The Impact of Organizational Structure and Lending Technology on Banking Competition

Supplement

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Differences in Borrower-Specific Transportation Costs

Borrower-specific transportation costs may stem from borrowers differing in the soft and hard information they can provide when applying for a loan. Consider an "informational portfolio" with two components: soft and hard information. Let δ describe the "value" of soft information in the borrower's portfolio, while $(1-\delta)$ is the value of hard information, with $\delta \in [0,1]$. Borrowers differ in the relevancy of soft and hard information they can employ in their loan applications; that is borrowers differ in δ. For example, larger and older firms may generate no relevant soft information but possess a lot of hard information, implying a δ close to zero. These are "hard firms". In contrast, small and young firms may lack verifiable and relevant hard information such that loan decisions are based mostly on soft information, implying a δ close to one; these are "soft firms". We model borrower-specific transportation costs to branch *i* to equal (and again assuming for simplicity that $\alpha = 1$ and $L = 1$, and that marginal costs equal zero for both banks): $t_i = s_i^{\delta} h_i^{1-\delta}$, with s_i and h_i the transportation costs of the borrower to bank *i* associated with soft and hard information, respectively.

The market share of bank *A* then equals: $y = \dfrac{s_B^{\delta} h_B^{1-\delta}}{s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta}}$.

All borrowers "to the left" of *y* ($0 \le x \le y \le 1$) are served by branch *A* at a loan rate: $r_{Ax} = s_B^{\delta} h_B^{1-\delta} - (s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta})x$. The other borrowers ($0 \le y \le x \le 1$) are served by branch *B* at loan rate: $r_{Bx} = -s_B^{\delta} h_B^{1-\delta} + (s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta})x$. In order to identify the implications for market shares and spatial pricing, we introduce some facilitating notation. First, let $\eta = \dfrac{h_A}{h_B}$. The parameter η captures the cost of using hard information when going to bank *A* relative to the cost of going to bank *B*. We call bank *B* "hard" when $\eta \ge 1$. η is larger than one, for example, if bank *B* is larger or more hierarchical than bank A and as a result handles hard information more effectively than bank *A*. Second, we define a parameter β for which $\dfrac{s_A}{h_A} = \beta \dfrac{s_B}{h_B}$. Bank *A* has a *comparative* advantage in handling soft information if $\beta \le 1$. By definition $\dfrac{s_A}{s_B} = \beta\eta$, hence bank *A* has an *absolute* advantage in handling soft information if $\beta\eta < 1$. Finally, let $\tau = \dfrac{s_B}{h_B}$. The parameter τ captures the relative cost of using soft versus

hard information when going to the rival bank; assume $\tau > 1$. Using this new notation the market share of *A* equals: $y = \frac{1}{\eta\beta^{\delta} + 1}$. It follows from this expression that bank A's market share y increases in δ, when bank A has a comparative advantage, or $0 \le \beta \le 1$.

