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TECHNICAL NOTES

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Legal environment and corporate finance: evidence from the Italian manufacturing industry

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Abstract

Considering the Italian manufacturing industry between 2014 and 2016 (more than 250,000 observations), this technical note analyzes the relation between the courts' ability to enforce credit rights and the opportunity to finance business activities with trade credits instead of financial debts, delaying payments and decreasing the financial costs. According to our results, and considering mortgage foreclosure, if the time necessary to settle an insolvency case increases by 1000 days, we can expect an increase in operating debt between 3 and 11%, and a decrease of financial expenses between 3000 and 7000 Euro.

Keywords: Manufacturing industry, Corporate finance, Institutional inefficiency

JEL Classification: G32, G33

1 Introduction

The financial market is fundamental to support companies and their business through credit access, which could be substituted by internal resources in case of financial constraints (Ughetto 2008; Farre-Mensa and Ljungqvist 2016). Nevertheless, companies can also be financed through trade credits, delaying payments and creating an alternative financial line with their suppliers (Garcia-Appendini and Montoriol-Garriga 2013; Carbo-Valverde et al. 2016). This latter approach might be amplified by the inability of the current judicial system to efficiently enforce credit rights. Indeed, if courts are unable to settle insolvency cases in a reasonable amount of time (i.e., mortgage foreclosure and bankruptcy cases), we expect a higher level of uncertainty and risks, which could increase companies' financial constraints, as well as their opportunities for moral hazard and strategic behaviors (Jappelli et al. 2005; Schiantarelli et al. 2020). In particular, Falavigna and Ippoliti (2020) suggest that inefficiency may lead debtors to postpone contractual deadlines, since they may remain unpunished, increasing trade credits and decreasing, in this way, the financial expenses. In other words, the longer the time needed to enforce payment, the greater the opportunities to delay such payment, due to the higher opportunity cost for a creditor of submitting an insolvency application to the competent court. Accordingly, we can expect judicial

inefficiency in enforcing credit rights to prompt debtors to substitute financial debts with trade credits.

This technical note aims at shedding new empirical evidence to confirm the expected impact of judicial inefficiency on corporate finance, testing empirically whether judicial delay can affect the substitution of financial debt with trade credits on a specific case study: the Italian manufacturing industry. Current data on the Italian judicial system and the dynamics of the Italian manufacturing industry can help us establish whether this corporate strategy actually exists, testing the expected positive relation between the time needed to settle a case of insolvency (i.e., mortgage foreclosure and bankruptcy) and the access to operating debts. At the same time, as robust test, we have the opportunity to analyze the expected negative relation between the same proxy of judicial efficiency (i.e., time necessary to settle a case of insolvency) and financial expenses. If the proposed hypothesis is confirmed, the economic implications of this negative externality could be far-reaching for the whole economy, decreasing both the competitiveness and the financial stability of the national system, as well as triggering a cascade effect on the market. This may be even truer in the Italian market, with its characteristic structure based mostly on small–medium enterprises (SMEs).

The remainder of this manuscript is organized as follows. The second section illustrates the case study and the methodology adopted to validate the above hypothesis and current evidence, as well as the results of the empirical analysis. The last section describes the conclusions of our research.

2 Methods and results

2.1 Case study: the Italian judicial system and insolvency procedures

The Italian Ministry of Justice is in charge of administering civil and criminal justice, which is divided into two main tiers and one lowest level. At the lowest level are the so-called *Justices of the Peace* (i.e., *Giudici di Pace*), with specific civil and criminal competences. At a higher level, the first tier includes first instance courts (i.e., *Tribunali Ordinari*), while the second tier comprises second instance courts (i.e., *Corte di Appello*), which are responsible for appeals against first instance judgments. In the period considered (i.e., between 2014 and 2016), there were 140 first instance courts and 26 s instance courts. The first and the second instance courts are grouped according to their judicial geography to form 26 judicial districts (i.e., *Distretto di Corte di Appello*). Finally, there is also a court of last resort (i.e. *Corte Suprema di Cassazione*), with seat in Rome and acting as the highest appellate court in all civil and criminal cases.

