Banking diversity, financial complexity and resilience to financial shocks: evidence from Italian provinces

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Plan of the Talk

1. Motivation and related literature
2. Data and methodology
3. Empirical results
4. Conclusions

Motivation and research question

- Covid-19 pandemic is imposing unprecedent challenges to the global economy and comes after two other major financial shocks have affected the European economy (Great Financial Crisis and Sovereign Debt Crisis)
- Current turmoil did not originate in the financial sector but the latter still crucial to alleviate the burden on firms and guarantee their survival during the hibernation of the economy
- New momentum to the literature on the relationship between financial markets' characteristics and stability
- Is diversity in financial markets beneficial to stability? Are more diverse local systems better able to cope with financial shocks?

Why should diversity matter?

More diverse financial systems achieve a more "diverse diversification" of risks (Beale et al., 2011; Haldane and May, 2011):

- Diversity in institutional models, legal structures and business attitudes guarantees diversification in business strategies, clientele and risk appetite by financial firms. This leads to greater stability and makes the financial sector less sensitive to systemic risk.
- Avoids "herding behaviour" by financial intermediaries.

Diversity breeds inclusion:

- Marginal consumers excluded from financial services when a single business model prevails are less constrained in diverse financial systems (Michie, 2011).
- This promotes better risk sharing and makes the financial system more resilient.

Beneficial effects of competition?

- Recent theoretical literature (Boyd and De Nicolo', 2005) questions the traditional charter value paradigm (Keeley, 1990) that associates competition in the banking sector to greater instability.
- Empirical evidence (Anginer et al., 2014; Fiordelisi and Mare, 2014; Aristei and Gallo, 2019), corroborates such competition-stability nexus, even if the issue is still debated.

This paper

What this paper does:

- We measure diversity in the Italian banking system at provincial level, building on Michie and Oughton (2013).
- Drawing from network theory we propose a measure of complexity of the overall financial system of Italian provinces.
- First, test whether more diverse banking (financial) systems are more stable in general. Second, our interest is placed on the role of greater diversity during periods of financial unrest.

What this paper is not about:

- Complexity in terms of increased interconnectedness (Stiglitz, 2010), and geographic ramification (Cetorelli and Goldberg, 2014) reached by financial institutions.
- Excessive sophistication attained by specific financial markets (Haldane and May, 2011).
- Instruments proliferation (Caccioli et al.,2009) and contract obscurity (Battiston et al, 2016).

Here we apply the complexity algorithm by Hidalgo and Hausmann (2009) to the financial sector and interpret the index as a measure of its diversity (and development).

Measuring diversity in banking

Four dimensions of diversity (Michie and Oughton, 2013):

- **Ownership diversity**: 1 minus Herfindahl-Hirschman index calculated on bank branches by ownership structure (joint stock, popolari, cooperatives and foreign banks).
- **Concentration/Competition**: 1 minus Herfindahl-Hirschman index calculated on the bank branches by banking group.
- **Geographic dispersion of banking services**: within-province average distance between each branch and the province's main city (normalized).
- **Funding strategy diversity**: sum of two components (1 minus concentration in the loans-deposits ratio and normalized inverse of the funding gap spread). ▸ Details

Aggregate indexes:

- **DIVERSITY**$_{OC}$:**Ownership + competition** $\in [0, 2]$
- **DIVERSITY**$_{OCG}$:**Ownership + competition + geographic diversity** $\in [0, 3]$
- **DIVERSITY**$_{ORIGINAL}$:**Ownership + competition + geographic + funding diversity** $\in [0, 5]$

▸ Map

Measuring diversity in the financial system

We apply the Economic Complexity by Hausman and Hidalgo (2009). Traditional context is export data, we apply it to data on active firms in the Ateco 2007 (Nace rev. 2) section K "Financial and Insurance Activities".

Construction of the bipartite network that connects provinces to their financial firms (5-digits sector).To avoid distortions (size), Balassa's Revelead Comparative Advantage measure to build matrix $M_{i,x}$ (value 1 if province i has RCA in financial intermediary x, 0 otherwise)

$$\text{RCA}_{i,x} = \frac{N_{ix}/\Sigma_i N_{ix}}{\Sigma_x N_{ix}/\Sigma_{ix} N_{ix}} = \frac{\text{Share of intermediary x in the "financial basket" of province i}}{\text{Share of intermediary x in the Italian "financial basket"}}$$

From $M_{i,x}$ you get two key measures:

- *Diversity* $= k_{i,0} = \Sigma_x M_{ix}$ (Summing over the rows of $M_{i,x}$)
- *Ubiquity* $= k_{x,0} = \Sigma_i M_{ix}$ (Summing over the columns of $M_{i,x}$)

Complexity algorithms differ in the way they combine such measures.

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Hidalgo and Hausman (2009, 2014)

Method of Reflections:

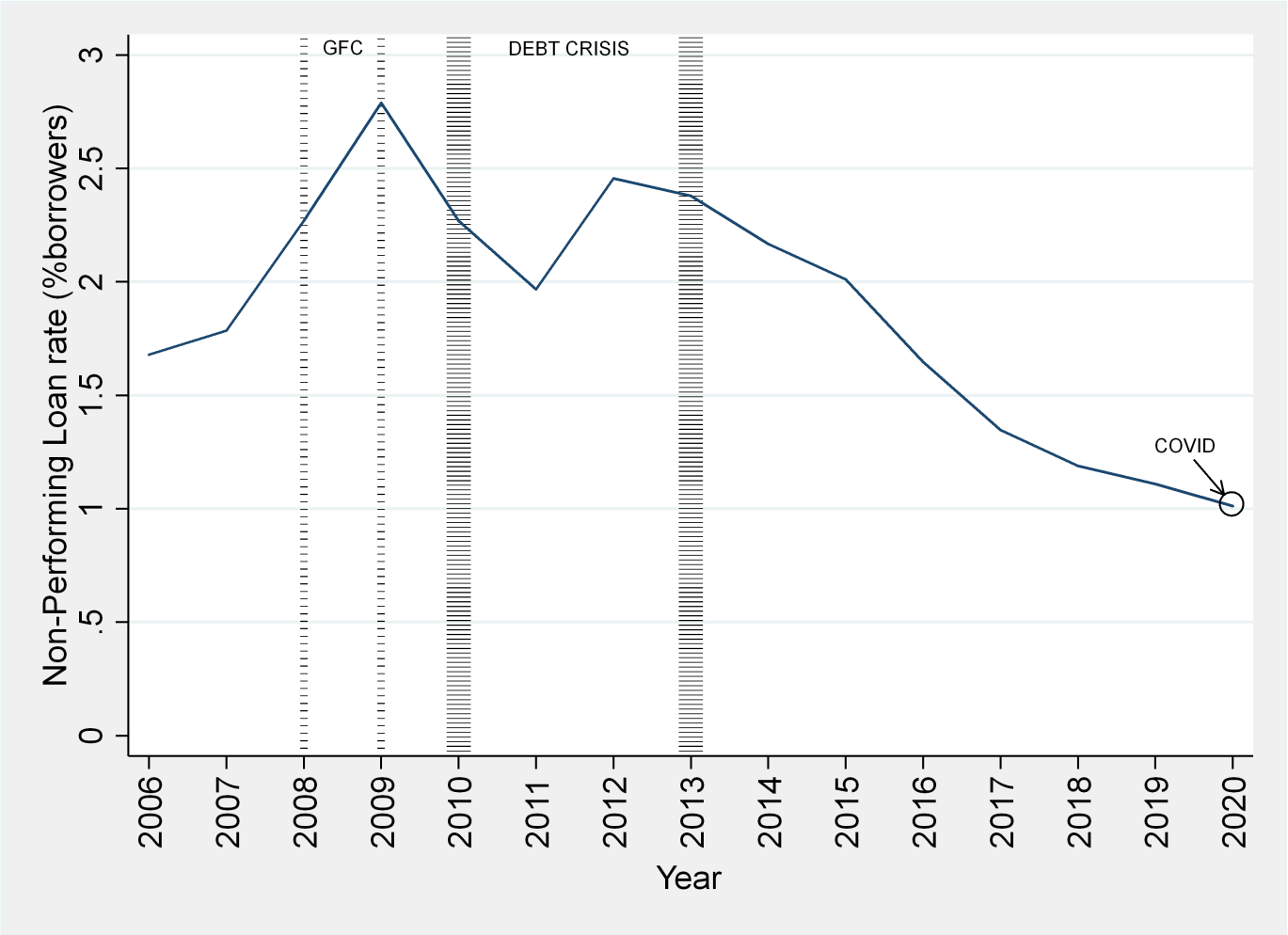
- Correct province's diversity for the average ubiquity of its financial intermediaries, then for the average diversity of provinces that have a similar financial basket, and so forth–>Economic Complexity Index ▸ ECI ▸ Example