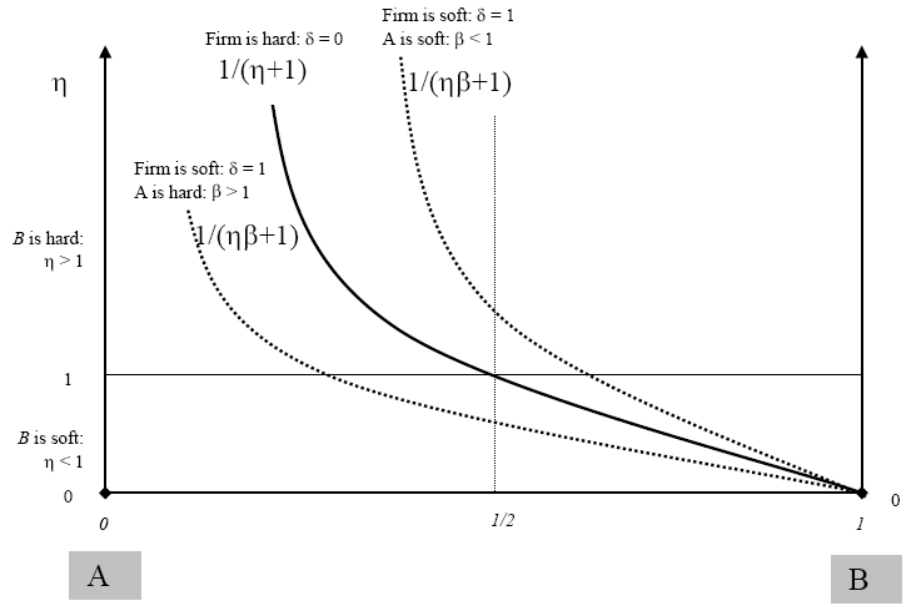

Figure. Market share and the cost of using hard information

A Figure displays the market share of banks *A* and B (on the horizontal axis) as a function of η (on the vertical axis). If firms use only hard information ($\delta = 0$) then $y = \frac{1}{\eta + 1}$. The figure displays this schedule in bold. Bank's *A* market share is clearly a decreasing function of the hardness of bank *B*. On the other hand, if firms use only soft information ($\delta = 1$) then $y = \frac{1}{\eta\beta + 1}$, and if bank *A* has a comparative advantage in handling soft information ($\beta < 1$), this latter "soft firm schedule" is situated to the right of the "hard firm schedule". If bank A does not have this comparative advantage ($\beta > 1$), its market share is further reduced and the "soft firm schedule" is situated to the left of the "hard firm schedule". Even in that case it is possible for bank *A* to have a larger market share than bank *B* if η is small enough for $\beta\eta < 1$. To conclude, *A*'s market share decreases in the hardness of *B*, but this effect is partly mitigated for soft firms in case *A* has a comparative advantage in handling soft information.[i]

[i] Each bank's market share or reach *y* remains positive for all type of firms, irrespective of the importance of soft information, *δ*, in the loan applications. The product differentiation literature has labeled this phenomenon "horizontal dominance": location dominates other heterogeneity in firm characteristics (e.g. Neven and Thisse

Next we analyze the degree of spatial pricing. For borrowers "to the left" of y ($0 \le x \le y \le 1$) served by branch A the slope at which the loan rate varies with distance equals:

$\frac{dr_{Ax}}{dx} = -\left(s_A{}^{\delta} h_A{}^{1-\delta} + s_B{}^{\delta} h_B{}^{1-\delta}\right) = -\tau^{\delta} h_B(\beta^{\delta}\eta + 1)$. Hence: $\frac{dr_{Ax}{}^2}{dxds_A} = -\delta(\frac{1}{\beta\tau})^{1-\delta} \le 0$,

$\frac{dr_{Ax}{}^2}{dxdh_A} = -(1-\delta)(\frac{1}{\beta\tau})^{\delta} \le 0$, $\frac{dr_{Ax}{}^2}{dxds_B} = -\delta(\frac{1}{\tau})^{1-\delta} \le 0$, and $\frac{dr_{Ax}{}^2}{dxdh_B} = -(1-\delta)(\frac{1}{\tau})^{\delta} \le 0$.

A decrease in hard transportation costs to bank B (h_B) will result in a softening of spatial pricing practiced by A, especially if hard transportation costs are high compared to soft information transportation costs ($\tau = 1$) and for hard firms ($\delta = 0$).

To conclude, the differential reliance by borrowers on soft and hard information introduces a heterogeneity in transportation costs in the loan granting process. This heterogeneity determines bank geographical reach and loan pricing. If relaying soft information entails relatively high transportation costs, borrowers with little hard information are more likely to deal with the bank with a cost advantage in dealing with soft information. The "soft bank" obtains a larger market share and spatial pricing is sharper for "soft borrowers", while the "hard" bank serves firms with more hard information. As such, "soft banks" specialize in "soft firms" whereas "hard banks" specialize in "hard firms". We leave the testing of these predictions to future work.

