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Banking Diversity, Financial Complexity and Resilience to Financial Shocks: Evidence from Italian Provinces

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

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Abstract

In this paper we investigate the influence of banking and financial diversity on stability. We compute an index of banking diversity for Italian provinces and, drawing from network theory, we propose a measure of the diversity and development of the overall provincial financial sector. Our results show that diversity in the banking and financial markets promotes greater stability. Such beneficial effects are particularly evident during periods of financial distress. We ascribe our findings to the better diversification achieved by more diverse financial systems, as documented by lower loans concentration and higher loans diversification in terms of economic destination and borrower category.

JEL Classification: G01; G20; P34
Keywords: financial diversity; financial stability; non-performing loans; financial complexity; financial crises; banking diversity

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1. Introduction

The outbreak of the Covid-19 pandemic has imposed unprecedent challenges to the global economy. While the pandemic is still ongoing at the time of writing, tremendous economic effects have accompanied the tragic loss of lives caused by the disease. Recent estimates document that globally in 2020 114 million jobs relative to 2019 were lost (ILO, 2021), worldwide GDP fell of about 3.3 % (IMF, 2021) and the adverse consequences of the pandemic are expected to last for the next years. Governments around the world adopted severe measures of social restrictions to fight the spread of the virus. Extraordinary monetary and fiscal support was provided to struggling firms and households, and public debt is piling up at unprecedent rates.

The burst of the Covid-19 pandemic comes after two other major financial shocks have affected the global economy in the last decades, giving new momentum to the literature on the relationship between financial market's characteristics and its stability. Even though, contrary to past crisis episodes, the turmoil did not originate in the financial sector, the role of the latter remains crucial to alleviate the burden on firms and guarantee their survival during the hibernation of the economy (Didier et al., 2021).

With this premise in mind, this paper enters this strand of research by testing whether more diverse banking and financial systems are less prone to fragility and more resilient during financial shocks. In particular, building on Michie and Oughton (2013) we compute an index of banking diversity for Italian provinces (NUTS 3). Moreover, we propose an index of diversity (and development) of the overall financial sector by implementing the complexity algorithm by Hidalgo and Hausman (2009). We examine the role of greater diversity in the banking and financial system on financial stability in a period (2006-2020) of high financial distress. The aim of our analysis is twofold. First, we want to investigate 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. Three shocks hit the Italian economy during the last decades (Great Financial Crisis, sovereign debt crisis and the Covid-19 pandemic) and our sample allows us to consider all of them. To preview our results, we show that greater diversity in the banking (financial) system is beneficial to stability. Moreover, a greater banking diversity mitigated the transmission of the three crises on local systems. The role of financial complexity was relevant too, although to a lower extent.

Past literature has identified three potential mechanisms at work in the diversity-stability nexus. First, 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 in the financial sector guarantees diversification in the implemented business strategies, clientele and risk appetite by financial firms. This in turn leads to greater stability and makes the financial sector less sensitive to systemic risk. Second, diversity breeds inclusion. Marginal consumers that may strive to access financial services when a single financial business model prevails are less constrained in diverse financial systems (Michie, 2011). This promotes better risk sharing and makes the financial system more resilient. Third, beneficial effects of competition may be at work too. Recent theoretical literature (Boyd and De Nicolò, 2005) is questioning the traditional charter value paradigm by 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. In general, the three mechanisms suggest that diversity promotes higher degrees of risk diversification by financial firms, and we provide evidence that this is the case. In particular, even if our data do not enable us to disentangle which channel is more relevant, our findings support the idea that greater diversity in the banking and financial system reduces the concentration of the lending activity on biggest borrowers, and encourages greater loan diversification, both in terms of economic destination and borrower category. In the coming years, support by the financial sector will be critical to sustain the post-pandemic recovery of our economies. To this end, this paper shows that more diversity in the financial system might be a useful tool.

The paper proceeds as follows. In section 2 we review the literature related to our work. Section 3 describes our measures of diversity and complexity and presents the data employed in the study. The econometric strategy and our main results are reported in section 4, while a vast array of robustness exercises is provided in section 5. Finally, section 6 concludes.

2. Related literature

Our paper relates to different strands of literature. First, we contribute to the discussion on the impact of banking diversity on financial stability. Traditionally, the European banking business witnesses the presence of different actors from both an institutional and operational point of view. The basic distinction emerging in such context is the one between commercial versus mutual and cooperative banks. Such players differ in their legal and governance structure, in the relationship they are willing to establish with costumers, in the business strategies they implement, in the market line they focus on. In particular, while commercial banks mainly follow the so-called SHV (shareholder value) model, mutual and cooperative banks are more prone to develop a STV (stakeholder value) model. Given the difficulty to determine which particular business model proves superior, the need to achieve greater diversity has emerged in the light of the Great Financial Crisis and following recession[1]. In the first studies on the matter, Beale et al. (2011) and Haldane and May (2011) provide a framework in which the role of homogeneity and herd behavior by banks proves detrimental to financial stability. The two works share a number of similarities as for the mechanism that leads greater homogeneity in the banking system to cause instability. In a nutshell, the works show that banks minimize their individual probability of failure by diversifying their risks. However, if diversification makes banks too similar, i.e. if many banks diversify in similar ways, then multiple failures become more likely and this massively increases systemic risk. To use Haldane and May (2011) 's words, "homogeneity bred fragility" (pp. 355). Both the papers suggest regulators to incentivize greater diversity in the banking industry in order to limit systemic risk. By promoting diversity in the balance sheet structures, business models and risk management systems,

[1] The topic has gained attention not only from academics, but also from policy makers. See for instance the European Parliament resolution of 5 June 2008 on Competition: Sector inquiry on retail banking (2007/2201(INI)), the Great Britain Treasury note "A new approach to financial regulation: judgement, focus and stability" and the European Commission Liikanen (2012) report "High-level Expert Group on reforming the structure of the EU banking sector".

regulators would lead banks to achieve a more "diverse diversification" and this would lead to a more stable financial system. In a similar vein, Michie (2011) explicitly addresses the issue of corporate diversity in the United Kingdom banking sector, and discusses how financial turmoil periods may be ascribed to the prevalence of a single business model (the large, shareholder-owned plc), accompanied with deregulation and the introduction of new risky financial instruments. According to the author, diversity of ownership types and business models would both enhance the soundness of the financial system and benefit consumers. First, by ensuring the right balance between public and private ownership, shareholder-owned (plcs) and stakeholder-owned institutions (mutuals, cooperatives and credit unions), the financial system would be less likely to produce crises and the latter would be less costly to the economy. This effect would mainly derive from the mitigation of risk appetite by SHV banks brought about by STV institutions. Second, a more diversified financial industry would result in increased competition and choice, quality of service and fairness, hence benefitting consumers, with particular reference to those which are currently not able to access financial services because they are not profitable enough. Similar conclusions are drawn by the comprehensive analysis of the European Banking sector by Ayadi et al. (2010).

Building on these first contributions, a number of papers have empirically tested the relation between financial diversity and stability. Weller and Zulfiqar (2013) show that financial market diversity promotes economic stability. In particular, greater diversity is associated with faster economic growth, deeper credit markets and deposit base, and a smaller likelihood of developing asset bubbles. Martin-Oliver et al. (2017) show how the migration of Spanish *cajas* (savings banks that fall into the category of private not-for-profit commercial banks) to the SHV model made them more vulnerable during the GFC. The authors remark how the ownership and governance profiles of banks become particularly important during periods of financial unrest.

Close to our work, Baum et al. (2020) find that higher institutional diversity in the banking sector positively affects bank stability, by focusing on a sample of European banks from 1998 to 2014. This effect is stronger during crisis periods. The authors ascribe such positive influence to the concept of diversification, in the sense that if a single institutional model prevails in a country and the latter is affected by a shock, then the entire financial sector will likely be hit via contagion. The paper is closely related to our work, as both share the aim to investigate whether more diverse territories enjoy a sort of shield during financial turmoil. On the other hand, we differentiate from it along several dimensions. First, we focus on sub-national territories and extend the sample to include the recent Covid-19 pandemic. Second, Baum et al. (2020) measure stability at bank level, while we consider financial stability at provincial level. Third, the authors compute their indexes of diversity by only focusing on two dimensions (ownership and competition), while we employ a broader concept that also encompasses the geographic spread of financial intermediaries within each province, and their balance sheet diversity. Finally, we also propose a measure of diversity and development for the overall financial system.

To summarize the main findings of this line of research, it seems that the prevalence of a single banking model proves detrimental to financial stability. Cooperative and mutual banks are found to be better able to deal with

soft-information and tend to engage in the so-called relationship-lending (see Cole et al., 2004 and Berger et al., 2005), and this may ease client firms' financial constraint and help them in bad times. Moreover, they increase access to financial services by marginal consumers (Michie, 2011). At the same time large joint stock banks are able to offer a vast array of advanced services, to finance innovation and to support client firms in frontier-sectors (Aristei and Gallo, 2017; Bronzini and D'Ignazio, 2017). On the contrary, it is the coexistence of different business models that is beneficial to territories, because it implies better risk sharing and lower probability of systemic crises. In sum, these findings seem to extend to the financial market the general idea that economic diversity has a positive role on stability (Deller and Watson, 2016).

Second, following the influential paper by Hidalgo and Hausman (2009), several attempts have been made to generalize the concept of economic complexity to different contexts. The authors consider export data as a bipartite network in which countries are connected to their export basket, and on this basis provide a numerical index that measures the underlying complexity of the economy. The approach of HH relies on the analysis of international trade data. In particular, it is possible to interpret the latter as a network that connects countries to the products they competitively export (using measures of Revealed Comparative Advantage). The resulting RCA matrix can be summarized by two dimensions, i.e. diversity (the number of products that countries export with a revealed comparative advantage) and ubiquity (the number of countries that have a revealed comparative advantage in each specific product). By iterating such measures, the authors compute the Economic Complexity Index (ECI) and the Product Complexity Index (PCI). The former is interpreted as a proxy for the capabilities available to the economy. In general, countries endowed with more capabilities will be able to produce (thus competitively export) more products, enjoying higher diversification. At the same time, only countries characterized by a high set of capabilities are able to produce complex products. Hence the latter will show a lower ubiquity. Complexity metrics have been extended beyond the traditional setting of export and applied at sectoral data. For instance, Sbardella et al. (2017) compute an index of industrial complexity of US counties by generalizing the Fitness-Complexity algorithm to employment at industry-level (NAICS 3 digits) data. Similarly, Ghao and Zhou (2018) calculate economic complexity of Chinese provinces by looking at active firms by sector. In the same vein, in this paper we employ disaggregated data for the financial sector, K section of the Italian Ateco 2007 classification (Nace rev.2), and compute an index of financial complexity for Italian provinces, in order to capture their financial diversity and development.

A number of papers have employed the term complexity with reference to the financial system. Complexity has indicated the increased interconnectedness (Stiglitz, 2010; Arinaminpathy et al., 2011), and geographic ramification (Cetorelli and Goldberg, 2014; Krause et al., 2017) reached by financial institutions. Similarly, it has been associated to the excessive sophistication attained by specific financial markets (Haldane and May, 2011) that comes together with instruments proliferation (Caccioli et al.,2009; Brock et al., 2009), contract obscurity (Battiston et al, 2016), and the exacerbation of the too-big-too fail distortion, regulatory problems, and ultimately greater financial instability (Rajan, 2006; Ellis et al., 2014). However, in this paper we do not address such issues. On the contrary, as we explain in more detail in Section 3, our measure of complexity

should be interpreted more as a close substitute for both diversity and development. Indeed, the scheme assigns a higher financial complexity to provinces denoted by the presence of a variety of different categories of financial firms (diversity), and that show a relatively higher orientation towards the rarer ones (non-ubiquity).

Third, we contribute to explain how episodes of financial instability heterogeneously affected Italian local systems in the last decades. A number of studies have shown that the specialization/diversification patterns of local systems is an important factor in determining their ability to cope with external shocks. For instance, Graziano and Rizzi (2016) introduce an index of production specialization in their measure of economic fragility of Italian regions (NUTS 2), on the basis that systems focused on a limited number of sectors are more vulnerable to crises than those with diversified economies, in line with the discussion provided by Martini (2018). Similarly, Lagravinese (2015) analyzes economic crises occurred in Italy in the period 1970-2011 and documents how manufacturing-oriented regions suffered more than those more specialized in services, particularly finance. This contrasts results from Di Caro (2015), that shows that a greater reliance on manufacturing activities has contributed to regional resilience during recessions occurred between 1993 and 2013. Other studies have analyzed the heterogeneous impact of the Great Financial Crisis and following recession at provincial level. Galardo et al. (2019) highlight the role of provincial social capital in mitigating the adverse effects of uncertainty shocks on bank credit supply. The financial structure of provinces matters, too. Barone et al. (2018) find that the real effects of the credit supply shock that followed the Great Financial Crisis varied across territories, depending on their industrial and financial structure. In particular, provinces more dependent on external financing were affected relatively more than the others. Moreover, provinces whose credit market was dominated by distant banks (i.e. not locally headquartered) experienced a more severe credit crunch (Presbitero et al., 2014).

Abstracting from the Italian experience, different papers have shown how recent episodes of financial and economic turmoil differently affected sub-national territories (see for instance Capello et al., 2015; Cuadrado-Roura and Maroto, 2016; Giannakis and Bruggeman, 2017; Gong et al., 2020, Jin et al., 2017), and the relevance of the local financial structure as a driver of resilience (Christopherson et al., 2010; Marelli et al., 2012; Martin, 2012).

In this sense, we contribute to the existing literature by investigating the role of a greater diversity and development of local financial systems as a mitigating factor of financial shocks. Focusing on Italian provinces has several advantages. Namely, while provinces share the financial regulatory framework and a number of social and economic characteristics, the Italian financial sector is: i) dominated by banks, so that banking diversity measures are likely to have an important impact on the economy; and ii) highly heterogeneous from both an industrial and territorial perspective. In particular, the Italian banking system comprises both few large national groups, basically joint-stock banks, and a large number of smaller players, that are usually organized following a cooperative or mutualistic model. At the same time, the relative importance of the different types of banks is greatly heterogeneous across provinces and only few territories have developed a financial system that offers credible alternatives to bank credit. Finally, at least two of the three shocks examined in this

paper (Great Financial Crisis and the Covid-19 pandemic) can fairly considered exogenous for Italy, and the nature of the third one (sovereign debt crisis) is at most debatable[2].

3. Data and descriptive statistics

Our data come from different sources. To build our measure of financial diversity we resort to data provided by the Bank of Italy, Istat (the Italian national statistics provider) and from Bankfocus by Bureau Van Djik (BVD). As for financial complexity, we retrieve data from Aida by BVD, Bank of Italy *Albo di Vigilanza* and Istat. Finally, our main dependent variables, additional financial data and controls at provincial level come from Bank of Italy and Istat datasets.

In our analysis we consider data from 100 Italian provinces (NUTS 3) in the period 2006-2020[3]. A number of new provinces were established in Italy in the last decades. In detail, in 2001 the region of Sardinia re-organized its territorial structure with the creation of four new provinces. At the same time, in 2004 three new provinces were created in Italy (Barletta-Andria-Trani, Fermo, Monza e della Brianza). Finally, a new reform was launched in Sardinia in 2016. The latter modified again the region's provincial territories. Most of the data used in this paper are available since 2006 for the newly created (2001) Sardinian provinces, while data for the 2004-established provinces are available only since 2010. To ensure continuity of data series throughout our period, we consider Sardinia as a single unit of observation. In this way we aggregate data from all the differently defined Sardinian provinces instead of considering the yearly allocation of single municipalities. On the other hand, as formerly the 2004-established provinces' territory virtually insisted in single provinces, since 2010 we aggregate them with the entity they were previously part of [4].

[2] Some doubts might be cast on the nature of the sovereign debt crisis, since as it is well-known it followed a loop dynamic at European level. From one point of view, sovereign debts deteriorated because of the rescue of huge financial institutions. At the same time, it was exacerbated by the holding of large amount of public debt by domestic banks. However, government support to the banking sector during the crisis was very limited in Italy, so that it should not have affected the diversity of local systems. Finally, banking diversity and financial complexity measures do not change much within-province over time (see Appendix D), so that we tend to exclude that crisis episodes affected diversity in our sample.

[3] This is the period under scrutiny as for the main econometric analysis. However, we are able to extend further our sample in ancillary exercises and consider the period 1995-2020, thanks to greater data availability. We prefer to exploit such additional information rather than ignore it, so that we do not reduce the sample (starting from 2006) when implementing such additional models.

