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by Silvia Magri

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Abstract

In this paper we test different theories on debt maturity that can be ascribed to either the demand or the supply side of the market. Firm risk, asymmetric information, agency costs are all aspects that should be considered in the analysis. We also include leverage in the firm decision process regarding debt maturity, relying on a simultaneous equations approach. Among Italian industrial firms, theories based on lenders using debt maturity to address information problems and default risk seem to have strong explanatory power. The demand side of the market appears to be less important in determining debt maturity. The role of the supply side of the market is confirmed when considering legal enforcement of loan contracts. Where legal enforcement is low, the negative consequences of asymmetric information are worse for lenders and this explains why they give more importance to asymmetric information proxies in determining debt maturity.

JEL classification: G32, K40, L14.

Keywords: corporate finance, debt maturity, legal enforcement.

Contents

* Bank of Italy, Economic Research Department; e-mail: silvia.magri@bancaditalia.it

1. Introduction[1]

Italian firms rely less on long-term financial debt than companies in other countries. Using the comprehensive source of Financial Accounts, the evidence is that in the recent past the share of long-term financial debt has increased in Italy from 42 per cent in 1995 to 52 per cent in 2003, but is still lower than in the euro-area countries (67 per cent). Table 1 shows that even normalised to GDP the share of long-term debt is far lower in Italy than in the euro-area average. Further, debt maturity is shorter for small and young firms and for those with fewer tangible assets (Table 2).[2]

The aim of this paper is to analyse the debt maturity choice of Italian firms. More precisely, the analysis is aimed at sorting out supply and demand explanations of the equilibrium value of debt maturity. On the demand side, a financial structure excessively tilted towards short-term debt may have some negative effects. Short-term debt matures before investment cash flow and must be refinanced. This gives more control to lenders, who may liquidate projects too often from the borrowers' point of view; this creates a liquidity risk (Diamond, 1991a). The firm's choice for debt maturity actually trades off between this cost of short-term debt and some advantages. Short-term debt is often less expensive. Further, as argued in Diamond (1991a), firms with unfavourable information on their projects decide to mimic the choice for short-term debt made by firms with favourable information (and therefore less subject to liquidity risk) to avoid being singled out by the lender. Finally, short-term debt can reduce the conflict of interests (i.e. agency costs) between shareholders and creditors, which can create an under-investment problem (Myers, 1977); this problem is emphasised for firms with high growth opportunities.

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[2] Financial Accounts consider as long-term debt that with original maturity of more than one year. Data in Table 2 refer to the Company Account Database, the data used throughout the paper and based on residual maturity.

From a lender's perspective, short-term debt is useful because it allows monitoring of firms and helps to reduce their misbehaviour with the threat of non-renewal of the loan (Demirgüç-Kunt and Maksimovic, 1999). These functions are particularly important under information asymmetries that create adverse selection and moral hazard problems. Debt maturity is therefore recognised as an instrument for coping with unknown and riskier customers. Among others, Diamond (1991b) argued that monitoring is important for reducing information asymmetries and screening moral hazard. However, monitoring is a costly task for lenders and should be used less often when either asymmetric information is less relevant or the firm is less risky.

Considering these different features of the demand and supply sides of the market, corporate finance theories, under brief review in Section 2, predict that some firm characteristics, which could be seen as proxies for asymmetric information, firm risk and agency costs, may actually have important effects on the equilibrium value of debt maturity. In the empirical part of the paper we test these theoretical predictions for Italian industrial firms. Overall, debt maturity has been less empirically studied than other indicators of the composition of financial resources, such as leverage (Ravid, 1996); this is particularly true for Italian companies whose leverage has been studied, among others, in Sapienza (1997) and Staderini (2001). Further, as clearly stated by Ortiz-Molina and Penas (2005), most of the papers have adopted as a reference theories mainly concerned with the demand side of the market, i.e. which debt maturity is preferred by firms, rather than considering the fact that lenders may have strong bargaining power in choosing debt maturity.

In order to improve our assessment of the importance of supply considerations in determining debt maturity, we conclude our empirical analysis by testing the effect of dissimilar legal enforcement of loan contracts in different areas of the country. Judicial efficiency matters for the composition of financial resources. Actually, financing is essentially based on information about the borrower available to outside investors. Nonetheless, financing is also linked to the enforcement of the lenders' right to repossess the money in the event of the borrower's default. Legal enforcement actually determines what rights lenders have and how well they are protected. We argue that a worse enforcement of loan contracts may have an effect mainly on the supply side of the market. When the legal system is inefficient, asymmetric information is more pervasive and hence adverse selection and moral hazard problems are more insidious.

The recent strand of law and economics literature (La Porta et al, 1997 and 1998) has shed light on these aspects. More explicitly on debt maturity, in a recent paper Diamond (2004) argues that if enforcement costs are large and creditor protection is weak, then lenders rely more heavily on short-term debt. Essentially, short-term debt, which is subject to "firms' runs", can serve to commit multiple lenders to enforce their claims, providing costly ex-post punishment to borrowers as well as beneficial ex-ante incentives. The poorer the judicial efficiency the greater the use of short-term debt.

However, in this paper we do not analyse the direct impact of judicial efficiency on debt maturity choice. An analysis based only on the direct effect implies the assumption that a worsening in the efficiency of justice has a homogenous effect on all borrowers. We argue this could not be the case. An increase in the inefficiency of justice may actually heighten adverse selection and moral hazard problems, which are likely to matter more for highly opaque borrowers, i.e. borrowers more affected by asymmetric information. For these reasons, the focus of this paper is on the impact that legal enforcement has on the importance, in the debt maturity equation, of some firm characteristics, such as size, tangible assets and age, which are actually proxies of the extension of firm information asymmetries.

This part of the paper is generally linked to the law and economics literature on this specific topic, which has indeed not reached clear-cut results. For a group of European countries, Giannetti (2000) finds that return volatility and tangible assets matter more, respectively for debt maturity and for leverage, when creditor protection is less developed in a country. This result is different from that in Rajan and Zingales (1995), who work with a sample of public firms in some major industrialised countries: their tests on the importance of legal institutions for leverage are disappointing. For example, they argue that size is an important proxy for bankruptcy risk and should be less significant in determining leverage where legal rules offer better protection to creditors; however, the authors find this is not the case. Giannetti argues that the different findings in Rajan and Zingales (1995) stem from the fact that they work with a sample tilted towards very large firms, which do not really face an asymmetric information problem. Finally Demirgüç-Kunt and Maksimovic (1999), who work with a sample of thirty developed and developing countries, find that improvements in legal rules seem to benefit essentially large firms as far as debt maturity is concerned. They argue this occurs because the smallest firms have limited access to the courts owing to the existence of some fixed costs; it is therefore likely that small firms can obtain more long-term credit from improvements in the banking system rather than in the legal system.

Italian firms represent an interesting case-study from this standpoint. Considering a specific country reduces the effects of several institutional differences that often blur the evidence of cross-country regressions, as in the empirical evidence mentioned above. The different areas of Italy are in fact subject to the same legal rules and bankruptcy code, but they show a wide variability in the degree of judicial efficiency (Figures 1 and 2). Further, in Italy there is a high concentration of small and opaque firms, which theories based on asymmetric information should be particularly suited to.

As a preview of the results, we find that for Italian companies supply explanations appear to matter more than demand reasons in determining the equilibrium value of debt maturity. This result is reinforced by the evidence that for firms located in provinces where legal enforcement is worse, we observe an increase in the importance of some proxies of information asymmetries in the debt maturity equation. The interpretation we offer is that lenders assign more weight to these proxies when asymmetric information has a more pervasive effect, i.e. when the lender has a lower probability of recovering the loan in the case of default because of worse legal enforcement.

This paper is organised as follows. In Section 2 we present the main predictions on debt maturity from corporate finance theories. In Section 3 we outline the test concerning the indirect impact of legal enforcement on debt maturity. In Section 4 we describe in detail the estimation method used. In Section 5 we present the data. Sections 6 and 7 contain the results of the estimations, while Section 8 includes some robustness exercises. Section 9 concludes.

2. Testable predictions on debt maturity

2.1 The impact of firm risk

The first theoretical prediction considered in this section refers to firm risk. In the Diamond two-period model (1991a) firms have private information on the net present value (NPV) of their projects that could be either positive or negative; lenders do not share this information, but they can assign an initial risk-rating to the firm, based on some differences they can observe. Creditors learn during the period and may refuse to roll-over short-term debt at the end of the first period, thus creating a liquidity risk.[3] In this framework, higher-rated borrowers with favourable private information *prefer* short-term debt because it is less expensive and they are likely to roll it over. Intermediate-rated firms with favourable private information use long-term debt to avoid the liquidity risk. This is true also for firms with unfavourable private information (NPV<0); the latter mimic the choice of firms with favourable information, otherwise creditors may identify them and deny credit (Berger et al, 2005). Essentially, an increase in debt maturity with firm risk-rating, from low-risk to intermediate-risk firms, is driven by the *preferences* of the firms, i.e. the demand side of the market.

