Real Effects of Imperfect Bank-Firm Matching

L. Farinha Banco de Portugal Kokas U of Essex **S. Tsoukas** U of Glasgow E. Sette Banca d'Italia

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Motivation

- Banks reduce the costs of acquiring information and in this way improve the allocation of credit (Levine, 05)
- The way credit is allocated is not random and it depends on how banks and firms match to form credit relationships
- In the Great Recession and in the EU debt crisis, a ↓ in firms' credit turned into a ↓ in their employment and investment
- If relationships are terminated in crisis periods:
 - Can firms find new banks?
 - If the new bank-firm matching is less efficient, to what extent are firms' credit, employment, investment and survival affected?

In this paper

Open the "black-box" of bank-firm matches:

- Rely on unique granular dataset on the universe of bank-firm matches from the Portuguese credit and firm registers
- Provide evidence on the drivers of bank-firm matches
- Compare active matches in crisis years relative to matches in pre-crisis times. Generate a match quality index measuring how much the former differs from the latter
- Analyze whether the match quality index affects the firm's credit provision and real outcomes in crisis times, using the EBA capital exercise as a supply shifter (IV)

Preview of the results

A. Matches are more likely to occur in pre-crisis times if:

- Banks have larger network: Branches in the same post-code with firms' location
- Banks have higher capital: Tier 1
- Firms are less risky: CB Prob(D)

B. Measure the difference between matches in crisis years relative to matches in pre-crisis years:

• The difference is larger for SMEs relative to their counterparts

It stems from:

- Deterioration in the bank and firm fundamentals
- New bank-firm matches are on average worse

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It stems from:

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- New bank-firm matches are on average worse

C. Match quality and firm outcomes during crisis years

• Larger difference results in contraction in credit; increase in unemployment; drop in investment and a rise in the probability of default

<u>Mechanism</u>: The above results are driven by small firms, which are typically more credit constrained in crisis times

Relevant literature

- Bank capital as the driver of bank-firm matches: Schwert (18)
 <u>Our Contribution</u>: Look at both bank and firm characteristics and use a sample that includes maninly SMEs and micro firms
- Relationship lending in crisis times: Sette and Gobbi (15), Bolton et al. (16), Beck et al. (18)...
 <u>Our Contribution</u>: Show which bank and firm characteristics matter in forming lending relationships
- Real effects of bank shocks: Duchin et al. (10), Darmouni (20)... <u>Our Contribution</u>: Go beyond the anticipated loss of information and analyze the deterioration of relative bank-firm characteristics
- Theories on bank-firm matching formation: Holmstorm & Tirole (97), Diamond & Rajan (01), Allen et al. (11)...
 <u>Our Contribution</u>: We test empirically the relevance of the different drivers of bank-firm matches

Data description

- We use the Central Credit Register (CRC) of Banco de Portugal from 2006 to 2016 *Reporting threshold: €50*
- Accounting are taken from the Central Balance Sheet which covers the entire universe of Portuguese non-financial firms
- Bank BS data come from the MFI Statistics and regulatory ratios are obtained from prudential reports
- Bank-branches information: Register of Financial Institutions (*Registro Especial de Instituicoes*)
- Firms' *prob(default)* on bank debt within one-year horizon from the Banco de Portugal

Results

Part A: Determinants of bank-firm matches

Definition of bank-firm matches

Degryse and Ongena (05) and Bonfim et al. (21)





Bank-firm matches: Reduced-form regression

 $\begin{aligned} & \textit{Prob}(\textit{Matching}_{b,f,l,t}) = \alpha_0 + \lambda_1 * (\textit{F Size}_{f,l,t} * \textit{B Size}_{b,l,t}) \\ & +\lambda_2 * \textit{Capital ratio}_{b,t} + \lambda_3 * \textit{HHI}_{b,l,t} + \lambda_4 * \textit{Prob}(\textit{d})_{f,t-1} + \epsilon_{b,f,l,t} \end{aligned}$

$$Matching_{b,f,l,t} = \begin{cases} \mathbb{1}, & \text{if bank } b \text{ and firm } f \text{ in a 4-d post code } l \\ & \text{at time } t \text{ are in the Credit Registry} \\ 0, & \text{otherwise} \end{cases}$$

