ALTERNATIVE FINANCING AND INVESTMENT IN INTANGIBLES: EVIDENCE FROM ITALIAN FIRMS

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Abstract

This paper uses the Italian 2012 reform that introduced minibonds, a financial instrument specifically designed for SMEs, to check whether more accessible market-based finance promotes investment in intangibles. We apply a propensity score matching to address selection bias, run diff-in-diff estimates over 1,454 different samples to test our hypotheses, and use a meta-analysis to summarize the results. We find that minibond-issuing firms increase investments in intangible assets, a component difficult to finance via bank credit, more than other firms and investments in tangibles. Two mechanisms are at work: minibond issuances increase financial resources available to the firm (*financial effect*) and, above all, signal an improvement in business practices (*reputational effect*). These effects are more intense for smaller, more opaque, and bank-dependent firms. Our results are not affected by model dependence or endogeneity issues and are robust to different specifications.

JEL Classification: G10; G23; G32; 030
Keywords: intangibles; corporate bonds; bank dependence; minibonds; market-based finance; SMEs; investment

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1. Introduction

This paper examines how the introduction of minibonds, a market-based financial instrument alternative to bank loans, affects firms' investment in intangible assets in Italy.

The last decades have witnessed the transition of developed countries from a traditional production system to the so-called knowledge economy, i.e. an economic system in which the production of goods and services levers intellectual capabilities more than physical capital and natural resources (Powell and Snellman, 2004). Consistently with this trend, the attention of scholars has shifted from tangible to intangible assets, and a growing literature has recognized the importance of the latter as a factor of economic growth. Since the 1970s, the expansion of R&D, customer relationships, managerial organization, logistic structure, employees training, human capital, and trademarks has been crucial for economic performance at the country and the firm levels (Corrado et al., 2009; Corrado and Shulten, 2010). Investments in intangibles spur productivity (Marrocu et al., 2012; Brynjolfsson et al., 2021), profitability (Orhangazi, 2019), and broadly speaking, economic growth (Corrado et al., 2013).

The recent development of ICT has raised new concerns about intangible investments. As asymmetric information tends to be larger for intangible assets than tangible ones, the Modigliani-Miller theorem does not hold, and firm investments are sensitive to the source of financing. Banks are typically reluctant to finance intangible investments because activities such as R&D, software purchases, or workers training are challenging to evaluate and re-sell in case of default. As they serve poorly as collateral for traditional bank loans, the cost of borrowing increases for intangible-intensive firms that are the companies with the highest growth potential (Cecchetti and Schoenholtz, 2018). Recently, banks have shifted their portfolio allocation away from commercial loans because of the upward trend in intangible investments (Dell'Ariccia et al., 2021). It reveals a growing reluctance of banks to provide credit to these firms. To relax the financial constraint on intangible investments, firms have recurred to alternative sources of financing such as internal liquidity (Bates et al., 2009),

equity issuance (Brown et al., 2009), tangible assets sales (Borisova and Brown, 2013), and liquidity injected by acquirers (Stiebale and Wößner, 2020).

Credit issues are more severe in well-known bank-based countries such as Italy. Traditionally, Italian firms have limited access to capital markets, and banks detain about 70% of domestic financial assets (Bugamelli et al., 2018). It has caused investment stagnation and low economic performance. Italian firms find going public too costly because of the low participation of institutional investors, the incentives to buy government bonds, and individual risk aversion. This situation is accompanied by a limited financial capacity of the Italian firms. Indeed, they are typically small, opaque, and family-owned (Carpenter and Rondi, 2006). The factors influencing the equity market also determine the underdevelopment of other segments, such as corporate bonds, venture capital, and private equity. Overall, innovative firms are particularly penalized (Giudici and Paleari, 2000; Magri 2009; Accornero et al., 2018). In a context in which investment in intangible assets determines comparative advantages, the excessive reliance of Italian firms on bank loans also undermines competitiveness and it becomes a comparative disadvantage at the country level.

In this paper, we use accounting data from the AIDA dataset by Burau Van Dijk to investigate how the investments in intangible assets react after a firm gains access to alternative market-based financial instruments. Scholars have analyzed the impact of alternative sources of financing on firms' investments in intangibles in Italy. For example, Bronzini et al. (2020) explore the potential role private equity and venture capital play in innovation. Here, we exploit the 2012 Italian reform that introduced a financial instrument called minibond and designed for helping firms to collect funds on capital markets as a quasi-natural experiment to analyze the effect of access to alternative finance on intangible investment. Issuing minibonds bridges the gap between bank loans and capital market financing. Anecdotal evidence suggests that minibonds are the first step towards more sophisticated capital markets. For example, Gelsis, a Southern Italian biotech start-up company, issued its first minibond in 2020. After getting acquainted with capital markets, it went public on the New York

Stock Exchange in 2022. Papers on minibonds in Italy have focused on the financial aspects from the firm or bank perspectives. For instance, Altman et al. (2020) find that minibond issuers show better *ex-ante* risk profiles than other Italian small-medium enterprises (SMEs, henceforth). Instead, Ongena et al. (2021) investigate the impact of issuing minibonds on the bank loan conditions after the issuance. They implement a matching procedure to remove potential selection bias and find that minibond issuers obtain lower interest rates on same-maturity loans than other firms. It indicates a higher bargaining power of firms that issued minibonds.

In this paper, we focus on the real effects of issuing minibonds and analyze how firms react to the exposure to a newly market-based instrument in terms of investments in intangible assets. As we move from financial aspects to the real economy, results become more general, complex, and relevant for policymakers. We expect that the Modigliani-Miller theorem does not hold due to asymmetric information, and minibonds promote investments in intangible assets. This is our *financial hypothesis*. It merely considers minibond issuances as new liquidity that releases firms' financial constraints in intangible investments. However, as we observe minibond issuances but not their values, firms issuing minibonds could invest more in intangibles because the issuance certificates that the firm is more mature, sophisticated, and reliable. If minibonds signal a lower level of risk, they can attract the intermediaries that were previously reluctant to finance innovative firm projects such as intangible investments. The signalling effect represents our *reputational hypothesis.* We disentangle it from the financial effect by comparing single and multiple issuances of minibonds, respectively. Under the assumption that issuances are independent events, the financial effect is, on average, proportional to the number of issuances, whereas the reputational effect concentrates on the first issuance. Alternatively, if minibonds are part of a more general business strategy, we can identify reputation by checking the reaction of intangible investments to their first issuance over different maturities. An increasing positive gap between long- and short-term impacts is consistent with a reputational effect because reputation builds gradually, whereas initially binding financial constraints weaken with minibond issuances. Finally, we consider the impact of asymmetric information through

firm size and bank dependence. If information asymmetries are larger for small bank-dependent firms, then these firms should benefit more from issuing minibonds. We call it the *heterogeneity hypothesis*.

Our empirical strategy consists of three steps. First, in a similar vein to Ongena et al. (2021), we apply a Propensity Score Matching (PSM, henceforth) to deal with the selection bias of the firms issuing minibonds and remove endogeneity. The procedure regresses a minibond issuance dummy on observable firm characteristics, assigns a score indicating the probability of issuing minibonds to each firm, and matches treated firms to the most similar untreated one(s). We run several PSM regressions to avoid model dependence and discretion (King and Nielsen, 2019). In detail, we obtain 1,454 pruned samples of treated and *ex-ante* similar control firms by combining the determinants of minibond-issuing firms used in the economic literature and the criteria adopted in the public calls for minibond issuances. Unlike Ongena et al. (2021), in the second step of our analysis, we focus on the investment activity, not the financial profile, and rely on a larger and longer dataset. For each sample generated by the PSM, we run diff-in-diff estimates to test (i) whether issuing minibonds has facilitated the financing of intangible investments (*financial hypothesis*), (ii) what the effect of multiple issuances and the long-run effect of one issuance are (*reputational hypothesis*), and (iii) whether this relationship is affected by other factors (*heterogeneity hypothesis*). In the last step, we apply a meta-analysis random-effects model to summarize the results obtained from 1,454 different samples.

Our results show that minibonds effectively relax the financial constraint of Italian firms and promote investments in intangible assets. Intangible investments increase less than proportionally with the number of minibond issuances, thus suggesting a relevant reputational effect at work. We find a more intense effect for smaller, unlisted and bank-dependent firms. Intensifying investments in intangibles is crucial for recovering from the Covid-19 economic turmoil and addressing the digital and ecological transitions that challenge the global economy. In this context, a more diversified financial system better supports the economy. If enhancing access to (alternative) market-based

financial instruments in bank-based economies is beneficial for investments in intangibles, there is a potential for policy interventions.

The paper is organized as follows. Section 2 introduces the institutional background of the reform. The description of the data appears in Section 3. Section 4 presents our empirical strategy and our testable hypothesis. The main findings are discussed in Section 5, while additional results are reported in section 6. Our robustness analysis is presented in section 7. Finally, section 8 concludes.

2. Institutional framework

In 2008, the European Union called for a change in the SMEs' financing policy. It endorsed the European "Small Business Act" to facilitate SMEs' access to finance (see communication from the Commission to the other bodies).[1] Since then, heterogeneous markets of similar financial instruments have developed in Europe. For example, in February 2010, the London Stock Exchange launched a platform within the main market in which small enterprises that cannot access the wholesale market can issue bonds tradable in units as small as £100 and no greater than £10,000. In the same year, the Stuttgart Börse in Germany created Bondm, a trading platform for instruments similar to Italian minibonds. Even though the German market suffered from some defaults at the beginning of the experiment, the number of issuances has increased significantly in 2020 compared to the previous years (Politecnico di Milano, 2020). Similar instruments were introduced in France and Spain.

The Italian Legislator introduced minibonds in 2012 as new debt security designed to finance the SMEs that have not gone public.[2] Previously, the general provision on the issuance of bonds was limited to listed companies. Law Decree 83/2012 and Law 134/2012 relaxed this constraint by allowing unlisted firms to issue bonds, with the only exclusions of banks and microenterprises. Later, regions implemented the law at the local level, and minibonds were included in the existing normative

[1] https://eur-lex.europa.eu/...CELEX:52008DC0394

[2] SMEs are defined as firms with the annual turnover between 2 and 50 million euro, and the number of employees smaller than 250 or total assets smaller than 43 million euro (and at least 10 employees); see European Union's recommendation 2003/361/CE.

framework. Art. 46 of *Testo Unico Bancario* (amended by Law Decree 145/2013 and Law 9/2014) provides banking privileges to movable assets suitable for business operations and allows companies to use minibonds as collateral for loans. Law Decree 145/2013 also reduces securitization costs for bonds and similar instruments, and it extends the guarantees provided by the Ministry for Economic Development to asset management companies that finance minibond-issuing companies through *Fondo Garanzia PMI* (art. 13, paragraph 6-bis).

Although the Legislator aimed to facilitate minibond issuances, he was concerned about SMEs having uncontrolled, unappropriated, or untransparent behavior. Therefore, he called for external financial experts to manage the issuance process. In particular, he required that the issuance of SME minibonds is subject to the supervision of a sponsor such as a bank or an asset management company. The sponsor must retain at least 5 percent of the overall value if the minibond issuance is smaller than 5 million euros, at least 3 percent if it is between 5 and 10 million euros, or at least 2 percent for issuances larger than 10 million euros. Furthermore, the sponsor is obligated to report if the amount of financial bills in circulation issued by a business is larger than its most recent total assets and assigns a credit score to the issuer on a 5-point scale (i.e. excellent, good, satisfactory, poor, negative). Minibond issuances are classified as having a high, standard, or low level of risk according to the credit score and the quality of the other warranties.[3]

The rationale for giving SMEs access to capital markets is to set an additional source other than bank loans to finance specific investments, refinance existing ones, or implement particular development projects. Minibonds are not investment-specific, and firms could use them for general financing as well as innovative or climate change projects. However, the Milan Stock Exchange has stressed that they are not meant to relieve the negative consequences of crises or support troubled firms.[4] They are intended to encourage investment in intangible assets. In 2013, *Borsa Italiana*

[3] The procedure is described in https://www.gazzettaufficiale.it/eli/id/2012/08/11/12A08941/sg
[4] See Milan stock exchange at https://www.borsaitaliana.it/notizie/focus-small-cap/strumenti/cosa-sono-i-minibond.htm (in Italian).

created *ExtraMOT*, a specific online trading platform for minibonds designed to remove as many barriers as possible and significantly reduce costs for issuing firms. Data show that minibonds are not used to finance big investment projects: in 2019, 86.7% of the minibond issuances was smaller than 50 million euro, and their average maturity was 5.3 years (Politecnico di Milano, 2019). Subscribers are typically institutional investors, i.e. banks, investment companies, asset management firms, and other financial intermediaries (see Art. 107 of *Testo Unico Bancario*).

Regional administrations introduced minibonds at the local level starting in 2014. Minibond policies are similar across regions, and they are aimed at promoting both firm-specific projects or policies of regional and national interest. For example, Apulia has focused on firms' internationalization, while Veneto has sought the relaunch of tourism facilities. In other words, regional governments used minibonds as a financial tool of fiscal policy to stimulate the economy and encourage growth.

Initially, issuing firms had to apply for their individual issuance. Regional administrations usually published a public call for interest with specific (although recurrent) requirements. For instance, Apulia listed six criteria for eligibility: (*i*) only SMEs headquartered in the region can apply; (*ii*) applicants cannot be listed companies or businesses in crisis; (*iii*) the minimum annual sales are 5 million euro; (*iv*) Ebitda over sales is larger than 4 percent; (*v*) Net Financial Position (NFP) over EBITDA is lower than 5; (*vi*) NFP over Equity is smaller than 3.5; Finlombarda, the in-house financial entity of Lombardy, relaxed the SME clause (see (*i*) above) but the constraint continues to hold in practice despite the weaker regulation. In the application, firms must report their financial information and indicate the nature of the investment financed by minibonds. Some industries are often excluded, such as gambling, pornography, weapons and arms, and carbon-intensive industries that could cause air pollution.[5]

[5] For example, see Puglia Sviluppo for Apulia region (https://www.sistema.puglia.it/SistemaPuglia/fondominibond) and Finlombarda for Lombardy region (https://www.finlombarda.it/finanziamenti-e-servizi/finanziamenti/imprese/investimenti-in-sviluppo-aziendale/minibond).