[4] The province of Fermo was created by dividing in two the province of Ascoli Piceno. The same happened for the province of Monza e della Brianza, from the territory of Milan. As for Barletta-Andria-Trani, four out of ten current municipalities previously belonged to the province of Foggia, while the rest was part of the province of Bari. However, the three main cities of the new entity belonged to the province of Bari and as of December 2017, 82% of the population of the new province lived in municipalities that were part of the province of Bari http://demo.istat.it/bilmens2017gen/index02.html. Hence, we aggregate the territory of Barletta-Andria-Trani to the latter. Sardinian new provinces were not established by splitting previous entities. On the contrary, the creation of the new provinces in 2001 was followed by several waves of changes of single municipalities across different provinces. Such a process ended in 2016, when a single additional province was created in order to incorporate most of the territory that belonged to the newly-2001-established entities. As a result of the different reforms, we would recur to single municipalities to reconcile data at NUTS3 level for Sardinia. Since financial data at municipality-level are not generally available or unreliable, we prefer to consider Sardinia as a single unit.

3.1 Banking diversity

Building on Michie and Oughton (2013), we compute an index of banking diversity for Italian provinces. The original index comprises four dimensions: i) ownership diversity in the banking sector, ii) concentration/competition in the banking sector, iii) funding strategy diversity in the banking sector, and iv) geographic dispersion of banking services. In this paper we follow such structure and adapt Michie and Oughton (2013)'s measure to the Italian context. The original indexes are computed at UK national level and are mainly based on data on loans and deposits. At provincial level we cannot rely on data on loans and deposits, since information on the latter are not available at corporate form or single branch level. Moreover, by using balance sheet data we would overlook the bias caused by the fact that the Italian banking sector is denoted by the presence of four big players with a widespread network of branches. In addition, balance sheet data are rather limited in the period of coverage and subject to missing information. All things considered, we rely on official data on branches by institutional organization and banking group to build our measure of ownership diversity, competition and geographic spread. On the other hand, we use balance sheet data to the purpose of analyzing funding strategy diversity.

3.1.1 Ownership diversity

The Italian banking sector is denoted by the presence of heterogeneous players from the point of view of institutional and ownership structure. In particular, it is possible to distinguish between large joint-stock banks, cooperative and popolari banks. Each category employs different organizational structures, responds to different regulation and supervision criteria, follows different development paths. In particular, while large commercial banks (and to a lesser extent popolari banks) are denoted by their widespread network of branches, cooperatives must have a local dimension, by law. Moreover, cooperatives are governed by their members on a one-member/one-vote basis, individual participation is limited to €50,000 per member, they are mandated to retain a high percentage of their profits as reserves, restricted from issuing tradable shares and conducting certain operations. In general, such measures are intended to preserve the mutualistic orientation of such intermediaries and their activity devoted primarily to members. Regulation is less stringent for popolari banks that, though closer to the commercial model, are still imposed a number of requirements on their activity and shareholder participation. In a sense, this represents an intermediate model between the two extremes. To the aim of this paper, we also consider branches of foreign banks as an additional category, since they present peculiar characters too.

Hence, to capture ownership diversity in the banking sector we retrieve data on branches by institutional category at provincial level from the Bank of Italy Statistical Database, and compute the following variable:

$$DIVERSITY_O = 1 - \sum_{j=1}^{4} \delta_j^2, \quad (1)$$

Where *j*=1, …,4, represents the number of distinct corporate forms, and δ the share of branches that belongs to each of the four institutional categories. Hence, the index potentially varies between 0 and 1, where higher values denote greater diversity in the branches structure[5].

3.1.2 Concentration/competition

To measure competition in the banking sector at provincial level we rely on information from the *Albo di Vigilanza* of the Bank of Italy, and compute a Herfindhal-Hirschman index based on branches by bank. The *Albo di Vigilanza* is the official Italian register of the banking activity and collects information on all authorized branches in the Italian territory. It provides data on the location, banking group, relevant dates (establishment and closure of the branch), main activity, etc. of all branches established in Italy.

Hence, we are able to calculate competition based on branches by province and year. In particular, we measure market shares of each bank as the number of branches belonging to the *nth* bank divided by the total number of branches that are located in the *jth* province, year by year. Our index of competition is then computed as follows:

$$DIVERSITY_C = 1 - HH_c, \quad (2)$$

where HH_c is the Herfindhal-Hirschman index:

$$HH_C = \sum_{i=1}^{N} s_i^2. \quad (3)$$

In this context *i*=1, …, N, denotes all banks that have at least one branch in the *jth* province, and *s* their market shares based on total provincial branches. $DIVERSITY_C$ varies between 0 and 1, where a value of 0 is attributed to a completely concentrated market, while an extremely competitive province-market takes value of 1. As an alternative to the previous index, we compute concentration as the sum of the branches of the five biggest players divided by total branches and subtract it to 1 to get $DIVERSITY_{CTOP5}$ and use it in a robustness check.

3.1.3 Funding strategy diversity

Banks rely on deposits and wholesale funding to finance their lending activities. During the GFC the concept of funding risk received great attention. Indeed, banks increasingly borrow from each other in the interbank market, especially in order to meet their short-term financing needs, and this increases their interconnectedness and the risk of systemic contagion. Two measures are widely used in order to capture the funding strategy adopted by banks, i.e. loans-deposits ratio and the funding gap ($\frac{Loans-Deposits}{Loans}$). As for diversity, the message delivered by the two variables is ambiguous. Indeed, while both a greater funding gap and a higher loans-deposits ratio might indicate a greater liquidity and systemic risk, they might also suggest more sophistication

[5] A value of 1 is only theoretical, since it would be attributed to a province that has no branch in its territory. Since we consider four corporate categories, the maximum score would be 0.75, reflecting a completely diverse financial structure (each institutional category accounting for 25% of the shares in provincial branches).

of the banking sector. A greater funding gap, for instance, emerges in large joint-stock banks that are able to better access the interbank market. On the other hand, small local banks rely on deposits to finance their activity. We replicate the index proposed by Michie and Oughton (2013) that combines information from bank's balance sheet in order to capture funding strategy diversity of Italian provinces. In particular, the $DIVERSITY_F$ is obtained as the sum of the following indexes:

$$DIV_{LDR} = 1 - \sum_{i=1}^{N} \left(\frac{\left(\frac{L}{D}\right)_i}{\left(\Sigma\left(\frac{L}{D}\right)_i\right)} \right)^2 \tag{4}$$

$$\frac{1}{FGS} = \frac{1}{\left(\frac{L-D}{L}\right)_{MAX} - \left(\frac{L-D}{L}\right)_{MIN}}, \tag{5}$$

where L stands for loans and D for deposits. The first subtracts one from a Herfindhal-Hirschman index that considers concentration in the loans-deposits ratio. The latter in turn would increase if the total loans to deposits ratio of banks located in the province is dominated by banks with a higher loans-deposits ratio, pointing to a greater concentration in the funding strategies of provincial banks and a greater orientation toward riskier practices. Conversely, a lower Herfindhal-Hirschman index indicates less concentrated funding models that favor the contribution of cooperative and popolari banks. By subtracting 1 to the Herfindhal-Hirschman index we impute more diversity to provinces denoted by less concentrated loans-deposits ratios. The second index is the inverse of the funding gap spread (FGS). It captures diversity by comparing, in each province, the maximum and minimum funding gap, as reported in bank's balance sheets. Overall, $DIVERSITY_F$ varies between 0 and 2 and attributes higher values to more diverse provinces.

In order to build the measure, we extract data from Bankfocus by BVD [6]. The database does not provide information on the province in which banks are headquartered, but only their municipality. We then recur to official data on municipalities and ZIP codes to recover such information. Moreover, to avoid that the presence of large banks with a widespread network of branches biases our results, we impute to each province the headquarter of the first four banking groups (Unicredit, Intesa San Paolo, Monte dei Paschi di Siena, and Ubi Banca). In this way we avoid attributing the entire amount of deposits and loans produced by the widespread network of branches of such banks to the province they are legally registered in. Moreover, in this way we are able to better reproduce the banking system of smaller provinces, in which no or few other banks are active apart from the recalled big four groups. Indeed, nationally in 2020 38% of total bank branches belonged to such groups, and the percentage increases in provinces in which no or few local banks are headquartered. However, by attributing to each province the business activity of the big four groups, we must accept the

[6] Bankfocus data are available since 2005 for Italian banks. On the other hand, banking data at provincial level coming from the Bank of Italy are available since 1995. Hence, aggregate indexes that considers the balance sheet diversity of provincial banks are available only since 2005. However, such dimension is rather stable over time. Hence, to extend our analysis backwards we compute the average $DIVERSITY_F$ by province from 2005 to 2020. Then, we consider such average and add it to the other dimensions of diversity to obtain our aggregate indexes in the period before 2005.

assumption that their funding strategy does not vary province by province. Although this might appear bold, we prefer it to alternative approaches, e.g. eliminating such banks or attributing them to their province of location.

3.1.4 Geographic dispersion of banking services

Michie and Oughton (2013) consider the distance between each bank's headquarter and the City of London and aggregate them in a single measure to capture geographic dispersion of banking services. In the same vein, we compute an index of within-province geographic dispersion by considering the average distance between each branch that is located in the provincial territory and its main city[7].

Distances between each Italian municipality are provided by Istat in the frame of its Distance Matrices dataset and are considered in both kilometers and time needed to reach the destination by car. We rely on the first definition and use ZIP codes to attribute each municipality to its province and to identify the provincial main city. We then rely on data from the *Albo di Vigilanza* of the Bank of Italy, and attribute to each authorized branch the distance between the municipality it is based on and the provincial main city[8]. We then compute a provincial average distance (in kilometers) and scale it by provincial area (km^2), to avoid that the size of the province biases results. Finally, the measure is normalized between 0 and 1, where higher values reflect more dispersion in the banking system, to get our $DIVERSITY_G$ index. A value of 0 would be attributed to a province in which branches are located only in the provincial main city. A greater $DIVERSITY_G$, on the other hand, indicates that banking services are available also in the rest of the province. We also compute $DIVERSITY_{GS}$, that considers the normalized average distance between the headquarter of financial intermediaries located in the province and the provincial main city, as an alternative proxy for geographic dispersion.

3.1.5 Aggregate indexes

In the remainder of the paper we employ different comprehensive indexes of financial diversity by aggregating the above descripted single measures. First, we focus on the impact of ownership diversity and competition by considering the $DIVERSITY_{OC}$ index, obtained as the sum of $DIVERSITY_O$ and $DIVERSITY_C$. The index takes values between 0 and 2, where higher values correspond to a higher diversity. Second, we include the influence of geographic dispersion and measure diversity as the sum of the ownership diversity, competition and geographic dispersion ($DIVERSITY_{OCG}$). Hence, the index varies between 0 and 3. As a robustness exercise, we employ alternative aggregate indexes that consider the different dimensions of competition and geographic spread reported in the previous sections ($DIVERSITY_{CTOP5}$ and $DIVERSITY_{GS}$). Finally, we move to the broadest measure of financial diversity ($DIVERSITY_{ORIGINAL}$), that considers also information on funding strategy diversity. The index can take values between 0 and 5. Again, the higher the values the more diverse a province is. Table 1 reports descriptive statistics of the diversity indexes. The maximum value observed for $DIVERSITY_{ORIGINAL}$ is 3.4 over 5, while the average value is 2.3. The alternative indexes are comparable to the main ones. However, by considering the $DIVERSITY_{GS}$ measure, that computes the normalized average

[7] Provincial main city is the provincial *capoluogo*, the official provincial capital.
[8] Hence, branches that are located in the main city are attributed a distance of 0 km.

distance between the headquarter of financial intermediaries located in the province and the provincial main city, the number of observations slightly decreases because it omits territories in which no bank is headquartered.

[Insert here Table 1]

In Figure 1 we plot the three main indexes of banking diversity by province in a representative year (2008). The measure of ownership and competition diversity seems to favor southern (especially Apulian) and north-eastern provinces, thanks to the greater importance of cooperative and popolari banks in such territories. However, by considering also the geographic and balance sheet dimensions of diversity, no clear-cut pattern emerges. In general, provinces in which the most populous cities (Rome, Milan, Naples, Turin, Genoa, Palermo, Florence, Catania and to a lesser extent Bologna and Bari) are located seem to be relatively less diverse than more marginal ones, probably because in the former the greater importance of large joint stock banks shrinks funding strategy diversity. At the same time, likely such big cities tend to centralize in their territory most financial services available in the province, so that their provinces enjoy a lower geographic dispersion of banking services.

[Insert here Figure 1]

3.2 Financial complexity

Different papers have generalized the measure of Economic Complexity by Hausman and Hidalgo (2009) and extended it beyond its classical application to export data. In this work we adopt the same approach and compute an index of financial complexity at the provincial level.

In general, two strategies would be feasible to this purpose. First, we might rely on employment data at a disaggregated Ateco 2007 (NACE rev. 2) level. Second, data on registered firms at the same level might be used. By focusing only on Ateco 2007 (NACE rev. 2) section K "Financial and Insurance Activities" and extracting data at 5-digits disaggregation, we are able to measure the complexity of provincial financial systems. Official employment data at provincial level and 5-digits sectors are publicly available from Istat only from 2012 to 2018. The same holds also for data on the *Unità Locali delle Imprese,* (local units of active enterprises), provided by Istat. We compute financial complexity using such data. However, to extend our sample, we consider a number of alternative datasets. In particular, first we recur to information coming from Aida (BVD) on the registered firms in the Ateco 2007 (NACE rev. 2) section K by province and year. The database collects balance sheet information on Italian firms and has been widely used in studies on the Italian economy[9]. Since it provides information on the incorporation and closure (if not currently active) date, apart from location and sub-sector of activity, we are able to identify the number of active financial firms in each province by year. Overall, the measure of financial complexity built from this dataset considers 41,637 financial firms active for at least one year during the period 1995-2020. Finally, we extract data on authorized

[9] See for instance Belloc et al. (2016) and Landini et al. (2020).

financial intermediaries' headquarters from the *Albo di Vigilanza* of the Bank of Italy and calculate an alternative measure of financial complexity. Although such dataset provides a very broad coverage period, comparable to Aida (BVD), it does not follow the Ateco 2007 (NACE rev. 2) classification. Hence, when computing complexity from such data, nodes are no longer 5-digits Ateco 2007 (NACE rev. 2) sectors. Conversely, we employ the official classification of the *Albo di Vigilanza* and consider 33 nodes (details available in Appendix B). At the same time, the *Albo di Vigilanza* collects information only on intermediaries regulated by the Bank of Italy (mainly banks, finance firms, hedge and mutual funds, asset management companies), while calculating complexity from this data omits the role of other entities , e.g. financial brokers, holdings, cash-transfer services, insurance companies, that are included in the Ateco 2007 (NACE rev. 2) section K. Moreover, the *Albo di Vigilanza* provides information on the legal headquarter of financial firms and since in different years no intermediary is headquartered in a number of provinces, it introduces a bias in the index[10].

All in all, we apply the Hausman and Hidalgo (2009) algorithm to the data described above and obtain different measures of provincial financial complexity (see Appendix B for details).

In Table 2 we report summary statistics for the four indexes of complexity we compute. The number of observations decreases when Istat data are employed, because of their lower coverage (2012-2018). As documented in Table 3, the four measures are highly correlated (from 46% to 74%).

[Insert here Table 2 and 3]

Also the provincial rankings provided by the four index is extremely correlated. For the representative year (2015) the correlation between the indexes goes from 62 % to 82%. The higher correlation insists between the measure of complexity built from the Aida BVD data and that coming from Istat, on the basis of active firms. Correlations are stable during our time span.

[Insert here Table 4]

Ideally, we would prefer Istat data because they are validated officially and the most reliable. However, their time coverage is rather limited. Aida and *Albo di Vigilanza* data offer a more suitable time span to conduct our analysis. However, as reported in Table 3 and 4, the index computed from Aida is the most correlated with Istat measures, both if we consider scores and rankings of provinces. In addition, it benefits from the usage of the Ateco 2007 (Nace rev. 2) classification, that guarantees a broader coverage of financial firms. Hence, in

[10] When applied to export data, the authors suggest eliminating nodes and territories that do not satisfy a certain threshold. In this context we cannot apply such threshold, but the introduction of provinces in which no intermediary is located introduces a severe bias in the algorithm. To avoid it, we eliminate such provinces and attribute to them the minimum financial complexity as observed in the overall sample. However, such procedure is prone to criticism. On the other hand, when computing complexity from the Aida dataset, we do not incur in such problem. Indeed, Aida not only reports information on firms that have their legal headquarter in the province, but also on subsidiaries (for example Aida reports information on insurance agencies, not only on the insurance company they belong to). This in turn implies that no province in our sample has zero firm imputed.

the remainder of the paper we mainly refer to Aida (BVD) data when employing our financial complexity measure. However, we also employ data from the other sources to validate our main results.