We apply the algorithm to data on active firms by 5-digits sectors of the K section "Financial and Insurance Activities" and calculate an index of diversity (and development) of the overall financial system for 100 Italian provinces (aggregation of 2004-created provinces and Sardinia). ▸ Top and Bottom 10

Financial Data and Controls

1. Financial data from the Bank of Italy Statistical Database and Albo di Vigilanza
   - *NPL* number of borrowers who become holders of adjusted non-performing loans divided by the number of borrowers (not classified as holders of adjusted non-performing loans) of the previous year as a proxy for financial instability (Barth et al., 2004; Gonzalez, 2005; Chau et al., 2020).
   - Number of bank branches by ownership category, list of authorized branch by banking group, list of authorized intermediary's headquarter by intermediary category, loans to province residents by economic destination and borrower category, concentration of loans.
2. Bureau Van Djik (Aida and Bankfocus)
   - Bank's balance sheet data.
   - Active firms by 5-digits sector in the K Ateco2007 section.
3. Controls from Istat
   - Share of employment in services, per capita recycled waste, average electricity outrage per user, Warehouse capacity of ports, number of airports, export data, foreign population residing in the province by nationality, employment and active firms by 5-digits sector in the K Ateco2007 section.

NPL evolution



▸ Alternative definitions

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Econometric strategy

Is banking (and financial) diversity beneficial to stability? (Linear model):

$$NPL_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 Controls_{i,t} + d_t + c_i + \epsilon_{i,t} \quad (1)$$

Is the effect of greater diversity more evident in bad times? (Interactions):

$$\begin{aligned} NPL_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 GFC + \beta_3 Diversity_{i,t} * GFC + \beta_4 DEBT + \\ \beta_5 Diversity_{i,t} * DEBT + \beta_6 COVID + \beta_7 Diversity_{i,t} * COVID \\ + \beta_8 PreGFC + c_i + \epsilon_{i,t} \end{aligned} \quad (2)$$

What about potential transmission channels?

$$Y_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 Controls_{i,t} + d_t + c_i + \epsilon_{i,t} \quad (3)$$

Dependent: different measures of loan concentration (by borrower, economic destination of loan and borrower category).

Main results. Dependent variable:NPL

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DIVERSITY_{OC}$	-0.447***				-0.455***			
	(0.098)				(0.098)			
$DIVERSITY_{OCC}$		-0.373***				-0.379***		
		(0.096)				(0.097)		
$DIVERSITY_{ORIGINAL}$			-0.225***				-0.234***	
			(0.082)				(0.082)	
$COMPLEXITY_{AIDA}$				-0.072***				-0.066***
				(0.017)				(0.017)
Recycling					1.020***	1.016***	1.033***	0.922***
					(0.257)	(0.258)	(0.259)	(0.259)
Openness					0.018	0.025	0.034	0.036
					(0.050)	(0.050)	(0.050)	(0.050)
Electricity Outages					0.023*	0.023*	0.021*	0.022*
					(0.013)	(0.013)	(0.013)	(0.013)
Tertiary Employment					-0.317	-0.311	-0.378	0.019
					(0.777)	(0.779)	(0.783)	(0.779)
Constant	2.460***	2.458***	2.424***	1.907***	2.479***	2.472***	2.495***	1.707***
	(0.123)	(0.144)	(0.190)	(0.025)	(0.538)	(0.545)	(0.572)	(0.520)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,500	1,500	1,500	1,500	1,498	1,498	1,498	1,498
Number of provinces	100	100	100	100	100	100	100	100
R^2 *within*	0.834	0.834	0.833	0.834	0.837	0.836	0.835	0.836
R^2 *overall*	0.521	0.510	0.515	0.568	0.439	0.427	0.426	0.492
F^{ALL}	20.98	15.09	7.579	18.61	8.410	7.176	5.694	7.262
$Prob(F^{ALL})>F$	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000

DIVERSITY$_{OC}$↑ one std. dev. –> NPL ↓ more than 10% of a std. dev. Same effect for COMPLEXITY$_{AIDA}$.

Main results. Dependent variable:NPL

VARIABLES	$DIVERSITY_{OC}$ (1)	$DIVERSITY_{OCG}$ (2)	$DIVERSITY_{ORIGINAL}$ (3)	(4)
DIVERSITY	1.510***	1.404***	0.862***	
	(0.137)	(0.132)	(0.110)	
$COMPLEXITY_{ATDA}$				-0.073**
				(0.030)
PreGFC	0.329***	0.325***	0.311***	0.232***
	(0.033)	(0.033)	(0.034)	(0.033)
GFC	1.458***	1.369***	1.663***	0.925***
	(0.240)	(0.230)	(0.293)	(0.033)
DEBT	1.575***	1.313***	1.329***	0.727***
	(0.201)	(0.184)	(0.234)	(0.026)
COVID	0.402	0.243	0.386	-0.644***
	(0.299)	(0.284)	(0.365)	(0.044)
*DIVERSITY*GFC*	**-0.354***	**-0.235#**	**-0.295****	
	(0.193)	(0.156)	(0.128)	
$COMPLEXITY_{ATDA}$*GFC*				**0.023**
				(0.032)
*DIVERSITY*DEBT*	**-0.669*****	**-0.391*****	**-0.260*****	
	(0.154)	(0.119)	(0.099)	
$COMPLEXITY_{ATDA}$*DEBT*				**-0.073*****
				(0.025)
*DIVERSITY*COVID*	**-0.785*****	**-0.556*****	**-0.413****	
	(0.237)	(0.189)	(0.162)	
$COMPLEXITY_{ATDA}$*COVID*				**0.057**
				(0.045)
Constant	-0.244	-0.442**	-0.325	1.701***
	(0.177)	(0.203)	(0.258)	(0.017)
Period	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No
Additional provincial controls	No	No	No	No
Observations	1,500	1,500	1,500	1,500
Number of provinces	100	100	100	100
R^2 *within*	0.597	0.594	0.581	0.567
R^2 *overall*	0.319	0.308	0.328	0.411
F^{ALL}	121.7	112.4	61.87	6.038
$Prob(F^{ALL})>F$	0.000	0.000	0.000	0.014

Similar results if we omit 2020 or add controls. ▸ Marginal effects

Additional results. Dependent variable:Loan Concentration (top 0.5% of borrowers)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DIVERSITY_{OC}$	-12.803***				-12.137***			
	(1.636)				(1.644)			
$DIVERSITY_{OCG}$		-12.473***				-11.795***		
		(1.610)				(1.618)		
$DIVERSITY_{ORIGINAL}$			-7.933***				-7.401***	
			(1.371)				(1.379)	
$COMPLEXITY_{AIDA}$				1.761***				1.751***
				(0.312)				(0.312)
Recycling					15.622***	15.652***	16.222***	16.644***
					(3.217)	(3.218)	(3.234)	(3.231)
Openness					0.362	0.408	0.617	1.334
					(0.985)	(0.985)	(0.990)	(0.986)
Electricity Outages					-0.257*	-0.241#	-0.255*	-0.280*
					(0.153)	(0.153)	(0.154)	(0.154)
Tertiary Employment					8.235	8.172	8.510	9.591
					(8.094)	(8.099)	(8.164)	(8.135)
Constant	48.546***	51.204***	50.929***	32.730***	43.659***	46.105***	45.439***	27.814***
	(2.096)	(2.449)	(3.195)	(0.559)	(5.652)	(5.824)	(6.334)	(5.122)
Period	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,298	2,298	2,298	2,298	2,296	2,296	2,296	2,296
Number of provinces	100	100	100	100	100	100	100	100
R^2 *within*	0.079	0.078	0.067	0.067	0.090	0.090	0.080	0.081
R^2 *overall*	0.026	0.105	0.072	0.303	0.099	0.188	0.165	0.311
F^{ALL}	61.24	60.01	33.46	31.77	17.92	17.65	12.70	13.25
$Prob(F^{ALL})>F$	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000

Additional results. Dependent variable:Loan Diversity (economic destination of loans)

