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Mandatory financial information disclosure and credit ratings

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ABSTRACT

When firms are forced to publicly disclose financial information, credit rating agencies are generally expected to improve their risk assessments. Theory predicts such an information quality effect but also suggests an adverse reputational concerns effect since credit analysts may become increasingly concerned about alleged rating failures. We empirically examine these predictions using a large-scale quasi-natural experiment in Germany, where a new compliance regime required firms to disclose annual financial statements publicly. Consistent with the reputational concerns hypothesis, we find an average increase in credit rating downgrades that is entirely driven by changes in the discretionary assessments of credit analysts rather than changes in firm fundamentals. Following public disclosure regulations, analysts tend to give positive private information less weight in their risk assessments while assigning greater weight to negative public information. A final set of results indicates that professional credit providers recognize that the resulting downgrades are not warranted.

1. Introduction

Over the past few decades, policymakers have introduced several amendments to reporting regulations with the aim of enhancing corporate financial transparency. The requirement that firms publicly disclose standardized financial information is a key element of these regulatory measures. When effectively enforced, the regulations make it more difficult for companies to conceal or manipulate financially relevant information. This change is intended to improve the quality of risk assessments and allocation of capital (Gigler, 1994; Rock, 2002; Seligman, 1983). Consistent with these expectations, several empirical studies have documented various capital market benefits following the implementation of the more stringent reporting regulations introduced in recent decades (Leuz and

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Wysocki, 2016).

Studies focusing on credit ratings, however, have shown that credit rating agencies (CRAs) have become increasingly conservative and less accurate over this same period (Baghai et al., 2014; Blume et al., 1998). This decline in rating accuracy is puzzling given the concurrent increase in publicly disclosed financial information.[1]

In this paper, we provide an explanation for this conundrum by documenting how mandatory financial statement disclosure leads to both more conservative and less accurate credit ratings. Our results confirm economic theory suggesting that public disclosure of information can have adverse effects if it crowds out the effective usage of private information (Goldstein and Yang, 2017; Morris and Shin, 2002). The driving force behind this crowding out effect is that informed professionals care about their reputations with uninformed decision makers (Scharfstein and Stein, 1990; Morris, 2001; Ottaviani and Sørensen, 2006).

In the context of CRAs, credit analysts are reluctant to use private information in their credit risk assessments, because rating failures based on private information are more likely to be attributed to misclassification than rating failures based on public information (e.g., Mariano, 2012). This idea is centered on the multilayered role of public disclosure: public information not only disseminates fundamental information, it also informs analysts about what other market participants know, thereby helping them to predict the actions of others (Morris and Shin, 2002). By following the same public information that others are following, analysts can diminish their own responsibility for potential rating mistakes that might occur.[2] Although this behavior is inefficient from a social standpoint, it can be rational from the perspective of analysts who are concerned with their reputations. The mechanism is very similar to herding in financial markets, where equity analysts have incentives to follow the mainstream opinion even if they are privately better informed (Trueman, 1994; Hong et al., 2000). Following this reasoning, we expect that the requirement that firms disclose information to the public will prompt credit analysts to strategically adjust their discretionary credit evaluations. More precisely, in their risk assessments, they will place more weight on information that becomes publicly available and less weight on information that remains private. This implies that credit rating accuracy will decline in response to public disclosure of financial information.

In addition to a decrease in rating accuracy due to the underutilization of private information, we expect that analysts will more likely issue overly conservative ratings. This kind of asymmetrical bias is likely to arise because credit analysts are penalized more heavily for overly optimistic ratings than for overly pessimistic ratings (Bolton et al., 2012; Dimitrov et al., 2015; Xia, 2014). The mechanism is twofold. First, the costs of rating failures to clients are more significant in the case of missed defaults compared to other types of rating failures (Bolton et al., 2012; Xia, 2014). Second, the likelihood of a client detecting a credit rating failure is highest when a firm defaults. Intuitively, it is unlikely that a client will complain about a speculative grade assigned to a firm that remains solvent, while an optimistic grade assigned to a firm that subsequently defaults may expose the CRA to criticism. Given that reputational risks are highest for analysts when they fail to predict defaults accurately (Xia, 2014), we expect that analysts will be particularly hesitant to rely on positive private information that contradicts negative public information, leading to more conservative ratings on average.