Differently from the plot of banking diversity, the graph of financial complexity by province in 2008 (Figure 2) points to a clearer divide between northern and southern provinces. Moreover, metropolitan cities (administrative units that have replaced provinces in territories with the most populous Italian cities) seem to benefit from a higher financial complexity, as opposed to Figure 1.

[Insert here Figure 2]

These facts are confirmed from Table 5, that presents top and bottom ten provinces by financial complexity in 1998, 2008 and 2018. First, financial hubs (Milan and Rome) prevail, even if the role of Rome seems to slightly decrease over time. Second, at least four metropolitan areas are in the top ten each year. The number increases to six in 1998 and 2008. Finally, only two southern provinces (Naples and Bari) enter the top ten ranking, and this happens only in 2008. On the contrary, the lowest financially complex provinces are mainly southern. Overall, the rankings seem rather stable over time.

[Insert here Table 5]

3.3 Dependent and control variables

The aim of this paper is to analyze the impact of banking diversity and financial complexity on the financial stability of provinces and their resilience during financial shocks. In the paper we employ *NPL*, the 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 our main dependent variable. Data are provided by the Bank of Italy Statistical Database. The variable is officially used as a proxy for financial fragility by the Bank of Italy in its regional analyses and commonly used in the literature on financial stability [11]. Additional variables serve as alternative dependents in robustness exercises or as controls in our main specifications. In particular, we retrieve from the Bank of Italy Statistical Database two different definitions of the NPL rate that only consider: i) non-financial and family firms and ii) non-financial firms, respectively. Hence, both variables exclude the mitigating effect of households, compared to the main NPL rate. Additional exercises are conducted using several proxies for loan concentration (or diversity) as dependent variable. In particular, we consider three dimensions of loan concentration. The first set of variables (*LoanConcentration* $_{TOP0.5\%}$, *LoanConcentration* $_{TOP1\%}$, *LoanConcentration* $_{TOP5\%}$ and *LoanConcentration* $_{TOP10\%}$) consider the share of loans detained by top borrowers (0.5, 1, 5 and 10%) at provincial level. They are retrieved from the Bank of Italy Statistical Database. We then build two indexes of loan diversity, based on data from the Bank of Italy. The first (*Loan Diversity*$_{DES}$), is computed by subtracting one to a Herfindhal-Hirschman index based on loans by economic destination. The second (*LoanDiversity*$_{BORROWER}$), is derived

[11] See Bank of Italy (2020) for details. Among the others, the non-performing loan rate (on margin) at country/region or bank level is used as a proxy for financial risk and instability by Sundararajan et al. (2001), Barth et al. (2004), Gonzalez (2005), Podpiera (2006), Agoraki et al. (2011), Cubillas and Gonzalez (2014), Ghosh, (2015), Lee and Lu (2015), Chau et al., (2020).

from data on loans by category of borrower (details on the two classifications are provided in Appendix C). The three measures of loans concentration/diversity are based on the province of residence of the borrower. Finally, several control variables are retrieved from Istat and Bank of Italy datasets. In detail, we use the amount of recycled urban waste divided by population (*Recycling*) as a proxy for social capital, import and export values divided by provincial GDP (*Openness*) and incoming international passengers (*International Passengers*) as a measure of openness to international markets, employment share in services (*Tertiary Employment*) and the average number of employees per local unit of enterprises (*Average size of firms*) to control for the sophistication of the provincial economy. The average number of electricity outages per user (*Electricity Outages*), number of active airports (*Airports*) and the warehouse capacity of ports' facilities (*Warehouse capacity of ports*) as infrastructural controls. Human capital availability and financial technology of provinces are taken into account by including the number of universities and research centers (*Universities*) and active point-of-access devices (*Point-of-Access*) as regressors. Finally, total foreign population, an index of diversity of foreign population, number of registered cars and car accidents are used as instruments in an Instrumental Variable (IV) check. The full list of variables' definition and sources is reported in Appendix A.

Table 6 presents descriptives for our main dependent variables, while summary statistics for controls are available in Table A.2. The overall measure of *NPL* is mitigated by the inclusion of households. Indeed, as expected it shows lower values than when considering the non-performing loans rate only for non-financial and family firms, and non-financial firms. Loan diversity is rather high in Italy, both if it is computed with data on economic destinations or borrower categories. However, the first dimension shows higher values than the second.

[Insert here Table 6]

We plot the evolution over time of *NPL* in Figure 3, and isolate the three shocks that affected Italy in the last decades. In detail, we date the Great Financial Crisis in the years 2008 and 2009, the sovereign debt crisis from 2010 to 2013, and the Covid-19 pandemic in 2020[12]. Evidence is rather ambiguous. While as expected the non-performing loans rate increased remarkably during the GFC and, to a lesser extent, during the debt crisis, it has undertaken since then a decreasing path that seems not to have been affected by the Covid-19 pandemic. On the contrary, *NPL* shows its lower value in the period under scrutiny in 2020. This does not come as a complete surprise, after all. Indeed, since the burst of the Covid pandemic and the first lock-down (March 2020), the Italian governments have undertaken a number of measures in order to limit financial distress for

[12] The Great Financial Crisis originated in 2007, but Italy was hit later on, after the collapse of Lehman Brothers. The GFC is usually dated between 2008 and 2009 for Italy, see for instance the influential database on banking crises by Laeven and Valencia (2018). The European sovereign debt crisis' first event is usually attributed to October/November 2009, when the newly elected Greek government revisited its budget deficit forecast. It started to propagate to other countries (Ireland, Portugal, Spain and Italy) in 2010, even if Italy was affected by major problems only since May 2011 (see Lane, 2012). We impute to 2013 the last year of crisis for Italy since in 2014, contrary to the previous two years, the Italian GDP did not experience a severe drop and remained stable (see World Bank data available at https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=IT). Such dates seem reliable and offer a consistent picture of the evolution of non-performing loans rate for Italy (Figure 3 and 4).

firms and households. In particular, apart from the monetary subsidies provided to the most affected economic categories, the emergency packages "Cure Italy", "Liquidity" and "Relaunch Italy" allowed for state guaranteed financing for SMEs and loans moratoria for SMEs and households. Moreover, private initiatives of the financial sector have extended the scope of the moratoria[13]. This has basically frozen the growth of non-performing loans. Indeed, many reports remark how the adverse effects of the pandemic will reflect into higher *NPL* only since 2021-2022, should the government eliminate such measures (Abi-Cerved, 2021; Bank of Italy, 2021; Ciocchetta et al., 2021).

In figure 4, we compare the evolution of the main *NPL* definition with its alternatives. Again, 2020 registers a decline in the three measures. However, an additional difference emerges. Indeed, while the overall *NPL* rate peaks during the GFC, the maximum level of the non-performing loan rate is reached during the debt crisis if we omit the role of households. Hence, as it is well-known, the sovereign debt crisis years affected relatively more firms than families. Apart from this, the three variables evolve similarly over time.

[Insert here Figure 3 and 4]

4. Empirical strategy and results

In line with the literature discussion, we investigate whether a higher banking diversity and financial complexity improves financial stability and shielded Italian provinces from the financial shocks that have denoted the last decades. In order to do that, we first estimate the following linear equation:

$$NPL_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 Controls_{i,t} + d_t + c_i + \varepsilon_{i,t} \quad (6)$$

Our dependent variable *NPL* serves as a proxy for financial instability and the severity of financial shocks. It is commonly used as a measure of financial instability both in studies at cross-country/regional (Sundararajan et al., 2001; Barth et al., 2004; Podpiera, 2006; Lee and Lu, 2015; Ghosh, 2015) and bank (Gonzalez, 2005; Agoraki et al., 2011; Cubillas and Gonzalez, 2014; Chau et al., 2020) level. As for controls, our baseline specification includes *Recycling* to capture the effect of social capital, in line with Galardo et al. (2019), *Electricity Outages* to control for infrastructure endowment as a factor of resilience (Fratesi and Perucca, 2018), *Tertiary Employment* that relates to the sophistication of the productive system and is expected to positively influence stability (Giannakis and Bruggeman, 2017) and *Openness* as a proxy for both exposure to international shocks (Faia, 2007; Kamber and Thoenissen, 2013, Montinari and Stracca, 2016) and economic resilience in case of domestic turmoil. Year dummies and province fixed effects complete the equation. Our main specification alternates the inclusion of banking diversity and financial complexity measures. Consistently with the literature review, we expect a positive role of diversity and complexity on the stability of the financial system. Such effect would result in a negative β_1, i.e. greater diversity (complexity) leading to

[13] For details, see the IMF monitoring of policy responses to the pandemic (https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#I) and the monitoring by the joint Task force between Ministero dell'Economia e delle Finanze, Ministero dello Sviluppo Economico, Bank of Italy, l'Associazione Bancaria Italiana (ABI), Mediocredito Centrale (MCC) and Sace, available at https://www.bancaditalia.it/focus/covid-19/task-force/index.html

a lower number of defaulted and impaired borrowers. This effect might stem from the ability of a more diverse banking system to cope with external shocks. If a crisis hits one particular type of bank, other types are still running and their activity work as a buffer. This mitigates adverse effects of external shocks in local economies. Moreover, in general, diversity enhances the soundness of the financial system. Intermediaries that are different in their business models, objectives, legal requirements, etc. deal with risk differently and this avoids herd behavior and a too high risk concentration. Finally, greater diversity implies greater access to financial services by consumers, and this makes the system less fragile. Similar arguments can be made on financial complexity, intended as a measure of diversity and development of the overall local financial market. Moreover, when considering the latter, we would capture the mitigating effects of alternatives to bank financing in situations of credit crunch and financial distress (Love et al., 2007; Garcia-Appendini and Montoriol-Garriga, 2013; Casey and O'Toole, 2014; Fernandez et al., 2018).

Since the beneficial effects of a greater diversity are particularly highlighted in periods of financial turmoil (Haldane and May, 2011; Baum et al., 2020), we move to a model that includes interaction terms between our variables of interest and crisis dummies:

$$NPL_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 GFC + \beta_3 (Diversity * GFC) + \beta_4 DEBT + \beta_5 (Diversity * DEBT) + \beta_6 COVID + \beta_7 (Diversity * COVID) + \beta_8 Controls_{i,t} + \beta_9 PreGFC + c_i + \varepsilon_{i,t} \quad (7)$$

The aim of this equation is to directly measure the contribution of banking diversity (financial complexity) on stability during turbulent periods. In particular, in this way we test whether provinces denoted by a greater banking diversity (financial complexity) are more resilient than others during financial crisis episodes. In such case, a negative coefficient would be associated to the three interaction terms. Since the equation above includes three dummies that capture different years denoted by financial instability, we do not include year dummies in the equation. However, the dummies in themselves capture the temporal dynamic of the phenomenon under scrutiny, dividing our sample in five periods: *PreGFC* (2006-07), *GFC* (2008-09), *DEBT* (2010-2013), *COVID* (2020) and the benchmark period between the debt and Covid-19 pandemic (2014-2019). Finally, province fixed effects are included in the specification. We expect a positive sign for β_2, β_4 and β_6. However, as explained in detail in the previous section, descriptive statistics suggest that while non preforming loans increased dramatically during the GFC and the sovereign debt crisis, this has not happened in the wake of the Covid-19 pandemic. This might introduce a confounding effect in our estimates.

Finally, we investigate potential channels through which diversity and complexity might make the financial system more stable. In particular, following the literature discussion, we focus on different measures of loans concentration, and test whether more diverse and financially complex provinces achieve greater loans diversification. This in turn might lead to more resilient financial sectors, since it implies a lower concentration of risks. We are interested in different dimensions of loans concentration/diversification, so that we distinguish between concentration in terms of borrowers, economic destination of the investment and borrower categories and test the following equation:

$$Y_{i,t} = \alpha + \beta_1 Diversity_{i,t} + \beta_2 Controls_{i,t} + d_t + c_i + \varepsilon_{i,t}, \quad (8)$$

where we alternatively use $LoanConcentration_{TOPx}$, $LoanDiversity_{DES}$ and $LoanDiversity_{BORROWER}$ as dependent variable. We expect that both higher levels of banking diversity and financial complexity are associated to lower degrees of loan concentration, as measured by the amount of loans detained by top borrowers. This implies $\beta_1 < 0$ when the dependent variable are the different indexes of $LoanConcentration_{TOPx}$. At the same time, we expect both variables to be positively related to diversification of loans, both in terms of a broader set of economic destinations and borrower categories. This would result in a positive β_1 when the specification considers $LoanDiversity_{DES}$ and $LoanDiversity_{BORROWER}$ as dependent. Since also demand effects might be at work in such framework, we validate our main results by adopting an instrumental variable approach as a robustness check.

4.1 Main results

In Table 7 we present results from the estimation of Eq.6. In the first four columns we only include our measure of banking diversity or financial complexity, year dummies and province fixed effects. From column 5 to 8, we also introduce provincial level controls. We start by considering the impact of a higher diversity, as measured by the ownership and competition dimensions, on the non-performing loans rate. The estimated coefficient is highly significant (1% level) and negative. It implies that, a unit increase in $DIVERSITY_{OC}$ is associated to a decrease of *NPL* of about 0.45%. Such effect is economically relevant. Indeed, a one standard deviation increase in $DIVERSITY_{OC}$ leads to a decrease of more than 10% of a standard deviation of the non-performing loans rate. Results slightly decrease in magnitude when we stepwise include the geographic spread ($DIVERSITY_{OCG}$) and the funding strategy ($DIVERSITY_{ORIGINAL}$) dimensions in the analysis in column 2 and 3, but remain largely negative and significant (1% level). In column 4 we estimate the influence of a higher complexity of the overall financial system on stability. Again, the estimated coefficient is negative and statistically significant. Moreover, as compared to the impact of banking diversity, it seems that $COMPLEXITY_{AIDA}$ has a comparable effect on *NPL* (the variable is normalized, hence a one standard deviation increase in complexity produces a decrease of the non-performing loans rate of 0.07%, about ten per cent of its standard deviation). Estimates do not change dramatically when we introduce additional covariates as controls. The coefficients associated to our main regressors are still negative and strongly significant from column 5 to 8. As for controls, worse infrastructures are related to more financial fragility, as expected. The impact of *Recycling* is rather ambiguous. Its coefficient suggests that higher social capital is detrimental to financial stability. However, it has already been noted that social capital, though generally associated to positive economic outcomes, is also denoted by a number of side effects (see Rostila, 2010 and De Blasio et al., 2019 for a more detailed discussion). For instance, it might produce closed social networks or too tight connections between the local banking system and firms (Battistin et al., 2011), that in turn might entail credit

distortions that make the financial system more fragile[14]. Other controls (*Openness* and *Tertiary Employment*) are not significant.

[Insert here Table 7]

Next, we move to estimate the impact of banking diversity and financial complexity on stability during periods of financial turmoil. Table 8 presents results following Eq. 7, that considers interactive terms between our core variables and crisis periods. As expected, both the GFC and sovereign debt crisis are associated to a higher *NPL* than the benchmark period (2014-2019). However, in 2020 no significant increase in the non-performing loans rate is found. On the contrary, a negative and significant coefficient is attributed to the *COVID* dummy in column 4. As discussed in the previous sections, the economic measures adopted by the Italian government have been effective in alleviating the distress caused by the pandemic. As for our main results, the three indexes of diversity show a positive and significant coefficient in tranquil periods (no interaction). However, a negative highly significant coefficient is associated to the interactions of the measures of diversity with all the three crisis dummies. This corroborates our hypothesis that higher banking diversity mitigates the adverse consequences of financial shocks on local economies. The effect is stronger during the debt and Covid-19 crises, than in the years of the GFC, when considering the ownership, competition and geographic dimension of diversity. However, the impact of the overall index ($DIVERSITY_{ORIGINAL}$) has a greater magnitude during the GFC than the debt crisis. Overall, the effect of banking diversity seems to be beneficial to financial stability. Only in column 2 the algebraic sum of the $DIVERSITY_{OCG}$ coefficients remains positive after taking into account the interactions with crisis periods. In column 4 we replicate the specification by considering our main measure of complexity of the overall local financial sector. Results are less clear-cut than in the previous cases. The linear coefficient associated to $COMPLEXITY_{AIDA}$ is negative and significant (5% level). However, only during the sovereign debt crisis a greater financial complexity seems to have brought about beneficial effects to provinces. Interaction terms with the other two periods of financial instability do not show a significant effect. Since the Covid-19 pandemic does not seem to have caused any increase in the non-performing loans rate, we exclude 2020 from our sample and check whether previous findings are driven by such inconsistency. Results are reported from column 5 to 8. Previous results on the GFC and debt crisis are confirmed. Provinces denoted by higher banking diversity have benefitted from a more financial stability during both the turbulent periods. Such effect is stronger when considering the overall measure of banking diversity. On the contrary, a higher financial complexity seems to have been relevant only during the sovereign crisis.

