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Law and Finance: Empirical Evidence from Germany, Spain, Portugal and Brazil

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Abstract

The global financial crisis of 2008 proved that many affected countries did not have effective insolvency laws at that moment. The increase of companies' insolvencies made it clear that reforms needed to be urgently proposed to amend the inaccurate proceedings. However, not all of the commenced insolvency reforms ended up having the impact upon debtors and creditors that it was intended. The purpose of this paper is thus to prove whether said reforms had a meaningful effect in a group of selected countries upon creditors. I provide a general overview of the insolvency laws for Germany, Spain, Portugal, and Brazil and describe some insolvency reforms that have come into force there recently. The paper then proceeds to the empirical analysis of companies' data, where descriptive but mostly inferential statistics are implemented, to examine whether investors changed their lending behaviour after the reforms' commencement. The Chow test and the Difference-in-difference estimation combined with a matching approach are two techniques used to give an answer to this question. The results show that Brazil is the only country where the commencement of the insolvency refom had a true impact upon leverage. Because the Brazilian insolvency law of study is thought to be a creditor-friendly reform, at least in some aspects, we observe that these results support the perspective that stronger creditor rights cause a decrease of financial leverage, also called demand-side view. Stronger creditor rights imply a higher chance that the companies' management will lose jobs and control in case of bankruptcy and thus the management feels reticent to rely on external financing.

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List of abbreviations

DV	Dependent Variable
IV	Independent Variable
OLS	Ordinary Least Squares
BLUEs	Best Linear Unbiased Estimators
FE	Fixed-effects
DiD	Difference-in-Difference
MDM	Mahalanobis Distance Measure
PSM	Propensity Score Measure

List of symbols

H	Statistical hypothesis
μ	Mean population leverage
y	Dependent variable leverage
α	Fixed-effects
β	Slope coefficient of the linear regression
δ	Slope coefficient of the linear regression
γ	Slope coefficient of the linear regression
ε	Error term of the linear regression
F	F statistic
SSR	Sum-of-squared residuals
N	Number of observations
k	Number of interaction terms
X	Explanatory variables of leverage
d	Post-reform indicator
T	Country indicator
Td	Treatment-effect indicator

1   Introduction

Insolvency law is a human invention that has been created to dissolve unviable businesses and give viable ones a second chance to reorganize and keep operating.[1] The viability of a business is measured by its long-term survival and its ability to sustain profits over a period of time.[2] If a business is considered to be unviable because it is unable to pay its debt when it falls due, then said business can also be referred as an insolvent business.[3] The entrepreneur, who brought the business idea into the market and now has to deal with his company in an insolvent state, will see his self-confidence as a professional lowered, especially if the business cannot be back on track and has to close doors. Entrepreneurs with the experience of a failed company behind them in a country where insolvency regulations do not work well, for instance, will be scared to try again and held back from starting a new business when the opportunity arises. The same entrepreneur, but on the contrary living in a country with an effective insolvency law, will see herself better protected and encouraged to start her own firm, which in the end incentives economic growth and dynamism. It then makes sense to expect that companies are much more likely to be built up if bankruptcy[4] proceedings are less costly in case of default. Although it is important to close an unviable business with efficient exit frameworks, being able to keep a viable business alive results in a much more gratifying outcome: employees hold onto their jobs, the supplier and customer networks are maintained and creditors get back a larger amount of their credit.[5] Therefore, an effective insolvency law aims at not only protecting entrepreneurs and business owners, but also supports the rest of the stakeholders and especially creditors in recovering as much of their loans as possible.

But as important as it can be, insolvency law is not a new invention. Insolvency law is believed to date back to times of the Roman Empire, where the debtor would suffer severe physical damage or have to sell his wife and children to slavery if he could not pay his creditors back. Fortunately, insolvency law evolved to a point where the debtor's property and not the persons themselves was the asset to pay out the credit. It was then that state authorities came into the field to regulate the procedure, and thus the modern insolvency law, although keeping concepts formulated by the Romans, was born. However, according to

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[1] See Kappler (2011), p. 1.
[2] See The Balance (2017).
[3] See Investopedia (2016).
[4] The terms "insolvency" and "bankruptcy" are used interchangeably throughout the paper.
[5] See Kappler (2011), p. 1.

Pagano[6], insolvency law did not exist strictly speaking in the ancient cultures, since insolvency law is only understood with the appearance of regulatory public authorities.

Nowadays, insolvency laws are not only in a state of flux, but also vary around the globe. Proof of this constant change is the amount of reforms that have commenced in a huge number of different economies in the recent years. The 2008 financial crisis and the following huge number of corporate bankruptcies showed a great need of effective insolvency frameworks.[7] Insolvency reforms have the ultimate purpose of strengthening the economic activity of a country by making insolvency procedures quicker and cheaper. Apart from changing over time, insolvency laws differ across countries and cultures as well. Different economies have different insolvency laws, which originate mainly from two major legal systems or traditions: civil law tradition and common law tradition. Civil law tradition is the most widely distributed around the world and is composed by three families of law: French, German and Scandinavian. Common law tradition, in turn, is in practice in English-speaking countries like Canada, USA, Australia, India and most of the UK.[8] La Porta et al.[9] have studied the relation between Law and Finance, coming up with very interesting results. They report that legal origin and the quality of law enforcement matter when talking about shareholder and creditor rights, both based on different variables. Regarding legal origin, common-law countries offer shareholders and creditors stronger legal protection, whereas French-civil-law countries offer the weakest. German-civil-law countries would be somewhere in the middle, although closer to the latter. It is not normally the case that some legal families protect shareholders and others protect creditors. Regarding law enforcement, results also show that legal families with laws protecting investors also have stronger law enforcement. For instance, investors in French-Civil-law countries have poor protection by the laws and the system enforcing them. Another find is that the level of GDP apparently has an impact on the quality of enforcement, having richer countries a better system to enforce law.[10]

The main goal of this Master Thesis is to provide evidence whether insolvency reforms commenced in any of the following four countries: Germany, Spain, Brazil and Portugal, had a real impact on firms and thus changed the lending behavior of their investors. In order to do that, I will first do a research on the Insolvency Law present in said four countries, and then look at the insolvency

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[6] See Pagano (1889), p. 9. cited in Vėlvys/Mikuckienė (2009), pp. 287-288.
[7] See Kappler (2011), p. 1.
[8] See La Porta et al. (1998), pp. 1117-1119.
[9] Ibid., pp. 1129, 1138-1139.
[10] Ibid., p. 1141.

reforms that have commenced there recently. Once a single reform has been picked for each country, the next step is to analyze, by means of a statistical program such as Stata, if the investors' lending behavior have experienced a change by looking at the change of leverage between the pre-reform and post-reform period.

2 Insolvency Law

This section focuses on different important aspects of insolvency law of four countries: Germany, Spain, Portugal and Brazil. The whole point is to provide a general view and understanding of each insolvency law, so only the basic and most important points are described below.[11]

2.1. Germany

The German Insolvency Code entered into force on 1 January 1999. It replaced the Bankruptcy Code of 1877 and was amended later in 2012 by the so-called "Reform Act".[12]

There are several tools used in pre-insolvency restructuring and undertaken by shareholders and creditors to avoid insolvency.[13] A debt-to-equity swap is one of those. With this transaction, the obligations or debts of the company are exchanged for something of value, equity. A debt-to-equity swap is especially appealing to creditors if the company is going through a momentary rough patch but still has long-term potential. Other tools used to prevent insolvency are inputs of shareholders' capital, although these are unlikely to be recovered in case the debtor files for insolvency.

The debtor is only legally obliged to file for insolvency proceedings in case of illiquidity or over-indebtedness and have a maximum period of three weeks to do so. If the petition is not filed in time, the management could be subject to personal liability. In case of impending illiquidity, however, the debtor is not obliged to file a petition for insolvency proceedings.[14]

Either the insolvent debtor or any creditor can file a petition for insolvency proceedings. The reason of the insolvency petition has to be illiquidity (unable to meet at least 90% of due payments liabilities within a three-week period), impending illiquidity (likely to become unable to meet its future payments when they fall due) and/or over-indebtedness (the total amount of liabilities exceeds the total amount of assets). If the debtor is the petitioner, any of said reasons is valid to commence the insolvency proceedings. However, if the creditor wants to file the petition, he or she can only base the petition on illiquidity or over-indebtedness.[15]

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[11] As the intention of this chapter is to provide a summary of different insolvency laws, all text is taken from external sources. However, it is properly cited and paraphrased as much as possible.
[12] Clifford Chance (2015), p. 95.
[13] Baker McKenzie (2016), pp. 198f.
[14] Clifford Chance (2015), p. 96.
[15] Baker McKenzie (2016), pp. 192f.

The insolvency procedure can be divided in two phases: preliminary insolvency proceedings and main insolvency proceedings. The goal of the preliminary insolvency proceedings (or interim proceedings), which start straight after the petition is filed and last around three months, is to evaluate the current financial situation of the debtor and to verify that he fulfills the requirements needed to begin with the insolvency proceedings. Said requisites are a valid insolvency reason and sufficient assets to cover the procedure costs.[16] A preliminary insolvency administrator, who at the same time will monitor the actions of the debtor and finally submit a report to the insolvency court, leads this task. If the abovementioned requisites are met, the court opens main insolvency proceedings. Alternatively, a preliminary custodian can be appointed instead if the proceedings are run as Debtor-in-Possession Proceedings, in which case he or she has no direct control of the debtor's operations. This procedure, which lets the management remain in charge of the business decisions throughout the insolvency proceedings, needs to be requested by the debtor and granted by the court. The Debtor-in-Possession Proceedings tended to be granted only under exceptional circumstances in the past, and there were many management's complaints about losing control over their businesses. However, after the ESUG came into force Debtor-in-Possession Proceedings became much more available.[17] If the debtor files a petition for insolvency proceedings before he is illiquid and also applies for Debtor-In-Possession Proceedings, he or she will be given a maximum period of three months to elaborate an insolvency plan, called Protective Shield Period. During this period, the debtor is granted protection, which prevents enforcement of any claims from disturbing the preparation of the insolvency plan.[18]

Regarding the main insolvency proceedings (or formal insolvency proceedings), the preliminary insolvency administrator/custodian is generally appointed by the court to continue its engagement, who is in charge of making sure the creditors are as satisfied as possible. According to the report made by the insolvency administrator/custodian and subject to the final decision of the creditor's assembly, the debtor can be immediately liquidated or continued for reorganization. The most popular option is generally the debtor's liquidation.[19]

The German Insolvency Law recognizes different types of creditors and classifies them according to participation in the insolvency proceedings, the extent to which their claims are secured and the rank of these claims.[20]

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[16] Clifford Chanze (2015), p. 96.
[17] Baker McKenzie (2016), pp. 193-196.
[18] Clifford Chanze (2015), p. 97.
[19] Baker McKenzie (2016), p. 195.
[20] Ibid., pp. 187-189.

- Creditors with right of segregation of an asset: right to separate their assets from the debtor's estate.
- Secured creditors: right of separate satisfaction, which allows such secured creditors to claim the proceeds generated on the realization of the collateral up to the amount of their secured claim.
- Estate creditors: satisfied before ordinary insolvency creditors. Estate claims are those acquired after the opening of insolvency proceedings and are usually paid in full.
- Insolvency creditors: their claims are unsecured and came into existence before the opening of the insolvency proceedings. Such insolvency creditors are rarely paid in full, but instead only get a small percentage of their claims (insolvency quota)
- Subordinated creditors: have the lowest priority

According to a report conducted by Noerr and McKinsey & company[21], "over 90 per cent of 220 experts surveyed", who were insolvency experts such as lawyers, judges, insolvency administrators, creditors and investors, "confirm that the reform has made German restructuring law more attractive." There are advantages seen by the experts. First, creditors have now a greater possibility to participate in the creditors' committee, so they are more willing to support the restructuring. Second, the restructuring process is now faster thanks to the protective shield. Regarding things that could be improved, there is the absence of a group insolvency law, which does not recognize insolvency proceedings covering groups of companies.

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[21] See Noerr (2015)

2.2. Spain

The Spanish Insolvency Law (SIL) 22/2003, named *Ley Concursal*, entered into force on 1 September 2004 and has been modified several times by Laws and Royal Decrees in the past years. The Insolvency Law regulates all norms applicable to the insolvency procedure *(concurso)*, which applies to all persons and entities, with exception of Public Administrators.[22]

There are two possible pre-insolvency measures: the insolvency postponement and the insolvency meditation. The first one opens a three-month negotiation period to reach a refinancing agreement (*acuerdo de refinanciación)* or a composition agreement (*convenio de acreedores)*. The second one provides out-of-court solutions for small restructuring cases and businesses that not yet been declared insolvent. Both alternatives extend the term during which the debtor must file for insolvency.[23]

A company or an individual is legally obliged to resort to insolvency proceedings when they find themselves in a situation of actual insolvency *(insolvencia actual)*, or in other words, if they cannot pay their debts as they fall due. The debtor may also file for insolvency, but is not obliged to, in case of imminent insolvency (*insolvencia imminente*). The Insolvency Law forces the insolvent debtor to file for the insolvency proceedings after maximum two months since the date, when he or she became aware, or should have, of the insolvency situation. [24] The debtor is entitled to pay all costs that derive from the insolvency proceedings, such as the attorneys' fees or the insolvency administrator's fees.[25]

However, the debtor can opt for the insolvency postponement mentioned above, where three additional months are granted to reach an agreement with creditors. Only if he or she can prove the initiation of either an out-of-court refinancing agreement with financial creditors or an early composition agreement (in-court restructuring) with creditors, an extra time period can be given. If of these two agreements neither is reached within the three-month period, and the debtor is still insolvent, he or she must file for insolvency proceedings within the following month.[26] This new rule, called the "2+3+1 rule" or "5 bis Moratorium", gives therefore the debtor an extra period of four months of protection to reach an agreement, while preventing creditors to enforce actions against necessary assets for the on-going of the business or file for necessary insolvency proceedings.[27]

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[22] Clifford Chance (2015), p. 107.
[23] Baker McKenzie (2016), pp. 384f.
[24] Uría Menéndez (2012), p. 11.
[25] Clifford Chance (2015), pp. 107f.
[26] Uría Menendez (2012), p. 11.
[27] Clifford Chance (2015), p. 108.