Shifting the attention to low-rated firms, lenders may refuse to offer long-term debt to firms that are initially considered to be high-risk because they have a high probability of a negative NPV. This result of the Diamond model is in line with the debt contracting literature, which has stressed that the most restrictive conditions of the loan contract are used with the high-risk borrowers, especially under asymmetric information (Berlin and Mester, 1992). Simplifying, we can argue that for these borrowers the "debt covenant view of debt maturity", i.e. the view that lenders have strong bargaining power in determining the maturity of loans, contrasts with the view that debt maturity is essentially chosen by the borrowers, which could be valid only for low-risk firms. On the whole, short-term debt with

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[3] The lender may liquidate the project too often from the borrower's point of view, because he cannot exploit some rents obtainable only by the borrowers because of private information, moral hazard or monitoring costs, i.e. market imperfections (Diamond, 1991a). This creates a liquidity risk associated with short-term debt, i.e. the risk that a borrower will lose non-assignable rents due to excessive liquidation incentive by lenders. In other words, the liquidity risk could be seen as the risk that a solvent but illiquid borrower is unable to obtain refinancing.

banks is the forced choice for high-risk borrowers. The negative relationship between debt maturity and firm risk-rating, from intermediate-risk to high-risk firms, is clearly influenced by the supply side of the market.

Therefore, based on the Diamond model (1991a), the first prediction we test in the paper is that there should be a non-monotonic relationship between debt maturity and credit-rating. Debt-maturity should increase with risk-rating from low-risk to intermediate-risk firms and then decrease with risk-rating among firms with higher risk. [4] In the paper we consider the return volatility as a classical measure of firm risk. A rise in the volatility of earnings increases the probability and hence the cost of financial distress (Bradley, Jarrell and Kim, 1984). The empirical evidence has generally found a negative correlation between debt maturity and return volatility (Mauer and Stohs, 1996; Johnson, 2003). A more comprehensive indicator of firm risk is the score indicator, for which the empirical results are more mixed. There is some evidence of a non-monotonic relationship with score as predicted by Diamond (Barclay and Smith, 1995; Mauer and Stohs, 1996). Other studies find that rated firms find it easier to borrow long-term, such as Johnson (2003); similarly, Ortiz-Molina and Penas (2005) get the result that firm owners that have been delinquent on personal obligations are granted loans with shorter maturity. By contrast, Berger et al. (2005), using loan issues rather than debt maturity structure, find that loan maturity appears to be an upward sloping function of firm risk-rating: they stress this finding is in contrast with the prediction of the Diamond model for high-risk firms.

2.2 The impact of asymmetric information

The second prediction we test in this paper is related to the asymmetric information theory. As mentioned in the Introduction, when there is wide asymmetric information between outsiders and insiders, lenders would rather use short-term debt so that they can

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[4] In the Flannery model (1986), where firms are initially observationally equivalent, the prediction is even stronger than in Diamond model. Firms with favourable private information demand short-term debt at a relatively low interest rate because they know they will have not problems in rolling it over; firms with unfavourable information are willing to pay high interest rates on long-term debt to avoid the high probability of paying higher rates in the second period. In this separating equilibrium creditors can infer some of the initially firm-specific private information and use it in assigning risk-rating, giving lower risk-rating to firms

better control the firm. With a shorter debt maturity lenders can avoid some incentive problems by refusing to renew the loan or modifying the terms of supply (Diamond, 1991a). This is particularly true for loans granted by banks, which can closely monitor their borrowers, unlike creditors that have bought bonds. Nonetheless, when asymmetric information weakens, lenders have an incentive to increase debt maturity in order to reduce monitoring costs.[5] *The second empirical prediction is therefore that debt maturity should be positively influenced by firm size as well as tangible assets and age, which are usual proxies for the extension of information asymmetries. This is clearly a supply explanation of debt maturity choice.*

More specifically, the theory is unambiguous in its prediction for the firm's size. Because a large firm is less subject to asymmetric information, lenders should be more willing to grant long-term debt as they are supposed to be less in need of a strict monitoring. The empirical findings support the positive correlation between size and debt maturity (Barclay and Smith, 1995; Mauer and Stohs, 1996; Titman and Wessels, 1988; Enria, 1999). In a similar vein, tangible assets or collateral may convey information to investors about the quality of the firm and reduce the degree of information asymmetries or opaqueness (Bonaccorsi di Patti and Dell'Ariccia, 2004); moreover, in the case of default, if a firm has more tangible assets to be used as collateral, lenders incur smaller losses. Therefore, an increase in assets that can be offered to lenders as collateral should increase long-term debt. Likewise, age reduces a firm's information asymmetries and the need for monitoring.[6] Therefore, lenders should be more willing to supply long-term credit to older firms; an increase in age should be reflected in a rising share of long-term debt. Nonetheless, this variable has seldom been used in previous empirical works on debt maturity. Enria (1999) finds different signs for the coefficient of firm age among European countries. The evidence

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that choose short-term debt and higher risk-rating to firms that choose long-term debt. Therefore debt maturity is predicted to be *always* positively linked to risk-rating.

[5] Banks may also use debt covenants for monitoring and for discipline; however, covenants are harder to enforce when dealing with small and opaque firms. So with the latter borrowers, for which asymmetric information is more pervasive, debt maturity is optimal as it allows more frequent renegotiations and close monitoring. When asymmetric information weakens, lenders can use covenants or other terms for monitoring (Ortiz-Molina and Penas, 2005).

[6] According to Diamond (1991b) higher reputation, connected with age, reduces the need for monitoring because it alone can reduce moral hazard. Nonetheless, where a developed bond market exists, ageing firms may rely more on public placed short-term debt; therefore, short-term debt may also increase with age.

in Ortiz-Molina and Penas (2005), concerning small firms in the US, is that age is positively related to debt maturity of the new lines of credit.

2.3 The impact of agency costs

As already mentioned, short-term debt entails a liquidity risk for the borrower, i.e. the risk that the borrower cannot refinance the debt. Nonetheless, on the demand side of the market there could be a rational in preferring short-term debt, as put forward by the agency costs theory. The agency costs theory hinges on imperfect information concerning managers' future attitudes, when incomplete contracts do not allow the moral hazard problems to be fully tackled. Conflicts of interest may arise both between different categories of shareholders and between shareholders and creditors. The optimal capital structure should minimise the agency costs deriving from the different conflicts of interest (Jensen and Meckling, 1976).

Specifically for debt maturity, Myers (1977) points out a serious agency problem between shareholders and creditors. If the firm has the option of taking future investment opportunities, the existence of debt that matures *after* the option expires may, in some states of nature, induce managers, acting in the shareholders' interest, to pass-up some profitable investment projects because shareholders cannot obtain a positive return. This is the so-called under-investment problem, which could be solved by shortening debt maturity.[7] Debt that matures *before* an investment option can be exercised does not induce sub-optimal investment decisions.[8] *The third prediction tested in the paper is that debt maturity should decrease when managerial discretion in choosing investment is greater. Therefore, debt maturity should be negatively correlated with higher opportunities for growth, as managers of these firms may have more discretion in choosing among different investment projects.*

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[7] Essentially, the problem is that without outstanding debt (creditors), the investment option is worth exercising if $V(s)-I>=0$,where $V(s)$ is the worth of the firm's assets at time $t=1$ and I is the investment. With outstanding debt maturing *after* the option expires, the investment is made if $V(s)-I-P>=0$ where P is the promised payment to creditors. The area under which the investment option is exercised is then reduced. In the case of $V(s)-P<I$, shareholders' outlay I will exceed the market value of their shares and the investment option could not be exercised. If the debt matures *before* the option expires, the disincentive to invest is eliminated; in this case, if $V(s)-I<P$ the bondholders will take over and will exercise the firm's option to invest if $V(S)>=I$.

[8] Other solutions are to reduce the presence of creditors and use restrictive covenants, which for example oblige managers to undertake all the projects with positive net present value.

On this last point, the literature has found it difficult to obtain a good proxy for growth opportunities. A variable often used is the ratio between market and book value of the firm's assets.[9] In this paper, as we do not have the market value for equity, we follow the empirical literature (Giannetti, 2000) in using as proxy for growth opportunities the growth rate of sales between t and t+1 at sector level. The empirical evidence is mixed on this point. Barclay and Smith (1995) find that smaller firms with more growth opportunities (measured as the market-to-book ratio) have indeed a lower share of long-term debt. On the contrary, using a similar indicator, the evidence in Mauer and Stohs (1996) is that debt maturity does not decrease when growth opportunities increase: they argue that this occurs because firms with high growth options have lower leverage (i.e. low debt compared with capital) and therefore little incentive to minimise conflicts of interests between shareholders and creditors using debt maturity. Mauer and Stohs control for leverage in the maturity equation, but without considering its nature as endogenous variable. Johnson (2003), considering that maturity and leverage are chosen simultaneously, finds support for Myers's prediction that using short-term debt diminishes the negative effect of growth opportunities on leverage.

2.4 The impact of leverage

In the estimations carried out in this paper we include leverage in the maturity equation and we consider that it could be chosen jointly with debt maturity (see Section 4 for the estimation procedure). As for the relationship between leverage and debt maturity, on the grounds of past evidence the results are not clear-cut. On the demand side, an increase in leverage is reflected in a higher liquidity risk, which firms should alleviate with more long-term debt (Diamond, 1991a; Mauer and Stohs, 1996, Giannetti, 2000). However, on the supply side some lenders may turn down applications for long-term debt because of the higher risk that an increasing leverage entails: in this case the relationship between leverage and debt maturity could be negative (Enria, 1999). *The fourth prediction to be tested is that if a supply explanation prevails, leverage should negatively affect debt maturity.*

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[9] The market value of assets is generally estimated as the book value of assets plus the difference between the market and book values of equity. Several authors argue that the more growth opportunities a firm has, the larger the ratio is, as the market value also prices the exercise of growth options (Mauer and Stohs, 1996).

