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REGULATION, TAX AND CAPITAL STRUCTURE: EVIDENCE FROM ADMINISTRATIVE DATA ON ITALIAN BANKS

by Steve Bond*, Kyung Yeon Ham*, Giorgia Maffini*, Andrea Nobili♣ and Giacomo Ricotti♦

Abstract

This paper explores the effect of taxation on the capital structure of banks. For identification, we exploit exogenous regional variations in the rate of the Italian tax on productive activities (IRAP) using administrative, confidential data on regional banks provided by the Bank of Italy (1998-2011). We find that IRAP rate changes do not always lead to a change in banks' leverage: banks close to the regulatory constraints do not change their leverage when tax rates change. This holds true for both tax cuts and tax hikes. Among less constrained entities, the leverage of smaller banks is more responsive to changes in tax rates than that of larger banks. Overall, the tax system has little effect on the capital structure of banks, especially for larger and possibly more systemically important institutions; regulatory constraints instead seem to be a first-order determinant. Our findings cast doubt on the role of the tax system as a cause or tool for addressing the negative externalities of excessive leverage in the banking system.

JEL Classification: G21, G32, G38, H25, H32.
Keywords: banks, corporate tax, capital structure, regulation, debt.

Contents

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1. Introduction[1]

One of the underlying features of the 2007-2011 global financial crisis was the build-up of excessive leverage in the banking system. This can impose substantial negative externalities on the economy. Debt cannot absorb losses, only capital can. Losses lead to a decline in bank capital and this not only imposes losses on shareholders but it generally implies a contraction in the availability of credit affecting the wider economy and leading to a decline in output, rising unemployment and deteriorating public finances.

Banks have a private incentive to leverage up. First, in good times leverage increases the return to equity. Second, financing activities with debt is more tax-efficient than financing them with equity: interest payments are deductible from the corporate income tax base while the cost of equity financing is not. Banks will leverage up until their private marginal cost of debt equals their private marginal benefit. If there are negative externalities of debt its social marginal cost will be higher than the bank's private cost and hence, banks will tend to have an excessive level of leverage; in other words, their equilibrium leverage will be higher than the socially optimum leverage.

Capital requirements are intended to limit the private incentives for banks to leverage up. Before the crisis, the capital requirements set out in Basel I and Basel II established minimum levels of capital for each bank, depending on the riskiness of its assets. Since the financial crisis, not only have the capital requirements been substantially strengthened but Basel III has also introduced a maximum limit for the leverage ratio, in recognition of the fact that banks' excessive leverage can generate substantial negative externalities.

Most tax systems offer incentives that work in the opposite direction of the regulatory requirements. By granting a deduction for the cost of debt financing (and not for equity financing), the tax system incentivises both financial and non-financial firms to increase leverage versus equity capital. Using accounting data for large, public companies, the literature summarised in Auerbach (2002), Graham (2003), Graham (2008), Graham and

[1] We would like to thank Strahil Lepoev for excellent research assistance, Miguel Almunia, Julian Alworth, Michael Devereux, Alessio De Vincenzo, Irem Guceri, Alan Morrison, Elena Pisano, Joel Shapiro, Jing Xing, Alessandro Zeli and Stefania Zotteri for their very useful comments. Giorgia Maffini gratefully acknowledges the financial support of the Leverhulme Trust (ECF−2013−323) and the University of Oxford John Fell OUP Research Fund (Project Ref: 121/483). Any errors remain the responsibility of the authors. The views here expressed are those of the authors and not of the institutions to which they belong.

Leary (2011), de Mooij (2011) and Feld *et al.*, (2013) found that tax positively affected the leverage of non-financial firms.

For banks, the problem is different from that of non-financial firms. Financial firms are heavily regulated and hence, if the regulation is binding, there may not be room for the tax system to affect banks' leverage decisions.

Taxation has been largely neglected as a possible determinant of capital structure in empirical studies of financial firms despite having been widely investigated as a determinant of the capital structure of non-financial firms. After the recent financial crisis the impact of tax on the capital structure of financial institutions has been examined more closely. Two pioneering papers lay the foundations for empirical research on the relationship between banks' capital structure and tax. Hemmelgarn and Teichmann (2014) find that changes in national corporate tax rates cause a change in banks' leverage in the short term: a 10- percentage-point increase in the statutory corporate tax rate leads to a 0.98- percentage-point increase in leverage. This translates into an elasticity of 0.04. Keen and de Mooij (2016) find a larger elasticity on a comparable sample: 0.14 for the short run and 0.25 for the long run. Such elasticities are entirely explained by the behaviour of capital-abundant banks which are far from the regulatory constraint.

Our paper explores the impact of taxation on the capital structure of banks by employing an exogenous regional and time variation in the rate of Italian tax on productive activities (IRAP) and confidential, administrative data on the universe of Italian mutual banks (*banche di credito cooperativo* or BCCs). For financial institutions, interest payments are deductible from the IRAP tax base and therefore IRAP provides the same incentives to debt financing as a standard corporate income tax. Variations in the IRAP rates are exogenous to the leverage decision of small, regional banks. IRAP revenues are earmarked to finance the regional healthcare expenditure and changes in the rates are either triggered by fluctuations in the deficit of the regional health service or by changes at the national level.

There are three main reasons why BCCs are a convenient choice for our identification strategy. First, by statute, BCCs are required to carry out their main activities within their original, local area. This implies that variations in their leverage can be matched to variations in the IRAP rate of the region where they operate. Second, BCCs cannot be part of a group and hence, the capital requirement rule relevant to them provides that capital be at least 8

percent of risk-weighted assets (RWAs) throughout our sample period (1998-2011). Third, they are simpler intermediaries in the sense that by statute, they are not allowed to invest in riskier activities such as derivatives and they do not have an investment banking arm. This implies that we can measure their distance from the regulatory constraint by using accounting equity as a proxy for regulatory equity.

Our paper contributes to the literature in four main ways.

First of all, it is the first paper to employ an exogenous variation in regional rates to estimate the effect of the tax system on banks' leverage, given the regulatory constraints. In the seminal contributions by Hemmelgarn and Teichmann (2014) and Keen and De Mooij (2016), the identification is based on cross-country variation in corporate income tax rates. In Schepens (2016) it is based on the comparison between a treatment group of Belgian banks for which an allowance for corporate equity is available since 2006, and a control group of other European banks. Cross-country differences in rates and tax systems could be correlated with cross-country differences such as different banking systems. It is hard to fully account for such diversity in a cross-country study. Our study focuses on Italy where regulation and other institutional settings are homogenous.

Second, the paper is the first to employ administrative data and not publicly available accounting data. The data is provided by the Bank of Italy, the Italian national regulatory authority for the banking sector. The information is therefore highly reliable, especially for items such as RWAs. The additional advantage of the dataset is that it includes the universe of Italian BCC banks and not a sub-sample. Publicly available data generally covers only large and very large institutions.

Third, the paper is the first to estimate the impact of tax controlling for the minimum capital requirements at the individual bank level. This captures the idea that each bank has a tailored level of leverage permitted depending on the riskiness of its portfolio. Hemmelgarn and Teichmann (2014) and Keen and De Mooij (2016) are the first to control for regulatory capital requirements in a regression of leverage over tax. They employ country-specific measures of capital requirements derived from the Banking Regulation and Supervision Database of the World Bank, which contains results from four surveys conducted between 1998 and 2012. We build a bank-year specific measure of capital requirements. Basel II requires each bank to hold a minimum level of equity equal to 8 percent of RWAs. Given the

RWAs of each bank in each year and a measure of equity capital, we can calculate the maximum leverage ratio for each bank as one minus the minimum allowed equity, given the RWAs of the bank. This variable is particularly reliable in the context of BCCs: such banks cannot be part of a group and hence, the regulatory requirement which applies is the 8 percent stated in the Basel II Accord. For banks which are part of a group, one of two ratios would apply: a subsidiary of a banking group could have a capital ratio of 6 percent if the same ratio was at least 8 percent for the whole group. Hence, when investigating larger banks which are generally part of a group, it may prove difficult to measure with precision whether a particular subsidiary is capital-abundant or not. Also, within a group, it is less meaningful to talk about how capital-tight a subsidiary is. This will depend not only on the capital ratios of the subsidiary but also on those of the whole group.

Fourth, the results are innovative. We consistently find that the effect of tax on leverage is muted when banks are closer to the constraint. This is in line with Keen and De Mooij (2016). We further show that this holds for banks of different size and for both tax cuts and tax hikes. Tax hikes would increase the benefit of debt financing and hence, they would induce financial institutions to leverage up. When banks are close to their regulatory constraint, they will not be able to take advantage of the additional debt benefit and hence, they will not increase their leverage as this would bring them too close or above the regulatory constraint. The effect is less clear for tax cuts. If a bank is at its optimal leverage level, tax cuts reduce the benefit of debt and leverage should decline. We find that both tax cuts and tax hikes have no effect on banks' leverage when a financial institution is close to its regulatory constraint. The unresponsiveness to tax cuts suggests that the optimal leverage of banks close to the constraint is well above what is permitted under the regulatory requirements. Regulation is hence of first-order importance for banks' capital structure. Keen and De Mooij (2016) show that the response of banks' leverage to changes in tax is entirely explained by how constrained banks are by capital requirements. We establish that, among unconstrained financial institutions, the leverage of smaller banks is responsive to changes in tax rates, although the effect remains small. The elasticity is 0.17.[2] Larger, unconstrained banks respond significantly less to changes in tax rates, even if they are relatively

[2] We calculate this elasticity using the results of column (6) in Table 10. The average leverage for banks responding to changes in the tax rate is 88 percent. The average tax rate is around 15 percent if we include both the IRAP rate and the corporate income tax rate and we account for the fact that 70 percent of earnings of BCCs are exempt from the corporate income tax. The coefficient on the lagged IRAP used here is -1.

unconstrained: their elasticity is around 0.03.[3] As a benchmark for comparison, the literature on the effect of tax on leverage of non-financial firms estimates much larger elasticities of around 0.65 (de Mooij, 2011). The significantly smaller response to tax of larger banks is driven by slow growing banks. Such banks remain the least sensitive to changes in tax and, at the same time, they are rather sensitive to changes in their individual level of maximum leverage. This again suggests that regulatory requirements are of first-order importance in the leverage decisions of financial institutions: the higher their sensitivity to capital requirements, the less tax will affect them. Large, slow growing banks may have attained their optimal leverage level (they are large and they grow slowly) and changing it in response to a somewhat small change in tax could entail high costs.

Overall, constrained, unresponsive banks represent up to 84 percent of total assets of the universe of BCC banks and they are larger than unconstrained banks.[4] Among the unconstrained institutions, large, slow growing banks responding only marginally to changes in tax rates represent another 7 percent of total BCC assets. Our findings cast doubts on the role of the tax system as a cause of or a tool to address the negative externalities of excessive leverage in the banking system, at least for an average tax rate of 15 percent (including both the IRAP rates and the corporate income tax rate).

The rest of the paper is structured as follows. Section 2 provides detailed background information on IRAP, the Italian banking system and its financial regulation. Section 3 outlines our identification strategy. Section 4 describes the data and section 5 explains the empirical strategy used. Section 6 presents the baseline results and section 7 investigates the effect of the regulatory constraints. Section 8 explores the possibility of a differential effect of tax hikes versus tax cuts. Section 9 concludes.

[3] Elasticity is calculated using the results in Table 10, column (6). The average leverage for banks responding less to changes in the tax rate is 89 percent. The average tax rate is around 15 percent, including both the IRAP rate and the corporate income tax rate and accounting for the fact that 70 percent of earnings of BCCs are exempt from the corporate income tax. The coefficient on the lagged IRAP used here -1+0.823 = -0.181.
[4] These results are taken from Table 10, column (5).

2. Background

2.1 IRAP

IRAP (*Imposta regionale sulle attivita' produttive*) was introduced in Italy in 1998[5] to fund the national health system (NHS): 90 percent of its revenues are devolved to Italy's regions, which are responsible for the administration and financing of the NHS in their geographical area. IRAP is a flat rate tax levied on the value added generated by all sectors of the Italian economy including the public administration. All types of business, corporations as well as un-incorporated businesses, partnerships and sole traders are subject to the tax. IRAP was adopted in 1998 at a national, flat rate of 4.25 percent for the non-financial sector and at the higher rate of 5.4 percent for the financial sector. For the financial sector, every region maintained a uniform IRAP rate until 2002. Since 2002, each region is allowed to increase or decrease the national rate by up to 1 percentage point (pp). Figure 1 shows the changes in the basic, national IRAP rates for banks and in the corresponding total IRAP rates that include an (unweighted) average of all regional surcharges.[6]

IRAP is levied on value added so that, for the non-financial sector, the base equals the sum of profits, wages and interest payments minus the tax depreciation allowances (Panteghini, 2010). For the non-financial sector, IRAP does not discriminate between debt and equity financing as neither interest payments nor dividend payments are deductible from the tax base. This is not the case for the financial sector. Banks deduct interest expenses from the IRAP base. Hence, for banks, IRAP works similarly to the corporate income tax whereby interest expenses are deductible. For the financial sector, the IRAP tax base equals the sum of profits, wages and loan losses/write downs, minus tax depreciation allowances.[7] While IRAP and corporate income tax (IRES) share the deductibility of interest payments, IRAP is more suitable than the corporate income tax for our purpose of examining the impact of tax rates on capital structure because it varies across regions. Corporate income tax is set at a uniform, national rate of 27.5 percent for all banks in Italy, and only shows minimum time variation.

[5] IRAP was instituted by Legislative Decree 446/97 in 1998.

[6] As shown in Figure 1, the basic IRAP rate was cut to 5 percent in 2001, to 4.75 percent in 2002 and to 4.25 percent in 2003. As the tax base was broadened in 2008, the basic IRAP rate was cut to 3.9 percent. Budget problems forced the government to increase the rate to 4.65 percent in 2011.

[7] In practice, the tax base of IRAP is calculated using a direct subtraction method. Details of the specific subtraction method applied for banks are described in Tables A1-A2 where the individual items are derived directly from the profit and loss account.

2.2 The Italian banking system and the BCCs

In Italy, banks can be organized as limited liability companies, mutual banks (BCCs), cooperative banks (*Banche Popolari* or BPs), or branches of foreign banks (Figure 2). BCCs constitute 55.5 percent of all banks in Italy (panel A of Figure 2) but together they only hold 5.5 percent of aggregate assets of the Italian banking system (panel B of Figure 2). Larger banks organized as limited liability companies hold over 73.5 percent of the total assets of the Italian banking system.

In our sample period, the Italian economy and its financial sector suffered two major shocks: the global financial crisis starting in 2007 and the sovereign debt crisis of 2011. Italian banks withstood the first financial crisis relatively well because of their traditional banking model wherein a substantial amount of their assets are represented by loans to residents funded by customer deposits: at the end of 2007, some 59 percent of total banking assets consisted of loans and 71 percent of these were disbursed to resident non-financial corporations. Italian banks were also less exposed to structured financial products due to their traditional funding and lending model. Our sample period runs from 1998 to 2011 and therefore encompasses the global financial crisis. The sovereign debt crisis, on the other hand, should not affect our estimates because the sample runs exactly up to 2011.

2.3 Nature and characteristics of BCCs[8]

Under Italian regulation BCCs' incorporation deeds must state that the activities of the institution can only be carried out in the municipalities where the bank has at least one branch and in neighbouring municipalities. BCCs are public companies even if they cannot be listed: the social capital (not less than €5 million) must be held by at least 200 shareholders who are resident or working in the area where each BCC operates. Each shareholder has the right to one vote at the general meeting, regardless of the value of their holding. Although the statute generally prescribes that an important purpose of these banks is to operate in the interest of their shareholders, BCCs differ from credit unions. Half of their assets can be lent to non-members. The other half has to be either employed towards its shareholders or can be invested in less risky assets such as sovereign bonds. The legislation also places limits on the permissible activities of BCCs, excluding the most risky ones. For example, a BCC cannot

[8] The data source for this paragraph is the Bank of Italy (2012).

take speculative positions in derivatives and is allowed to employ them for the sole purpose of hedging. BCCs do not have an investment banking arm.