More recently, local administrations extended minibond policies from individual issuances to portfolios of minibonds called regional basket bonds. These bonds consist of Asset-Backed Security (ABS) backed by a pool of minibonds issued by SMEs located in the same region. It creates greater diversification across firms that, in turn, reduces risk and increases the market appetite for this security. Moreover, Cassa Depositi e Prestiti, the leading Italian financial institution for long-term public investments, boosted the popularity of regional basket bonds among investors by acting as an anchor investor. Regional basket bonds are built on a geographical basis and, hence, they tend to be thematic. As a result, they are less diversified than expected. Overall, they have been successful (e.g. *Garanzia Campania Bond*, *Basket Bond Puglia*, and *ELITE Basket Bond Lombardia*). Detailed information on basket minibonds is not available. Hence, we cannot include them in our analysis as one single issuance and consider each firm issuing minibonds in the frame of a basket as an individual issuer. As basket minibonds became more popular after 2019, the bias on our results is marginal.

Using debt securities such as minibonds for SMEs is crucial for Italy because small firms represent 79% of employment and typically face binding financial constraints and limits to growth (Politecnico di Milano, 2020). Since the introduction of minibonds, 671 different firms have resorted to this instrument, issuing 1,504 minibonds. Most of the firms were SMEs (Politecnico di Milano, 2021). Table 1 reports details on the temporal evolution of the phenomenon. Minibond issuances and the number of issuing firms have progressively increased, reaching a peak in 2019. It documents that the reform is taking hold in the business community. Although the number of firms issuing multiple bonds in the same year is increasing too, the vast majority of firms has opted for single annual issuances. In other words, issuing minibonds remains a niche phenomenon still.

[Table 1 around here]

3. Data and summary statistics

Investments in Italy have stagnated in the last decades. In particular, compared with other large European economies, Italy has lagged behind in intangible investments. Moreover, the gap with the

United Kingdom, France, and Germany has continuously widened since the late 1990s (Figure 1, top graph). Results are similar in relative terms: rather tangible-oriented investments have led Italy to the second-lowest share of intangible over total investments after Spain (Figure 1, bottom graph). Many economists indicate the reduced investments in R&D, patents, and workforce training among the leading factors responsible for the weak economic performance and low labor productivity in Italy. However, since 2012, Italian firms have increased investments in intangible assets more quickly than those in other assets. The introduction of minibonds might have played a positive role even if access to this financial instrument is still not widespread. In other words, although the Italian economy remains heavily tangible-oriented, firms have recognized the benefits of intangible investments, and they are prone to invest in such activities more intensively and frequently than a few years ago.

[Figure 1 around here]

The primary reason for the Italian underinvestment in intangibles is that Italy is a bank-based economy. As we discussed in Section 1, banks serve poorly as a source of financing for intangible investments. This evidence holds for all developed economies, not only Italy. Figure 2 shows the negative correlation between bank reliance as measured by bank credit on stock market capitalization and the ratio of intangible over total investments among OECD countries using cross-sectional data (top-left graph) and panel data (top-right graph). The pattern is similar when bank reliance is scaled for the volume of corporate bond issuances (bottom graphs). This result is well-consolidated in the literature. The introduction of minibonds in Italy aims to reduce the excessive dependence of firms on bank loans and this might expand their investment capacity in intangible assets.

[Figure 2 around here]

We retrieve data from two sources to conduct our empirical analysis. First, balance sheet data on the universe of Italian firms come from the AIDA database (Bureau Van Dijk, 2021). They consist of around 17 million observations from the 1,680,967 firms that, by law, published their balance sheets from 2010 to 2019. We combine them with the firm-level data on minibond issuances

published in the annual reports of the *Osservatorio Minibond* project by Politecnico di Milano. Minibond data cover the period from their introduction in 2012 to the end of 2020, and they consist of 1,054 total issuances (960 annual issuances) from 671 different firms (Politecnico di Milano, 2021).[6] After merging the two datasets, we remain with 546 minibond-issuing firms, corresponding to 653 annual issuances.[7] As shown in Figure 3, our granular dataset confirms the negative correlation (ρ=-0.03) between the intangible orientation of the firm as measured by intangible over total investments and bank dependence as captured by bank loans over total financial debt.

[Figure 3 around here]

Table 2 compares the main features of the firms issuing minibonds with those of other Italian firms at the beginning and the end of our sample period. Minibonds were introduced in 2012, but we present 2014 as the initial year (Panel A) to allow the reform to be implemented at the regional level and become common knowledge, and 2019 as the final year (Panel B) to consider the most recent year with complete data. Overall, this time interval reduces missing values, and it is still sufficiently long to capture trends.

[Table 2 around here]

Firm features are statistically different through the two sub-samples. The mean comparison test (last column of Table 2) shows that firms issuing minibonds are larger, more profitable, more indebted, and own more liquid assets than other Italian firms. More interestingly, firms issuing minibonds in 2019 were also statistically different from other firms, i.e. systematic differences exist even after seven years from the reform when minibonds were common knowledge. The only exception is the ratio of intangible over total assets. It suggests that neither a large share of intangible assets compromises the firm's ability to apply for minibond issuance nor more experience with

[6] We group monthly data on minibond issuances at the annual level to be consistent with the balance sheet variables.
[7] Issuing multiple tranches of minibonds during the same year was frequent but since we work with annual data, we cannot consider each single tranche and we mainly accounted all minibond issuances in the same year as a single issuance. We lose observation because 1) the time coverage between minibonds data and accounting data is different, 2) there are missing values in the accounting data, and 3) the fuzzy matching algorithm fails to match some firms (e.g. typos).

intangible assets provides a comparative advantage. All other *ex-ante* firm features systematically influence the decision to resort to minibonds, resulting in a selection bias in our sample. We present our strategy to deal with this issue in the next section.

Minibond-issuing and other firms are also very different from institutional and geographical perspectives. For example, joint-stock companies are about 75% of the firms issuing minibonds and only 2% among other firms. As expected, firms less familiar with sophisticated financial instruments such as limited liability companies and cooperatives apply for minibonds much less frequently than joint-stock companies. Figure 4 shows the distribution of minibond-issuing and other firms by firm size and sectors. More than 45 percent of the former have less than 50 employees (small firms), and almost 80 percent have less than 250 employees (SMEs). These shares are 97 and 99 percent, respectively, among other firms (left graphs). The selection bias is probably due to a different distribution of firms across sectors. For instance, manufacturing firms are three times more frequent among minibond-issuing firms than other firms, but half less frequent among wholesale and retail trade, repair of motor vehicles, and construction ones (compare the right graphs).

[Figure 4 around here]

Geographically, 72% of minibond issuances are concentrated in the North (particularly in Lombardy), while the Center and the Mezzogiorno represent 15% and 13% of the issuances; see Figure 5 (left map). This regional distribution does not reflect the distribution of firms (right map). They issued proportionally more minibonds in the North of Italy and less in the Centre and Mezzogiorno despite the efforts made by local administrations to ease issuances in the latter areas. In particular, 27 percent of minibond issuances are in Lombardy and 20 percent in Veneto (both Northern regions) against a share of total firms of 20 percent and 8 percent, respectively. Significant discrepancies in the Centre and Mezzogiorno are in Lazio, Campania, Apulia, and Sicily. This pattern is in line with the heterogeneity in the Italian regional development (Fratianni and Marchionne, 2012).

[Figure 5 around here]

In brief, as minibond-issuing firms have specific firm features, show preferred institutional settings, and are geographically concentrated, the subsample of firms issuing minibonds is affected by selection bias. It negatively affects results if not properly handled.

4. Empirical strategy

We apply the PSM by Rosenbaum and Rubin (1983) to remove selection bias and provide a robust counterfactual to test our hypotheses. This procedure summarizes a set of observable variables into a single score through a binary regression. Then, it uses the score to select a control group of firms *ex-ante* similar to minibond-issuing firms, our treated group. Despite its popularity, King and Nielsen (2019) have recently criticized the PSM for exacerbating group imbalance, algorithm inefficiency, and selection bias, and introducing model dependence and research discretion. They raise two concerns. First, when the knowledge of the data generation process is limited (as it is usually in a PSM analysis), the assumption of knowing the true model to estimate is very questionable. Second, when estimates using different samples provide different results but similar goodness of fit, researchers choose the set that produces (the best) results in line with their hypotheses, thus originating model dependence. Limited knowledge of the data generation process and model dependence can turn theoretically unbiased estimators into potentially (severely) biased ones and the PSM suffers significantly from both these two shortcomings. In particular, it could generate high levels of imbalance and discretion in the control group(s) since matching only on the base of the propensity score (in place of the complete set of variables) is unbiased but *ex-ante* inefficient. King and Nielsen's (2019) arguments mainly refer to one-to-one matching without replacement, a specific form of PSM; other PSM algorithms perform much better and are recommended for causal analysis in several contexts (Jann, 2017; Wang, 2021).

With this background in mind, our strategy consists of three steps. Intuitively, we first pair minibond-issuing firms with other similar firms through the PSM. It produces a control group that is not affected by selection bias and endogeneity issues. We obtain several comparable samples by

changing the PSM specification. In place of selecting one single sample and face model dependence, we decided to keep all the samples. Second, we run the same set of diff-in-diff panel estimates for each sample. It creates directly comparable results. Finally, we combine individual outcomes through a meta-analysis to produce summary statistics of our findings. This new strategy, described in detail below, removes the drawbacks of a diff-in-diff analysis in which the endogenous treatment is handled with a PSM. The diff-in-diff design is increasingly popular, but scholars typically ignore its limits.

In the first step, we match minibond-issuing firms with other similar firms. We run a large number of logit regressions in which the dependent variable, $Minibond_{i,t}$, is a dummy equal to one if firm *i* has issued minibonds during year *t*, zero otherwise. Our baseline specification is:

$$Minibond_{i,t} = f\left(\alpha + \beta Feature_{i,t} + \epsilon_{i,t}\right) \quad (1)$$

where *f(·)* indicates a logit transformation function, *Feature* consists of firm characteristics that influence the probability of issuing minibonds, and $\varepsilon_{i,t}$ is a well-behaved error term. We draw 20 firm features that previous literature considered relevant to access alternative sources of financing and (above all) regional governments indicated as evaluation criteria in assessing the applications for the minibond issuance supporting programs. This transparency unveils the data generation process and avoids King and Nielsen's first critique.

To achieve a parsimonious specification, we divide the vector of firm features, *Feature,* into two groups based on the relevance of the variables in the economic literature. The first group includes six essential characteristics that we add to every regression based on equation (1). They are total assets (ln), EBITDA, the net financial position, the ratio of intangibles over total assets, a dummy for listed companies, and a dummy for joint-stock firms. They control for firm size, profitability, indebtedness, business orientation, structure, and ownership, respectively. The second group consists of 14 additional variables that we insert alternatively as a regressor because they are less important than the former and tend to be (multi)collinear among them. The list includes total debt (ln), liquid resources (ln), borrowing costs (ln), borrowing costs over sales, total sales (ln), debt-to-equity ratio,

short-term debt ratio, net financial position over EBITDA, cash flow over total assets, EBITDA over borrowing costs, net income, equity (ln), the ratio of liquid assets over short-term debt, and internal over external resources. Most of the papers that apply a PSM procedure use between six and ten regressors. To avoid model dependence, we run one regression for each combination of the six essential features plus two to four additional variables included in *Feature*. In total, we run 1,456 PSM estimates. In other words, we cover all the possible combinations of control variables within the most frequent range of regressors used in the literature. We essentially block model dependence.

Matching algorithms mainly differ in the criteria to identify similar neighborhoods of treated units and the weights assigned to the control group observations. Broadening the neighborhoods reduces the variance but increases the bias due to grouping less similar firms and vice versa (Caliendo and Kopeinig, 2008). We opt for a nearest-neighbor algorithm (one-to-one) with replacement, and we require exact matching by year, industry, and macro-region (i.e. North, Centre, and Mezzogiorno). This procedure matches each treated firm with one that has never issued minibonds and i) operates in the same sector, ii) is located in the same macro-region, and iii) is comparable in terms of balance sheet information in the year of the minibond issuance. In practice, the algorithm associates the closest unit in the control group with each minibond-issuing firm, conditional to data availability. The calculation burden using replacement is relatively low. Even if the same observation can be used multiple times as a match, this event is rare given the large size of our dataset. Replacement also minimizes King and Nielsen's (2019) *ex-ante* inefficiency issue.

Our second step consists of diff-in-diff panel estimates of an intangible assets growth model. Issuing minibonds, our treatment effect, could violate the conditional independence assumption because it does not capture systematic differences in the firm characteristics not included in the PSM. We apply a panel estimator to control for unobservable time-invariant firm characteristics and produce unbiased estimates. We avoid model dependence by repeating the analysis for all the 1,456 PSM samples. In other words, we tie our hands by producing and presenting the results from all the

possible samples. It avoids model dependence because we do not select one or a few samples on which we run our estimates. To our knowledge, we are the first to apply a brute-force approach against model dependence in a diff-in-diff framework with endogenous treatment.

We test three main hypotheses. First, we check if the issuance of minibonds promotes investments in intangible assets. Our intangible asset growth equation is as follows:

$$\Delta Int_{i,t} = \alpha + \beta \cdot Int_{i,t-1} + \gamma_1 \cdot MB_{i,t}^{after} + \rho \cdot CTRL_{i,t} + \theta_t + \mu_i + \epsilon_{i,t} \quad (2)$$

in which the annual percentage change of intangible assets of firm *i* at the time *t*, $\Delta Int_{i,t}$, depends on its initial level of intangibles $Int_{i,t-1}$, a set of control variables $CTRL_{i,t}$, year fixed effects θ_t and firm fixed effect μ_i; $\epsilon_{i,t}$ indicates the idiosyncratic error term. Like in Crouzet and Eberly (2018), $CTRL_{i,t}$ includes *Markup* to control for market power and M&As that drive intangibles up and *Demand* to capture sectoral demand trends and expectations. The availability of other sources of financing could bias our results. Several studies find that intangible investments increase with internal financing (Ughetto, 2008; Borisova and Brown, 2013; Sun and Xiaolan, 2019) and equity issuance (Brown et al., 2009). Recent contributions have also remarked that bank debt may be ill-suited to finance intangible investments such as R&D, software, employees training, etc. (Dell'Ariccia et al., 2021; Cecchetti and Schoenholtz, 2018). Since Italy is a strongly bank-based economy, we also consider the role of bank lending. Hence, we add *Liquidity* (ln) and *Bank debt* (ln) to control for internal financing and bank credit, respectively. Finally, we include the lagged amount of total debt (ln) to capture firm size and indebtedness in line with Lim et al. (2020).