2.5 The impact of the asset maturity

Finally, another classical determinant of debt maturity is the maturity of firm's assets, which clearly stands on the demand side of the market. Matching the length of assets and liabilities is an important task for a firm. On the one hand, if the debt is too short, the firm may not have the money to repay the principal and will need to refinance it, thus encountering a liquidity risk (Diamond, 1991a). On the other hand, if the debt has a longer maturity, the firm may fall short of the cash flow from assets it needs for debt repayment. *The fifth empirical prediction to test is therefore that an increase in asset maturity implies longer debt maturity because of the matching theory.*[10] The empirical evidence is generally consistent with this hypothesis. As in most other papers (Mauer and Stohs, 1996; Barclay, Marx and Smith, 2003; Johnson, 2003), firm asset maturity is measured as the weighted average of the maturity of current assets and of net property, plant and equipment. The maturity of current assets is measured as current assets divided by the value of goods sold, while the maturity of net property, plant and equipment is obtained dividing this amount by depreciations; these two ratios are weighted by the relative size of current assets and net property, plant and equipment.[11]

In summary, we finally estimate the following equation for debt maturity:

$$\begin{aligned}(1)\quad & Debt-maturity_{it} = \beta_0 + \beta_1 assmat_{it-1} + \beta_2 size_{it-1} + \beta_3 collateral_{it-1} + \beta_4 age_{it-1} + \beta_5 risk_{it} \\ & + \beta_6 growth-options_{(\sec tor)t+1} + \beta_7 leverage_{it} + dtime_t + darea_i + dindustries_i + \varepsilon_{it}\end{aligned}$$

The dependent variable is the ratio between long-term financial debts (maturing in more than one year and using residual maturity) and total financial debts.[12] For the precise definition of the other variables see Table 3, while *darea* stands for area dummies, *dtime*

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[10] Further, Myers (1977) states that matching the maturity of assets and liabilities can reduce agency conflicts between shareholders and creditors by ensuring that debt repayments are scheduled to correspond with the decline in the value of assets in place.

[11] As argued in Mauer and Stohs (1996), the rational for this indicator is that current assets, like inventory, supports production measured by its value. Further, straight-line depreciations of long-term assets, which are used in the balance sheet, provide a better approximation of economic depreciation than do accelerated depreciations that firms use for tax purposes.

[12] Trade debt (account payables) is excluded from the definition of financial debt and hence is not included in short-term debt.

for year dummies, which should also capture changes in the relative cost of short-term versus long-term debt, and *dindustries* for sector dummies.

3. The test using legal enforcement and asymmetric information proxies

The purpose of this section is to explain why and how we rely on a test related to the quality of legal enforcement in order to assess our understanding of the importance of supply considerations in determining the equilibrium value of debt maturity.

When the quality of judicial efficiency worsens, legal enforcement of loan contracts is weaker. Lenders therefore have a greater need to monitor borrowers and would like to use more short-term debt. However, this effect should be stronger for borrowers who are more affected by asymmetric information problems. In other words, when the legal system is inefficient, adverse selection and moral hazard problems matter more and so does the asymmetric information that is at the origin of these problems. Hence the proxies for asymmetric information should have greater importance for the lenders in choosing debt maturity when legal enforcement is low.

Our test therefore consists in assessing whether size, tangible assets and age, the usual proxies for the extensions of firm asymmetric information, matter more when the quality of judicial efficiency worsens. As the expected impact of the asymmetric information proxies on debt maturity is positive (Section 2), essentially our test on the sign of this cross partial derivative is:

(2)
$$\frac{dDebt - maturity}{dAI * djustice} > 0$$

where *AI* stands for asymmetric information proxies, such as firm size, tangible assets and age, and *justice* for the quality of judicial efficiency. As justice is a measure of the length of civil trials (see Section 5 for details), an increase in justice reflects a worsening in the quality of judicial efficiency.

4.The estimation strategy

4.1 A simultaneous equation framework for debt maturity and leverage

In the estimations carried out in this paper we include leverage in the debt maturity equation. Following Barclay, Marx and Smith (2003) and Johnson (2003), we consider the particular nature of leverage as a choice variable jointly with debt maturity. The different decisions about corporate finance, such as the firm's choice between equity or debt, debt maturity, debt priority and covenants, are likely to be taken simultaneously. In particular, it is highly unlikely that the decision for debt maturity is taken separately from that concerning leverage. In order to estimate a debt maturity equation, we therefore consider a system of two simultaneous equations, one for debt maturity and the other for leverage. The system is estimated using a two-stage least square. In the second stage, in the maturity equation the predicted value of leverage is included, rather than its actual value; the predicted value is obtained by regressing, in a first-stage regression, leverage on *all* the exogenous variables of the system.[13]

The theory suggests that leverage and debt maturity decisions are roughly driven by similar firm characteristics. However, this type of estimation requires some exclusion restrictions from the theory in order to identify the structural coefficients (Greene, 2003). In line with some previous empirical studies (Barclay, Marx and Smith, 2003; Johnson, 2003), we estimate the system of two equations using the following exclusion restrictions. We include *only* in the debt maturity equations the explanatory variable concerning asset maturity, which should not affect leverage. Conversely, we include *only* in the leverage equations the explanatory variable measuring the non-debt tax shield (depreciations on total assets), which should matter only for leverage; if there are alternative ways, such as

[13] Using just a reduced-form regression for debt maturity from the system of equation, i.e. considering only exogenous variables in the right-hand side and therefore excluding endogenous leverage from the maturity equation, implies that changing one of the exogenous variables can have a *direct* effect on maturity and an *indirect* effect through leverage. If the theory implies these effects are reinforcing, then the theory has some unambiguous predictions for reduced-form regression coefficients. On the contrary, if the two effects are offsetting and the theory cannot predict their relative size, we do not have predictions that are testable using reduced-form regressions. However, even if the reduced-form coefficients do not yield unambiguous predictions, the theory can still be tested using the structural-equation regressions (Barclay, Marx and Smith, 2003).

depreciations, which can be used to reduce the tax burden, leverage is less attractive for this purpose. Taxes should have an effect on leverage, but not on maturity decisions (Barclay, Marx and Smith, 2003). Further, profits are included *only* in the leverage equation because, according to the pecking-order theory (Myers, 1984; Myers and Majluf, 1984), profits should be negatively linked to firm leverage; on the other hand, there is no theory asserting an explanatory power of profits for debt maturity (Johnson, 2003). This is basically the identification strategy used in this paper.[14] Given these exclusion restrictions, the system of two equations is identified and can be estimated by two-stage least square (Johnson, 2003).[15]

Unlike previous empirical studies, as the share of long-term debt is between 0 and 1, we rely on both the Tobit model (censored dependent variable) and a model where the dependent variable is transformed in log-odds in order to have a variable that spans all real values.[16] We estimate an unbalanced panel made up of around 68,000 firm-year observations (roughly 14,900 firms) that controls for firm heterogeneity and allows us to consider the hypothesis that the errors are not independent within the firm. For the Tobit model, we estimate a panel random-effect model, which assumes the unobserved individual effects as uncorrelated with the other explanatory variables. For the estimation in log-odds, we are also able to estimate a panel fixed-effect model, which allows the unobserved individual effects to be correlated with the other explanatory variables, though exploiting only time-series variability.[17]

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[14] In other words, we want to have only an exogenous variation in leverage. Therefore, we instrument it with some variables that are strongly correlated with leverage, while they should not with the error term (unobserved factors) in the debt maturity equation.

[15] Unlike other studies, we keep in the maturity equation the variable tangible assets, which should control for the firm's ability to offer collateral to the lender. The rational is that the ability to provide collateral should matter for the lender as it reduces the opacity of the borrower and therefore the need for monitoring that induces lenders to use short-term debt.

[16] Before the transformation of the share y in log-odds z, i.e. $z=\log(y/(1-y))$ with z unbounded, we replace shares equal to 0 with the lowest share and shares equal to 1 with the highest share in the distribution. Sensitivity analysis has been carried out in order to check the results when substituting different values for 0 and 1.

[17] The random-effect panel model may suffer from inconsistency if the assumption of the absence of correlation between regressors and unobserved individual effect is not satisfied (Hausman and Taylor, 1981). Even if some authors have proposed fixed-effect Tobit panel models, their estimation is still tricky. In this paper, on the basis of the similarity of the results between the estimations using Tobit and log-odds, we prefer to verify the results using the panel fixed-effect estimation with the dependent variable transformed in log-odds.

In order to avoid simultaneity problems, all the explanatory variables in the equation (1) are lagged one period; they are therefore treated as predetermined variables (i.e. not correlated with the current error term), except the firm return volatility, which is fixed in the period under analysis; the growth opportunities proxy, which is measured by the growth rate of sales between t and t+1 at a sector level; and the score, for which the contemporaneous value is used (see Section 5).

4.2 The implementation of the test on legal enforcement

In order to implement test (2) mentioned above, first we create interaction terms using the efficiency of justice measured as a continuous variable. We therefore interact the proxies for AI (size, tangible assets and age) with justice measured in length. In this case the test (2) is clearly implemented. The coefficients of the interaction terms are an indication of the second cross partial derivative of debt maturity with respect to the proxies of AI and to the efficiency of justice. Under the expected case of a positive impact of the variable measuring AI on debt maturity, this second derivative is expected to be positive (test in 2); i.e. when the inefficiency of justice increases, the first partial derivative of debt maturity with respect to the firm's characteristic is expected to be higher.