According to the Italian law, there are two formal procedures to settle an insolvency case (Rodano et al. 2016; Falavigna and Ippoliti 2020). The creditors can either initiate a process of mortgage foreclosure (i.e., *esecuzione forzata*), which can target the debtors' movables or real estate, or apply to certify the debtor's insolvency (i.e., *istanza di fallimento*); after this preliminary step, the court will enforce their credit rights through a bankruptcy procedure (i.e., *fallimento*). Moreover, the debtor can apply for an arrangement with creditors through the mediation of the court (i.e., *concordato*

preventivo). Obviously, in the latter case, the creditors cannot expect to fully recover the amounts due, but the defaulting debtor may be expected to cooperate.

Under the Italian law, all creditors can engage in a mortgage foreclosure procedure, that is to say, all secured and unsecured credits can be enforced by courts through mortgage foreclosure of debtors' goods (i.e., movable and/or real estate). The main difference between secured and unsecured credits revolves around the goods involved in the insolvency procedure. In the former situation, there is a specific good that represents the collateral in case of insolvency with respect to that specific secured credit, which cannot be involved by other creditors in other insolvency procedures (i.e., there is an exclusive right to use that good as collateral for a single secured credit). In the latter situation, there are no specific guarantees for unsecured credits, i.e., all the remaining debtors' goods that do not represent a collateral for a secured credit can be involved in the insolvency procedure to collect the due amount of money. In both cases, there is a specific judicial procedure aimed at certifying the insolvency status of the debtor (e.g., an unpaid invoice), and an order of payment is then issued by the same court (i.e., *Decreto Ingiuntivo di Pagamento*). After 40 days, if there are no oppositions by the debtor and/or the due payment is not made, the aforementioned order is enforceable and the foreclosure procedure can start. At this point, the payment of secured credits is facilitated by the current procedure, since a foreclosure order is not necessary (i.e., *Atto di Pignoramento*), simplifying the bailiff's work and reducing the time needed to collect the due amount of money, since the object of the foreclosure has already been identified (i.e., the collateral). The alternative approach to foreclosure is bankruptcy, which is largely a debtor-protective process and prevents creditors from seizing and selling the debtor's assets piecemeal, giving time to liquidate the debtor in an orderly fashion or, more commonly, sell the business as a going concern or reorganize its capital structure. Note that only the biggest companies can be involved in bankruptcy procedures. Indeed, according to current regulations, creditors can initiate bankruptcy procedures if, and only if, the debtors have in the three previous year at least one of the following index: assets higher than 300,000.00 Euro, gross revenues higher than 200,000.00 Euro or total debts higher than 500,000.00 Euro. On the other hand, all insolvent debtors can be involved in mortgage foreclosure procedures. Lastly, the current procedures prescribe that judicial competence for insolvency cases depends on the location of either the registered office or the main production facility of the insolvent business. Therefore, the creditor will apply for a declaration of insolvency or mortgage foreclosure to the competent court of first instance, taking the location of the debtor's registered office or production facility into account, and then, if necessary, present an appeal against this judgment to the competent court of second instance.

Table 4 in the [Appendix](#) presents an overview of the average time (expressed in days) necessary to settle insolvency procedures between 2014 and 2016, according to judicial districts and geographical macro-areas.

2.2 Empirical strategy

The case study under investigation is the Italian manufacturing industry, which is extremely interesting. On the one hand, Italy's judicial system is one of the worst

in the European Union (CEPEJ 2016); while, on the other hand, the manufacturing industry is characterized by one of the highest level of trade credits according to the European Committee of Central Balance Sheet Data Offices (ECCBSO). Considering judicial delay (see <https://webstat.giustizia.it>), the average time needed to settle a bankruptcy case was equal to 3000 days in 2016, which is absolutely unreasonable.¹ This unsustainable opportunity cost may force creditors to wait for payments instead of submitting an insolvency application.

In particular, authors analyze the Italian manufacturing industry (more than 250,000 observations) and a panel of 3 years (from 2014 to 2016), with a strongly balanced sample. We test the proposed hypothesis by merging two main sources of information: data on judicial inefficiency at the first instance level (insolvency cases), extracted from the database of the Italian Ministry of Justice, and financial information on Italian manufacturing companies, extracted from AIDA (Bureau van Dijk’s database). Lastly, in order to collect more robust results, we look at the *Median Absolute Deviation (MAD)* to detect and then drop the outliers (Leys et al. 2013).

