How forced switches reveal switching costs: evidence from the loan market

Karolis Liaudinskasa

Internet Appendix (IA). Figures and tables for additional robustness tests

FIGURE IA.1
Placebo tests

Figure IA.1 presents two distributions of difference-in-differences in borrowing costs estimated by using specification (1) and by splitting all surviving firms into treatment and control groups randomly 1,000 times. A firm's "survival" is defined by taking at least one new loan in the post-shock period. The histogram on the left uses as a shock the DB's closure. The histogram on the right assumes the shock to occur at the end of 2012q1, thus, the pre-shock period is 2011q4-2012q1 and the post-shock period is 2012q2-2012q4 (to avoid effects of the real shock). Firm-quarter-level borrowing costs equal an average interest rate weighted by loan outstanding amounts. Leasing contracts, term loans and credit lines are considered. After the shock, only contracts issued after the shock are considered. True difference-in-differences, estimated using actual DB's customers as a treatment group and customers of all other banks as a control group, are shown by arrows. A firm is considered a customer of a bank if it had any debt with that bank within one year prior to the shock. The numbers of firms in random treatment and control groups match the numbers in the real groups.

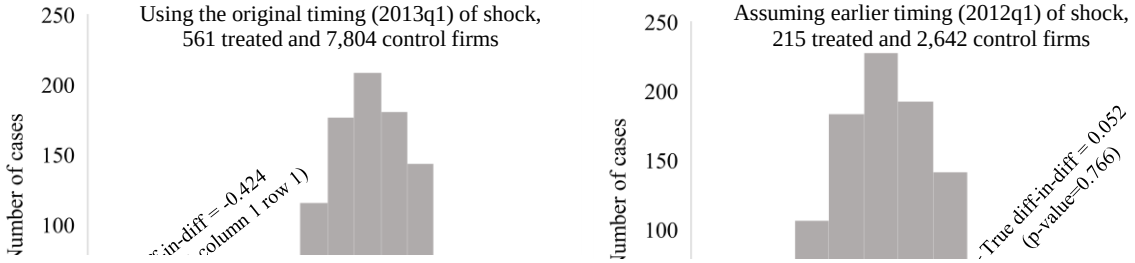

TABLE IA.1

Preferential treatment for DB's bad borrowers: loan matching results

Dependent variable (spread of):	Interest rate	Collateralization	Loan size	Time to maturity
Matching variables:	(1)	(2)	(3)	(4)
Firm	Yes	Yes	Yes	Yes
Year_quarter	Yes	Yes	Yes	Yes
Loan_type	Yes	Yes	Yes	Yes
Loan_ttm (+-1 year)	Yes	Yes	Yes	
Loan_size (+-30%)	Yes	Yes		Yes
Loan_collateralization (+-30%)	Yes		Yes	Yes
Loan_interest_rate (+-30%)		Yes	Yes	Yes
Number of DB's bad borrowers	14	23	16	21
Number of loans issued by DB	40	82	59	57
Number of loans issued by other banks	32	92	46	49
Number of observations (matched pairs)	218	1061	751	472
Average spread between DB's loan and another bank's loan	**-5.2** (bp)**	**-127.4*** (pp)**	**19731.7*** (EUR)**	**3.7*** (quarters)**
	(0.028)	**(0.000)**	**(0.000)**	**(0.000)**

Table IA.1 reports an average spread in four loan characteristics, namely interest rate (column 1), collateralization, i.e., collateral value/loan size ratio, (column 2), time to maturity (column 3), and loan size (column 4), between two matched loans. Loans were matched if they were issued to the same bad (assigned to "bad bank" by KPMG) borrower of DB by two different banks - DB and another bank, were outstanding in the same pre-shock quarter, and had the same loan type, similar time to maturity (+-1 year), similar size (+-30%), similar collateralization (collateral value/loan size ratio) (+-30%), and similar interest rate (+-30%). In every column, I exclude one matching variable which corresponds to the dependent variable specified in row 1. I estimate the gap in the dependent variable between a DB's loan and another bank's loan, and regress that difference on a constant. The estimated coefficients on the constant are reported in the bottom row. P-values are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, two-tailed, respectively.