There are further restrictions on BCCs. Firstly, a BCC is prohibited from holding more than 20 percent of the capital of other banks. This means that they cannot be part of a banking group. As we have highlighted above, this is an advantage for our identification strategy. Secondly, the allocation of earnings is subject to constraints. At least 70 percent of net profits have to be allocated to a legal reserve, which cannot be distributed to shareholders; in addition, 3 percent of net profits should be paid to specific funds designed to support other cooperatives. The remainder can be used to re-evaluate stocks, to increase other reserves for the payment of dividends or to support charities. To compensate for these restrictions, a more lenient tax regime is provided for BCCs: until 2001, profits allocated to non-distributable reserves were exempt from corporate income tax; since 2002, at least a portion of the profits is taxed, even if allocated to non-distributable reserves (e.g., from 2004-2011 at least 27% of profits were taxed). There is no exemption from IRAP for BCCs. In other words, from 1999-2011 the effective corporate income tax (CIT) rate ranged from 0 percent to 11.1 percent, while IRAP– applied to a broader tax base than the CIT one – varied between 3.19 percent and 5.75 percent.

The composition of BCCs' assets differs from that of non-BCC banks. Figure 3 shows that in 2011, 74 percent of these banks' assets were in loans to Italian residents and to the Italian public administration whilst the corresponding figure was 55 percent for non-BCC banks. BCC loans to other Italian banks constitute 5 percent of their assets, versus 11 percent for non-BCC banks. Overall, for BCCs, loans to Italian banks, the public administration and other residents constitute 79 percent of total assets. For non-BCCs, the corresponding figure is 66 percent. The difference between the two figures amounts to the difference in the share of securities and loans issued by non-residents which is below 1 percent for BCCs (because of the geographical limitation of their activities) and 11 percent for non-BCCs. The total share of assets invested in government bonds and bonds issued by other Italian residents is comparable for BCCs and non-BCCs (20 percent for BCCs and 19 percent for non-BCCs). The composition of such investment in bonds is different: BCCs invest 15 percent of their assets in government bonds and 5 percent in other bonds. Non-BCCs invest 5 percent of their assets in government bonds and 14 percent in other bonds.

BCCs and non-BCCs are more similar in the composition of their liabilities (Figure 3). For both BCCs and non-BCCs the bulk of the funding comes from deposits of resident entities and individuals. Overall deposits[9] amount to 48 and 38 percent of total liabilities for BCCs and non-BCCs respectively, with BCCs relying more heavily on current accounts (35 percent of total liabilities versus 20 percent for non-BCCs). The difference in the two figures roughly corresponds to the difference in the liabilities versus foreign residents, which are close to zero for BCCs and 12 percent for non-BCCs. BCCs are funded more heavily by their own bonds: 31 percent versus 25 percent for non-BCCs. The difference between the two figures roughly corresponds to the difference in the share of deposits of the Italian central bank and other Italian banks, which stands at 9 percent for BCCs and at 17 percent for non-BCCs.

BCCs tend to have more prudential capital than the rest of the Italian banking system, especially with respect to top quality capital (Core tier 1 in Basel II) due to the requirements of setting earnings aside (Table 1).

The profitability of BCCs is comparable to that of non-BCC banks in terms of both pre-tax[10] ROE and ROA, although at the peak of the financial crisis in 2011 the ROE for non-BCCs dipped substantially whilst the ROE of BCCs remained fairly stable.

2.4 Financial regulations for Italian banks

The relevant set of financial regulations enforced along our sample period are Basel I and Basel II, introduced in 1988 and 2006 respectively. BCCs are subject to the same regulations as other Italian banks in terms of required minimum capital and RWAs. According to Basel II, each bank is required to hold capital reserves calculated based on the following equation:[11]

[9] This is the sum of current accounts, deposits redeemable at notice, deposits with fixed duration and repurchase agreements.

[10] We report pre-tax figures because BCCs and non-BCCs are taxed differently for corporate income tax purposes. There are no differences between BCCs and non-BCCs for IRAP purposes.

[11] In terms of regulations and how assets are risk weighted in Basel II, there are three types of risk: credit risk, operational risk, and market risk. Credit risk is the risk that a borrower will default on any type of debt by failing to make payments. The credit risk component can be calculated in three different ways with varying degrees of sophistication: the standardized approach, the foundation Internal Rating-Based (IRB) approach, and the advanced IRB. The two IRB approaches involve banks creating their own internal systems to rate risk with the help of regulators. Since BCCs are too small to operate this internal system, they rely on the standardized approach. The standardized approach extends the approach to capital weights used in Basel I to include market-based rating agencies. In Basel I, risk weights are calculated by assigning relative riskiness thresholds to all assets held by the institution: at 0%, 10%, 20%, 50%, 100%. In Basel II, the framework has been kept simple and only six weights are used according to the rating assigned and/or category of debtors.

Capital Reserve = 0.08 x (Credit Risk exposure +Operational Risk exposure +Market Risk exposure)

≈ 0.08 x Credit Risk exposure

Otherwise stated, in our sample period BCCs are required to hold capital reserves equal to 8 percent of their RWAs. The operational and market risk reserves only account for less than 10 percent of the capital reserves of BCCs as they are subject to relatively low operational and market risk (Table 1). Therefore, in our calculations, we will not account for operational and market risk reserves.

3. Identification

We identify the effect of tax on banks' leverage by specifically focusing on BCC banks and variations in the Italian regional IRAP rates. There are many reasons for this choice.

First, each BCC bank can be matched to the IRAP rate of its region because BCCs can operate only in the area where they were originally established and in neighboring areas. Therefore, both cross-sectional (cross-regional) variation and time variation in the regional

Rating	From AAA to AA-	From A+ to A-	From BBB+ to BBB-	From BB+ to B-	less than B-	No rating	Retail
Weights	0%	20%	50%	100%	150%	100%	75%

The difference between Basel II and Basel I is that instead of being discounted on the basis of OECD membership, sovereign claims are now discounted according to the credit rating they are assigned by an authorized rating institution. If debt is rated from AAA to AAA-, it is assigned a 0% weight; if rated from A+ to A-, a 20% weight; if BBB+ to BBB-, a 50% weight; if BB+ to BB-, a 100% weight; and if rated below B-, a 150% weight. Unrated debt is weighted at 100%. If debt is denominated and funded in local currency, regulators can also assign a lower weight to its relative riskiness. For bank debt, authorities can choose between two risk weighting options. They can risk-weight this type of debt at one step less favourable than the debt of the banks' sovereign government. For example, if a sovereign bond is rated as A+, the risk weight of the banks under its jurisdiction would be 50%. Risk is capped at 100% if the sovereign rating is below BB+ or unrated. The other option for the risk-weighting of bank debt follows an external credit assessment similar to sovereign bonds. AAA to AAA- debt is weighted at 20%, A+ to BBB- debt is weighted at 50%, BB+ to BB- debt is weighted at 100%, and debt rated below B- is risk-weighted at 150%. Unrated debt is weighted at 50%. Short-term bank claims with maturities of less than three months are weighted at one step lower than a sovereign bond, where BB+ debt is given a 50% weight instead of a 100% value. In the standard approach, corporate debt is weighted in the same manner as bank debt, except the 100% category is extended to include all debt rated between BBB+ and BB-. All debt rated below BB-is weighted at 150%; unrated debt is risk-weighted at 100%. Home mortgages are, in addition, risk-weighted at 35%, while corporate mortgages are weighted at 100%.

IRAP rate can be exploited to identify the effect of taxation on the capital structure of banks.[12]

Second, we argue that changes in regional IRAP rates are exogenous to the BCCs' choice of leverage. The main reason is that IRAP revenues are used to finance the NHS and, hence, regional rates change in response to variations in the deficit of the local NHS. Additionally, the Italian central government has also introduced automatic increases in the regional IRAP rates for regions running a health care deficit above a certain threshold. In six cases, the regional rate was increased automatically.[13] Finally, other changes in the IRAP rate derive from variations in the national rate and these variations are unlikely to be determined along with the leverage decisions of small, regional banks such as the BCCs. From 1998-2011 there were 114 variations in the IRAP tax rate applied to the banking sector. A total of 96 out of 114 were exclusively due to a decision of central government; the variations decided by the central government were either due to a modification of the basic tax rate or to a compulsory increase caused by a health care deficit.

Overall, all these changes generate exogenous time and regional variations in the IRAP tax rates which this study employs to identify the effect of taxes on the capital structure of banks. We control for the regional economic cycle which could introduce a correlation between changes in the IRAP rate and the leverage of regional banks.

Third, as BCCs cannot be part of a group, a maximum leverage ratio imposed by minimum capital requirements can be calculated with precision. In fact, Basel II imposes different capital requirements on banking groups as a whole as opposed to individual subsidiaries: a subsidiary of a banking group must hold capital of not less than 6 percent of RWAs (plus operational risk and market risk), whilst the whole group must hold capital not less than 8 percent of RWAs (plus operational risk and market risk); therefore, it is not clear how the maximum leverage should be computed for non-BCC banks that are part of a banking group.

Fourth, BCC banks are smaller and simpler in structure and, at the same time, they act in exactly the same way as standard financial intermediaries, making it easier to model them

[12] For non-BCC banks, it is not straightforward to identify the applicable IRAP rate because non-BCC banks operate across multiple regions. In principle, a weighted average of effective IRAP rates can be calculated for non-BCC banks using confidential tax returns data. Unfortunately, in our sample this data is missing for some non-BCC banks. Additionally, a weighted average of regional IRAP rates may also be less salient to the managers of these larger banks.

[13] In 2006, there was a mandatory 1-percentage-point tax rate increase for Abruzzo and Campania. In 2010, Campania, Calabria, Lazio and Molise had to increase their rates by 0.15 percentage points.

than more complex non-BCC banks which also engage in various activities such as investment banking. From this point of view, for BCCs the 'accounting' equity (equity as reported in the accounts) is close to what it would be when calculated for regulatory purposes and this allows us to take the accounting equity as a close substitute of the regulatory capital.

4. Data and descriptive statistics

4.1 Data source

This paper uses administrative data provided by the Bank of Italy. The data contains regional IRAP tax rates, banks' financials, and regional economic indicators for the 20 Italian regions from 1998 to 2011.[14] Overall, there are 617 BCC banks with 6,265 bank-year observations in the original dataset. At the end of the sample period in 2011, there are 395 banks left in the data. The majority of banks in the data existed prior to 1998. There are 62 bank entries and 222 bank exits since 1998. The number of entries and exits by year is recorded in Table A4.

For some BCC banks, however, there are gaps where leverage ratios are missing. Banks with these gaps are removed from the dataset. Moreover, the observations in the first year of entry for each bank are dropped as leverage ratios are low in the first year of entry. There are 62 banks that enter our sample after 1998.[15] Figure A5 shows the comparison between the first-year and the second-year leverage of these banks. While the first-year observations in the left panel include many outliers that are unusually low, the second-year observations in the right panel have commonly observed levels of leverage. One possible explanation is that banks may not have reached their optimal leverage ratios in their first year due to time and credit constraints. We are left with 607 banks with 6,100 bank-year observations after eliminating bank observations with missing leverage ratios and the first-year observations of banks that only appear in our sample after 1998.

The IRAP rate varies across regions from 2002 as reported in Table A6. Table A6 also contains the number of banks and the percentage of BCCs in each region over the total number of BCCs. In our sample, there are 114 IRAP rate changes of which 75 are reductions in the IRAP rate with respect to the previous year.

[14] The list of all 20 regions in Italy is included in Table A3 in the appendix.
[15] Since the data starts from 1998, banks that started in 1998 cannot be fully identified.

Since we take the asset size at the end of the previous year (in *t-1*) as a measure for the size of the firm at the beginning of the current year (at time *t*), the number of observations further decreases as the first observations of each bank is dropped: this leaves 557 banks with 5,493 bank-year observations in the dataset.

4.2 Variables and summary statistics

For our analysis we employ banks' leverage, total assets, the growth rate of total assets, assets' riskiness (RWAs/total assets), return on assets (ROA), and maximum leverage.

Leverage L is defined as $1 - \frac{\mathrm{E}}{\mathrm{A}}$ where E is the equity of the bank at the end of the financial year and includes the net profit of the same financial year. A is the total assets of the bank at the end of the financial year. We adjust total assets to constant prices using the Consumer Price Index (CPI) published by the OECD with 2005 as a reference year.

The growth rate of total assets is calculated as the adjusted assets in *t-1* minus adjusted assets in *t-2* divided by adjusted assets in *t-2*.[16] The analysis also employs a riskiness index, which is the ratio between risk-weighted assets and total assets. The lower the riskiness index, the less risky the assets are.

Regional economic indicators used in the analysis are the regional Gross Domestic Product (GDP), GDP per capita and the employment ratio, all provided by the Italian National Institute of Statistics (ISTAT). Regional GDP and GDP per capita are both deflated using CPI with 2005 as the reference year. The employment ratio is defined as the total number of persons employed divided by the total population in each region.

4.2.1 Definition of maximum leverage

One of the innovations in this paper is that we can accurately control for how binding the capital requirements are for each individual bank in each year. We construct a new, firm-level time-varying variable called maximum leverage to control for the impact of the regulatory capital requirements on leverage. The underlying idea is that each bank has a different level of maximum leverage allowed based on the riskiness of its portfolio as capital requirements are a function of the bank's portfolio risk.

[16] Growth rate = $\frac{Adjusted\ assets_{\ t-1} - Adjusted\ assets_{\ t-2}}{Adjusted\ assets_{\ t-1}}$

Minimum capital requirements do not specify a certain ratio of equity (or debt) over total assets, but require a certain ratio of equity over RWAs instead. This implies that banks with relatively safe assets are allowed to hold less equity (more debt) and therefore may have higher maximum leverage ratios compared to banks with relatively riskier assets.

The detailed construction of the maximum leverage variable is as follows.

$$L_{\max} = 1 - \frac{E_{min}}{\mathrm{A}}$$

A represents total assets. E_{min} represents the minimum capital requirements as set out in Basel I and II and defined as the minimum ratio of equity over RWAs $k=\frac{E_{min}}{RWA}$. Rewriting the equation

$$E_{\min} = \mathrm{k} * RWA$$

RWA can be calculated using the riskiness index I in the data which is the ratio between risk-weighted assets and total assets, $I=\frac{RWA}{A}$. Substituting this into the equation above yields

$$E_{\min} = \mathrm{k} * RWA = k * I * A$$

Substituting these terms into the definition of L_{max}

$$L_{\max} = 1 - \frac{E_{min}}{\mathrm{A}} = 1 - \frac{kIA}{\mathrm{A}} = 1 - kI$$

In our sample period, k = 8% for all observations. The equation suggests that when a bank holds risky assets and therefore has a high riskiness index, the maximum leverage ratio allowed for that bank will be lower.

4.2.2 Summary statistics

Panel A of Table 1 shows summary statistics for leverage, (adjusted) total assets, the growth rate of total assets, the riskiness index and the maximum leverage ratio of the working sample comprising 5,493 observations. Over the sample, the average leverage ratio of BCC banks is 88 percent which is very close to that reported in Keen and De Mooij (2016).[17] The standard

[17] This average leverage ratio is much higher than that of non-financial firms whose average leverage ratio is usually between 40 and 60 percent (Rajan and Zingales (1995)). This is unsurprising as banks invest in loans and other assets by financing their positions through liabilities of different maturities such as customers' deposits, interbank lending and bonds.

deviation in the observed leverage ratio is around 4 percent. The riskiness index, on the other hand, has a mean of 68 percent and a standard deviation of 14 percent. Maximum leverage has an average of 95 percent, well above the 88 percent average leverage, and a standard deviation of 1 percent which is noticeably low.