Considering the *i*th company at time *t*, we study several OLS multivariate regression models (panel data with random effects and robust standard errors)² with the following forms:

$$\begin{aligned}
 DEBT_{i,t} = & \beta_0 + \beta_1 JUD_{i,t-1} + \sum_{z=1}^3 \gamma_z SIZE_{i,z,t} + \sum_{r=1}^{24} \alpha_r INDU_{i,r,t} + \sum_{k=1}^5 \delta_k AREA_{i,k,t} \\
 & + \sum_{z=1}^3 \gamma_z FORM_{i,z,t} + \beta_2 LIQ_{i,t} + \beta_3 AGE_{i,t} + \beta_4 InnSME_{i,t} \\
 & + \beta_5 InnStUp_{i,t} + u_{i,t} + \varepsilon_{i,t},
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 FIN_{i,t} = & \beta_0 + \beta_1 JUD_{i,t-1} + \sum_{z=1}^3 \gamma_z SIZE_{i,z,t} + \sum_{r=1}^{24} \alpha_r INDU_{i,r,t} + \sum_{k=1}^5 \delta_k AREA_{i,k,t} + \sum_{z=1}^3 \gamma_z FORM_{i,z,t} \\
 & + \beta_2 LIQ_{i,t} + \beta_3 AGE_{i,t} + \beta_4 InnSME_{i,t} + \beta_5 InnStUp_{i,t} + u_{i,t} + \varepsilon_{i,t},
 \end{aligned} \tag{2}$$

where *DEBT* is the percentage of operating debts in the short term (i.e., less than 1 year) over the total amount of debts in the short term (i.e., operating and financial debts),³ while *FIN* is the total amount of financial expenses in the short term (i.e., less than 1 year). Both variables represent the dependent variable of the proposed models.

The former model represents our main analysis, while the latter is a robust check to support our results. On the one hand, the operating debt ratio denotes how managerial strategies change according to the judicial environment, showing whether companies fund their activities with trade credits; while, on the other hand, financial expenses can confirm the previous model, highlighting whether the financial costs are coherently affected by the same judicial environment. In other words, the higher

¹ According to the same statistics, the average time to settle a mortgage foreclosure case was equal to 250 days (movable) and to 1,600 days (real estate).

² Authors adopt random effects since the key explanatory variables (i.e., mortgage foreclosure and bankruptcy) have a very slow year-to-year variation, and a fixed effects approach might bias the collected estimations.

³ Note that in this estimation we do not consider debts toward subsidiary, associate, and parent companies.

the judicial inefficiency, the higher the operating debt ratio (i.e., the higher the adoption of trade credits to support companies' activities) and, consequently, the lower the financial expenses (i.e., the lower the access to external financial resources by companies).

Afterwards, *JUD* is the time needed to settle an insolvency case (log transformation) in the *j*th district, in which the company is located, and represents our key explanatory variable. Both models look at judicial inefficiency at time *t-1*, i.e., on the lagged variable. In detail, three case matters are considered in order to observe the impact of judicial inefficiency: mortgage foreclosure (i.e., both movable and real estate) and bankruptcy.

We also introduce some internal and external control variables, recalling the models proposed by Falavigna and Ippoliti (2020). Among the former controls, we include the following characteristics of companies:

- *LIQ*, which is a continuous variable equal to financial and operating activities divided by debts payable before the end of the year, and it represents firms' liquidity at short run;
- *AGE*, which is a continuous variable indicating the seniority of our observations (log transformation);
- *SIZE*, which is a matrix of dummy variables equal to 1 according to the European Union classification (3 total assets-based categories: large, medium, and small company);
- *FORM*, which is a matrix of dummy variables equal to 1 according to the company's legal classification (3 classes: public limited company, private limited company, other legal form);
- *InnSME*, which is a dummy variable equal to 1 if the observation is classified as an innovative small and medium enterprise (SME), 0 otherwise;
- *InnStUp*, which is a dummy variable equal to 1 if the observation is classified as an innovative start-up, 0 otherwise;
- *INDU*, which is a matrix of dummy variables equal to 1 if the productivity sector (2 digit) belongs to the selected NACE sector, 0 otherwise;

while, among the latter controls, we analyze the following environmental characteristics:

- *AREA*, which is a matrix of dummy variables equal to 1 if the observation is located in that NUTS 1 geographical macro area (5 categories: North West, North East, Center, South, and Islands).

Table 1 shows some descriptive statistics of dependent and explanatory variables.

Lastly, Tables 5 and 6 in the Appendix present a more detailed overview of debt ratio and financial expenses between 2014 and 2016, according to judicial districts and geographical macro-areas.