Either the debtor or the creditor to the Commercial Court of the capital of the province in which the debtor has its center of main interest (COMI) can file the petition for insolvency proceedings. If the applicants are the directors of the company, it is called voluntary insolvency proceedings (*concurso voluntario*) and they must documents such as a description of the company's current situation, the accounting books… The petition together with the supporting documents must be submitted to the commercial courts of the capital of province where the COMI of the company lies.[28] However, if the applicant is any creditor, it is called involuntary insolvency proceedings, and he or she must provide evidence of their debt and of the insolvency situation (although it can be difficult to prove that the debtor is not regularly paying its debts as they fall due). In the latter case, if the application is rejected, the creditor may be sued and ordered to pay the corresponding costs and fees. In involuntary insolvency proceedings, the debtor is given the chance to object the creditors' petition before any insolvency procedure is opened. [29]

A part from the petitioner criteria, the insolvency proceedings can also be classified according to its length into ordinary insolvency proceedings or summary insolvency proceedings. The latter ones are applied if the insolvency there are less than 50 creditors and the debtor's liabilities amount to less than 5 million euros. The summary insolvency proceedings may also be applied if the debtor submits a liquidation plan attached with the insolvency proceedings or if she files a proposal for an early composition agreement.[30] According to a report from the EAE Business School[31], around 95% of the insolvency proceedings declared in 2013 in Spain were voluntary and 77% of them were summary insolvency proceedings, whose costs averaged around 11% of their goods.

Once the application is filed, the Spanish Commercial Courts declare the insolvency state. The time it takes them to do so depends on a number of factors, such as who files the petition, if the documentation is complete or not and the workload of the courts at that moment. This is on average between two and four weeks.[32]

After the insolvency declaration (*auto-declaración de concurso*), the insolvency procedure (*concurso*) is initiated, which consists of two phases. The main goal of the first phase, also called common phase, is to appoint the insolvency administrator or trustee, to specify what are the assets and liabilities of the company and to finally come up with a list of the insolvency creditors and their

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[28] Ibid.
[29] Ibid., pp. 108f.
[30] Uría Menéndez (2012), p. 43.
[31] See EAE Business School (2014)
[32] Clifford Chance (2015), p. 109.

ranked claims within two months of being appointed, or one month in summary insolvency proceedings.[33] The insolvency administrator, either a lawyer, or an economist or auditor is appointed by the insolvency judge and will supervise the company's activities in case of voluntary insolvency proceedings, or take control of the company and be in charge of all further decisions in case of involuntary insolvency proceedings. Even an auditor company (provided that it has both a lawyer and an economist or auditor) can be appointed as insolvency administrator.[34] For large insolvency cases, auditors, consultancy firms or law firms are appointed as insolvency administrators. The administrator's fees are taken from the insolvency estate (debtor's assets and rights at the moment of the insolvency declaration) and depend on the number of creditors and the size of the proceedings. Creditors, who are also paid out of the insolvency state, must report their claims within one month of the declaration of insolvency.[35] It is then when the insolvency administrator has enough information to elaborate the abovementioned list.

In the second phase, the debtor can opt for a composition arrangement (*convenio*) with the creditors or the liquidation of his assets.[36] If after the common phase the debtor has not requested liquidation, the court will go for the composition agreement. For this purpose, a creditors' meeting (*junta de acreedores*) is scheduled and proposals of payment reduction, payment delay or both in the presence of the insolvency administrator and the judge take place. Actually, there are two types of composition agreements: early composition agreement and ordinary composition agreement.[37] To file for the first one, the debtor needs the support of creditors representing at least 20% of the overall amount of claims. There is not much time to do so between the insolvency petition and the deadline for the creditors' claims report, as result of which no many early composition agreements are submitted. The creditors can also file the ordinary composition agreement, unlike the abovementioned agreement. If no proposal is approved or the debtor fails to comply with the composition agreement in force, the court will start the liquidation.

The liquidation is based on the cease of the management from directors. Either the debtor or the creditors can also request the liquidation at any time during the insolvency proceedings, and a liquidation plan's submission is allowed already at the very beginning with the insolvency petition. The selected insolvency

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[33] Uría Menéndez (2012), pp. 23f.
[34] Ibid., p. 17.
[35] Ibid., p. 22.
[36] Ibid., p. 13.
[37] Ibid., p. 35.

administrator is in charge now of selling the debtor's assets and the money is distributed among creditors according to priority rules.[38] The liquidation plan foresees direct transfer of the debtor's assets when possible or otherwise these will be sold in an auction.

There are two main groups of creditors: insolvency creditors (*acreedores concursales*) and creditors of the insolvency state (*acreedores de la masa*). The the claims against the insolvency state, such as the fees for filing for insolvency and fees incurred by the insolvency administrator, must be paid from the insolvency state as they fall due and before the insolvency state distribution to the insolvency creditors starts.[39] As mentioned above, the insolvency administrator needs to prepare a list of the insolvency creditors' claims in the common phase. These can be classified into:[40]

- Privileged claims: can be either generally prioritized (salaries, tax claims…) or specially prioritized (mortgages). The specially prioritized creditors are not subject to the composition arrangement and the first to be paid in case of liquidation. The value of the special credit rights must be 90 % of the so-called "reasonable value".
- Ordinary claims (suppliers)
- Subordinated claims: those paid last (fines, sanctions)

If the debtor comes to an agreement in the previous two years of the declaration of insolvency and the insolvency administrator can prove that it was "detrimental to the insolvency estate", the judge can withdraw such agreement. This may arise even in the absence of fraudulent intent. The decision of whether an action or agreement was detrimental depends on each case. In order for a refinancing agreement, understood as such increasing the borrower's funds or extending the maturity date of a previous financing agreement, to be immune to a claw-back action, it must meet several requirements.[41]

The cram-down mechanism implies that, in the event that qualified majorities vote in favor of the refinancing agreements mentioned above, its effects may also be imposed on dissenting or absent creditors. Therefore, dissident creditors who vote against a pre-insolvency refinancing agreement or do not vote at all, may be crammed down. This cramming down measures provided by refinancing agreements are extended also for creditors' arrangements. The purpose of these measures remains similar: creditors' arrangements should not be

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[38] Uría Menéndey (2012), p. 40.
[39] Ibid., p. 22.
[40] Ibid., pp. 24-26.
[41] Uría Menéndez (2012), pp. 29-31.

unfeasible only because a few minority voted for it. [42]

Either if directors fail to file for insolvency proceedings within the abovementioned two-month period or there has been a possible misconduct or gross negligence from directors that caused or contributed to the company's insolvency (*concurso culpable*), the management would be considered liable to pay any debts that cannot settled with the liquidation of the debtor's assets.[43] It is when the declaration of insolvency takes place that an examination of the causes is initiated.

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[42] See Ruiz (2015), p. 26.
[43] Uría Menéndez (2012), p. 41.

2.3. Portugal

The Portuguese Insolvency Law, called *Código da Involsvência e Recuperação de Empresas*, was amended for the last time by Decree-law No. 26/2015, which entered into force on 3 March 2015.[44]

There are two pre-insolvency procedures: PER (*Proceso Especial de Revitalização*, court-monitored) and the SIREVE (*Sistema de Recuperação por Via Extrajudicial*, out-of-court). Both procedures aim at enabling companies in difficulty to restructure at an early stage and preventing their insolvency through an agreement between the company and its creditors. The main difference between them is that the PER involves judicial intervention, while the SIREVE is out-of-court.[45]

The PER allows the debtor with economic difficulties or imminently insolvent to enter negotiations and arrange a restructuring plan, which is mainly prepared by the debtor and has to be devised in maximum period of three months, under the supervision of an administrator appointed by the court. The PER aims at the recovery of the debtor without starting an insolvency procedure, which would require the declaration by the court of the debtor's insolvency and would lead to a greater time consumption. The judicial administrator is in charge of preparing a list of all creditors involved and their claims, who are invited to file them and participate in the negotiations of the agreements.[46]

The SIREVE grants creditors and companies going through a rough financial patch or in an imminent or current insolvency situation the possibility of an extrajudicial agreement, which aims at the recovery of said companies. These negotiations should be concluded within a period of three months, which may be extended for an additional one more month. If the settlement is accepted by at least 2/3 of total amount of credit, the recovery plan may be submitted before the court[47]. The goal of this procedure is to speed up the negotiation process with the main creditors of the companies in order to guarantee the improvement of their working conditions, assuming IAPMEI (Agency for Competitiveness and Innovation) the mediator role, being then not monitored by the courts, and driving force in the whole process. The SIREVE is available to companies which are still viable and does not involve the court nor requires to change the company's management. The intervention of a judicial administrator is not needed either.[48]

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[44] See Serra (2015)
[45] Ibid.
[46] See Cuatrecasas, Gonçalves Pereira (2016), pp. 89f.
[47] See Cuatrecasas, Gonçalves Pereira (2016), p. 88.
[48] See AERLIS

Since the moment on which a company becomes aware of its insolvency or should become aware, the company has 30 days to file for insolvency. Apart from the debtor, the creditor can also file a petition for insolvency proceedings (involuntary), but in this case the attached documents providing information about the insolvency state and the creditors' claims are needed. The debtor then has 10 days to object to the creditor's petition. Once the petition is filed, the court may appoint an interim administrator to provide the company's management with support[49]

If the petition is accepted by the court, it will open the insolvency procedure. An insolvency administrator is appointed and a deadline for the creditors to file their claims and a creditors' general meeting is set. The insolvency administrator prepares a list of all the claims, which needs to be presented after 15 days of the abovementioned deadline. If there are no objections made by the creditors with respect to the list, the court makes a decision about the credit delivery and priority.[50] If no insolvency plan is submitted or approved within the following 60 days of the first creditors' general meeting, the insolvency administrator must go on with the liquidation. According to the Portuguese Law, there are four different types of creditors[51]:

- Secured creditors: those with security over assets seized up to the value of such assets (banks)
- Preferential creditors: those with a right to be preferentially paid up to the value of the assets (employees)
- Non-secured creditors: those who do not obtain assets as collateral (suppliers, customers…)
- Subordinated creditors: those paid only after the non-secured creditors have been paid in full

The credits incurred during the insolvency procedure (court fees and insolvency administrator's remuneration) have the highest priority.

The average time of an insolvency proceeding is not easily determinable, because it will vary depending on several factors, such as the number of creditors, passive volume, the composition of the insolvent estate and the presentation of objections to the list of credits recognized by the insolvency administrator, amongst other variables. On average it could take from two to nine years for the most complex cases.

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[49] Law Business Research Ltd review (2014), pp. 364f.
[50] Ibid., pp. 365f.
[51] Ibid, p. 367.

2.4. Brazil

The Brazilian Bankruptcy Law, named *Nova Lei de Falências e Recuperação de Empresas* Law No. 11.101/05, replaced in 2005 the previous bankruptcy law, which had governed insolvency proceedings for 60 years. According to Colombo and Braga[52], the insolvency law ultimately changed "from a liquidation-oriented and outdated legislation to embrace modern principles of corporate restructuring designed to rescue distressed but viable businesses."

The new system offers three alternatives in case of insolvency: judicial reorganization, extrajudicial reorganization and bankruptcy (liquidation). The main difference between the first two procedures is that judicial reorganization is a court-supervised reorganization proceeding, while extrajudicial reorganization means out-of-court reorganization. Different sets of conditions and requirements have to be met for triggering each of these procedures. [53]

The main goal of judicial reorganization is to provide means to overcome financial troubles so that the productive business can keep going. Judicial reorganization is the most common insolvency mechanism for companies in Brazil and its petition, as well as the petition for extrajudicial reorganization, can only be commenced by the debtor. The development of the recovery plan is coordinated by the insolvency administrator, who is appointed by the court. In this case, the management keeps the control of the business with the assistance of the insolvency administrator and the supervision of a creditors' committee. The judicial reorganization proceeding may last for approximately two years and in the first 180 days following the legal recovery announcement, the creditor is forbidden to sell "productive capital goods" essential to the operations of the company. With regard to the abovementioned recovery plan, it must contain: what restructuring mechanisms to be used (debt rescheduling, corporate reorganization, partial sell of assets, shutdown of loss-making units, capital increases…), proof of economic viability of the company and a document of the debtor's assets. The recovery plan must be accepted by the four categories forming the creditors' committee: labour creditors, secured creditors, unsecured creditors and small companies.[54]

The extrajudicial restructuring plan is prepared by the financially distressed company to obtain more favorable terms and conditions for the payment of debts. This plan needs to be discussed between the debtor and the creditors. This

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[52] See Colombo/Braga (2016), p.11.
[53] See Rapisardi/Zujkewoski (2014)
[54] Baker Mckenzie (2016), pp. 73f.

proceeding can be commenced by the financially distressed company and the management can stay in control of the business.[55]

The aim of the bankruptcy is to sell the assets, preferably as a whole or in blocks, and use the money obtained to pay the creditors, which has a higher risk of diminished returns than if the debtor is restructured, especially for low-priority creditors. Unlike the other two abovementioned proceedings, bankruptcy can be filed by either the insolvent debtor or any creditor. In this case, the management is not allowed to stay in charge of the company anymore and the court judge appoints an administrator for that matter. In case of Bankruptcy, the company has the right to question the nature of the bankruptcy request within a 10-day period. The liquidation of assets must be made according to the following preferential order:

- Labor claims
- Secured claims
- Tax claims
- Privileged claims
- Unsecured claims
- Subordinated claims

Most of the bankruptcy cases in Brazil are filed by the creditor because of, among other reasons, the non-existing obligation to file for self-liquidation, the loss of control over the business and the bad reputation that may arise.[56]

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[55] Ibid., pp. 71f.
[56] Ibid.

3 Insolvency reforms

In Section 3, tables regarding some insolvency reforms that have been commenced in the previous years can be found for each of the four countries of study. The goals and some important changes made to the insolvency law are described for each reform of the table. For the analysis in Chapter 4, and especially for the Chow test and Difference-in-Difference Estimation, I have chosen the following reforms:

- Germany: *Gesetz zur weiteren Erleichterung der Sanierung von Unternehmen* (ESUG) of 2012
- Spain: Law 38/2011
- Portugal: Law 16/2012
- Brazil: Law 11101/05

Regarding the event date, two options are taken into account. First, the whole analysis is conducted for the case where the event date is considered to be the commencement date. The Difference-in-Difference approach, the most important and revealing part of the analysis, is then also repeated for the case where the event date is supposed to be one year prior to the reform commencement. The reason why I want to take this possibility into account is that in some countries the insolvency reform passed on a year prior to its commencement and it is sometimes the case that some aspects of the reform come into force right after the publication.

Table 1. Summary of the *Gesetz zur weiteren Erleichterung der Sanierung von Unternehmen* (ESUG).

Country	Year	Name	Passed on	In effect since	Overarching goal	Changes to old law	Impact on Stakeholder Rights
Germany[57]	2012	Gesetz zur I iteren Erleichterung der Sanierung von Unternehmen (ESUG)	07.12.2011	01.03.2012	- To improve the position of creditors in insolvency proceedings over the assets of German companies (granting more power and influence to the creditors) - Enhance the legal framework for Debt-in-possession proceedings	- Introduction of Protection Shield Period (three-month period granted to the debtor to work on the insolvency plan) - Introduction of preliminary creditors' committee with wide powers (creditors have now a greater influence on the selection of the insolvency administrator) - Allowance of debt-equity swaps (claims by creditors may also be converted to share or membership rights in the corporate debtor) - Easier access to Debt-In-Possession Proceedings (the debtor remains in charge of the company's decisions)	Creditor-friendly

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[57] See Höher (2012), pp. 18f.

Table 2. Summary of Law 38/2011.