Based on these considerations, the reputational concerns hypothesis yields the following empirical predictions: (1) increased public disclosure leads to more conservative credit ratings; (2) increased public disclosure leads to a decrease in credit rating accuracy; (3) the shift toward more conservative ratings and the decrease in rating accuracy are driven by changes in credit analysts' discretionary personal assessments, not by changes in firm fundamentals or the availability of information to analysts; (4) analysts strategically adjust ratings by giving more weight to negative information that becomes publicly available and less weight to positive information that remains private; and (5) these effects are more pronounced for analysts with heightened reputational concerns.

Importantly, the reputational concerns hypothesis does not necessarily imply a negative impact of disclosure regulation on capital markets or credit supply. It might well be the case that lenders take an unwarranted change in credit ratings into account when making lending decisions (Baghai et al., 2014). In such a scenario, the public availability of financial information might still lead to improvements in credit allocation. To shed light on the economic impact of disclosure-induced credit rating changes, we investigate whether credit providers change their reliance on credit ratings once firms publicly disclose financial information. Specifically, we test whether the sensitivity of debt to credit ratings declines. Additionally, we assess whether more sophisticated users of credit ratings (i.e., banks) are more likely to change their reliance on credit ratings than less sophisticated users (i.e., trade credit providers such as suppliers). The latter group may be more likely to act upon unwarranted credit rating changes due to their lack of in-house knowledge and resources to conduct additional independent checks of firms' creditworthiness.

Our empirical analysis exploits the introduction of a mandatory disclosure regime in Germany. Since 1987, Germany has required all private limited liability firms to publicly disclose financial statements. However, due to a lack of enforcement, only approximately 5% of private firms complied with these requirements prior to 2006 (Bernard, 2016; Breuer, 2021; Breuer et al., 2023). In 2007, a

[1] For example, Dyer et al. (2017) documented a substantial increase in firms' information disclosure from 1996 to 2013. This increase was driven by various changes in standards and disclosure requirements. A broad literature has shown that these regulatory reforms yield numerous capital market benefits for firms (see Leuz and Wysocki, 2016, for an overview). Other scholars, however, have found significant increases in credit rating conservatism around these law changes. For example, Alp (2013) noted a significant increase in rating conservatism after 2002, when SOX was implemented. Similarly, Jorion et al. (2005) described an increase in rating downgrades and a decrease in rating upgrades after Regulation Fair Disclosure (p. 316).

[2] For example, when an analyst issues a rating that is primarily based on public information, users of credit ratings will likely arrive at similar conclusions about the firm's creditworthiness. As a result, the users will be less likely to blame the analyst if the rating turns out to be incorrect. In addition, relying primarily on public information enables analysts to ascribe rating failures more easily to unexpected events, incomplete or inaccurate information disclosed by the company to the public, an inadequate assessment by the auditors, or a collective misunderstanding by multiple CRAs.

change in enforcement regulations compelled over a million firms to disclose their financial statements for the first time publicly. Using a difference-in-differences (DiD) design, we evaluate the impact of this regulatory reform on treated firms' credit ratings through comparison with three different control groups: (1) private unlimited liability firms operating in Germany that were not required to disclose financial statements before or after the reform, (2) private limited liability firms operating in Austria that had already been mandated to disclose financial statements since 1996, and (3) German private limited liability firms that voluntarily disclosed financial statements to the public prior to the enforcement change.

Our main data source is the Mannheim Enterprise Panel (MEP), which includes credit rating data from Creditreform, the largest CRA in Germany. This proprietary database covers the universe of firms operating in Germany. It includes all credit ratings issued by the CRA, along with the underlying information used to construct these ratings. It includes publicly and privately disclosed financial information as well as the discretionary personal assessments of credit analysts. The latter enable us to isolate changes in the subjective opinion of credit analysts from changes in firm fundamentals. In addition, because we have access to all elements considered by analysts to construct credit ratings, we can control for differences in firm characteristics between treated and control firms that might impact their rating.