Table 1 Descriptive statistics: dependent and independent variables (Italy, 2014–2016)

Variable	Explanation	Obs	Mean	Std. Dev	Min	Max
DEBT _t	Debt ratio _t	220,729	0.734	0.288	0.000	1.000
FIN _t	Financial expenses _t ^ψ	215,509	2.579	1.595	0.000	6.907
JUD _{t-1}	Mortgage foreclosure (real estate) _{t-1} ^ψ	160,273	7.044	0.337	6.041	8.482
	Mortgage foreclosure (movable) _{t-1} ^ψ	160,273	5.252	0.401	3.804	6.541
	Bankruptcy _{t-1} ^ψ	160,273	7.699	0.419	4.875	8.889
LIQ _t	Liquidity _t	258,469	43.553	140.597	− 534.609	1642.681
AGE _t	Age _t ^ψ	258,469	2.556	1.025	0.000	4.963
SIZE _t	Large company _t	258,469	0.453	0.498	0.000	1.000
	Medium company _t	258,469	0.096	0.295	0.000	1.000
	Small company _t	258,469	0.451	0.498	0.000	1.000
	North East _t	258,469	0.290	0.454	0.000	1.000
AREA _t	North West _t	258,469	0.362	0.481	0.000	1.000
	Center _t	258,469	0.186	0.389	0.000	1.000
	South _t	258,469	0.126	0.332	0.000	1.000
	Islands _t	258,469	0.036	0.185	0.000	1.000
FORM _t	Public limited company _t	258,468	0.086	0.281	0.000	1.000
	Private limited company _t	258,468	0.888	0.315	0.000	1.000
	Other legal form _t	258,468	0.026	0.158	0.000	1.000
InnStUp _t	Innovative start-up _t	258,469	0.002	0.049	0.000	1.000
InnSME _t	Innovative SME _t	258,469	0.002	0.042	0.000	1.000

^ψ logarithmic transformation

2.3 Results

Tables 2 and 3 present the results of the multivariate regression models, using a panel sample with random effects and robust standard errors. In detail, Table 2 illustrates the results of model A (i.e., with debt ratio as dependent variable), while Table 3 shows the results of model B (i.e., with financial expenses as dependent variable).

Note that the number of observations in the third column varies depending on the companies that may be subjected to a bankruptcy procedure (*Italian Legislative Decree no. 169/2007*). According to the Wald Chi-square statistics, the models are statistically significant (i.e., at least one of the regression coefficients is not equal to zero), while the R-squared is extremely interesting, ranging between 0.15 and 0.16 in model A, and between 0.31 and 0.32 in model B.

Lastly, in order to verify whether the collected estimations are biased by this censoring phase, we propose as robust analysis the same models, but without dropping the outliers, i.e., considering the whole sample of observations. Tables 7 and 8 present the collected results on the robust test.

2.4 Discussion

Based on these results, we cannot reject the hypothesis that judicial inefficiency can affect corporate finance. The greater the judicial inefficiency in insolvency procedures, the higher the share of operating debts, as well as the lower the financial expenses. In other words, institutional inefficiency has an impact on corporate finance, prompting managers to adopt opportunistic strategies in the short run. These

Table 2 Model A: analysis of the Italian manufacturing industry with judicial insolvency procedures at time $t-1$ (Italy, 2014–2016)

Variable	Debt ratio t (1)	Debt ratio t (2)	Debt ratio t (3)
Liquidity	− 3.47e−05*** (4.64e−06)	− 3.44e−05*** (4.64e−06)	− 2.19e−05*** (4.83e−06)
Age ψ	− 0.0296*** (0.000893)	− 0.0296*** (0.000893)	− 0.0277*** (0.000979)
Large company	0.0640*** (0.00178)	0.0640*** (0.00178)	0.0744*** (0.00190)
Medium company	− 0.0707*** (0.00391)	− 0.0708*** (0.00391)	− 0.0821*** (0.00415)
Mortgage foreclosure (real estate) $_{t-1} \psi$	0.0324*** (0.00234)		
Mortgage foreclosure (movable) $_{t-1} \psi$		0.0214*** (0.00171)	
Bankruptcy $_{t-1} \psi$			0.0163*** (0.00200)
Private limited company	− 0.0271*** (0.00574)	− 0.0271*** (0.00573)	− 0.00498 (0.00675)
Public limited company	− 0.217*** (0.00724)	− 0.217*** (0.00724)	− 0.181*** (0.00811)
Innovative start-up	− 0.00827 (0.0146)	− 0.00877 (0.0146)	− 0.0193 (0.0189)
Innovative SME	− 0.0788*** (0.0209)	− 0.0779*** (0.0208)	− 0.0747*** (0.0213)
Constant	0.694*** (0.0187)	0.812*** (0.0120)	0.759*** (0.0183)
Macro-area (FE)	Yes	Yes	Yes
NACE code (FE)	Yes	Yes	Yes
Wald Chi-square (p -value)	0.0000	0.0000	0.0000
R-squared (between)	0.16	0.16	0.16
R-squared (overall)	0.15	0.15	0.16
Observations	135,665	135,665	120,373
Number of companies	84,155	84,155	74,835