VARIABLES	(1)	(2)	(3)	(4)	(5)
COMPLEXITY$_{AIDA}$	0.006***	0.006***			
	(0.001)	(0.001)			
DIVERSITY$_{OC}$			-0.006		
			(0.006)		
DIVERSITY$_{OCG}$				-0.006	
				(0.006)	
DIVERSITY$_{ORIGINAL}$					-0.004
					(0.005)
Recycling		-0.052***	-0.053***	-0.053***	-0.053***
		(0.012)	(0.012)	(0.012)	(0.012)
Openness		0.015***	0.014***	0.014***	0.014***
		(0.004)	(0.004)	(0.004)	(0.004)
Electricity Outages		0.001	0.001#	0.001#	0.001#
		(0.001)	(0.001)	(0.001)	(0.001)
Tertiary Employment		-0.039	-0.027	-0.027	-0.027
		(0.031)	(0.031)	(0.031)	(0.031)
Constant	0.816***	0.835***	0.836***	0.837***	0.837***
	(0.003)	(0.020)	(0.022)	(0.022)	(0.024)
Period	1995-2020	1995-2020	1995-2020	1995-2020	1995-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,592	2,298	2,298	2,298	2,298
Number of provinces	100	100	100	100	100
R^2 *within*	0.588	0.644	0.640	0.640	0.640
R^2 *overall*	0.406	0.424	0.459	0.456	0.459
F^{ALL}	24.50	12.91	7.267	7.254	7.187
Prob(F^{ALL})>F	0.000	0.000	0.006	0.000	0.000

Additional results. Dependent variable:Loan Diversity (borrower category)

VARIABLES	(1)	(2)	(3)	(4)	(5)
COMPLEXITY$_{AIDA}$	0.009***	0.009***			
	(0.001)	(0.001)			
DIVERSITY$_{OC}$			-0.009		
			(0.007)		
DIVERSITY$_{OCG}$				-0.006	
				(0.007)	
DIVERSITY$_{ORIGINAL}$					-0.013**
					(0.006)
Recycling		0.030**	0.029**	0.029**	0.029**
		(0.013)	(0.013)	(0.013)	(0.013)
Openness		0.032***	0.030***	0.030***	0.030***
		(0.004)	(0.004)	(0.004)	(0.004)
Electricity Outages		-0.001	-0.001	-0.001	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)
Tertiary Employment		0.122***	0.138***	0.139***	0.133***
		(0.033)	(0.034)	(0.034)	(0.034)
Constant	0.709***	0.633***	0.634***	0.631***	0.657***
	(0.002)	(0.021)	(0.023)	(0.024)	(0.026)
Period	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,300	2,298	2,298	2,298	2,298
Number of provinces	100	100	100	100	100
R^2 *within*	0.327	0.352	0.338	0.338	0.339
R^2 *overall*	0.109	0.111	0.148	0.148	0.147
F^{ALL}	45.88	26.26	16.74	16.54	17.49
Prob(F^{ALL})>F	0.000	0.000	0.006	0.000	0.000

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Interpretation of results

To sum up it seems that:

- Banking diversity and financial complexity increase stability;
- A greater banking diversity has shielded Italian provinces from the financial shocks occurred in the last decades, while a greater diversity of the overall financial system seems to have been beneficial only during the Debt Crisis;
- Past literature suggests different potential channels at work in the diversity-stability nexus. Their implications are similar, greater diversity improves diversification opportunities and we provide evidence that this is the case;
- Benefits of financial complexity on diversification evident when the role of alternatives to banks can be remarkable (financing of less traditional types of loans and categories of borrower) ▸ Loans classification

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Robustness checks

- Stability:
  - Alternative dependent variable (different definitions of NPL) ▸ NPL
  - Alternative diversity indexes and inclusion of additional covariates ▸ Spec
- Resilience to financial shocks:
  - Different data for 2020 (March and June) ▸ 2020
  - Alternative diversity indexes and inclusion of additional covariates ▸ Spec1
- Loans concentration/diversification:
  - Alternative definitions of Loan Concentration (top % borrowers) ▸ Loan Concentration
  - Instrumental variables (top % borrowers) ▸ IV1
  - Instrumental variables (Loan Diversity) ▸ IV2

Conclusions

In this paper we have investigated the role of diversity in the financial system in promoting stability, in particular during periods of financial turmoil. In particular we have shown that:

- Both greater banking diversity and financial complexity reduce the non-performing loans rate;
- Diversity in the banking sector has curbed the detrimental effects of the three crises episodes;the diversity (and development) of the overall financial systems has mitigated the impact of the sovereign debt crisis;

Previous literature suggests that diversity promotes higher degrees of risk diversification by financial firms, and we provide evidence that this is the case. In detail:

- Greater diversity in the financial system reduces the concentration of loans to resident borrowers, and encourages greater loan diversity, both in terms of economic destination and category of borrower.

The argument for a greater diversity is today more compelling than ever–> access by firms to liquidity being one of the most critical concerns in the Covid-19 age and recovery.

Financial diversity one of the arrows in our quiver.

THANK YOU FOR YOUR ATTENTION

Funding strategy diversity

Banks rely on deposits and wholesale funding to finance their lending activities. Banks increasingly borrow from each other in the interbank market and this increases the risk of systemic contagion. Two measures capture the funding strategy adopted by banks, i.e. loans-deposits ratio and the funding gap (Loans-Deposits)/Loans.
As for diversity, the message of the two variables is ambiguous. Both a greater funding gap and a higher loans-deposits ratio might indicate a greater liquidity and systemic risk, but they also suggest more sophistication. Michie and Oughton (2013) sum up the following components:

$$DIV_{LDR} = 1 - \Sigma_i \left(\frac{(\frac{L}{D})_i}{(\Sigma(\frac{L}{D})_i)} \right)^2$$