For the sake of testing the robustness of the results concerning the impact of worse legal enforcement, we also create interaction terms between, respectively, size, tangible assets and age with dummies for the efficiency of justice, rather than using a continuous variable. Two interaction terms are defined. The former is obtained by interacting the variables with a dummy equal to 1 when the length of the first-degree civil action is greater than the first quartile and lower than the median value. The latter is obtained by interacting the variables with a dummy that is equal to 1 when the length is over the median value; statistics on length are measured over the 95 Italian provinces.[18] The coefficient of the first interaction term therefore measures the increase in the base coefficient for firms located in

[18] The sample which includes firms located in the Italian provinces where the length of civil actions is below the first quartile accounts for 27 per cent of all observations. The sample that included firms located in the provinces belonging between the first quartile and the median accounts for 42 per cent. The remaining sample includes all the companies facing a length of first-degree civil actions that is greater than the median value (31 per cent).

the provinces where the length of actions is greater than the first quartile, but lower than the median value. The coefficient of the second interaction term makes it possible to obtain the change in the base coefficient for observations belonging to the provinces where the length of actions is greater than the median (Greene, 2003).[19] Simple t-tests allow us to test the significance of the coefficients of the interaction terms. Our analysis focuses on these coefficients. The coefficient of the variable of interest (size, tangible assets and age) not interacted with the dummies measures the effect of this variable on debt maturity when justice is highly efficient, i.e. the length is in its first quartile.

In this part of the paper, we estimate only a panel random-effects model even when using log-odds, as we need to retain some cross-section variability because our indicator of the efficiency of justice does not vary with time. Further, even if we had a time-varying indicator of the efficiency of justice, we argue that for the lender the problem of evaluating two firms with different asymmetric information (proxied by firm characteristics) living in areas with different values for the efficiency of justice (*cross-section variability*) is more important than that of evaluating the same firm with different degrees of asymmetric information in different periods of its life, characterised by a changing level of the efficiency of justice in the same province (*time-series variability*, the only captured by panel fixed-effects estimators).

Nonetheless, the results obtained with a random-effects panel model are checked using cross-section estimations, i.e. estimations based on firm-specific means calculated by

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[19] For example, considering the following equation $y = \beta_1 + \beta_2 X_2 + \beta_3 \delta_1 X_2 + \beta_4 \delta_2 X_2 + \mu$, where the dummy $\delta_1 = 1$ when the length of actions is greater than the first quartile and lower than the median, $\delta_2 = 1$ when the length of actions is over the median, and X_2 is a variable for which we want to test the differential impact of the efficiency of justice, then we have:

$$X*\beta = \begin{bmatrix} 1 & X_{21} & 0 & 0 \\ 1 & X_{22} & 1*X_{22} & 0 \\ 1 & X_{23} & 0 & 1*X_{23} \end{bmatrix} * \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix}$$

where β_2 is the coefficient of the variable X_2 for the observations belonging to the first quartile of the length of actions, $\beta_2 + \beta_3$ is the coefficient for firms belonging to the second quartile, and $\beta_2 + \beta_4$ applies to firms for which the length is over the median.

averaging firm data over years; this avoids serial correlations of the error terms implicit in the panel estimation.

5. The data and the variables used in the estimation

In estimating the model specified in Section 2 and in carrying out the test in Section 3 we use a dataset made up of industrial firms from the Company Accounts Database (CAD - *Centrale dei Bilanci*), covering an eight-year period (1993 – 2000). Data on firms' balance sheets, which are reclassified to ensure cross-sectional comparability, have been collected since 1982 from a consortium of banks; the sample is not randomly drawn as firms enter only if they borrow from one of the banks in the consortium. Since 1993 the Company Accounts Database has included some smaller companies from another dataset managed by the Chambers of Commerce (*Cerved*) and is less biased towards large-size firms.[20] Roughly, the balance sheets of more than 20,000 industrial companies are included in the dataset each year.

We drop from the dataset some outliers in order to reduce their impact on the results. All the firm-year observations for which some variables used in the estimation are less than the 1st percentile or above the 99th percentile are deleted. We also drop firm-year observations for which age turns out to be wrong and for firms involved in mergers and acquisitions.

Table 3 contains a list of all the variables used in the estimation. In the following part of the section we dwell on the measures for judicial efficiency and the firm score used in the paper; we also present some descriptive statistics.

5.1 The measure for judicial efficiency and for the risk of the firm

Using the province where the firm is located, we include in the dataset an indicator of the efficiency of justice, the length of first-degree civil actions measured at a provincial level

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[20] In 2002, non-financial firms surveyed in the CAD sample (more than 30,000) accounted for 40 per cent of the value added of the whole sector of non-financial firms, based on Institutional Accounts by the National Institute of Statistics.

(95 provinces). This measure is provided by the National Institute of Statistics; it is well correlated with other traditional measures of the efficiency of justice, such as the backlog of pending civil actions (Figure 1; Bianco and Giacomelli, 2004; Bianco, Jappelli and Pagano, 2004).[21]

Our preferred measure of the risk of firms is the score indicator computed by the Company Accounts Database using a discriminant analysis. Firms are classified into four categories: the first includes safe firms (score=1,2), the second solvent firms (score=3,4), the third and the fourth categories vulnerable firms (score=5,6) and risky firms (7,8,9) respectively. This variable is interesting as it is supposed to capture the quality of the firms in a very stylised way; further, it is released around 15 months after the period it refers to. We therefore use its contemporaneous value in the estimation. In the paper we also consider the return volatility of the firm as a classical measure of the firm's risk. We use the firm's standard deviation of the operating income rate of growth, an indicator that cannot be directly affected by the firms' debt level; this variable is calculated over the period 1993-2000 and does not change with time.

5.2 Descriptive statistics

In Table 2 we report debt maturity, defined as the share of firms' long-term financial debts, i.e. debts that mature after one year, by quartiles of the main explanatory variables.[22] Debt maturity appears to be strongly positively correlated with asset maturity, size, tangible assets and age and negatively linked to firm risk and leverage. Table 4 reports some statistics on the variables used in the estimations. In general, firms show strong cross-section variability in their relevant characteristics. They also face quite different degrees of the efficiency of justice: the mean and the median value of the length of first-degree civil actions

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[21] The correlation coefficient considering the 27 Italian districts is positive and equal to 0.6. Previous estimates based on data referring to 27 Italian districts, rather than 95 provinces, showed that results using backlogs were quite similar to those obtained with the length of civil actions.

[22] Recent empirical papers have generally analysed maturity rather than duration. Some authors have tested maturity of new issues. However, in other studies it is assumed that firms follow a continuous optimal policy, resulting in a capital structure that reflects their preferred maturity. One can then test the theory by regressing a measure of debt maturity against different characteristics of firms (Ravid, 1996).

is more than 3 years, while in the best province it is 2 years and in the worst roughly 6 years (Table 4 and Figure 2).

6. The results for the baseline estimation of debt maturity

In this paragraph we focus our attention on the baseline estimation for debt maturity of Italian industrial companies. In Table 5 the results obtained with both the estimation in log-odds (panel GLS) and Tobit model are reported. The results we got with the two types of estimations are very similar (first and second columns); this is true also from an economic point of view. [23]

As in most other studies, we find that controlling for matching with asset maturity is an important aspect of debt maturity choice: the proxy measuring asset maturity is positively correlated with the incidence of long-term financial debt. Nonetheless, the economic impact of this variable is rather modest.

The variables that are proxies for asymmetric information have an important explanatory power in the debt maturity equation. Tangible assets have a positive effect on debt maturity. The economic impact of this variable is quite important: moving from the 1st to the 3rd quartile of tangible assets, debt maturity increases by roughly 7 percentage points (14 p.p moving from the 10th to 90th percentiles). Size and age also matter with the expected sign. Long-term debts have a higher incidence for larger and older firms. The economic effect of firm size is such that, moving from the 1st to the 3rd quartile of this variable, debt maturity increases by more than 4 percentage points (9 p.p moving from the 10th to the 90th percentiles). As for firm age, the linear term has a positive coefficient, while the squared term has a negative coefficient, revealing an inverted U-shape relationship. This relationship is actually positive up to the age of 40 years (the 90th percentile) and then becomes negative;

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[23] The following calculations of the economic impact are obtained using Tobit estimations and putting all the other explanatory variables, but the one considered, at their mean values for the sample used in the panel estimation. With regression using log-odds of the dependent variable, we cannot directly estimate the conditional expectation of the dependent variable without further assumptions. Simulations based on the methodology proposed by Duan (1983) show an even stronger economic impact for the variables such as size, tangible assets, age and, in particular, leverage.

however, moving from the 1st to the 3rd quartile of age, debt maturity increases by only 1 percentage point.

Considering the prediction related to firm risk, the coefficient of the return volatility, a classical measure of firm risk, has a negative sign; when we insert the squared term of the return volatility, we still find that the relationship between debt maturity and risk is negative for the most important part of the risk distribution. The indicator used is the standard deviation of the operating income growth rate measured over the period under analysis; a similar result is obtained using the standard deviation of the first difference of earnings before interests and taxes, scaled by total assets (Johnson, 2003). However, the economic impact of this variable is quite modest: moving from the 1st to the 3rd quartile of return volatility, debt maturity decreases by only 0.2 points; important changes occur only in the upper tail of the distribution (beyond the 95th percentile).