[Insert here Table 8]

We provide a more intuitive visualization of our findings in Figure 5 and 6, where we plot the marginal effects of the three crisis dummies on *NPL*, for different values of $DIVERSITY_{ORIGINAL}$ and $COMPLEXITY_{AIDA}$. Marginal effects are computed from the complete specifications of Table 8 (columns 3 and 4), and the

[14] Ambiguous or inconclusive results on the relationship between social capital measures and resilience in Italy appears also in works that consider a longer time span (see for instance Sabatino, 2019).

estimated coefficients and confidence intervals are available in Tables A.3 and A.4, respectively. The message of the figures is clear. The impact of the three crisis periods on *NPL* is inversely proportional to $DIVERSITY_{ORIGINAL}$. Higher banking diversity has mitigated the consequences of the GFC and the debt crisis on local financial stability. Moreover, the estimated marginal effects of the Covid-19 pandemic are generally negative, and their magnitude increase when moving from lower to higher values of 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%. A similar picture can be drawn for the complexity of the overall financial system, although only during the years between 2010 and 2013. In such period, theoretically a province denoted by the maximum financial complexity observed in our sample (7.18) enjoys a *NPL* ratio that is lower of about 0.7% than that attributable to the minimum-complexity province (-2.16).

[Insert here Figure 5 and 6]

In Table 9 we replicate previous estimates by extending the benchmark specification, to check the sensitivity of our findings to the inclusion of additional controls (*Recycling*, *Openness*, *Tertiary Employment* and *Electricity Outages*). Previous results are largely confirmed and improve. The linear coefficient associated to diversity measures remain positive, although consistently lower in magnitude than in Table 8. Moreover, the algebraic sum of the linear and interactive coefficients becomes negative for each measure of banking diversity. All interaction terms between diversity indexes and crisis periods are negative, even if $DIVERSITY_{OC}$ and $DIVERSITY_{OCG}$ seem to be less relevant in attenuating the effects of the GFC (columns 1 and 3, 5 and 6). However, when considering the overall measure of banking diversity, the three interactions are statistically significant. Results on financial complexity are in line with Table 8, too. It seems to have mitigated the sovereign debt crisis. In sum, Table 9 supports our previous findings. Banking diversity and financial complexity have a beneficial role on the stability of local financial systems. Their overall effect on *NPL* is negative, i.e. higher values of diversity and complexity are associated to a reduction in the non-performing loans rate. Evidence from single episodes of widespread financial distress is blurrier. Higher banking diversity have shielded provinces from the financial shocks occurred in Italy in the past decades. On the other hand, a more complex local financial industry has been effective only during the sovereign debt crisis. This might reflect the overreliance of the Italian economy on banks, so that the role of other financial intermediaries on financial soundness is less pronounced. A cross-section analysis that exploits the limited within-province variability of our main variables of interest supports these findings (Appendix D).

[Insert here Table 9]

4.2 Additional results

In section 4.1 we document how higher banking diversity and financial complexity have a beneficial effect on financial stability. In this section we investigate one potential channel through which the two measures operate and determine a sounder financial system. In particular, past literature has identified three potential

mechanisms at work. First, 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 in the financial sector imply differences in the implemented business strategies, segment of clientele and risk appetite. This in turn leads to greater stability and makes the financial sector less sensitive to systemic risk. Second, diversity breeds inclusion. Marginal consumers that may strive to access financial services when the single STV banking model prevails are less constrained in diverse financial systems (Michie, 2011). This promotes better risk sharing and makes the financial system more resilient. Third, beneficial effects of competition may be at work too. Even if the impact of greater competition on stability is still debated (Beck et al., 2013), a recent strand of literature (Boyd and De Nicolò, 2005; Fiordelisi and Mare, 2014) is questioning the traditional charter value paradigm by Keeley (1990) that associates competition in the banking sector to greater instability. Depending on the country-specific regulatory environment, competitive forces encourage banks to take on more diversified risks, resulting in less fragile banking systems (Anginer et al., 2014). Recent empirical evidence from Italian banks corroborates such competition-stability nexus (Aristei and Gallo, 2019). Our province-level setting does not enable us to test specific mechanisms. However, since the ultimate effect of the three channels described above is essentially the same, i.e. diversity promoting higher degrees of risk diversification, we investigate if this is the case in our framework. In particular, we investigate whether higher levels of banking diversity and financial complexity decrease loans concentration at province-level. To do so, as detailed in section 4 we alternatively employ three dimensions of loans concentration/diversity: percentage of loans detained by the top 0.5% of borrowers, diversity of economic destinations of loans and diversity of borrower categories.

In Table 10 we estimate Eq. 8 and test the impact of banking diversity and financial complexity on $LoanConcentration_{TOP0.5\%}$. Since data are available since 1998, we decide to exploit such additional information and broaden our temporal coverage[15]. From column 1 to 4 our models are parsimonious and only consider diversity (complexity) indexes, year dummies and province fixed effects. From column 5 to 8 we introduce additional province-level covariates to corroborate previous findings. As expected, banking diversity measures are related to a decrease in loan concentration, as measured by the percentage of loans detained by the top 0.5% of borrowers, and coefficients are strongly significant. Results are rather meaningful in magnitude, too. A unit increase in the $DIVERSITY_{OC}$ index leads to a decrease of $LoanConcentration_{TOP0.5\%}$ of about 13%. To put such result in another perspective, a one standard deviation increase in $DIVERSITY_{OC}$ reduces loan concentration of more than 2.10% (about 20% of a standard deviation). Economic effects are rather stable when we move to more comprehensive measures of banking diversity (peaking in column 2), even if the estimated coefficients slightly decrease, and do not change when we introduce additional regressors in the specification[16]. Such evidence corroborates the three channels discussed above and point to the ability of more diverse banking sectors to achieve better risk diversification profiles. However, this does not seem to

[15] Results are confirmed when considering the time span of section 4.1 (2006-2020).

[16] A one standard deviation increase in $DIVERSITY_{OCG}$ translates into a 2.70% decrease in loan concentration, while a one standard deviation increase in $DIVERSITY_{ORIGINAL}$ predicts a 2.10% decrease in the dependent variable.

be the case when we move to our main measure of complexity of the overall financial system. Indeed surprisingly, $COMPLEXITY_{AIDA}$ shows a positive and significant coefficient. This result goes against our predictions and requires further investigation. It may be related to the aspects captured by the complexity algorithm or to endogeneity issues (demand effects).

[Insert here Table 10]

In Table 11 we provide additional evidence on the role of banking diversity and financial complexity on provincial loan diversity. To analyze alternative facets of the phenomenon we estimate the impact of our variables of interest on $LoanDiversity_{DES}$, a diversity measure based on the economic destination of loans granted to province residents (see section 3 and Appendix C for details). Table 11 provides a different picture than the previous one. Indeed, when considering such dimension of risk diversification, it seems that while the complexity of the overall financial system leads to higher loan diversity by economic destination, banking diversity does not play any role in the phenomenon. Diversity measures do not show any significant explanatory power in the regressions, while the coefficient associated to $COMPLEXITY_{AIDA}$ is positive and strongly significant (1% level) as expected. The metrics, apart from diversity, also captures the sophistication of local financial industries. Moreover, it is able to consider the role of alternative intermediaries to banks. Hence, greater values of complexities are assigned to provinces that are denoted by the presence of a vast array of financial intermediaries (e.g. leasing and factoring firms, finance firms, institutional investors, insurance companies, etc.) that are probably better suited to finance a broader set of investment than traditional banks (e.g. financial investment, machinery and durables, public infrastructures). Since all these categories of investment enter our measure of loan diversity (see Appendix C), comprehensive indexes of *financial* diversity (and development) are more relevant than indexes based on the *banking* sector in this context[17].

[Insert here Table 11]

Finally, in Table 12 we estimate Eq. 8 by introducing $LoanDiversity_{BORROWER}$ as dependent. The index is computed on the basis of loans by borrower category (details in Appendix C) and offers an additional perspective on the diversification profile of local financial systems. Also in this case, it seems that the complexity of the overall financial sector encourages a greater diversification of loans, while the impact of banking diversity is non-significant if not negative (column 5). Again, such result can be attributed to the greater coverage of the complexity measures as opposed to the indexes of banking diversity.

[Insert here Table 12]

[17] For brevity, we do not report regressions that consider single elements of the loan diversity index as dependent. However, higher $COMPLEXITY_{AIDA}$ is associated to higher levels of less traditional loans (e.g. financial investment, public infrastructure, purchases of real estate not as consumer households' dwellings, durables by firms, etc.) than $DIVERSITY_{ORIGINAL}$. The latter translates mainly into higher levels of traditional loans, such as mortgages for the purchase of dwellings by consumer households. This supports the explanation provided in text. Results can be imputed to the broader plethora of intermediaries considered by our complexity measure. These, in turn, are better able to finance a broader array of investment. On the contrary, banking diversity measures are too narrow to capture such effect.

All in all, our findings tend to support the view that higher diversity in the banking and in the overall financial sector promotes a better diversification of risks. In particular, provinces denoted by a higher banking diversity show a reduced exposure to the top distribution of borrowers by size. Moreover, a positive contribution of diversity on loan diversification emerges when considering our measure based on the overall local financial industry. Indeed, we provide evidence that higher financial complexity leads to more diversified loans, both in terms of economic destination and borrower category. The lower concentration of risks observed in more diverse systems might be conducive to less systemic fragility, as postulated by past literature. However, as remarked above, demand effects might be at work, too. This in turn would pose some endogeneity concerns and question our findings. We address such issues in section 5.

5. Robustness

To validate our results we implement a vast array of robustness exercises. First, as showed by Figure 4, the temporal evolution of the non-performing loans rate is sensitive to the employed definition. Hence, we check whether our findings are confirmed in case we consider a differently measured non-performing loans rate as dependent. Second, we test the sensitivity of our results to: i) changes in the specification and ii) changes in the indexes of banking diversity and financial complexity. Third, since economic measures undertaken by the Italian government have mitigated the impact of the Covid-19 pandemic on the stability of the financial system, we check whether the evidence presented in the previous section is corroborated when using a different month as reference for *NPL* in 2020. Finally, we move to test the reliance of our additional results on loan concentration and: i) employ different definitions for the dependent variables and ii) adopt an IV approach that deals with the potential endogeneity in the previous estimates.

As we have documented in section 3, households' data mitigates our *NPL* measure. Definitions of the non-performing loans rate that do not include households are higher in magnitude and show differences in their evolution during the period under scrutiny, to a limited extent. Moving to such variables might provide a better picture of the financial distress experienced in the last decades. Hence, as a first robustness test we replicate the estimates presented in Table 7, by changing the dependent variable of Eq. 6. Results are reported in Table 13. In the first four columns we employ the *NPL* ratio as observed only for non-financial firms as dependent. From column 5 to 8, we also take into account impaired family firms. Moving to more stringent measures of *NPL* does not change our results. Both the measures of banking diversity and financial complexity are associated to negative, highly significant coefficients. In addition, while the economic effect of banking diversity measures is basically unaffected (in general a one standard deviation increase translates into a 10% of a standard deviation decrease in *NPL*), financial complexity impacts slightly more pronouncedly on the *NPL* at firm-level (column 4) than in Table 7. This probably relates to the greater importance of the index for firms, rather than households, as discussed in section 4.2.

[Insert here Table 13]

In Table 14 we replicate our baseline model (Eq. 6) by first employing alternative indexes of banking diversity and financial complexity (column 1 to 6), and then by modifying the set of provincial controls in the specification (column 7 to 10). In column 1 we consider an alternative index for ownership and competition diversity (DIV_{OCTOP5}). In column 2, we add the geographic dimension to the previous ones. However, the former is computed on the basis of *headquarters* of intermediaries, rather than *branches*. In column 3, DIV_{OCF} takes into account ownership, competition and funding diversity, excluding the geographic component of the original measure. In column 4, the geographic dimension of the original index is replaced according to the average distance between *headquarters* of intermediaries and the province main city. In column 5 and 6, we replace the financial complexity index based on Aida (BVD) data with those measured with Istat data (local units of active enterprises and employment). Previous results are corroborated. Higher banking diversity and financial complexity lead to more stable financial systems and the relation is not sensitive to changes in the main indexes. This holds also when modifying the set of regressors used as controls (column 7 to 10). Results are not sensitive to the inclusion of alternative measures of infrastructure endowment (warehouse capacity of ports and active airports), international exposure (*International passengers*), sophistication of the productive system (*Average firm size*), and including proxies for human capital (*Universities*) and financial technology (*Point-of-Access*).

[Insert here Table 14]

We then move to analyze the role of banking diversity and financial complexity during periods of financial unrest (Eq. 7). Our main concern is that since government's measures have mitigated the level of *NPL* during the Covid-19 crisis, the sensitivity of provinces to all crisis episodes (Tables 8 and 9) might be affected. Hence, we estimate Eq. 7 by replacing data on *NPL* for the year 2020. In particular, while *NPL* data used in the rest of the paper are referred to Dec. 31st of each year, we substitute 2020 observations with the ratio of *NPL* as registered on March 31st (Table 15, column 1-4) and June 30th (columns 5-8), respectively. The rationale of the exercise is that in such periods we should have data less affected by government's interventions. This is particularly true for data coming from the end of March 2020, when the effectiveness of most of the measures was limited[18]. However, this comes to the price of losing much information on the economic unrest provoked by the pandemic (first measures of generalized lock-down were implemented since March 11th in Italy). Hence, to have a picture in the middle between March and December, we also use data coming from the end of June. To this date, the pandemic had already caused relevant economic distress but, at the same time, borrowers had recurred to moratoria on loans and other measures to a lower extent than in December[19]. All previous findings

[18] First loan moratoria were introduced with the "Cure Italy" decree adopted on March 17th. However, such measures needed time to become fully operational and the resort to the moratoria was limited until April.

[19] This is confirmed by the monitoring of the Bank of Italy on the participation in debt moratoria. End of December data are higher than those coming from the end of June for both moratoria by government impulse ('Cure Italy' and 'Liquidity' decree laws for firms, access to the 'Gasparrini' Fund for households' mortgages) and financial sector initiatives. The same is true for requests for financing backed by the Central Guarantee Fund by SMEs (under Article 13 of the 'Liquidity' decree law). See data on the monitoring available at https://www.bancaditalia.it/focus/covid-19/tabelle-moratorie.pdf. See also Ciocchetta et al. (2021) and data from the joint Task force between Ministero dell'Economia e delle Finanze,

are confirmed. A greater banking diversity curbed the impact of the three periods of financial turmoil, while more financially complex territories showed a higher resilience during the sovereign debt crisis.

[Insert here Table 15]

We then check the sensitivity of results from Table 8 and 9 to changes in the specification, both in terms of alternative indexes of diversity and complexity and of different covariates as controls. Table 16 replicates the structure of Table 14, as for the alternatives to our main variables and controls. However, in this case we use financial complexity as measured on Bank of Italy *Albo di Vigilanza* data as robustness for $COMPLEXITY_{AIDA}$, instead of the Istat indexes that do not cover a sufficient time span to estimate Eq. 7. Overall, main results are corroborated and not sensitive to changes in the main indexes (column 1 to 5) or to the introduction of alternative regressors (column 6 to 9). The only relevant difference with the evidence of section 4 lies in column 9. The coefficient associated to $COMPLEXITY_{AIDA}$ remains negative during the sovereign debt crisis. However it turns positive and significant during 2020 and negative and marginally significant during the GFC. Overall, its beneficial impact on stability is confirmed.

[Insert here Table 16]

In Table 17 we validate our results on risk concentration, in terms of loans by top borrowers (Table 10). Here we use alternative definitions of $LoanConcentration_{TOPx\%}$ as dependent variable. Namely, the ratio is calculated on the basis of loans detained by the first 1, 5 and 10% of borrowers, respectively. Our findings are corroborated, confirming that a greater banking diversity is beneficial to risk diversification by banks, as measured by a lower exposure to the entire top distribution of borrowers by size.