Our variable of interest is $MB_{i,t}^{after}$, a dummy equal to one from the year firm *i* issues a minibond on, 0 otherwise. We hypothesize that a minibond issuance is beneficial for intangible investments, i.e. HYP1a: $\gamma_1 > 0$. It produces two effects. First, as minibonds are more suited to finance intangible investments than traditional instruments, issuing firms finance projects in R&D, patents, etc., more easily than other firms. In other words, diversification through financing sources increases flexibility, reduces risks, and relaxes financial constraints on intangible investments

(*financial hypothesis*). Second, issuing an innovative instrument represents a structural break for the firm because acquaintance with capital markets provides better financing opportunities. In this case, using a new instrument signals financial maturity to the market and attracts investors less reluctant to finance innovative projects (*reputational hypothesis*). A positive impact of minibond issuances on intangible investments is a necessary but not sufficient condition to determine their effectiveness. We need to exclude that $\gamma_1 > 0$ results from a general increase in all investments' components. So, we re-estimate equation 2 using tangibles as a counterfactual and expect a positive but smaller $MB_{i,t}^{after}$ coefficient γ^c (superscript *c* is for "counterfactual"). Minibonds promote the firm's intangible asset orientation if $\gamma_1 > 0$ (HYP1a) and $\gamma_1 > \gamma_1^c$ (HYP1b), where γ_1 and γ_1^c are respectively the sensitivity of intangible and tangible investments to $MB_{i,t}^{after}$.

We disentangle the financial and reputational channels affecting intangible investments by distinguishing between single and multiple issuances in our growth model as follows:

$$\Delta Int_{i,t} = \alpha + \beta \cdot Int_{i,t-1} + \delta_2' \cdot MB_{i,t}^{after} + \delta_2'' \cdot MB_{i,t}^{count} + \rho \cdot CTRL_{i,t} + \theta_t + \mu_i + \epsilon_{i,t} \qquad (3)$$

In equation 3, we capture the intensity of minibond issuances by adding the cumulative number of minibond issuances $MB_{i,t}^{count}$ to the previous equation. If minibonds only represent a source of fresh liquidity for firms, multiple issuances should gradually relax financial constraints and promote intangible investments also after the first issuances i.e. *HYP2a*: $\delta_2''>0$ (*financial hypothesis*). The only exception is if firms divert minibond resources to tangible investments (e.g. a project for which firms could not find sufficient resources through traditional channels). In this case, minibond issuances could have a perverse impact on intangible assets (i.e. $\delta_2'' <0$) because of the resource diversion from the original intangible investment to the previously unfeasible tangible one. Once we control for the financial effect through $MB_{i,t}^{count}$, a positive $MB_{i,t}^{after}$ coefficient captures only the reputational effect, i.e. *HYP2b*: $\delta_1' > 0$ (*reputational hypothesis*). As this is a static exercise, we cannot determine the

path over time but only the overall impact: for minibond-issuing firms, the reputational effect dominates the financial one if $\delta_1' - \delta_2'' x > 0$, where *x* indicates the number of minibond issuances.

Also, temporal dynamics can help to disentangle the two hypotheses. Minibond issuances promptly release financial constraints, but their impact fades when constraints become less binding. On the contrary, the signalling effect starts with the first issuance but takes time to unfold and spread. Hence, reputation is gained gradually. The implication is that only the financial effect is at work immediately after the minibond issuance, whereas the reputational one emerges in the medium run. Both the effects vanish in the long run. To investigate these temporal dynamics, we estimate equation 2 in right-truncated samples (indicated with superscript *rt*) obtained by aligning the years of minibond issuances across firms at time *t=0* and progressively cutting observations with *t>1, t>2*,…, *t>5* away. Since minibonds merely represent additional liquidity when they become quickly ineffective in promoting intangible investments, our *financial hypothesis* holds if the positive effect of minibond issuances fades over time, i.e. *HYP3a*: $\gamma_1^{r1} > \cdots > \gamma_1^{r5} > 0$. On the opposite, if the effect increases, the *reputational hypothesis* prevails, i.e. *HYP3b*: $\gamma_1^{r5} > \cdots > \gamma_1^{r1} > 0$. Note that the $MB_{i,t}^{after}$ coefficient captures the overall effect. Hence, our test is very conservative and works against the reputational hypothesis because (i) the coefficient tends to decrease over time due to the decreasing financial effect, and (ii) both the effects gradually vanish. Hence, a coefficient increasing with maturities strongly support the *reputational hypothesis*. Yet, the hypothesis cannot be rejected if the coefficient slowly decreases over time.

Finally, we investigate whether results are heterogeneous for different types of firms by estimating the following equation:

$$\begin{aligned}\Delta Int_{i,t} = \alpha + \beta \cdot Int_{i,t-1} &+ \gamma_3 \cdot MB_{i,t}^{after} + \rho \cdot CTRL_{i,t} + \theta_t + \mu_i + \epsilon_{i,t} \\ &+ (\lambda_3 \cdot Listed_{i,t} + \lambda'_3 \cdot MB_{i,t}^{after} * Listed_{i,t}) \\ &+ (\eta_3 \cdot Employment_{i,t} + \eta'_3 \cdot MB_{i,t}^{after} * Employment_{i,t-1}) \\ &+ (\delta_3 \cdot BankIndependence_{i,t-1} + \delta'_3 \cdot MB_{i,t}^{after} * BankIndependence_{i,t-1}) \end{aligned} \quad (4)$$

We first interact $MB_{i,t}^{after}$ with the dummy *Listed* (line 2) that is equal to one for publicly listed companies, then with *Employment* (line 3) that indicates the number of employees, and finally with *Bank Independence* (line 4), that is one minus bank loans over total financial debt. The interactive terms check if the issuance effect is larger respectively for less transparent (and financially sophisticated), smaller, and bank-dependent firms. We hypothesize that minibonds release financial constraints more for unlisted firms than for listed ones because the former typically have limited access to capital markets; i.e. HYP3a: $\gamma_3 > 0$ and $\lambda'_3 < 0$. For similar reasons, smaller firms should also benefit more from a minibond issuance; i.e. HYP3b: $\gamma_3 > 0$ and $\eta'_3 < 0$. Finally, bank-dependent firms find minibonds more beneficial than firms that are already diversified because the latter already enjoy a financial structure that is better suited to finance intangibles; HYP3c: $\gamma_3 > 0$ and $\delta'_3 < 0$.

We estimate equations (2), (3), and (4) using each of the 1,456 pruned samples obtained through the *PSM* described in equation (1). In a setting similar to equation (2), we also investigate three additional hypotheses to verify if the reform achieved its goals. In particular, we test if i) minibond-issuing firms experience an increase in the overall debt capacity after the issuance (*complementary effect*) or if minibonds only replace other sources of financing (*substitution effect*), ii) the instrument relaxes previous financial constraints, and iii) minibonds increase firm profitability. We expect minibond issuances to increase debt capacity, release financial constraints, and improve profitability.

Last but not least, we run a meta-analysis for every specification to summarize the 1,456 diff-in-diff estimates in one and present all our results. This methodology usually applies to studies addressing the same question but reporting findings with some degrees of error because samples are different. When meta-analysis is applied to our PSM samples, we avoid the main shortcomings of this approach, i.e. how to search for studies, selection criteria, and incomplete data. Hence, this method perfectly suits our needs. We run a random effects (RE) meta-analysis that handles the studies

included in the analysis as random samples generated from a larger population (Hedges 1983; Der Simonian and Laird 1986). Unlike fixed-effects models, random effects assume different effects across studies. They are more appropriate with a large number of samples, and their inference can be unbiasedly extended to the entire universe (Tufanaru et al., 2015). However, although meta-analysis efficiently summarizes many estimates in one (thus preventing model dependence), average values could still hide some results in which our hypotheses are rejected. We also address this concern by presenting the worst and best results through our set of 1,456 estimates for each model. A narrow variability range of each coefficient provides further evidence of the validity of our results.

5. Main findings

We end up with 1,454 out of the 1,456 potential samples with the matching procedure because the PSM logit model does not converge in two specifications after 50 iterations. Table 3 reports the number of specifications in which each of the 20 variables considered (see Section 4) is significant at 1, 5, 10, and 15 percent levels and the significance intensity, i.e. the percentage of specifications in which each variable is significant at least at 15 percent level. Our six essential PSM variables are highly statistically significant. Among the 14 additional determinants, cash flow over total assets, the debt-equity ratio, EBITDA over borrowing costs, and the ratio of liquid assets over short-term debt have the lowest explanatory power. Overall, 12 out of 20 variables are significant in almost all the specifications in which they are included.

[Table 3 around here]

The PSM matches around 468 minibond-issuing firms per sample to their nearest neighbor (spanning from 441 to 483). As expected, the procedure achieved a good result. The difference between treated and untreated firms shrinks after matching. Table 4 compares unbalanced and balanced samples in the best and worst scenarios. Using the specification that produces the lowest McFadden Pseudo R^2, three out of the eight differences between mean variables that were originally significant turn to be not significant after pruning, and the magnitude of many gaps reduces (Panel A). On the opposite

side, nine out of ten differences were statistically significant in the specification associated with the highest McFadden Pseudo R^2 (Panel B). The matching procedure eliminates five differences but not those in total assets, total debt, borrowing costs, and the legal structure of the firms. In brief, our matching procedure considerably reduces but doesn't completely remove the systematic differences between treated and untreated firms.

[Table 4 around here]

Table 5 reports the RE meta-analysis results based on the 1,454 diff-in-diff estimates of equation 2. Our parsimonious specification (column 1) includes the lagged value of intangible assets (ln), the lagged value of total debt (ln), year and firm fixed effects, and $MB^{after}_{i,t}$ as determinants of the intangible assets growth rate. The negative coefficient of lagged intangible assets validates the investment growth model. Minibond-issuing firms increase intangible investments by around 12% compared to similar untreated units. It corroborates HYP1a. The effect is economically relevant, consisting of 16% of one standard deviation increase in intangible investments (i.e. 0.121 / 0.75 = 16.1%; see Appendix A for descriptive statistics).

In column 2, we add *Liquidity* (ln) as a proxy of self-financing and *Bank debt* (ln) as a measure of bank borrowing to control for alternative sources of financing, *Demand* (ln) to seize trends in sectoral demand, and *Markup* to capture the supply-side market structure. As the pecking order theory suggests that financing costs increase with asymmetric information, we expect a larger *Liquidity* coefficient than the *Bank debt* one. However, a heavily bank-based economy and sample selection could explain why that is not the case in our samples. It might depend on the characteristics of our pruned samples that, as shown in the previous sections, comprise firms larger than the universe of Italian companies. Also, after controlling for these additional factors, past total (over)indebtedness hinders investments. As expected, intangible investments increase with *Markup*: risk-averse firms invest in intangible assets when they feel sufficiently safe against the competition, i.e. when their markup raises. Instead, the negative *Demand* coefficient reflects the counter-cyclical investment

theory (Aghion et al. 2010). Intuitively, during recessions, firms expect that sectoral demand will improve and take the momentum to invest and be ready for the next expansion. Investments are more counter-cyclical for intangible than tangible assets because the former are not collateralizable (i.e. a larger coefficient in absolute value).[8]

Our variable of interest, MB^{after}, has a positive coefficient. It confirms that minibonds promote intangible investments (HYP1a). However, this is a necessary but not sufficient condition to verify HYP1. When we move from columns 1 and 2 to 3 and 4, we find that MB^{after} also promotes tangible investments, but the magnitude is substantially smaller. So, although minibonds spur all investments, intangible ones benefit the most (HYP1b). In brief, the alternative financing instrument introduced by the 2012 Italian reform is better suited to promote intangible investments than other traditional financial tools. Note that the impact becomes more intense when we increase the number of control variables in the specification, thus suggesting a strong and stable relationship.

[Table 5 around here]

We use the information on multiple minibond issuances to disentangle financial and reputational effects. Table 6 reports the estimates of equation (3). In column (1), we add MB^{count} to the specification as reported in equation (3). MB^{count} is the cumulative number of minibond issuances. For example, if firm *i* issues two minibonds in 2014 and one in 2016, MB^{count} is equal to zero until 2013, two in 2014 and 2015, and three from 2016 on. Under the assumption of independent issuances, MB^{count} captures the financial effect and MB^{after} the reputational one. Both are positive and statistically significant, but the latter (0.111) largely dominates the former (0.009). The difference is economically relevant and persists after ten years (0.111-0.009*10=0.021). A potential explanation of this pattern

[8] With perfect credit markets, opportunity costs drive investments, and the *Demand* coefficient is negative since firms invest when prices are low and are expected to growth, that is during recession. In other words, investments are counter-cyclical. Moreover, as risk-averse investors prefer collateralizable (tangible) assets, the impact of *Demand* is more negative on intangible than tangible investments. On the contrary, when funds are restricted, firms postpone unessential activities, and their investments turn from counter- to pro-cyclical. In this case, *Demand* coefficient should be positive for all investments but more positive for tangible ones because liquidity shocks are more likely to interrupt long-term investments such as intangible ones (Aghion et al. 2010). As the Italian financial markets are sufficiently developed, it is reasonable to assume that the counter-cyclical investment theory prevails.

is that minibond issuances gradually relax financial constraints, but firms can immediately capitalize on their higher reputation in the traditional credit market by borrowing under better conditions. They can finance larger intangible investments the first time they issue minibonds but only smaller ones later when reputation has stabilized at a higher level and banks do not further ease credit. Therefore, a higher reputation materializes into an initial financing boost. An alternative explanation is that firms build their reputation gradually and the reputational effect originates a persistently higher level of intangible investments. In this case, the minibond issuance is not a one-shot opportunity but a certificate of business soundness. The static regression in column (1) captures the overall average impact of a minibond issuance and doesn't allow us to distinguish between the two cases.