Another valuable indicator of firm risk is the score measured by CAD using a discriminant analysis. This is a more complete measure of firm risk, which changes over time. Unfortunately, it is highly correlated with leverage (0.80); for this reason we prefer to run separate estimations (in third and fourth columns of Table 5). We do not actually find evidence of a non-monotonic relationship, as predicted by Diamond (1991a). Our result is that debt-maturity is always decreasing as far as firm risk is increasing, actually reaching a minimum level at the maximum level of the score. The economic impact of the score is important: moving from the 1st (score equal to 4) to the 3rd quartile (score equal to 6) of the score, debt maturity decreases by 4 percentage points. Importantly, as score and leverage are highly correlated at the firm level, we also try a similar estimation dropping leverage from the debt maturity equation; we obtain similar results (Table 5, fourth column).[24]

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[24] Diamond says that empirical studies of debt maturity will measure a mixture of the presence of short-term debt for low-risk and high-risk firms. This could make inference complicated. One way around this would be to use short-term bank debt as a proxy for the lower-rated borrowers, who are *forced* to choose short-term debt, and directly placed commercial paper as the proxy for the higher-rated borrowers, who *choose* short-term debt. In Italy the latter group of borrowers is not large and, for the median firm, bank debts account for more than 95 per cent of financial debts (the mean value is around 80 per cent). The shortage of an instrument like commercial paper could help to explain why in Italy we just observe a monotonic relationship between debt maturity and firm risk; debt maturity is a downward sloping function of firm risk as low-risk firms cannot rely on short-term directly placed debt, while short-term bank debt is often not cheaper than long-term debt.

Considering the prediction regarding agency costs, our evidence does not seem to support Myers's explanation (1977). The proxy used for opportunities of growth, the growth of sales measured at sector level between t and t+1 (we use an indicator at sector level as this variable is potentially endogenous at firm level), does not significantly influence debt maturity. Similar results are obtained using the growth of value added, always measured at a sector level between t and t+1. Further, the evidence is analogous using the future growth of sales at firm level, although this variable can be potentially endogenous. We also include the ratio of research and development on sales, on the basis that more innovative firms can have greater growth opportunities, and therefore managers can have more discretion in choosing investments; in this case a negative relationship arises, though not significantly different from zero. Therefore, theories based on the conflicts of interest between shareholders and creditors do not find support in the Italian data. This result is different from that in Barclay and Smith (1995) and Barclay, Marx and Smith (2003), who find an inverse relationship between growth opportunities and debt maturity. Demand factors, which are at the origin of these explanations, do not seem to have important explanatory power for Italian industrial firms.

As for the impact of firm leverage (predicted value[25]) on debt maturity, we find that leverage is negatively linked to debt maturity; the economic impact is around 1 percentage point moving from the 1st to the 3rd quartile of leverage (3 p.p moving from the 10 th to the 90th percentile). This evidence is not consistent with the results found in other papers, where leverage is positively correlated with debt maturity for US firms (Mauer and Stohs, 1996), and for European firms when the main countries are pooled together (Giannetti, 2000). However, Enria (1999) finds a negative relationship for selected European countries such as Austria, Germany and Italy. A positive relationship is likely to reflect the prevalence of a demand effect: an increasing leverage raises the liquidity risk and induces firms to ask for more long-term debt (Diamond, 1991a). In Italy, by contrast, supply considerations seem to dominate: Italian lenders are likely to consider firms with more leverage as riskier and they

[25] The pseudo R squared of the first-stage leverage equation in the Tobit estimation is 0.22.

prefer to shorten their debts for stricter monitoring; the cumulative effect is an increase in the liquidity risk for Italian firms.[26]

All the results commented in this section, reported in Table 5, refer to a panel random-effects model. However, they hold when a panel fixed-effects, exploiting only time-series variability, is estimated.[27] Summing up, we can conclude that, after controlling for asset maturity, Italian firms' debt maturity is positively influenced by firm size, tangible assets and age: a decrease in the asymmetric information proxies has a positive influence on debt maturity, reflecting the importance of a supply effect. Further, for the whole risk distribution, debt maturity is negatively linked to risk indicators, such as the score and firm return volatility; in the Diamond framework (1991a) this result reflects the prevalence of a supply effect. No clear evidence emerges that growth opportunities and agency costs influence debt maturity, according to which firms should prefer (i.e. demand effect) short-term debt to reduce the conflicts of interest between shareholders and creditors. Finally, debt maturity is negatively related to leverage, a result that can be explained on the grounds that lenders prefer to shorten debt maturity to highly leveraged firms, as they are riskier.

Overall, supply considerations seem to dominate in determining the equilibrium value of debt maturity.

7. The results of the test based on legal enforcement

In this section, we present the results of the test explained in Section 3, aimed at improving our understanding of the importance of a supply explanation in determining the equilibrium value of debt maturity. For the sake of space, we only report the results obtained using the dependent variable in log-odds and a panel random-effect estimator (GLS); similar

[26] It is worth saying that Barclay, Marx and Smith (2003) also find a negative relationship between leverage and debt maturity in the debt maturity equation. However, they interpret this evidence on the basis of the agency cost theory. They argue leverage and debt maturity are not strategic complements, but substitutes in addressing the under-investment problem. In other words, when leverage increases, the conflicts of interest between shareholders and creditors matter more; the firm can reduce these conflicts by using less long-term debt.

[27] Hausman test, which compares an estimator that is known to be consistent (fixed-effects – footnote 17) with an estimator that is efficient (random-effects), rejects the null hypothesis that the coefficients for the two estimators are similar.

evidence is found when using a Tobit panel random-effect estimator. All the results commented in this section hold when we rely on a cross-section estimation, averaging the firm values over time (i.e. between estimation). This regression on a cross-section eliminates the problem of serially correlated errors, though not controlling for unobserved heterogeneity; it preserves the dispersion across firms, but does not exploit any time-series variation in the observations.

First, we consider the results of the test in (2) when the proxies of asymmetric information (size, tangible assets and age) are interacted with the continuous value of the efficiency of justice (Table 6); the heads of the columns refer to the variable of interest, which is included in the interaction term: for example, in the first column the results obtained interacting size are shown. As argued in Section 3, these proxies of asymmetric information influence debt maturity for supply reasons, i.e. when, for example, either size or age increases, asymmetric information fades, monitoring becomes less important and lenders are willing to increase debt maturity. We argue that when the justice is less efficient, asymmetric information problems should be more pervasive for lenders. We therefore expect that the impact of our proxies of asymmetric information on debt maturity is stronger when justice is less efficient.

This is actually the evidence in Table 6, as the coefficients of the interaction terms (the second cross partial derivative in 2) have a positive sign for size, tangible assets and age. Therefore, as long as the length of first-degree civil actions increases, we find that the positive slopes (the first derivatives) for size, tangible assets and age become steeper. Consequently, as the efficiency of justice worsens, firm size, tangible assets and age become more important in influencing debt maturity. The supply explanation is therefore confirmed.

We also test the robustness of the results by running a regression with interaction terms using dummies for legal enforcement, rather than a continuous variable. We find the positive correlation between debt maturity and firms' size and tangible assets (Table 7, first and second columns) to increase where legal enforcement is worse: the coefficients of the interaction terms are positive and significant. It seems, therefore, that when enforcement costs are higher, lenders are more selective and attach more weight to firm size and tangible assets in choosing debt maturity. The changing importance of tangible assets is also evident for firms facing an initial deterioration in the efficiency of justice (from the 1st quartile to the median value), while size is more relevant only when the length of first-degree civil actions is greater than the median value. Mixed results are found for the relationships with age. The coefficients of this variable seem to be reinforced in its positive sign when the inefficiency of justice is greater (Table 7, third column), though the positive coefficient of the interaction term is imprecisely estimated. To verify the results concerning the impact of enforcement costs, we include in the equation all the interaction terms at the same time and obtain similar results: the influence of firm size and tangible assets is greater for firms facing a higher degree of inefficiency of justice (Table 8, first column).

To summarise, an increase in size, tangible assets and age, which reduces information asymmetries, has a positive impact on debt maturity; this effect is stronger when the quality of justice is lower, i.e. when information asymmetries matter more. Overall, as the test in (2) shows in general a positive sign, we can conclude that a supply explanation of the determinants of debt maturity is confirmed.

8. Robustness exercises

In this section we carry out some exercises to assess the robustness of the results previously commented; specifically we aim at verifying that the results are not determined by the particular choices of the sample, variables and specifications.

As for the baseline estimation, we first verify the sensitivity of the results to the simultaneous equation framework. We estimate the debt maturity equation in a single equation framework, i.e. we use a reduced form equation with only exogenous variables on the right-hand side and therefore excluding leverage from the estimation. The main results hold (Table 8, second column). The aim is to check if previous results were affected by multicollinearity problems that can arise in the two-stage framework. Actually, in the maturity equation the correlations between the predicted leverage and the other explanatory variables are not very high; this explains why multicollinearity problems do not affect the main results.

Coming back to the simultaneous equation framework, we try different instruments for leverage. We first rely only on the non-debt tax shield (depreciation on total assets); then, we use a proxy for the non-debt tax shield and profits measured by return on equity rather than return on assets; finally, we use profits measured by the return on assets and non-debt tax shield proxied by depreciation normalised on operating income rather on total assets. All the previous results hold.

Considering the correlation between explanatory variables in the baseline estimation, the highest is between the asset maturity and tangible assets (0.45). Omitting asset maturity, the effect of tangible assets is unchanged. We also try to measure asset maturity in an alternative way, i.e. as a ratio between tangible and intangible assets on total assets (fixed assets); the variable capturing the tangibility of the assets is the ratio between tangible and fixed assets (Demirgüç-Kunt and Maksimovic, 1999). The results are unaffected.

Belonging to a business group can be seen as another mechanism for mitigation of information asymmetries, possibly affecting the maturity structure of debt. In other words, belonging to a group is a mechanism whereby firm characteristics reflecting the quality of the firm might become less important in influencing debt maturity. Interacting size, tangible assets and age with a dummy equal to 1 when the firm belongs to a group, the evidence is that all the three variables actually matter less in the debt-maturity equation for firms in a group. This confirms the role of these three variables as proxies of information asymmetries.