The observations are then allocated to evenly distributed size groups and growth groups based on asset size (adjusted for the price index) and the growth rates of total assets, respectively. Panel B of Table 1 provides summary statistics for four different size groups. Size group 1 includes the smallest banks, size group 2 medium-small banks, size group 3 medium-large banks, and size group 4 the largest banks. Leverage increases as size increases: from size group 1 to size group 4, leverage is 87, 88, 88, and 89 percent respectively. The mean riskiness index increases from size group 1 to size group 3 but then decreases for size group 4. Maximum leverage does not differ much across different size groups: its mean is between 94 and 95 percent across all the groups. The growth rates in each size group do not show any particular trend. To check whether there is any particular correlation between size and growth rates, the number of bank-year observations in each size-growth group is noted in Table A7. According to Table A7, there is a comparable number of banks in each size-growth group which implies that there is no particular correlation between the size and growth of banks.[18]

Panel C of Table 3 provides similar summary statistics for four different growth groups. Growth group 1 has the slowest growth rate of total assets, growth group 2 a medium-slow growth rate, growth group 3 medium-fast growth rate, and growth group 4 the fastest growth rate. Faster growing banks have a higher mean and lower variance in leverage as in the case of larger banks. Moreover, unlike in the summary statistics for the four different size groups, the riskiness index appears to increase slightly when the growth rate increases. There is no significant pattern in size and maximum leverage across different growth groups.

4.2.3 Distribution of leverage and maximum leverage

Figure 6 plots leverage against total assets for every bank-year observation. Bigger banks appear to converge to a particular level of leverage (approximately 92 percent). This suggests that bigger banks may already be close to the minimum capital requirements. If this is true,

[18] For instance, a positive correlation between bank size and growth would suggest that there will be more bank-year observations that belong to size group 1 and growth group 1. However, the numbers are relatively evenly spread out across size-growth groups and do not suggest any particular correlation.

they may not be affected by other determinants of capital structure such as taxation. On the other hand, smaller banks display more variations in their level of leverage. This implies that there is more room for taxation to affect the leverage of smaller banks than bigger banks.

Figure 6 also plots maximum leverage against size. Even though banks have different levels of leverage, the majority have a similar level of maximum leverage – between 92 and 97 percent with larger banks converging to a level of 96 percent.

Table 1 shows that, on average, the distance between actual (88 percent) and maximum leverage (95 percent) is about 7 percentage points, implying that banks in our sample hold a buffer of about 7 percent. The buffer is rather stable across size classes (8 percentage points for the smallest banks and 6 for the other banks) but it declines as the rate of growth of total assets rises. For example, it is 8 percentage points for growth group 1, 2 and 6 percentage points for growth group 3, and 5 percentage points for the fastest growing banks.

5. Empirical strategy

5.1 Baseline specification

We estimate the following regression

$$L_{it} = \beta\tau_{it-1} + \gamma(\tau_{it-1} * X_{it}^{*}) + \delta X_{it} + \lambda_t + \eta_i + \varepsilon_{it}$$

where τ indicates the IRAP rate.[19] X_{it} is a vector of other determinants of capital structure often appearing in the literature on the capital structure of both banks and non-financial firms such as the size and rate of growth of total assets (Keen and De Mooij (2016), Gu, De Mooij and Poghosyan (2012)). Most empirical works find leverage to be positively correlated with asset size and growth rate. As explained above, bank-year observations are divided into four subgroups in terms of size and growth rates as described in the summary statistics. Each subgroup is then identified by a dummy. The size dummies and the growth dummies are

[19] In the regressions, we use its lagged value as it turns out to be more informative for the leverage ratio than the current IRAP rate. This result is included in Table 3. This is in line with Hemmelgarn and Teichmann (2014) as well as with the intuition that the adjustment of leverage in response to a change in the IRAP rate may not be immediate.

assigned to each subgroup and are included in X_{it}^{*} a subgroup of X_{it}. Regional variables, such as GDP, per capita GDP and the employment ratio are also included in X_{it} . The interaction term $(\tau_{it-1} * X_{it}^{*})$ distinguishes the impact of the IRAP tax rate on leverage for different size and growth subgroups of banks.

Moreover, as leverage is generally increasing over time in our data (see Figure A8),[20] year-fixed effects λ_t are included to control for common-year effects. η_i is a firm-fixed effect that controls for firm-specific time-invariant factors.[21]

6. Results

6.1 Baseline specification results

Column (1) of Table 3 reports the results for an OLS model including year dummies and region dummies to account for year-specific and region-specific components. The result shows that the coefficient on the IRAP rate is positive and significant at a 1 percent significance level showing that an increase in the IRAP rate leads to an increase in banks' leverage.

Gropp and Heider (2010) show that bank-specific time-invariant factors are the most important determinant of the capital structure of banks. Column (2) presents the results for a fixed-effect (FE) model. The estimated coefficient on the IRAP rate is still highly significant, although the magnitude of the coefficient decreases. Column (3) presents results for a model where standard errors are clustered by banks. This allows for within-bank serial correlation in the errors. In column (4), the standard errors are clustered by a region-year indicator as well as by banks. Clustering by region-year allows the error terms for different banks in the same region and the same year to be correlated with each other. Standard errors in column (4) are higher than in column (3). This suggests that there may be cross-sectional correlation as well as serial correlation between the error terms. Therefore, except where stated, the standard errors reported in all the subsequent tables will allow for both serial correlation and for cross-

[20] Figure A8 is a graph of weighted and unweighted averages of leverage by year, which shows an upward trend over time.

[21] Among various explanatory variables, Lemmon *et al.* (2008) find that for UK private firms, which share the same set of financial regulations and economic environment, most of the variation in leverage can be explained by unobserved firm-specific time-invariant factors.

sectional dependence within region-year pairs. The estimated coefficient on the IRAP rate still remains statistically significant in all FE models.

Column (5) tests the idea of Hemmelgarn and Teichmann (2014) that the lagged value of the IRAP rate is more informative than the current IRAP rate. We run a FE regression of the leverage ratio on the lagged IRAP rate: the estimated coefficient on the lagged IRAP rate is both positive and statistically significant. In column (6) we run a horserace between the current and the lagged IRAP rate. The coefficient on the current IRAP rate loses statistical significance while the coefficient on the lagged IRAP rate remains positive and statistically significant at a 5 percent significance level. This shows that the impact of the IRAP rate on leverage is not immediate. In unreported results, further lagged values of the tax rates included in the regression are statistically insignificant. This suggests that changes in the IRAP rate take approximately one year to affect leverage ratios, but no longer than one year. For the rest of the paper we continue to use the lagged IRAP rate.

In order to identify the institutions whose capital structure is the most sensitive to changes in IRAP tax rates, we interact the size dummies with the lagged IRAP rate. IRAP S1 is an interaction term between the lagged IRAP rate and the dummy for Size group 1, which contains bank-year observations with the smallest asset size. IRAP S2, IRAP S3, and IRAP S4 are constructed in the same way. The interaction of the tax rate with size-group dummies allows us to detect nonlinear relationships between leverage and tax rates. An additional advantage of dummies with respect to a continuous control for size (for example, the logarithm of total assets) is that dummies for broad size classes will be less influenced by unobserved shocks also affecting leverage.

Size group 2, Size group 3, and Size group 4 are the size dummies for each size group. Growth group 2, Growth group 3, and Growth group 4 are the growth-group dummies for each growth group where bank-year observations are allocated to them on the basis of the growth rate of adjusted total assets.

Column (1) of Table 4 allows for the impact of the IRAP rate to vary across different size groups. Column (2) includes dummies for different growth groups. Columns (1) and (2) commonly show that the IRAP rate has a statistically significant and positive effect on leverage for banks in the first three size groups (S1, S2 and S3) while it does not have a significant effect on the leverage of the largest size group (S4). The coefficient on the IRAP

rate for the smallest size group in column (2) is approximately 0.617, which implies that a 1-percentage-point increase in the IRAP rate leads to a 0.62-percentage-point increase in the leverage ratio on average for the banks in the bottom quartile of the size distribution.

The impact of the IRAP rate on leverage is similar in magnitude for banks in the first and second quartiles while it is somewhat smaller for banks in the third quartile. This is consistent with the observed pattern in Figure 6 where the leverage ratios chosen by smaller banks appear to be less bounded by the capital requirements and therefore possibly more prone to being affected by tax considerations.

Considering only the direct impact of size on leverage, the statistically significant coefficient on the dummy Size group 4 shows that the banks in the top quartile of the size distribution tend to have leverage ratios that are significantly different from those in the bottom quartile. Banks in other size groups, on the other hand, do not have leverage ratios that are significantly different from that of banks in the first size group as the coefficients on the relative size group dummies are insignificant.

Column (3) adds a control for profitability and the current return on assets (ROA). In column (4) we control for the lagged value of ROA as unobserved shocks could be affecting both current ROA and current leverage. The pattern of the coefficients on IRAP interacted with the size dummies does not change and remains very similar to the previous columns. Column (5) includes regional variables controlling for variations in the regional economic cycle. Among GDP, per capita GDP, and the employment ratio, only per capita GDP proves significant. This suggests that when per capita GDP is higher, there tends to be less debt financing and more equity financing of BCC banks. This is unsurprising as it may be easier to expand the number of shareholders in regions where the population is better off.

In column (6) we test whether the effect of the tax for each size group is statistically different from that of the smallest banks (S1). Only the coefficient on Lagged IRAP S4 is statistically significant showing that only banks in the largest size group behave differently. In particular, the coefficient is negative and its magnitude compensates the positive coefficient in Lagged IRAP indicating that the largest banks are insensitive to tax, as shown in column (1) to (5).

Overall, smaller banks in the bottom three quartiles of the size distribution change their leverage when IRAP rates change. They are also the banks with a lower level of leverage. On

the other hand, banks in the top quartile of the size distribution display a higher level of leverage and their leverage is unaffected by changes in tax rates.

6.2 Robustness checks on the baseline specification

In Table 5, we run the first set of robustness checks. Banks in the region of Trentino Alto Adige represent 21 percent of our sample (Table A6). Column (1) of Table 5 shows that our results are not sensitive to excluding all banks located in Trentino. The leverage of banks in the first 3 size groups remains sensitive to the IRAP rate whilst the largest banks in size group 4 do not react to changes in the IRAP rate. Banks with very low levels of leverage at some point in time could be driving the results on S1 and its interaction with lagged IRAP. In column (2), we drop all banks with at least one observation of adjusted total assets below the bottom 1 percent of the distribution. We drop about 100 observations for 20 banks. The results are very similar to our benchmark specification, with the coefficient on Lagged IRAP * S1 remaining positive and statistically significant at 1 percent. On the other hand, the largest banks in S4 could be those not responding to changes in the IRAP rate and hence driving the results for the insignificant coefficient on Lagged IRAP * S4. In column (3) we exclude banks with adjusted total assets above the top 1 percent of the distribution at least once in our sample. We drop 13 banks and the results remain qualitatively unchanged. In column (4) we exclude 125 banks that went out of business during our sample period and banks in the first three size groups remain sensitive to changes in IRAP with coefficients that are very close to each other. In column (5) we run our benchmark specification only on banks that went out of business in our sample period and the smallest two size groups remain sensitive to changes in IRAP rates.

Between 1998 and 2011 Italy implemented the so-called dual income tax (DIT) whereby an imputed normal return to equity was taxed at a lower rate of corporate income tax. This should have increased the incentive to finance investment with equity relative to debt. There is no regional variation in the design of DIT in Italy and therefore we can control for its effect only by constructing a dummy which takes value one for the period 1998-2001 and interacting it with Lagged IRAP. Column (6) shows that during the implementation of DIT, the effect of IRAP on leverage is reduced by around 13 percentage points. Although we cannot disentangle the effect of DIT from that of a more general economic cycle in the period 1998-2001, the negative coefficient on the interaction between Lagged IRAP and DIT

indicates that the latter may have reduced the sensitivity of banks' leverage with respect to changes in tax rates.[22] This is in accordance with Schepens (2016).

Italy, like other countries, was hit by the 2007-2008 financial crisis. Kalemli-Ozcan *et al.* (2012) remarks that the leverage ratios of banks display a very different pattern before and after the financial crisis.[23] Therefore, it is useful to explore whether the relationship between leverage and the IRAP rate differs in the pre- and post-crisis periods. To do so, we define a pre-crisis dummy that is equal to one for the period from 1998 to 2006 and a post-crisis dummy equal to one for the period from 2007 to 2011.[24] All variables are interacted with the pre-crisis dummy, post-crisis dummy, size-group dummies, growth-group dummies, and all the regional variables. The results are presented in column (7) of Table 5. Estimated coefficients on IRAP S Pre-Crisis and Post-Crisis variables (IRAP S1 Pre-Crisis, IRAP S2 Pre-Crisis etc.) measure the difference in the impact of the IRAP rate on different size groups of banks in the pre-crisis and post-crisis period with respect to the S1 group before the crisis.

In the pre-crisis period, it appears that the IRAP rate had a positive and significant impact on banks in the bottom quartile of the size distribution. The other coefficients on the pre- and post-crisis S1, S2, and S3 dummies interacted with Lagged IRAP are statistically insignificant, showing that the IRAP rate has had a positive and similar impact on the bottom three quartiles of the size distribution both before and after the crisis. Surprisingly, however, the IRAP rate has a negative and significant coefficient for banks in the top quartile in the pre-crisis period that more than compensates the positive coefficient on lagged IRAP. In the post-crisis period, the coefficient for Lagged IRAP * S4 turns insignificant pointing to the fact that, after the crisis, the largest banks seem to become sensitive to changes in the IRAP rate. Nonetheless, this result is not robust in further, unreported specifications investigating the effects of tax only after the financial crisis.

In a further set of robustness checks we employ a partial adjustment model as leverage is thought to be persistent over time (Flannery and Rangan (2006), Gropp and Heider (2010),

[22] Italy also implemented an Allowance for Corporate Equity (ACE) in 2011 whereby an imputed normal return to equity is deductible from the corporate income tax base. This should reduce the tax incentive for leverage. Unreported results show that ACE in 2011 has not reduced the sensitivity of banks' leverage to the tax system. This is unsurprising as its introduction was announced at the beginning of December 2011, that is, very close to the end of the fiscal year and hence banks would have had very little time to react to the announcement.

[23] For a more detailed description of the impact of the financial crisis on the Italian economy, see Dongili and Zago (2014).

[24] In an unreported additional robustness check we define the post-crisis period as 2008-2011 and the regression produces similar results.

and Keen and De Mooij (2016)). Table 6 shows the results for a model including a lagged dependent variable. Column (1) reports the results of a simple OLS model which includes both year- and region-fixed effects. It appears that the persistence of the leverage ratio is very high (0.903). The OLS is likely to have an upward bias in the estimate of the coefficient of the lagged dependent variable. Column (2) presents a FE model where bank-specific time-invariant effects are included. The coefficient on the lagged leverage ratio is significantly lower (0.682) than that of the OLS model, consistent with the result that a FE estimator is likely to generate a downward bias on the coefficient of the lagged dependent variable (Nickell (1981)). In order to correct for the bias in the coefficient of lagged leverage in the OLS and the FE models, column (3) reports the results for a difference GMM model (Arellano and Bond, 1991) where the first differences transformation is applied in order to remove bank-specific fixed effects.

In this particular difference GMM model, the third, fourth and fifth lags of leverage are used as instrumental variables for the lagged leverage term in the first differenced equations. The second lag is excluded from the instrument set because the validity of the instrument set including the second lag is rejected by the Hansen test of over-identifying restrictions. For the same reasons, we use the sixth lag of ROA. First differences of lagged IRAP rates and year dummies are also used as instruments.

In the Arellano-Bond test for AR(1), we reject the null hypothesis of no first-order serial correlation at 1 percent. We cannot reject the null hypothesis of no second-order serial correlation. This suggests that the errors in the original specification are likely to be serially uncorrelated. The Hansen test suggests that we cannot reject the null hypothesis that the instrument set is valid at 5 percent. In column (3) the coefficient on lagged leverage is 0.569, which is smaller than the corresponding coefficient from the dynamic FE specification in column (2). Since the coefficient from the dynamic FE model is already likely to be biased downward, this suggests that the difference GMM estimator is also likely to be biased. This problem has been noted in Blundell and Bond (1998) as the difference GMM estimators may suffer from a weak instrument problem when the true coefficient on the lagged dependent variable approaches unity.