TABLE IA.2

Main results when controlling for other loan characteristics

	Model specification:	Specification 1 (**all** surviving firms)	Specification 1 (**matched** surviving firms)	Specification 6 in the Heckman model (**all** firms)	Specification 6 in the Heckman model (**matched** firms)
		(1)	(2)	(3)	(4)
	1. Treatment group: all (good and bad) DB's customers				
Row 1	Difference-in-differences	-0.454***	-0.501***	-0.489***	-0.411***
		(0.001)	(0.000)	(0.000)	(0.001)
	Observations	149,684	23,873	17,925	2,761
	# of firms in treatment group	561	344	1,158	677
	# of firms in control group	7,804	1,022	16,798	2,086
	2. Treatment group: Good DB's customers – not assigned to the "bad bank" by KPMG				
Row 2	Difference-in-differences	-0.631***	-0.759***	-0.730***	-0.740***
		(0.000)	(0.000)	(0.000)	(0.000)
	Observations	147,636	22,210	17,725	2,621
	# of firms in treatment group	449	254	898	524
	# of firms in control group	7,804	1,022	16,798	2,086
	3. Treatment group: Bad DB's customers – assigned to the "bad bank" by KPMG				
Row 3	Difference-in-differences	0.257	0.242	0.486***	0.547**
		(0.147)	(0.184)	(0.005)	(0.010)
	Observations	141,275	19,215	17,002	2,225
	# of firms in treatment group	112	90	260	153
	# of firms in control group	7,804	1,022	16,798	2,086
	4. Treatment group: all HB's customers				
Row 4	Difference-in-differences	0.197	-0.419	0.157	-0.196
		(0.127)	(0.111)	(0.377)	(0.506)
	Observations	150,675	2,794	17,925	235
	# of firms in treatment group	116	36	153	54
	# of firms in control group	8,277	107	17,803	181

Table IA.2 reports the same regression coefficients as Table 3 (main results), but estimated after including other loan characteristics as controls. Specification (1) (columns 1 and 2) has been extended with three firm-quarter-level average (loan-amount-weighted average across outstanding loans) loan characteristics: (1) time to maturity, (2) percentage of loan collateralized (i.e., collateral value divided by the loan outstanding amount), and (3) loan size. These three variables were then averaged for every firm across quarters before the bank closures (up to 2012 q4), and the resulting firm-level ex-ante average loan characteristics were included into both specification (6) (columns 3 and 4) and the selection equation (specification 5). For brevity, I report only the difference-in-differences of borrowing costs. I use four model specifications (listed in columns) and four treatment groups (listed in rows and underlined). In all four rows, the control group comprises firms that were customers of other banks than the closed bank. P-values are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, two-tailed, respectively. Robust standard errors are clustered multiway at the firm and quarter levels in columns (1) and (2), and unclustered in columns (3) and (4). Heckman's model in columns (4) and (5) is estimated using Heckman's two-step consistent estimator.

TABLE IA.3

Main results when controlling for other loan characteristics and assuming 100% collateralization for leasing contracts

	Model specification:	Specification 1 (**all** surviving firms)	Specification 1 (**matched** surviving firms)	Specification 6 in the Heckman model (**all** firms)	Specification 6 in the Heckman model (**matched** firms)
		(1)	(2)	(3)	(4)
		1. Treatment group: all (good and bad) DB's customers			
Row 1	Difference-in-differences	-0.446***	-0.478***	-0.475***	-0.420***
		(0.001)	(0.000)	(0.000)	(0.001)
	Observations	149,684	23,873	17,925	2,761
	# of firms in treatment group	561	344	1,158	677
	# of firms in control group	7,804	1,022	16,798	2,086
	2. Treatment group: Good DB's customers – not assigned to the "bad bank" by KPMG				
Row 2	Difference-in-differences	-0.618***	-0.733***	-0.717***	-0.747***
		(0.000)	(0.000)	(0.000)	(0.000)
	Observations	147,636	22,210	17,725	2,621
	# of firms in treatment group	449	254	898	524
	# of firms in control group	7,804	1,022	16,798	2,086
	3. Treatment group: Bad DB's customers – assigned to the "bad bank" by KPMG				
Row 3	Difference-in-differences	0.246	0.248	0.500***	0.502**
		(0.166)	(0.174)	(0.004)	(0.019)
	Observations	141,275	19,215	17,002	2,225
	# of firms in treatment group	112	90	260	153
	# of firms in control group	7,804	1,022	16,798	2,086
	4. Treatment group: all HB's customers				
Row 4	Difference-in-differences	0.191	-0.408	0.164	-0.188
		(0.134)	(0.123)	(0.354)	(0.522)
	Observations	150,675	2,794	17,925	235
	# of firms in treatment group	116	36	153	54
	# of firms in control group	8,277	107	17,803	181