- Bank-firm determinants: Theories of matching formation⁵⁰⁰
- α_0 : Firm, bank, year, location, bank*year, firm*year, bank*firm fixed effects
- ϵ is the stochastic disturbance

Results on the determinants

- <u>Size</u>: Both large and small firms are more likely to form a match with a large bank, within a 4 digit postcode
- Capitalization: Banks that are better capitalized are more likely to form credit relationships
- Setter capitalized banks are more likely to match with riskier firms, pointing to an allocation of risk toward banks that have a higher risk-bearing capacity
- Results are qualitatively and quantitatively similar across different sets of time-varying fixed effects

Table

Part B: Imperfect match index

- We estimate the model in the pre-crisis period (2006-2008) to predict matches out of sample in the crisis period (2009-2016) Figures
- We define the index as $(Realized Predicted)^2$ from 2009 to 2016. The index ranges from 0 to 1
- Larger values of the index indicate that the relative bank-firm characteristics in pre-crisis matching (fewer frictions) are not aligned with the crisis period (0--> NO deviation)
- For this reason we call it "imperfect match index"

Evolution of the imperfect match index



Part C: Variation in the imperfect match index

- The index indicates a worsening of match quality during the crisis years
- Variation stems mainly from:
 - Deterioration in bank and firm fundamentals
 - 2 New bank-firm relationships are on average worse

Table

Part D: Validation

Credit provision:

 1 std worsening in match quality corresponds to a drop of credit between €9,000 and €45,000, a non-trivial amount as the average loan outstanding amount is €85,852 Table

Switching a lender:

• 1 std worsening in match quality increases the likelihood of switching a lender by 1% Table

Termination of lending:

• 1 std worsening in match quality increases the likelihood of terminating an existing relationship by 1.5% (Table)

Part E: Firms' real outcomes

Firm-level regressions: Weighed by share of credit

- OLS estimates are not causal: Matching $index_{f,t} \not\perp Firm \ outcomes_{f,t}$
- So, we use an IV estimation for supply-driven changes in the match quality index
- <u>Instrument</u>: Unexpected EBA capital exercise after a round of stress tests, e.g., Gropp et al. 19; Blattner et al. 21

Imperfect $Match_{f,t} = \alpha_0 + \rho * EBA$ borrowing $share_{f,t} + \gamma * F_{f,t} + \eta_{f,t}$

$$Y_{f,t} = \alpha_0 + \left| \beta_1 * \textit{Imperfect Match}_{f,t} \right| + \beta_2 * F_{f,t} + \mu_f + \mu_t + \epsilon_{f,t}$$

• EBA borrowing share
$$f_{f,t} = \frac{\sum_{EBA} Outstanding amount_{f,t}}{\sum_{All bank} Outstanding amount_{f,t}}$$

	Panel A: First stage			
	I II		III	
Dependent variable		Imperfect Mat	ch	
Group	Full sample	Single lending	Multiple lending	
EBA borrowing share	0.003***	0.004***	-0.009	
	Panel B: Second stage			
	I	II	III	
Dependent variable		Ln(# of employ	rees)	
Group	Full sample	Single lending	Multiple lending	
Imperfect Match	-5.300***	-5.339***	0.292	
Firm control variables	Y	Y	Y	
Observations R-squared	134,267 0.936	115,359 0.935	21,297 0.254	
Year & Firm FE	Υ	Υ	Υ	

Table 1: Imperfect match index and employment

Summary:

 $\overline{^{1}}$ Following the EBA capital exercise the imperfect-match index deteriorates 2 One std worsening in match quality is associated with a drop in firms' employment by 0.9%

 3 The effect is driven by firms with a single lender

	Panel A: First stage			
	I	П	III	
Dependent variable		Imperfect Mat	ch	
Group	Full sample	Single lending	Multiple lending	
EBA borrowing share	0.003***	0.004***	-0.009	
	Panel B: Second stage			
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	I	11 111			
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Firms that switch lenders, but keeping the number of lenders constant