We also verify the results using a balanced panel, i.e. a sample of firms that are present in a row for 6 years. All the results obtained in the baseline estimation hold. As for the coefficients of the interaction terms with the efficiency of justice measured as a continuous variable (Table 6), we find that size and age matter more where the efficiency of justice decreases.

As another way of testing the robustness of the results, we also split the sample into three sub-samples, according to the length of first-degree civil actions: below the first quartile, between the first quartile and the median, over the median. Compared with using interactions terms, where only the coefficients of the interacted variables are entitled to change, in this case *all* the variables are allowed to have different coefficients in the sub-samples. We then use a Wald test to verify whether the coefficients of the variables we are interested in are different.[28] Unreported results reveal evidence analogous to that presented in Tables 6 and 7.

Further, we repeat the same estimations considering the provinces where the firms operate, rather than those where they are located: similar results are obtained.

Finally, we try to assess another strand of theory according to which firms, i.e. the demand side, should prefer short-term debt. Diamond predicts (1991a) that when a firm foresees an improvement in its quality, it asks for more short-term debt in order to obtain rapidly some benefits in payment terms. We use the score, assuming that at time t firms have already some clues for measuring their risk rating, which will be released to banks by CAD only after 15 months. We rely on a fixed-effect panel estimation, which should capture only time-series variability and therefore should be best suited to measure this effect. As before, we drop leverage because of its high correlation with score. We find that the Diamond prediction is not supported by data for Italian firms: the fixed-effect estimation shows that as long as firm risk decreases (i.e. a firm foresees an improvement in its quality), debt maturity increases rather than diminishes (Table 8, third column). This evidence reinforces the idea that debt maturity choice is more likely to be driven by supply-side than demand-side motivations.

9. Concluding remarks

After controlling for asset maturity, the equilibrium share of debt maturity for Italian firms is positively influenced by their size, tangible assets and age. This evidence is partly in line with that concerning other countries. We interpret it as whether a decrease in asymmetric information problems reduces the need for monitoring and induces lenders to grant more long-term debt. Further, we do not find any evidence of a non monotonic relationship between debt maturity and firm risk as predicted in Diamond: for Italian firms debt maturity essentially decreases when firm risk increases, reflecting the importance of a supply explanation. Unlike firms in some other countries, debt maturity is inversely correlated with leverage, another clue to the importance of lenders' decisions in determining

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[28] This Wald test is valid whether or not the variance of the samples is the same; it is based on the

debt maturity. Finally, conflicts of interests between shareholders and creditors, which should induce firms (i.e. the demand side of the market) to ask for short-term debt, seem to have no effect on firm debt maturity choice.

It seems, therefore, that the quality of the firm as perceived by the lender and the corresponding monitoring problem are very important in determining the equilibrium result for debt maturity. On the contrary, the explanations that the theory puts forward to explain debt maturity on the demand side, i.e. the positive relationship between debt maturity and risk-rating as stated in the Diamond model (1991a) and the preference for short-term debt to reduce under-investment problems for firms with high growth opportunities, do not seem to have enough explanatory power, at least as far as Italian industrial firms are concerned. Lenders, or the supply-side of the market, are likely to have strong bargaining power in choosing the maturity of financial debt to address informational problems (Ortiz-Molina and Penas, 2005; Schiantarelli and Sembenelli, 1997). In other words, lenders are likely to exert control over borrowers by choosing shorter maturities when informational asymmetries and default risk are more important.

The importance of the supply side of the market in determining firm debt maturity is confirmed when we analyse the impact of legal enforcement. Where judicial efficiency is worsen, i.e. the enforcement costs of the loan contract are higher, the positive impact of firm size, tangible assets and age on debt maturity increases. The interpretation we offer is that lenders assign more weight to these proxies of asymmetric information when asymmetric information has more pervasive effect, i.e. where it is more difficult to enforce the loan contract and the lender has less probability of recovering the loan in the case of default. In our view, these results support a supply explanation of debt maturity in Italy.

Overall, this paper underlines an important task for debt maturity in addressing lenders' information and control problems.

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assumption of independent samples (Greene, 2003).

Tables and Figures

Table 1

A COMPARISON OF LIABILITY COMPOSITION FOR NON-FINANCIAL COMPANIES
(as a percentage of GDP - 2000)

	Loans from resident Monetary Financial Institutions	of which long-term (> 1 year)	Securities other than shares	of which long-term (> 1 year)
France	35.9	24.9	17.6	10.3
Germany	38.6	27.4	2.6	1.9
Greece	34.4	10.8	0.0	0.0
Ireland	33.5	18.3	-	-
Italy	41.6	17.5	2.0	1.5
Spain	43.1	28.0	3.5	3.0
Euro area	42.5	27.2	7.6	5.1

Report on Financial Structure, European Central Bank (2002).

Table 2

ITALIAN FIRMS' DEBT MATURITY ACCORDING TO SOME RELEVANT FIRM CHARACTERISTICS

	Size	Tangible assets	Age
1st quartile	0.246 [0.257] (0.146) No. firms:17,440	0.185 [0.219] (0.062) No. firms:17,133	0.278 [0.329] (0.197) No. firms:17,145
2st quartile	0.292 [0.289] (0.223) No. firms:17,207	0.282 [0.304] (0.210) No. firms:17,117	0.302 [0.331] (0.241) No. firms:19,403
3st quartile	0.324 [0.316] (0.271) No. firms:16,763	0.340 [0.346] (0.292) No. firms:17,121	0.309 [0.330] (0.253) No. firms:15,575
4 st quartile	0.352 [0.351] (0.309) No. firms:17,071	0.405 [0.428] (0.387) No. firms:17,110	0.325 [0.319] (0.271) No. firms:16,358
	Asset maturity	**Opportunities for growth**	**Leverage**
1st quartile	0.202 [0.209] (0.059) No. firms:17,121	0.296 [0.324] (0.234) No. firms:17,152	0.369 [0.438] (0.289) No. firms:17,122
2st quartile	0.298 [0.296] (0.224) No. firms:17,120	0.309 [0.323] (0.251) No. firms:17,113	0.323 [0.359] (0.281) No. firms:17,121
3st quartile	0.339 [0.344] (0.290) No. firms:17,120	0.311 [0.335] (0.253) No. firms:17,158	0.284 [0.331] (0.251) No. firms:17,129
4 st quartile	0.372 [0.393] (0.346) No. firms:17,120	0.294 [0.325] (0.228) No. firms:17,058	0.236 [0.276] (0.194) No. firms:17,109
	Return volatility	**Score**	**Area (1,2)**
1st quartile /North-West	0.342 [0.364] (0.291) No. firms:17,128	0.361 [0.398] (0.311) No. firms:34,071	0.307 [0.325] (0.245) No. firms:30,499
2st quartile /North-East	0.301 [0.331] (0.244) No. firms:17,113	0.284 [0.326] (0.249) No. firms:12,275	0.303 [0.336] (0.247) No. firms:21,430
3st quartile/Centre	0.290 [0.321] (0.220) No. firms:17,123	0.219 [0.267] (0.175) No. firms:10,511	0.274 [0.302] (0.199) No. firms:11,038
4 st quartile/South	0.278 [0.295] (0.209) No. firms:17,117	0.227 [0.265] (0.185) No. firms:11,517	0.338 [0.344] (0.284) No. firms:5,514

Company Accounts Database, industrial firms. Debt maturity is the ratio of long-term financial debts (maturing after one year) to total debts. Unweighted average [aggregate ratios or weighted average] (median values) for 1993-2000 years. All the statistics are calculated for the observations used in the panel estimation. (1) Using the province where the firm is located; the evidence is similar considering the province where the firm operates. (2) Areas are reported in the first column.

Table 3

THE VARIABLES USED IN THE ESTIMATION

	Description	Source
Debt maturity	The ratio of long-term financial debt (maturing after 1 year and using residual maturity) to total financial debt.	CAD
Size	The logarithm of the number of employees. If this number is missing, we estimate it using labour costs and average labour cost per head in the firm's industry (four-digit figures).	CAD
Tangible assets	The ratio of net equipment and gross plant to total assets.	CAD
Asset maturity	The maturity of current assets is measured as current assets divided by the value of goods sold, while the maturity of net property, plant and equipment is obtained dividing this amount by depreciation; these two ratios are weighted by the relative size of current assets and net property, plant and equipment.	CAD
Age	The age of the firm, equal to the difference between the year to which the data refer and the date of birth.	CAD
Return volatility	The firm's standard deviation of the operating income growth rate, an indicator that cannot be directly affected by the firm's debts. This variable is calculated over the period 1993-2000 and does not change with time.	CAD
Opportunities for growth	The growth rate of sales (or value added) between t and t+1 at sector level (four-digit figure)	CAD
Leverage	The ratio of the book value of financial debt (short and long-term) to the book value of equity and financial debts.	CAD
Score	Indicator of the firm risk profile computed using discriminant analysis. CAD classifies firms in four categories: the first includes safe firms (score=1,2), the second includes solvent firms (score=3,4), the third and the fourth categories include vulnerable firms (score=5,6) and risky firms (score=7,8,9).	CAD
Profits	The ratio of earnings before interests and taxes to total assets (return on assets). We use earnings before interests to obtain a profitability indicator that is the least influenced by leverage.	CAD
Non-debt tax shields	The ratio of depreciations of tangible and intangible assets to total assets	CAD
Judicial efficiency	The length of first-degree civil actions. Average value at provincial level (95 provinces), measured weighting length by the number of actions and for the years 1995-1998 (*tribunali* and *preture)*. The length is the interval between the date of the initial filing and that of the judgement in civil actions.	National Institute of Statistics (ISTAT)