Country	Year	Name	Passed on	In effect since	Overarching goal	Changes to old law	Impact on Stakeholder Rights
Spain[58]	2011	Law 38/2011 or "The Amendment"	10.10.2011	01.01.2012	- To improve the pre-insolvency period by receiving judicial approval of a refinancing agreement - To anticipate the outcome and thus speed-up insolvency proceedings - To reinforce the role and responsibility of insolvency trustees - To facilitate the out-of-court restructuring for companies undergoing financial difficulties	- The debtor no longer needs to be in a state of actual insolvency to be able to file the notice with the court (allows debtors to anticipate the whole process) - One unique insolvency administrator (before that: three insolvency trustees: lawyer, auditor/economist and unsecured creditors) - Liquidation by the administrator in case of business inactivity - Legal persons can become insolvency administrators - Sets different requirements for refinancing agreements	Not defined

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[58] Banco de España (2016), pp. 13-15.

Table 3. Summary of Law 16/2012.

Country	Year	Name	Passed on	In effect since	Overarching goal	Changes to old law	Impact on Stakeholder Rights
Portugal[59]	2012	Law 16/2012	20.04.2012	20.05.2012	- To allow companies in financial distress to initiate recovery and debt relief negotiations with their creditors	- Amendment of the CIRE and establishment of the PER - Reduction of many procedures time limits (petition must be filed within 30 days, not 60 days) - Reinforcement of the rules regarding the liability of the persons affected by the court decision of insolvency - Better definition of insolvency administrator's role and responsibilities	Creditor-friendly

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[59] Campos Ferreira Sá Carneiro & Associados (2012), pp. 1, 5f.

Table 4. Summary of Law 11101/05.

Country	Year	Name	Passed on	In effect since	Overarching goal	Changes to old law	Impact on Stakeholder Rights
Brazil[60]	2005	Law 11101/05 or Nova Lei de Falências e Recuperação de Empresas	09.02.2005	09.06.2005	- To increase the effectiveness and efficiency of judicial reorganization and liquidation proceedings in Brazil - To enable companies to negotiate restructuring plans directly with creditors, allowing them to participate more actively	- Creation of two new legal proceedings: Judicial Reorganisation and Extrajudicial Reorganisation - Creditors now play a more important role in reorganization - Debtors are given a 180-day stay - Secured credit is given priority over tax credit - Credits extended during the reorganisation are given first priority in liquidation	Creditor-friendly

[60] See Funchal et al. (2008), p. 250.

4   Empirical research

In this section, an empirical research on the most important reforms commenced in each country will be done. The goal of this part is to conduct an analysis of financial data around the reform date and see if there is statistically significant difference in leverage before and after said reform to be able to affirm that there has been a change in the investors' lending behavior.

4.1. Data collection

The financial data collected for the mentioned analysis comes from Thomson Reuters Datastream database, and it is entirely manipulated by means of the statistical program Stata/IC 13.1. It is data belonging to the most important companies in each country. In the case of Germany, for instance, the companies are the ones listed in DAX, MDAX, SDAX and TecDAX stock indices, or in the case of Spain, the ones listed in the IBEX35 stock index, including medium and small capitalization firms.

The parameter that I am most interested about is leverage, measured as the debt to total assets ratio. The change of a company's leverage reflects the change of the investor's lending behavior, in the sense of these being more or less willing to lend companies money. The relation between leverage and creditor rights, which are supposed to be fostered by impactful creditor-friendly insolvency reforms, have two different interpretations. For instance, if an insolvency reform is believed to be creditor-friendly, we would expect that once the reform has commenced, creditors tend to lend more money, since they would feel better protected. Because of stronger creditors' rights, the likelihood of payback would increase, which in turn would mean that creditors would face less risk and lower returns. As La Porta et al. state[61], "to the extent that better legal protections enable the financiers to offer entrepreneurs money at better terms, we predict that the countries with better legal protections should have more external finance". However, there is another position regarding the link between creditor rights and company leverage. It might be the case that, because of creditors have stronger rights, the company's management feels reticent about increasing corporate leverage so they do not lose control in case of financial distress. This view is supported by Rajan and Zingales[62], who report that "[strong creditor protection]

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[61] La Porta et al. (1997), p. 1132. cited in El Gohul et al. (2011), p. 3.
[62] Rajan/Zingales (1995), p.1444. cited in El Gohul et al. (2011), p. 3.

commits creditor to penalizing management (and equity holders) if the firm gets into financial distress, thus giving management strong incentives to stay clear of it." The study of El Gohul et al.[63] reports how creditor rights link to corporate leverage, although it does not take into account bankruptcy reforms in the sample period and thus suppose a stable creditor rights index over time. Djankov et al.[64], on the contrary, consider bankruptcy reforms in their research, but they study how said reforms affect the size of private credit markets of countries and not corporate leverage.

The data for the analysis will not only be composed by only companies and leverage values, but also by the correspondent other variables that might explain the leverage behavior, as it is mentioned later in Section 4.2.3. Leverage is the dependent variable (DV), while the explanatory variables are the independent variables (IV). Our data is a combination of cross-sectional data and time series data, in the sense of being made up of numerous companies across time. Said data can have two different structures: panel data set or independently pooled cross section. In our case I rely on panel data sets, since data is collected for the same individuals across time. In contrast, independently pooled cross section shows data gathered randomly from a large population instead.[65] It is obvious that the size of the panel data set is going to differ across countries, since not all of them will have the same number of public companies.

Once the panel data set is properly constructed, I need to exclude financial institutions from our analysis, because, as stated by Fama and French[66], "the high leverage that is normal for these firms probably does not have the same meaning as for nonfinancial firms, where high leverage more likely indicates distress". To account for this, I only consider firms whose SIC Code lie outside the range 6000-6999. In addition, I limit the extreme values of all variables to the 1 and 99 percentile to prevent outliers from misleading our study. This process, known as winsorization, does not have to be confused with trimming, since the latter is simply cutting off data, which would imply a loss of information.[67]

4.2. Data overview

The first three steps of the analysis are meant to give a general impression of our data and expound how leverage relates to its explanatory variables. For

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[63] See Djankov et al. (2007), pp. 318-323 cited in El Gohul et al. (2011), p. 2.
[64] See El Gohul et al. (2011), pp. 19f.
[65] See Wooldridge (2013), pp. 432f.
[66] Fama/French (1992), p. 429.
[67] See Myles (2015)

this purpose, descriptive statistics, hypothesis tests, and regression models are used.

4.2.1. Descriptive statistics

The first step of the data analysis is to compute the descriptive statistics of the winsorized leverage. This is clearly supposed to provide only a first idea of the data I have and its principal characteristics in a summarized form. However, descriptive statistics may not be used to draw conclusions about the population that the data sample represents.[68] Therefore, I cannot to tell if there is a significant difference in leverage between the period before and after the reform date by just looking at the descriptive statistics. To be able to reach conclusions that extend the immediate data alone one needs to rely on inferential statistics.

4.2.2. Two-sample t test with unequal variance

The second step of the data analysis is thus conducting a two-sample t test with unequal variances to check whether leverage is statistically different or not between both pre-reform and post-reform periods. Actually, comparing the means of two groups is one of the simplest applications of inference statistics.[69] The corresponding null and alternative hypothesis of the test are shown below:

$$H_0 : \mu_1 = \mu_2$$
$$H_a : \mu_1 \neq \mu_2$$

$$(1)$$

where μ_1 and μ_2 are the population leverage means of the period before and after the reform, respectively.

Since our interest lies in the immediate surroundings of the reform date, I cannot consider a huge year range in our analysis. Taking into account years quite distant from the event would provide misleading results, because the means would be easily altered by observations far away from the reform year. Nonetheless, the two-sample t test cannot declare firmly that there has been an actual change of tendency regarding leverage after the reform, which in fact is the main purpose of our analysis. As mentioned previously, the t test can only tell a difference in means instead, and thus further analysis will be necessary.

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[68] See Laerd Statistics (2013)
[69] See Minitab 17 Support (2016)

4.2.3. *Multiple linear regression model*

The third step is multiple linear regression analysis. Although regression analysis provides an idea of the relationship among variables of our data, it does not yet give us a direct answer to our question of leverage change at first glance. However, it is worth introducing this concept here, since it is later used for the Chow test in Section 4.3.1. The reason why I use a multiple linear regression model (or multiple regression model) instead of a single linear regression model between leverage and time is that other explanatory variables of leverage that might have an effect on it can be taken out of the error term and be put explicitly in the equation.[70] According to Rajan and Zingales[71], these independent variables are the company sales, the market to book value, the return on assets and the tangibility of assets (ratio of fixed to total assets). Sales act as a proxy for firm size, market to book value for growth opportunities and return on assets is used as a proxy for business profitability. It is also important not to forget any of the mentioned relevant variables, because otherwise I would be wrongly giving inappropriate explanatory power to the rest of the variables (omitted variable bias). This bias appears in the estimators of the variables' parameters of the regression model, meaning that they would differ from their correspondent population value even if the omitted variable is not correlated with all variables in the model.[72] The mentioned multiple regression model can be estimated using different methods, and it depends on the assumptions regarding our data which one to choose. The one used in this paper, the Ordinary Least Squares (OLS) estimation method, calculates the estimates to minimize the sum of squared residuals. [73]

Previous to a further analysis of our data, it is important to have a quick look at it, see how it behaves and what are some important commands in Stata that need to be taken into account in this preliminary stage if I want the regression results to be reliable. Regression models are fit to panel data using the OLS estimation method to calculate the several coefficients using the `xtreg` command in Stata.[74] In order for the OLS estimation method to not only provide unbiased estimators, but also with the smallest variance, the Gauss-Markov Theorem needs to apply. Only then our OLS estimators will be Best Linear Unbiased Estimators (BLUEs).[75]

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[70] See Wooldridge (2013), p. 65.
[71] See Rajan/Zingales (1995) pp. 1451f.
[72] See Wooldridge (2013), pp. 84-88.
[73] Ibid., pp. 28f.
[74] See StataCorp. (2013), pp. 359-364.
[75] See Wooldridge (2013), p. 98.

4.2.4. Individual and Time fixed-effects

Because of the nature of our data, each company has its own internal characteristics (unobserved individual fixed-effects/unobserved company-level heterogeneity), which may or may not influence the independent variables and be determinant of leverage. So when I use the fixed-effects (FE) estimator, a method for eliminating the unobserved fixed effect along with any time-constant explanatory variable, I control for omitted variables that vary across companies but are constant over time (ex.: some companies might belong to a different industry, and different industries might have different leverage policies). In other words, I control for the impact or bias that the characteristics of the panel variable, in our case the company, have on the dependent or independent variables.[76] The FE model ultimately removes the effect of those time-invariant characteristics so the real effect of the predictors on the outcome variable can be properly assessed. To employ this fixed-effects linear model, Stata uses the `xtreg, fe`[77] command. Another way to do so is by manually including "i.company" in our regression, as we will see with the time-fixed effects.[78] The OLS method is applied to estimate this regression model, although it can estimate many more regression models.

In addition, apart from company-related characteristics, characteristics present in the years of study (unobserved year-level heterogeneity) might also exist. To control in Stata for those omitted variables that are constant across companies but vary over time (ex.: in some years, increasing/decreasing leverage was more popular for some reason and firms tended to do that), I must include time dummies in each regression by typing "i.year". The reason why I must use this way to proceed is that Stata does not have a command to fit two-way FE models.[79] With time fixed-effects, however, no time trend is perceived. Including time dummies for each year allows the model to attribute some of the variation in the data to unobserved events that took place each year or otherwise characteristics of that year. In other words, if I omitted the year dummies, an increase or decrease in leverage would only be attributed to the other explanatory variables.

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[76] See Torres-Reyna (2007), p. 9.
[77] See StataCorp. (2013), pp. 359-364.
[78] See Torres-Reyna (2007), p. 18.
[79] See Baum (2006), p. 224.

4.2.5. Heteroscedasticity

Because I are using the OLS method to come up with the variables' coefficients of the regression, it is important to check first for heteroscedasticity in our data. After running the command which tests for it, called `xttest3`[80], I conclude that, indeed, heteroscedasticity exists and thus the variance of our error term is not constant over the whole range of the independent variables, at least for one of them. The problem with heteroscedasticity is that OLS does not provide the estimators with the smallest variance, becoming the regression not as much efficient as it could be.[81] The coefficients, also known as estimators, remain unbiased, although their variances do not. This, in turn, implies unreliable hypothesis tests. To correct for heteroscedasticity I use the `vce(cluster id)` option in Stata.[82] I cluster our data in cross-sectional units (company groups) because observations are related to each other within them, but not necessarily between them. By using the cluster option at the end of the `xtreg` command, I obtain standard errors and test statistics (including t statistics and F statistics) so that they are valid even with heteroscedasticity.[83] We must bear in mind once again that heteroscedasticity does not cause bias or inconsistency in the coefficients, but invalidates the test statistics.

Sales, which are a proxy for the company's size, show a particular behavior in relation with leverage. In fact, most part of the observations lie in a very short range of sales. To smoothen this very abrupt display of observations and spread them more homogenously, I use the well-known logarithm operator. Consequently, the level of heteroscedasticity present in our data is reduced. The same treatment can also be applied to tangibility to decrease heteroscedasticity.

In case we would like to see if leverage has a shrinking or increasing trend across year and include company fixed-effects, the following regression would be appropriate:

$$y_{it} = \beta_0 + \alpha_i + \beta_1 Year_t + \beta_2 Market\ to\ book\ value_{it} \qquad (2)$$
$$+ \beta_3 Return\ on\ assets_{it} + \beta_4 \log(Sales)_{it}$$
$$+ \beta_5 \log(Tangibility)_{it} + \varepsilon_{it}$$

If, on the contrary, we are more interested in a general regression of leverage with company and time fixed-effects, it would look like this:

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[80] See Torres-Reyna (2007), p. 35.
[81] See Wooldridge (2013), pp. 258f.
[82] See StataCorp. (2013), pp. 359-364.
[83] See Wooldridge (2013), p. 688.

$$y_{it} = \beta_0 + \alpha_i + \alpha_t + \beta_1 Market\ to\ book\ value_{it} + \beta_2 Return\ on\ assets_{it} \qquad (3)$$
$$+ \beta_3 \log(Sales)_{it} + \beta_4 \log(Tangibility)_{it} + \gamma d_t + \varepsilon_{it}$$

where α_i and α_t represent the company fixed-effects and the time fixed-effects, respectively. Subindex "i" represents the firm and subindex "t" represents the year.[84] The leverage of firm is denoted by y and d represents a dummy variable, also known as a binary variable with a value of zero for a group and a value of one for the other. In our case, zero corresponds to the pre-reform period, and one corresponds to the post-reform period, event date included. The random, unobserved error term, which contains all omitted variables affecting y, is represented by ε.

4.3. Leverage change

The following fourth and fifth steps have the purpose of finally helping us determine if leverage changed its trend after the insolvency reform had commenced, and thus so did the creditors' lending behaviour. Two different approaches are taken to give an answer to this question: the Chow test and the Difference-in-Difference estimation. Although they both ultimately rely on regressions, the idea that lies behind is somehow different.