To shed light on this point, we investigate the overall temporal evolution of the financial and reputational effects. We truncate the sample at *t+1, t+2,..., t+5* where *t* represents the year of the issuance, and we focus on the effect of an issuance until *n* years after *t* (i.e. until one, two … five years later). Estimates reported in columns 2-6 confirm that the positive effect of minibond issuances is not limited to relaxing financial constraints. The $MB_{i,t}^{after}$ coefficient is always positive and significant, but the impact on intangible investments drops after two years from the first minibond issuance and increases over the initial level in the rest of the period. Under the assumption of a constant financial effect, this path is consistent with both our explanations; under a more realistic diminishing financial effect, it supports the second explanation; when we consider that this impact increases over time, the reputational effect certificates clearly the quality of the firm.

[Table 6 around here]

Finally, we check for potential heterogeneities in our results. We expect smaller, less transparent, and less financially diversified firms to benefit more from minibond issuances because they suffer from higher asymmetric information and have more binding financial constraints. To test these hypotheses, we estimate equation (4). First, we interact minibond issuances with the listing status of a firm to capture its transparency and experience with equity issuances. Second, we employ

the number of employees as a proxy for firm size in the interactive term. Finally, we introduce an interaction with *Bank Independence*, one minus the ratio of bank to total financial debt. We expect listed firms to benefit relatively less from minibond issuances ($\lambda'_3 < 0$) because they are already acquainted with sophisticated financial instruments and enjoy better conditions in more developed capital markets (e.g. stock). On the contrary, as unlisted firms do not have these opportunities, they should benefit more from issuing minibonds. Similar reasons hold to firm size and bank credit. Intangible investments underreact to minibond issuances when the issuing firm is larger ($\eta'_3 < 0$) and when the firm already has a diversified financial structure ($\delta'_3 < 0$).

Table 7 reports our results. They are in line with our expectations. Unlisted firms benefit more from minibonds than listed companies.[9] Larger firms invest more in intangible assets, but the smaller the firm, the larger the impact on intangible investments. Similarly, firms that do not rely excessively on bank credit invest more in intangible assets but benefit the least from issuing minibonds, confirming our expectations. Figures 6, 7, and 8 represent these three heterogeneities graphically. Figure 6 illustrates the impact of minibond issuances for listed and unlisted firms and the corresponding confidence intervals. Clearly, unlisted firms have an advantage in resorting to the instrument. Figure 7 focuses on the interactive term with employment. The larger the firm, the more the investments in intangible assets regardless of minibonds, but smaller firms issuing minibonds do proportionally better (solid line). We find that all firms with less than 3,600 employees benefit from the reform. Given the Italian firm size, this finding excludes basically only multinational companies and national champions. Hence, the 2012 reform has also supported medium firms. However, the smaller the size of the firm, the higher the benefits of issuing the bond.

Finally, Figure 8 shows that minibond issuances are particularly beneficial for bank-dependent firms. Even if issuing the instrument is beneficial for each degree of bank dependence, it spurs intangible investments (relatively) more for firms excessively relying on bank credit than other

[9] Stand-alone dummy *Listed* is absorbed by firm fixed effects.

firms. The higher the bank independence, the lower the benefits from the issuances (lower distance between the solid and dashed lines). Hence, minibonds can be seen as the first step toward a more effective diversification of the financial structure that, in turn, is more intangibles-friendly.

In sum, alternative market-based financial instruments such as minibonds play a relevant role in promoting intangible investments because self-financing and bank credit are insufficient to finance R&D processes, data acquisitions, employees training, etc. Italian firms benefit from access to capital markets through minibonds. This is particularly important for small firms that are the backbone of the Italian economy because a higher bank dependence has recently restrained their orientation towards innovation. When the low innovation rate depends on credit supply factors such as a low bank propensity to provide loans for intangible investments, minibonds can release financial constraints, promote these investments, and improve economic growth. However, our most interesting result is that the beneficial effect of minibond issuances has not a mere financial profile. The positive impact of minibond issuances on intangible investments increases over time, but additional issuances are not so beneficial as the first one. This pattern is not consistent with a financial explanation of the phenomenon and suggests a relevant reputational effect at work. In other words, accessing alternative market-based financial instruments represents a structural break for the firm: it reflects a different financing approach and works like a certificate of a safe mature business.

[Table 7 around here]

[Figure 6, 7, and 8 around here]

6. Additional findings

In this section, we provide additional evidence of the effect of minibond issuances on the evolution and performance of firms. First, we scrutinize whether minibond-issuing firms reduce their exposure to banks and other intermediaries after the minibond issuance or if it increases their debt capacity. Second, we investigate whether minibond-issuing firms are affected by financial constraints

and whether minibonds attenuate such issues. Finally, we study the evolution of minibond firms in terms of profitability. Results are presented in Table 8.

[Table 8 around here]

Minibond issuances promote intangible investments, but also other financial instruments could play a similar role. From a policy perspective, the reform is successful only if the firm increases its overall debt capacity. On the one hand, firms could reduce their exposure to other intermediaries after gaining access to minibonds as documented in Ongena et al. (2021). A substitution effect probably reduces borrowing costs but undermines the positive view on minibonds because overall available resources don't increase. On the other hand, if minibond issuances certificate a higher reputation, they facilitate bank borrowing and expand financial resources. When minibonds and other financial instruments are complements, their issuances have a positive signaling effect on credit markets, similarly to Bronzini et al. (2020).

To test if minibond issuances increase the firm's overall debt capacity or merely operate a rotation among financing sources, we estimate their effect on bank debt, non-bank financial debt (net of bonds), and total financial resources.[10] Results should be interpreted with caution because estimates could suffer from reverse causality. In fact, firms cut the demand for bank loans when they find a cheaper alternative. In this case, the causality is from minibond issuances to bank debt. However, in line with the theoretical predictions of Crouzet (2018), Altavilla et al. (2019) find that firms partially substitute bank borrowing with bond issuing when the banking system shrinks credit supply. It suggests a reverse causality from bank debt to minibond issuances. As external factors caused credit supply contractions in Italy during our sample period (e.g. subprime crisis, EBA creation, sovereign debt crisis, etc.), firms might have issued minibonds as a reaction to bank credit supply shocks, not the opposite.

[10] All in natural logarithm.

Empirically, dual causality is usually dealt with instrumental variables. However, this approach is inferior to our (quasi) natural experiment and unfeasible in our 1,454 samples because we should manually identify good instruments in each estimate, thus making results not comparable. Note that we cannot control and eliminate bank-level idiosyncratic shocks from our data. However, the matching procedure pairs firms in the same industry, year, and macro area and controls for the differences in the firm's financial structure and common episodes of credit tightening. Consequently, it mitigates reverse causality because, for each treated firm, the sample includes an untreated twin firm that is exposed to the same common credit shocks. In brief, the quasi-experimental nature of our setting combined with the matching procedure ensures that the causal link for the treatment variable of the diff-in-diff analysis is from minibond issuances to bank debt reduction.

We find that after issuing minibonds, firms reduce bank debt (column 1) and significantly increase non-bank financial debt, net of bonds (column 2). The latter category includes leasing, factoring, and financing from insurance companies, pension funds, investment funds, finance firms, development capital companies, financial vehicle corporations, special purpose entities, and venture capital corporations. Both large firms and SMEs increasingly use all these alternative financing sources in Europe (Fernandez et al., 2018; Bańkowska et al., 2020; Holm-Hadulla et al., 2021). The impact of MB^{after} on total financial resources combines the modest substitute effect with bank debt (-0.097 in column 1) and the substantial complementary effect with non-bank debt (0.486 in column 2). The overall effect remains largely positive (0.342 in column 3). Thanks to the access to capital markets, not only do minibond-issuing firms offset the reduction of bank debt, but their higher reputation also allows them to increase total financial resources by more than 30%. This is consistent with the signaling effect of minibonds and confirms previous evidence by Ongena et al. (2021).

The intuition of our second exercise is that tapping alternative financing sources is beneficial to treated firms when they are affected by financial constraints. We expect that the new instrument made available by the 2012 reform mitigates financial issues for constrained Italian firms. We test

this hypothesis through three standard exercises. First, we estimate the investment sensitivity to cash flow (Fazzari et al., 1988). Financially constrained firms become less sensitive to cash flows after issuing minibonds. We expect that investments are positively associated with cash flows before the issuance and negatively after it. The estimate in column 4 corroborates this hypothesis: the *Cash flow* coefficient is positive and statistically significant (0.102), but it reduces (-0.011) after the minibond issuance (interactive term with $MB_{i,t}^{after}$).

Then, we test whether minibond-issuing firms save less cash than others. The intuition is that when firms have limited access to financial markets, they tend to accumulate excessive liquidity (Erel et al. 2015). Hence, as alternative financing sources reduce constraints, minibond-issuing firms should hold less cash. We find the opposite results in column 5 (0.0006), even if its effect is very small and only marginally significant. Firms could have used minibonds to satisfy their working capital needs or for precautionary/regulatory reasons. Note that the PSM procedure rules out that minibond-issuing firms hold more cash because they are in better shape than other firms that have met the requirements for issuing minibonds. In other words, PSM excludes reverse causality.

Finally, in line with Almeida et al. (2004), we estimate the cash holding sensitivity to cash flow changes in column 6. The rationale is that firms should save a higher proportion of additional cash flow when they are financially constrained to reduce the illiquidity risk (i.e. precautionary reason). Like in Erel et al. (2015), the change in the cash flow sensitivity of cash holding around the time of the treatment matters, because it reflects the effect of issuing minibonds on the firm's liquidity management. The coefficient of the interactive term $MB_{i,t}^{after} * Cash\ flow$ is negative (-0.00001) and strongly statistically significant. It halves the cash sensitivity to cash flow before minibond issuance (0.00002). In brief, two out of three exercises on financial constraints fully confirm that they are alleviated after minibond issuances; the third exercise shows only marginally significant results against our hypothesis.

Our last econometric exercise focuses on firms' productivity and profitability. Relieving financial constraints and increasing the investment capacity in intangible assets should improve minibond firms' performance. We test this hypothesis by regressing per capita sales, EBITDA margins, and the ratio of EBITDA over total assets on the $MB_{i,t}^{after}$ and firm-level control variables. The first variable is a rough proxy for productivity, while the other two are widespread measures of firm profitability. We expect an increase in each of the three variables after a minibond issuance.

Access to alternative capital markets plays a positive role in terms of productivity. After issuing minibonds, firms experience a relevant rise in per capita sales (252.54 €) and a 33 percent increase in profitability as measured by the EBITDA margin (column 7). In contrast, the $MB_{i,t}^{after}$ coefficient is marginally negative when we check the impact on the ratio of EBITDA over assets (-0.011). This reaction is probably related to the increased investment activity experienced by minibond-issuing firms, as documented in section 5. As a result of greater access to financial resources, firms increase investments that, in turn, expand total assets and inflate the denominator of the EBITDA/assets ratio. However, the positive effect of these investments is likely to show up only in the long run when the increase in intangible assets translates into an income increase. Conversely, the ratio could drop in the short run.

In sum, our results suggest that minibond-issuing firms show better performances than other similar companies in terms of productivity and profitability. However, our results might underestimate this effect because of the short sample period. A longer time period could provide clearer results.

7. Robustness

This section presents two robustness exercises: the first reduces further model dependence, and the second addresses the omitted variable potential issue.

Although the meta-analysis on all 1,454 PSM estimates has mitigated model dependence, average values can still hide adverse results. To sweep away any doubt, Table 9 reports the best and worst scenarios of the impact of minibond issuance on intangible investments. The best scenario (Panel A) is the regression that provides the highest (significant) $MB_{i,t}^{after}$ (or $MB_{i,t}^{count}$) coefficient. Under this scenario, after the first minibond issuance, intangible investments have increased by 22.5 percent (column 1A), whereas tangible ones by 9% (column 2A). It confirms that minibonds are particularly well-suited to finance intangible assets. The worst scenario is the regression with the lower (insignificant) $MB_{i,t}^{after}$ (or $MB_{i,t}^{count}$) coefficients. Column 1B shows a not significant 2% increase in intangible investments and column 6 a marginally insignificant decrease in the tangible component. As for multiple issuances, all estimates show a dominant effect of the first issuance (columns 3A, 4A, 3B, and 4B) even if it is not significant under the worst scenario. Similarly, Table 10 examines the temporal evolution of the impact of minibond issuances on intangible investments. The effect achieves the maximum level when the sample is cut three years after the first issuances, but it is equal to a statistically significant 23.7 percent under the best scenario and only a (non-significant) 2 percent under the worst one. In both cases, once achieved the maximum, the effect remains stable. Overall, previous results are corroborated even though the worst scenario tends to produce close-to-zero insignificant coefficients.

[Table 9 and 10 around here]

The second exercise focuses on the omitted variables issue. To rule out that our matching procedure and estimates are affected by missing determinants, we present a full set of saturated regressions that replicate our main specifications in Tables 5 and 6. In particular, apart from firm fixed effects and year dummies, we include i) the interactions between year and province (NUTS3) dummies, ii) the interactions between year and sector dummies, and iii) both sets of interactions. We present the results in Tables 11 and 12. Our previous findings are corroborated. Estimated coefficients

very similar to those presented in section 4 confirm that our matching procedure is appropriate enough.

[Table 11 and 12 around here]

8. Concluding remarks

Investments in intangible assets are crucial in knowledge economies like developed countries. They spur productivity, profitability, and economic growth and determine comparative advantages at both country and firm levels. However, bank credit is ill-suited to finance these investments due to higher asymmetric information.

We exploit the 2012 introduction of minibonds in Italy to check whether access to alternative market-based financial instruments promotes investments in intangible assets. First, we match data on minibond-issuing firms from the *Osservatorio Minibond* project by Politecnico di Milano with the AIDA dataset and apply a Propensity Score Matching procedure to remove the selection bias. We obtain 1,454 different pruned samples from our initial 17 million observations. Then, we run a diff-in-diff analysis on each sample using minibond issuance as a treatment. Finally, we summarize all results through a meta-analysis to avoid model dependence., i.e. the researcher's discretion in choosing the most favorable pruned sample.