(1990) and Degryse (1996)). We find that horizontal dominance always arises in environments characterized by spatial price discrimination, as a bank enjoys a comparative advantage for its closest borrowers independent of the per-unit transportation cost differential between the two banks.

Correlations Between Key Variables

The table lists the correlation coefficients between key variables. All variables are defined in Table I in the paper.

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Size Bank	*1*	1							
Hierarchy Bank	*2*	0.375	1						
Span Organization Lender	*3*	-0.073	-0.025	1					
Span Organization Competitor	*4*	0.073	0.009	0.249	1				
Levels to Telex Lender	*5*	0.003	0.024	0.405	0.328	1			
Levels to Telex Competitor	*6*	0.263	0.347	-0.099	0.062	-0.010	1		
Fax Lender	*7*	0.017	-0.005	-0.053	-0.086	-0.129	-0.073	1	
Fax Competitor	*8*	0.044	-0.047	0.034	-0.117	0.064	0.094	0.025	1
Urban	*9*	-0.042	0.036	0.041	-0.181	0.051	-0.031	0.148	0.071

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Quartile Reach	*1*	1								
Maximum Reach	*2*	0.879	1							
Number of Loans	*3*	0.264	0.348	1						
Size Bank	*4*	-0.003	-0.016	-0.047	1					
Hierarchy Bank	*5*	-0.059	-0.066	-0.008	0.375	1				
Span Organization	*6*	0.139	0.084	0.137	0.178	0.070	1			
Levels to Telex	*7*	0.270	0.158	0.209	0.172	0.211	0.213	1		
Fax	*8*	-0.237	-0.242	-0.227	0.015	-0.005	-0.017	-0.040	1	
Foreign Bank	*9*	0.074	0.045	0.047	-0.427	-0.197	-0.197	-0.011	-0.056	1
Urban	*10*	0.059	0.040	-0.008	-0.042	0.036	-0.117	-0.057	-0.089	0.260

Variables		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Loan Rate	*1*	1									
ln(Loan Size)	*2*	-0.5852	1								
ln (1 + Distance to Lender)	*3*	-0.0544	0.0859	1							
ln(1 + Distance to Competitor)	*4*	0.0156	0.0022	0.256	1						
Size Bank	*5*	0.005	0.0041	0.036	-0.067	1					
Hierarchy Bank	*6*	-0.0019	0.0026	-0.018	-0.048	0.375	1				
s(Span Organization)	*7*	0.045	-0.0273	-0.068	0.024	0.042	0.001	1			
s(Levels to Telex)	*8*	0.0358	-0.026	-0.107	-0.013	0.176	0.247	0.328	1		
s(Fax)	*9*	0.037	-0.0266	0.059	-0.039	0.037	-0.028	-0.125	-0.067	1	
Foreign Bank	*10*	0.0268	0.0072	-0.016	0.050	-0.427	-0.197	-0.250	-0.176	0.146	1
Urban	*11*	-0.0283	0.032	-0.008	0.017	-0.042	0.036	-0.147	0.019	0.162	0.260