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ ψ logarithmic transformation

results are rather robust, since we can observe the same positive relations across all case matters, which are statistically significant (p -value < 0.01).

Focusing on the judicial procedures, *ceteris paribus*, we expect to detect the highest impact in relation to mortgage foreclosure (real estate). Indeed, taking model A into consideration, if the time necessary to settle a case using this procedure increases by 1000 days, we expect operating debts to rise by 10.85%. Focusing on the other two case matters, assuming the same delay of 1000 days, we expect an increase equal to 2.70% (movable goods) and to 3.20% (bankruptcy). Taking model B into account, if the time necessary to settle a case increases by the same delay of 1000 days, we expect financial expenses to decrease by 7464 Euro (real estate), 3236 Euro (movable goods) and 2153 Euro (bankruptcy). Hence, we cannot reject previous evidence on

Table 3 Model B: analysis of the Italian manufacturing industry with judicial insolvency procedures at time $t-1$ (Italy, 2015–2016)

Variable	Financial expenses ψ (1)	Financial expenses ψ (2)	Financial expenses ψ (3)
Liquidity	0.000212*** (1.74e–05)	0.000211*** (1.74e–05)	0.000171*** (1.81e–05)
Age ψ	0.228*** (0.00503)	0.224*** (0.00503)	0.208*** (0.00519)
Large company	– 0.778*** (0.0103)	– 0.780*** (0.0103)	– 0.796*** (0.0105)
Medium company	0.610*** (0.0206)	0.611*** (0.0206)	0.633*** (0.0205)
Mortgage foreclosure (real estate) $_{t-1} \psi$	– 0.291*** (0.00957)		
Mortgage foreclosure (movable) $_{t-1} \psi$		– 0.170*** (0.00717)	
Bankruptcy $_{t-1} \psi$			– 0.111*** (0.00815)
Private limited company	0.203*** (0.0330)	0.201*** (0.0329)	0.123*** (0.0350)
Public limited company	1.291*** (0.0401)	1.292*** (0.0400)	1.154*** (0.0416)
Innovative start-up	– 0.0587 (0.0805)	– 0.0624 (0.0804)	0.0193 (0.0901)
Innovative SME	0.643*** (0.0952)	0.640*** (0.0943)	0.629*** (0.0933)
Constant	3.638*** (0.0820)	2.455*** (0.0580)	2.639*** (0.0793)
Macro-area (FE)	Yes	Yes	Yes
NACE code (FE)	Yes	Yes	Yes
Wald Chi-square (p -value)	0.0000	0.0000	0.0000
R-squared (between)	0.32	0.32	0.32
R-squared (overall)	0.31	0.31	0.31
Observations	135,366	135,366	125,016
Number of companies	79,789	79,789	74,340

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ ψ logarithmic transformation

the relation between the time needed by courts to enforce debtors' obligations and the time needed by enterprises to repay their debts. Indeed, Falavigna and Ippoliti (2020) suggest that if the time needed to settle bankruptcy cases increases by 25%, we can expect the payment delay to increase by 1%; while, focusing on foreclosure cases, we can expect the payment index to increase by 2%.