	Panel A: First stage			
	1	П	III	
Dependent variable		Imperfect Mat	ch	
Group	Full sample	Single lending	Multiple lending	
EBA borrowing share	0.003***	0.003***	0.001***	
	Panel B: Second stage			
	1	П	Ш	
Dependent variable		Ln(# of employ	vees)	
Group	Full sample	Single lending	Multiple lending	
Imperfect Match	-3.441***	-3.380***	-5.313***	
Firm control variables	Y	Y	Y	
Observations	57,909	50,149	7,734	
R-squared	0.292	0.313	0.202	
Year & Year FE	Y	Y	Y	

Table 2: New matches and employment

Firms that switch lenders, but keeping the number of lenders constant

	Panel A: First stage			
	I	II	III	
Dependent variable		Imperfect Mat	ch	
Group	Full sample	Single lending	Multiple lending	
EBA borrowing share	0.003***	0.003***	0.001***	
	Panel B: Second stage			
	I	II	III	
Dependent variable		Ln(# of employ	rees)	
Group	Full sample	Single lending	Multiple lending	
Imperfect Match	-3.441***	-3.380***	-5.313***	
Firm control variables	Υ	Y	Y	
Observations	57,909	50,149	7,734	
R-squared	0.292	0.313	0.202	
Year & Year FE	Y	Y	Y	

Table 2: New matches and employment

Firms that switch lenders, but keeping the number of lenders constant

		Panel A: First s	tage	
	I	II	III	
Dependent variable		Imperfect Mat	ch	
Group	Full sample	Single lending	Multiple lending	
EBA borrowing share	0.003***	0.003***	0.001***	
	Panel B: Second stage			
	I	II	III	
Dependent variable		Ln(# of employ	rees)	
Group	Full sample	Single lending	Multiple lending	
Imperfect Match	-3.441***	-3.380***	-5.313***	
Firm control variables	Υ	Y	Υ	
Observations	57,909	50,149	7,734	
R-squared	0.292	0.313	0.202	
Year & Year FE	Y	Y	Y	

Table 2: New matches and employment

Imperfect match index and firms' outcomes In the paper

Investment:

• A 1 std worsening in the imperfect-match index is associated with a drop in firms' tangible assets of 2.7% Table

Probability of Default:

• A 1 std worsening in the imperfect-match index is associated with a drop in firms' survival of 4.2% Table

Additional tests

Further tests:

- Determinants of matching: Single VS multiple lending Table
- Heterogeneous effects on bank-firm matching Table
- OLS estimates for the real effects Table
- Results on EBA and outstanding amount Table
- Placebo test: Firm outcomes during the pre-crisis period Table

Sensitivity tests:

- Alternative definitions for the bank-firm matching
- Alternative calculation for the imperfect match index
- Exclude Lisbon and Porto Table
- Results with bootstrap SE Table
- Industry-location-size FEs Table

Conclusions

- In this paper we open the "black-box" of bank-firm matches
- We study how matches in place and newly formed matches during crises differ from those in pre-crises times
- A worsening in the matching quality reduces firms' credit, employment, investment, and chances of survival
- Results hold also for firms that manage to keep the same number of relationships, showing that the relative characteristics of banks and firms in a credit relationship matter
- Relative characteristics between a bank and a firm matter and we go beyond the standard proxies for relationship lending

Appendix

Definition of bank-firm matching

- First step: Identify all potential matches.
- Use geography 4-digit postcode (Degryse and Ongena 05; Bonfim et al., 21).
 - Postal code number example:



- ► 72 -- > postal distribution centers (Amadora)
- ► 5--> designed address
- ► 075--> building block
- All banks with a branch in the same post-code as the firm's headquarter constitute a potential match.
- Also tried 7-digit post code and geolocalizing bank-branches and firm-headquarters but found that 70% of the matches are in a 4-digit post code.

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#	Freq.	Percent	Cum.	
1	690,488	69.83	69.83	
2	178,496	18.05	87.89	
3	65,424	6.62	94.5	
4	29,012	2.93	97.44	
5	14,250	1.44	98.88	
6	6,840	0.69	99.57	
7	2,814	0.28	99.85	
8	944	0.10	99.95	
9	297	0.03	99.98	
10	130	0.01	99.99	
11	44	0.00	100	
12	24	0.00	100	
Total	988,763	100		
Unique number of banks: 453				
Unique number of firms : 512,446				

Table A1: Total number of matches within firm-year

The table reports the distribution of the total number of realized matches in the final

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sample.