Intangible assets are particularly difficult to finance via traditional bank credit and alternative market-based financial instruments can mitigate this issue through two channels. On the one hand, minibond issuances represent additional liquidity and relax financial constraints. On the other hand, they signal a high level of financial sophistication, increase market reputation, and reduce other intermediaries' risk perception of the firm.

Our results show that firms issuing minibonds invest more in intangible assets than other firms. Investments grow not only in the year after the minibond issuance but still five years after the issuance. The high persistence reveals a strong reputational effect that easily dominates the financial

one. We also document that this effect is larger for smaller, less transparent, and more bank-dependent firms, but it does not benefit very large companies.

Our findings come from a bank-based economy where intangible investments have stagnated in the last decades. However, they are also relevant for post-Covid-19 economies facing the challenges of a digital and ecological transition. In this context, intangible assets are crucial. A sound, well-diversified financial system plays a pivotal role in creating and maintaining favourable conditions for investments in such components. Consistent with our results, our policy recommendation is to use the issuance of alternative market-based financial instruments to certify the good conditions of smaller, less transparent, and more bank-dependent firms. Their higher reputation creates a convergence of resources towards intangible investments that, in turn, should lead to economic growth. Our policy recommendation is not only less expensive than direct subsidy policies, but it also produces smaller economic distortions because the market still maintains the task of screening and selecting the best investment projects.

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Table 1. Minibond issuances. Evolution by year.

Year	Issuances	Issuing firms	Firms issuing for the first time	Firms that issue once	Firms that issue more than once in the year
2012	2	2	2	2	0
2013	28	25	25	23	2
2014	71	65	36	61	4
2015	78	54	48	42	12
2016	106	88	74	75	13
2017	170	137	103	115	22
2018	198	176	123	157	19
2019	207	183	129	165	18
2020	194	176	131	170	6

Notes: Authors elaboration on data from Osservatorio Minibond, Politecnico di Milano.

Table 2. Comparison between minibond-issuing firms and other Italian firms, 2014 vs 2019.

Samples:	Minibonds			No Minibonds			Test
Panel A: Year 2014							
Variables	**Obs**	**Mean**	**St. Dev.**	**Obs**	**Mean**	**St. Dev.**	**Mean[a]**
Intangibles/Tot. Assets	53	0.045	0.063	941,284	0.050	0.119	
Tot. Assets (ln)	56	11.107	1.618	946,733	5.936	1.952	***
Sales (ln)	56	9.041	3.003	946,397	4.568	2.789	***
Employees	56	277.125	1060.179	942,274	9.381	195.300	*
Ebitda	53	5,502.774	8775.077	944,231	182.411	9,862.365	***
Tot. Debt (ln)	53	10.489	1.706	944,254	5.360	2.084	***
Liquidity (ln)	52	7.398	2.571	825,405	2.963	1.935	***
Panel B: Year 2019							
Variables	**Obs**	**Mean**	**St. Dev.**	**Obs**	**Mean**	**St. Dev.**	**Mean[a]**
Intangibles/Tot. Assets	150	0.053	0.081	897,046	0.048	0.120	
Tot. Assets (ln)	150	10.249	1.316	900,992	5.956	1.952	***
Sales (ln)	150	8.972	3.043	900,984	4.887	2.697	***
Employees	150	193.800	537.587	877,180	10.701	197.085	***
Ebitda	150	3,281.320	5662.946	899,513	249.665	1,3026.140	***
Tot. Debt (ln)	150	9.792	1.445	899,519	5.296	2.060	***
Liquidity (ln)	149	6.523	2.425	820,215	3.317	1.990	***

Notes: (a) Test of comparison between means: minibonds vs no minibonds.
***p<0.01, **p<0.05, *p<0.10

Table 3. PSM analysis: number of specifications in which the variable is significant and significance intensity.

Variable	N. spec.	***	**	*	#	Sig. Intensity
Panel A: Essential 6 variables						
Listed firm (dummy)	1,454	1,454	-	-	-	100%
Joint-stock firm (dummy)	1,454	1,454	-	-	-	100%
EBITDA	1,454	1,454	-	-	-	100%
Intangibles/Tot. Assets	1,454	1,058	13	175	70	91%
Tot. Assets (ln)	1,454	1,214	2	1	14	85%
Net financial position	1,454	153	838	205	44	85%
Panel B: Additional 14 variables						
Tot. Debt (ln)	377	377	-	-	-	100%
Liquidity (ln)	377	377	-	-	-	100%
Borrowing costs (ln)	377	377	-	-	-	100%
St. Debt ratio	377	377	-	-	-	100%
Equity (ln)	377	312	13	22	6	94%
Net income	377	1	177	54	110	91%
Net financial position/Ebitda	377	0	5	155	134	78%
Sales (ln)	377	50	72	34	25	48%
Borrowing costs/Sales	377	0	25	78	75	47%
Internal/External resources	377	19	50	10	21	27%
Ebitda/Borrowing costs	377	0	0	2	61	17%
Liquidity/St. Debt	377	0	13	24	24	16%
Debt equity ratio	377	0	0	0	0	0%
Cash flow/Tot.Assets	377	0	0	0	0	0%
Exact matching:						
Year	1,454					
Industry	1,454					
Macro-area	1,454					

NOTES: The total number of specifications is 1,454 because two specifications do not converge after 50 iterations. N. Spec. = number of specifications including the variable. Sig. Intensity = percentage of specifications in which the variable is significant at 15% or lower level. Macro-areas are North, Center, and South and Islands (Mezzogiorno).
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 4. Differences between unbalanced and balanced samples across the highest and lowest McFadden Pseudo R2 estimates.

Variable	Unbalanced sample				Balanced sample			
	Treated	Untreated	Diff.	t-test	Treated	Untreated	Diff.	t-test
Panel A: Worst PSM								
Listed (dummy)	0.082	0.001	0.081	***	0.035	0.055	-0.021	
Joint stock (dummy)	0.770	0.054	0.716	***	0.530	0.787	-0.257	***
Tot. Assets (ln)	10.763	6.816	3.947	***	10.267	10.765	-0.497	***
Net financial position	3,500,000	88,486	3,411,514	***	3,300,000	1,700,000	1,600,000	
Ebitda	8,587	512	8,075	***	23,107	11,072	12,035	**
Intangibles/Tot. Assets	0.072	0.048	0.024	***	0.069	0.062	0.007	
Ebitda/Borrowing costs	10.078	30.484	-20.406	***	14.791	159.578	-144.787	***
Debt equity ratio	2.128	2.629	-0.501		2.060	2.445	-0.384	
Borrowing costs/Sales	4.483	2.482	2.001	***	5.513	1.482	4.031	***
Int./Ext. resources	38.943	29.842	9.100		35.849	37.645	-1.797	
Panel B: Best PSM								
Listed (dummy)	0.084	0.000	0.083	***	0.043	0.062	-0.020	
Joint stock (dummy)	0.778	0.038	0.740	***	0.577	0.827	-0.250	***
Tot. Assets (ln)	10.739	6.250	4.489	***	10.430	10.929	-0.499	***
Net financial position	3,300,000	57,452	3,242,548	***	3,300,000	2,500,000	800,000	
Ebitda	8,107	343	7,764	***	21,895	27,790	-5,895	
Intangibles/Tot. Assets	0.069	0.048	0.020	***	0.069	0.066	0.004	
Tot. Debt (ln)	10.304	5.718	4.585	***	9.882	10.469	-0.587	***
Borrowing costs (ln)	6.309	1.462	4.847	***	5.568	6.178	-0.610	***
Liquidity/St. Debt	1.555	1.700	-0.145		1.580	2.062	-0.482	
St. Debt ratio	0.620	0.848	-0.228	***	0.664	0.647	0.016	

NOTES: Panel A (3,010,259 observations) and Panel B (4,671,031 observations) report different specifications. All specifications include industry, year and macro-area (North, Centre, South and Islands) exact matching.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 5. Impact of minibond issuance on intangible and tangible investments.

Variable	ΔIntangibles		ΔTangibles	
	(1)	(2)	(3)	(4)
MB^{after}	**0.122*** **	**0.121*** **	**0.065*** **	**0.026*** **
Intangibles (ln, lag)	-0.415***	-0.446***		
Tangibles (ln, lag)			-0.419***	-0.439***
Total Debt (ln, lag)	0.025***	-0.152***	-0.003**	-0.182***
Liquidity (ln)		0.051***		0.063***
Bank debt (ln)		0.072***		0.065***
Demand		-0.312***		-0.040***
Markup		0.091***		0.058***
Constant	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Number of studies	1,454	1,454	1,454	1,454
Study random effects	Yes	Yes	Yes	Yes
Average Obs.	6,982	5,848	6,983	5,848
Average R^2-within	0.217	0.269	0.257	0.335
Average R^2-overall	0.030	0.040	0.050	0.060
Average nr. of firms	848	775	848	775

NOTES: Random effects meta-analysis model. Period: 2012-2019. *MB^{after}* is a dummy equal to one from the year in which firm i issues a minibond onwards, zero otherwise. *Intangibles* is the amount of intangible assets. *Tangibles* is the amount of tangible assets. *Markup* is calculated as sales over costs of production. *Demand* is calculated as total sectoral sales minus firm i sales. *Liquidity* is the amount of liquid resources of the firm (cash and similar assets). *Bank debt* is the amount of bank debt. *Total debt* is the amount of total indebtedness.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 6. Impact of multiple issuances on intangible investments and temporal evolution of the impact on intangible investments.

	Static	*Dynamic*				
Variable	**All period**	**[t-k, t+1]**	**[t-k, t+2]**	**[t-k, t+3]**	**[t-k, t+4]**	**[t-k, t+5]**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
MB^{after}	**0.111*****	**0.111*****	**0.109*****	**0.118*****	**0.118*****	**0.121*****
MB^{count}	**0.009*****					
Intangibles (ln, lag)	-0.446***	-0.487***	-0.472***	-0.460***	-0.452***	-0.447***
Total Debt (lag, ln)	-0.152***	-0.149***	-0.151***	-0.155***	-0.155***	-0.155***
Liquidity (ln)	0.051***	0.055***	0.053***	0.053***	0.052***	0.051***
Bank debt (ln)	0.072***	0.069***	0.069***	0.073***	0.072***	0.072***
Demand	-0.312***	-0.296***	-0.293***	-0.324***	-0.32***	-0.315***
Markup	0.091***	0.001#	0.096***	0.099***	0.099***	0.093***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of studies	1,454	1,454	1,454	1,454	1,454	1,454
Study random effects	Yes	Yes	Yes	Yes	Yes	Yes
Average Obs.	5,848	4,994	5,372	5,605	5,746	5,825
Average R^2-within	0.269	0.296	0.287	0.279	0.275	0.270
Average R^2-overall	0.040	0.044	0.044	0.042	0.041	0.040
Average n. of firms	775	771	774	774	774	775

NOTES: Random effects meta-analysis model. Period: 2012-2019. *ΔInt* indicates intangible investments. *MB^{after}* is equal to one from the year of the first minibond issuance onwards, zero otherwise. *MBCount* is the number of minibonds issued by firm *i* at time *t*. *Intangibles* is the amount of intangible assets. *Tangibles* is the amount of tangible assets. *Markup* is the ratio of sales over the costs of production. *Demand* is total sectoral sales minus firm *i*'s sales. *Liquidity* is the amount of the liquid resources of the firm (cash and similar assets). *Bank debt* is the amount of bank debt. *Total debt* is the amount of total indebtedness.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 7. Heterogenous impacts of minibond issuances on intangible investments.

Variable	(1)	(2)	(3)
Intangibles (ln, lag)	-0.446***	-0.452***	-0.414***
MB^{after}	**0.125*** **	**0.144*** **	**0.127*** **
MB^{after} *Listed	**-0.060*** **		
Employment (lag)		0.0001***	
MB^{after} *Employment (lag)		**-0.00004*** **	
Bank Independence (lag)			0.106***
MB^{after} *Bank Independence (lag)			**-0.021*** **
Constant	Yes	Yes	Yes
Additional firm-level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Number of studies	1,454	1,454	1,454
Study random effects	Yes	Yes	Yes
Average Obs.	5,849	5,821	5,133
Average R^2-within	0.269	0.272	0.213
Average R^2-overall	0.040	0.041	0.027
Average nr. of firms	775	774	720

NOTES: Random effects meta-analysis model. Period: 2012-2019. Dependent variable: *ΔInt*. Additional firm-level controls: *Demand*, *Bank Debt (ln)*, *Tot. Debt (ln, lag)*, *Liquidity (ln)*. MB^{after} is a dummy equal to one from the year in which firm *i* issues a minibond onwards, zero otherwise. *Intangibles* is the amount of intangible assets. *Markup* is calculated as sales over costs of production. *Demand* is calculated as total sectoral sales minus firm *i* sales. *Liquidity* is the amount of liquid resources of the firm (cash and similar assets). *Bank debt* is the amount of bank debt. *Total debt* is the amount of total indebtedness. *Listed* is a dummy equal to one if the firm is publicly listed, zero otherwise. *Employment* is the number of employees. *Bank independence* is one minus bank credit over total financial debt.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 8. Impact of minibond issuances on other and total financial debt, financial constraints, and productivity and profitability.