4.3.1. Chow test for structural change across time

The fourth step is to conduct the Chow test. Such test is highly used when working with time-series data in order to observe if an event on a certain date has modified significantly the behavior of said data, and therefore, there has been what is called a structural change.[85] In our specific case, this test will What the Chow test does, more specifically, is to check if two different regressions, one before and one after the event date, are equal by looking at the coefficients of their independent variables. To implement that with Stata, I construct two regressions in one by including a dummy variable and interacting all independent variables with our time dummy variable.[86] The reason why I also include interaction terms in the regression is that I are not only interested in an intercept shift, but also want to allow for a difference in slopes, which will tell us if the impact of the other variables

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[84] From this point on I omit to mention the subindexes „i" and „t" when referring to variables in the text to ease notation.
[85] See Baum (2006), p. 183.
[86] See Wooldridge (2013), p. 437.

in leverage differ between before and after the reform. Only then I will be able to test the equality of regression parameters across time periods and see if there is a statistically significant difference in leverage, or in other words, an actual structural break. The second part of the Chow test is to test for joint significance of the year dummy and all of the interaction terms, whose null hypothesis is that leverage follows the same model for both groups, or in other words, for the period before and after the reform date. This null hypothesis can be written as follows:

$$H_0: \gamma = 0, \delta_i = 0 \tag{4}$$

where γ corresponds to the coefficient of the dummy variable and δ_i to the coefficient for each interaction term.[87] If one of those coefficients is different from zero, then the model is different for before and after the reform. To let the intercept term of the regression change, however, I only test the interaction terms jointly. It is important to know that in we cannot rely on the individual t statistics for testing a joint hypothesis such as the one mentioned. The regression used for the Chow test would look like this:

$$
\begin{aligned}
y_{it} = \beta_0 &+ \alpha_i + \alpha_t + \beta_1 Market\ to\ book\ value_{it} + \beta_2 Return\ on\ assets_{it} \tag{5}\\
&+ \beta_3 \log(Sales)_{it} + \beta_4 \log(Tangibility)_{it} + \gamma d_t \\
&+ \delta_1 Market\ to\ book\ value\_d_{it} + \delta_2 Return\ on\ assets\_d_{it} \\
&+ \delta_3 \log(Sales)\_d_{it} + \delta_4 \log(Tangibility)\_d_{it} + \varepsilon_{it}
\end{aligned}
$$

where variables $Market\ to\ book\ value\_d$, $Return\ on\ assets\_d$, $\log(Sales)\_d$ and $\log(Tangibility)\_d$ represent the already mentioned interaction terms.

When dealing with the Chow test, I encounter an issue that was not present before: multicollinearity. Multicollinearity, understood as the fact of independent variables being not only correlated to the dependent variable but also to each other, might be a problem with regression analysis. It increases standard errors of coefficients, which can lead to conclude that the respective variables are statistically insignificant when they should not be.[88] The reason multicollinearity appears now and in an excessive amount is because of the presence of the interaction terms needed in the Chow test. In our particular case, $\log(Sales)$ and $log(Sales)\_d$ seem to be highly correlated to each other as their variation inflation

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[87] See Wooldridge (2013), p. 236.
[88] See The Minitab Blog (2013)

factor (VIF) shows. Therefore, multicollinearity is a problem that needs to be solved. One way to decrease it is by standardizing the predictor $\log(Sales)$.[89]

4.3.1.1. Traditional Chow test

There is another way to prove if there is a structural break in our data other than doing the Chow test with time dummies and interaction terms: computing the F statistic of the traditional Chow test. This method to implement the Chow test, which would be referred to as traditional Chow test, is normally used in cases where there is a lot of explanatory variables, what would represent a lot of interactions to test for group differences. The F statistic For the Chow test, also called Chow statistic, is as follows:[90]

$$F = \frac{[SSR_p - (SSR_1 + SSR_2)]}{SSR_1 + SSR_2} \cdot \frac{[N - 2(k+1)]}{k+1} \tag{6}$$

As we can see, the F statistic is based only in the sum-of-squared residuals of the pooled regression (SSR_p), the regression for group 1 (SSR_1) and the regression for group 2 (SSR_2). N refers to the number of observations and k to the number of interaction terms.

One limitation of the F statistic for the traditional Chow test is that the H_0 does not allow for differences at all between groups, meaning that either both groups are exactly equal or not. There is no allowance for only intercept difference, for example.[91] The other limitation regarding the traditional Chow test is that, as we already know, the presence of heteroscedasticity makes the F statistic based on the sum-of-squared residuals not valid. Therefore, the previous equation is not valid in our case and a heteroscedasticity-robust F statistic needs to be computed. Unfortunately, computing said statistic manually is much more time-consuming, since we cannot rely on the sum-of-squared residuals anymore and instead we must use the robust variance-covariance matrix.[92] However, a heteroscedasticity-robust F statistic can be easily computed in Stata by simply using the option `vce(cluster id)` at the end of the `xtreg` command, as mentioned in Section 4.2.5.

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[89] See The Minitab Blog (2016)
[90] See Wooldridge (2013), pp. 235-237.
[91] Ibid., p. 237.
[92] Ibid., p. 263.

4.3.2. Difference-in-Difference estimator

The fifth and last step of the analysis is the Difference-in-Difference (DiD) estimator. The DiD estimator is a Double Difference estimator is the combination of two other estimators: Single Pre versus Post Estimator and Simple Treatment versus Control Estimator. The former measures the leverage difference between the pre-reform and the post-reform period in the treatment group[93], while the latter measures the outcome difference between the treatment and the control group in the post-reform period. The DiD estimation circumvents problems like endogeneity problems[94] (correlation between the explanatory variables and the error term) and thus appears to be stronger than the Chow test that I carried out previously in terms of reliability, since the F statistic of the Chow test only compares two regressions belonging to two different time periods.

The regression used for Difference-in-Difference estimation is shown below:

$$y_{it} = \beta_0 + \alpha_i + \alpha_t + \gamma X_{it} + \beta_2 d + \beta_3 T + \beta_4 Td + \varepsilon_{it} \tag{7}$$

where X_{it} is referred to the control variables mentioned above plus the GDP of the country to account for business cycles and γ denotes a vector of coefficients for each of the variables in X_{it}. The variable d is the post-reform indicator equal to one in the post-reform period, while T is the country indicator equal to one for the treatment group. The variable Td is the product of the two precedent variables in the regression, and consequently, it is also a dummy variable. The Difference-in-difference estimator is represented by β_4 and compares the difference in leverage in the treatment group before and after the reform, denoted by $\beta_2+\beta_4$, to the difference in leverage in the control group before and after the reform, denoted by β_2. The difference of those two differences can be written is as follows[95]:

$$\widehat{\beta_4} = \left(\bar{y}_{d=1,T=1} - \bar{y}_{d=0,T=1} \right) - \left(\bar{y}_{d=1,T=0} - \bar{y}_{d=0,T=0} \right)$$
$$E[\widehat{\beta_4}] = \left(E[\bar{y}_{d=1,T=1}] - E[\bar{y}_{d=0,T=1}] \right) - \left(E[\bar{y}_{d=1,T=0}] - E[\bar{y}_{d=0,T=0}] \right) \tag{8}$$
$$E[\widehat{\beta_4}] = (\beta_2 + \beta_4) - (\beta_2) = \beta_4$$

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[93] To be in accordance with the referenced literature, I use the terminology of "treatment and control group" from now on when referring to the country that enacted the law and the country that did not, respectively.
[94] See Roberts/Whited (2012), pp. 6, 34-36; Albouy (2004), pp. 2f.
[95] See Roberts/Whited (2012), p. 39.

The following table helps understand what the rest of the coefficients found in the Difference-in-Difference regression actually measure[96]:

Table 5. Slope coefficients of the Difference-in-Difference regression

	Pre-reform	Post-reform	Pre-post Difference
Treatment	$\beta_0+\gamma+\beta_3$	$\beta_0+\gamma+\beta_2+\beta_3+\beta_4$	$\beta_2+\beta_4$
Control	$\beta_0+\gamma$	$\beta_0+\gamma+\beta_2$	β_2
T-C Difference	$\beta_0+\gamma+\beta_3$	$\beta_0+\gamma+\beta_3+\beta_4$	β_4

As can be seen from the table, the Difference-in-Difference estimator can also be understood as the comparison of the difference in leverage between both groups before the reform and the difference in leverage between both groups after the reform. In the table above, the Single Pre versus Post Estimator is represented by $\beta_2+\beta_4$ and the Simple Treatment versus Control Estimator is denoted by $\beta_3+\beta_4$. It is important to notice that even though variable d appears in Eq. (5) and Eq. (8) and is created in the same way, the interpretation of its coefficient differs between both cases. Regarding Eq. (5), γ represents the change in the mean leverage when going from pre-treatment to the post-treatment period. However, in Eq. (8), β_2 captures the difference in leverage between both periods in the control group. The equivalent of γ in its interpretation would be the Single Pre versus Post Estimator, $\beta_2+\beta_4$, as mentioned at the beginning of this section.

To compute the DiD estimator, first I need to make sure that the assumption of Parallel Trend between the treatment group and the control group is fulfilled, in the sense of both having the same leverage trend in the pre-reform period. Such verification is usually done by means of graphical tools.[97] To increase the likelihood of the Parallel Trend beforehand, it is important that the treatment group and the control group have a shared law frame so they are as similar as possible in terms of insolvency policies. In the first case of Germany, the control group chosen is Austria because they are both German-civil-law countries. For that reason, they offer lower protection to both shareholders and investors than Common-law countries, although higher than French-civil-law countries (closer to the latter). Regarding Spain, the correspondent chosen control group is France, since they are French-civil-law countries. They have the weakest protection to both shareholders and investors. In the matter of Brazil, the control group is Portugal, another French-civil-law country. However, the Law of Portugal had some amendments coming from the German civil tradition at the beginning of the 20th century. Brazil is based in Portuguese law with also German influences.[98] The

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[96] Ibid.
[97] Ibid., pp. 41f.
[98] See Brüggemeier (2011), pp. 203f.

same pattern shows for choosing a control group for Portugal, which happens to be The Netherlands.[99]

4.3.2.1. Matching approach

However, our Difference-in-Difference analysis could be refined by previously matching our data, which would increase the comparability of both treatment and control group. The basic idea behind the matching approach is to make both treatment and control group as similar as possible so any differences between the two groups can only be assumed to be a result of the treatment[100].

There is a wide variety of matching approaches available depending on the measure of the similarity between two units, also called "distance". Some of these approaches are used to do exact matching -match treated and control units which have the same values of covariates-, while others are used to do approximate matching -match treated units with control units that are close to each other-. The distance used in approximate matching is generally either the Mahalanobis distance or the Propensity Score.[101] Both Mahalanobis Distance Matching (MDM) and Propensity Score Matching (PSM) are often implemented through one-to-one nearest-neighbor greedy matching, meaning that a treated unit is matched to the closest comparison individual or control unit according to the preselected measure. The matching approach can include replacement as well, which means that a control unit is used several times as a match, as opposed to without replacement, where a control unit can only be used once.[102]

In our particular analysis, I am interested in matching firms between the treatment and the control group that not only have a similar size, but also belong to the same industry. Our first part of the matching consists on one-to-one nearest neighbor matching where the Mahalanobis distance is the measure assessing the similarity between observations. As stated by Roberts and Whited[103], only variables that are not affected by the treatment should be included in the matching process. The variable sales, used as a proxy for firm size, meets this requirement. However, the Stata command `teffects nnmatch`[104] used in this case for the matching approach does not understand panel data. This means that it does not care about clusters and thus treats each observation as independent (e.g. firm A in year 2008 could be matched with firm X, but firm A in year 2009 could be matched with firm Y also). On the contrary, I intend to match one treatment firm

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[99] See La Porta et al. (1998), pp. 1130f.
[100] "Treatment" refers to the commencement of the insolvency reform.
[101] See Blackwell et al. (2010), p. 2.
[102] See Caliendo/Kopeinig (2005), p. 9.
[103] See Roberts/Whited (2012), p. 75.
[104] See StataCorp. (2015), pp. 266-269.

with the same control firm across all years of study. To achieve that, one way is to first change the dataset long format into wide format. Only then, each company would be one single observation. It is obvious, however, that each company cannot be matched on sales for each year, so matching firms on the average sales over time in the pre-treatment period is a good workaround.

Additionally, I am also interested in matching observations on industry as previously mentioned. However, Stata does not allow doing so with the data available. The reason behind is that in order to perform such matching approach, Stata needs minimum three matches on industry for each treated observation in the treatment group or control observation in the control group to estimate the robust standard errors.[105] For most of the countries, this is rarely the case, since companies tend to be spread across industries heterogeneously, thus making it very difficult to see all industries with three or more companies each. This issue leaves no other option than to discard matching on industry with the data available.

Replacement is included in the matching approach as well, since I consider that it increases substantially the quality of the matching. It does so by allowing treated and control units that are similar to other units to be used more than once. I could also perform caliper matching, which is a variant of one-to-one matching with the particularity of increasing the quality of matches by imposing a maximum allowed distance on the sales between a treat and control units. This distance, called caliper radius, has the same purpose that replacement, in the sense of avoiding ending up with poor-quality matches.[106] The problem with calipers is that it is generally not trivial what caliper to choose as reasonable and also it becomes even more complex in our case since the variable "sales" has a very large range of values. Although including a second exact matching on years in our matching approach would probably mean much more accurate results, it cannot be accomplished due to a lack of observations.

Once the above mentioned matching approach is implemented, the reduced matched sample needs to be constructed. First, I change the dataset wide format back to long format or panel dataset. In addition, I need to account for the fact that several control units are used as a match more than once, since the matching approach used the option replacement. Therefore, each of those units has to be duplicated in the dataset as many times as they have been used as a match, minus one. The command `expandcl` in Stata does exactly this. At the end, the number of treated and control units should be the same if the duplication has been done properly.

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[105] See StataCorp. (2015), pp. 268,276.
[106] See Caliendo/Kopeinig (2005), p. 10.

Before jumping into the Difference-in-Difference estimation, however, it is important first to examine the quality of the resulting matched sample. To do so, several numerical diagnostics, such as the standardized difference in means or the two sample t-test (see Section 4.2.2), are available.[107] Both of them compare covariate distribution, in our case only the variable sales, before and after matching. Additionally, graphical diagnostics, such as box plots, can be used.[108] These two mentioned quality diagnostics are also mentioned in the Stata documentation.[109] If the matching quality appears to be satisfying, then Difference-in-Difference regression can be implemented.

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[107] See Caliendo/Kopeinig (2005), pp. 15f.
[108] See Stuart (2010), p. 15.
[109] See StataCorp. (2015), pp. 169-173,184-189.