Table A2: Summary statistics

	Level	Obs	Mean	Std	Min	Max
Panel A: Credit Regist	ry dataset only for ne	w relationsh	ips (out of ti	he registry fo	or 12 mor	nths)
Amount outstanding	Bank-Firm	1,626,578	49,660.87	2.2M	50	1,444M
# of new relations	Bank-Firm	1,626,578	2.02	1.760	1.000	61.000
	Panel B: Active	bank branch	es dataset			
# branches per zipbase	Branch-Zipbase	104,675	41.386	35.996	1.000	191.000
Bank's shares (branches)	Branch-Zipbase	104,675	0.131	0.129	0.005	1.000
Rescaled HHI (0-1)	Branch-Zipbase	104,675	0.058	0.053	0.008	1.000
# of competitors branches	Branch-Zipbase	104,675	37.799	34.326	0.000	190.000
Panel C: Final dataset						
New relationship dummy	Bank-Firm-Zipase	5,647,211	0.127	0.333	0.000	1.000
# of possible matches	Bank-Firm-Zipase	5,647,211	20.935	14.664	1.000	74.000
Big_Big	Bank-Firm-Zipase	5,647,211	0.242	0.428	0.000	1.000
Small_Small	Bank-Firm-Zipase	5,647,211	0.247	0.431	0.000	1.000
Small_Big	Bank-Firm-Zipase	5,647,211	0.258	0.438	0.000	1.000
Big_Small	Bank-Firm-Zipase	5,647,211	0.252	0.434	0.000	1.000
HHI branch concentration	Branch-Zipbase	5,647,211	0.544	0.384	0.070	9.000
Capital ratio	Bank	5,023,981	0.106	0.164	0.000	5.017
Prob(default)	Firm	5,635,477	0.055	0.065	0.000	0.905
Outstanding amt	Loan	718,461	27,294.01	1,214,540	0.000	619,500,000
Imperfect match index (2009)	Bank-Firm-Zipbase	2,937,273	-0.196	0.335	-0.500	0.901
Switch lender	Bank-Firm-Zipbase	5,647,211	0.033	0.177	0.000	1.000
Termination of lending	Bank-Firm-Zipbase	5,647,211	0.040	0.195	0.000	1.000
Successful consultation	Bank-Firm-Zipbase	239,608	0.499	0.500	0.000	1.000
EBA shock	Bank	5,647,211	0.029	0.168	0.000	1.000



Table A3: Bank-firm matching: Determinants

	I	II	111	IV	V	VI	VII
Large_large Small_large	0.119*** 0.089***	0.102*** 0.083***	0.031*** 0.012***	0.031*** 0.012***	0.033*** 0.026***	0.017***	0.013*** 0.012***
Small_small Capital ratio HHI Prob(dofault)	-0.025*** -0.024*** -0.016***	-0.015*** -0.012*** -0.014***	-0.015*** 0.003*** -0.012***	-0.015*** 0.003*** -0.012***	0.004***	-0.018*** -0.008***	-0.038*** 0.012*** -0.014***
Observations R-squared	5,013,829 0.038	5,011,739 0.082	5,011,739 0.099	5,011,739 0.099	5,010,697 0.118	5,011,739 0.111	3,049,146 0.467
Year FE Firm FE Bank FE Locations FE Firm*Year FE Bank*Year FE Firm*Bank FE	Y	Y Y	Y Y Y	Y Y Y Y	Y Y Y	Y Y Y	Y Y Y
SE	Robust	Robust	Robust	Robust	Robust	Robust	Robust

1.Both large and small firms are more likely to form a match with a big bank, within a 4 digit postcode. 2.The relative size matching is not just a mechanical effect driven by big banks having more branches. Overall, results are qualitatively and quantitatively similar across different sets of fixed effects.