$$\frac{1}{FGS} = \frac{1}{(\frac{L-D}{L})_{MAX} - (\frac{L-D}{L})_{MIN}}$$

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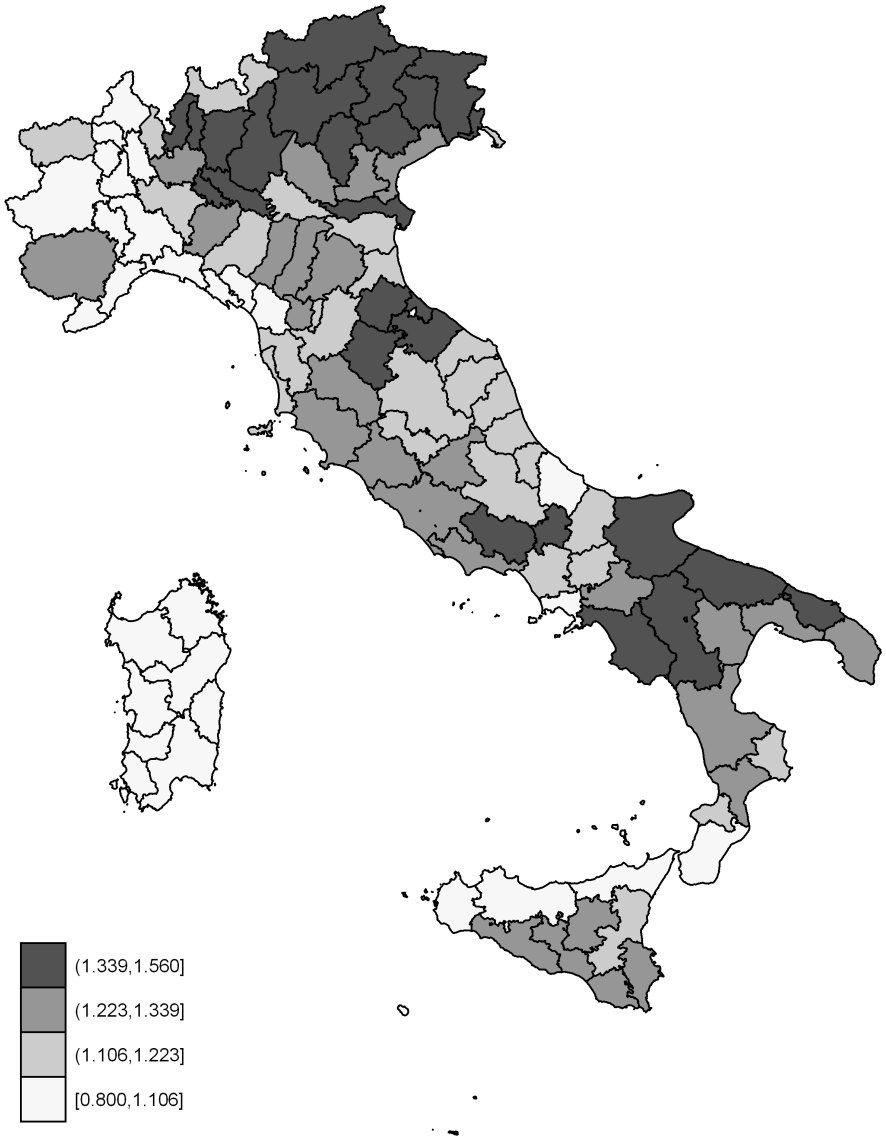
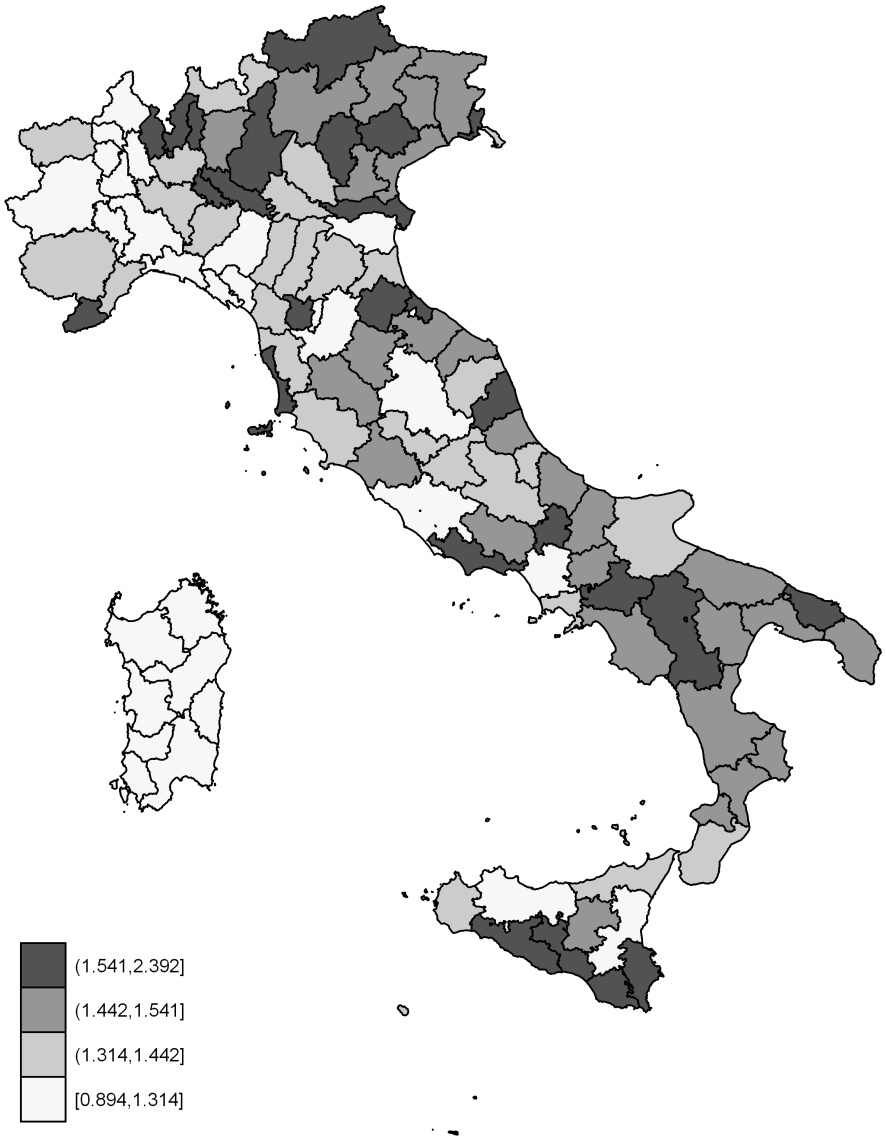
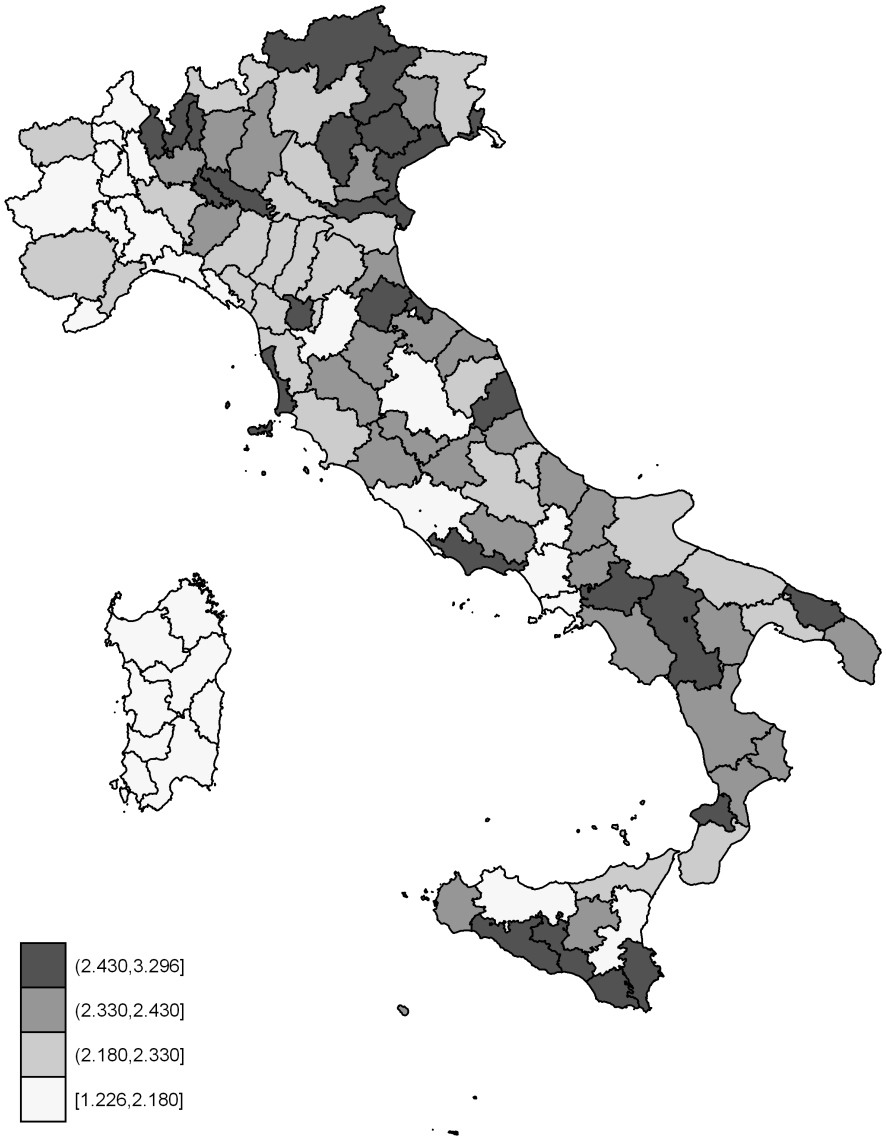
Banking diversity (OC) in 2008



Banking diversity (OCG) in 2008



Banking diversity (Original) in 2008



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ECI in math

$$K_{i,N} = \frac{1}{k_{i,0}} \Sigma_x M_{ix} k_{x,\ N\text{-}1}$$
$$K_{x,N} = \frac{1}{k_{x,0}} \Sigma_i M_{ix} k_{i,\ N\text{-}1}$$

for $N \geq 1$. Ultimately the ECI is defined as:

$$ECI_i = \frac{\vec{K} - < \vec{K} >}{std(\vec{K})}$$

where <.> is the mean function and std(.) the standard deviation of the vector $\vec{K}$, and the latter is the eigenvector associated to the second largest eigenvalue of the matrix $\widetilde{M}_{i,i'} = \Sigma_x \frac{M_{ix} M_{i'x}}{k_{i,0} k_{x,0}}$. Matrix that connects provinces that have similar financial baskets, weighted by the inverse of the ubiquity of a certain financial intermediary $k_{x,0}$ and normalized by the territorial diversity $k_{i,0}$

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HH example

Diversity (i)	Ubiquity (x)
k1,0=4	k1,0=1
k2,0=1	k2,0=2
k3,0=2	k3,0=2
k4,0=1	k4,0=3

HH example-Higher iterations

The first consists of the average ubiquity of country's products and of the average diversification of a product's exporters