5 Results

Graphs and numeric results, such as descriptive statistics and test p-values, are shown in this section. A significance level of 0.05 is used for all statistical tests. The most important Stata commands used in each step of the analysis are all collected and presented in Appendix A. For the reason already mentioned in Section 4.1, the results displayed below exclude financial institutions. Since the same analysis is conducted for all four countries, all cases show the same pattern in terms of presented results. In order not to be too repetitive, a lengthy description of each result and additional comments are only provided for the first country when possible.

5.1. Germany

The most important descriptive statistics of leverage are presented in the following table thanks to the user-written code `univar` available in Stata. As mentioned in Section 4.1, the stock indices used in the case of Germany are DAX, MDAX, SDAX and TecDAX.

Table 6. Descriptive statistics. Germany.

Leverage	Total	Pre-reform	Post-reform
N	735	315	420
Mean	22.13	23.03	21.46
Stdt. Deviation	17.24	17.94	16.69
Min	0	0	0
P25	8.22	8.45	8.06
Median	20.49	21.89	19.60
P75	32.19	33.37	30.98
Max	70.32	70.32	70.32

Firms show a slight decrease in leverage after the reform (ΔM = -1.57 pp). As mentioned in Section 4.2.1, however, this result only corresponds to the sample data and is not sufficient to conclude a significant leverage change in the whole population between periods.

In the two-sample t test, no statistically significant difference in the population means of leverage between the pre-reform and post-reform period was found, $t(650.89) = 1.21$, $p = 0.2265$. However, and as previously said in Section 4.2.2, I cannot affirm that there is no change in leverage trend based on this result.

Referring to Section 4.2.3, different multiple linear regression models are estimated with the purpose of determining what predictors of leverage are

significant. In the first regression I want to see if there is an overall time trend of our leverage, or in other words, what is the overall direction our leverage is moving across time (the effect is not specific to any year), while controlling for the other explanatory variables. The rest of the nine regressions are classified in three different time frames around the reform date. For each time frame, I first include company fixed-effects, and later also time fixed-effects (See Section 4.2.4). The most interesting regressions are the last three, since they include company and time fixed-effects, and specially the first of those. Because said multiple regressions are not part of the main results strictly speaking, they are all found in tables in Appendix B, together with some remarks.

But again, regressions only serve the purpose of discovering what are the relations between the dependent and independent variables. After dealing with multicollinearity and running the joint test (See Section 4.3.1), no interaction term shows to be significant, $F(4,104) = 0.76$, $p = 0.5549$, indicating that the only difference between the two regressions is the intercept term. Because all interaction terms have been tested jointly, I can drop them out of the equation all at the same time. The new regression without the interaction terms shows d to be statistically significant, $F(1,104) = 6.49$, $p = 0.0123$, indicating that the leverage was significantly 2.568 pp lower before the reform than after the reform.

Before looking at the results from the Difference-in-Difference estimation, it is advisable to first check if the matching approach has been implemented properly, as mentioned in Section 4.3.2.1. After verifying that the number of firms in the treatment group is the same of those in the control group, I asses the quality of the matching by using numerical and graphical diagnostics. In the following table, the standardized difference in sales means between both treatment and control group before and after matching are shown:

Table 7. Standardized differences between treatment and control group. Germany.

	Standardized differences	
	Before matching	After matching
sales	-0.3557	-0.2651

According to Caliendo and Kopeinig[110], a standardized difference reduction below 5% is often seen as enough. Table 6 proves this requirement is met by far. The following box plot also help us diagnose the covariate balance, where Germany is the Treatment group and Austria is the Control group.
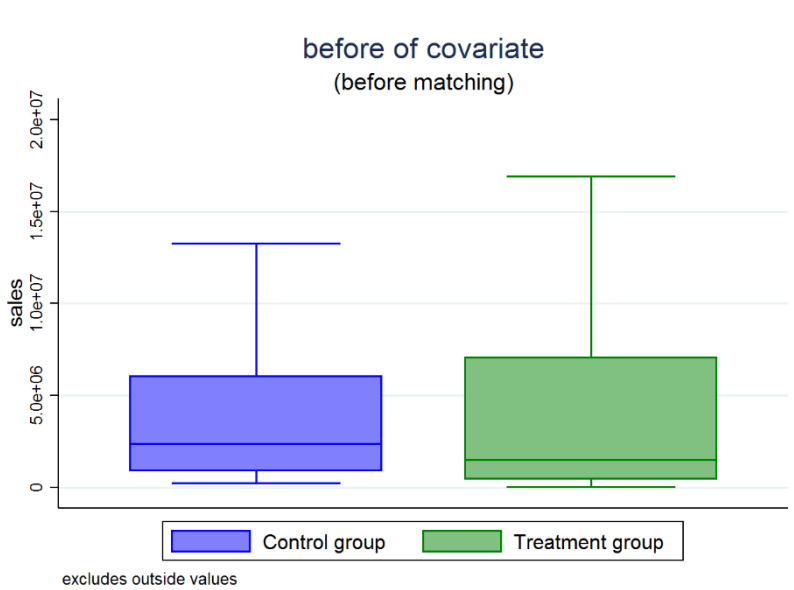
Figure 1. Box plot of sales for the treatment and control group before the matching. Germany.
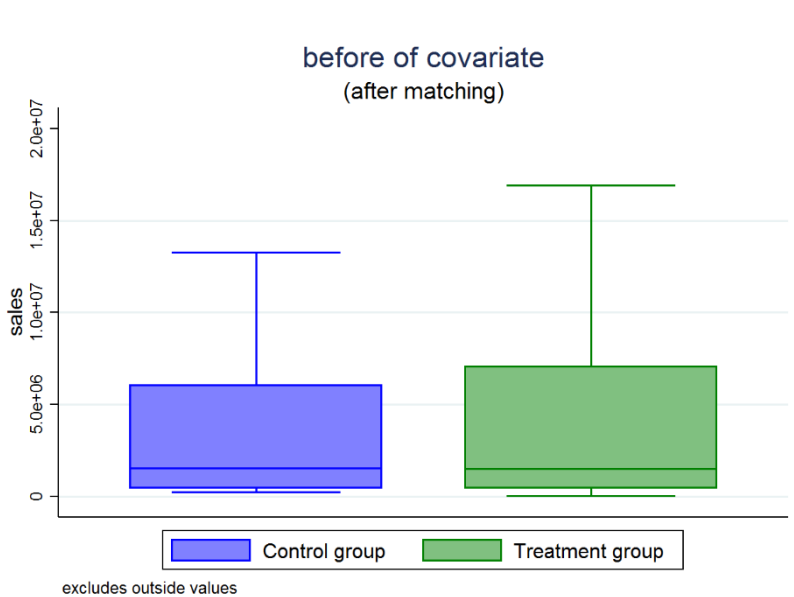
Figure 2. Box plot of sales for the treatment and control group after the matching. Germany.

The boxplots of the matched data also indicate a better covariate balance after matching, since the covariate distribution becomes more similar. Therefore, I conclude that the quality of the matching approach is good and the Difference-in-

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[110] See Caliendo/Kopeinig (2005), p. 15.

Difference estimation can be implemented. The following graphs illustrate the mean leverage for each year between groups before and after matching. The reform date is represented by Year=0.
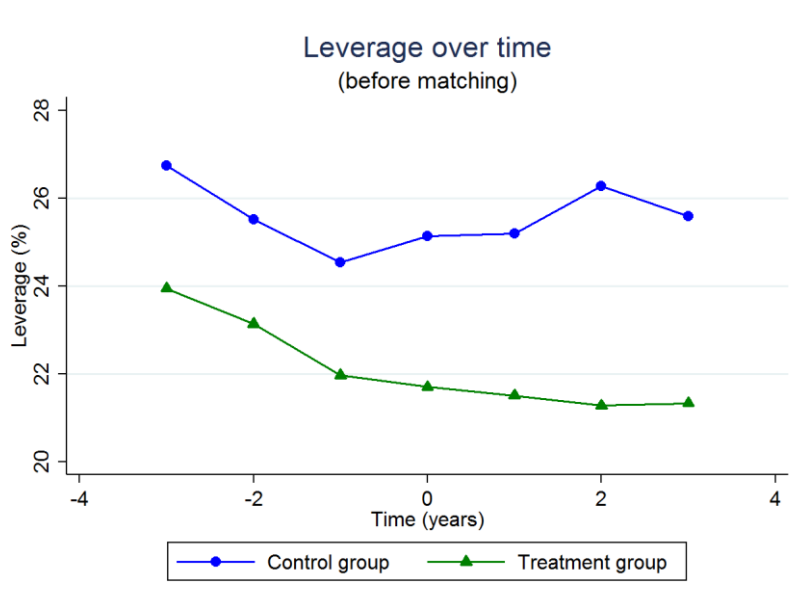
Figure 3. Leverage between 2009 and 2015 for the treatment and control group before matching. Germany.
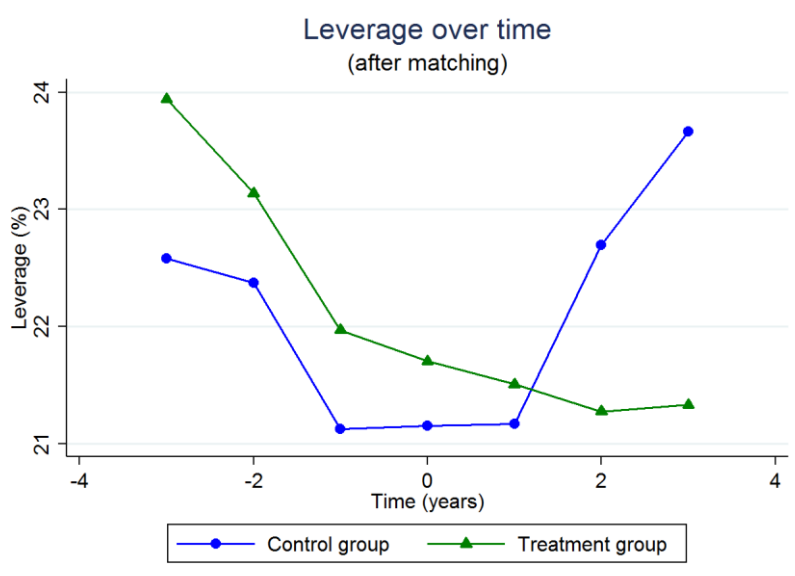
Figure 4. Leverage between 2009 and 2015 for the treatment and control group after matching. Germany.

As is shown by Fig. 3, the mean leverage for the treatment and control group is different; German firms are more leveraged than Austrian firms, on average. Both figures also illustrate the approximate fulfillment of the Parallel Trend assumption; both countries have decreasing time trend in leverage. In Appendix D, the complete tables of the Difference-in-Difference regressions can be found. The

following table shows only the p-values of two of the most interesting coefficients of the Difference-in-Difference regression before and after matching, as stated in Section 4.3.2:

Table 8. P-values of the most important coefficients in the DiD regression with 2012 as the event date. Germany.

Event date: 2012	P-value	
Difference-in-Difference	Before matching	After matching
β_2	0.808	0.418
β_4	0.267	0.921
$\beta_2+\beta_4$	0.249	0.196

As mentioned in Chapter 3, I now compute the Difference-in-Difference estimator in the case where the event date is a year prior to the reform commencement date:

Table 9. P-values of the most important coefficients in the DiD regression with 2011 as the event date. Germany.

Event date: 2011	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.230	0.254
β_4	0.825	0.930
$\beta_2+\beta_4$	0.082	0.131

Some remarks can be derived from Table 8:

- The Single Pre versus Post Estimator shows a p-value above the significance level for both situations, meaning that the treatment group does not experience a mean change in leverage between the pre and post-reform period.

- The Difference-in-Difference estimator has a quite high p-value in both cases, meaning that the reform does not have a significant effect, and thus there was no change after the reform in leverage experienced by firms in Germany relative to the change in leverage experienced by firms in Austria.

- It can be drawn from the above results that the matching approach is not really helping in the case of Germany. Actually, and as pointed out by Schechter in Stata FAQ[111], the impact of matching is not predictable, and sometimes can lead to decreasing the apparent magnitude of the treatment effect.

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[111] See Stata FAQ (2017)

5.2. Spain

The most important descriptive statistics of leverage are presented in the following table. The stock indices used in this case are: IBEX35, IBEX Medium Cap and IBEX Small Cap.

Table 10. Descriptive statistics. Spain.

Leverage	Total	Pre-reform	Post-reform
N	336	144	192
Mean	33.36	33.72	33.10
Stdt. Deviation	18.62	18.48	18.77
Min	0.01	0.49	0.01
P25	19.31	19.43	18.71
Median	31.77	31.79	31.77
P75	46.63	47.20	45.93
Max	84.84	72.18	84.84

Firms show a very slight decrease in leverage after the reform (ΔM = -0.62 pp).

In the two-sample t test, no statistically significant difference in the population means of leverage between the pre-reform and post-reform period was found, $t(313.62) = 0.30$, $p = 0.7613$.

After dealing with multicollinearity and running the joint test, no interaction term shows to be significant, $F(4,47) = 1.52$, $p = 0.2106$. Because all interaction terms have been tested jointly, I can drop them out of the equation all at the same time. The new regression without the interaction terms shows d to be statistically insignificant, $F(1,47) = 0.21$, $p = 0.6462$, indicating that there was no significant change in leverage before and after the reform.

In the following table, the standardized difference in sales means between both treatment and control group before and after matching are shown:

Table 11. Standardized differences between treatment and control group. Spain.

	Standardized differences	
	Before matching	After matching
sales	0.0662	-0.0065

The following box plot also help us diagnose the covariate balance, where Spain is the treatment group and France is the Control group:

Figure 5. Box plot of sales for the treatment and control group before the matching. Spain.

Figure 6. Box plot of sales for the treatment and control group after the matching. Spain.

The boxplots indicate a better covariate balance after matching as well. The following graphs show the mean leverage for each year between groups before and after matching.
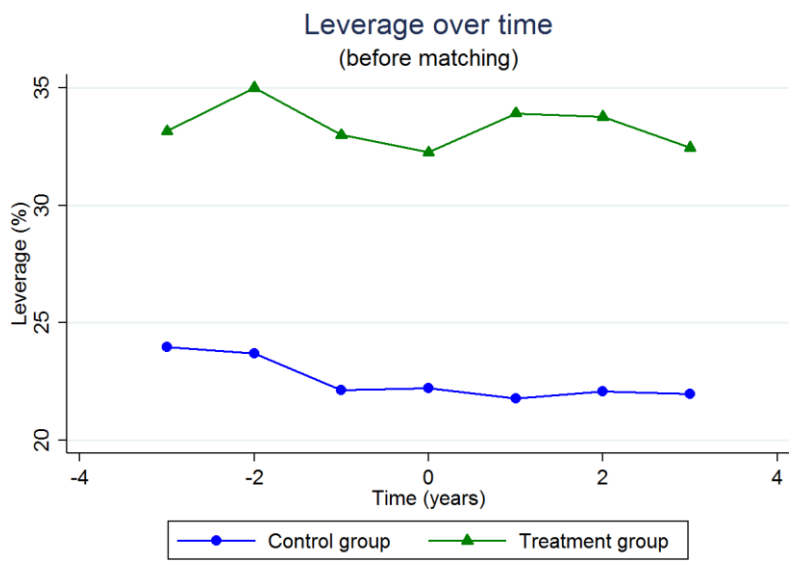
Figure 7. Leverage between 2008 and 2014 for the treatment and control group before matching. Spain.