	ļ	II	
	Full sample	Single lending	Multiple lending
Large_large	0.031***	0.031***	0.042***
Small_large	0.012***	0.039***	-0.009
Small_small	-0.015***	-0.009***	-0.002
Capital ratio	0.003***	0.013***	-0.018***
HHI	-0.012***	0.004**	-0.019*
Prob(default)	-0.060***	0.005	-0.070**
Observations	5,011,739	4,173,031	838,653
R-squared	0.099	0.061	0.175
Year FE	Y	Y	Y
Firm FE	Y	Υ	Y
Bank FE	Y	Y	Υ
Locations FE	Y	Y	Υ
SE	Robust	Robust	Robust

Table A4: Bank-firm matching : Single versus multiple lending

Business & Household credit growth

Greenwood, Hanson, Shleifer and Sorensen (2020)



Pre-crisis period (2006-2008) is characterized by moderate credit growth and the absence of credit or housing bubbles. Matching index

	I	II	III
Large_large	0.032***	0.032***	0.023***
Small_large	0.011***	0.003**	-0.009***
Small_small	-0.016***	-0.024***	-0.026***
Capital ratio	-0.001	0.003**	-0.029***
HHI	-0.013***	-0.012***	-0.012***
Prob(default)	-0.061***	-0.134***	0.084***
Small_firm * Capital_ratio	0.008***		
Small_firm * Prob(default)		0.172***	
Large_firm * Prob(default)			-0.185***
Large_firm * High_capital			-0.005***
High_capital * Prob(default)			-0.082***
Large_firm * High_capital * Prob(default)			0.025**
Observations	5,011,739	5,011,739	5,011,739
R-squared	0.099	0.099	0.099
Year FE	Υ	Υ	Υ
Firm FE	Y	Y	Y
Bank FE	Y	Y	Y
Locations FE	Υ	Y	Y
SE	Robust	Robust	Robust

Table A5: Bank-firm matching: Heterogeneous effect



Table A6: Bank-firm matching: Alternative tests

	I	II	111	IV	V
Large_large	0.032***	0.114***	0.031***	0.031***	0.023***
Small_large	0.023***	0.003	0.012***	0.015***	0.004***
Small_small		-0.196***	-0.015***	-0.012***	-0.015***
Capital ratio		0.149***	0.003***	0.004***	0.006***
HHI		-0.032***	-0.012***	-0.013***	-0.013***
Prob(default)		0.197***	-0.060***	-0.057***	-0.060***
Ln(turnover)				-0.001**	
Ln(total expenses)				0.008***	
Ln(deposits)					0.006*
Bank cash					0.000***
Observations	5,645,040	4,977,513	5,011,739	4,616,007	5,011,739
R-squared	0.097		0.099	0.100	0.099
X-sq (Probit)		203174			
Year FE	Y	Y	Y	Y	Y
Firm FE	Υ		Y	Υ	Υ
Bank FE	Υ	Υ	Υ	Υ	Y
Locations FE	Y	Y	Y	Y	Υ
Industry*Location*Size*Year FE	Y				
SE	Robust	Robust	Bank*Firm	Robust	Robust

	I	11		IV	V
Imperfect match # of bank-branches	-4.563***	-0.340***	-0.760**	-1.429***	-1.427*** 0.058
Observations R-squared	258,627 0.104	130,398 0.651	31,043 0.704	38,698 0.708	38,698 0.708
Year FE Bank FE Firm FE	Y Y	Y Y Y		Y	Y
Locations FE Firm*Year FE Bank*Year FE		Y	Y Y Y	Y	Y
Firm*Bank FE				Y	Y
Cluster SE	Bootstrap	Bootstrap	Bootstrap	Bootstrap	Bootstrap

	I	II
Dependent Variable:	Ln (Credit)	Ln (Credit)
EBA exercise	-0.571***	-0.614**
Capital ratio	0.493	1.965***
HHI	-0.024	-0.008
Ln(deposits)	-0.000	-0.001*
Bank size	-0.336**	0.020
Observations	407,556	407,553
R-squared	0.020	0.046
Year FE	Y	Y
Bank FE		Y
Cluster SE	Bank	Bank

