paid *ex ante*) then interest margins (paid *ex post*) are higher. When interest margins are lower, fees are lower. This is consistent with lenders using loan contract terms, and here specifically the price components, as options that are embedded in a loan contract, and to alter the *ex post* incentives. Thus, our evidence is consistent with lenders using a complex pricing structure, rather than a single loan price (Berg et al., 2016). It is also consistent with risk adjusted pricing models.

Table 3
SUR estimates.

Dependent Variables:	(1) Interest Margin	(2) Interest Margin	(3) Loan Fees	(4) Loan Fees
<i>Contract Terms:</i>				
ln(Loan Fees)	0.010*** (0.000)	0.010*** (0.000)		
ln(Interest margin)			5.133*** (0.019)	5.128*** (0.019)
High Street Bank		-0.924*** (0.005)		
LTD				0.619*** (0.067)
Controls	Yes	Yes	Yes	Yes
LEP Region FE	Yes	Yes	Yes	Yes
SIC sector FE	Yes	Yes	Yes	Yes
No. Obs	76,437	76,437	76,437	76,437
Adj. R-squared	0.702	0.702	0.368	0.369
Breusch-Pagan Test χ^2	121.921	121.921	17,250.97	17,214.21
Correlation	-0.040***	-0.040***	-0.475***	-0.475***

Notes: *** indicates significance at 1 % level, ** indicates significance at 5 % level, and * indicates significance at 10 % level. Figures in parentheses are standard errors.

Table 4
IV estimation.

	(1) First Stage	(2)	(3) Second Stage	(4)
Dependent Variables:	Loan Fees	Interest Margin	Interest Margin	Loan Fees
<i>Contract Terms:</i>				
Predicted ln(Loan Fees)			0.032*** (0.011)	
Predicted ln(Interest Margin)				5.337*** (0.029)
High Street Bank		−0.955*** (0.003)		
LTD	1.083*** (0.087)			
Controls	Yes	Yes	Yes	Yes
LEP Region FE	Yes	Yes	Yes	Yes
SIC sector FE	Yes	Yes	Yes	Yes
No. Obs	76,445	76,437	76,437	76,437
First stage F-test P-value	0.0000	0.0000		
Adj. R-squared	0.270	0.675	0.340	0.354
Minimum eigenvalue statistic	155.928	107,651		

Notes: *** indicates significance at 1 % level, ** indicates significance at 5 % level, and * indicates significance at 10 % level. Figures in parentheses are standard errors.

7. Conclusion

We used a number of alternative empirical specifications to examine the empirical relationship between loan interest rate margins and fees in small business lending contracts under the UK government CBILS scheme which was operational during the Covid-19 pandemic period. Our estimates generate similar positive relationships but with different magnitudes of the respective effects of interest rate margins and fees on each other. We conclude that incorporating the endogenous nature of loan contract price terms in empirical work generates estimates that are consistent with those predicted by loan contracting theory and price options being embedded into loan contracts. They are also consistent with lenders pricing risk across all elements of loan contracts. In respect of many loan contract terms and firm characteristics, CBILS is quite similar to its predecessor loan guarantee scheme, the Enterprise Finance Guarantee scheme.

CRedit authorship contribution statement

Marc Cowling: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. **Huan Yang:** Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

No competing interests. We would like to thank the UK Department for Business and Trade and the British Business Bank for their support with this research and for sharing the data. The views expressed here are those of the authors and not the UK government.

Data availability

The authors do not have permission to share data.

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