	Other and total financial debt			Financial constraints			Productivity and profitability		
Variable	**Bank debt**	**Non-bank debt (net of bonds)**	**Tot. Fin. Debt**	**Total Investments**	**Cash holding**	**ΔCash holding**	**Sales/Employees**	**Ebitda margin**	**Ebitda/Assets**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
MB^{after}	**-0.097*****	**0.486*****	**0.342*****	**0.174*****	**0.0006***	**-0.00001**	**252.539*****	**0.325*****	**-0.011****
Cash flow (ln)				**0.102*****	-0.003***	**0.00002*****			
MB^{after}*Cash flow (ln)				**-0.011*****		**-0.00001*****			
Total Assets (ln, lag)	0.567***	0.355***	0.597***	-0.551***	-0.001***	0.001***	-402.9***	5.173***	6.742***
Intangibles (ln, lag)	0.215***	0.102***	0.238***				13.9***	0.098***	-0.079***
Demand	-0.770***	-0.006	-0.111***	0.026***	-0.005***	-0.003***	362.4***	-4.752***	-0.684***
Liquidity (ln)	-0.017***	0.015***	0.024***				-1.959#	-0.842***	-0.080***
Bank debt (ln)							-18.939***	-0.147***	0.020***
Markup				-0.095***	0.00002***	0.00001***	2155.7***	-0.137***	0.223***
Total Debt (lag, ln)				-0.106***	0.0002***	0.0002***	258.2***	-4.350***	-4.879***
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional firm-level controls	No	No	No	Yes	Yes	Yes	No	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of studies	1,454	1,454	1,454	1,454	1,454	1,454	1,454	1,454	1,454
Study random effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average Obs.	5,850	5,848	5,843	5,343	5,247	5,415	5,727	5,787	5,848
Average R^2-within	0.053	0.025	0.079	0.595	0.007	0.007	0.047	0.007	0.176
Average R^2-overall	0.024	0.115	0.139	0.088	0.008	0.001	0.023	0.003	0.001
Average nr. of firms	775	775	775	760	748	791	755	765	775

NOTES: Random effects meta-analysis model. Period: 2012-2019. Dependent variables: (1) *Bank debt* = the amount of bank debt (ln), (2) *Non-bank debt* = the amount of non-bank debt net of bonds (ln), (3) *Tot. Fin. Debt*= the amount of total financial debt (ln), (4) *Total Investments* = the annual percentage change in total assets, (5) *Cash holding* = cash over total assets, (6) *ΔCash holding* = the annual change in cash holding. (7) *Sales/Employees* = sales per employee. (8) *Ebitda margin* = EBITDA over sales. (9) *Ebitda/Assets* = EBITDA over total assets. *MB^{after}* = dummy equal to one from the first minibond issuances onwards, zero otherwise. *Cash flow* = firm cash flow. Additional firm-level controls: variation of non-cash working capital and variation short-term debt. *Intangibles* is the amount of intangible assets (ln). *Demand* is calculated as total sectoral sales minus firm *i* sales (ln). *Tot. Assets* is the lagged amount of assets (ln). *Liquidity* is the amount of cash and similar liquid assets of the firm (ln). *Markup* is calculated as sales over costs of production. *Bank debt* is the amount of bank debt (ln). *Total debt* is the lagged amount of total indebtedness (ln). *Cash flow* is firm cash flow. *Total debt* is the amount of total indebtedness.

*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 9. Best and worst impact of minibond issuances on intangibles and tangible investments.

Variable	ΔInt.	ΔTang.	ΔInt.	ΔInt.
PANEL A: *Best scenario*	**(1A)**	**(2A)**	**(3A)**	**(4A)**
MB^{after}	**0.225*****	**0.088*****	**0.197*****	**0.193*****
MB^{Count}			**0.025**	**0.028**
Intangibles (ln, lag)	-0.431***		-0.431***	-0.469***
Tangibles (ln, lag)		-0.443***		
Constant	Yes	Yes	Yes	Yes
Additional firm-level controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Obs.	5,870	5,875	5,870	5,800
R^2-within	0.288	0.361	0.288	0.315
R^2-overall	0.035	0.062	0.0350	0.0370
N. of firms	781	782	781	768
PANEL B: *Worst scenario*	**(1B)**	**(2B)**	**(3B)**	**(4B)**
MB^{after}	**0.021**	**-0.044#**	**0.031**	**0.056**
MB^{Count}			**-0.010**	**-0.015**
Intangibles (ln, lag)	-0.450***		-0.450***	-0.437***
Tangibles (ln, lag)		-0.411***		
Constant	Yes	Yes	Yes	Yes
Additional firm-level controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Obs.	5,805	5,750	5,805	5,926
R^2-within	0.267	0.301	0.267	0.240
R^2-overall	0.042	0.059	0.042	0.0370
N. of firms	775	767	767	787

NOTES: Period: 2012-2019. Panel A and B report the best and worst impact of minibond issuances estimate for each specification. Columns 1-3 present the best and worst estimates based on the coefficient associated with $MB^{after.}$ Columns 4 present the best and worst estimates based on the coefficient associated with MB^{Count}. MB^{after} is a dummy equal to one from the first minibond issuance onwards, zero otherwise. MB^{count} is a count variable equal to the number of minibonds issuances of firm *i* over time. *Intangibles* is the amount of intangible assets. *Tangibles* is the amount of tangible assets. Additional firm-level controls: *Markup*, *Demand* (ln), *Bank debt* (ln), *Liquidity* (ln), *Tot. Debt* (ln, lag). *Markup* is calculated as sales over costs of production. *Demand* is calculated as total sectoral sales minus firm i sales (ln). *Bank debt* is the amount of bank debt (ln). *Liquidity* is the amount of cash and similar liquid assets of the firm (ln). *Total debt* is the lagged amount of total indebtedness (ln).
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 10. Best and worst impact of minibond issuances on intangible investments over time.

	[t-k, t+1]	[t-k, t+2]	[t-k, t+3]	[t-k, t+4]	[t-k, t+5]
PANEL A: *Best scenario*	**(1A)**	**(2A)**	**(3A)**	**(4A)**	**(5A)**
***MB*^{after}**	**0.234*****	**0.234*****	**0.237*****	**0.234*****	**0.228*****
Intangibles (ln, lag)	-0.483***	-0.463***	-0.452***	-0.440***	-0.432***
Constant	Yes	Yes	Yes	Yes	Yes
Additional firm-level controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Obs.	5,002	5,387	5,619	5,764	5,845
R^2-within	0.325	0.311	0.303	0.297	0.289
R^2-overall	0.042	0.039	0.038	0.037	0.035
Nr. of firms	780	781	781	781	781
PANEL B: *Worst scenario*	**(1B)**	**(2B)**	**(3B)**	**(4B)**	**(5B)**
***MB*^{after}**	**-0.001**	**-0.001**	**-0.001**	**-0.001**	**-0.001**
Intangibles (ln, lag)	-0.523***	-0.523***	-0.523***	-0.523***	-0.523***
Constant	Yes	Yes	Yes	Yes	Yes
Additional firm-level controls	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Obs.	4,918	4,918	4,918	4,918	4,918
R^2-within	0.295	0.295	0.295	0.295	0.295
R^2-overall	0.044	0.044	0.044	0.044	0.044
Nr. of firms	764	764	764	764	764

NOTES: Period: 2012-2019. *MB*^{after} is a dummy equal to one from the first minibond issuance onwards, zero otherwise. *Intangibles* is the amount of intangible assets. Additional firm-level controls: *Markup*, *Demand*, *Bank debt*, *Liquidity*, *Tot. Debt*. *Markup* is calculated as sales over costs of production. *Demand* is calculated as total sectoral sales minus firm *i* sales (ln). *Liquidity* is the amount of cash and similar liquid assets of the firm (ln). *Bank debt* is the amount of bank debt (ln). *Total debt* is the lagged amount of total indebtedness (ln).
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

Table 11. Saturated regressions. See Table 5 for comparison.

Variable	ΔIntangibles			ΔTangibles		
MB^{after}	**0.119*** **	**0.117*** **	**0.115*** **	**0.020*** **	**0.026*** **	**0.022*** **
Intangibles (ln, lag)	-0.445***	-0.447***	-0.447***			
Tangibles (ln, lag)				-0.434***	-0.438***	-0.434***
Markup	0.069***	0.091***	0.068***	0.050***	0.058***	0.050***
Demand	-0.315***			-0.060***		
Bank debt (ln)	0.072***	0.072***	0.072***	0.064***	0.065***	0.064***
Liquidity (ln)	0.047***	0.051***	0.047***	0.063***	0.063***	0.063***
Total Debt (ln, lag)	-0.133***	-0.159***	-0.139***	-0.179***	-0.182***	-0.179***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year*NUTS3 FE	Yes	No	Yes	Yes	No	Yes
Year*Sector FE	No	Yes	Yes	No	Yes	Yes
Number of studies	1,454	1,454	1,454	1,455	1,456	1,457
Study random effects	Yes	Yes	Yes	Yes	Yes	Yes
Average Obs.	5,652	5,821	5,651	5,653	5,821	5,652
Average R^2-overall	0.423	0.357	0.435	0.479	0.435	0.491
Average nr. of firms	775	775	775	775	775	775

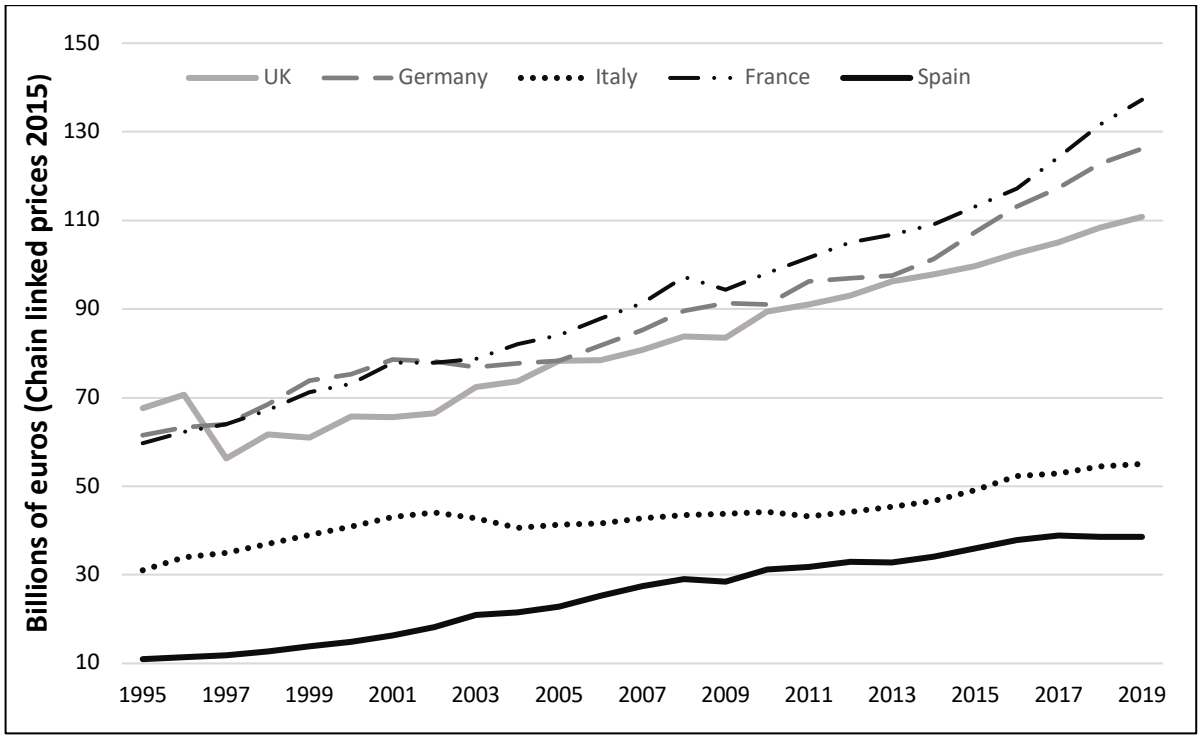
NOTES: Random effects meta-analysis model. Period: 2012-2019. *MB^{after}* is a dummy equal to one from the year in which firm *i* issues a minibond onwards, zero otherwise. *Intangibles* is the amount of intangible assets. *Tangibles* is the amount of tangible assets. *Markup* is calculated as sales over costs of production. *Demand* is calculated as total sectoral sales minus firm *i* sales. *Liquidity* is the amount of liquid resources of the firm (cash and similar assets). *Bank debt* is the amount of bank debt. *Total debt* is the amount of total indebtedness.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

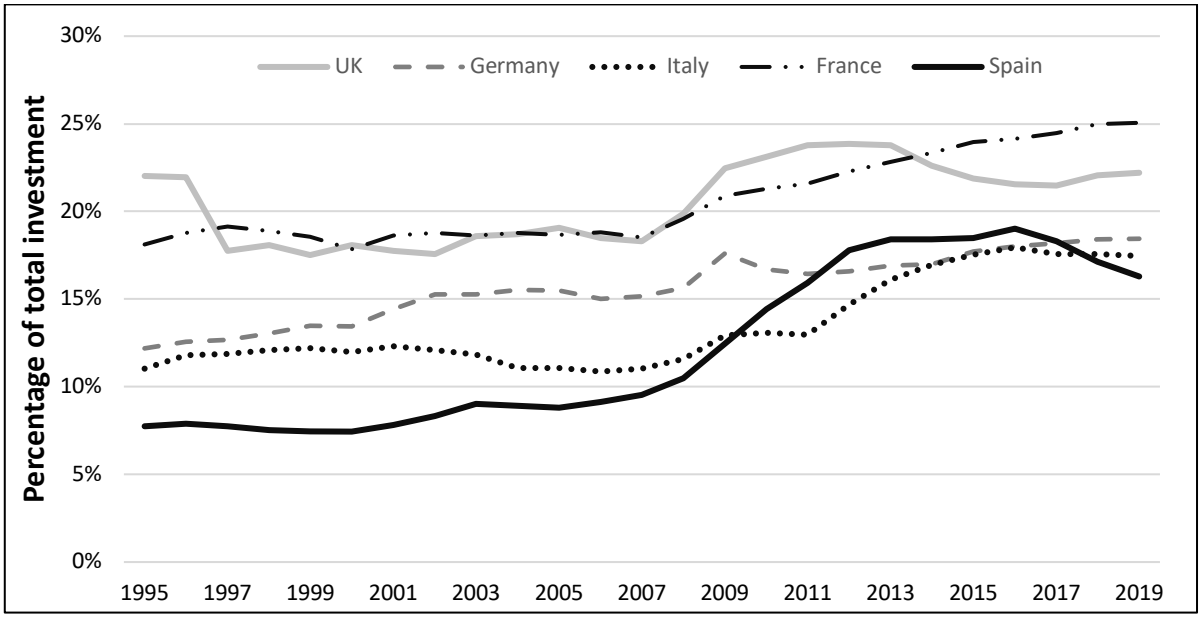
Table 12. Saturated regressions. See Table 6 for comparison.