Arellano and Bover (1995) propose a system GMM estimator that exploits moment conditions based on both the first differenced equations as well as the level equations. This

approach yields consistent estimates with a smaller finite sample bias on the coefficient on the lagged dependent variable. Column (4) reports the estimates from the system GMM model where the third, fourth and fifth lags of leverage are used as instrumental variables for the lagged leverage term in the first differenced equations. First differences of lagged IRAP rates are also used as instruments for the first differenced equations. For the level equations, first differences of the second lag of leverage are used as instruments for lagged leverage, while lagged IRAP rates, year dummies and region dummies are included as instrumental variables. Similarly to column (3) the Arellano-Bond test suggests that the error terms in the level equations are serially uncorrelated. The Hansen test also indicates that the hypotheses of valid instruments cannot be rejected at 5 percent.

The results show that the estimated coefficient (0.894) on lagged leverage in the system GMM model is between the estimates of the OLS and the FE, as the theory suggests. The long-run impact of the IRAP rate is estimated at 1.32, which is both positive and significant. Overall, the impact of the IRAP rate on leverage is significant across all specifications.

Column (5) allows for heterogeneity in the impact of the IRAP rate across different size groups. For banks in the first three quartiles of the size distribution there is still a positive and significant impact of the IRAP rate on leverage while for those in the top quartile there is no significant effect of the IRAP rate.

Overall, the robustness checks carried out in Table 5 and 6 confirm that banks in the top quartile of the size distribution do not change their leverage decisions in response to changes in the IRAP rates whilst the leverage of smaller financial institutions is sensitive to tax rate variations.

7. The effect of regulatory constraints

Unlike non-financial firms, banks are restricted by regulatory requirements in the choice of leverage. In Table 4 we show that banks whose leverage reacts to changes in the IRAP rate are also those with lower levels of leverage. These are the banks in the bottom three quartiles of the size distribution. On the other hand, banks in the top quartile of the size distribution do not react to changes in the IRAP rate and at the same time, they display a higher leverage

than the other banks. Taken together, this may mean that it is the distance from the regulatory constraint that determines whether banks react to changes in tax rates.

First, an estimate of the (lagged) maximum leverage[25] ratio allowed by the regulatory authority is included as an explanatory variable in our benchmark specification. This extension integrates capital requirements into the regression without imposing the restriction that there is a one-to-one relationship between actual leverage and maximum level of leverage.

The regression is as follows

$$L_{it} = \theta L_{max\ \ it} + \beta\tau_{it-1} + \gamma(\tau_{it-1} * X_{it}^{*}) + \delta X_{it} + \lambda_t + \eta_i + \varepsilon_{it}$$

If an increase in the (lagged) maximum leverage ratio is matched by the same increase of the actual leverage ratio, $\theta = 1$. In contrast, if an increase in the maximum leverage ratio does not affect the actual leverage ratio, $\theta = 0$.

Table 7 shows the varying impact of the IRAP rate across different size groups of banks when (lagged) maximum leverage is included as one of the explanatory variables. The regression includes year-fixed effects, bank-fixed effects and the regional variables. For simplicity, in column (1) we reduce the model to one where we distinguish the effect of IRAP rates only between banks in the top quartile and the rest of the banks as in column (6) of Table 4 we established that there is no statistically significant difference across the bottom three quartiles of the size distribution.

Column (2) of Table 7 includes (lagged) maximum leverage. The coefficient θ is estimated to be 0.129 and statistically significant at 5 percent. This indicates that when the constraint on maximum leverage is increased by 1 percentage point, on average banks only increase their leverage by 0.13 percentage points. The results on the effects of the IRAP rate across size groups remain very similar to those of column (1). Column (3) allows for a differential impact of (lagged) maximum leverage across different size groups. In other words, θ is

[25] We use lagged maximum leverage because the current level of maximum leverage could be endogenous as the financial institution could manipulate the riskiness of its portfolio and hence RWAs in order to take advantage of changes in the IRAP rate.

allowed to vary across different subgroups. For example, the coefficient on the maximum leverage among the banks in the top quartile in terms of size (Lagged Max leverage S4) is 0.259, which suggests that there is a 0.26-percentage-point increase in leverage when the maximum leverage ratio set by a combination of capital requirements and the bank's portfolio riskiness (RWAs) increases by 1-percentage-point. For smaller banks, θ is statistically insignificant. Among the subgroups in which θ is statistically significant, θ is still considerably below 1. This may be due to the fact that individual banks do not recognize the increase in the maximum leverage ratio fully. Banks may be cautious in their financing decisions and not react fully to the increase in the maximum possible leverage ratio even when they are perfectly aware of it.

Column (4) tests whether the coefficient for the top quartile of the size distribution is statistically different from that of the other quartiles. The negative and statistically significant coefficient on Lagged Max leverage * S1 and on Lagged Max leverage * S2 show that banks in S1 and S2 do not react to changes in maximum leverage. The coefficient on Max leverage * S3 is not statistically significant indicating that S3 banks do not behave differently from S4 banks. In column (5) we drop banks with at least one observation of leverage above maximum leverage. We drop 40 banks. The results remain virtually identical to those of column (4).

The patterns across the estimates of the coefficients on IRAP rates and IRAP * S4 are largely similar to the pattern observed in Table 4 where the maximum leverage is not included. The larger the bank, the smaller the impact of the IRAP rate on leverage. Table 7 shows a clear pattern: the larger the effect of maximum leverage on the leverage, the smaller the impact of the IRAP rate on leverage. This indicates that the effect of taxation on the leverage of financial institutions is influenced by regulatory requirements.

For these reasons, we test whether the distance from the regulatory constraint explains why smaller banks adjust their leverage in response to changes in the IRAP rate whilst larger banks shown to have higher levels of leverage do not appear to do so. To test this hypothesis, we construct the variable distance from the regulatory constraint as

$$Distance_t = \underbrace{Max\ leverage_t - leverage_t}_{Distance\ (lagged)}$$

We discretise distance and we employ it as dependent variable.[26]

In Table 8 we run regressions for banks always located close to their maximum leverage separately from other banks. Defining whether a bank is close or far from the constraint is somewhat arbitrary. Figure 7 shows the distribution of distance by quartiles of size. Banks in the top quartiles are generally closer to the constraint. There is some mass at 0.05 where many institutions are positioned, especially those in the top quartile. In column (1) and (2), we separate banks with distance from the constraint below and above 0.05, respectively. In column (1) we run the regression on banks with distance from the constraint always below 0.05. The coefficient on lagged IRAP is not statistically significant and very close to zero. The coefficients on the interaction between lagged IRAP and S2, S3 and S4 are not statistically significant. Across all size classes, when banks are very close to their individual maximum leverage, the leverage of banks does not change when the IRAP rate changes. In Column (2), the regression is run on banks with distance from maximum leverage not always below 0.05. The coefficient on lagged IRAP is negative and statistically significant: when the IRAP rate changes, leverage increases and hence the distance from maximum leverage decreases. Banks in size class S2 and S3 react in the same way, as the coefficients on lagged IRAP interacted with S2 and S3 are not statistically significant. The coefficient on lagged IRAP * S4 is statistically significant at 10 percent and positive. When added to the coefficient on lagged IRAP, the total effect approaches zero, revealing once again that the leverage of larger banks does not respond to changes in the IRAP rate, even when banks are further away from their individual constraint. The same pattern can be observed for columns (3) to (6). In column (3) and (4), we separate banks with distance from the constraint below and above 0.09, representing the 75th percentile of the distribution of distance.[27] In column (5) and (6), we separate banks with distance from the constraint below and above 0.134, representing the 95th percentile of the distribution of distance.

[26] In principle, we could discretise the distance measure and interact it with the IRAP rate. In practice, this could be problematic for two reasons. First, the regulatory measure (max leverage) could be manipulated by banks: RWA can be changed to take advantage of tax increases and hence distance would be endogenous. Second, controlling for distance would introduce the dependent variable on the right-hand side of the regression equation. We could use lagged distance but this would introduce a lagged dependent variable in the regression ($leverage_{t-1}$) which would also be endogenous.

[27] In unreported results we separate banks with distance from the constraint below and above 0.06, respectively. The results are similar to those of column (3) and (4).

Table 8 shows that the distance from the regulatory constraint explains some, but not all, of the banks' response to changes in the IRAP rate. First, banks close to the regulatory constraint do not change their leverage when the IRAP rate changes (odd columns). Second, most banks react to changes in the IRAP rate when they are away from the constraint. The exception is larger banks (even columns). Their leverage is not responsive to taxation, even when they are not constrained by regulations.

7.1 Impact of IRAP on leverage for different growth groups of banks

To investigate further the behaviour of unconstrained, larger banks, we first divide bank-year observations into four different, equally sized subgroups based on the growth rates of assets. Lagged IRAP G1 is an interaction term between the lagged IRAP rate and a dummy for growth group 1, which contains the banks in the lowest quartile of the rate of growth of adjusted total assets. Lagged IRAP G2, Lagged IRAP G3, and Lagged IRAP G4 are constructed in the same fashion.

In column (1) of Table 9 we include the interactive terms between the growth dummies and the IRAP rate. The results show that the impact of the IRAP rate on banks' leverage in different growth groups is significant and positive except in the fastest growing group of banks. The impact of the IRAP rate on leverage is greatest in the first two quartiles.

Moreover, the unreported coefficient on the Growth group 2 dummy variable is insignificant while those on Growth group 3 and 4 are positive and significant. This indicates that banks in the second quartile in terms of growth rate distribution do not have significantly higher leverage ratios than those in the first quartile. Compared to the banks in the first quartile, those in the third and fourth quartiles tend to have significantly higher leverage ratios. The general pattern is that faster growing banks have higher leverage ratios. These observations can help explain the pattern of the impact of the IRAP rate on leverage for different growth groups of banks: faster growing banks have higher leverage ratios and accordingly are closer to the regulatory maximum. There is therefore less room for the leverage choices of the fast growing banks to be affected by tax considerations. In column (2), we show that growth class G1 and G2 have similar coefficients as the coefficient on lagged IRAP * G2 is not statistically significant. The coefficients on lagged IRAP * G3 and lagged IRAP * G4 are negative and statistically significant indicating that banks in the top two quartiles of the growth distribution (G3 and G4) react much less to changes in the IRAP rate.

In column (3) we include lagged IRAP interacted with dummies for size groups S1, S2, S3 and S4. In this specification the results show that only the top quartile of size (S4) and of growth (G4) react differently from the other size and growth groups.

To allow the impact of the IRAP rate on leverage to vary across both size and growth groups, we construct IRAP S G interaction variables. We first simplify our classification to two size groups and two growth groups. The dummy variable S123 is one for banks in the first three quartiles of the size distribution and zero otherwise. As before, S4 is one for banks in the top quartile of the size distribution and zero otherwise. The dummy variable G123 is one for banks in the first three quartiles of the growth distribution. As before, G4 is one for banks in the top quartile of the growth distribution.

Since there are two size groups and two growth groups, each bank can be classified into four different size-growth groups. For instance, S123*G123 is a dummy variable equal to 1 for bank-year observations that are in the first three quartiles of the size distribution and in the first three quartiles of the growth rate distribution, and 0 otherwise. The S G variables are interacted with the IRAP rate to construct IRAP S G variables. They each reflect the impact of the IRAP rate in each size-growth group.

For example, Lagged IRAP * S123 * G4 represents the impact of the IRAP rate on leverage for the banks that are in the bottom three quartiles in terms of asset size and in the top quartile in terms of growth rates. As shown in the descriptive statistics, there is no clear correlation between size and growth rates.

Column (4) shows that only banks in the bottom three quartiles of their size distribution respond to changes in the IRAP rate. Banks in the top quartile do not, irrespective of their growth rate. The pattern does not change when we control for maximum leverage (column (5)), nor when we allow the effect of maximum leverage to vary by size-growth groups (column (6)). In column (6) we interact maximum leverage with S * G variables and we find that only small, fast growing banks and banks in the top quartile of the size distribution change their leverage when their maximum leverage allowed changes.

In Table 10 we test whether the rate of growth explains the differential behaviour of larger banks when they are further away from the constraint. As in Table 8 we divide banks between those always located close to the constraint and other banks. In column (1) and (2) we separate banks with distance from the constraint below and above 0.05, respectively. In

column (3) and (4), we separate banks with distance from the constraint below and above 0.09.[28] In column (5) and (6) we separate banks with distance from the constraint below and above 0.139. Consistently with the results in Table 8, the leverage of banks close to the constraint (odd columns) does not change when the IRAP rate changes: the coefficients on lagged IRAP and on its interaction with size-growth dummies are insignificant. The even columns instead show that banks react to changes in the IRAP rate when the regulatory constraint is less binding as the coefficient on the lagged IRAP rate is negative and statistically significant in columns (2), (4) and (6). The coefficients on the interaction between the IRAP rate and size-growth dummies are insignificant, indicating that there is no differential behaviour of banks in different groups. The exception is the group of banks in the top quartile of the size distribution (S4) but in the bottom three quartiles of growth (G123): the coefficient is positive and statistically significant and when added to the coefficient on Lagged IRAP, the overall coefficient ranges from -0.299 (column 4) to -0.181 (column 6). This indicates that large, slow growing, unconstrained banks react much less or not at all, if we consider the 95 percent confidence interval, to changes in the tax rates and hence are likely to be the institutions driving the results in Table 8. These are possibly the banks that have already attained their optimal size (they are large and growing slowly) and hence, it may prove too costly to change their leverage when tax changes.

We also explore whether regulatory constraints remain an important determinant of the capital structure of banks when the financial institution is further away from the constraint.

In Table 11 we continue dividing the dataset between banks always below a specific distance from maximum leverage and other banks. The dependent variable is leverage and we simultaneously control for both the effect of tax and of maximum leverage. In columns (1) to (3) we show that financial institutions which are closer to the regulatory constraint are insensitive to tax changes but, at the same time, are sensitive to changes in their individual level of maximum allowed leverage. When the sample is large enough (columns 2 and 3), the coefficients on maximum leverage increases with the size and rate of growth, showing that larger and faster growing banks are more sensitive to regulatory requirements. In columns (4) to (6) we show that the pattern remains the same for less constrained banks. In particular,

[28] In unreported results we separate banks with distance from the constraint below and above 0.06 (median value of the distribution of distance from maximum leverage), respectively. The results are similar to those of column (3) and (4).

large banks are the most responsive to changes in maximum leverage. This includes large, slow growing banks which respond much less to tax and indicates that regulatory capital requirements also remain very important for unconstrained institutions.

In short, regulatory constraints remain a first-order determinant of the capital structure of banks: for constrained institutions, the effect of tax rate changes on leverage is muted. Additionally, when further away from the constraint, the tax effect appears only when banks are less sensitive to their maximum leverage, that is, to capital requirements.

8. Asymmetric effects of tax hikes and tax cuts

The previous analysis established that banks closer to their regulatory constraint do not change their leverage in response to changes in the IRAP rate. In the case of an increase in the IRAP rate, it would be too risky for the bank to increase its leverage further. Nonetheless, for cuts in the IRAP rate, banks could decrease their leverage and this would not risk them getting too close to the regulatory constraint.

The literature has recently investigated asymmetric responses of leverage to tax cuts and tax increases for non-financial firms. Strebulaev and Whited (2012) describe a world where firms take out perpetual debt and where debt cannot be paid off but only renegotiated. In their model, the firm will not reduce its debt because after debt has been issued, shareholders' and bondholders' interests are not aligned when, after a tax cut, the need to renegotiate arises. This implies that when the tax rate is cut, leverage does not change. On the contrary, when the tax rate increases, the firm has an incentive to issue more debt. At the issuance of new debt, shareholders' and bondholders' interests are aligned and hence the firm will increase leverage. In a panel of American, large public non-financial firms, Heider and Ljungqvist (2015) find that tax cuts do not affect leverage whilst leverage increases in response to tax increases.