Figure 1 highlights the same positive relation, seen from a different perspective. In this case, we plot the judicial districts, weighting the observations by the number of companies located in that district, and we look at the relation between the days needed to settle a bankruptcy case and our dependent variables, i.e., the debt ratio (on the left) and the financial expenses (on the right). According to the estimated coefficients (p -value < 0.01), on average, if judicial inefficiency increases by 1000 days,

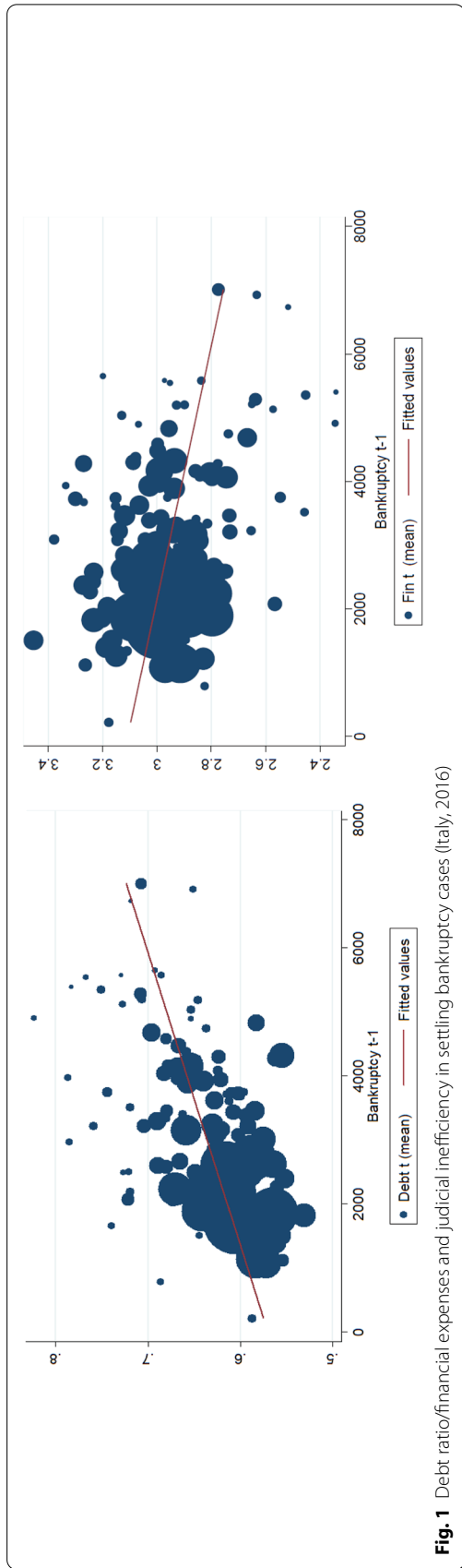


Fig. 1 Debt ratio/financial expenses and judicial inefficiency in settling bankruptcy cases (Italy, 2016)

we expect our companies to react by increasing their operating debts in the short run by 2.20%, and decreasing the financial expenses of 1000 Euro. Note that an increasing of 1000 days is not so unrealistic since, according to statistics of the Italian Ministry of Justice, the average time in 2016 to settle bankruptcy cases is 3,000 days, as well as highlighted in the first section.

3 Conclusions

The current literature highlights the expected positive impact of judicial efficiency on market dynamics, thus encouraging economic growth (Hayo and Voigt 2013). Indeed, a judicial system able to efficiently enforce the law can support entrepreneurship (Lichand and Soares 2014; Fu et al. 2018), firm growth (Giacomelli and Menon 2017), as well as financial dynamics (Haselmann and Wachtel 2010; Moro et al. 2018; Shah et al. 2017). What about corporate finance? Taking insolvency procedures into account, is it admissible to hypothesize that inefficient courts can affect the financial strategies adopted by companies?

This technical note aims to confirm evidence on the relation between institutional performance and firm dynamics, testing the hypothesis that efficiency in settling mortgage foreclosure and bankruptcy cases can affect firms' access to the capital market. Coherently with Falavigna and Ippoliti (2020), our evidence suggest that institutional efficiency can affect firms strategies, showing how inordinately long waiting times to enforce credit rights may increase their access to the trade credits.

Policy-makers ought to be aware of these dynamics, so as to evaluate opportunities to improve the current insolvency procedures (Falavigna and Ippoliti 2021). This necessity becomes even more significant if we consider the Italian case, since its market is shaped around micro- and small enterprises, which may not survive such opportunistic finance strategies.

Obviously, these are results that should be investigated in greater depth to collect more robust evidence on this key issue. For example, data about the financial market can add information on financial constraints and related difficulties in collecting external resources, which are likely to force companies to adopt the suggested strategies. Nevertheless, this work can contribute to shedding new light on such an important matter, steering interest in this direction.

Appendix

See Tables 4, 5, 6, 7, 8.4, Table 5, Table 6, Table 7, Table 8.