Figure 8. Leverage between 2008 and 2014 for the treatment and control group after matching. Spain.

As is shown by Fig. 7, the treatment group has a mean leverage higher than the control group. Also the Parallel Trend assumption is approximately fulfilled in both cases.

Table 12. P-values of the most important coefficients in the DiD regression with 2011 as the event date. Spain.

Event date: 2011	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.109	0.327
β_4	0.781	0.812
$\beta_2+\beta_4$	0.110	0.459

Table 13. P-values of the most important coefficients in the DiD regression with 2010 as the event date. Spain.

Event date: 2010	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.629	0.489
β_4	0.536	0.266
$\beta_2+\beta_4$	0.727	0.468

Some remarks from Table 12:

- The Single Pre versus Post Estimator shows in this case a very high p-value. This means that there is no mean change in leverage from before to after the reform for Spain.

- The Difference-in-Difference estimator has a high p-value in both situations, meaning that the reform date does not have a significant effect, and thus, there was no change after the reform in leverage experienced by firms in Spain relative to the change in leverage experienced by firms in France.

- It seems that in the case of Spain the matching approach does not help increase the treatment effects generally speaking either.

5.3. Portugal

The most important descriptive statistics of leverage are presented in the following table. The stock index used in the case of Portugal is the PSI20.

Table 14. Descriptive statistics. Portugal.

Leverage	Total	Pre-reform	Post-reform
N	98	42	56
Mean	34.79	38.08	32.33
Stdt. Deviation	17.64	18.15	17
Min	0.04	4.54	0.04
P25	24.59	26.34	20.12
Median	30.96	35.66	29.81
P75	42.68	45.36	40.88
Max	75.78	75.78	71.04

Firms show a decrease in leverage after the reform (ΔM = -5.75 pp).

In the two-sample t test, no statistically significant difference in the population means of leverage between the pre-reform and post-reform period was found, $t(87.10) = 1.59$, $p = 0.1143$.

After dealing with multicollinearity and running the joint test, no interaction term shows to be significant, $F(4,13) = 4.24$, $p = 0.0205$, indicating that in this case the interaction terms are statistically significant.

In the following table, the standardized difference in sales means between both treatment and control group before and after matching are shown:

Table 15. Standardized differences between treatment and control group. Portugal.

	Standardized differences	
	Before matching	After matching
sales	0.2402	0.0034

The following box plot also help us diagnose the covariate balance, where Portugal is the treatment group and The Netherlands is the Control group:
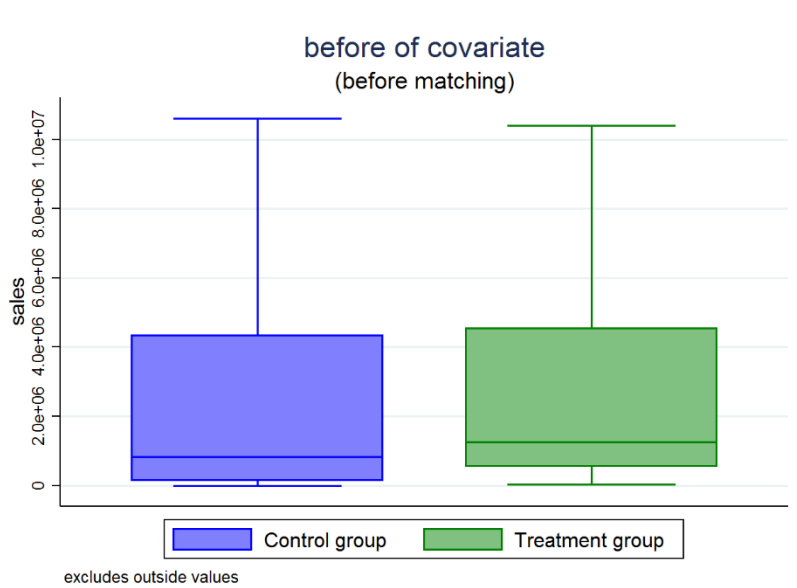

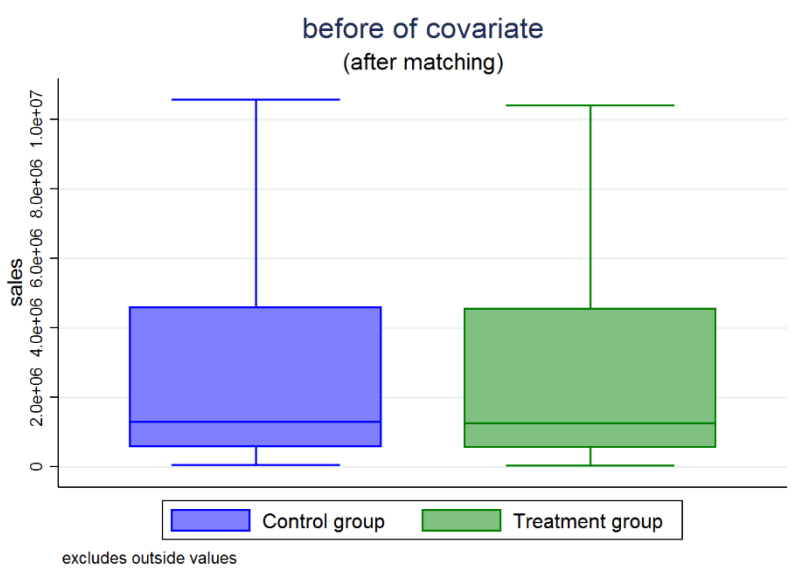**Figure 9**. Box plot of sales for the treatment and control group before the matching. Portugal.

Figure 10. Box plot of sales for the treatment and control group after the matching. Portugal.

The boxplots of the matched again indicate a better balance of the covariate. The following graphs show the mean leverage for both groups before and after matching:
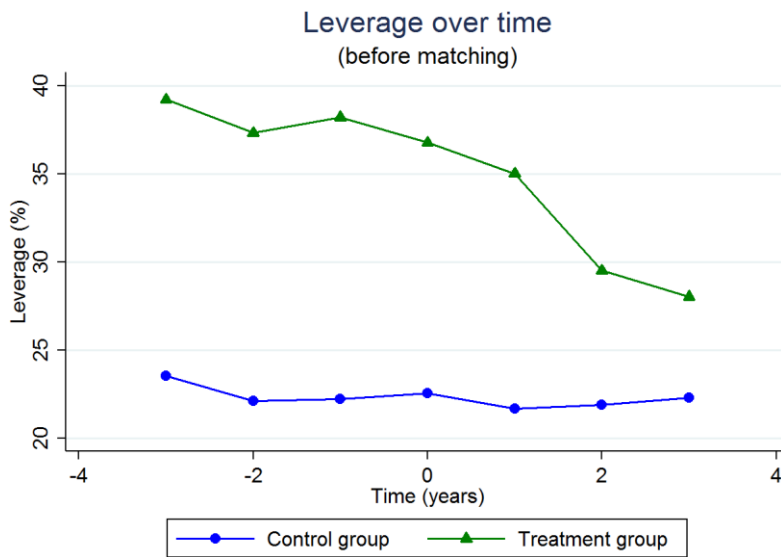
Figure 11. Leverage between 2009 and 2015 for the treatment and control group before matching. Portugal.
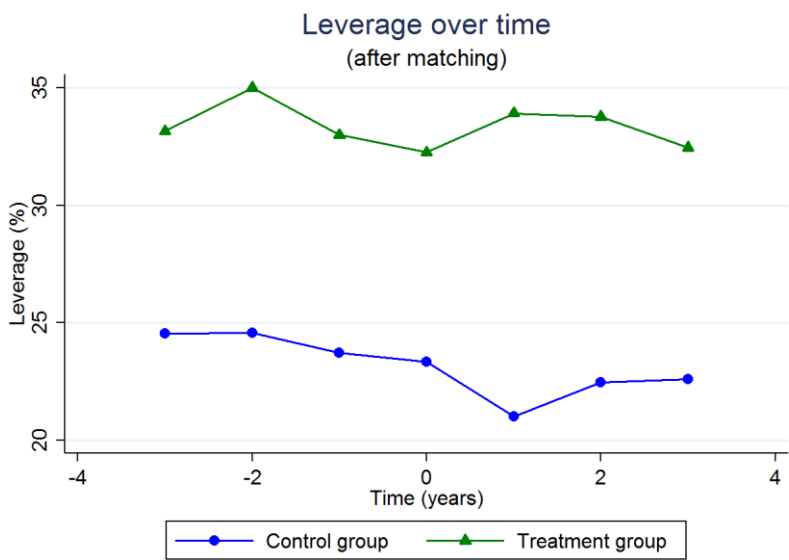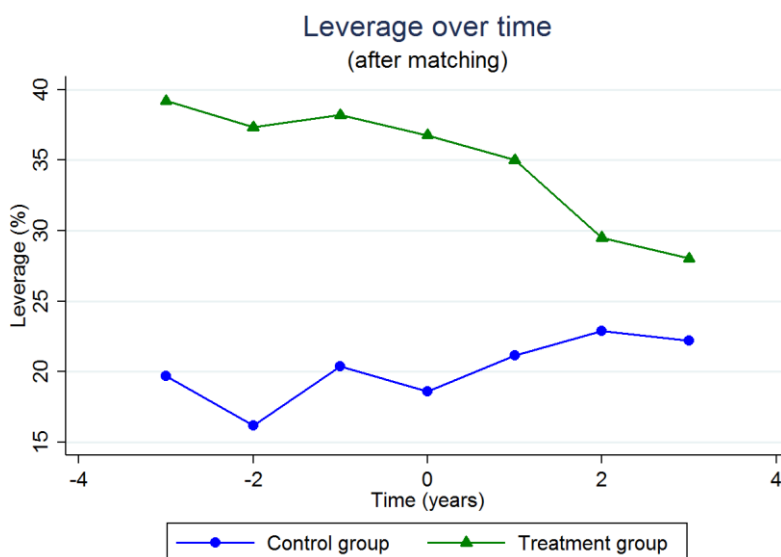

Figure 12. Leverage between 2009 and 2015 for the treatment and control group after matching. Portugal.

As is shown by Fig. 11, the treatment group has a mean leverage higher than the control group. Also the Parallel Trend assumption is approximately fulfilled in both situations.

Table 16. P-values of the most important coefficients in the DiD regression with 2012 as the event date. Portugal.

Event date: 2012	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.250	0.898
β_4	0.290	0.357
$\beta_2+\beta_4$	0.162	0.484

Table 17. P-values of the most important coefficients in the DiD regression with 2011 as the event date. Portugal.

Event date: 2011	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.0496	0.665
β_4	0.633	0.649
$\beta_2+\beta_4$	0.143	0.882

Some remarks from Table 16:

- The Single Pre versus Post Estimator shows a p-value a bit above the significance level before and after matching. This means that there is no mean change in leverage from before to after the reform for Portugal.

- The Difference-in-Difference estimator reflects a high p-value in both situations, meaning that the reform does not have a significant effect, and thus, there was no change after the reform in leverage experienced by firms in Portugal relative to the change in leverage experienced by firms in The Netherlands.

- As can be observed, until now the matching approach does not increase the treatment effect, but instead in this case the matching reduces it.

5.4. Brazil

The most important descriptive statistics of leverage are presented in the following table. The observations come from the most important Brazilian stock index known as BOVESPA.

Table 18. Descriptive statistics. Brazil.

Leverage	Total	Pre-reform	Post-reform
N	154	66	88
Mean	31.18	34.62	28.60
Stdt. Deviation	14.05	14.11	13.52
Min	2.50	3.03	2.50
P25	21.30	25.67	18.69
Median	30.95	34.25	26.81
P75	41.19	46.01	38.10
Max	64.41	64.41	62.01

Firms show a noticeable decrease in leverage after the reform (ΔM = -6.02 pp).

In the two-sample t test, there is a statistically significant difference in the population means of leverage between the pre-reform and post-reform period, $t(138.79) = 2.67$, $p = 0.0085$.

After dealing with multicollinearity and running the joint test, no interaction term shows to be significant, $F(4,21) = 0.90$, $p = 0.4832$. Because all interaction terms have been tested jointly, I can drop them out of the equation all at the same time. The new regression without the interaction terms shows d to be statistically insignificant, $F(1,21) = 19.41$, $p < 0.001$, indicating that the leverage was significantly 15.675 pp lower before the reform than after the reform.

In the following table, the standardized difference in sales means between both treatment and control group before and after matching are shown:

Table 19. Standardized differences between the treatment and control group. Brazil.