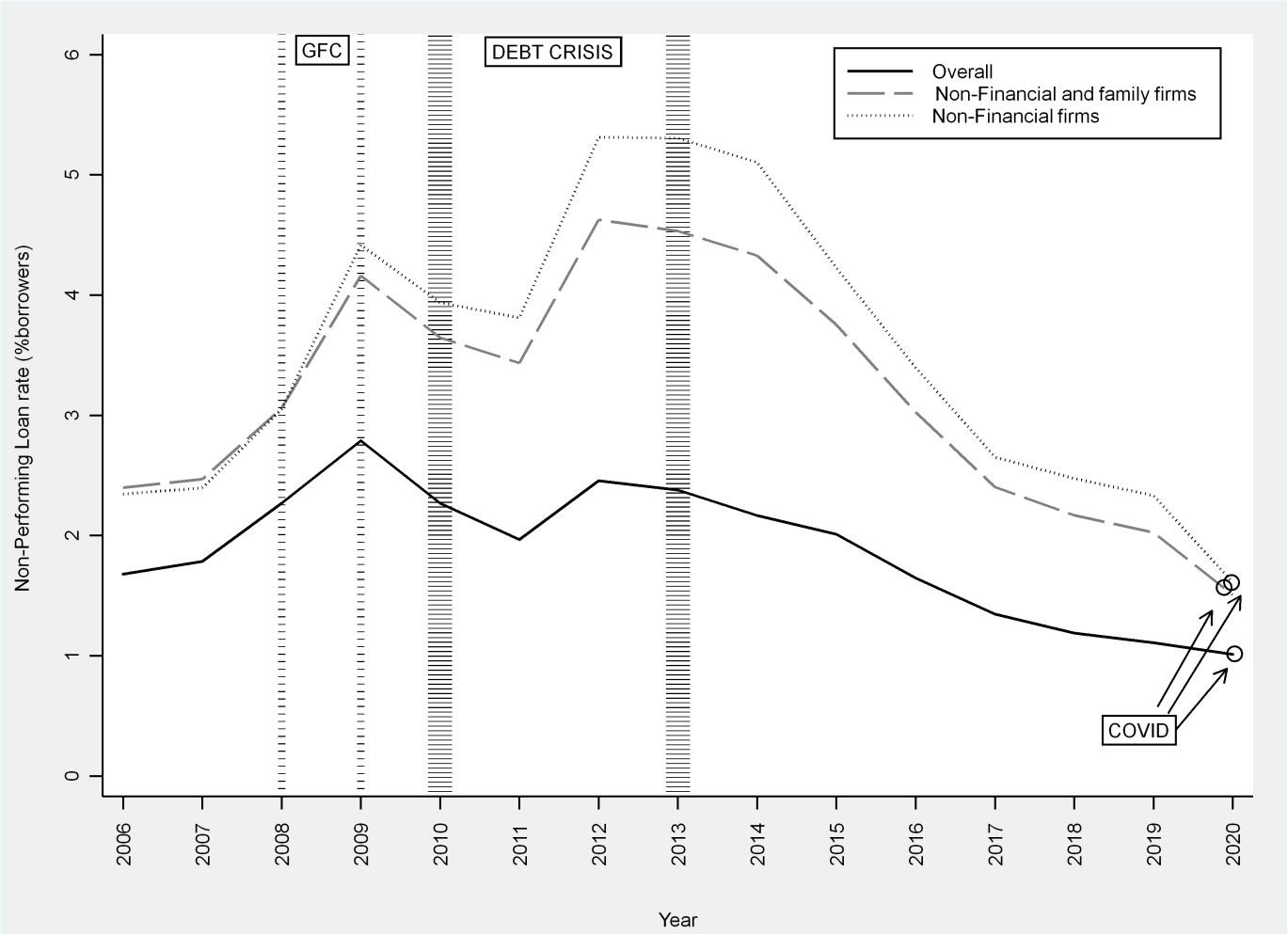
Countries	Products
k1,1=(1/4)(1+2+2+3)=2	k1,1=(1/1)(4)=4
k2,1=(1/1)(2)=2	k2,1=(1/2)(4+1)=2.5
k3,1=(1/2)(2+3)=2.5	k3,1=(1/2)(4+2)=3
k4,1=(1/1)(3)=3	k4,1=(1/3)(4+2+1)=2.33

The second reflection is given by the average first reflection values of a node's neighbors.

Countries	Products
k1,2=(1/4)(4+2.5+3+2.33)=2.96	k1,2=(1/1)(2)=2
k2,2=(1/1)(2.5)=2.5	k2,2=(1/2)(2+2)=2
k3,2=(1/2)(3+2.333)=2.66	k3,2=(1/2)(2+2.5)=2.25
k4,2=(1/1)(2.333)=2.33	k4,2=(1/3)(2+2.5+3)=2.5

and so on. back

NPL alternative definitions



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Top and bottom 10 provinces by financial complexity

TOP 10					
1998		2008		2018	
Roma	5.939	Roma	5.843	Milano	4.554
Milano	4.286	Milano	3.682	Treviso	3.478
Trieste	2.248	Trieste	2.634	Torino	2.707
Torino	2.119	Treviso	2.241	Roma	2.490
Treviso	1.380	Torino	1.753	Bologna	2.201
Firenze	1.227	Bergamo	1.459	Padova	2.057
Bologna	1.144	Verona	1.252	Lecco	1.994
Verona	1.097	Napoli	1.166	Parma	1.442
Genova	1.091	Bari	0.999	Modena	1.402
Bergamo	1.027	Genova	0.877	Vicenza	1.357
BOTTOM 10					
1998		2008		2018	
Caltanissetta	-0.801	Enna	-0.829	Caserta	-0.934
Reggio di Calabria	-0.811	Cremona	-0.843	Viterbo	-0.950
Rovigo	-0.827	Ragusa	-0.879	Teramo	-0.961
Isernia	-0.854	Caltanissetta	-0.888	Gorizia	-0.972
Trapani	-0.867	Terni	-0.952	Trapani	-0.975
Catanzaro	-0.896	Reggio di Calabria	-0.953	L'Aquila	-0.986
Asti	-0.899	Catanzaro	-0.966	Chieti	-1.086
Chieti	-0.902	Trapani	-1.052	Caltanissetta	-1.103
Rieti	-1.029	Rieti	-1.243	Crotone	-1.136
Crotone	-1.589	Crotone	-2.155	Ragusa	-1.141