Coefficients of Control Variables in Selected Specifications

The table lists the coefficients from regressions with the indicated dependent variable. All *variables* are defined in Table I. Light gray cells were already reported in the other tables. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	**6**	**7**	**8**
Number of Observations	*13,130*	*13,130*	*13,130*
Dependent Variable	Quartile Reach	Maximum Reach	Number of Loans
Size Bank	-0.01	0.01	-0.07 ***
Hierarchy Bank	-0.13 ***	-0.18 ***	-0.02 ***
Span Organization	0.06 *	-0.09 *	0.00
Levels to Telex	0.49 ***	0.28 ***	0.32 ***
Fax	-0.28 ***	-0.50 ***	-0.10 ***
Urban	0.01	0.03 *	-0.02 ***
Herfindahl-Hirschman Index	0.04	-0.09 *	-0.03 ***
Number of Firms	0.06 ***	0.07 ***	0.01 ***
Main Bank	0.01	0.00	-0.01 ***
Duration of Relationship	-0.02 ***	-0.02 ***	-0.01 ***
Collateral	0.06 ***	0.07 ***	-0.04 ***
ln(1 + Repayment Duration of Loan)	0.03	0.04	0.00
Mortgage	-0.04	-0.06	0.05 ***
Term	-0.05 *	-0.07	0.09 ***
Securitizable term	-0.08 *	-0.10	0.05 ***
Bridge	-0.07	0.02	0.03
Prepay taxes	-0.44	-0.49	0.04
Consumer credit	-0.03 *	-0.04 **	0.02 ***
Rollover	0.02	0.05 **	0.00
Term Spread	-0.03 **	-0.05 **	-0.01 **
Constant	0.00	0.00	0.00
8 Postal Area Dummies	Yes	Yes	Yes
4 Loan Revisability Dummies	Yes	Yes	Yes
49 Industry Dummies	Yes	Yes	Yes
2 Year Dummies	Yes	Yes	Yes
Adjusted R-squared	0.27	0.18	0.19

Branch Reach for Small Loans

The table lists the coefficients from regressions with the indicated dependent variable. We restrict the sample to loans smaller than 200,000 Belgian Francs. *Quartile* (*Maximum*) *Reach* is the log of one plus the shortest traveling time to the quartile most remote borrower of the branch, in minutes. *Number of Loans* is the relative size of the lending branch by the number of loans, in percent. All *independent variables* are defined in Table I. We employ ordinary least squares estimation. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Number of Observations	*5,850*	*5,850*	*5,154*	*5,154*	*5,850*	*5,154*	*5,154*	*5,154*
Dependent Variable	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Maximum Reach	Number of Loans
Size Bank	-0.02					-0.02	0.05	-0.02
	(0.03)					(0.04)	(0.06)	(0.01)
Hierarchy Bank		-0.08 ***				-0.23 ***	-0.29 ***	-0.04 ***
		(0.03)				(0.03)	(0.05)	(0.01)
Span Organization			0.46 ***			0.33 ***	0.34 ***	0.12 ***
			(0.05)			(0.05)	(0.08)	(0.02)
Levels to Telex				1.50 ***		1.50 ***	1.34 ***	0.38 ***
				(0.08)		(0.08)	(0.12)	(0.03)
Fax					-0.35 ***	-0.34 ***	-0.54 ***	-0.13 ***
					(0.02)	(0.02)	(0.03)	(0.01)
Urban	0.03	0.03	0.06 ***	0.06 **	0.00	0.04 *	0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)
Herfindahl-Hirschman Index	0.52 ***	0.51 ***	0.04	0.42 ***	0.37 ***	0.17 ***	0.08	0.01
	(0.06)	(0.06)	(0.03)	(0.06)	(0.05)	(0.06)	(0.09)	(0.02)
Number of Firms	0.02 ***	0.02 ***	0.07 ***	0.04 ***	0.02 ***	0.03 ***	0.04 ***	0.01 ***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Main Bank	0.01	0.01	0.00	0.01	0.00	0.00	0.01	-0.01 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)
Duration of Relationship	-0.05 ***	-0.05 ***	-0.02 ***	-0.03 ***	-0.04 ***	-0.03 ***	-0.04 ***	-0.01 ***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Constant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Other Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.02	0.02	0.26	0.09	0.06	0.14	0.09	0.14

References for Supplement

Degryse, H. (1996) On the Interaction between Vertical and Horizontal Product Differentiation: An Application to Banking, *Journal of Industrial Economics* **44**, 169-186.

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