Table 4

SUMMARY STATISTICS FOR THE VARIABLES USED IN THE ESTIMATION

	Mean (median)	Standard deviation	Min Max	I Quartile III Quartile	No. of non missing observations
Debt maturity	0.30 (0.24)	0.29	0 1	0.02 0.49	68,481
Size (1)	94 (56)	129	1 2,646	32 102	68,481
Tangible assets	0.22 (0.20)	0.14	0.00 0.72	0.11 0.30	68,481
Asset maturity	2.66 (1.84)	3.32	0.15 281	1.14 3.08	68,481
Age	22.4 (19)	15.4	1 207	12 28	68,481
Return volatility	1.45 (0.53)	3.30	0.08 42.4	0.34 1.12	68,481
Opportunity for growth	0.11 (0.08)	0.17	-0.34 0.90	0.06 0.18	68,481
Leverage	0.55 (0.60)	0.25	0 1	0.38 0.75	68,481
Non-debt tax shields	0.04 (0.03)	0.03	0.00 0.15	0.02 0.05	68,481
Profits	0.08 (0.07)	0.06	-0.17 0.35	0.04 0.11	68,481
Score	4.67 (5)	1.62	1 9	4 6	68,371
Judicial efficiency (2)	3.51 (3.37)	0.68	2.17 5.78	3.07 4.01	

Company Accounts Database, industrial firms. Data on judicial efficiency are provided by the National Institute of Statistics (ISTAT). All the statistics are calculated for the observations used in the panel estimation and over the period 1993-2000. Mean are unweighted averages over the whole period under analysis. (1) Number of employees. (2) Measured on 95 Italian provinces.

Table 5

THE BASELINE ESTIMATION OF DEBT MATURITY
(panel estimation with random effects for 1993-2000)

	GLS estimation log-odds	Tobit estimation	GLS estimation log-odds With score	GLS estimation log-odds With score & without leverage
Age	0.026 (5.20)	0.002 (5.19)	0.047 (4.67)	0.030 (6.20)
Age squared	-0.000 (-5.24)	-0.000 (-6.82)	-0.000 (-5.6)	-0.000 (-5.7)
Size	0.666 (21.1)	0.053 (21.1)	0.654 (18.4)	0.674 (21.6)
Asset maturity	0.012 (2.78)	0.001 (1.87)	0.014 (2.79)	0.011 (2.62)
Tangible assets	6.465 (33.5)	0.553 (37.9)	5.847 (16.4)	6.324 (33.1)
Opportunities for growth	-0.005 (-0.05)	-0.003 (-0.38)	0.311 (1.73)	0.023 (0.24)
Return volatility	-0.035 (-3.69)	-0.003 (-2.95)	-0.018 (-1.38)	-0.035 (-3.83)
Leverage (predicted)	-0.373 (-5.25)	-0.176 (-10.3)	3.270 (1.98)	
North	-0.039 (-0.31)	-0.001 (-0.13)	-1.175 (-2.29)	-0.194 (-1.66)
Centre	-0.158 (-1.11)	-0.012 (-1.08)	-1.159 (-2.52)	-0.303 (-2.21)
Score			-3.856 (-2.06)	-0.152 (-2.77)
Score squared			0.199 (1.98)	0.001 (0.19)
Constant	-7.003(-29.0)	-0.030 (-1.52)	6.207 (0.93)	-6.276 (-23.1)
No. observations	68,481	68,481	68,371	68,371
No. groups	14,899	14,899	14,884	14,884
R^2 (overall)	0.0648		0.0818	0.0966
No. of left-censored obs.		15,762		
No. of right –censored obs.		1,567		
Wald test all the regressors =0 (excluding constant) – p.value		0.000		
LR Test (panel variance=0) –p.value		0.000		

The dependent variable is the ratio of long-term financial debt to all financial debt and has been transformed into log-odds when using GLS; leverage is also transformed into log-odds when using GLS; test t are in parentheses. The independent variables are lagged one period, excluding the opportunity for growth proxy, which is measured in t+1, and the return variability, which is fixed during the sample period. All the estimations contain time and industry dummies. The instruments for leverage are non-debt tax shields and profits, plus all the other exogenous variables used in the estimation of the maturity equations. When using GLS log-odds, similar results are obtained with fixed-effects panel estimations. With GLS log-odds standard errors are corrected for 2-stage estimation.

Table 6

THE IMPACT OF JUDICIAL EFFICIENCY USING A CONTINUOUS VARIABLE
(GLS panel with random effects for 1993-2000)

	Size	Tangible assets	Age
Age	0.027 (5.25)	0.026 (5.23)	0.004 (0.39)
Age squared	-0.000 (-5.24)	-0.000 (-5.23)	-0.000 (-5.13)
Size	0.522 (8.36)	0.666 (21.1)	0.666 (21.1)
Asset maturity	0.012 (2.79)	0.012 (2.75)	0.013 (2.81)
Tangible assets	6.457 (33.4)	4.820 (6.35)	6.456 (33.4)
Opportunities for growth	-0.004 (-0.04)	-0.004 (-0.04)	-0.004 (-0.05)
Return volatility	-0.035 (-3.69)	-0.035 (-3.69)	-0.035 (-3.68)
Leverage (predicted)	-0.371 (-5.23)	-0.371 (-5.23)	-0.373 (-5.25)
North	0.056 (0.43)	0.037 (0.29)	0.030 (0.24)
Centre	-0.121 (-0.85)	-0.112 (-0.82)	-0.131 (-0.92)
Constant	-7.712 (-32.1)	-7.067 (-29.1)	-7.059 (-29.1)
JE*Size	0.044 (2.69)		
JE*Tangible assets		0.498 (2.24)	
JE*Age			0.007 (2.53)
No. observations	68,481	68,481	68,481
No. groups	14,899	14,899	14,899
R^2 (overall)	0.0653	0.0651	0.0651

The dependent variable is the ratio of long-term financial debt to all financial debt and has been transformed into log-odds; leverage is also transformed into log-odds; test t are in parentheses. The independent variables are lagged one period, excluding the opportunity for growth, which is measured in t+1 and the return variability, which is fixed during the sample period. All the estimations contain time and industry dummies. The instruments for leverage are non-debt tax shields and profits, plus all the other exogenous variables used in the estimation of the maturity equations; the standard errors are corrected for 2-stage estimation. JE is the efficiency of justice measured as a continuous variable.

Table 7

THE IMPACT OF JUDICIAL EFFICIENCY USING DUMMIES

(GLS panel with random effects for 1993-2000)

	Size	Tangible assets	Age
Age	0.026 (5.20)	0.026 (5.19)	0.025 (4.21)
Age squared	-0.000 (-5.18)	-0.000 (-5.21)	-0.000 (-5.02)
Size	0.606 (10.4)	0.667 (21.1)	0.666 (21.1)
Asset maturity	0.013 (2.82)	0.012 (2.74)	0.013 (2.83)
Tangible assets	6.464 (33.5)	5.547 (15.9)	6.465 (33.5)
Opportunities for growth	-0.006 (-0.07)	-0.004 (-0.04)	-0.006 (-0.06)
Return volatility	-0.035 (-3.72)	-0.035 (-3.69)	-0.035 (-3.70)
Leverage (predicted)	-0.374 (-5.28)	-0.371 (-5.23)	-0.375 (-5.28)
North	-0.030 (-0.23)	-0.020 (-0.15)	-0.027 (-0.21)
Centre	-0.148 (-1.04)	-0.140 (-0.98)	-0.153 (-1.07)
Jud. efficiency (JE1)	0.043 (0.14)	0.338 (-2.78)	0.001 (0.01)
Jud. efficiency (JE2)	-0.816 (-2.56)	-0.276 (-2.07)	-0.146 (-1.04)
Constant	-6.736 (-20.8)	-7.429 (-28.9)	-6.968 (-26.7)
JE1*Size	-0.026 (-0.35)		
JE2*Size	0.202 (2.65)		
JE1*Tangible assets		1.266 (2.94)	
JE2*Tangible assets		1.207 (2.66)	
JE1*Age			-0.002 (-0.60)
JE2*Age			0.007 (1.31)
No. observations	68,481	68,481	68,481
No. groups	14,899	14,899	14,899
R^2 (overall)	0.0652	0.0653	0.0646

The dependent variable is the ratio of long-term financial debt to all financial debt and has been transformed into log-odds; leverage is also transformed into log-odds; test t are in parentheses. The independent variables are lagged one period, excluding the opportunity for growth, which is measured in t+1 and the return variability, which is fixed during the sample period. All the estimations contain time and industry dummies. The instruments for leverage are non-debt tax shields and profits, plus all the other exogenous variables used in the estimation of the maturity equations; the standard errors are corrected for 2-stage estimation. JE1 is a dummy that is equal to 1 for the provinces where the length of first-degree civil actions is over the 1st quartile and less than the median; JE2 is a dummy equal to 1 for the provinces where the length of first-degree civil actions is over the median value.