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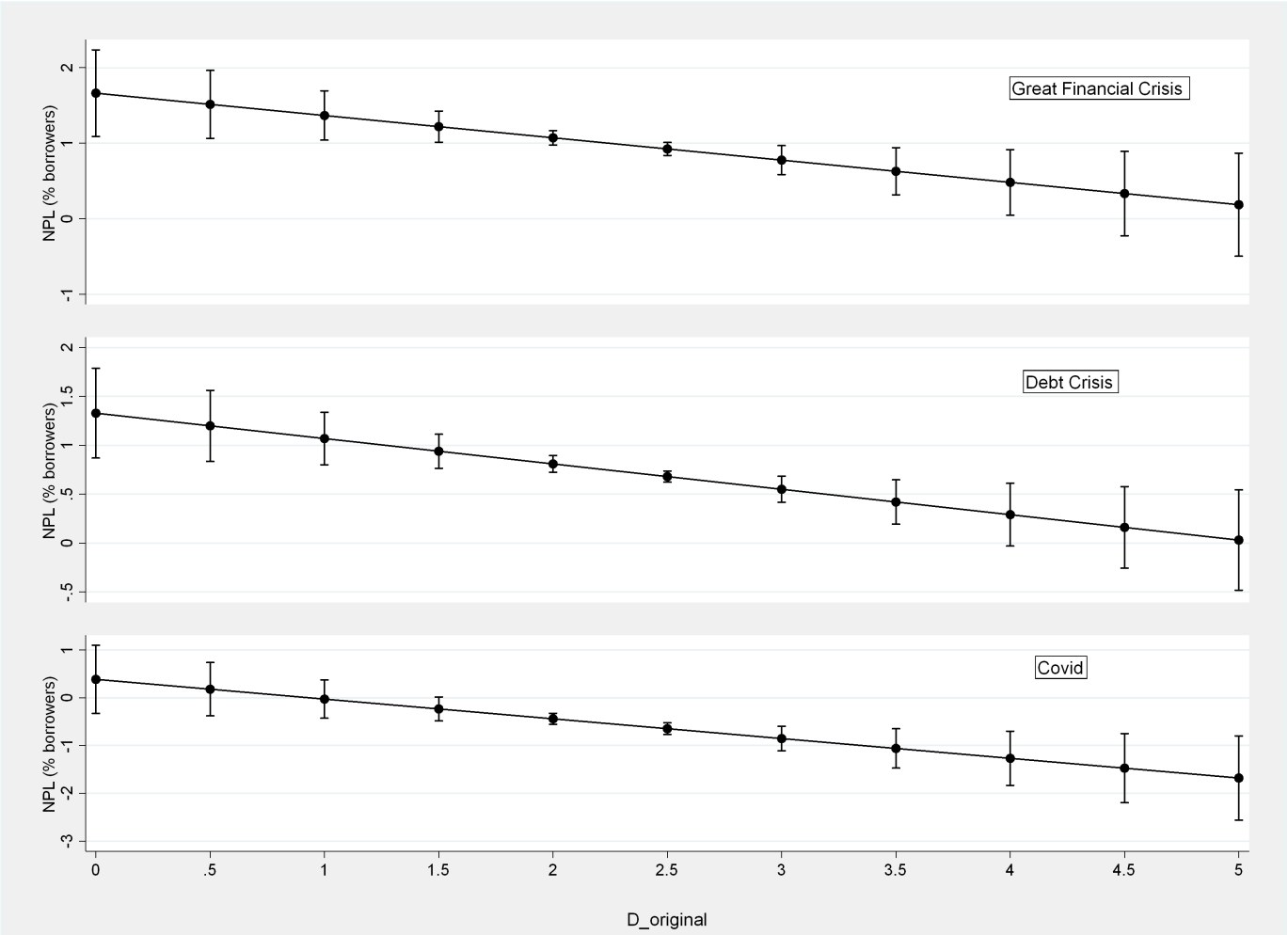
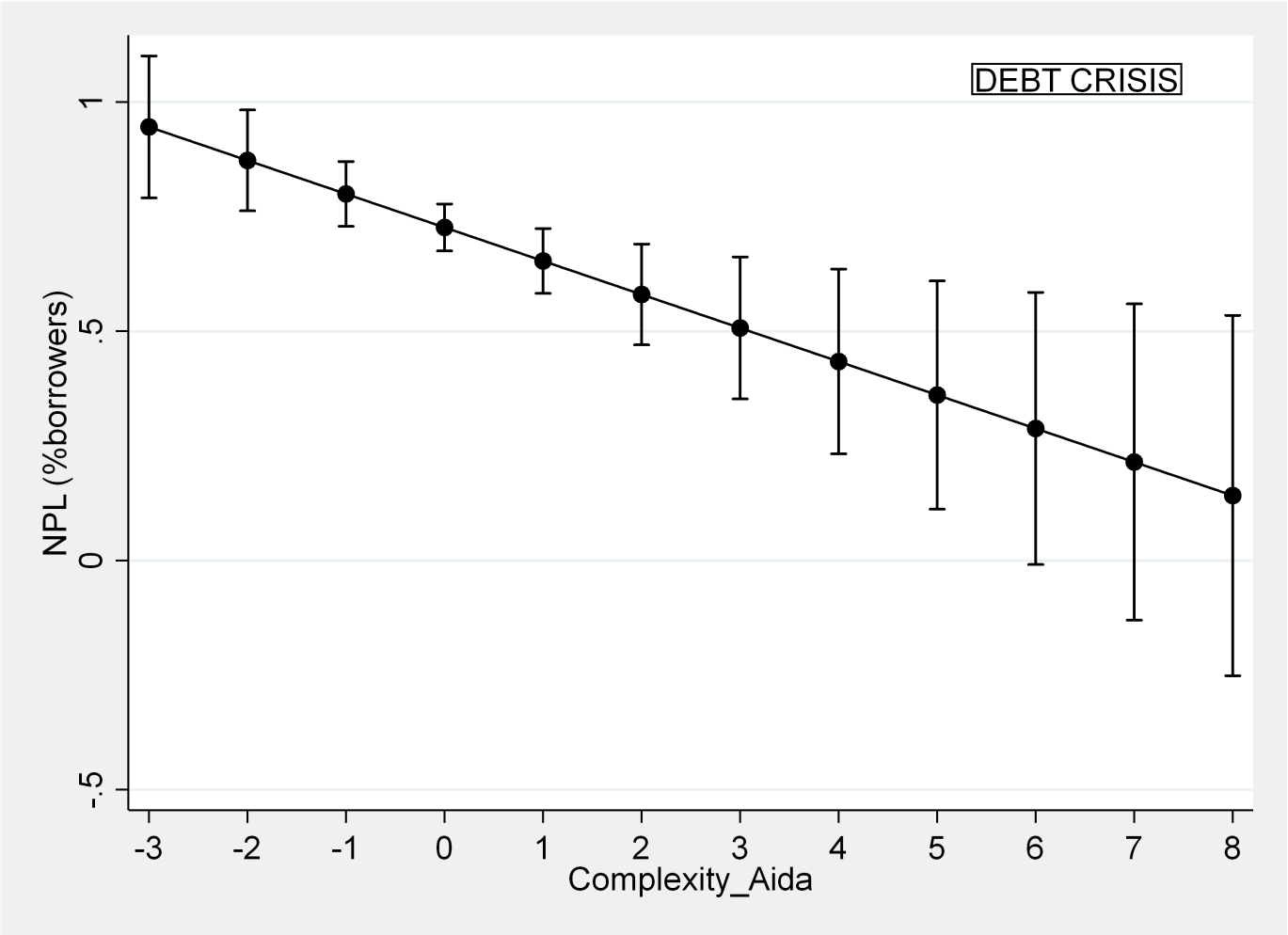
Marginal Effects - Banking diversity



On average, moving from the lowest observed value of diversity (1.17) to the maximum (3.41) brings about a decrease of the marginal effects of the three crisis periods on NPL of about 0.9%.

Marginal Effects - Financial complexity



A province denoted by the maximum financial complexity enjoys a NPL ratio that is lower of about 0.7% than that of the minimum-complexity province. back

Loans by economic destination

Construction of residential buildings
Durable goods purchases of consumer households
Financial investments
Construction of public buildings
Purchases of buildings: dwellings of consumer households
Purchases of buildings: other dwellings
Non-fin invest.: construction - non-residential buildings
Non-fin invest.:invest.in machinery,equip.,transport equip.,sundry products
Other invest.:purchases of real estate -other real estate
Non-fin. invest.:invest in construction other than dwellings
Other invest.:purchases of real estate not consumer households' dwellings
Other invest.:sundry other than purchases of real estate

Loans by borrower category

Associations of non-financial corporations
Consumer households
Public corporations
Private companies net of captive financial institutions
Craft non-financial quasi-corporations
Other non-financial quasi-corporations
Non-MMF investment funds
Financial auxiliaries
Captive financial institutions and money lenders
Insurance corporations
Pension funds
Financial corporations other than MFIs, investment funds and captive financial institutions
Central government
Local government
Social security funds
Producer households (up to 5 employees)
Non-profit institutions serving households
Unclassifiable and unclassified units

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Alternative definitions of NPL

	NPL (Non-Financial Firms)				NPL (Non-Financial Firms and Family Firms)			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DIVERSITY$_{OC}$	-1.111***				-1.024***			
	(0.238)				(0.189)			
DIVERSITY$_{OCG}$		-0.944***				-0.879***		
		(0.234)				(0.186)		
DIVERSITY$_{ORIGINAL}$			-0.658***				-0.622***	
			(0.199)				(0.159)	
COMPLEXITY$_{ATDA}$				-0.184***				-0.128***
				(0.040)				(0.032)
Recycling	0.968#	0.958#	1.011#	0.702	1.346***	1.337***	1.387***	1.152**
	(0.623)	(0.625)	(0.626)	(0.625)	(0.495)	(0.496)	(0.498)	(0.499)
Openness	0.266**	0.279**	0.297**	0.302**	0.303***	0.316***	0.331***	0.347***
	(0.121)	(0.121)	(0.121)	(0.121)	(0.096)	(0.097)	(0.097)	(0.096)
Electricity Outages	0.094***	0.093***	0.089***	0.091***	0.063***	0.063***	0.059**	0.060**
	(0.030)	(0.030)	(0.031)	(0.030)	(0.024)	(0.024)	(0.024)	(0.024)
Tertiary Employment	2.345	2.353	2.122	3.230*	0.683	0.688	0.465	1.377
	(1.881)	(1.885)	(1.895)	(1.884)	(1.494)	(1.498)	(1.507)	(1.503)
Constant	2.035#	2.050#	2.320*	0.112	3.094***	3.121***	3.400***	1.395
	(1.302)	(1.320)	(1.384)	(1.258)	(1.034)	(1.049)	(1.100)	(1.004)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,498	1,498	1,498	1,498	1,498	1,498	1,498	1,498
Number of provinces	100	100	100	100	100	100	100	100
R^2 within	0.820	0.819	0.818	0.820	0.824	0.823	0.822	0.822
R^2 overall	0.574	0.559	0.560	0.627	0.490	0.472	0.469	0.541
F^{ALL}	8.773	7.652	6.560	8.600	12.06	10.61	9.199	9.301
Prob(F^{ALL})>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Alternative indexes of diversity and covariates