Variable	(1)	(2)	(3)
MB^{after}	**0.109*** **	**0.116*** **	**0.108*** **
MB^{Count}	**0.009*** **	**0.001**	**0.006*** **
Intangibles (ln,lag)	-0.445***	-0.447***	-0.446***
Markup	0.068***	0.091***	0.068***
Demand	-0.315***		
Bank debt (ln)	0.072***	0.072***	0.072***
Liquidity (ln)	0.046***	0.052***	0.047***
Total Debt (ln, lag)	-0.134***	-0.159***	-0.139***
Constant	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Year*NUTS3 FE	Yes	No	Yes
Year*Sector FE	No	Yes	Yes
Number of studies	1,455	1,456	1,457
Study random effects	Yes	Yes	Yes
Average Obs.	5,652	5,821	5,651
Average R^2-overall	0.423	0.357	0.435
Average n. of firms	775	775	775

NOTES: Random effects meta-analysis model. Period: 2012-2019. Dependent variable: ΔInt. MB^{after} is equal to one from the year of the first minibond issuance onwards, zero otherwise. MB^{Count} is the number of minibonds issued by firm *i* at time *t*. *Intangibles* is the amount of intangible assets. *Tangibles* is the amount of tangible assets. *Markup* is the ratio of sales over the costs of production. *Demand* is calculated as total sectoral sales minus firm *i*'s sales. *Liquidity* indicates the amount of the liquid resources of the firm (cash and similar assets). *Bank debt* is the amount of bank debt. *Total debt* is the amount of total indebtedness.
*** p<0.01, ** p<0.05, * p<0.10, # p<0.15

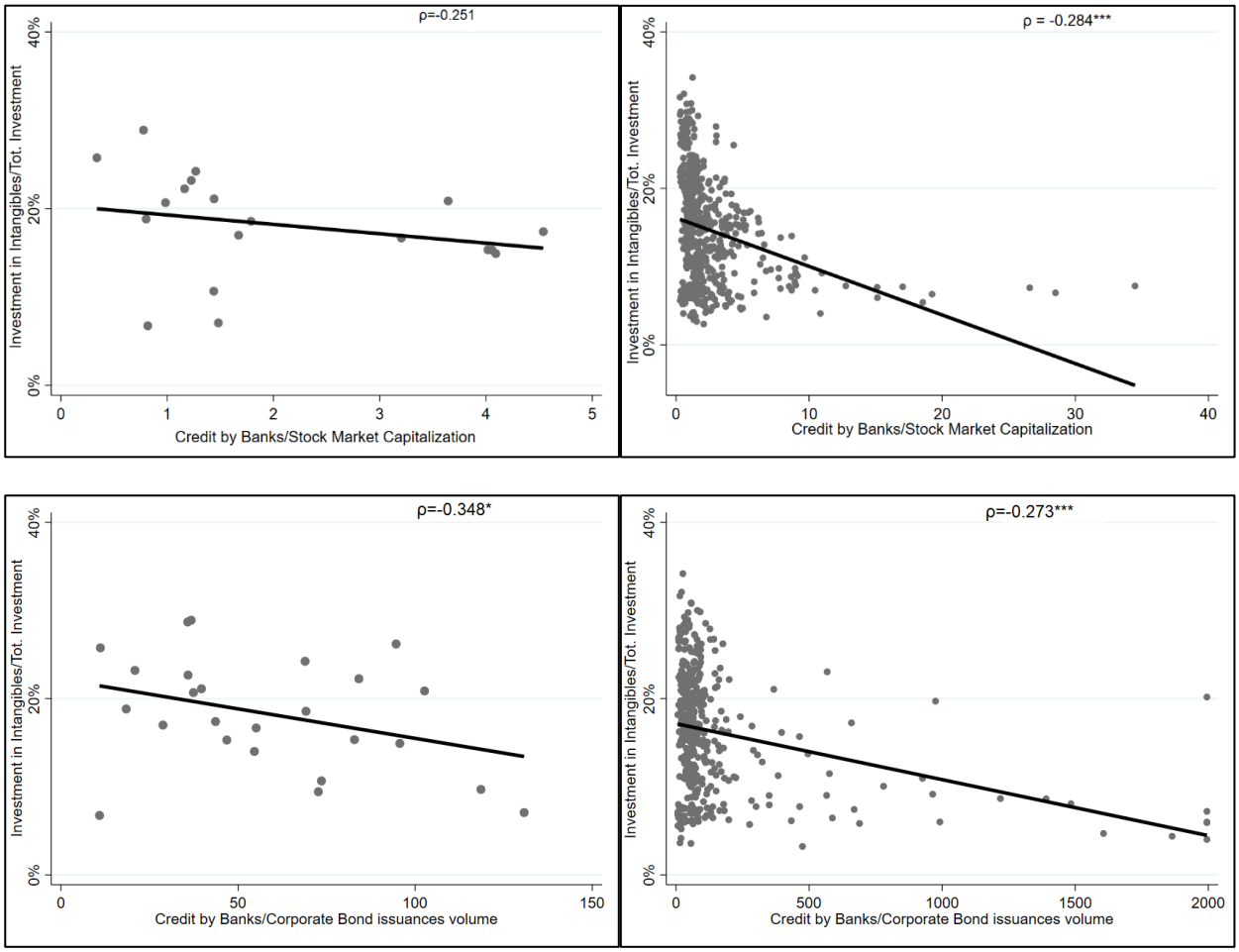
Figure 1. Intangible investments: Italy vs. selected European countries, 1995-2019.





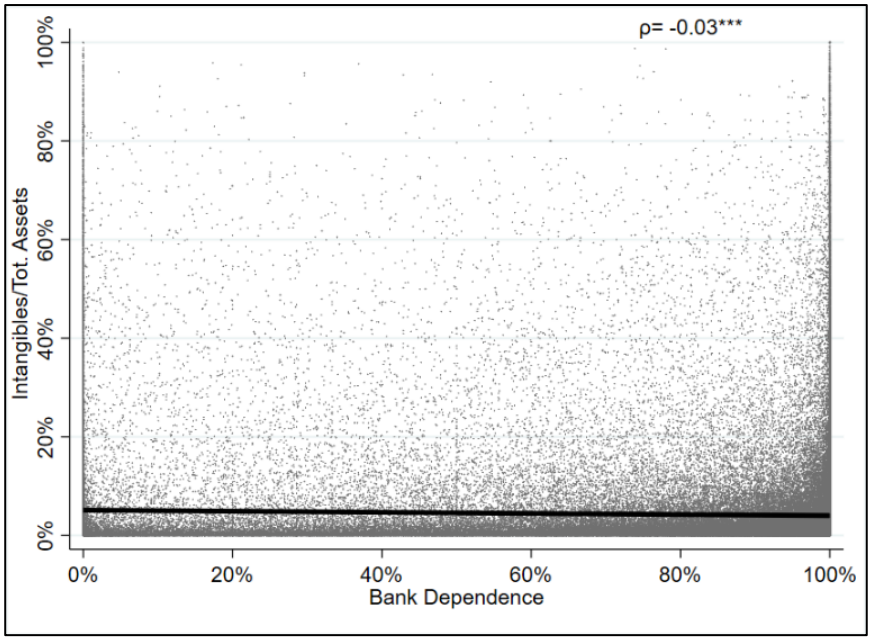
NOTES: Source: Eurostat. Data are available only for investment in intellectual property products included in national accounts. Intangible assets such as human capital, consumer relationships, and distribution systems are not included

Figure 2. Intangible investments and bank dependence: correlation among OECD countries in 2014 (left), 1995-2017 (right), scaled by stock market capitalization (top) and corporate bond issuance volume (bottom).



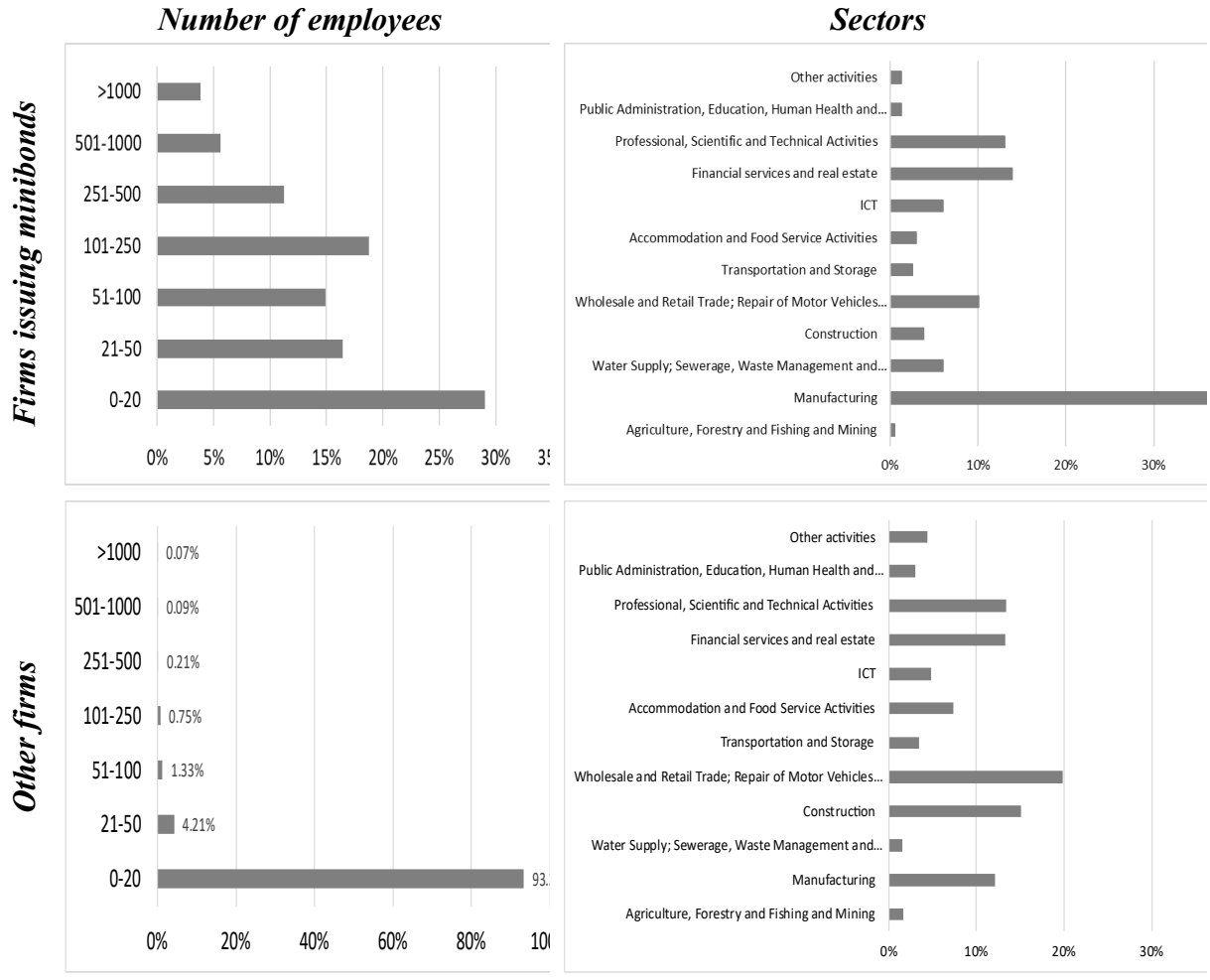
NOTES: Source: OECD and World Bank. Data are available only for investment in intellectual property products included in national accounts. Intangible assets such as human capital, consumer relationships, and distribution systems are not covered in national accounts. We removed outliers (1st and 99th percentiles) for graphical representation reasons.

Figure 3. Correlation of firm's intangible orientation and bank dependence, 2014.



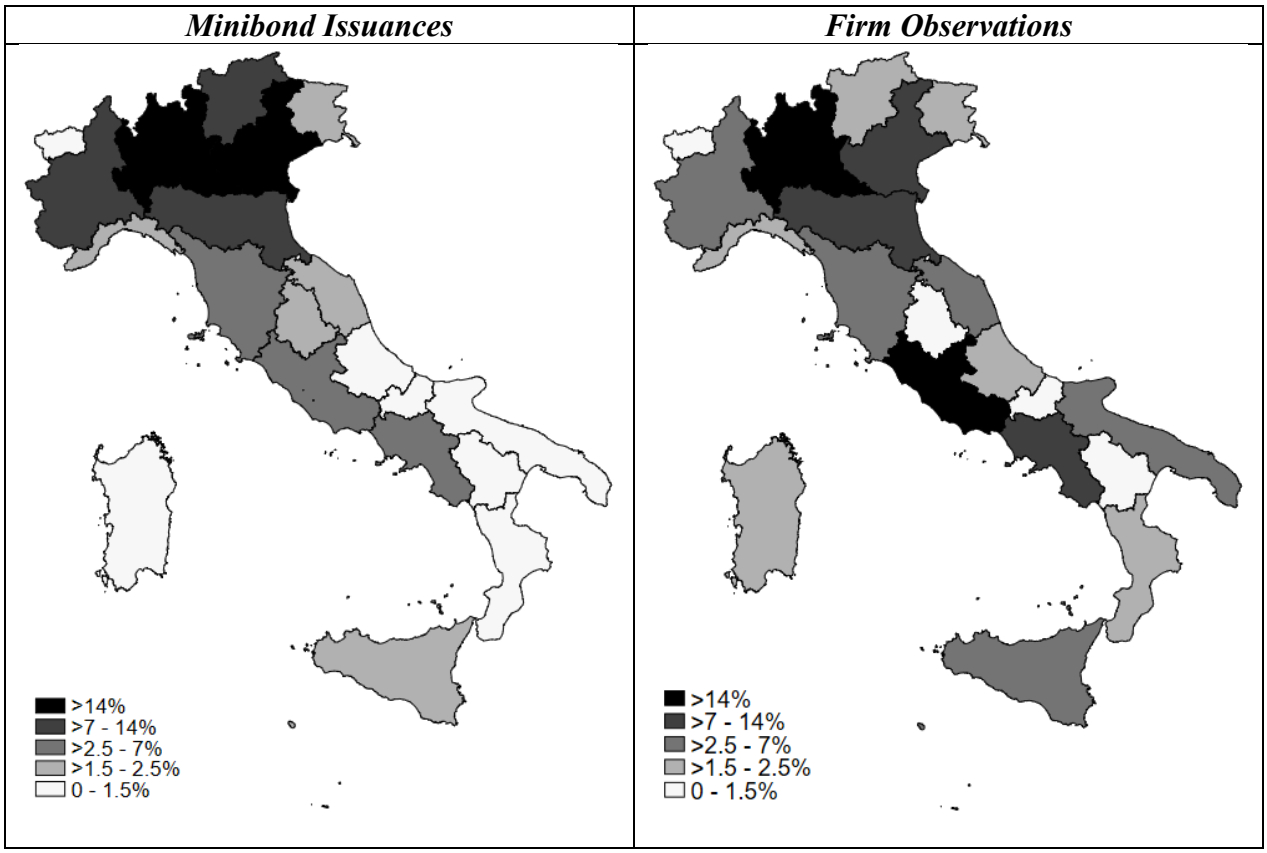
NOTES: Source:Aida Bureau Van Dijk.