Table A8: EBA exercise and outstanding credit



Table A9: Imperfect-match index and real effects: Excluding Lisbon and Porto

	Panel A: First stage					
	I	II	III	IV	V	VI
Dependent variable			Imperfe	ect match		
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
EBA borrowing share	0.002***	0.002***	0.000	0.002***	0.002***	0.000
	Panel B: Second stage					
	I	II	Ш	IV	V	VI
Dependent variable	Ln(#	of employee	es)	Ln(fixed tangible assets)		
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
Imperfect Match	-8.470***	-8.742***	-59.992	-32.894***	-34.067***	-107.162
Firm control variables	Y	Y	Y	Y	Y	Y
Observations	115,346	99,243	18,056	112,683	96,799	17,777
Year & Firm FE	Y	Y	Y	Y	Y	Y
SE	Robust	Robust	Robust	Robust	Robust	Robust

	I	II	Ш	IV	V	VI
Dependent variable	Ln(# of employe	es)	Ln(fix	ed tangible as	sets)
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
Imperfect match	-5.581*** [-136.321]	-6.074*** [-136.138]	-4.394*** [-36.860]	-11.736*** [-143.236]	-12.816*** [-141.528]	-8.026*** [-37.357]
Firm control variables	Y	Y	Υ	Y	Y	Y
Observations R-squared	279,000 0.119	257,691 0.136	21,309 0.085	267,530 0.146	246,548 0.164	20,982 0.109
Year FE Firm FE	Y Y	Y Y	Y Y	Y Y	Y Y	Y Y
Cluster SE	Robust	Robust	Robust	Robust	Robust	Robust

Table A10: Imperfect-match index and real effects: Firm-level OLS estimates

Sanity check 1: Loan-level

	I	II	111	IV	V
Imperfect Match	-4.563***	-0.340***	-0.706***	-1.429***	-1.427***
# of bank-branches					0.058
Observations	258,627	130,398	31,043	38,698	38,698
R-squared	0.108	0.651	0.704	0.708	0.708
Year FE	Y	Y		Y	Y
Bank FE	Y	Y			
Firm FE		Y			
Locations FE		Y	Y	Υ	Y
Firm*Year FE			Y		
Bank*Year FE			Y		
Firm*Bank FE				Y	Y

Table A11: Dependent Variable: Ln(Outstanding amt)

1 std worsening in match quality is associated with a drop in credit between 263,000 and 657,000 \in , depending on the specification.



Sanity check 2: Loan-Level

	l	II	111	IV	V	VI
Dependent variable	Prob(Switching le	ender)	Prob(Ter	mination of	lending)
Imperfect Match	0.019***	0.054***	0.053***	0.057***	0.101***	0.100***
Observations	297,301	252,610	252,567	297,301	252,610	252,567
K-squared	0.443	0.452	0.455	0.435	0.444	0.448
Control Variables	Y	Y	Y	Υ	Y	Y
Year FE	Y			Υ		
Firm FE	Y			Y		
Bank FE	Y	Υ		Y	Y	
Locations FE	Y	Υ	Υ	Y	Y	Y
Firm*Year FE		Υ	Υ		Y	Y
Bank*Year FE			Υ			Υ

Table A12: Switching lenders and terminating relationships

Higher quality matches are less likely to be associated with either a switch or an outright termination.

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Table A13: Imperfect match index and investment

		Panel A: First stage				
	I	П	Ш	IV	V	VI
Dependent variable			Imperfee	t match		
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
EBA borrowing share	0.001***	0.001**	-0.003	0.002***	0.003***	0.001***
			Panel B: Se	econd stage		
	l	П	III	IV	V	VI
Dependent variable		All firms		Only for fire	ms that swite	ch lenders
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
Imperfect Match	-16.318***	-16.767***	-0.407	-6.932***	-7.465***	-6.242**
Firm control variables	Y	Y	Y	Y	Υ	Y
Observations R-squared Year and Firm FE	131,204 0.908 Y	112,528 0.908 Y	20,967 -258.8 Y	58,071 0.247 Y	50,325 0.269 Y	7,723 0.249 Y
SE	Robust	Robust	Robust	16.38	16.38	16.38