	Standardized differences	
	Before matching	After matching
sales	-0.9120	-0.6886

The following box plot also help us diagnose the covariate balance, where Brazil is the Treatment group and Portugal is the Control group:
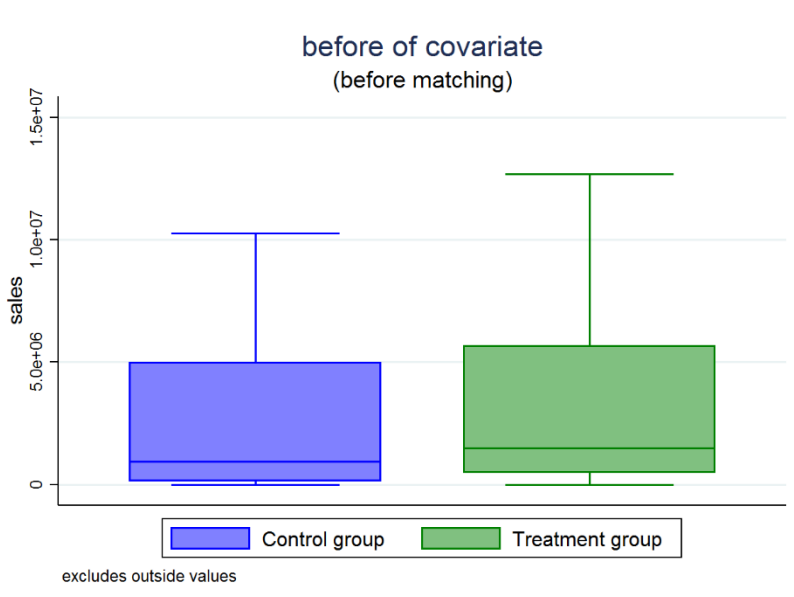
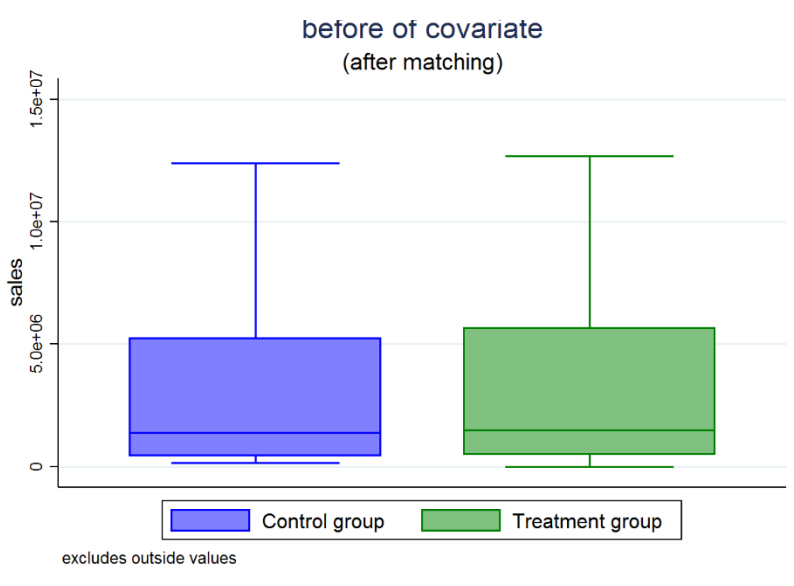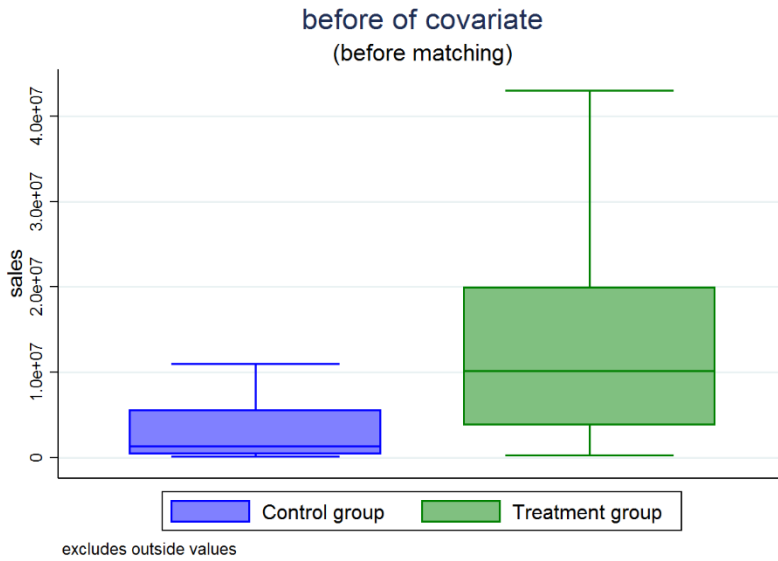**Figure 13**. Box plot of sales for the treatment and control group before the matching. Brazil.
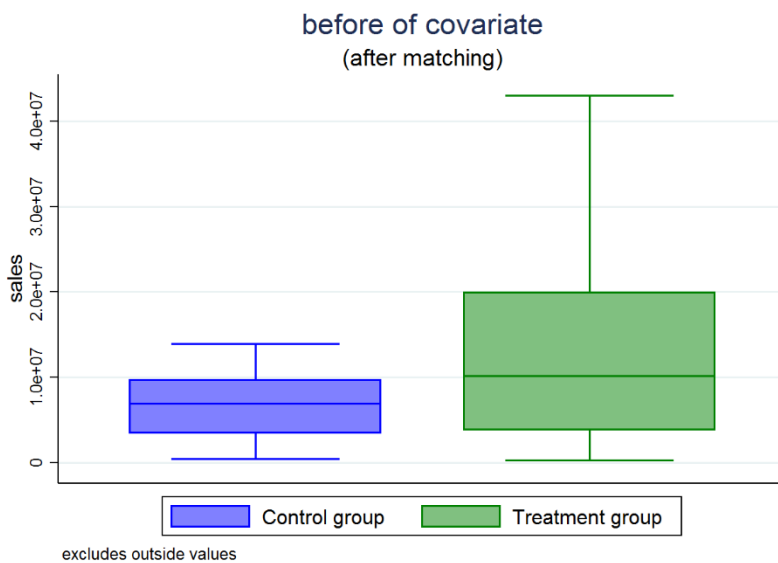
Figure 14. Box plot of sales for the treatment and control group after the matching. Brazil.

Both box plots show that after the matching the covariate sales has a more similar distribution regarding the treatment group. The following graphs show the mean leverage for each year for each group before and after matching:
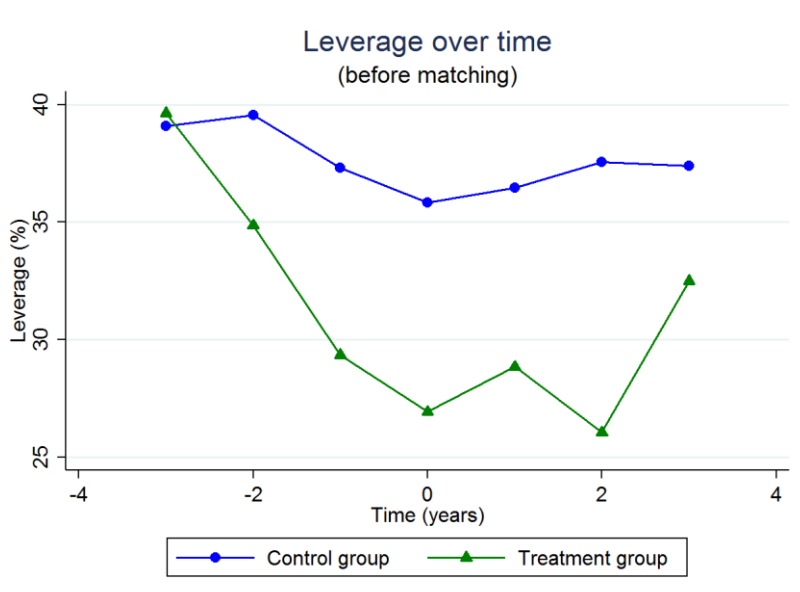
Figure 15. Leverage between 2002 and 2008 for the treatment and control group before matching. Brazil.
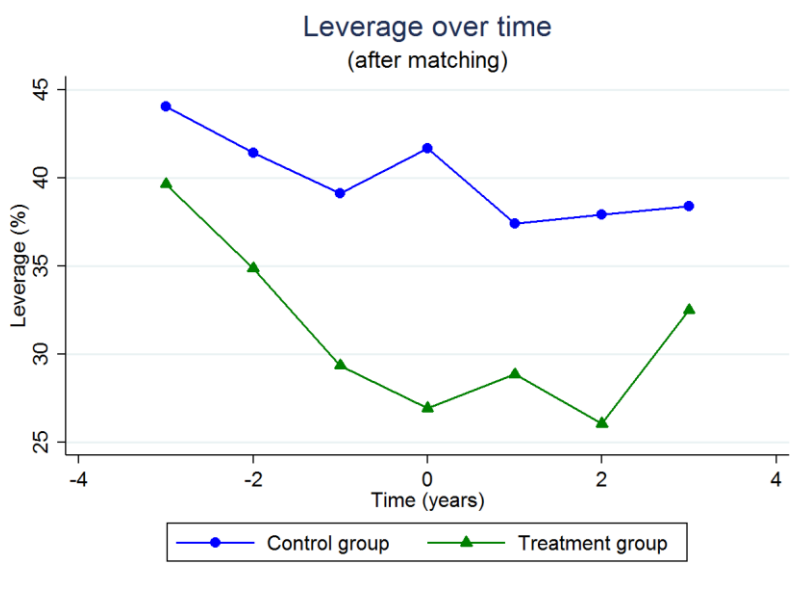
Figure 16. Leverage between 2002 and 2008 for the treatment and control group after matching. Brazil.

As is shown by Fig. 15, the treatment group has a mean leverage below that of the control group. Also the Parallel Trend assumption is better fulfilled after matching.

Table 20. P-values of the most important coefficients in the DiD regression with 2005 as the event date. Brazil.

Event date: 2005	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.001	0.027
β_4	0.160	0.027
$\beta_2+\beta_4$	0.001	<0.001

Table 21. P-values of the most important coefficients in the DiD regression with 2004 as the event date. Brazil.

Event date: 2004	P-value	
Difference-in-Difference	Before Matching	After Matching
β_2	0.446	0.915
β_4	0.189	0.025
$\beta_2+\beta_4$	0.291	0.045

Some remarks:

- The Single Pre versus Post Estimator decreases its p-value below the significance level after matching. This means that there is a mean change in leverage from before to after the reform for the treatment group.

- The Difference-in-Difference estimator becomes more significant after matching. Therefore, there was a change after the reform in leverage experienced by firms in Brazil relative to the change in leverage experienced by firms in Portugal.

- As mentioned before, the matching approach helps increase the treatment effect in the case of Brazil.

6 Conclusion

Results of the Difference-in-Difference estimator show that none of the studied countries, except for Brazil, had a significant leverage change in their companies after the reforms commenced. Not even by matching data beforehand I could see significant leverage changes in Germany, Spain or Portugal. Those countries also did not show a change in leverage if the event date was considered to be a year before the commencement. On the contrary, Brazil did show a change in the leverage behavior of its investors after the reform commencement. In this case, using the matching approach helped increase the treatment effect. Because the Brazilian insolvency law Law 11101/05 is thought to be a creditor-friendly reform, at least in some aspects, the leverage decrease supports the demand-view of the relation between creditor protection and leverage, which states that strong creditor rights lead to managers decreasing leverage and thus reducing the risk of bankruptcy. This found negative relation between creditor rights and leverage is in line with the findings of El Gohul et al.[112] The idea that strong creditor rights imply risk-avoiding behavior from the management side is also supported by Acharya, Ahimud and Litov[113], who report that strong creditor rights lead firms to opt for risk-reducing acquisitions.

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[112] See Gohul et al. (2011)
[113] See Acharya/Amihud/Litov (2008), p. 27. cited in El Gohul et al. (2011)

Appendix A. Stata commands

Descriptive statistics

```
univar lev_w if finan_inst==0
univar lev_w if finan_inst==0 & d==0
univar lev_w if finan_inst==0 & d==1
```

Two-sample t test with unequal variances

```
ttest lev_w if finan_inst==0, by(d) welch
```

Chow test for structural change across time – regression

```
xtreg lev_w i.year mb_w s_logsales roa_w logtang d mb_d logsales_d
roa_d logtang_d if finan_inst==0, fe vce(cluster companycode)
```

Chow test for structural change across time – joint test

```
test roa_d mb_d logsales_d logtang_d
```

Matching approach

```
teffects nnmatch (mymean_leverage mymean_sales) (treatment),
generate(match) osample(newvar) metric(euclidean)
```

Quality of matching – standardized differences in means

```
stddiff sales_w, by(treatment)
```

Quality of matching – box plot

```
graph box sales_w, over(treatment) asyvars box(1,color(blue))
box(2, color(green)) nooutside title("Balance of covariate")
subtitle("(after matching)") ylabel(,labsize(small))
legend(order(1 "Control group" 2 "Treatment
group"))graphregion(color(white))
```

Difference-in-Difference estimator – regression

```
xtreg lev_w i.year mb_w logsales roa_w logtang GDP d treatment
treatmentxd if finan_inst==0, fe vce (cluster companycode)
```

Difference-in-Difference estimator – graph

```
graph twoway (connected meanc_w`W' yearcode, sort lcolor(blue)
mcolor(blue) msymbol(circle)) (connected meant_w`W' yearcode, sort
lcolor(green) mcolor(green) msymbol(triangle)), title(Leverage over
time) subtitle((after matching)) legend(order(1 "Control group" 2
"Treatment group")) ytitle(Leverage (%)) xtitle(Time (years))
graphregion(color(white))
```

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Appendix B. Multiple linear regression models

Table 22. Determinants of leverage for Germany. This table presents ordinary least squares regressions, using a sample of 105 non-financial firms over the period 2009-2015. The dependent variable is leverage. Results are shown separately for different time windows, where [-2 +2], for example, indicates the two years prior and post the reform of 2012. Variable *d* is the post-reform indicator equal to one after 2012, 2012 included, and zero otherwise.

Independent variables	(1) [-3 +3]	(2) [-3 +3]	(3) [-2 +2]	(4) [-1 +1]	(5) [-3 +3]	(6) [-2 +2]	(7) [-1 +1]	(8) [-3 +3]	(9) [-2 +2]	(10) [-1 +1]
d		-1.938**	-1.504**	-0.415	-2.324***	-1.801**	-0.552	-2.568**	-2.472***	-0.521
		(0.759)	(0.698)	(0.674)	(0.722)	(0.691)	(0.653)	(1.008)	(0.735)	(0.612)
year2010								-0.0139		
								(0.766)		
year2011								-1.654*	-1.668**	
								(0.916)	(0.640)	
year2013								-0.419	-0.283	-0.107
								(0.525)	(0.560)	(0.521)
year2014								-0.693	-0.596	
								(0.659)	(0.663)	
year2015								-1.245		
								(0.923)		
Market to book value	0.624*	0.544*	0.436	-0.125	0.544	0.484	-0.130	0.560*	0.399	-0.102
	(0.335)	(0.310)	(0.473)	(0.563)	(0.332)	(0.509)	(0.636)	(0.336)	(0.532)	(0.673)
Log(Sales)	3.443*	1.088	0.846	0.612	2.609	2.520	2.164	3.632**	3.425	2.217
	(1.804)	(0.700)	(0.803)	(0.779)	(1.739)	(2.004)	(2.629)	(1.814)	(2.135)	(2.668)
Return on assets	-0.437***	-0.421***	-0.327***	-0.282***	-0.433***	-0.338***	-0.291**	-0.441***	-0.356***	-0.293**
	(0.0913)	(0.0982)	(0.0952)	(0.0821)	(0.0940)	(0.101)	(0.111)	(0.0918)	(0.0999)	(0.113)
Log(Tangibility)	4.568***	4.605***	4.840***	3.863***	4.697***	4.893***	3.560***	4.591***	4.821***	3.532***
	(1.293)	(1.116)	(1.165)	(0.922)	(1.259)	(1.388)	(1.219)	(1.304)	(1.395)	(1.251)
Year	-0.685***									
	(0.215)									
Constant	-17.47	17.74	21.10	22.75*	-3.697	-2.800	-0.0979	-17.91	-14.75	-0.950
	(25.52)	(10.98)	(12.97)	(12.79)	(24.31)	(28.59)	(37.59)	(25.45)	(30.26)	(38.29)
Company FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	735	735	525	315	735	525	315	735	525	315
R-squared	0.155				0.150	0.165	0.132	0.159	0.178	0.133
Number of companies	105	105	105	105	105	105	105	105	105	105

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 23. Determinants of leverage for Spain. This table presents ordinary least squares regressions, using a sample of 48 non-financial firms over the period 2008-2014. The dependent variable is leverage. Results are shown separately for different time windows, where [-2 +2], for example, indicates the two years prior and post the reform of 2011. Variable *d* is the post-reform indicator equal to one after 2011, 2011 included, and zero otherwise.