SOME ROBUSTNESS EXERCISES

(GLS panel with random effects for 1993-2000)

	Interacting all the relevant variables simultaneously	Excluding leverage reduced-form approach	Including firm score & excluding leverage fixed-effect estimator
Age	0.025 (4.27)	0.035 (7.21)	0.185 (12.4)
Age squared	-0.000 (-4.98)	-0.000 (-6.41)	-0.001 (-4.46)
Size	0.620 (10.5)	0.691 (22.2)	0.446 (6.73)
Asset maturity	0.013 (2.82)	0.074 (1.72)	0.015 (3.19)
Tangible assets	5.569 (15.9)	6.340 (33.2)	4.110 (15.2)
Opportunities for growth	-0.005 (-0.06)	-0.009 (-0.10)	0.043 (0.45)
Return volatility	-0.035 (-3.73)	-0.043 (-4.56)	
Leverage (predicted)	-0.373 (-5.26)		
Score			-0.251 (-3.82)
Score squared			0.006 (0.93)
North	-0.032 (-0.25)	-0.246 (-2.10)	-0.693 (-0.82)
Centre	-0.145 (-1.02)	-0.364 (-2.66)	-0.879 (-0.99)
Jud. efficiency (JE1)	-0.143 (-0.45)		
Jud. efficiency (JE2)	-1.050 (-3.15)		
Constant	-6.588 (-20.0)	-7.009 (-29.1)	-8.415 (-8.18)
JE1*Size	-0.035 (-0.48)		
JE2*Size	0.176 (2.27)		
JE1*Tangible assets	1.277 (2.96)		
JE2*Tangible assets	1.110 (2.44)		
JE1*Age	-0.002 (-0.51)		
JE2*Age	0.005 (0.89)		
No. observations	68,481	68,481	68,371
No. groups	14,899	14,899	14,884
R^2 (overall)	0.0655	0.0961	0.0350

The dependent variable is the ratio of long-term financial debt to all financial debt and has been transformed into log-odds; leverage is also transformed into log-odds; test t are in parentheses. The regressors are lagged one period, excluding the opportunity for growth, which is measured in t+1, the return variability, which is fixed during the sample period and the score, which is released with lags. All the estimations contain time and industry dummies. The instruments for leverage are non-debt tax shields and profits, plus all the other exogenous variables used in the estimation of the maturity equations; the standard errors are corrected for 2-stage estimation. JE1 is a dummy that is equal to 1 for the provinces where the length of first-degree civil actions is over the 1st quartile and less than the median; JE2 is a dummy equal to 1 for the provinces where the length of first-degree civil actions is over the median value.

Figure 1

JUDICIAL EFFICIENCY IN THE 27 ITALIAN DISTRICTS
(average 1995-98)

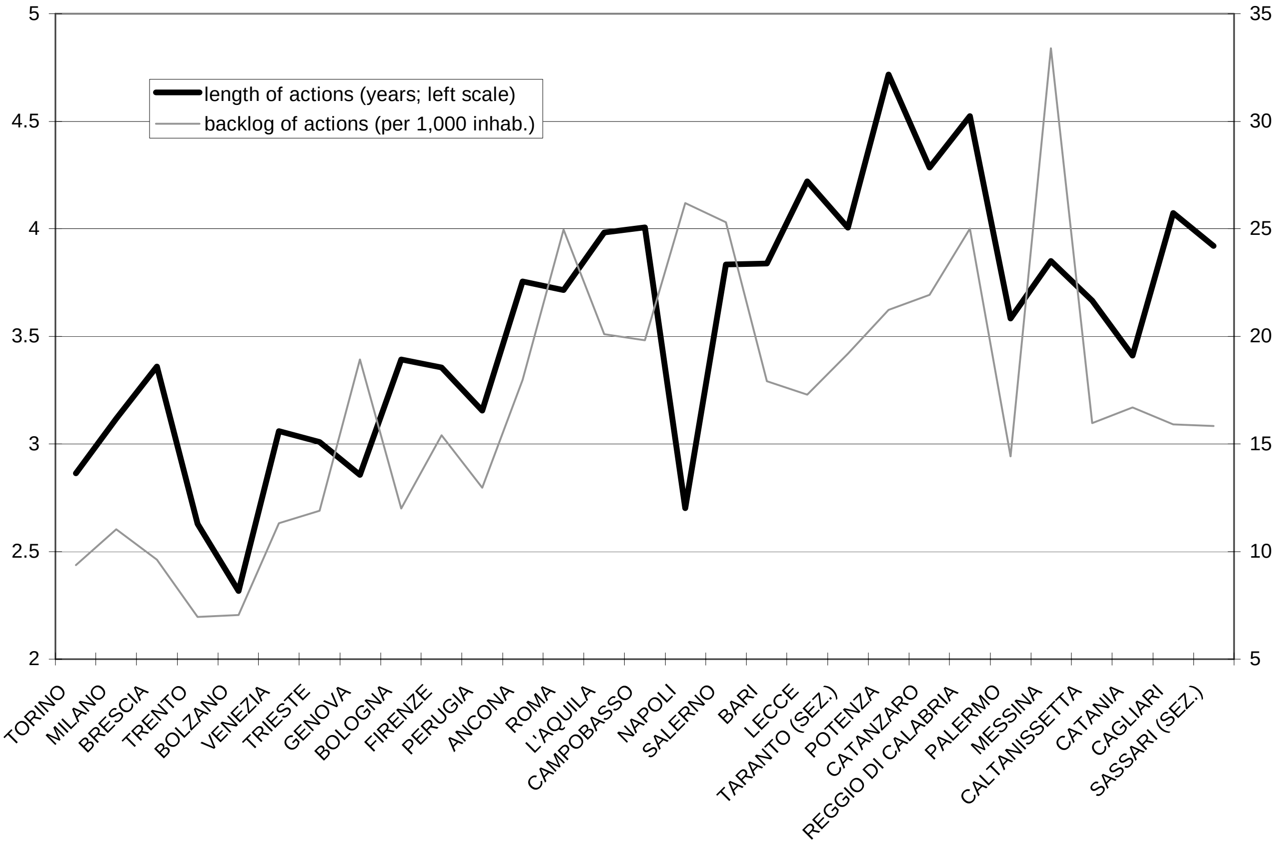
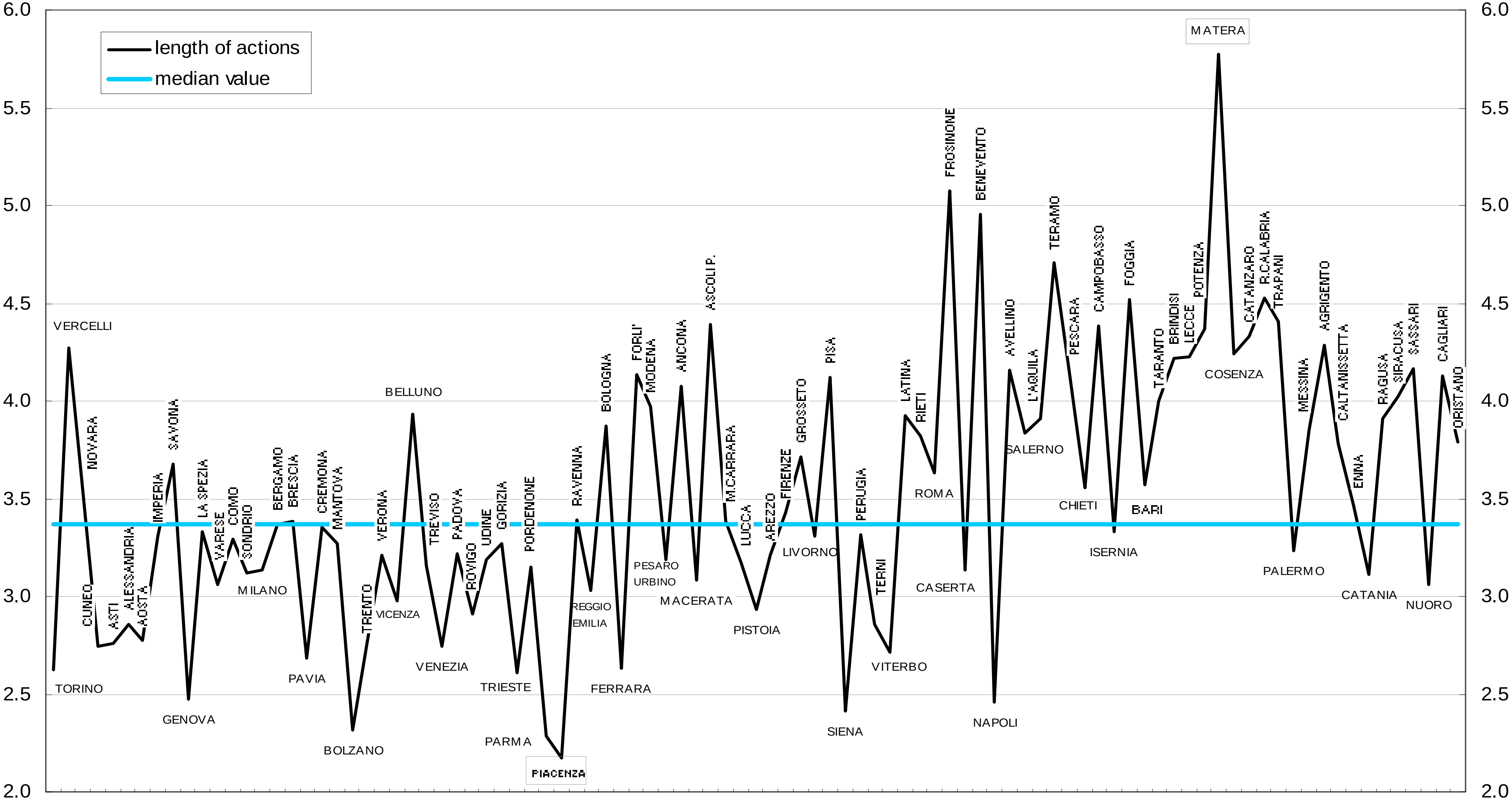


Figure 2

JUDICIAL EFFICIENCY AMONG 95 ITALIAN PROVINCES
(length of first degree civil actions– average 1995-98)



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