Other Tests Results

			Panel A:	First stage		
	I	П	Ш	IV	V	VI
		All firms		Only for firn	ns that swite	ched lenders
Dependent variable			Imperf	ect match		
Group	Full sample	Single	Multiple	Full sample	Single	Multiple
EBA borrowing share	0.001***	0.001***	0.000	0.001***	0.001***	0.001
			Panel B: S	Second stage		
	I	П	111	IV	V	VI
		All firms		Only for firn	ns that swite	ched lenders
	-					

Table A14: Imperfect-match index and the probability of default

Group Full sample Single Multiple Full sample Single Multiple 0.194*** Imperfect Match 0.274*** 0.269*** -0.854 0.203*** 3.113 Firm control variables Υ Υ Y Υ Υ Υ Observations 148,238 128,056 22,543 55,172 47.092 9,736 R-squared 0.697 0.685 0.0647 0.708 0.719 0.118 Year & Firm FE Υ Υ Y Υ Υ Υ SE Robust Robust Robust Robust Robust Robust

1 std increase int he imperfect match index increases the firm $\mathsf{Prob}(\mathsf{D})$ by 4% (Column II). This increase represents 72% of the sample mean (5.5%).

Other Tests Results

Table A15: Bank-firm matching: Determinants

	I	II		IV	V	VI	VII
Large_large	0.119***	0.102***	0.031***	0.031***	0.033***	0.017***	0.013***
Small_large	0.089***	0.083***	0.012***	0.012***	0.026***		0.012***
Small_small	-0.025***	-0.015***	-0.015***	-0.015***		-0.018***	-0.038***
Capital ratio	-0.024***	-0.012***	0.003***	0.003***	0.004***		0.012***
HHI	-0.016***	-0.014***	-0.012***	-0.012***		-0.008***	-0.014***
Prob(default)	0.044***	-0.060***	-0.060***	-0.060***		-0.060***	-0.060***
Observations	5,013,829	5,011,739	5,011,739	5,011,739	5,010,697	5,011,739	3,049,146
R-squared	0.038	0.082	0.099	0.099	0.118	0.111	0.467
Year FE	Y	Y	Y	Y			Y
Firm FE		Υ	Υ	Υ		Υ	
Bank FE			Υ	Υ	Υ		
Locations FE				Υ	Υ	Υ	Υ
Firm*Year FE					Y		
Bank*Year FE						Y	
Firm*Bank FE							Υ
SE	Robust						

1.Both large and small firms are more likely to form a match with a big bank, within a 4 digit postcode.

2. The relative size matching is not just a mechanical effect driven by big banks having more branches.

Overall, results are qualitatively and quantitatively similar across different sets of fixed effects.

Index decomposition at the Firm-Year

Table A16: Decomposition of the changes in the imperfect match index

Decomposition of the change in the imperfect match index between 2009 and 2016 $$							
Mean of imperfect match index (Year=2009): 0.160 Mean of imperfect match index (Year=2016): 0.190							
Components Absolute difference Proportion (%)							
Firm and Bank characteristics (Block 1)	0.0272	87.37					
Changes in the credit amount (Block 2)	-0.0000	-0.09					
New relations opened (Block 3) 0.0042 (13.52)							
Relationships closed (Block 4) -0.0002 -0.80							
Overall	0.0312	100					

1.Overall, the index changes from 0.160 in 2009 to 0.190 in 2016, indicating a worsening of match quality during the crisis years.

2.Variation comes mainly from changes in bank and firm characteristics (block 1) and from the opening of new bank-firm relationships (block 3).



Table A17:	Placebo	test in	pre-crisis	period:	Imperfect-match	index	and	firm
outcomes								

	I	11		IV
Dependent variable	Ln(amount)	Ln(# of employees)	Ln(fixed tangible assets)	Prob(default)
Imperfect match	0.434 [0.893]	0.032 [0.878]	0.174* [1.879]	0.003 [0.850]
Firm control variables	Y	Y	Υ	Y
Observations R-squared	36,663 0.657	89,547 0.962	94,670 0.935	100,802 0.759
Year FE Firm FE	Y Y	Y Y	Y Y	Y Y
Cluster SE	Robust	Robust	Robust	Robust