[Insert here Table 17]

However, some endogeneity concerns might arise in such context. Indeed, as discussed in section 4.2, the influence of banking diversity on loan concentration might be the result of demand effects and thus be prone to reverse causality. We control for such problem in Table 18, where estimates from a fixed effects IV approach are reported. A number of internal and external variables are used as instruments for banking diversity in the first stage regression. Different lag structures of the diversity indexes enter the set of internal instruments. Moreover, drawing from the idea that diversity in local society translates into economic diversity (Alesina et al., 2016; Mickiewicz et al, 2019) we use a measure of foreign population diversity (one minus Herfindahl-Hirschman index) and the total number of foreign residents as instrumental variables for banking diversity. Population heterogeneity as instrument for different dimensions of diversity have already been used in the financial literature, se for instance Anderson et al. (2011) and Talavera et al. (2018)[20]. The set of instruments appears relevant. Moreover, the Hansen test never rejects the null hypothesis of instruments validity, even if

Ministero dello Sviluppo Economico, Bank of Italy, l'Associazione Bancaria Italiana (ABI), Mediocredito Centrale (MCC) and Sace, available at https://www.bancaditalia.it/focus/covid-19/task-force/index.html

[20] These studies use population diversity (in terms of age and gender) as instruments for board diversity of resident firms and banks, respectively. Other studies have used measures of diversity of the external environment as instruments for other financial phenomena (Liu et al., 2014; Shim, 2019).

the latter diminishes when both the external instruments are used contemporaneously. Previous findings are confirmed. Higher banking diversity leads to a lower concentration of loans granted to province residents. This translates into negative and significant coefficients for each banking diversity index, although results from Table 10 seem to be slightly inflated from endogeneity.

[Insert here Table 18]

In a similar vein, we account for potential endogeneity in the relationship between financial complexity and loans diversification, both in terms of economic destination of loans and loans by borrower category. Also in this context, reverse causality might affect results from Table 11 and 12. Hence we implement different fixed effects IV models that use internal and external (number of cars and number of car accidents) variables as instruments for financial complexity[21]. Again, first stage statistics point to a proper specification (instruments are highly relevant and the Hansen test of instrument validity is not rejected). Financial complexity promotes a greater diversification of loans to province residents. Moreover, the coefficients estimated in Table 19 are higher in magnitude than those reported in Table 11 and 12, suggesting a stronger impact of financial complexity once endogeneity is taken into account.

[Insert here Table 19]

6. Concluding remarks

In this paper we have investigated the role of diversity of the financial system in promoting stability, in particular during periods of financial turmoil. Building on Michie and Oughton (2013) we propose an index of banking diversity for Italian provinces (NUTS 3). In addition, drawing from network and complexity literature, we compute a measure of the diversity and development of the overall financial system by implementing the complexity algorithm by Hidalgo and Hausman (2009).

Our empirical analysis, that covers three periods of high financial distress (GFC, sovereign debt crisis and Covid-19 pandemic), suggests that greater diversity in the local banking and financial markets has beneficial effects on financial stability. Moreover, this is particularly evident in periods of financial unrest. In detail, both greater banking diversity and financial complexity reduce the non-performing loans rate of the province. In addition, diversity in the banking sector has curbed the detrimental effects of the three crises episodes. At the same time, the diversity (and development) of the overall financial systems seem to have mitigated the impact of the sovereign debt crisis on local economies.

Previous literature has highlighted different channels that might be at work in such setting. First, 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 in the financial sector guarantees

[21] We also use the foreign diversity index and foreign population as instruments in this setting. Results on financial complexity are confirmed. However, the Hansen test points to endogeneity problems affecting our instruments. Hence, we modify the instruments set used in these specifications. Moreover, results form Table 18 are confirmed used cars and car accidents as instruments, not reported for brevity.

diversification in the implemented business strategies, clientele and risk appetite by financial firms. This in turn leads to greater stability and makes the financial sector less sensitive to systemic risk. Second, diversity increases inclusion. Marginal consumers that may strive to access financial services when the single STV banking model prevails are less constrained in diverse financial systems (Michie, 2011). This promotes better risk sharing and makes the financial system more resilient. Third, beneficial effects of competition may be at work too. Recent theoretical literature (Boyd and De Nicolò, 2005) is questioning the traditional charter value paradigm by 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. In general, the three mechanisms suggest that diversity promotes higher degrees of risk diversification by financial firms, and we provide evidence that this is the case. In particular, even if our data do not enable us to disentangle which channel is more relevant, our findings support the idea that greater diversity in the banking and financial system reduces the concentration of loans to resident borrowers, and encourages greater loan diversification, both in terms of economic destination and category of borrower.

Our main results are corroborated by a vast array of robustness exercises and relevant for regulators and policy makers. In the wake of the GFC, both academics and policy makers have highlighted the need to achieve greater diversity in the financial system. The argument for a greater diversity is today more compelling than ever. The disastrous economic effects of the Covid-19 pandemic are well-documented, with access by firms to liquidity being one of the most critical concerns. Support by the financial sector will play a crucial role in avoiding firms' serial defaults and in determining the ability of our economies to recover from the pandemic. To this aim, we showed that a greater financial diversity might be one of the arrows in our quiver.

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Table 1. Different definitions of banking Diversity. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Median	Max
$DIVERSITY_{OC}$	2,500	1.259	0.169	0.645	1.277	1.580
$DIVERSITY_{OCG}$	2,500	1.498	0.210	0.744	1.498	2.517
$DIVERSITY_{ORIGINAL}$	2,500	2.311	0.264	1.172	2.328	3.412
$DIVERSITY_{OCTOP5}$	2,500	0.759	0.203	0.154	0.777	1.257
$DIVERSITY_{OCTOP5\_GS}$	2,455	0.932	0.256	0.167	0.951	1.856
$DIVERSITY_{ORIGINAL\_GS}$	2,392	2.273	0.247	1.422	2.293	3.270

NOTES: See Appendix A for variables' definitions and sources.

Table 2.Different measures of financial Complexity. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Median	Max
$COMPLEXITY_{AIDA}$	2,600	0.000	1.000	-2.155	-0.260	7.178
$COMPLEXITY_{ISTAT\_ULA}$	700	0.000	1.001	-1.536	-0.392	2.868
$COMPLEXITY_{ISTAT\_ADD}$	700	0.000	1.001	-1.011	-0.336	4.647
$COMPLEXITY_{ALBO}$	2,600	-0.023	1.000	-1.000	-0.242	9.511

NOTES: See Appendix A for variables' definitions and sources.

Table 3.Different financial Complexity measures. Correlation matrix.

Variables	$COMPLEXITY_{ISTAT\_ULA}$	$COMPLEXITY_{ISTAT\_ADD}$	$COMPLEXITY_{AIDA}$	$COMPLEXITY_{ALBO}$	Coverage
$COMPLEXITY_{ISTAT\_ULA}$	1.000				2012-2018
$COMPLEXITY_{ISTAT\_ADD}$	0.552***	1.000			2012-2018
$COMPLEXITY_{AIDA}$	0.744***	0.674***	1.000		1995-2020
$COMPLEXITY_{ALBO}$	0.456***	0.655***	0.620***	1.000	1995-2020

NOTES: See Appendix A for variables' definitions and sources. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 4.Different measures of financial complexity. Correlation of the rankings for the year 2015.

Ranks 2015	$COMPLEXITY_{ISTAT\_ULA}$	$COMPLEXITY_{ISTAT\_ADD}$	$COMPLEXITY_{AIDA}$	$COMPLEXITY_{ALBO}$
$COMPLEXITY_{ISTAT\_ULA}$	1.000			
$COMPLEXITY_{ISTAT\_ADD}$	0.784***	1.000		
$COMPLEXITY_{AIDA}$	0.818***	0.754***	1.000	
$COMPLEXITY_{ALBO}$	0.659***	0.624***	0.632***	1.000

NOTES: See Appendix A for variables' definitions and sources. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 5.Top and bottom ten provinces by $COMPLEXITY_{AIDA}$. Representative years.

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

Table 6. Main dependent variables. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Median	Max
NPL	1,837	2.006	0.747	0.431	1.952	4.662
NPL (Non Financial and family firms)	1,837	3.347	1.354	0.648	3.181	8.283
NPL (Non Financial firms)	1,837	3.722	1.653	0.823	3.478	10.617
***Loan Concentration*$_{TOP0.5\%}$**	2,299	34.616	11.765	10.915	31.740	83.120
***Loan Concentration*$_{TOP1\%}$**	2,299	41.681	11.246	14.720	39.290	85.450
***Loan Concentration*$_{TOP5\%}$**	2,299	60.416	9.128	25.825	59.460	90.790
***Loan Concentration*$_{TOP10\%}$**	2,299	68.894	7.927	31.205	68.420	93.170
***Loan Diversity*$_{DES}$**	2,592	0.780	0.043	0.465	0.782	0.874
***LoanDiversity*$_{BORROWER}$**	2,300	0.685	0.044	0.512	0.685	0.810

NOTES: See Appendix A for variables' definitions and sources.

Table 7.Impact of banking diversity and financial complexity on the NPL rate. Different specifications.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DIVERSITY$_{OC}$	**-0.447*****				**-0.455*****			
	(0.098)				(0.098)			
DIVERSITY$_{OCG}$		**-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

NOTES: Dependent variable: *NPL*. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 8. Impact of banking diversity and financial complexity on the NPL rate during crisis episodes. Different samples.

VARIABLES	$DIVERSITY_{OC}$ (1)	$DIVERSITY_{OCG}$ (2)	$DIVERSITY_{ORIGINAL}$ (3)	(4)	$DIVERSITY_{OC}$ (5)	$DIVERSITY_{OCG}$ (6)	$DIVERSITY_{ORIGINAL}$ (7)	(8)
DIVERSITY	1.510***	1.404***	0.862***		1.572***	1.478***	0.928***	
	(0.137)	(0.132)	(0.110)		(0.142)	(0.138)	(0.117)	
$COMPLEXITY_{AIDA}$				-0.073**				-0.068*
				(0.030)				(0.036)
PreGFC	0.329***	0.325***	0.311***	0.232***	0.333***	0.329***	0.317***	0.232***
	(0.033)	(0.033)	(0.034)	(0.033)	(0.034)	(0.034)	(0.035)	(0.034)
GFC	1.458***	1.369***	1.663***	0.925***	1.451***	1.361***	1.655***	0.925***
	(0.240)	(0.230)	(0.293)	(0.033)	(0.245)	(0.235)	(0.299)	(0.034)
DEBT	1.575***	1.313***	1.329***	0.727***	1.538***	1.282***	1.295***	0.727***
	(0.201)	(0.184)	(0.234)	(0.026)	(0.206)	(0.188)	(0.240)	(0.027)
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****		**-0.345***	**-0.226**	**-0.290****	
	(0.193)	(0.156)	(0.128)		(0.197)	(0.159)	(0.130)	
$COMPLEXITY_{AIDA}$****GFC***				**0.023**				**0.024**
				(0.032)				(0.033)
DIVERSITY*DEBT	**-0.669*****	**-0.391*****	**-0.260*****		**-0.641*****	**-0.372*****	**-0.246****	
	(0.154)	(0.119)	(0.099)		(0.157)	(0.122)	(0.101)	
$COMPLEXITY_{AIDA}$****DEBT***				**-0.073*****				**-0.072*****
				(0.025)				(0.026)
DIVERSITY*COVID	**-0.785*****	**-0.556*****	**-0.413****					
	(0.237)	(0.189)	(0.162)					
$COMPLEXITY_{AIDA}$****COVID***				**0.057**				
				(0.045)				
Constant	-0.244	-0.442**	-0.325	1.701***	-0.323*	-0.555***	-0.480*	1.701***
	(0.177)	(0.203)	(0.258)	(0.017)	(0.184)	(0.212)	(0.276)	(0.017)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2019	2006-2019	2006-2019	2006-2019
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	1,400	1,400	1,400	1,400
Number of provinces	100	100	100	100	100	100	100	100
R^2 ***within***	0.597	0.594	0.581	0.567	0.515	0.512	0.494	0.475
R^2 ***overall***	0.319	0.308	0.328	0.411	0.232	0.222	0.240	0.337
F^{ALL}	121.7	112.4	61.87	6.038	122.4	114.3	62.85	3.550
Prob(F^{ALL})>F	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.060

NOTES: Dependent variable: *NPL*. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 9. Impact of banking diversity and financial complexity on the NPL rate during crisis episodes. Extended specification.

VARIABLES	DIVERSITY$_{OC}$ (1)	DIVERSITY$_{OCG}$ (2)	DIVERSITY$_{ORIGINAL}$ (3)	(4)	DIVERSITY$_{OC}$ (5)	DIVERSITY$_{OCG}$ (6)	DIVERSITY$_{ORIGINAL}$ (7)	(8)
DIVERSITY	0.823***	0.765***	0.418***		0.802***	0.762***	0.417***	
	(0.136)	(0.131)	(0.105)		(0.140)	(0.135)	(0.111)	
COMPLEXITY$_{AIDA}$				-0.106***				-0.100***
				(0.027)				(0.033)
PreGFC	-0.050	-0.061	-0.089#	-0.167***	-0.046	-0.054	-0.083	-0.166***
	(0.060)	(0.060)	(0.060)	(0.057)	(0.062)	(0.061)	(0.062)	(0.059)
GFC	0.942***	0.952***	1.213***	0.590***	0.915***	0.942***	1.206***	0.586***
	(0.232)	(0.222)	(0.274)	(0.050)	(0.234)	(0.224)	(0.277)	(0.052)
DEBT	1.182***	1.008***	1.022***	0.469***	1.128***	0.974***	0.997***	0.461***
	(0.195)	(0.177)	(0.223)	(0.034)	(0.197)	(0.179)	(0.225)	(0.035)
COVID	0.322	0.144	0.199	-0.384***				
	(0.279)	(0.265)	(0.336)	(0.042)				
DIVERSITY*GFC	**-0.199**	**-0.179**	**-0.245****		**-0.179**	**-0.172**	**-0.243****	
	(0.181)	(0.146)	(0.118)		(0.183)	(0.147)	(0.119)	
COMPLEXITY$_{AIDA}$*GFC				**0.024**				**0.023**
				(0.029)				(0.029)
DIVERSITY*DEBT	**-0.526*****	**-0.333*****	**-0.226****		**-0.489*****	**-0.314*****	**-0.218****	
	(0.145)	(0.112)	(0.092)		(0.147)	(0.113)	(0.093)	
COMPLEXITY$_{AIDA}$*DEBT				**-0.077*****				**-0.077*****
				(0.022)				(0.023)
DIVERSITY*COVID	**-0.567****	**-0.357****	**-0.248***					
	(0.222)	(0.177)	(0.150)					
COMPLEXITY$_{AIDA}$*COVID				**0.053**				
				(0.041)				
Constant	0.334	0.301	0.436	1.535**	0.140	0.080	0.214	1.331*
	(0.743)	(0.748)	(0.774)	(0.719)	(0.768)	(0.772)	(0.801)	(0.745)
Period	2006-2020	2006-2020	2006-2020	2006-2020	2006-2019	2006-2019	2006-2019	2006-2019
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No	No	No
Additional provincial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,498	1,498	1,498	1,498	1,398	1,398	1,398	1,398
Number of provinces	100	100	100	100	100	100	100	100
R^2 within	0.651	0.650	0.646	0.650	0.591	0.590	0.585	0.588
R^2 overall	0.539	0.543	0.541	0.550	0.476	0.482	0.479	0.493
F^{ALL}	71.03	70.33	65.79	67.01	76.69	76.52	72.11	71.93
Prob(F^{ALL})>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

NOTES: Dependent variable: *NPL*. Additional provincial controls: *Reciclyng, Openness, Electricity Outages, Tertiary Employment*. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 10.Impact of banking diversity and financial complexity on LoanConcentration$_{TOP0.5\%}$. Different specifications.

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

NOTES: Dependent variable: *LoanConcentration$_{TOP0.5\%}$* . See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 11.Impact of banking diversity and financial complexity on LoanDiversity$_{DES}$. Different specifications.

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

NOTES: Dependent variable*: LoanDiversity$_{DES}$* . See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 12.Impact of banking diversity and financial complexity on $LoanDiversity_{BORROWER}$. Different specifications.

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

NOTES: Dependent variable: *$LoanDiversity_{BORROWER}$* . See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 13.Impact of banking diversity and financial complexity on the NPL rate. Different dependent variables.

	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$_{AIDA}$				**-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

NOTES: See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 14. Impact of banking diversity and financial complexity on the NPL rate. Different indexes of diversity and complexity, different specifications.