Table 4 Average time needed to settle an insolvency case according to judicial procedures (expressed in days) (Italy, 2014–2016)

Judicial district of second instance	Mortgage foreclosure (movable)	Mortgage foreclosure (real estate)	Bankruptcy
Milan	162	1091	2039
Turin	185	1046	2549
Genoa	147	921	3103
Brescia	188	1175	2211
North West	170	1058	2476
Trento	117	749	2234
Venice	173	1198	2384
Bologna	185	1079	1801
Trieste	177	771	2061
Bolzano	123	628	1663
North East	155	885	2029
Ancona	265	1658	3329
Florence	258	1197	2408
Rome	290	1467	3514
Perugia	272	1216	2028
Center	271	1384	2820
Bari	366	2169	3746
Campobasso	297	1770	2430
Catanzaro	255	2417	3658
L'Aquila	231	1536	3224
Lecce	382	1360	3707
Naples	303	1930	3466
Potenza	369	2947	4917
Reggio Calabria	385	2982	4135
Salerno	301	2095	4138
Taranto	194	3177	5097
South	308	2238	3852
Cagliari	331	2028	3361
Palermo	227	2536	4659
Caltanissetta	278	3001	4680
Catania	309	2668	4937
Messina	445	2709	5604
Sassari	243	2027	3616
Islands	305	2495	4476

Table 5 Descriptive statistics on financial expenses according to judicial districts and geographical macro-areas Italy, 2014–2016

Judicial district of second instance	Mean ^ψ	Std. Dev	Frequency (i.e., number of firms)
Milan	2.612	1.628	39,455
Turin	2.663	1.605	18,097
Genoa	2.536	1.589	3742
Brescia	2.789	1.601	22,293
North West	2.650	1.606	83,587
Trento	2.903	1.605	1995
Venice	2.608	1.582	32,469
Bologna	2.662	1.591	26,123
Trieste	2.731	1.591	5725
Bolzano	2.989	1.653	1350
North East	2.779	1.604	67,662
Ancona	2.626	1.515	9557
Florence	2.569	1.539	18,891
Rome	2.270	1.654	10,052
Perugia	2.671	1.660	3419
Center	2.534	1.592	41,919
Bari	2.498	1.628	5042
Campobasso	2.406	1.557	515
Catanzaro	2.190	1.524	1563
L'Aquila	2.580	1.651	4244
Lecce	2.364	1.601	2236
Naples	2.226	1.660	9057
Potenza	2.454	1.593	942
Reggio Calabria	2.177	1.681	379
Salerno	2.524	1.726	2912
Taranto	2.472	1.607	963
South	2.389	1.623	27,853
Cagliari	2.383	1.624	940
Palermo	2.295	1.570	2211
Caltanissetta	2.304	1.549	549
Catania	2.286	1.627	2570
Messina	2.227	1.587	755
Sassari	2.327	1.585	1003
Islands	2.304	1.590	8028

^ψ logarithmic transformation

Table 6 Descriptive statistics on debt ratio according to judicial districts and geographical macro-areas Italy, 2014–2016

Judicial district of second instance	Mean	Std. Dev	Frequency (i.e., number of firms)
Milan	0.747	0.288	42,709
Turin	0.730	0.290	18,791
Genoa	0.751	0.282	3980
Brescia	0.678	0.303	21,585
North West	0.727	0.291	87,065
Trento	0.693	0.294	1857
Venice	0.730	0.285	33,952
Bologna	0.697	0.296	25,921
Trieste	0.707	0.285	5776
Bolzano	0.707	0.311	1269
North East	0.707	0.294	68,775
Ancona	0.721	0.274	9127
Florence	0.714	0.291	17,972
Rome	0.819	0.256	12,536
Perugia	0.707	0.291	3353
Center	0.740	0.278	42,988
Bari	0.787	0.273	5754
Campobasso	0.783	0.265	529
Catanzaro	0.842	0.228	1868
L'Aquila	0.759	0.283	4595
Lecce	0.801	0.251	2641
Naples	0.827	0.263	12,034
Potenza	0.803	0.258	990
Reggio Calabria	0.833	0.243	489
Salerno	0.777	0.286	3690
Taranto	0.797	0.259	1078
South	0.801	0.261	33,668
Cagliari	0.814	0.251	1093
Palermo	0.817	0.248	2636
Caltanissetta	0.812	0.254	629
Catania	0.819	0.254	3079
Messina	0.827	0.243	972
Sassari	0.811	0.247	1167
Islands	0.817	0.249	9576