Independent variables	(1) [-3 +3]	(2) [-3 +3]	(3) [-2 +2]	(4) [-1 +1]	(5) [-3 +3]	(6) [-2 +2]	(7) [-1 +1]	(8) [-3 +3]	(9) [-2 +2]	(10) [-1 +1]
d		-0.381	-0.395	0.0489	-0.410	-0.442	-0.113	-0.616	-2.164*	-0.973
		(1.095)	(1.054)	(0.897)	(1.093)	(1.082)	(0.952)	(1.333)	(1.239)	(0.780)
year2009								1.335		
								(0.957)		
year2010								0.415	-1.258	
								(1.150)	(0.878)	
year2012								1.829	1.934	1.907
								(1.303)	(1.269)	(1.255)
year2013								1.114	1.319	
								(1.215)	(1.218)	
year2014								0.278		
								(1.558)		
Market to book value	0.325	0.310	0.347	0.278	0.318	0.384	0.349	0.342	0.406	0.425
	(0.228)	(0.214)	(0.262)	(0.400)	(0.229)	(0.285)	(0.453)	(0.232)	(0.280)	(0.451)
Log(Sales)	1.793	1.302	1.129	1.060	1.872	1.886	8.659	2.136	2.279	8.109
	(3.114)	(1.291)	(1.375)	(1.364)	(3.140)	(5.037)	(6.407)	(3.235)	(5.151)	(6.556)
Return on assets	-0.261***	-0.296***	-0.235**	-0.134	-0.263***	-0.170	-0.0260	-0.251***	-0.148	-0.0130
	(0.0855)	(0.0824)	(0.0999)	(0.0869)	(0.0859)	(0.108)	(0.0762)	(0.0862)	(0.102)	(0.0691)
Log(Tangibility)	4.206*	4.833**	4.537**	3.211	4.166*	3.214	-4.496	4.108*	2.878	-4.270
	(2.335)	(1.907)	(2.145)	(2.451)	(2.340)	(2.621)	(3.545)	(2.398)	(2.637)	(3.305)
Year	-0.0694									
	(0.293)									
Constant	14.45	22.80	24.69	22.84	13.52	11.58	-97.94	8.965	5.960	-90.04
	(44.29)	(18.45)	(19.75)	(20.30)	(44.55)	(71.53)	(91.93)	(46.06)	(73.06)	(93.83)
Company FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	336	336	240	144	336	240	144	336	240	144
R-squared	0.095				0.096	0.066	0.052	0.106	0.082	0.078
Number of companies	48	48	48	48	48	48	48	48	48	48

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 24. Determinants of leverage for Portugal. This table presents ordinary least squares regressions, using a sample of 14 non-financial firms over the period 2009-2015. The dependent variable is leverage. Results are shown separately for different time windows, where [-2 +2], for example, indicates the two years prior and post the reform of 2012. Variable *d* is the post-reform indicator equal to one after 2012, 2012 included, and zero otherwise.

Independent variables	(1) [-3 +3]	(2) [-3 +3]	(3) [-2 +2]	(4) [-1 +1]	(5) [-3 +3]	(6) [-2 +2]	(7) [-1 +1]	(8) [-3 +3]	(9) [-2 +2]	(10) [-1 +1]
d		-2.695*	-2.163	-2.433	-2.296	-1.914	-2.626	1.117	0.462	-1.605
		(1.611)	(1.433)	(1.820)	(1.650)	(1.451)	(1.905)	(2.846)	(2.030)	(1.125)
year2010								0.965		
								(1.536)		
year2011								2.463	1.963	
								(2.670)	(1.986)	
year2013								-1.529	-1.831	-2.302
								(2.418)	(2.354)	(2.431)
year2014								-2.650	-2.294	
								(2.048)	(1.930)	
year2015								-4.487*		
								(2.140)		
Market to book value	0.609	0.923	2.577	2.296	0.712	2.498	3.768	1.030	2.592	4.189
	(0.796)	(0.897)	(1.747)	(2.497)	(0.800)	(1.453)	(2.434)	(1.017)	(1.807)	(2.847)
Log(Sales)	-5.599	-3.031	-2.460	-2.618	-6.704	-7.072	-7.575**	-5.674	-6.803	-7.885*
	(5.556)	(3.271)	(3.233)	(2.868)	(5.665)	(6.297)	(3.060)	(5.864)	(6.733)	(4.284)
Return on assets	-0.440	-0.579**	-0.737*	0.425	-0.448	-0.760	0.113	-0.377	-0.643	0.0324
	(0.340)	(0.278)	(0.416)	(1.292)	(0.352)	(0.533)	(1.573)	(0.380)	(0.508)	(1.504)
Log(Tangibility)	6.233	7.128	5.135	7.061*	6.907	3.344	2.510	8.626	2.606	-1.049
	(7.212)	(4.935)	(3.679)	(4.291)	(7.468)	(6.339)	(8.954)	(7.266)	(7.217)	(12.35)
Year	-0.741									
	(0.457)									
Constant	122.3	88.77*	76.65	77.43*	139.9*	140.1	142.1***	124.8	133.8	142.5**
	(76.33)	(48.58)	(48.88)	(42.52)	(77.55)	(87.14)	(42.70)	(80.52)	(93.50)	(58.48)
Company FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	96	96	69	42	96	69	42	96	69	42
R-squared	0.257				0.241	0.230	0.256	0.297	0.270	0.298
Number of companies	14	14	14	14	14	14	14	14	14	14

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 25. Determinants of leverage for Brazil. This table presents ordinary least squares regressions, using a sample of 22 non-financial firms over the period 2002-2018. The dependent variable is leverage. Results are shown separately for different time windows, where [-2 +2], for example, indicates the two years prior and post the reform of 2005. Variable *d* is the post-reform indicator equal to one after 2005, 2005 included, and zero otherwise.

Independent variables	(1) [-3 +3]	(2) [-3 +3]	(3) [-2 +2]	(4) [-1 +1]	(5) [-3 +3]	(6) [-2 +2]	(7) [-1 +1]	(8) [-3 +3]	(9) [-2 +2]	(10) [-1 +1]
d		-6.498***	-5.530***	-2.026	-5.964***	-5.236***	-3.872**	-15.67***	-11.08***	-4.248**
		(2.064)	(1.885)	(1.412)	(1.861)	(1.738)	(1.377)	(3.558)	(2.659)	(1.555)
year2003								-5.869***		
								(1.701)		
year2004								-12.73***	-7.873***	
								(2.991)	(1.751)	
year2006								1.121	0.980	1.545
								(1.523)	(1.667)	(1.551)
year2007								-2.569	-3.298	
								(2.324)	(2.517)	
year2008								2.707		
								(1.889)		
Market to book value	-0.562	-0.157	0.0660	-0.530	-0.486	-0.588	-1.573*	-0.117	-0.550	-1.625*
	(0.539)	(0.467)	(0.513)	(0.578)	(0.494)	(0.678)	(0.768)	(0.478)	(0.690)	(0.805)
Log(Sales)	3.340	0.416	0.951	3.720	0.591	3.499	14.89***	5.824*	10.68***	13.81***
	(2.531)	(1.785)	(2.243)	(2.934)	(2.289)	(2.962)	(2.867)	(2.846)	(2.506)	(2.412)
Return on assets	-0.254	-0.213	-0.217	0.0484	-0.273	-0.339	0.0409	-0.0582	-0.0470	0.101
	(0.192)	(0.171)	(0.241)	(0.234)	(0.188)	(0.256)	(0.204)	(0.201)	(0.284)	(0.230)
Log(Tangibility)	3.453	-0.117	1.090	-4.882	2.777	8.827	-10.91*	3.550	7.980	-10.45*
	(8.777)	(3.758)	(3.747)	(4.913)	(8.568)	(10.76)	(5.382)	(7.064)	(9.129)	(5.369)
Year	-1.864***									
	(0.603)									
Constant	-13.98	30.92	20.84	-33.68	32.37	-8.478	-213.4***	-45.17	-121.4***	-196.6***
	(36.30)	(30.79)	(38.10)	(49.82)	(33.23)	(44.82)	(45.71)	(39.35)	(36.73)	(38.42)
Company FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	154	154	110	66	154	110	66	154	110	66
R-squared	0.162				0.166	0.173	0.331	0.326	0.282	0.346
Number of companies	22	22	22	22	22	22	22	22	22	22

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For the following remarks, I will be only focusing at the (8) regression of each table from Table 21 to Table 24. Results show that Germany is the only country where company leverage is correlated with all the determinants of leverage mentioned in Section 4.2.3. On the contrary, Portuguese firms show no correlation between leverage and those independent variables.

Tangibility of assets is always positively correlated with leverage in all four countries. This strong relation is not surprising. As mentioned by Rajan and Zingales[114], firms with a big proportion of fixed assets have the opportunity to use them as collateral in case of financial distress, thus making creditors more willing to lend them money. Return on assets appears to be negatively correlated with leverage in all countries. The reason behind is that profitable business tend to reduce external financing and rely more on internal funding. Sales, in turn, show a positive correlation with leverage in all countries except for Portugal. This positive relation can be explained by the fact that bigger companies, which means higher sales, have a better chance to rely on debt since they are seen as more reliable and less likely to fail. Finally, results show that market to book value is correlated with leverage positively in all cases except for Brazil, which of what we could expect. Theory says that a company with high market to book value, which is a proxy for the future growth opportunities, finances itself with a greater amount of equity rather than debt.[115] However, Chen and Zhao[116] report that this is the case for firms with already high market to book value. If market to book value lies between low and medium, the relation with leverage then becomes negative. Actually, this fits with our results, since Brazilian companies appear to have the highest market to book value, on average.

The post-reform indicator shows to be statistically significant for Germany and Brazil, as already seen in the Chow test results. Therefore, those countries did experience a change in leverage after the insolvency reform commencement, both cases proving a leverage decrease.

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[114] See Rajan/Zingales (1995), p. 1451.
[115] Ibid.
[116] See Chen/Zhao (2006), p. 1.

Appendix C. Difference-in-difference estimator

Table 26. Difference-in-Difference for Germany and Austria after matching. This table presents the Difference-in-Difference regression, using a sample of 120 matched firms over the period 2009-2015. Variable *d* is the post-reform indicator equal to one after 2012, 2012 included, and zero otherwise. Variable *treatment* is the country estimator equal to one for Germany and zero for Austria. In this case, Stata omits it because of the presence of the company fixed-effects. Variable *treatmentxd* is the treatment-effect indicator, product of the previously mentioned dummy variables.

Independent variables	Germany/Austria
year2010	0.532
	(0.932)
year2011	-0.135
	(1.236)
year2013	-0.573
	(0.373)
year2014	0.0233
	(1.032)
year2015	0.147
	(1.287)
Market to book value	0.700*
	(0.419)
Log(Sales)	4.210*
	(2.352)
Return on assets	-0.418***
	(0.0784)
Log(Tangibility)	4.486***
	(1.265)
GDP	-1.07e-05
	(8.68e-06)
d	-0.816
	(1.409)
o.treatment	-
treatmentxd	-0.132
	(1.331)
Constant	-12.07
	(33.35)
Company FE	YES
Observations	1,162
Number of companies	116
R-squared	0.141

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 27. Difference-in-Difference for Spain and France after matching. This table presents the Difference-in-Difference regression, using a sample of 58 matched firms over the period 2008-2014. Variable *d* is the post-reform indicator equal to one after 2011, 2011 included, and zero otherwise. Variable *treatment* is the country estimator equal to one for Spain and zero for France. In this case, Stata omits it because of the presence of the company fixed-effects. Variable *treatmentxd* is the treatment-effect indicator, product of the previously mentioned dummy variables.

Independent variables	Spain/France
year2009	-0.118
	(1.205)
year2010	-0.869
	(1.051)
year2012	-0.574
	(0.930)
year2013	0.0747
	(0.985)
year2014	0.206
	(1.038)
Market to book value	-0.00250
	(0.298)
Log(Sales)	1.921
	(2.391)
Return on assets	-0.330***
	(0.0651)
Log(Tangibility)	4.418***
	(1.663)
GDP	-6.52e-06
	(2.14e-05)
d	-1.777
	(1.801)
o.treatment	-
treatmentxd	0.545
	(2.284)
Constant	21.61
	(50.75)
Company FE	YES
Observations	714
R-squared	0.146

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 28. Difference-in-Difference for Portugal and The Netherlands after matching. This table presents the Difference-in-Difference regression, using a sample of 15 matched firms over the period 2009-2015. Variable *d* is the post-reform indicator equal to one after 2012, 2012 included, and zero otherwise. Variable *treatment* is the country estimator equal to one for Portugal and zero for The Netherlands. In this case, Stata omits it because of the presence of the company fixed-effects. Variable *treatmentxd* is the treatment-effect indicator, product of the previously mentioned dummy variables.

Independent variables	Portugal/The Netherlands
year2010	-2.554
	(1.724)
year2011	-1.989
	(2.589)
year2013	0.428
	(1.775)
year2014	-0.633
	(2.073)
year2015	-4.423**
	(1.921)
Market to book value	-0.813
	(0.846)
Log(Sales)	-0.502
	(5.234)
Return on assets	-0.206
	(0.211)
Log(Tangibility)	6.096
	(5.399)
GDP	0.000259*
	(0.000148)
d	-0.428
	(3.286)
o.treatment	-
treatmentxd	-1.972
	(2.096)
Constant	-54.84
	(68.28)
Company FE	YES
Observations	194
R-squared	0.191

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 29. Difference-in-Difference for Brazil and Portugal after matching. This table presents the Difference-in-Difference regression, using a sample of 26 matched firms over the period 2002-2008. Variable *d* is the post-reform indicator equal to one after 2005, 2005 included, and zero otherwise. Variable *treatment* is the country estimator equal to one for Brazil and zero for Portugal. In this case, Stata omits it because of the presence of the company fixed-effects. Variable *treatmentxd* is the treatment-effect indicator, product of the previously mentioned dummy variables.

Independent variables	Brazil/Portugal
year2003	-4.136***
	(0.975)
year2004	-8.513***
	(1.844)
year2006	-2.522*
	(1.262)
year2007	-4.866***
	(1.184)
year2008	-2.404
	(1.724)
Market to book value	0.435
	(0.270)
Log(Sales)	4.011
	(2.419)
Return on assets	-0.105
	(0.173)
Log(Tangibility)	6.863
	(7.546)
GDP	1.45e-05*
	(7.63e-06)
d	-5.698**
	(2.437)
o.treatment	-
treatmentxd	-7.220**
	(3.090)
Constant	-23.36
	(33.06)
Company FE	YES
Observations	336
R-squared	0.304

<center>Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1</center>

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Declaration of Academic Integrity

Hereby, I declare that I have composed the presented paper independently on my own and without any other resources than the ones indicated. All thoughts taken directly or indirectly from external sources are properly denoted as such.

This paper has neither been previously submitted to another authority nor has it been published yet.

Place, Date

Signature