If debt is not perpetual but financial and non-financial institutions use a mix of short- and long-term debt, at every point in time, it is likely that some old debt is paid off. If the tax rate comes down, both financial- and non-financial firms may simply decide not to take on more debt to respond to a rate cut. Additionally, financial institutions have a whole portfolio of liabilities with different maturities, which can be adjusted very rapidly. In Table 11 we test

whether tax cuts have a different effect on leverage than tax hikes by interacting lagged IRAP with a dummy equal to one if the change in the tax rate between *t-1* and *t-2* was negative (Lagged IRAP * dummy: tax cut). Column (1) shows that the coefficient on lagged IRAP remains positive and significant indicating that generally speaking, changes in the IRAP rate affect leverage. The coefficient on the interaction between IRAP and a dummy for tax cuts is not statistically significant indicating that there is no evidence of a differential effect between tax hikes and tax cuts. These results may hide some heterogeneity. Prudential regulation constrains leverage from above. Hence, for banks close to the constraint, it may be easier to adjust debt downwards rather than upwards and for banks closer to the constraint, tax hikes may not produce changes in leverage but tax cuts could. We test this idea in columns (2) and (3) where we restrict banks to be close to their maximum leverage. The dependent variable is the distance from maximum leverage restricted to below 0.09 and 0.139, respectively. Also in this case, the coefficient on the interaction between lagged IRAP and a dummy for tax cuts is not statistically significant and hence, there is no evidence of a differential effect of tax cuts (versus tax hikes). When banks are close to the constraint, their leverage does not change in response to changes in tax rates, whether they are tax increases or tax cuts. In the case of an increase in the IRAP rate, it would be too risky for the bank to increase its leverage further. The evidence that tax cuts do not affect the leverage of constrained institutions suggests that the optimal level of leverage for constrained banks is well above that permitted by the regulatory requirements.

In columns (4) and (5) banks are further away from their maximum leverage. As in the previous columns there is no evidence of a differential effect of tax cuts with respect to tax hikes: the coefficient on lagged IRAP is negative and statistically significant but the coefficient on lagged IRAP interacted with a dummy for tax cuts is not statistically significant.

Overall, even if it is possible that for non-financial firms adjusting debt downward is more costly than adjusting it upwards, financial institutions seem to behave very differently. There might be two reasons for this. First, banks manage liabilities with different maturities daily and hence can adjust their leverage upwards or downwards very quickly. Second, financial institutions are constrained in the maximum amount of leverage that they can assume and hence increasing leverage when the tax rate increases may prove difficult or too risky.

9. Conclusion

This paper employs plausibly exogenous variations in the Italian regional IRAP rates to examine the impact of the tax rates on the leverage of Italian regional BCC banks. In order to identify the differential impact of the IRAP rate on different types of banks, we divide the banks into four groups by both size and growth rates. The main regression shows that the IRAP rate has a statistically significant impact on leverage among banks in the first three quartiles in terms of their asset size as well as among banks in the first three quartiles in terms of growth rates. The findings suggest a clear pattern of the banks' responses: the smaller and more slowly growing the bank is, the higher the impact of the IRAP rate on its leverage. In contrast, the leverage of large and fast growing banks is not responsive to the IRAP rate.

We adopt various robustness checks among which a partial adjustment model to account for persistence in leverage. The basic findings remain qualitatively unchanged: the impact of the IRAP rate on the banks in the bottom three quartiles in the size distribution is positive and significant.

We then test the impact of regulatory capital requirements on the effect of tax. We run a regression including the bank-specific maximum level of leverage permitted by the regulatory authority. The maximum leverage ratio is calculated according to Basel II financial regulation and to the bank-specific portfolios. In general, banks with a low-risk profile can have higher levels of maximum leverage. The results are largely robust to the inclusion of this new variable. Interestingly, the leverage of large and fast growing banks respond less to the IRAP rate, while it responds more to the maximum leverage. This suggests that the banks which are less bound by capital requirements may be more susceptible to the influence of other possible determinants of the capital structure, such as taxation.

We then separate banks that are always closer to the regulatory constraint from the others and we find that for the first group, changes in the tax rate do not affect leverage. For the second group, variations in tax rates affect leverage but the effect is very small. Overall, these results indicate that capital requirements are of first-order importance in determining the capital structure of financial institutions and only when the constraints are not binding, the tax system can have an, albeit small, effect on banks' leverage.

This is further demonstrated by two additional findings. First, larger, slow growing banks react significantly less than others to changes in tax rates, even if they are relatively unconstrained. At the same time, such banks are more sensitive than smaller banks to variations in their maximum leverage showing that when the sensitivity to regulatory constraints is high, the effect of tax is small.

Finally, we consistently find that the effect of tax is muted when banks are closer to the constraint for both tax cuts and tax hikes. Tax hikes would increase the benefit of debt financing and hence would induce financial institutions to leverage up. When banks are close to their regulatory constraint they will not be able to take advantage of the additional debt benefit and accordingly will not increase their leverage as this would bring them too close to or above the regulatory constraint. The effect is less clear for tax cuts. If a bank is at its optimal leverage level, tax cuts reduce the benefit of debt and leverage should decline. We find that both tax cuts and tax hikes have no effect on banks' leverage when a financial institution is close to its regulatory constraint. Unresponsiveness to tax cuts suggests that the optimal leverage of banks close to the constraint is well above what is permitted under the regulatory requirements and hence, capital requirements are a first-order factor in the capital structure decisions of financial institutions.

Overall, our findings cast doubt on the role of the tax system as a primary determinant of the capital structure of banks and hence, as a cause or tool to address the negative externalities of excessive leverage in the banking system.

Constrained, unresponsive banks represent up to 84 percent of total assets of the universe of BCC banks and they are larger than unconstrained banks. Among the unconstrained institutions, large, slow growing banks responding only marginally to changes in tax rates represent another 7 percent of total BCC assets.

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Figures

Figure 1. Average regional and total IRAP rates

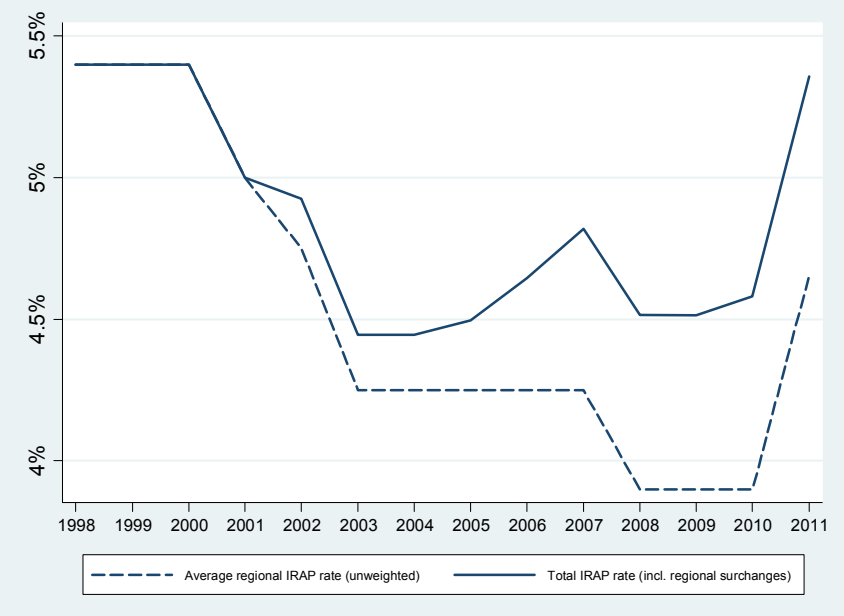
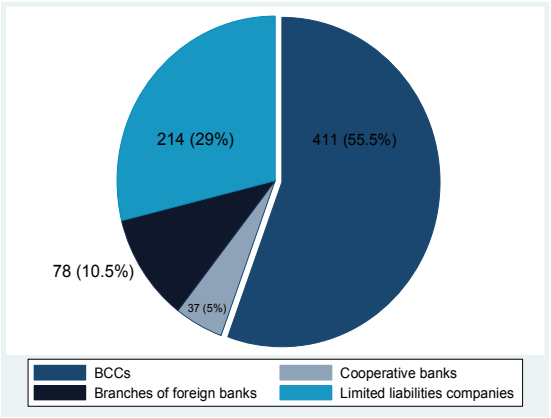


Figure 1 shows the evolution of the average, unweighted regional IRAP rate and the total IRAP rate for banks only (1998-2011).

Figure 2. Structure of the Italian banking system (2011)

Panel A. Number of banks by type



Panel B. Assets of banks by type (€ bln.)

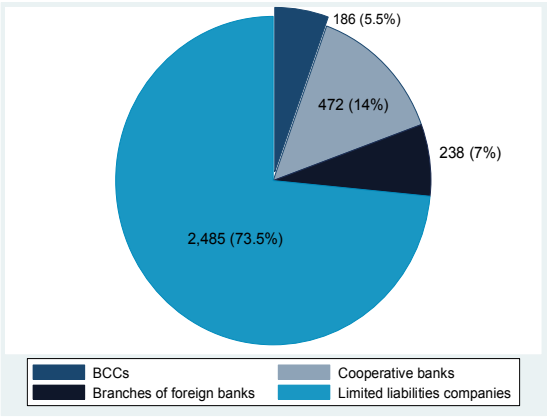


Figure 2 presents the composition of the Italian banking system by bank type for 2011, the last year of our sample. Panel A displays the number of banks where the total number of banks is 740. Panel B shows the value of total assets in billions of euros where the total value of assets of the Italian banking system is €3,381 billion. Source: Bank of Italy (2012), statistics for 2011 (Tables 16.1, a17.6).

Figure 3. Asset composition, BCCs and the rest of the Italian banking system (2011)

Panel A. BCCs **Panel B. Non-BCC banks**

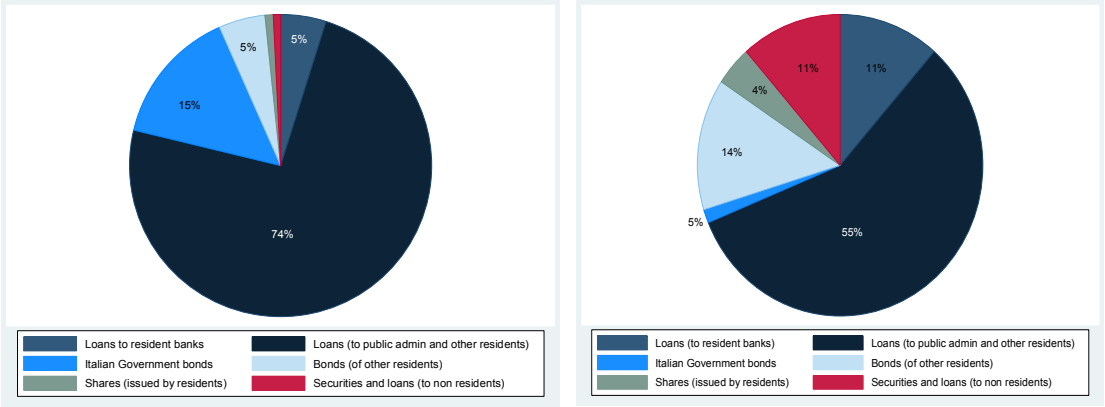


Figure 3 shows the composition of the assets held by BCCs and non-BCCs in 2011, the last year of our sample. Panel A displays that of BCCs. Panel B shows the asset composition for the rest of non-BCC banks. Source: Bank of Italy (2012), statistics for 2011 (Table a17.6).

Figure 4. Liability composition, BCCs and the rest of the Italian banking system (2011)

Panel A. BCCs **Panel B. Non-BCC banks**

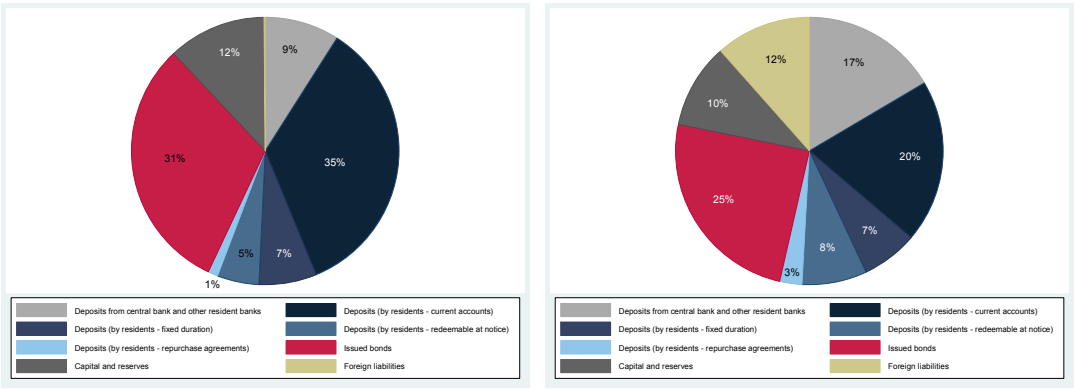


Figure 4 shows the composition of the liabilities of BCCs and non-BCCs in 2011, the last year of our sample. Panel A displays that of BCCs. Panel B shows the liability composition for the rest of non-BCC banks. Source: Bank of Italy (2012), statistics for 2011 (Table a17.6).

Figure 5. Profitability, BCCs and the rest of the Italian banking system (2007-20013)

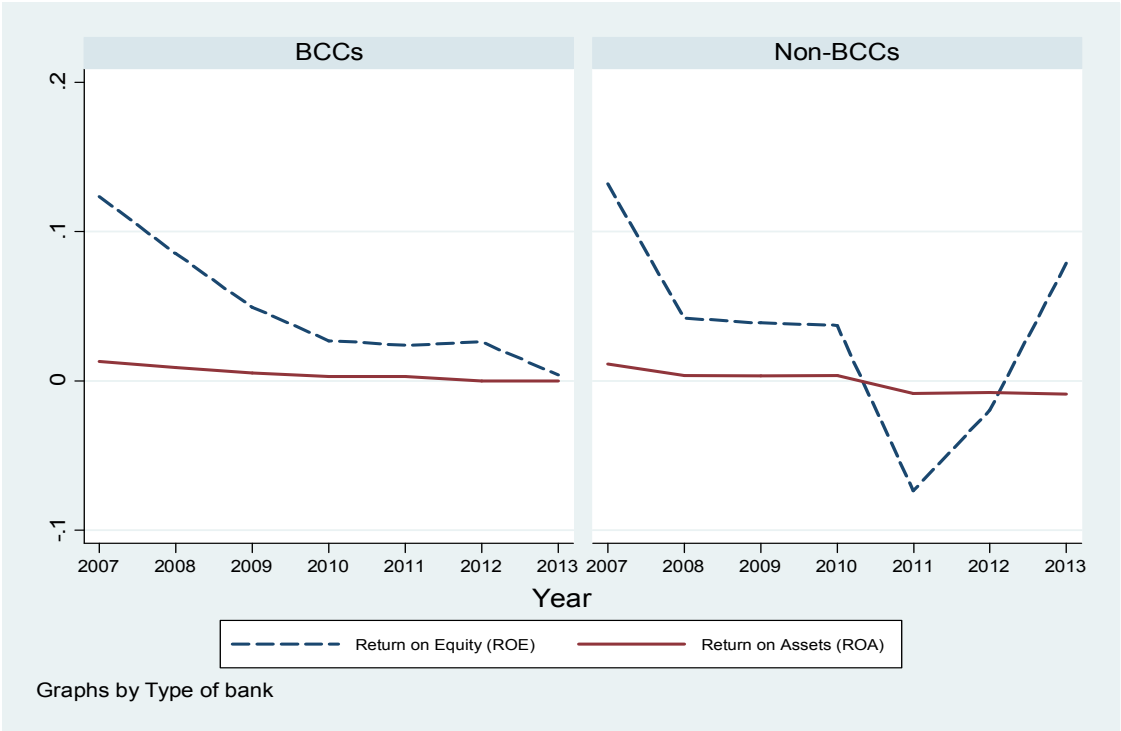


Figure 5 presents the evolution of the pre-tax return on equity (ROE) and the pre-tax return on assets (ROA) for BCCs and non-BCCs between 2007 and 2013. Source: Bank of Italy (2014), statistics for 2013.