To further strengthen identification, we focus on firms that disclose all requested information to the CRA, irrespective of whether that information is publicly available. We thus specifically focus on firms whose financial statement information exogenously switches from being privately available to analysts to being publicly available. We compare these firms with a control group in which financial statement information is either always privately disclosed to the CRA or, alternatively, always publicly available. This approach rules out biases from changes in available firm-specific information to credit analysts (e.g., Breuer et al., 2022).

Based on a panel of approximately 260,000 private firms observed between 2002 and 2012, we find that firms, on average, receive more conservative ratings when they disclose their financial statements to the public. Specifically, we find that approximately one out of every four firms experiences a one-notch rating downgrade on the S&P rating scale after disclosure. Consistent with the reputational concerns hypothesis, we find that these changes in credit ratings are entirely driven by changes in the discretionary assessments of credit analysts and not by changes in fundamentals or the business environment. Moreover, if we control for changes in the discretionary assessment of credit analysts, the adjusted credit ratings would actually predict an improvement in the firms' creditworthiness. However, the observed improvements are not large enough to offset the negative effect driven by the analysts' increased concerns about alleged misclassifications. Consistently, we also find that rating accuracy declines following the provision of these more conservative ratings. Default warnings increase even though these firms are actually less likely to default and more likely to pay off their debt obligations. These results further support the idea that the observed increase in rating downgrades is unwarranted.

Detailed analyses of the determinants of credit ratings provide additional support for the idea that reputational concerns about alleged rating failures drive the decline in rating accuracy. First, we show that positive information that the CRA privately possesses is less likely to positively influence a credit analyst's opinion, while negative publicly available information is more likely to lead to a more conservative opinion. Second, we document that the effect is more pronounced for firms with a rating around the investment/speculative grade cutoff (i.e., firms with a rating of approximately BBB-). In contrast, firms with top-tier ratings and firms with the worst ratings did not experience a significant change in their ratings. These results are consistent with the idea that analysts are more likely to adjust ratings for firms when they anticipate possible complaints about alleged rating failures. Lastly, our findings indicate that analysts who have previously made inaccurate credit assessments are more prone to issuing overly conservative ratings. This behavior is likely driven by their desire to avoid additional rating errors in response to their heightened concerns about job security.

In our final set of tests, we examine the impact of this increase in conservatism on the sensitivity between credit ratings and debt provision. Besides confirming that debt provision strongly correlates with firms' credit ratings, we show that the sensitivity between ratings and bank debt provision decreases by about 29% for treated firms after disclosure regulation, while the sensitivity between ratings and trade credit provision decreases by only 6%. This supports the idea that sophisticated credit providers are more likely to understand that the disclosure-induced rating changes are unwarranted; consequently, these credit providers are less likely to rely on credit ratings. In contrast, unsophisticated credit providers do not seem to significantly change their reliance on credit ratings. Given that the sensitivity of trade credit to ratings remains largely unchanged, and that trade credit is one of the most important sources of external financing for firms (Berger and Udell, 1998; Bundesbank, 2012), disclosure regulation and its associated effect on credit ratings might adversely impact some firms' financing opportunities. It is important to note, though, that the average firm experienced an increase in trade credit and bank debt provision following disclosure regulation. This finding is consistent with prior literature (Deno et al., 2020) and suggests that the unintended impact on credit ratings is neither the only nor dominant channel through which transparency influences the debt financing landscape.

Our study contributes to the broader debate on how public information disclosure changes the information environment and affects financial markets (e.g., Breuer et al., 2018; Breuer et al., 2022; Goldstein and Yang, 2017; Scharfstein and Stein, 1990). This literature has repeatedly challenged the conventional wisdom that public information disclosure unambiguously improves efficiency. One of the main arguments put forward is that public information may crowd out various types of private information. Our study extends this literature by investigating how mandatory financial statement disclosures influence corporate credit ratings and trigger reputational concerns among informed experts. We provide novel evidence that credit rating analysts are more likely to rely on public information and less on private information in their credit risk assessments when information becomes publicly available.