Table 7 Model A: analysis of the Italian manufacturing industry with judicial insolvency procedures at time $t-1$ (Italy, 2014–2016)

Variable	Debt ratio t (1)	Debt ratio t (2)	Debt ratio t (3)
Liquidity	– 3.07e–06 (2.82e–06)	– 2.76e–06 (2.82e–06)	6.31e–06** (2.87e–06)
Age ψ	– 0.0294*** (0.000873)	– 0.0294*** (0.000874)	– 0.0273*** (0.000958)
Large company	0.0625*** (0.00173)	0.0625*** (0.00173)	0.0716*** (0.00185)
Medium company	– 0.0688*** (0.00371)	– 0.0689*** (0.00371)	– 0.0808*** (0.00395)
Mortgage foreclosure (real estate) $_{t-1} \psi$	0.0316*** (0.00227)		
Mortgage foreclosure (movable) $_{t-1} \psi$		0.0217*** (0.00165)	
Bankruptcy $_{t-1} \psi$			0.0165*** (0.00195)
Private limited company	– 0.0253*** (0.00560)	– 0.0253*** (0.00559)	– 0.00392 (0.00658)
Public limited company	– 0.213*** (0.00702)	– 0.213*** (0.00701)	– 0.178*** (0.00786)
Innovative start-up	– 0.00514 (0.0142)	– 0.00573 (0.0142)	– 0.0127 (0.0184)
Innovative SME	– 0.0778*** (0.0207)	– 0.0768*** (0.0207)	– 0.0732*** (0.0211)
Constant	0.699*** (0.0182)	0.810*** (0.0116)	0.758*** (0.0178)
Macro-area (FE)	Yes	Yes	Yes
NACE code (FE)	Yes	Yes	Yes
Wald Chi-square (p -value)	0.0000	0.0000	0.0000
R-squared (between)	0.16	0.16	0.16
R-squared (overall)	0.15	0.15	0.15
Observations	143,905	143,905	127,712
Number of companies	87,557	87,557	77,853

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ ψ logarithmic transformation

Table 8 Model B: analysis of the Italian manufacturing industry with judicial insolvency procedures at time $t-1$ (Italy, 2015–2016)

Variable	Financial expenses ζ^ψ		
	(1)	(2)	(3)
Liquidity	7.90e−05*** (1.15e−05)	7.62e−05*** (1.16e−05)	5.21e−05*** (1.21e−05)
Age $^\psi$	0.227*** (0.00497)	0.224*** (0.00498)	0.207*** (0.00514)
Large company	− 0.783*** (0.0101)	− 0.786*** (0.0101)	− 0.798*** (0.0104)
Medium company	0.589*** (0.0196)	0.590*** (0.0196)	0.613*** (0.0196)
Mortgage foreclosure (real estate) $_{t-1}^\psi$	− 0.288*** (0.00944)		
Mortgage foreclosure (movable) $_{t-1}^\psi$		− 0.170*** (0.00704)	
Bankruptcy $_{t-1}^\psi$			− 0.104*** (0.00812)
Private limited company	0.189*** (0.0327)	0.188*** (0.0327)	0.106*** (0.0347)
Public limited company	1.274*** (0.0394)	1.276*** (0.0393)	1.133*** (0.0408)
Innovative start-up	− 0.0492 (0.0790)	− 0.0526 (0.0790)	0.0361 (0.0880)
Innovative SME	0.616*** (0.0984)	0.612*** (0.0977)	0.597*** (0.0974)
Constant	3.627*** (0.0809)	2.466*** (0.0571)	2.603*** (0.0790)
Macro-area (FE)	Yes	Yes	Yes
NACE code (FE)	Yes	Yes	Yes
Wald Chi-square (p -value)	0.0000	0.0000	0.0000
R-squared (between)	0.32	0.32	0.32
R-squared (overall)	0.30	0.30	0.30
Observations	142,370	142,370	131,611
Number of companies	82,247	82,247	76,755

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

$^\psi$ logarithmic transformation

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Authors' contributions

The authors have made substantial contributions to the conception and design of the work, the acquisition, analysis, and interpretation of data. Moreover, the authors have approved the submitted version and agree to be personally accountable for the author's own contributions and for ensuring that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and documented in the literature.

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Declarations

Competing interests

The authors declare no conflict of interest.

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