Table IA.3 reports the same regression coefficients as Table 3 (main results), but estimated after including other loan characteristics as controls and assuming that all leasing contracts are fully collateralized, i.e., collateral value divided by the loan amount equals one. Specification (1) (columns 1 and 2) has been extended with three firm-quarter-level average (loan-amount-weighted average across outstanding loans) loan characteristics: (1) time to maturity, (2) percentage of loan collateralized (i.e., collateral value divided by the loan outstanding amount), and (3) loan size. These three variables were then averaged for every firm across quarters before the bank closures (up to 2012 q4), and the resulting firm-level ex-ante average loan characteristics were included into both specification (6) (columns 3 and 4) and the selection equation (specification 5). For brevity, I report only the difference-in-differences of borrowing costs. I use four model specifications (listed in columns) and four treatment groups (listed in rows and underlined). In all four rows, the control group comprises firms that were customers of other banks than the closed bank. P-values are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, two-tailed, respectively. Robust standard errors are clustered multiway at the firm and quarter levels in columns (1) and (2), and unclustered in columns (3) and (4). Heckman's model in columns (4) and (5) is estimated using Heckman's two-step consistent estimator.

TABLE IA.4

Main results when using unweighted average interest rate as dependent variable

	Model specification:	Specification 1 (**all** surviving firms)	Specification 1 (**matched** surviving firms)	Specification 6 in the Heckman model (**all** firms)	Specification 6 in the Heckman model (**matched** firms)
		(1)	(2)	(3)	(4)
		1. Treatment group: all (good and bad) DB's customers			
Row 1	Difference-in-differences	-0.616***	-0.592***	-0.649***	-0.546***
		(0.000)	(0.000)	(0.000)	(0.000)
	Observations	149,684	23,873	17,925	2,761
	# of firms in treatment group	561	344	1,158	677
	# of firms in control group	7,804	1,022	16,798	2,086
	2. Treatment group: Good DB's customers – not assigned to the "bad bank" by KPMG				
Row 2	Difference-in-differences	-0.776***	-0.839***	-0.878***	-0.879***
		(0.000)	(0.000)	(0.000)	(0.000)
	Observations	147,636	22,210	17,725	2,621
	# of firms in treatment group	449	254	898	524
	# of firms in control group	7,804	1,022	16,798	2,086
	3. Treatment group: Bad DB's customers – assigned to the "bad bank" by KPMG				
Row 3	Difference-in-differences	0.030	0.114	0.280	0.429*
		(0.889)	(0.634)	(0.106)	(0.050)
	Observations	141,275	19,215	17,002	2,225
	# of firms in treatment group	112	90	260	153
	# of firms in control group	7,804	1,022	16,798	2,086
	4. Treatment group: all HB's customers				
Row 4	Difference-in-differences	0.048	-0.488*	0.147	-0.278
		(0.704)	(0.062)	(0.412)	(0.356)
	Observations	150,675	2,794	17,925	235
	# of firms in treatment group	116	36	153	54
	# of firms in control group	8,277	107	17,803	181

Table IA.4 reports the same regression coefficients as Table 3 (main results), but estimated using unweighted average interest rate as the dependent variable $borrowing\_costs_{f,q}$. For brevity, I report only the difference-in-differences of borrowing costs. I use four model specifications (listed in columns) and four treatment groups (listed in rows and underlined). In all four rows, the control group comprises firms that were customers of other banks than the closed bank. P-values are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, two-tailed, respectively. Robust standard errors are clustered multiway at the firm and quarter levels in columns (1) and (2), and unclustered in columns (3) and (4). Heckman's model in columns (4) and (5) is estimated using Heckman's two-step consistent estimator.