	DIV_{OCTOP5}	DIV_{OCTOP5_GS}	DIV_{OCF}	$DIV_{ORIGINAL\_GS}$	$COMPL_{ISTAT\_ULA}$	$COMPL_{ISTAT\_ADD}$	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

NOTES: Dependent variable: *NPL*. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 15. Impact of banking diversity and financial complexity on the NPL rate during crisis episodes. Different data for the year 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$_{AIDA}$				-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$_{AIDA}$*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$_{AIDA}$*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$_{AIDA}$*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

NOTES: Dependent variable: *NPL*. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 16. Impact of banking diversity and financial complexity on the NPL rate during crisis episodes. Different indexes for diversity and complexity, different specifications.

	DIV_{OCTOP5}	DIV_{OCTOP5_GS}	DIV_{OCF}	$DIV_{ORIGINAL\_GS}$	$COMPL_{ALBO}$	DIV_{OC}	DIV_{OCG}	$DIV_{ORIGINAL}$	$COMPL_{AIDA}$
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

NOTES: Dependent variable: *NPL*. Additional provincial controls*: Number of universities, number of international passengers registered in local airports (normalized by population), number of active Point-of-Access, warehouse capacity of ports, number of active airports, average size of local firm*s. See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 17. Impact of banking diversity and financial complexity on LoanConcentration. Different dependent variables.

	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

NOTES: See Appendix A for variables' definitions and sources. F^{ALL} is the statistics of the full specification F-test. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 18. Impact of banking diversity and financial complexity on LoanConcentration$_{TOP0.5\%}$. 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$_{OCG}$		**-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

NOTES: Dependent variable: *LoanConcentration $_{TOP0.5\%}$*. See Appendix A for variables' definitions and sources. $F^{INSTRUMENTS}$ is the F-statistics of the full set of instruments. The null of the Hansen overidentification test is that instruments are valid. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table 19. Impact of financial complexity on LoanDiversity $_{DES}$ and LoanDiversity $_{BORROWER}$: impact of banking diversity on LoanConcentration $_{TOP0.5\%}$. Instrumental variables.

	Loan Diversity DES				Loan Diversity BORROWER			
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(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

NOTES: See Appendix A for variables' definitions and sources. . $F^{INSTRUMENTS}$ is the F-statistics of the full set of instruments. The null of the Hansen overidentification test is that instruments are valid. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Figure 1. Banking diversity per province, year 2008. $DIVERSITY_{OC}$ (Top-left panel), $DIVERSITY_{OCG}$ (Top-right panel), $DIVERSITY_{ORIGINAL}$ (Bottom panel).

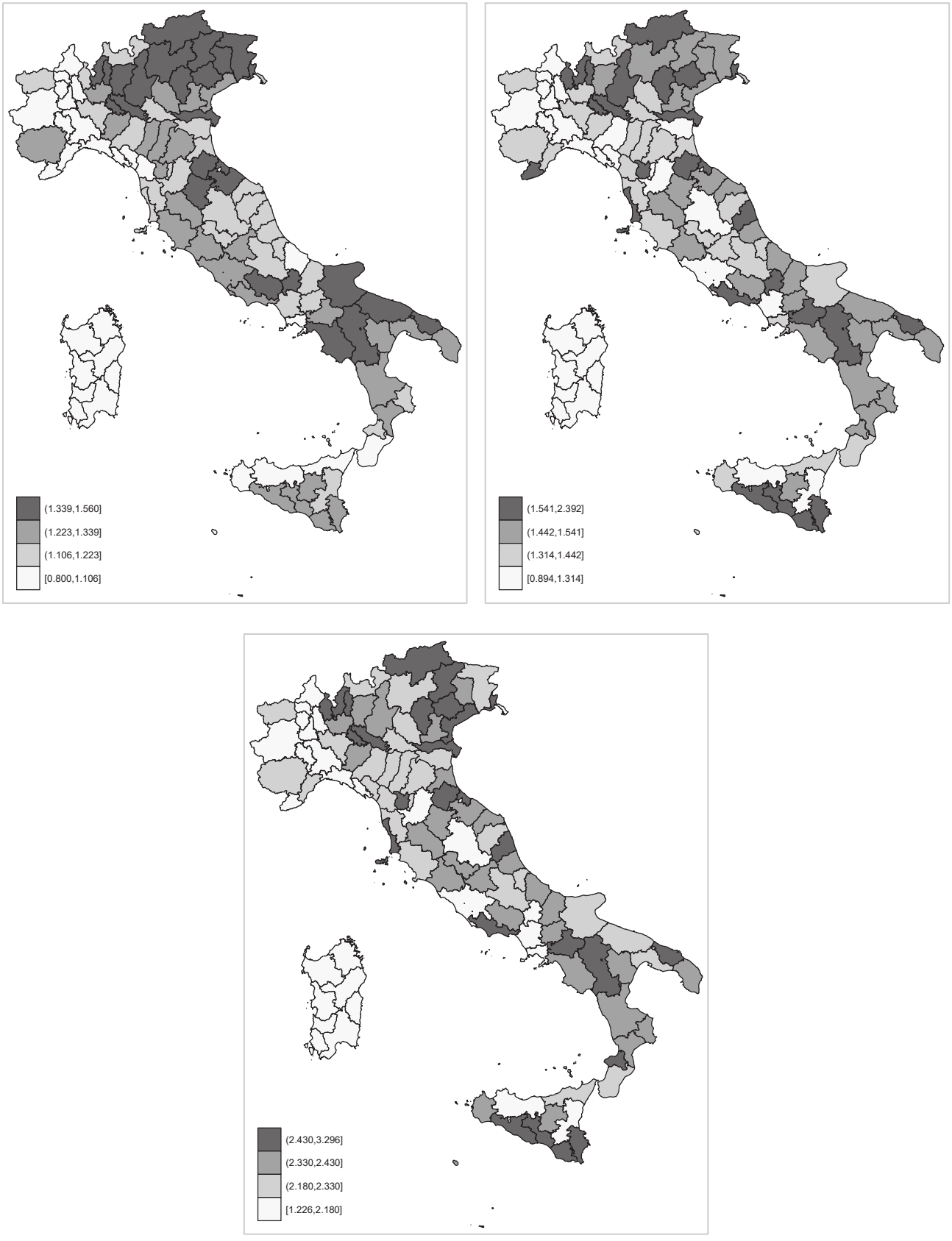


Figure 2. Financial complexity per province, year 2008. COMPLEXITY$_{AIDA}$.

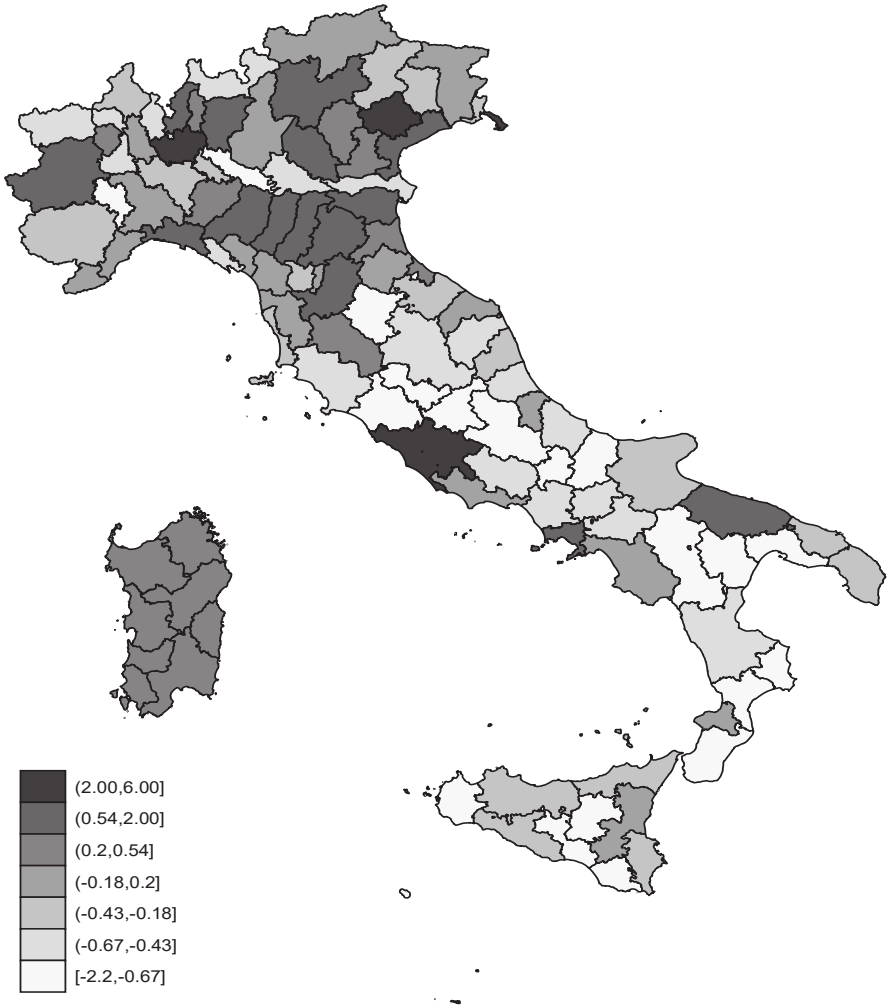


Figure 3. Evolution over time of the Non-performing loan rate in Italy.

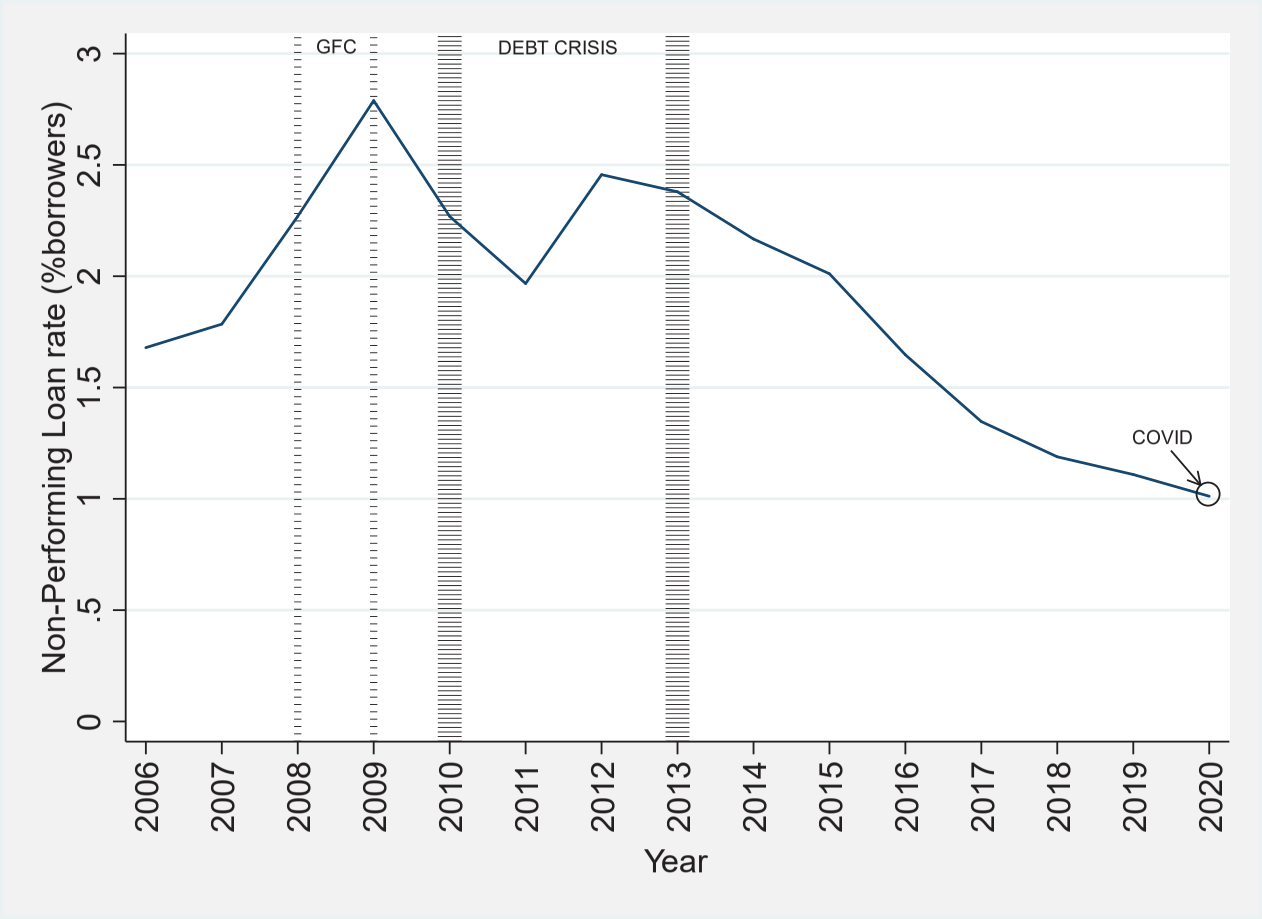


Figure 4. Evolution over time of different definitions of the Non-performing loan rate in Italy.

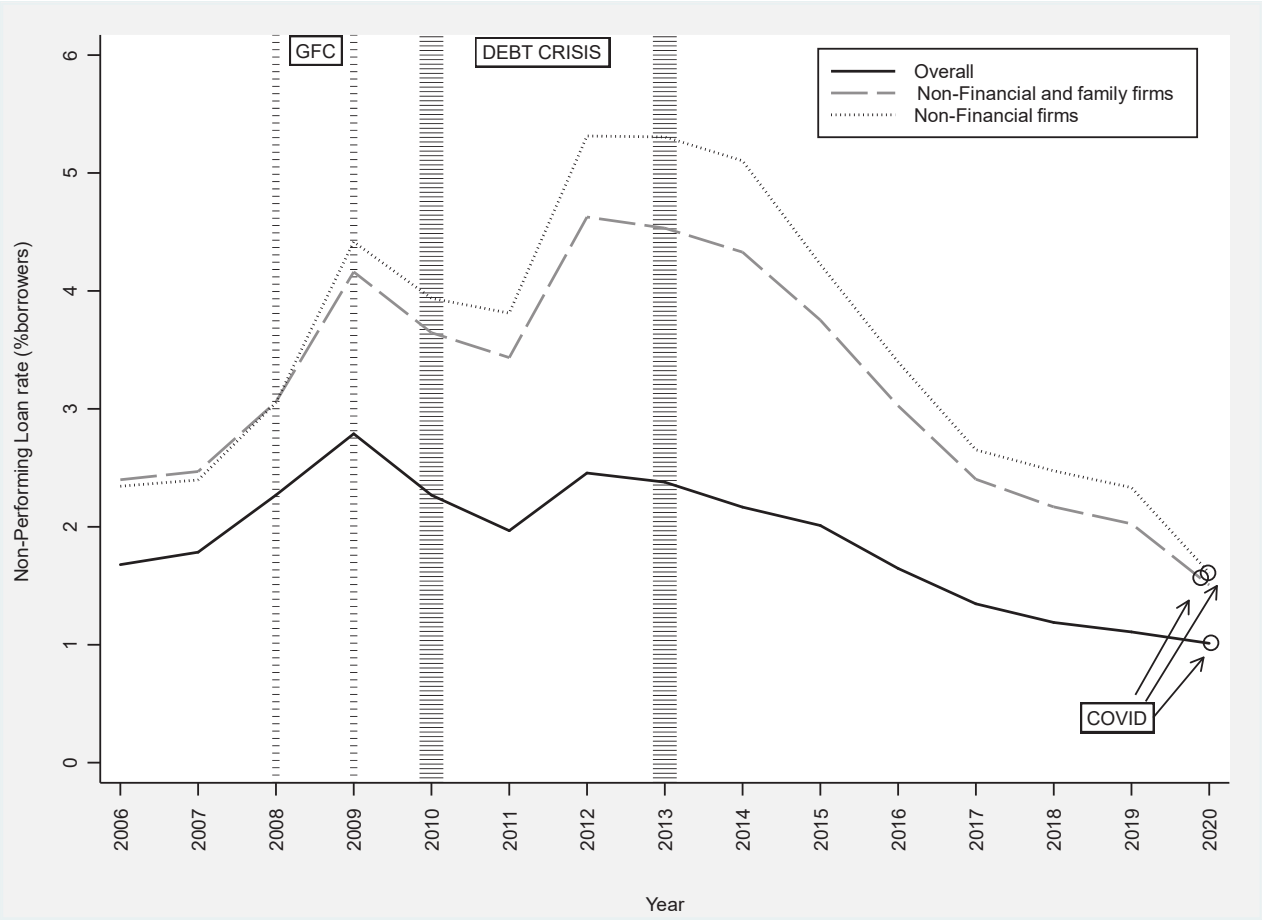


Figure 5. Marginal effects of crisis periods for different values of $DIVERSITY_{ORIGINAL}$. See Table A.3 for details.