Figure 6. Leverage, maximum leverage and size

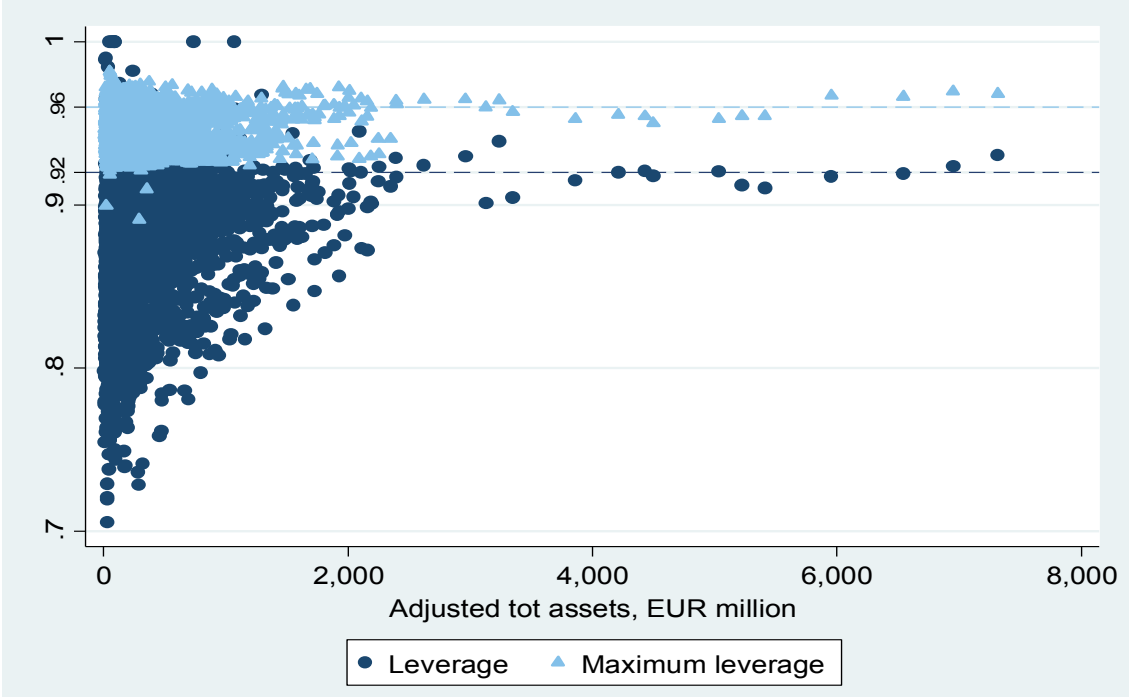


Figure 6 presents the distribution of leverage (dark blue dots) and maximum leverage (light blue triangles) against size. Maximum leverage is calculated as L_{max}*= 1- (8%*RWA/total assets)*, where *8%*RWA is the minimum capital required according to Basel II. Leverage is calculated as 1 – Equity/Total assets.*

Figure 7. Distance from maximum leverage and size

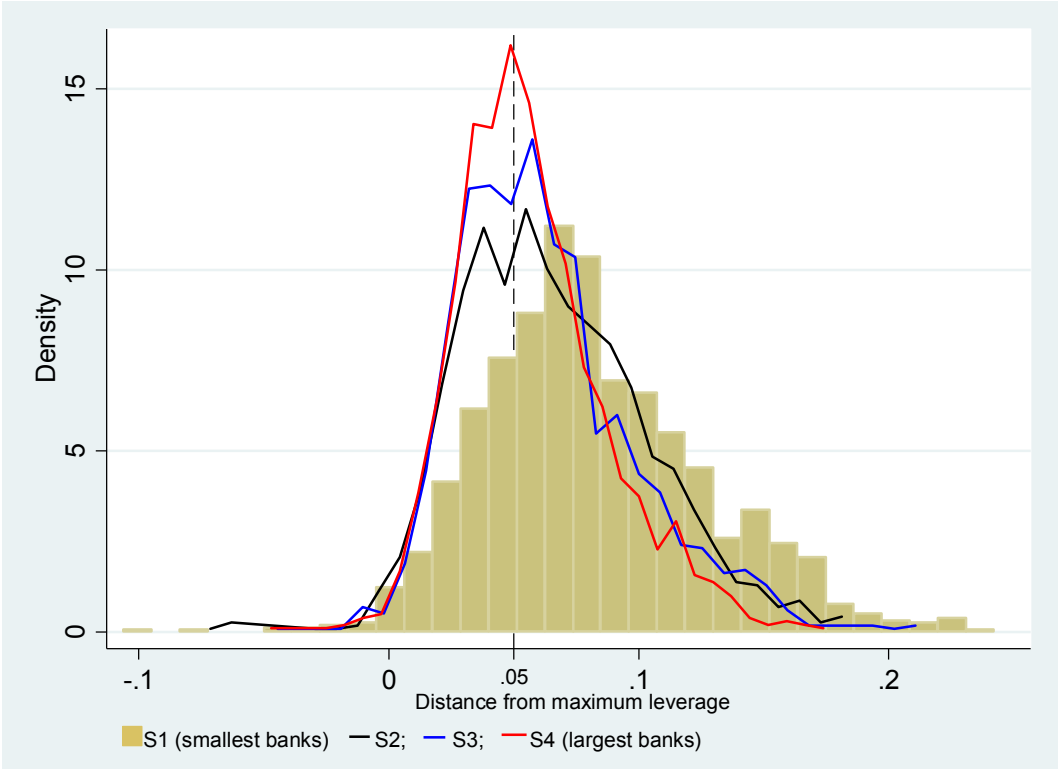


Figure 7 shows the distribution of the distance of actual leverage from the maximum allowed leverage for banks, by size of adjusted total assets. Maximum leverage is calculated as L_{max}*= 1-(8%*RWA/total assets)*, where *8%*RWA is the minimum capital required according to Basel II. Leverage is calculated as 1 – Equity/Total assets. The distance from maximum leverage is calculated as leverage minus maximum leverage. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution.*

Tables

Table 1. Composition of capital and distribution of regulatory capital requirements in 2011-2013

Italian banking system (including BCCs)							
	Capital composition (%)			Distribution of regulatory capital requirements (%)			
Year	Core Tier 1	Tier 1	Tier 1 + Tier 2	Credit risk	Market risk	Operational risk	Other
2011	9.3	10.0	13.0	86.4	4.1	8.3	1.3
2012	10.6	11.1	13.8	86.3	3.4	9.1	1.3
2013	10.5	11.0	13.9	82.7	3.6	9.5	4.3
Only BCCs							
2011	14.0	14.0	15.1	90.4	0.2	7.4	2.0
2012	14.1	14.1	15.1	90.2	0.2	7.7	2.0
2013	14.4	14.4	15.4	89.0	0.2	8.5	2.3

Source: Bank of Italy (2014). Note: Core tier 1, tier 1, and tier 2 capital are all measured as a percentage over RWAs. For a detailed definition of core tier 1, tier 1, tier 2 capital, see BIS (2004). BCCs have almost the same amount of core tier 1 capital and tier 1 capital. The amount of tier 1 capital is very close to the amount of tier 1 and tier 2 capital, which suggests the absence of complex financial instruments such as hybrid instruments. Credit risk includes counterparty risk. 90% of the capital requirement is based on credit risk.

Table 2. Descriptive statistics for different size and growth groups

Panel A. Size groups					
Full sample					
	Observations	**Mean**	**Standard devation**	**Minimum**	**Maximum**
Leverage	5,493	88%	4%	71%	104%
Total assets (millions of euros)	5,493	284.4	385.2	5.4	7,318.5
Rate of growth of total assets	5,493	7%	11%	-20%	152%
Riskiness index	5,493	69%	14%	23%	136%
Maximum leverage	5,493	95%	1%	89%	98%
Return on assets (ROA)	5,489	0.68%	0.74%	-21%	3.7%
Panel B. Size groups					
Size group 1 (S1)					
Leverage	1,373	87%	4%	71%	104%
Total assets (millions of euros)	1,373	54.0	20.4	5.4	172.6
Rate of growth of total assets	1,373	8%	14%	-17%	136%
Riskiness index	1,373	66%	14%	23%	126%
Maximum leverage	1,373	95%	1%	90%	98%
ROA	1,372	0.64%	1.08%	-21%	3%
Size group 2 (S2)					
Leverage	1,373	88%	4%	74%	101%
Total assets (millions of euros)	1,373	124.7	29.5	71.5	308.7
Rate of growth of total assets	1,373	6%	11%	-19%	152%
Riskiness index	1,373	70%	14%	30%	96%
Maximum leverage	1,373	94%	1%	92%	98%
ROA	1,370	0.69%	0.70%	-9%	4%
Size group 3 (S3)					
Leverage	1,373	88%	4%	73%	98%
Total assets (millions of euros)	1,373	250.6	52.4	137.1	495.1
Rate of growth of total assets	1,373	7%	9%	-18%	94%
Riskiness index	1,373	71%	13%	31%	136%
Maximum leverage	1,373	94%	1%	89%	98%
ROA	1,373	0.74%	0.55%	-6%	3%
Size group 4 (S4)					
Leverage	1,374	89%	3%	76%	100%
Total assets (millions of euros)	1,374	707.8	574.9	294.4	7,318.5
Rate of growth of total assets	1,374	7%	8%	-20%	113%
Riskiness index	1,374	68%	14%	33%	95%
Maximum leverage	1,374	95%	1%	92%	97%
ROA	1,374	0.67%	0.52%	-3%	2%

Note: see Table A9 for further details on size groups.

Table 2. Descriptive statistics for different size and growth groups

Panel C. Growth groups					
Growth group 1 (G1)					
Leverage	1,373	87%	4%	71%	101%
Total assets (millions of euros)	1,373	209.0	272.4	9.6	4,499.6
Rate of growth of total assets	1,373	-1%	3%	-20%	2%
Riskiness index	1,373	67%	14%	23%	126%
Maxium leverage	1,373	95%	1%	90%	98%
ROA	1,369	0.51%	0.86%	-9%	3%
Growth group 2 (G2)					
Leverage	1,373	87%	4%	72%	99%
Total assets (millions of euros)	1,373	286.0	409.1	13.1	7,318.5
Rate of growth of total assets	1,373	4%	1%	2%	5%
Riskiness index	1,373	69%	14%	26%	136%
Maxium leverage	1,373	95%	1%	89%	98%
ROA	1,373	0.68%	0.62%	-7%	4%
Growth group 3 (G3)					
Leverage	1,373	88%	3%	76%	104%
Total assets (millions of euros)	1,373	319.8	383.2	9.5	6,951.4
Rate of growth of total assets	1,373	8%	1%	5%	10%
Riskiness index	1,373	69%	13%	30%	96%
Maxium leverage	1,373	94%	1%	92%	98%
ROA	1,373	0.74%	0.78%	-21%	3%
Growth group 4 (G4)					
Leverage	1,374	89%	3%	74%	100%
Total assets (millions of euros)	1,374	322.8	444.0	5.4	6,543.3
Rate of growth of total assets	1,374	18%	16%	10%	152%
Riskiness index	1,374	69%	14%	26%	113%
Maxium leverage	1,374	94%	1%	91%	98%
ROA	1,374	0.80%	0.66%	-8%	3%

S1 groups the bank-year observations belonging to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. G1 groups the bank-year observations belonging to the bottom quartile of the growth rate distribution. The growth rate is calculated as (adjusted total assets$_{t-1}$ – adjusted total assets $_{t-1}$)/adjusted total assets$_{t-2}$.G2, G3 and G4 indicate groups of faster growing banks with G4 representing the banks in the top quartile of the distribution of the rate of growth.

Table 3. The effect of IRAP on leverage

	Dependent variable: leverage					
	(1) OLS	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
Current IRAP rate	1.427***	0.317***	0.317***	0.317**		0.012
	(0.110)	(0.058)	(0.103)	(0.128)		(0.145)
Lagged IRAP rate					0.427***	0.419**
					(0.142)	(0.178)
Constant	0.829***					
	(0.005)					
Region FE	Yes	-	-	-	-	-
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	[0.100]	[0.402]	[0.402]	[0.402]	[0.405]	[0.406]
Clustered by	-	-	Bank	Two ways	Two ways	Two ways
Observations	5,493	5,440	5,440	5,440	5,440	5,440
Number of banks	504	504	504	504	504	504

*Note: standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the specified level. Reported R-square for the Fixed Effects (FE) model is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 4. Impact of IRAP rate across different size classes

	Dependent variable: leverage					
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ROA			-0.935***		-0.938***	-0.938***
			(0.080)		(0.081)	(0.081)
Lagged ROA				-0.761***		
				(0.110)		
Lagged IRAP						0.506**
						(0.202)
IRAP * S1	0.629***	0.617***	0.571***	0.602***	0.506**	
	(0.211)	(0.212)	(0.204)	(0.203)	(0.202)	
IRAP * S2	0.596***	0.588***	0.553***	0.594***	0.532***	0.026
	(0.170)	(0.169)	(0.149)	(0.161)	(0.141)	(0.174)
IRAP * S3	0.450***	0.426***	0.353**	0.426***	0.288**	-0.218
	(0.157)	(0.159)	(0.144)	(0.150)	(0.141)	(0.189)
IRAP * S4	0.080	0.056	-0.011	0.050	-0.102	-0.608***
	(0.192)	(0.190)	(0.168)	(0.170)	(0.164)	(0.219)
Size group 2 (S2)	0.004	0.004	0.003	0.003	0.002	0.002
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Size group 3 (S3)	0.013	0.014	0.015*	0.013	0.016*	0.016*
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
Size group 4 (S4)	0.032***	0.034***	0.035***	0.034***	0.037***	0.037***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Growth group 2 (G2)		0.002***	0.003***	0.003***	0.003***	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 3 (G3)		0.004***	0.005***	0.005***	0.005***	0.005***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 4 (G4)		0.008***	0.010***	0.009***	0.010***	0.010***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln(GDP)					-0.004	-0.004
					(0.023)	(0.023)
Ln(GDP per capita)					-0.129***	-0.129***
					(0.031)	(0.031)
Ln(employment ratio)					0.043	0.043
					(0.029)	(0.029)
R-squared	[0.411]	[0.433]	[0.503]	[0.472]	[0.511]	[0.511]
Observations	5,440	5,440	5,436	5,437	5,436	5,436
Number of banks	504	504	504	504	504	504

*Note: ROA is Return on Assets. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. G1 is a dummy for bank-year observations which belong to the bottom quartile of the rate of growth of total assets. G2, G3 and G4 are groups of larger banks by rate of growth with G4 being the group in the top quartile of the distribution of rate of growth of adjusted total assets. All regressions include year fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 5. Robustness checks on the impact of IRAP on leverage