TABLE IA.5
Post-shock loan matching variables

Category	Matching variable	Two loans were matched if:
Macro	Year_quarter	Both loans were issued in the same year and quarter.
Bank	Bank	Both loans were issued by the same bank.
Firm	Age (+-1 year)	The first appearance of both firms in the credit register was in the same quarter (+- 1 year).
Firm	Size (+-30%)	In the quarter of the loan issuance, both firms had a similar (+-30%) total debt to banks.
Firm	Collateralization (+-30%)	In the quarter of the loan issuance, both firms had a similar (+-30%) average collateralization ratio, i.e., loan collateral value divided by loan outstanding amount, across their outstanding loans.
Firm	Rep_delays (1 or 0)	Either both firms had at least one or both firms had zero repayment delays up to the quarter of the loan issuance.
Firm	Exclusive (1 or 0)	Either both firms had loans outstanding with only one bank or both firms had loans outstanding with more than one bank within one year before the DB's closure.
Firm	Ttm (+-1 year)	In the quarter of the loan issuance, both firms' latest maturing loans had a similar (+-1 year) maturity date.
Firm	Rel_length (+-1 year)	In the quarter of the loan issuance, both firms had a similar (+-1 year) average (across their banks) length of existing lending relationships.
Loan	Loan_type	Both loans were of the same type, i.e., term loans, leasing contracts or credit lines.
Loan	Loan_ttm (+-1 year)	Both loans had a similar (+-1 year) time to maturity.
Loan	Loan_size (+-30%)	Both loans had a similar (+-30%) loan amount.
Loan	Loan_collateral (+-30%)	Both loans had a similar (+-30%) collateralization ratio, loan collateral value divided by loan amount.

Table IA.5 provides variable descriptions for the post-shock loan matching analysis whereby loans of good, i.e., not assigned to the "bad bank", DB's customers are matched with loans of other firms that were not customers of DB.

TABLE IA.6
Post-shock loan matching results

Matching variables:	(1)	(2)	(3)	(4)
Bank	Yes	Yes	Yes	Yes
Year_quarter	Yes	Yes	Yes	Yes
Loan_type	Yes	Yes	Yes	Yes
Age (+-1 year)	Yes	Yes	Yes	Yes
Size (+-30%)	Yes	Yes		Yes
Collateralization (+-30%)		Yes		Yes
Rep_delays (1 or 0)		Yes	Yes	Yes
Exclusive (1 or 0)		Yes	Yes	Yes
Ttm (+-1 year)		Yes		Yes
Rel_length (+-1 year)		Yes	Yes	Yes
Loan_ttm (+-1 year)			Yes	Yes
Loan_size (+-30%)			Yes	Yes
Loan_collateral (+-30%)			Yes	Yes
Number of DB's clients	393	46	181	20
Number of other firms	2,661	68	513	23
Number of loans issued to DB's clients	2,119	105	703	33
Number of loans issued to other firms	7,244	117	1,156	29
Number of observations (matched pairs)	17,421	234	2,142	45
Spread in basis points	**-1.3**	**-6.9**	**4.9**	**-24.9**
	(0.709)	**(0.365)**	**(0.323)**	**(0.244)**

Table IA.6 reports an average spread between an interest rate on a new loan issued after the DB's closure to a good, i.e., not assigned to the "bad bank", DB's customer and an interest rate on a similar new loan issued in the same quarter by the same bank to a similar firm which was not a customer of DB. A firm is considered a bank's customer if it had any outstanding loans with that bank within one year before the DB's closure. All loans are considered only in a quarter of issuance. I use matching variables defined in Table IA.4 and listed in the first column of this table to pair every loan taken by DB's customers with as many as possible loans taken by other firms. Estimated interest rate spreads are regressed on a constant. The estimated coefficients on the constant are reported in the bottom row. Every column represents a different set of matching variables used. P-values are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, two-tailed, respectively. Robust standard errors are clustered at the DB customers' loan level.