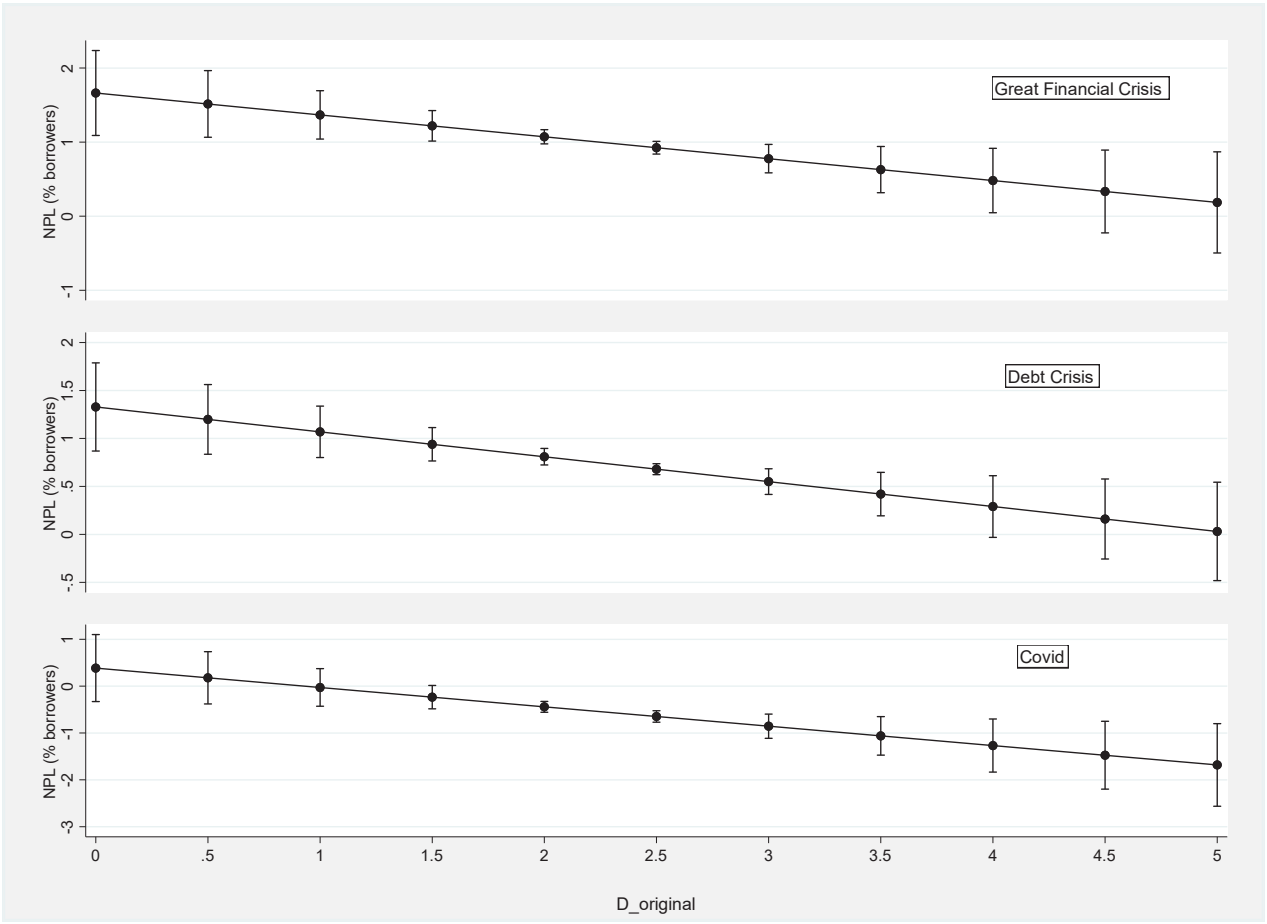
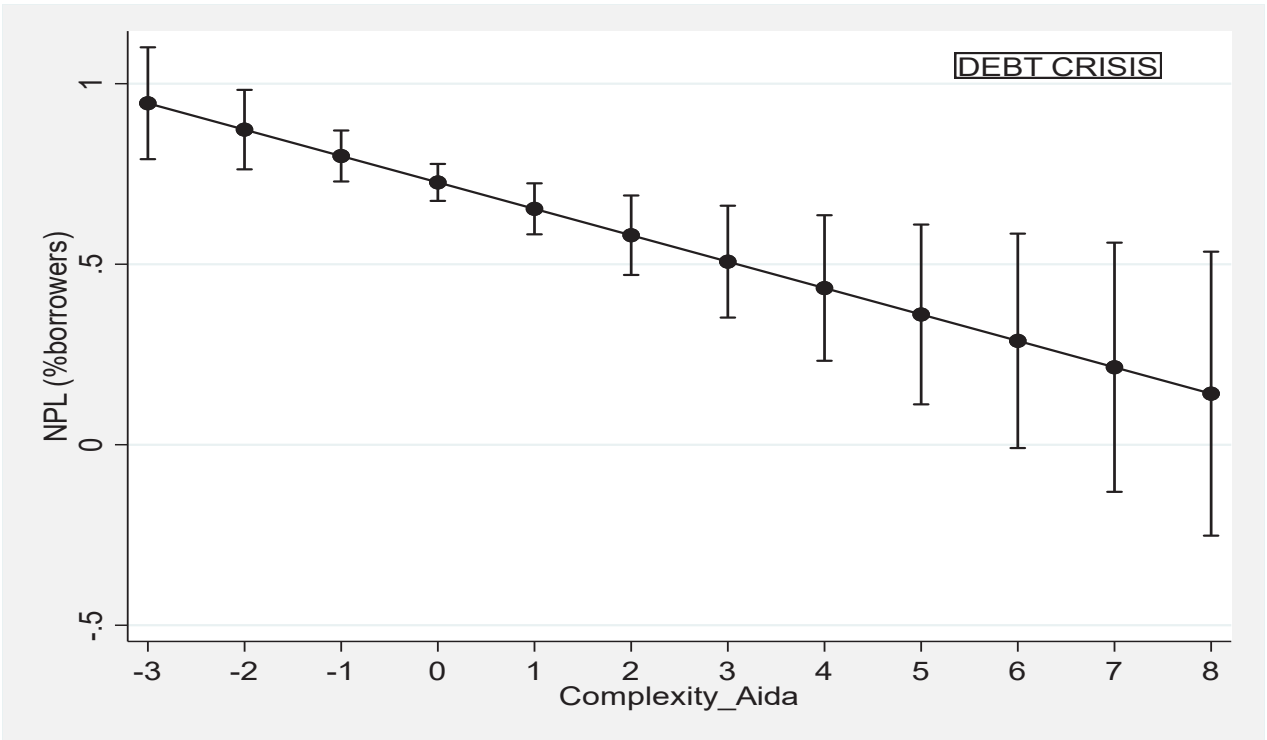


Figure 6. Marginal effects of Debt crisis for different values of $COMPLEXITY_{AIDA}$. See Table A.4 for details.



Appendix A. Additional material

Table A 1. List of variables' definitions and sources.

Variable	Definition	Source
$DIVERSITY_{OC}$	Banking Diversity index (ownership plus concentration/competition)	Author calculation from Bank of Italy Statistical Database and Bank of Italy Albo di Vigilanza
$DIVERSITY_{OCG}$	Banking Diversity index (ownership plus concentration/competition plus geographic spread)	Author calculation from Bank of Italy Statistical Database and Bank of Italy Albo di Vigilanza
$DIVERSITY_{ORIGINAL}$	Banking Diversity index (ownership plus concentration/competition plus geographic spread plus funding strategy)	Author calculation from Bank of Italy Statistical Database, Bank of Italy Albo di Vigilanza and Bureau Van Dijk Bankfocus
$DIVERSITY_{OCTOP5}$	Banking Diversity index (ownership plus concentration/competition). The concentration/competition is computed as one minus the sum of the branches of the five biggest banks divided by total branches	Author calculation from Bank of Italy Statistical Database and Bank of Italy Albo di Vigilanza
$DIVERSITY_{OCF}$	Banking Diversity index (ownership plus concentration/competition plus funding strategy)	Author calculation from Bank of Italy Statistical Database, Bank of Italy Albo di Vigilanza and Bureau Van Dijk Bankfocus
$DIVERSITY_{OCTOP5\_GS}$	Banking Diversity index (ownership plus concentration/competition plus geographic spread). The concentration/competition is computed as one minus the sum of the branches of the five biggest banks divided by total branches. Geographic spread is computed on the basis of headquarters of banks in the province.	Author calculation from Bank of Italy Statistical Database and Bank of Italy Albo di Vigilanza
$DIVERSITY_{ORIGINAL\_GS}$	Banking Diversity index (ownership plus concentration/competition plus geographic spread plus funding strategy). The concentration/competition is computed as one minus the sum of the branches of the five biggest banks divided by total branches. Geographic spread is computed on the basis of headquarters of banks in the province.	Author calculation from Bank of Italy Statistical Database, Bank of Italy Albo di Vigilanza and Bureau Van Dijk Bankfocus
$COMPLEXITY_{AIDA}$	Financial complexity index following Hausmann and Hidalgo (2009). Computed on active firms in the NACE section K.	Author calculation from Bureau Van Dijk (2020). AIDA database.
$COMPLEXITY_{ISTAT\_ULA}$	Financial complexity index following Hausmann and Hidalgo (2009). Computed on local units of active enterprises (Unità Locali delle Imprese) in the NACE section K.	Author calculation from Istat (2020). I.stat database

COMPLEXITY$_{ISTAT_ADD}$	Financial complexity index following Hausmann and Hidalgo (2009). Computed on employment in local units of active enterprises (Unità Locali delle Imprese) in the NACE section K.	Author calculation from Istat (2020). I.stat database
COMPLEXITY$_{ALBO}$	Financial complexity index following Hausmann and Hidalgo (2009). Computed on authorized financial intermediaries.	Author calculation from Bank of Italy (2020) Albo di Vigilanza.
NPL	Ratio between the following quantities: - The numerator is equal to the number of borrowers who become holders of adjusted non-performing loans during the year in which the data are collected. - The denominator is equal to the number of borrowers recorded in the Central Credit Register and not classified as holders of adjusted non-performing loans.	Bank of Italy (2021). Statistical Database.
NPL (Non Financial and family firms)	Ratio between the following quantities: - The numerator is equal to the number of borrowers (non-financial and family firms)who become holders of adjusted non-performing loans during the year in which the data are collected. - The denominator is equal to the number of borrowers (non-financial and family firms) recorded in the Central Credit Register and not classified as holders of adjusted non-performing loans.	Bank of Italy (2021). Statistical Database.
NPL (Non Financial firms)	Ratio between the following quantities: - The numerator is equal to the number of borrowers (non-financial firms)who become holders of adjusted non-performing loans during the year in which the data are collected. - The denominator is equal to the number of borrowers (non-financial firms) recorded in the Central Credit Register and not classified as holders of adjusted non-performing loans.	Bank of Italy (2021). Statistical Database.
Loan Concentration**TOP0.5%**	Share of loans detained by the first 0.5% of borrowers	Author calculation from Bank of Italy Statistical Database.
Loan Concentration**TOP1%**	Share of loans detained by the first 1 per cent of borrowers	Author calculation from Bank of Italy Statistical Database.
Loan Concentration**TOP5%**	Share of loans detained by the first 5 per cent of borrowers	Author calculation from Bank of Italy Statistical Database.
Loan Concentration**TOP10%**	Share of loans detained by the first 10 per cent of borrowers	Author calculation from Bank of Italy Statistical Database.
Loan Diversity$_{DES}$	One minus Herfindahl-Hirschman calculated on the basis of loans by destination	Author calculation from Bank of Italy Statistical Database.

LoanDiversity$_{BORROWER}$	One minus Herfindahl-Hirschman calculated on the basis of of loans by category of borrower	Author calculation from Bank of Italy Statistical Database.
Openness	Import plus export divided by provincial GDP	Author calculation from Istat (2018) Coeweb database
Foreign population diversity	One minus Herfindahl-Hirschman calculated on the basis of resident foreign population by country	Author calculation from Istat (2021) Immigrati.Stat database
Foreign population	Total resident foreign population	Author calculation from Istat (2021) Immigrati.Stat database
Number of cars	Number of running cars in the province	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
Car accidents	Number of registered car accidents	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
Airports	Number of active airports in the province	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
International Passengers (% Pop.)	Number of incoming international passengers at local airports divided by provincial population	Author calculation from Istat (2020) ASTI Atlante Statistico Territoriale delle Infrastrutture.
Average size of firms	Average employment of the province's local units of active enterprises (Unità Locali delle Imprese)	Author calculation from Istat (2018) I.stat database
Number of universities	Number of universities and research centres headquartered in the province	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
Recycling	Amount of recycled urban waste in the province divided by population	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
Tertiary Employment	Provincial employment share in services	Istat (2018). I.stat database
Electricity Outages	Average number of electricity Outages per user	Istat (2020). Indicatori Territoriali per le Politiche di Sviluppo database
Warehouse capacity of ports	Warehouse capacity of ports facilities	Istat (2020). ASTI Atlante Statistico Territoriale delle Infrastrutture
Point-of-Access	Number of point-of-access devices	Author calculation from Bank of Italy Statistical Database.

Table A 2. Control variables. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Median	Max
Recycling	2,500	0.162	0.125	0	0.154	0.582
Openness	2,598	0.171	0.210	0	0.123	2.451
Electricity Outages	2,300	2.566	1.586	0	2.100	16.800
Tertiary Employment	2,600	0.669	0.076	0.444	0.672	0.888
Foreign population diversity	1,800	0.844	0.082	0.418	0.873	0.957
Foreign population	1,800	50,938	92,200	683	26,526	1,113,440
Number of cars	2,300	455,221	502,814	35,480	303,673	3,732,839
Car accidents	2,300	2,114	3,208	100	1,359	31,560
Warehouse capacity of ports	2,400	84,160	410,953	0	0	4,936,900
Airports	2,500	0.462	0.656	0	0	4
International Passengers (% Pop.)	2,500	0.480	1.397	0.000	0.000	11.181
Average dimension of firms	2,600	3.355	0.628	1.957	3.338	6.045
Point-of-Access	2,406	14,462	23,327	0	8,506	290,187
Number of universities	2,500	1.068	1.655	0	1	16

Table A. 3. Marginal effects of crisis periods for different values of $DIVERSITY_{ORIGINAL}$. See Figure 5.

	GFC				DEBT CRISIS				COVID			
$DIVERSITY_{ORIGINAL}$	***Marginal Effect***	***Std. Error***	***[95% Conf. Interval]***		***Marginal Effect***	***Std. Error***	***[95% Conf. Interval]***		***Marginal Effect***	***Std. Error***	***[95% Conf. Interval]***	
0	1.663***	0.293	1.089	2.237	1.329***	0.234	0.869	1.788	0.386	0.365	-0.329	1.100
0.5	1.515***	0.230	1.065	1.965	1.199***	0.185	0.836	1.563	0.179	0.285	-0.379	0.737
1	1.368***	0.167	1.041	1.694	1.069***	0.137	0.801	1.337	-0.028	0.205	-0.430	0.374
1.5	1.220***	0.105	1.014	1.426	0.939***	0.089	0.765	1.114	-0.234*	0.127	-0.484	0.015
2	1.072***	0.049	0.976	1.168	0.810***	0.044	0.724	0.896	-0.441***	0.059	-0.557	-0.325
2.5	0.925***	0.044	0.839	1.010	0.680***	0.029	0.623	0.737	-0.648***	0.062	-0.770	-0.526
3	0.777***	0.098	0.586	0.968	0.550***	0.068	0.417	0.684	-0.854***	0.132	-1.113	-0.596
3.5	0.629***	0.159	0.318	0.941	0.420***	0.115	0.194	0.646	-1.061***	0.210	-1.472	-0.650
4	0.482**	0.222	0.047	0.916	0.291*	0.164	-0.030	0.612	-1.268***	0.289	-1.835	-0.701
4.5	0.334	0.285	-0.224	0.893	0.161	0.213	-0.256	0.578	-1.474***	0.369	-2.198	-0.750
5	0.186	0.348	-0.496	0.869	0.031	0.262	-0.482	0.544	-1.681***	0.450	-2.563	-0.799

NOTES:Marginal effects of crisis periods for different values of $DIVERSITY_{ORIGINAL}$.Results based on the specification of Table 8 column 3.*** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Table A .4 Marginal effects of debt crisis for different values of $COMPLEXITY_{AIDA}$. See Figure 6.