Dependent variable: leverage							
	(1) Excl. Trentino	(2) Excl. bottom 1%	(3) Excl. top 1%	(4) Excl. out of business	(5) Only out of business	(6) DIT	(7) Crisis
Lagged IRAP rate	0.423**					0.531***	0.381*
	(0.207)					(0.198)	(0.224)
Lagged IRAP * S1		0.526***	0.429**	0.447**	0.916*		
		(0.192)	(0.198)	(0.221)	(0.517)		
Lagged IRAP * S2	-0.013	0.501***	0.473***	0.488***	0.952***	0.005	
	(0.233)	(0.141)	(0.137)	(0.148)	(0.345)	(0.174)	
Lagged IRAP * S3	-0.313	0.255*	0.240*	0.273*	0.408	-0.241	
	(0.232)	(0.141)	(0.141)	(0.146)	(0.533)	(0.188)	
Lagged IRAP * S4	-0.729***	-0.128	-0.058	-0.131	0.458	-0.635***	
	(0.256)	(0.164)	(0.161)	(0.169)	(0.416)	(0.218)	
Lagged IRAP * DIT						-0.130***	
						(0.027)	
Lagged IRAP * S2 * Pre-crisis							0.007
							(0.218)
Lagged IRAP * S3 * Pre-crisis							-0.303
							(0.227)
Lagged IRAP * S4 * Pre-crisis							-0.795***
							(0.259)
Lagged IRAP * S1 * Post-crisis							-0.007
							(0.300)
Lagged IRAP * S2 * Post-crisis							0.091
							(0.241)
Lagged IRAP * S3 * Post-crisis							-0.088
							(0.262)
Lagged IRAP * S4 * Post-crisis							-0.156
							(0.258)
ROA	-0.956***	-0.934***	-0.917***	-0.942***	-0.863***	-0.930***	-1.220***
	(0.101)	(0.066)	(0.080)	(0.081)	(0.180)	(0.080)	(0.075)
ROA * Post-crisis							0.466***
							(0.118)
Size group dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size group dummies * Post-crisis							Yes
Growth group dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Growth group dummies * Post-crisis							Yes
Regional economic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional economic variables * Post-crisis							Yes
R-squared	0.522	0.523	0.503	0.522	0.484	0.508	0.525
Observations	4,095	5,339	5,277	4,684	752	5,436	5,436
Number of banks	387	485	491	379	125	504	504

*Note: ROA is Return on Assets. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. G1 is a dummy for bank-year observations which belong to the bottom quartile of the rate of growth of total assets. G2, G3 and G4 are groups of larger banks by rate of growth with G4 being the group in the top quartile of the distribution of the rate of growth of adjusted total assets. Pre-crisis is a dummy equal to one for the period 1998-2007. Post-crisis is a dummy equal to one for the period 2007-2011. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank- and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 6. Partial adjustment model of leverage

	Dependent variable: leverage				
	(1) OLS	(2) FE	(3) Diff GMM	(4) Sys GMM	(5) Sys GMM
ROA	-0.889***	-0.792***	-0.350	-0.773***	-0.716***
	(0.051)	(0.042)	(0.367)	(0.168)	(0.174)
Lagged leverage	0.903***	0.682***	0.569***	0.894***	0.910***
	(0.009)	(0.029)	(0.077)	(0.025)	(0.029)
Lagged IRAP rate	0.133***	0.184***	0.201***	0.140***	
	(0.035)	(0.056)	(0.056)	(0.035)	
IRAP * S1					0.229***
					(0.046)
IRAP * S2					0.160***
					(0.041)
IRAP * S3					0.125***
					(0.040)
IRAP * S4					0.049
					(0.040)
Constant	0.083***			0.090***	0.073***
	(0.009)			(0.023)	(0.026)
Size and growth dummies	Yes	Yes	Yes	Yes	Yes
Regional variables	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	-	-	-	-
R-squared	[0.937]	[0.753]			
Clustered by	-	Two ways	Bank	Bank	Bank
Observations	5,489	5,436	4,930	5,489	5,489
Number of banks	557	504	504	557	557
AR(1)			-3.266	-3.798	-3.754
AR(1) p-value			[0.001]	[0.000]	[0.000]
AR(2)			1.239	1.469	1.419
AR(2) p-value			[0.215]	[0.142]	[0.156]
Hansen			45.18	69.12	69.26
P-value Hansen test			[0.095]	[0.056]	[0.055]
IRAP long-run effect	1.371	0.579	0.466	1.321	
IRAP long-run effect (S1)					2.544
IRAP long-run effect (S2)					1.778
IRAP long-run effect (S3)					1.389
IRAP long-run effect (S4)					0.544

*Note: ROA is Return on Assets. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 7. The impact of regulatory constraints

Dependent variable: leverage					
	(1)	(2)	(3)	(4)	(5)
	FE	FE	FE	FE	FE
ROA	-0.936***	-0.934***	-0.936***	-0.936***	-0.875***
	(0.081)	(0.081)	(0.081)	(0.081)	(0.075)
Lagged IRAP rate	0.432***	0.419***	0.359***	0.359***	0.288**
	(0.130)	(0.130)	(0.127)	(0.127)	(0.130)
Lagged IRAP * S4	-0.531***	-0.509***	-0.449***	-0.449***	-0.389***
	(0.153)	(0.154)	(0.150)	(0.150)	(0.146)
Lagged Max leverage		0.129**		0.259***	0.283***
		(0.064)		(0.076)	(0.077)
Lagged Max leverage * S1			0.012	-0.247*	-0.251*
			(0.124)	(0.134)	(0.134)
Lagged Max leverage * S2			0.033	-0.227**	-0.225**
			(0.081)	(0.092)	(0.093)
Lagged Max leverage * S3			0.190**	-0.069	-0.051
			(0.078)	(0.080)	(0.080)
Lagged Max leverage * S4			0.259***		
			(0.076)		
Size group 2 (S2)	0.003*	0.003**	-0.016	-0.016	-0.020
	(0.002)	(0.002)	(0.125)	(0.125)	(0.129)
Size group 3 (S3)	0.006**	0.006**	-0.162	-0.162	-0.181
	(0.002)	(0.002)	(0.123)	(0.123)	(0.125)
Size group 4 (S4)	0.033***	0.032***	-0.204	-0.204	-0.209*
	(0.008)	(0.008)	(0.126)	(0.126)	(0.126)
Growth group 2 (G2)	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 3 (G3)	0.005***	0.005***	0.005***	0.005***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 4 (G4)	0.010***	0.010***	0.010***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln(GDP)	-0.006	-0.005	-0.006	-0.006	-0.008
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Ln(GDP per capita)	-0.127***	-0.117***	-0.112***	-0.112***	-0.109***
	(0.031)	(0.030)	(0.030)	(0.030)	(0.029)
Ln(employment ratio)	0.042	0.038	0.034	0.034	0.028
	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)
R-squared	[0.510]	[0.512]	[0.515]	[0.515]	[0.519]
Number of banks	504	504	504	504	464
Observations	5,436	5,436	5,436	5,436	5,059

*Note: ROA is Return on Assets. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. G1 is a dummy for bank-year observations which belong to the bottom quartile of the rate of growth of total assets. G2, G3 and G4 are groups of larger banks by rate of growth with G4 being the group in the top quartile of the distribution of the rate of growth of adjusted total assets. Pre-crisis is a dummy equal to one for the period 1998-2007. Post-crisis is a dummy equal to one for the period 2007-2011. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 8. Distance from the regulatory constraint

Dep. variable: distance from maximum leverage (Max leverage – leverage)						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	0.05	0.05	0.09	0.09	0.139	0.139
ROA	0.375	0.958***	0.798***	0.970***	0.937***	0.812***
	(0.233)	(0.086)	(0.121)	(0.115)	(0.101)	(0.154)
Lagged IRAP rate	0.001	-0.429*	0.204	-0.871***	-0.026	-1.298***
	(0.536)	(0.227)	(0.185)	(0.313)	(0.187)	(0.501)
Lagged IRAP * S2	0.286	-0.132	-0.264	-0.108	-0.240	-0.021
	(0.568)	(0.211)	(0.197)	(0.301)	(0.177)	(0.580)
Lagged IRAP * S3	0.178	0.074	-0.097	0.076	-0.110	0.590
	(0.562)	(0.221)	(0.199)	(0.314)	(0.191)	(0.496)
Lagged IRAP * S4	0.141	0.465*	-0.184	0.999***	0.113	1.302**
	(0.537)	(0.260)	(0.211)	(0.386)	(0.234)	(0.566)
Size group 2 (S2)	-0.015	0.000	0.010	-0.003	0.007	-0.009
	(0.030)	(0.010)	(0.010)	(0.015)	(0.009)	(0.028)
Size group 3 (S3)	-0.010	-0.015	-0.001	-0.021	-0.001	-0.054**
	(0.029)	(0.011)	(0.010)	(0.016)	(0.009)	(0.025)
Size group 4 (S4)	-0.006	-0.035***	0.002	-0.067***	-0.013	-0.092***
	(0.028)	(0.013)	(0.010)	(0.019)	(0.011)	(0.028)
Growth group 2 (G2)	0.001	-0.003***	-0.002*	-0.003***	-0.003***	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 3 (G3)	-0.000	-0.006***	-0.004***	-0.006***	-0.005***	-0.005***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 4 (G4)	-0.003	-0.010***	-0.007***	-0.011***	-0.009***	-0.012***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Ln(GDP)	-0.074**	0.004	-0.031	0.004	0.001	-0.068
	(0.030)	(0.027)	(0.027)	(0.041)	(0.027)	(0.063)
Ln(GDP per capita)	0.015	0.068**	0.032	0.108**	0.062*	0.037
	(0.049)	(0.033)	(0.036)	(0.049)	(0.032)	(0.065)
Ln(employment ratio)	0.075	-0.029	0.065**	-0.085*	0.004	-0.046
	(0.046)	(0.030)	(0.030)	(0.048)	(0.031)	(0.076)
R-squared	[0.409]	[0.402]	[0.422]	[0.411]	[0.402]	[0.396]
Observations	732	4,704	2,859	2,577	4,340	1,096
Number of banks	69	435	251	253	380	124

*Note: Distance from maximum leverage is calculated as leverage minus maximum leverage. ROA is Return on Assets. S1 is a dummy equal to one if the bank-year observation belongs to the bottom quartile of the adjusted total asset distribution. S2, S3 and S4 indicate larger groups with S4 representing the banks in the top quartile of the size distribution. G1 is a dummy for bank-year observations which belong to the bottom quartile of rate of growth of total assets. G2, G3 and G4 are groups of larger banks by rate of growth with G4 being the group in the top quartile of the distribution of the rate of growth of adjusted total assets. Pre-crisis is a dummy equal to one for the period 1998-2007. Post-crisis is a dummy equal to one for the period 2007-2011. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 9. Controlling for the rate of growth of total assets

Dependent variable: leverage						
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
ROA	-0.931***	-0.931***	-0.934***	-0.936***	-0.933***	-0.930***
	(0.081)	(0.081)	(0.081)	(0.082)	(0.082)	(0.082)
Lagged IRAP rate		0.392***	0.587***			
		(0.152)	(0.226)			
Lagged IRAP * S2			0.015			
			(0.175)			
Lagged IRAP * S3			-0.220			
			(0.189)			
Lagged IRAP * S4			-0.596***			
			(0.217)			
Lagged IRAP * G1	0.392***					
	(0.152)					
Lagged IRAP * G2	0.320***	-0.072	-0.039			
	(0.122)	(0.092)	(0.086)			
Lagged IRAP * G3	0.192	-0.200*	-0.155			
	(0.120)	(0.106)	(0.105)			
Lagged IRAP * G4	0.139	-0.253**	-0.211*			
	(0.141)	(0.126)	(0.124)			
Lagged IRAP * S123*G123				0.296**	0.295**	0.253**
				(0.120)	(0.118)	(0.117)
Lagged IRAP * S123*G4				0.322**	0.320**	0.271*
				(0.148)	(0.147)	(0.163)
Lagged IRAP * S4*G4				0.035	0.051	0.033
				(0.178)	(0.176)	(0.166)
Lagged IRAP * S4*G123				-0.013	0.000	-0.037
				(0.147)	(0.145)	(0.147)
Lagged Maximum leverage					0.144**	
					(0.065)	
Lagged Maximum leverage * S123*G123						0.072
						(0.071)
Lagged Maximum leverage * S123*G4						0.150*
						(0.078)
Lagged Maximum leverage * S4*G123						0.260***
						(0.084)
Lagged Maximum leverage * S4*G4						0.336***
						(0.083)
Size and growth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional variables	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	[0.507]	[0.507]	[0.512]	[0.506]	[0.509]	[0.511]
Observations	5,436	5,436	5,436	5,436	5,436	5,436
Number of banks	504	504	504	504	504	504

*Note: All regressions are run using a within-group estimator. ROA is Return on Assets. S123 is a dummy for the smallest 3 groups of banks by size (S1, S2, and S3). S4 indicates the group of largest banks by assets. G123 is a dummy for the 3 smallest groups of banks by the rate of growth of total assets (G1, G2, and G3). G4 is the group of largest banks by rate of growth. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 10. Controlling for the rate of growth of assets

Dependent variable: distance from maximum leverage (max leverage – leverage)						
	(1)	(2)	(3)	(4)	(5)	(6)
	<=0.05	>0.05	<=0.09	>0.09	<=0.139	>0.139
ROA	0.378	0.958***	0.797***	0.968***	0.938***	0.800***
	(0.235)	(0.087)	(0.121)	(0.117)	(0.101)	(0.155)
Lagged IRAP rate	0.185	-0.353**	0.067	-0.736***	-0.103	-1.004***
	(0.145)	(0.142)	(0.120)	(0.204)	(0.118)	(0.360)
Lagged IRAP * S123 * G4	0.009	-0.055	0.013	-0.032	0.036	-0.319
	(0.164)	(0.132)	(0.114)	(0.201)	(0.111)	(0.316)
Lagged IRAP * S4 * G4	0.033	0.076	-0.097	0.307	0.032	0.456
	(0.225)	(0.188)	(0.142)	(0.322)	(0.151)	(0.498)
Lagged IRAP * S4 * G123	-0.018	0.194	-0.098	0.437*	0.041	0.823**
	(0.143)	(0.143)	(0.111)	(0.250)	(0.116)	(0.405)
Size group 2 (S2)	-0.000	-0.005***	-0.003	-0.007**	-0.004**	-0.009
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.006)
Size group 3 (S3)	-0.001	-0.010***	-0.006**	-0.015***	-0.006**	-0.025***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)	(0.007)
Size group 4 (S4)	0.001	-0.020***	-0.002	-0.039***	-0.008	-0.070***
	(0.009)	(0.008)	(0.006)	(0.013)	(0.006)	(0.022)
Growth group 2 (G2)	0.001	-0.003***	-0.002*	-0.004***	-0.003***	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 3 (G3)	-0.000	-0.006***	-0.004***	-0.006***	-0.005***	-0.005***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 4 (G2)	-0.004	-0.007	-0.007	-0.008	-0.010*	0.004
	(0.008)	(0.006)	(0.006)	(0.009)	(0.005)	(0.015)
Ln(GDP)	-0.071**	0.005	-0.032	0.008	-0.000	-0.068
	(0.029)	(0.027)	(0.027)	(0.042)	(0.027)	(0.060)
Ln(per capita GDP)	0.015	0.062*	0.028	0.097**	0.058*	0.032
	(0.049)	(0.033)	(0.036)	(0.049)	(0.032)	(0.065)
Ln(employment ratio)	0.077	-0.024	0.065**	-0.075	0.007	-0.044
	(0.048)	(0.030)	(0.030)	(0.049)	(0.031)	(0.077)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	[0.409]	[0.400]	[0.421]	[0.405]	[0.401]	[0.390]
Observations	732	4,704	2,859	2,577	4,340	1,096
Number of banks	69	435	251	253	380	124
Number of observations in S123-G123	364	2,738	1,459	1,643	2,444	658
Number of observations in S123-G4	176	837	600	413	779	234
Number of observations in S4-G123	148	865	602	411	849	164
Number of observations in S4-G4	62	299	231	130	305	56
Average total assets (millions of euros)	297	282	318	247	298	228
Standard deviation	302	396	439	311	403	298
Percentage of total BCCs' assets	14%	86%	59%	41%	84%	16%

*Note: All regressions are run using a within-group estimator. Distance from maximum leverage is calculated as leverage minus maximum leverage. ROA is Return on Assets. S123 is a dummy for the smallest 3 groups of banks by size (S1, S2, and S3). S4 indicates the group of largest banks by assets. G123 is a dummy for the 3 smallest groups of banks by the rate of growth of total assets (G1, G2, and G3). G4 is the group of largest banks by rate of growth. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent. As regards characteristics of banks in column (6) see Table A10.*

Table 11. Tax effect and maximum leverage effect on leverage - varying by distance from the constraint