Figure 4. Minibond-issuing vs other firms by number of employees (left) and sector (right).



Notes: Source: Osservatorio Minibond and Aida Bureau Van Dijk. Sectors are authors elaboration on Nace rev.2.

Figure 5. Regional distribution of minibond issuances and total firm observations. 2021-2019.



Notes: Source: Osservatorio Minibond and Aida Bureau Van Dijk.

Figure 6. Effect of *MB*^{after} on ΔIntangibles, listed and unlisted firms (see Table 7).

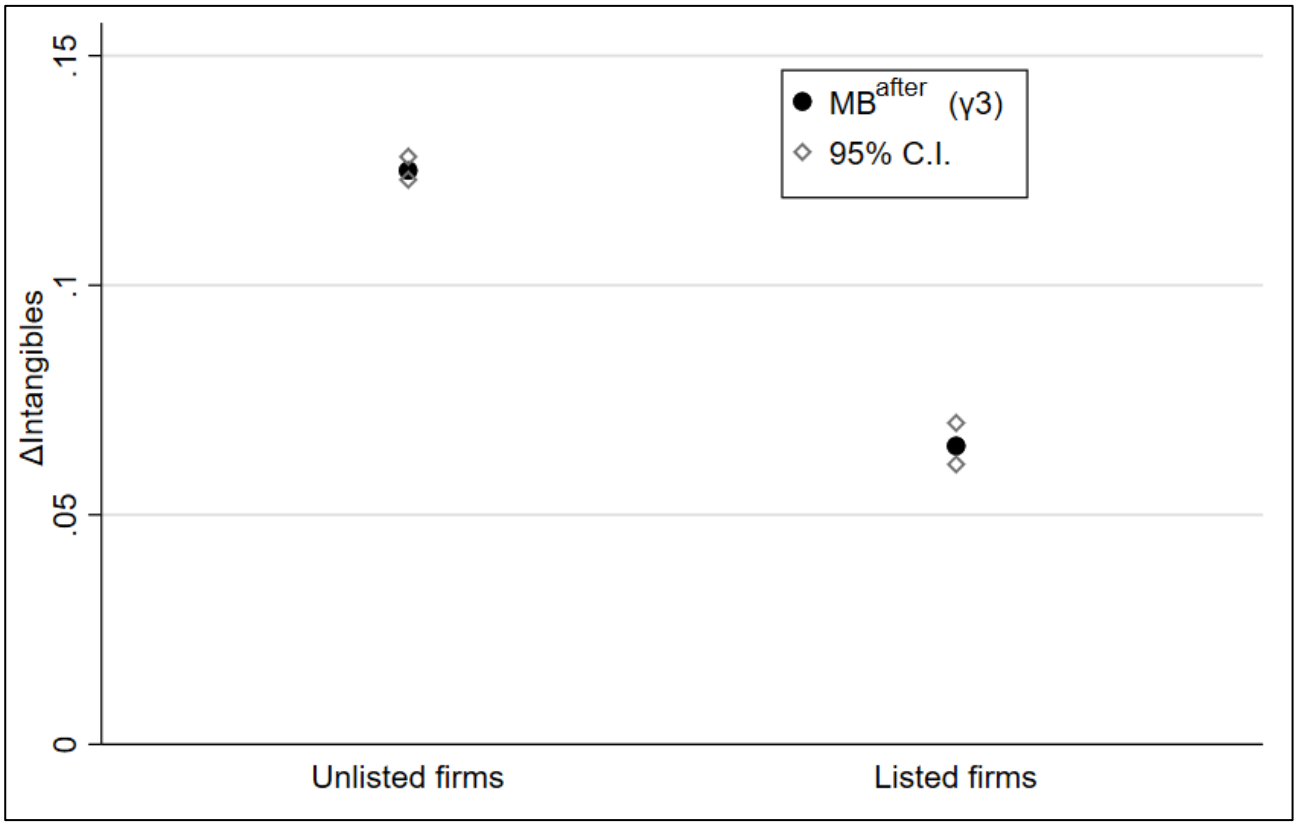


Figure 7. Effect of employment on ΔIntangibles, minibond and no minibond firms (see Table 7).

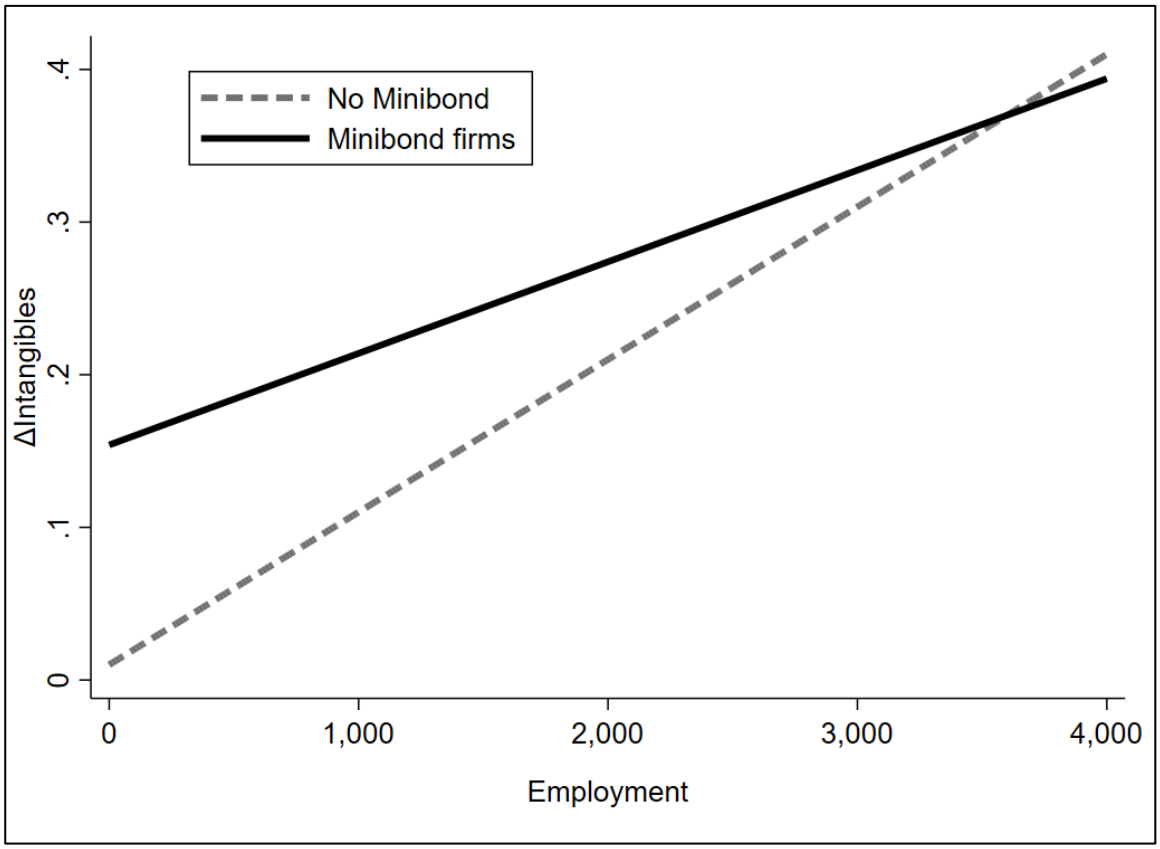
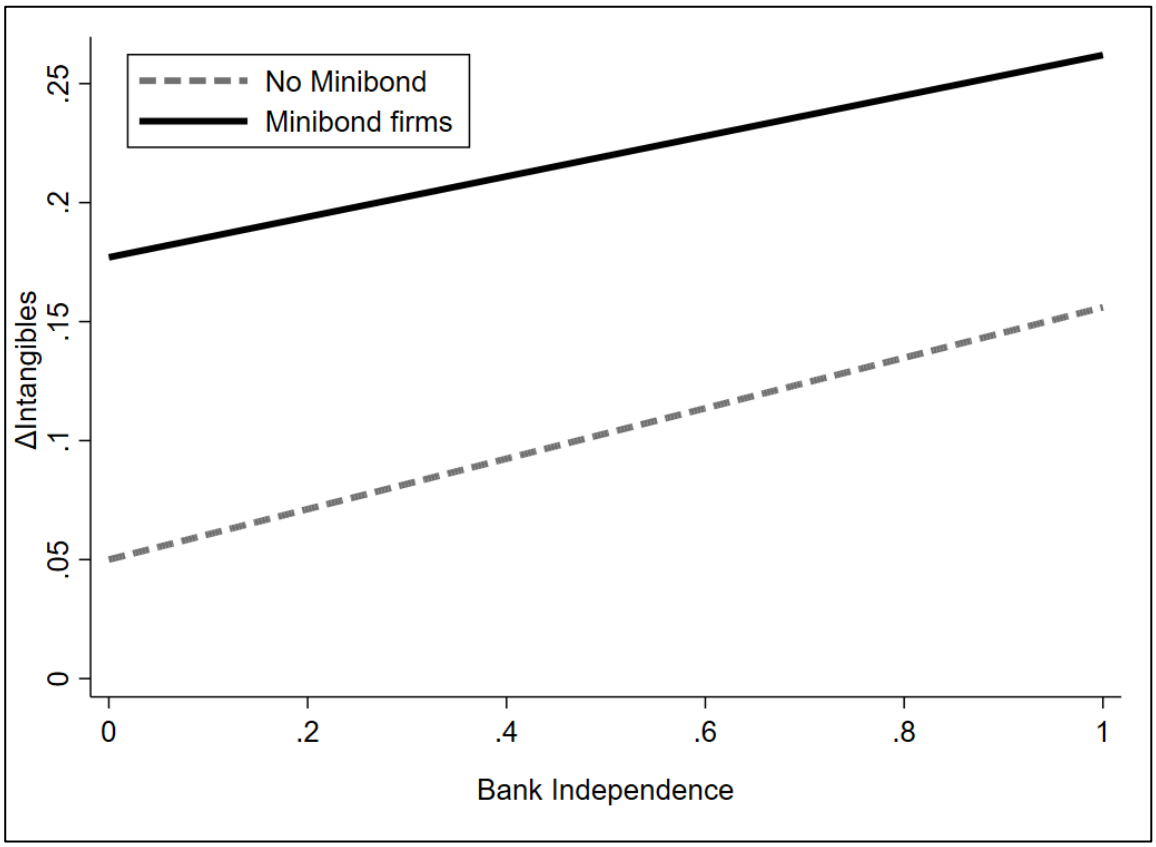


Figure 8. Effect of bank independence on ΔIntangibles, minibond and no minibond firms (see Table 7).



Appendix A.

Table A 1. Descriptive statistics.

Variables	N. Obs.	Mean	Median	Min	Max	Std. Dev.
Tot. Debt (ln)	9,393,685	5.338	5.460	0	10.097	2.090
Liquidity (ln)	8,322,321	3.047	2.944	0	8.032	1.942
Borrowing costs (ln)	9,387,919	1.295	0.693	0	5.996	1.554
Equity (ln)	8,412,714	4.480	4.277	0	9.896	2.031
Borrowing costs/Sales	8,175,849	4.439	0.500	0	54.900	61.720
Liquidity/St. Debt	8,733,780	1.704	0.980	0.010	8.480	10.517
Internal/External resources	8,981,336	39.295	22.770	-31.730	100	240.573
Sales (ln)	9,406,875	4.636	5.124	0	10.285	2.783
Debt equity ratio	6,578,460	3.222	0.010	-10.010	57.880	172.104
Net income	9,406,634	58.576	1.000	-674.000	1,312	11,068
St. Debt ratio	9,203,913	0.784	0.995	0	1	0.355
Net financial position/Ebitda	5,003,137	145.689	0.400	-1,043	2,047	5,956
Listed firm (dummy)	16,900,000	0.000	0.000	0	1	0.015
Joint-stock firm (dummy)	16,900,000	0.019	0.000	0	1	0.137
Tot. Assets (ln)	9,415,009	5.925	5.943	1.099	10.720	1.950
Net financial position	5,003,137	57,206	0.140	-2,128	797,547	1,662,820
EBITDA	9,396,413	202.213	14.000	-355.000	2,443	10,996
Intangibles/Tot. Assets	9,369,146	0.049	0.002	0.000	0.687	0.119
Cash flow/Tot.Assets	9,368,511	-0.102	0.024	-1.603	0.533	23.334
Ebitda/Borrowing costs	5,360,445	20.228	4.267	-66.000	301.000	391.217
MB^{Count}	16,900,000	0.000	0	0	6	0.012
Intangibles (ln, lag)	9,393,395	1.436	0.693	0	7.063	1.843
Demand	9,407,497	333,000,000	154,000,000	24,100,000	868,000,000	306,000,000
Markup	9,159,765	1.019	1.000	0	4.688	5.611
Bank debt (ln)	811,027	3.888	3.892	0	10.969	3.731
Liquidity (ln)	8,322,321	3.047	2.944	0	8.032	1.942
ΔIntangibles	7,660,114	-0.030	0.000	-2.303	2.944	0.750
ΔTangibles	7,661,053	0.025	0.000	-2.485	3.178	0.832

NOTES: See the text for the definition of the variables.