	DEBT CRISIS			
$COMPLEXITY_{AIDA}$	***Marginal Effect***	***Std. Error***	***[95% Conf. Interval]***	
-3	0.946***	0.079	0.791	1.101
-2	0.873***	0.056	0.763	0.983
-1	0.800***	0.036	0.729	0.870
0	0.727***	0.026	0.675	0.778
1	0.653***	0.036	0.583	0.724
2	0.580***	0.056	0.470	0.690
3	0.507***	0.079	0.352	0.662
4	0.434***	0.103	0.232	0.636
5	0.361***	0.127	0.112	0.610
6	0.288*	0.151	-0.009	0.585
7	0.215	0.176	-0.130	0.560
8	0.141	0.201	-0.252	0.535

NOTES:Marginal effects of crisis periods for different values of $COMPLEXITY_{AIDA}$.Results based on the specification of Table 8 column 3.*** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

Appendix B. Complexity methodology

The first step to calculate the index of economic complexity regards the construction of the bipartite network that connects territories to the product they export. To avoid distortions coming from the territory's size, it is common to recur to Balassa's RCA definition and build a matrix (M_{ix}) whose elements take value 1 if the territory *i* is a significant exporter of product *x*, 0 otherwise. Territories are considered significant exporters of a specific product if they have RCA in the export (production) of that product. In math, the RCA index is calculated as follows:

$$RCA_{ix} = \frac{EXP_{ix}}{\Sigma_i EXP_{ix}} / \frac{\Sigma_x EXP_{ix}}{\Sigma_{i,x} EXP_{ix}} \quad (9)$$

Where EXP_{ix} is the monetary value of the export by territory *i* of product *x*. Hence the RCA index is calculated as the ratio between the export share of product *x* in the export basket of territory *i* to the share of such product in total world export. What the index tells, is that a territory has RCA in a product if it exports more than its natural share, i.e. the share of the export of that product in total world trade. This implies $RCA_{ix} \geq 1$. Hence the elements of the RCA matrix M_{ix} take value 1 if the RCA index of territory *i* for product *x* is greater or equal to 1, 0 otherwise.

From the RCA matrix M_{ix} is possible to extract the two key measures that will define economic complexity, i.e. diversification and ubiquity. These are obtained by summing over the rows or columns of the matrix. In particular, diversity measures the number of products for which territory *i* has RCA, hence it is obtained by summing over the rows of M_{ix}:

$$Diversity = k_{i,0} = \sum_x M_{ix} \quad (10)$$

On the other hand, ubiquity measures the number of territories competitively exporting product *x:*

$$Ubiquity = k_{x,0} = \sum_i M_{ix} \quad (11)$$

Hidalgo and Hausman (2009) and Hausman et al. (2014) proceed by calculating their ECI with a method they call Method of Reflections. This consists in iteratively calculating the average value of the previous-level properties of the node's neighbors, where the two nodes are represented by territories and products. In other words, this operation requires to correct territory's diversity for the average ubiquity of the products it exports, then for the average diversity of territories that have a similar export basket, and so forth. This procedure ultimately provides the ECI for territories. On the other hand, to get PCI, it is necessary to correct products ubiquity for the average diversity of the territories that export them, then for the average ubiquity of the other products that belong to their export basket. In math:

$$k_{i,N} = \frac{1}{k_{i,0}} \Sigma_x M_{ix} k_{x,N-1} \tag{12}$$

$$k_{x,N} = \frac{1}{k_{x,0}} \Sigma_i M_{ix} k_{i,N-1} \tag{13}$$

for N≥1. Ultimately, the ECI is defined as:

$$ECI = \frac{\vec{K} - \langle \vec{K} \rangle}{std(\vec{K})} \tag{14}$$

where $\langle \cdot \rangle$ is the mean function and $std(\cdot)$ the standard deviation of the vector $\vec{K}$, and the latter is the eigenvector associated to the second largest eigenvalue of the matrix $\widetilde{M}_{ii'} = \Sigma_x \frac{M_{ix} M_{i'x}}{k_{i,0} k_{x,0}}$. The latter matrix can be interpreted as the one that connects territories that have similar production baskets, weighted by the inverse of the ubiquity of a certain production ($k_{x,0}$) and normalized by the territorial diversity ($k_{i,0}$) (see Hausman et al. ,2014 for details) [22].

We apply such procedure not to export data, but to different datasets that consider employment and active firms by Ateco 2007 (Nace rev. 2) section K 5 digits-sectors (Istat data and Aida-BVD) or legally headquartered financial firms by type of intermediary (Bank of Italy *Albo di Vigilanza*), respectively. In this way, the RCA matrix we compute indicates provincial revealed comparative advantage in the presence of a certain financial intermediary. As it is common when implementing such algorithms to sub-national territories, RCA are computed with reference to the domestic market. In other words, the provincial share in a certain node is compared to the share of that specific node in the overall Italian market. For instance, by employing the categories of the Bank of Italy *Albo di Vigilanza* in 2020 15 joint stock banks are registered in the province of Rome (out of 100 financial intermediaries in total). This means that the share of joint stock banks in the financial market of the province of Rome is 15%. At the same time, in Italy 129 joint stock banks are registered in the same year (out of 947 financial intermediaries in general). This implies that the relative share of joint stock banks in the Italian market is 14%. Hence, the province of Rome is denoted by a RCA in joint stock banks, because the relative share in such province of this intermediary is greater than the expected one (the share of joint stock banks in the overall domestic context). Correspondingly, the measure of diversity extracted from the RCA matrix indicates for each year the number of financial intermediaries for which the province has revealed comparative advantage. At the same time, ubiquity of each intermediary refers to the number of provinces that have RCA for that specific financial category. Table B1 and B2 report information on the Ateco 2007 (Nace rev. 2) and Bank of Italy *Albo di Vigilanza* classifications of the nodes used to compute the financial complexity indexes.

[22] Conversely, the PCI is defined as $PCI = \frac{\vec{Q} - \langle \vec{Q} \rangle}{st\,\mathrm{d}(\vec{Q})}$ where $\vec{Q}$ is the eigenvector of the matrix $\widetilde{M}_{xx'}$ (product level counterpart of $\widetilde{M}_{ii'}$) associated to the second largest eigenvalue.

Table B 1. ATECO 2007 (NACE rev. 2) classification of section K.

64	**ATTIVITÀ DI SERVIZI FINANZIARI (ESCLUSE LE ASSICURAZIONI E I FONDI PENSIONE)**	**FINANCIAL SERVICE ACTIVITIES, EXCEPT INSURANCE AND PENSION FUNDING**
64.11.00	Attività della Banca Centrale	Central banking
64.19.10	Intermediazione monetaria di istituti monetari diverse dalle Banche centrali	Other monetary intermediation
64.19.20	Fondi comuni di investimento monetario	Money Market Funds
64.19.30	Istituti di moneta elettronica (Imel)	Payment services and Electronic money institutions
64.19.40	Cassa Depositi e Prestiti	Cassa Depositi e Prestiti
64.20.00	Attività delle società di partecipazione (holding)	Activities of holding companies
64.30.10	Fondi comuni di investimento (aperti e chiusi, immobiliari, di mercato mobiliare)	Mutual funds and similar financial entities
64.30.20	Sicav (Società di investimento a capitale variabile)	Sicav (Società di investimento a capitale variabile)
64.91.00	Leasing finanziario	Financial leasing
64.92.01	Attività dei consorzi di garanzia collettiva fidi	Mutual Credit Guarantee Consortia
64.92.09	Altre attività creditizie nca	Other credit institutions
64.99.10	Attività di intermediazione mobiliare	Securities Investment Firms
64.99.20	Attività di factoring	Factoring
64.99.30	Attività di merchant bank	Merchant banks
64.99.40	Attività delle società veicolo	Financial Vehicle Corporations
64.99.50	Attività di intermediazione in cambi	Foreign Exchange Intermediation
64.99.60	Altre intermediazioni finanziarie nca	Other financial intermediaries
65	**ASSICURAZIONI, RIASSICURAZIONI E FONDI PENSIONE (ESCLUSE LE ASSICURAZIONI SOCIALI OBBLIGATORIE)**	**INSURANCE, REINSURANCE AND PENSION FUNDING, EXCEPT COMPULSORY SOCIAL SECURITY**
65.11.00	Assicurazioni sulla vita	Life insurance
65.12.00	Assicurazioni diverse da quelle sulla vita	Non-life insurance
65.20.00	Attività di riassicurazione	Reinsurance
65.30.10	Attività dei fondi pensione aperti	Pension funding (open)
65.30.20	Attività dei fondi pensione negoziali	Pension funding (closed)
65.30.30	Attività dei fondi pensione preesistenti	Pension funding (established before 1992)
66	**ATTIVITÀ AUSILIARIE DEI SERVIZI FINANZIARI E DELLE ATTIVITÀ ASSICURATIVE**	**ACTIVITIES AUXILIARY TO FINANCIAL SERVICES AND INSURANCE ACTIVITIES**
66.11.00	Amministrazione di mercati finanziari	Administration of financial markets
66.12.00	Attività di negoziazione di contratti relativi a titoli e merci	Security and commodity contracts brokerage

66.19.10	Attività di gestione ed elaborazione di pagamenti tramite carta di credito	Credit card payments processing
66.19.21	Promotori finanziari	Financial advisors
66.19.22	Agenti, mediatori e procacciatori in prodotti finanziari	Financial and credit agents
66.19.30	Attività delle società fiduciarie di amministrazione	Trust and fiduciary companies
66.19.40	Attività di Bancoposta	Bancoposta
66.19.50	Servizi di trasferimento di denaro (money transfer)	Money Transfer
66.21.00	Attività dei periti e liquidatori indipendenti delle assicurazioni	Risk and damage evaluation
66.22.01	Broker di assicurazioni	Activities of insurance agents and brokers
66.22.02	Agenti di assicurazioni	Insurance agents
66.22.03	Sub-agenti di assicurazioni	Insurance sub-agents
66.22.04	Produttori, procacciatori ed altri intermediari delle assicurazioni	Other insurance intermediaries
66.29.01	Autorità centrali di vigilanza su assicurazioni e fondi pensione	Insurance and pension funds Supervision Institutions
66.29.09	Altre attività ausiliarie delle assicurazioni e dei fondi pensione nca	Other auxiliary activities to insurance and pension funding
66.30.00	Gestione di fondi comuni di investimento e dei fondi pensione	Mutual and Pension funds management activities

Table B 2. Bank of Italy Albo di Vigilanza classification of financial intermediaries.

SGR a capitale ridotto	Asset management companies - limited capital (closed)
SGR abilitate a gestire fondi speculativi	Asset management companies -speculative funds authorized
Agenzie di prestito su pegno	Pawnbrokers
Altro	Other
Banche estere	Foreign banks
SICAF autogestite	Self-managed SICAF(fixed capital investment companies)
Confidi	Mutual Credit Guarantee Consortia
Banche di Credito Cooperativo	Cooperative banks
SICAF eterogestite	Hetero-managed SICAF
Finanziarie non vigilate-altro	Non-Bank Financial Intermediary - other
Finanziaria non vigilata - credito al consumo	Non-Bank Financial Intermediary - consumer credit
Finanziaria non vigilata - factoring	Non-Bank Financial Intermediary - factoring
Finanziaria non vigilata - leasing	Non-Bank Financial Intermediary - leasing
Finanziaria non vigilata - assunzione di partecipazioni	Non-Bank Financial Intermediary – private equity
Finanziaria non vigilata - intermediazione finanziaria	Non-Bank Financial Intermediary - financial intermediation
Gefia UE	EU Alternative investment fund managers (hedge funds, private equity, real estate funds, etc.)
Imel a operatività piena	Electronic money institutions
Imel comunitario con succursale	EU Electronic money institutions with branch in Italy
Intermediario finanziario di credito (non Confidi)	Non-Bank Financial Intermediary
Istituto di pagamento comunitario con succursale	EU Payment service institution with branch in Italy
Istituto di pagamento a operatività piena	Payment service institution-full operativity
Istituto di pagamento a operatività limitata	Payment service institution -limited operativity
SGR non abilitate a gestire fondi speculativi	Asset management companies -speculative funds not authorized
Operatori di microcredito	Microcredit institutions
Operatori di microcredito e di finanza mutualistica e solidale	Microcredit and solidarity finance institutions
Banche Popolari	Popolari Banks
SGR	Asset management companies
SIS	Venture capital
Società di covered bond	Covered bond vehicles
Società di gestione UE	EU asset management companies
Società fiduciarie	Trusts and fiduciaries
Banche SPA	Joint stock banks
SPV	Special Purpose vehicles

Appendix C. Loan diversity

Table C 1. Loans by economic destination to borrowers in the province. Bank of Italy Statistical database.

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

Table C 2.Loans by borrower category to province residents. Bank of Italy Statistical database.

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

Appendix D. Cross-section analysis

Our measures of banking diversity and financial complexity do not show much within-province variation over time (Table D.1). We exploit such characteristic of our dataset and develop a cross-section analysis to further corroborate our main results.

[Insert here Table D.1]

In particular, we provide further evidence on the beneficial role of banking diversity and financial complexity during periods of financial distress. Table D.2 reports cross-section regressions that consider the non-performing loans rate during the three crisis episodes as dependent. *NPL* is first regressed on the $DIVERSITY_{ORIGINAL}$ and $COMPLEXITY_{AIDA}$ indexes as observed in 1996, regional (NUTS 2) fixed effects, and a set of province-level controls (column 1 to 3). Then, the same specification is replicated by using the average diversity and complexity in the period 1996-2006 as main regressors. The cross-section analysis generally validates our main results on financial resilience. Banking diversity shielded provinces from the three financial shocks. On the other hand, the diversity and development of the overall financial industry was effective only during the sovereign debt crisis. The only problematic specification, compared to previous results, is the one presented in column 3. In particular, while associated to a negative coefficient, the role of banking diversity during the Covid-19 pandemic is not significant (p-value of about 28%). Probably the issues with 2020 data discussed in detail in text are exacerbated by the reduced number of observations and the fact that we are not taking into account province-level specific effects (and unobservables). Moreover, this result might depend on the low correlation between diversity in 1996 and 2020. Indeed, when we move to consider the average value of banking diversity in the years 1996-2006 results significantly improve[23].

[Insert here Table D.2]

Table D 1. Between and within summary statistics.

Variable		Mean	Std. Dev.	Min	Max	Dimension
$DIVERSITY_{ORIGINAL}$	Overall	2.311	0.264	1.172	3.412	N = 2500
	Between		0.243	1.377	3.246	n = 100
	Within		0.104	1.317	2.883	T = 25
$COMPLEXITY_{AIDA}$	Overall	0.000	1.000	-2.155	7.178	N = 2600
	Between		0.930	-1.431	4.555	n = 100
	Within		0.357	-2.343	2.620	T = 26

[23] The correlation between the index in 1996 and 2020 is about 76%, while that between the index in 1996 and the index in the period of the GDC and debt crisis is about 88%. The correlation improves when considering the average value of diversity in 1996-2006 and the value observed in 2020.

Table D 2. Cross-section regressions

	t0=1996			t0=mean(1996-2006)		
VARIABLES	**GFC**	**DEBT**	**COVID**	**GFC**	**DEBT**	**COVID**
***DIVERSITY*$_{ORIGINAL}$ (t0)**	**-0.364***	**-0.243****	**-0.091**	**-0.423****	**-0.283*****	**-0.123#**
	(0.206)	(0.109)	(0.084)	(0.197)	(0.105)	(0.081)
***COMPLEXITY*$_{AIDA}$ (t0)**	**-0.049**	**-0.084*****	**0.007**	**-0.041**	**-0.083*****	**0.007**
	(0.048)	(0.026)	(0.026)	(0.0450)	(0.027)	(0.028)
***NPL*$_{2006}$**	0.541***	0.230***	0.0312	0.559***	0.249***	0.0370
	(0.137)	(0.079)	(0.060)	(0.138)	(0.080)	(0.060)
Constant	2.182***	3.077***	1.574***	2.249***	3.116***	1.626***
	(0.765)	(0.417)	(0.319)	(0.735)	(0.405)	(0.306)
Period	2008-09	2010-2013	2020	2008-09	2010-2013	2020
NUTS 2 Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200	400	100	200	400	100
Number of provinces	100	100	100	100	100	100
Additional provincial controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.544	0.722	0.876	0.547	0.722	0.878

NOTES: See Appendix A for variables' definitions and sources. Additional provincial controls=Recycling Electricity Outages, Average size of firms, Openness, number of active airports, average size of local firms. *** p<0.01, ** p<0.05, * p<0.10, # p<0.15.

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