	DIV_{OCTOP5}	DIV_{OCTOP5_GS}	DIV_{OCP}	$DIV_{ORIGINAL\_GS}$	$COMPL_{ISTAT\_ULA}$	$COMPL_{ISTAT\_AIDD}$	DIV_{OC}	DIV_{OCG}	$DIV_{ORIGINAL}$	$COMPL_{AIDA}$
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DIVERSITY	-0.310***	-0.165**	-0.303***	-0.177***			-0.437***	-0.365***	-0.204**	
	(0.088)	(0.068)	(0.088)	(0.066)			(0.099)	(0.097)	(0.083)	
COMPLEXITY					-0.057**	-0.046**				-0.068***
					(0.023)	(0.023)				(0.017)
Recycling	1.022***	1.063***	1.134***	1.175***	0.603	0.630				
	(0.258)	(0.262)	(0.259)	(0.262)	(0.465)	(0.466)				
Openness	0.027	0.054	0.048	0.064	0.171**	0.176**				
	(0.050)	(0.051)	(0.050)	(0.050)	(0.071)	(0.071)				
Electricity Outages	0.021*	0.023*	0.014	0.017	-0.007	-0.008				
	(0.013)	(0.013)	(0.012)	(0.013)	(0.016)	(0.016)				
Tertiary Employment	-0.350	-0.631	-0.337	-0.389	0.524	0.477				
	(0.780)	(0.802)	(0.801)	(0.810)	(1.417)	(1.420)				
International passengers							-0.007	-0.008	-0.007	-0.012
							(0.018)	(0.018)	(0.018)	(0.018)
Warehouse capacity (ports)							-0.000	-0.000	-0.000	-0.000
							(0.000)	(0.000)	(0.000)	(0.000)
Airports							-0.090**	-0.093**	-0.095**	-0.101***
							(0.038)	(0.038)	(0.039)	(0.038)
Average firm size							-0.063#	-0.058	-0.053	-0.046
							(0.041)	(0.041)	(0.041)	(0.041)
Point-of-Access							0.001***	0.001***	0.001***	0.001***
							(0.000)	(0.000)	(0.000)	(0.000)
Universities							0.032	0.031	0.028	0.011
							(0.041)	(0.041)	(0.041)	(0.041)
Constant	2.171***	2.267***	2.566***	2.353***	2.153**	2.182**	2.646***	2.629***	2.548***	2.076***
	(0.530)	(0.542)	(0.577)	(0.567)	(0.977)	(0.979)	(0.202)	(0.216)	(0.257)	(0.146)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2012-2018	2012-2018	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,498	1,453	1,452	1,420	698	698	1,500	1,500	1,500	1,500
Number of provinces	100	100	97	97	100	100	100	100	100	100
R^2 *within*	0.836	0.833	0.840	0.838	0.874	0.874	0.837	0.837	0.836	0.837
R^2 *overall*	0.440	0.413	0.409	0.389	0.412	0.384	0.532	0.517	0.522	0.582
F^{ALL}	6.549	5.632	6.919	6.227	2.870	2.417	6.612	5.810	4.625	6.184
$Prob(F^{ALL})>F$	0.000	0.000	0.000	0.000	0.014	0.035	0.000	0.000	0.000	0.000

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Different data for NPL in 2020

	March 2020				June 2020			
	DIVERSITY$_{OC}$	DIVERSITY$_{OCG}$	DIVERSITY$_{ORIGINAL}$		DIVERSITY$_{OC}$	DIVERSITY$_{OCG}$	DIVERSITY$_{ORIGINAL}$	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DIVERSITY	1.513***	1.407***	0.869***		1.523***	1.415***	0.875***	
	(0.136)	(0.132)	(0.109)		(0.136)	(0.132)	(0.109)	
COMPLEXITY$_{ARDA}$				-0.063**				-0.062**
				(0.030)				(0.030)
PreGFC	0.329***	0.325***	0.312***	0.232***	0.330***	0.325***	0.312***	0.232***
	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)	(0.034)	(0.033)
GFC	1.462***	1.371***	1.665***	0.925***	1.459***	1.369***	1.663***	0.925***
	(0.239)	(0.229)	(0.292)	(0.033)	(0.239)	(0.229)	(0.292)	(0.033)
DEBT	1.572***	1.311***	1.324***	0.727***	1.568***	1.308***	1.321***	0.727***
	(0.201)	(0.184)	(0.234)	(0.026)	(0.201)	(0.184)	(0.234)	(0.026)
COVID	0.369	0.232	0.413	-0.497***	0.450#	0.280	0.445	-0.484***
	(0.298)	(0.283)	(0.364)	(0.044)	(0.298)	(0.283)	(0.363)	(0.044)
*DIVERSITY*GFC*	-0.357*	-0.237#	-0.296**		-0.354*	-0.234#	-0.295**	
	(0.193)	(0.155)	(0.127)		(0.192)	(0.155)	(0.127)	
*COMPLEXITY$_{ARDA}$*GFC*				0.023				0.022
				(0.032)				(0.032)
*DIVERSITY*DEBT*	-0.666***	-0.389***	-0.258***		-0.663***	-0.388***	-0.256***	
	(0.153)	(0.119)	(0.098)		(0.153)	(0.119)	(0.098)	
*COMPLEXITY$_{ARDA}$*DEBT*				-0.073***				-0.073***
				(0.025)				(0.025)
*DIVERSITY*COVID*	-0.639***	-0.449**	-0.359**		-0.695***	-0.473**	-0.367**	
	(0.237)	(0.188)	(0.161)		(0.237)	(0.188)	(0.161)	
*COMPLEXITY$_{ARDA}$*COVID*				0.031				0.033
				(0.045)				(0.045)
Constant	-0.248	-0.447**	-0.342	1.701***	-0.260#	-0.458**	-0.356	1.701***
	(0.176)	(0.202)	(0.257)	(0.016)	(0.176)	(0.202)	(0.257)	(0.016)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No	No	No
Additional provincial controls	No	No	No	No	No	No	No	No
Observations	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Number of provinces	100	100	100	100	100	100	100	100
R^2 *within*	0.578	0.575	0.561	0.545	0.577	0.573	0.559	0.544
R^2 *overall*	0.297	0.287	0.306	0.386	0.294	0.284	0.303	0.384
F^{ALL}	123	113.6	63.27	4.450	124.6	115	64.16	4.407
Prob(F^{ALL})>F	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.036

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Alternative indexes of diversity and covariates

	DIV_{OCTOP5}	DIV_{OCTOP5_GS}	DIV_{OCF}	$DIV_{ORIGINAL\_GS}$	$COMPL_{ALBO}$	DIV_{OC}	DIV_{OCG}	$DIV_{ORIGINAL}$	$COMPL_{ALBO}$
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DIVERSITY	1.246***	0.671***	0.981***	0.497***		1.393***	1.285***	0.747***	
	(0.125)	(0.107)	(0.118)	(0.100)		(0.142)	(0.138)	(0.114)	
COMPLEXITY					0.090***				-0.094***
					(0.029)				(0.029)
PreGFC	0.268***	0.243***	0.326***	0.278***	0.226***	0.303***	0.293***	0.275***	0.194***
	(0.032)	(0.033)	(0.034)	(0.035)	(0.033)	(0.037)	(0.037)	(0.038)	(0.036)
GFC	1.302***	1.154***	2.315***	1.709***	0.918***	1.412***	1.257***	1.550***	0.905***
	(0.120)	(0.119)	(0.386)	(0.314)	(0.033)	(0.240)	(0.231)	(0.292)	(0.036)
DEBT	1.113***	0.962***	1.852***	1.211***	0.721***	1.550***	1.200***	1.250***	0.661***
	(0.103)	(0.098)	(0.288)	(0.237)	(0.026)	(0.203)	(0.186)	(0.234)	(0.027)
COVID	-0.222#	-0.338**	0.510	0.110	-0.635***	0.372	0.331	0.571#	-0.586***
	(0.151)	(0.163)	(0.502)	(0.403)	(0.044)	(0.297)	(0.284)	(0.365)	(0.043)
*DIVERSITY*GFC*	**-0.440*** **	**-0.232***	**-0.635*** **	**-0.336****		**-0.333***	**-0.177**	**-0.258****	
	(0.157)	(0.126)	(0.185)	(0.140)		(0.192)	(0.156)	(0.127)	
*COMPLEXITY*GFC*					**0.016**				**-0.053#**
					(0.033)				(0.033)
*DIVERSITY*DEBT*	**-0.521*** **	**-0.261*** **	**-0.528*** **	**-0.211****		**-0.670*** **	**-0.337*** **	**-0.241****	
	(0.126)	(0.098)	(0.133)	(0.102)		(0.154)	(0.119)	(0.098)	
*COMPLEXITY*DEBT*					**-0.043***				**-0.145*** **
					(0.025)				(0.026)
*DIVERSITY*COVID*	**-0.475****	**-0.316***	**-0.513****	**-0.322***		**-0.745*** **	**-0.601*** **	**-0.489*** **	
	(0.203)	(0.169)	(0.248)	(0.179)		(0.236)	(0.189)	(0.162)	
*COMPLEXITY*COVID*					**0.037**				**0.149*** **
					(0.043)				(0.046)
Constant	0.737***	1.081***	-0.399#	0.563**	1.708***	0.330	0.097	0.382	2.862***
	(0.098)	(0.104)	(0.254)	(0.234)	(0.017)	(0.307)	(0.331)	(0.385)	(0.225)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020	2006-2020
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No	No	No	No
Additional provincial controls	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	1,500	1,455	1,454	1,422	1,500	1,500	1,500	1,500	1,500
Number of provinces	100	100	97	97	100	100	100	100	100
R^2 *within*	0.592	0.565	0.589	0.570	0.566	0.603	0.601	0.589	0.591
R^2 *overall*	0.299	0.330	0.337	0.351	0.320	0.399	0.364	0.416	0.522
F^{ALL}	100.2	39.13	68.65	24.51	9.332	20.64	19.23	12.86	12.52
Prob(F^{ALL})>F	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000