Dependent variable: leverage						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	<=0.05	<=0.09	<=0.139	>0.05	>0.09	>0.139
ROA	-0.440*	-0.820***	-0.955***	-0.970***	-0.981***	-0.808***
	(0.237)	(0.107)	(0.095)	(0.080)	(0.113)	(0.145)
Lagged IRAP rate	-0.108	0.032	0.158	0.355***	0.623***	0.912***
	(0.114)	(0.112)	(0.110)	(0.134)	(0.187)	(0.299)
Lagged IRAP * S123 * G4	-0.177	-0.009	-0.051	0.046	0.006	0.258
	(0.222)	(0.128)	(0.126)	(0.149)	(0.217)	(0.322)
Lagged IRAP * S4 * G4	0.070	-0.093	-0.161	-0.227	-0.267	-0.412
	(0.194)	(0.139)	(0.156)	(0.185)	(0.328)	(0.430)
Lagged IRAP * S4 * G123	-0.084	0.036	-0.168	-0.314**	-0.596**	-0.824*
	(0.152)	(0.103)	(0.116)	(0.146)	(0.254)	(0.422)
Lagged Maximum leverage * S123*G123	0.368***	0.177**	0.110*	0.061	0.018	-0.038
	(0.093)	(0.072)	(0.066)	(0.078)	(0.112)	(0.166)
Lagged Maximum leverage * S123*G4	0.410***	0.240***	0.136*	0.148*	0.130	0.152
	(0.111)	(0.078)	(0.072)	(0.083)	(0.125)	(0.191)
Lagged Maximum leverage * S4*G123	0.191**	0.265***	0.338***	0.286***	0.405***	-0.136
	(0.093)	(0.081)	(0.080)	(0.092)	(0.151)	(0.223)
Lagged Maximum leverage * S4*G4	0.213*	0.334***	0.362***	0.373***	0.504***	0.047
	(0.120)	(0.089)	(0.080)	(0.085)	(0.141)	(0.227)
Size and growth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional variables	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	[0.519]	[0.567]	[0.544]	[0.535]	[0.530]	[0.510]
Observations	732	2,859	4,340	4,704	2,577	1,096
Number of banks	69	251	380	435	253	124

*Note: All regressions are run using a within-group estimator. Distance from maximum leverage is calculated as leverage minus maximum leverage. ROA is Return on Assets. S123 is a dummy for the smallest 3 groups of banks by size (S1, S2, and S3). S4 indicates the group of largest banks by assets. G123 is a dummy for the 3 smallest groups of banks by the rate of growth of total assets (G1, G2, and G3). G4 is the group of largest banks by rate of growth. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Table 12. Asymmetric effects of tax hikes and tax cuts

	Dep. var: leverage	Dep. var: distance from maximum leverage (max leverage – leverage)			
	(1)	(2)	(4)	(3)	(5)
	All sample	<=0.09	<=0.139	>0.09	>0.139
ROA	-0.935***	0.796***	0.935***	0.967***	0.794***
	(0.081)	(0.121)	(0.101)	(0.117)	(0.159)
Lagged IRAP rate	0.279**	0.060	-0.072	-0.654***	-0.890**
	(0.124)	(0.120)	(0.122)	(0.204)	(0.349)
Lagged IRAP * dummy: tax cut	-0.006	0.014	0.017	0.017	0.055
	(0.025)	(0.027)	(0.023)	(0.035)	(0.052)
Size group 2 (S2)	0.003	-0.003	-0.004**	-0.007**	-0.008
	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)
Size group 3 (S3)	0.004*	-0.006**	-0.006**	-0.015***	-0.025***
	(0.002)	(0.003)	(0.003)	(0.005)	(0.007)
Size group 4 (S4)	0.007**	-0.007**	-0.007**	-0.019***	-0.029***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.010)
Growth group 2 (G2)	0.003***	-0.002*	-0.003***	-0.003***	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Growth group 3 (G3)	0.005***	-0.004***	-0.005***	-0.006***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth group 4 (G2)	0.010***	-0.007***	-0.009***	-0.011***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Ln(GDP)	-0.009	-0.032	0.002	0.013	-0.048
	(0.024)	(0.027)	(0.026)	(0.042)	(0.062)
Ln(per capita GDP)	-0.122***	0.030	0.059*	0.094*	0.024
	(0.032)	(0.036)	(0.033)	(0.049)	(0.066)
Ln(employment ratio)	0.037	0.061*	0.004	-0.073	-0.037
	(0.030)	(0.032)	(0.032)	(0.048)	(0.074)
R-squared	0.506	0.421	0.400	0.401	0.384
Observations	5,436	2,859	4,340	2,577	1,096
Number of banks	504	251	380	253	124
No. of tax cuts (% of total observations)	1,656 (30%)	891 (31%)	1,365 (31%)	765 (29%)	291 (26%)
No of tax increases (% of total observations)	361 (7%)	209 (7%)	297 (7%)	152 (6%)	64 (6%)

*Note: All regressions are run using a within-group estimator. Distance from maximum leverage is calculated as leverage minus maximum leverage. ROA is Return on Assets. S1 is a dummy for the smallest group of banks by size. S2, S3 and S4 indicate larger groups with S4 representing the largest group of banks by assets. G1 is a dummy for the smallest group of banks by the rate of growth of total assets. G2, G3 and G4 are groups of larger banks by rate of growth with G4 being the group with the largest rate of growth. All regressions include year-fixed effects. All regressions include year-fixed effects. Standard errors are in parentheses, robust to general heteroscedasticity and corrected for clustering at the bank and region-year level. Reported R-square is the within R-squared for the within-group estimator. *** Significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.*

Appendix

A1-A2. The evolution of the IRAP tax base for banks

	A1. The introduction of IRAP
Year	
1998	• Tax base = value added (net income type); labour costs are not deductible. • IRAP tax base calculated according to the rules applied for corporate income tax (CIT). • Tax base equal to: + Interest received and similar income - Interest expenses and similar expenses + Commission income - Commission expenses + Net income from financial operations + Other income - Other administrative expenses - Loan losses and devaluation - Capital allowances for fixed and intangible assets
	A2. IRAP tax base: modifications
Year	
2005	• Deductions allowed if there is an increase in the number of permanent workers • Loan losses and devaluation no longer deductible
2007	• Extra deductions allowed for the cost of labour, promoting open-end jobs • Deductibility of social security contributions on open-end jobs.
2008	• Modification of tax base: CIT rules no longer apply; financial statement and balance-sheet data employed for the calculation of the IRAP tax base. • Tax base equal to: + Interest received and similar income - Interest expenses and similar expenses (only 97% of interest expenses deductible) + Commission fees - Commission costs incurred + 50% of received dividends and similar income + Net trading income + Net hedging income + Gains (- losses) on disposal or re-acquisition of credits, financial assets and liabilities + Net result from financial assets and liabilities measured at fair value - 90% of capital allowances for fixed and intangible assets - 90% of other administrative expenses
2009	• Only 96% of interest expenses deductible
2013	• Loan losses and devaluations of loans become deductible

A3. List of Regions

ABRUZZO	BASILICATA	CALABRIA
CAMPANIA	EMILIA ROMAGNA	FRIULI-VENEZIA GIULIA
LAZIO	LIGURIA	LOMBARDIA
MARCHE	MOLISE	PIEMONTE
PUGLIA	SARDEGNA	SICILIA
TOSCANA	TRENTINO	UMBRIA
VALLE D'AOSTA	VENETO	

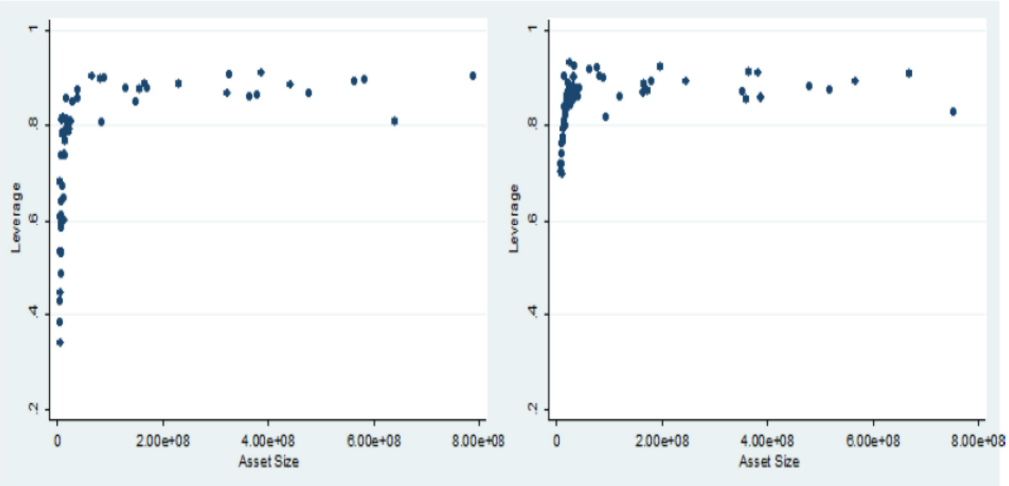
Note: There are 20 regions in Italy. The regions are listed alphabetically.

A4. Entries and Exits by Year

Entry year	Number of entries	Number of exits
1998	554	43
1999	11	47
2000	13	33
2001	12	19
2002	6	16
2003	2	9
2004	3	6
2005	3	4
2006	2	3
2007	7	10
2008	1	19
2009	1	9
2010	1	4
2011	1	395
Total number of banks	617	617

Note: The number of entries records the number of banks that were first observed that year. Since the data starts from 1998, 544 were observed in 1998 for the first time, but are likely to have existed prior to 1998. The number of exits in each year reflects the number of banks whose last appearance in the data was in that year. Since 2011 is the last year in the sample period, 395 banks are observed last in 2011. However, most of them continued to operate even after 2011.

A5. Leverage of First year And Second Year Observations of Banks That Entered After 1998



Note: The right panel includes the first year observations of the banks that entered the dataset after 1998. The left panel includes the second year observations of the same group of banks. The graphs suggests that the banks have unusually low leverage in their first years.

A6. IRAP rates by region (1999-2011)

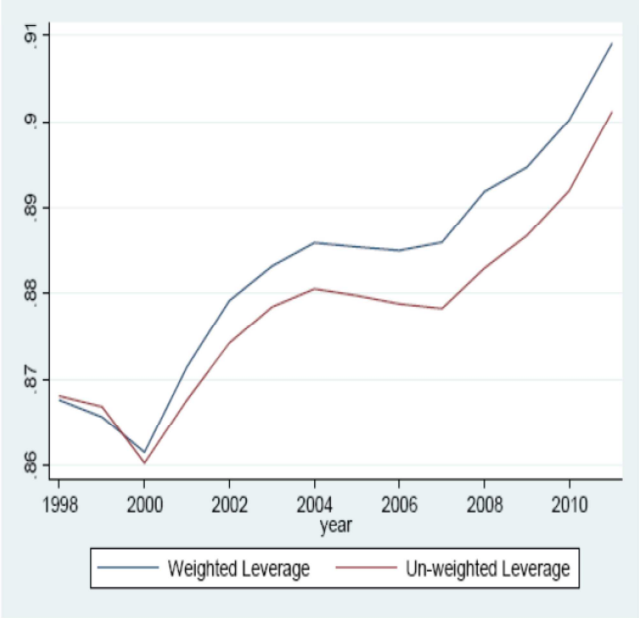
	% total obs.	IRAP rates															
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Hikes	Cuts	Total
Abruzzo	2.3	5.4	5.4	5	4.75	4.25	4.25	4.25	5.25	5.25	4.82	4.82	4.82	5.57	2	4	6
Basilicata	1.5	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.90	3.90	3.90	4.65	1	4	5
Calabria	5.8	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.90	4.82	4.97	5.72	3	4	7
Campania	7.7	5.4	5.4	5	4.75	4.25	4.25	4.25	5.25	5.25	4.82	4.82	4.97	5.72	3	4	7
Emilia-Romagna	6.3	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	5.25	4.82	4.82	4.82	5.57	2	4	6
Friuli-Venezia Giulia	3.3	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.90	3.90	3.90	4.65	1	4	5
Lazio	6.6	5.4	5.4	5	5.75	5.25	5.25	5.25	5.25	5.25	4.82	4.82	4.97	5.57	3	3	6
Liguria	0.7	5.4	5.4	5	4.75	4.25	4.25	4.25	5.25	5.25	4.82	4.82	4.82	5.57	2	4	6
Lombardia	9.9	5.4	5.4	5	5.75	5.25	5.25	5.25	5.25	5.25	4.82	4.82	4.82	5.57	2	3	5
Marche	3.6	5.4	5.4	5	5.75	5.15	5.15	5.15	5.15	5.15	4.73	4.73	4.73	5.48	2	3	5
Molise	0.8	5.4	5.4	5	4.75	4.25	4.25	5.25	5.25	5.25	4.82	4.82	4.97	5.72	3	4	7
Piemonte	2.1	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	5.25	4.82	4.82	4.82	5.57	2	4	6
Puglia	4.3	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	4.82	4.82	4.82	5.57	2	3	5
Sardegna	0.3	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.90	3.90	3.90	4.65	1	4	5
Sicilia	7.4	5.4	5.4	5	5.25	5.25	5.25	5.25	5.25	5.25	4.82	4.82	4.82	5.57	2	2	4
Toscana	6.6	5.4	5.4	5	4.75	4.40	4.40	4.40	4.40	5.25	4.82	4.82	4.82	5.57	2	4	6
Trentino - Alto Adige	21	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.44	3.40	3.19	4.65	1	6	7
Umbria	1	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	4.82	4.82	4.82	5.57	2	3	5
Val d'Aosta	0.5	5.4	5.4	5	4.75	4.25	4.25	4.25	4.25	4.25	3.90	3.90	3.90	4.65	1	4	5
Veneto	8.4	5.4	5.4	5	4.75	4.25	5.25	5.25	5.25	5.25	4.82	4.82	4.82	5.57	2	4	6
Total	***100***														***39***	***75***	***114***

A7. The Number of Bank-Year Observations across Size Groups and Growth Groups

	Growth group 1	Growth group 2	Growth group 3	Growth group 4
Size group 1	431	337	243	362
Size group 2	387	353	325	308
Size group 3	320	315	395	343
Size group 4	235	368	410	361

Note: Total number of bank-year observations is 5493.

A8. Weighted and Un-weighted Average of Leverage by Year



Note: Both the weighted average of leverage and un-weighted average of leverage increase over time.

A9. Consolidation in the Italian banking system

Year	Size group 1		Size group 2		Size group 3		Size group 4		Banks per year	Average size (millions of euros)
	Banks	per year	Banks	per year	Banks	per year	Banks	per year		
1999	221	44	124	25	109	22	48	10	502	156
2000	181	40	120	26	106	23	50	11	457	171
2001	164	38	110	25	107	25	53	12	434	197
2002	129	30	118	28	104	24	77	18	428	221
2003	105	25	121	29	112	26	86	20	424	247
2004	99	24	111	26	112	27	99	24	421	268
2005	87	21	109	26	112	27	109	26	417	288
2006	79	19	108	26	111	27	117	28	415	307
2007	73	18	105	25	106	26	131	32	415	330
2008	70	17	97	24	100	25	141	35	408	362
2009	61	15	87	22	101	26	147	37	396	385
2010	52	13	83	21	97	25	155	40	387	409
2011	51	13	77	20	96	25	161	42	385	424
Total	1,372		1,370		1,373		1,374		5,489	284

A10. Characteristics of banks in Table 10, column (6)

	Adjusted total assets (millions of euros)	Leverage	Maximum leverage	Distance from maximum leverage	Riskiness (RWAs/total assets)
Group S123-G123					
Mean	111	84	94.7	11.2	58.1
S.D.	78	5	1.2	5.1	16.7
N	658	658	658	658	658
Group S123-G4					
Mean	103	87	94.9	7.6	57.9
S.D.	89	4	1.2	4.3	13.3
N	234	234	234	234	234
Group S4-G123					
Mean	652	86	94.6	8.3	68.2
S.D.	310	4	1.0	3.9	13.5
N	164	164	164	164	164
Group S4-G4					
Mean	894	87	94.3	6.9	73.6
S.D.	424	4	1.1	3.9	11.6
N	56	56	56	56	56