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Alternative definitions of Loan Concentration

	TOP 1%			TOP 5%			TOP 10%		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DIVERSITY$_{OC}$	-11.737***			-9.282***			-7.639***		
	(1.550)			(1.316)			(1.200)		
DIVERSITY$_{OCG}$		-11.339***			-8.892***			-7.274***	
		(1.526)			(1.295)			(1.181)	
DIVERSITY$_{ORIGINAL}$			-7.157***			-5.350***			-4.175***
			(1.300)			(1.104)			(1.006)
Recycling	17.597***	17.632***	18.177***	22.972***	23.005***	23.445***	22.657***	22.688***	23.057***
	(3.033)	(3.035)	(3.050)	(2.575)	(2.577)	(2.589)	(2.349)	(2.350)	(2.360)
Openness	1.065	1.114	1.312	1.963**	2.006**	2.179***	1.623**	1.661**	1.815**
	(0.929)	(0.929)	(0.934)	(0.789)	(0.789)	(0.793)	(0.719)	(0.719)	(0.722)
Electricity Outages	-0.222#	-0.207	-0.220#	-0.187#	-0.175	-0.186#	-0.173#	-0.164#	-0.173#
	(0.144)	(0.144)	(0.145)	(0.122)	(0.123)	(0.123)	(0.112)	(0.112)	(0.112)
Tertiary Employment	1.140	1.110	1.406	-9.560#	-9.550#	-9.138	-10.994*	-10.965*	-10.490*
	(7.632)	(7.637)	(7.700)	(6.480)	(6.485)	(6.536)	(5.910)	(5.914)	(5.957)
Constant	54.480***	56.728***	56.201***	78.163***	79.807***	78.681***	87.070***	88.347***	86.877***
	(5.329)	(5.492)	(5.975)	(4.524)	(4.663)	(5.072)	(4.126)	(4.253)	(4.622)
Period	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2020	1998-2021
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,296	2,296	2,296	2,296	2,296	2,296	2,296	2,296	2,296
Number of provinces	100	100	100	100	100	100	100	100	100
R^2 *within*	0.108	0.107	0.097	0.128	0.127	0.117	0.174	0.173	0.165
R^2 *overall*	0.106	0.195	0.170	0.162	0.245	0.219	0.208	0.283	0.258
F^{ALL}	20.45	20.02	14.93	29.28	28.74	23.80	29.70	29.15	24.81
Prob(F^{ALL})>F	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000

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Instrumental Variables

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DIVERSITY$_{OC}$	-8.335***			-8.974***			-8.526***		
	(2.356)			(2.359)			(2.355)		
DIVERSITY$_{OCC}$		-7.935***			-8.553***			-8.135***	
		(2.361)			(2.364)			(2.360)	
DIVERSITY$_{ORIGINAL}$			-4.032#			-5.438**			-4.864**
			(2.485)			(2.474)			(2.467)
Recycling	3.249	3.272	3.278	3.272	3.297	3.393	3.256	3.280	3.346
	(3.870)	(3.872)	(3.888)	(3.871)	(3.873)	(3.892)	(3.870)	(3.872)	(3.890)
Openness	1.922**	1.962**	2.183**	1.879**	1.921**	2.076**	1.909**	1.949**	2.119**
	(0.908)	(0.908)	(0.917)	(0.908)	(0.908)	(0.917)	(0.908)	(0.908)	(0.917)
Electricity Outages	-0.074	-0.074	-0.083	-0.074	-0.074	-0.086	-0.074	-0.074	-0.085
	(0.204)	(0.204)	(0.205)	(0.204)	(0.204)	(0.205)	(0.204)	(0.204)	(0.205)
Tertiary Employment	-0.381	-0.423	-1.592	-0.569	-0.617	-2.870	-0.437	-0.486	-2.349
	(11.394)	(11.403)	(11.635)	(11.397)	(11.406)	(11.645)	(11.395)	(11.403)	(11.638)
Constant	44.719***	46.143***	44.245***	45.661***	47.210***	48.365***	45.000***	46.488***	46.685***
	(8.876)	(9.133)	(10.963)	(8.879)	(9.137)	(10.947)	(8.875)	(9.133)	(10.930)
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,796	1,796	1,796	1,796	1,796	1,796	1,796	1,796	1,796
Number of provinces	100	100	100	100	100	100	100	100	100
Instruments	Foreign population diversity; Diversity$_{t-1}$; Diversity$_{t-2}$			Foreign population; Diversity$_{t-1}$; Diversity$_{t-2}$			Foreign population diversity; Foreign population; Diversity$_{t-1}$; Diversity$_{t-2}$		
Ins. significance	**/***/***	**/***/.	**/***/**	*/***/***	*/***/.	***/***/***	**/#/***/***	**/#/***/.	*/***/***/***
$F^{INSTRUMENTS}$	640.00***	589.88***	226.02***	638.05***	588.08***	229.62***	481.39***	443.25***	173.30***
Hansen overidentification test	4.352	4.206	2.819	3.33	3.376	2.792	6.085	6.035	5.942
Hansen p value	0.1135	0.122	0.244	0.189	0.185	0.247	0.108	0.11	0.115

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Instrumental Variables 2

VARIABLES	Loan Diversity DES (1)	(2)	(3)	(4)	Loan Diversity BORROWER (5)	(6)	(7)	(8)
COMPLEXITY$_{AIDA}$	0.010***	0.012***	0.011***	0.012***	0.021***	0.018***	0.021***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Recycling	-0.054***	-0.054***	-0.054***	-0.054***	0.023*	0.023*	0.023*	0.023*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Openness	0.015***	0.015***	0.015***	0.015***	0.032***	0.032***	0.032***	0.032***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Electricity Outages	0.001	0.001	0.001	0.001	-0.001#	-0.001#	-0.001#	-0.001#
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tertiary Employment	-0.063*	-0.066**	-0.064**	-0.066**	0.087***	0.093***	0.086***	0.086***
	(0.032)	(0.032)	(0.032)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
Constant	0.850***	0.852***	0.851***	0.852***	0.656***	0.651***	0.656***	0.656***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.021)
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098
Number of provinces	100	100	100	100	100	100	100	100
Instruments	Complexity$_{t-1}$; Car accidents	Complexity$_{t-2}$; Complexity$_{t-3}$; Car accidents	Complexity$_{t-2}$; Complexity$_{t-3}$; Cars	Complexity$_{t-2}$; Complexityt-3; Car accidents; Cars	Complexity$_{t-1}$; Car accidents	Complexity$_{t-2}$; Complexity$_{t-3}$; Car accidents	Complexity$_{t-2}$; Complexity$_{t-3}$; Cars	Complexity$_{t-2}$; Complexityt-3; Car accidents; Cars
Ins. significance	***/**	***/***/***	***/***/*	***/***/***/#	***/**	***/***/***	***/***/*	***/***/***/#
F^{INSTRUMENTS}	1539.04***	468.44***	461.12***	352.29***	1539.04***	468.44***	461.12***	352.29***
Hansen overidentification test	3.054	3.903	0.214	4.571	0.309	3.61	5.751	5.751
Hansen p value	0.086	0.142	0.898	0.206	0.578	0.165	0.125	0.124

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