Our results also inform the growing theoretical and empirical credit rating literature (see Jeon and Lovo, 2013, for an overview). Several theoretical papers have studied biases in credit ratings, highlighting reputational concerns as a key driving force (e.g., Bouvard and Levy, 2018; Mariano, 2012). We offer evidence that supports the validity of those theories. Prior empirical studies have shown that credit ratings have generally become more conservative over time, and the market only partially eliminates the impact of conservatism on debt provision (e.g., Baghai et al., 2014). Factors contributing to rating conservatism include the unexpected collapse of WorldCom

(Alp, 2013), increased regulatory scrutiny after the Dodd-Frank Act (Dimitrov et al., 2015), and increased competition from investor-paid CRAs (Xia, 2014). Our study contributes to this line of research by showing how the requirement to disclose financial information contributes to the provision of overly conservative ratings.

2. Data and identification strategy

2.1. Data

To empirically assess how credit analysts strategically change their credit ratings when firms publicly disclose information, we utilize the Mannheim Enterprise Panel (MEP), hosted by the Leibniz Centre for European Economic Research (ZEW). The database contains credit ratings of all firms operating in Germany. Important for our study, it also includes the underlying data that credit analysts use to construct these credit ratings.

The data originally stems from Creditreform, the largest CRA in Germany. Creditreform regularly screens the official German company register, ensuring a complete coverage of the corporate landscape. From 2000 onward, the database contains firm-level data for approximately 3 million German firms on a yearly basis. It includes data on all public companies, as well as information on almost all limited liability and unlimited liability private companies operating in Germany (see Bersch et al., 2014, and the Online Appendix for more details about the MEP).

The core business of Creditreform is selling credit ratings to banks and suppliers that want to determine the amount of (trade) credit they should offer. For example, banks buy these credit ratings as an input to approve or reject loan applications, to determine the loan conditions, or to supplement their own creditworthiness assessments. Suppliers of firms buy ratings to help determine the amount of trade credit to offer their clients. Creditreform thus employs an investor-paid business model, similar to the business model of Credit Safe, Dun and Bradstreet, Equifax, and Experian, which operate in other parts of the world.

Creditreform has 130 business offices in Germany and over 4000 employees. Each of the 130 offices has a local regional monopoly with the exclusive right to construct ratings for firms operating in their respective regions. Creditreform has approximately 125,000 clients and sold more than 15 million reports in 2010 (Creditreform, 2010). Their market share, at around 70%, has remained stable over recent decades (Creditreform, 2007, 2010).

When one of the clients of Creditreform requests a credit rating for a company, an analyst collects the necessary information to construct a credit report. The most important element in the credit report is the credit rating, which reflects a given firm's likelihood of being in default within the following year. All ratings sold to clients are available in our database. The MEP also includes all the underlying data used to construct the ratings: (a) payment behavior, (b) order prospects, (c) general business development and growth, (d) financial statement information, (e) age, (f) sales, (g) employees, (h) productivity, (i) equity, (j) legal form, and (k) industry and regional information (Creditreform, 2020). This information is gathered from both public sources (e.g., corporate websites, publicly available financial statements, and court cases) and private sources (e.g., management reports or financial statements disclosed through private channels). Nonpublic information is obtained through interviews with managers and supplemented with data from clients and suppliers (e.g., data on the firm's payment behavior).

To determine the associated probability of default, Creditreform employs a credit risk model that incorporates all elements listed above, including indicators for missing information. In addition, analysts independently examine all available information to provide an individual assessment of a given firm's creditworthiness. All these elements are assigned weights and combined to determine the final credit rating. A company's payment behavior and the discretionary assessment of the credit analyst carry the most weight, with each accounting for approximately 25% (Creditreform, 2020). Each of the other risk factors is weighted at around 5%. The Online Appendix provides an example of a fictitious company. The model closely resembles the rating methodologies used by other CRAs, where analysts have considerable influence over the final credit rating (e.g., Fracassi et al., 2016; Dun and Bradstreet, 2020; S&P, 2020).

2.2. Institutional setting

To empirically examine the impact of financial statement disclosure on credit ratings, we use a quasi-natural experiment originating from the EU directive 2003/58/EC. This directive mandated that all EU member states establish an electronic company register by January 1, 2007, with the goal of making all corporate financial statements electronically available to the public.

Prior to 2007, the EU had already required private firms to disclose annual financial statements to the public. However, in Germany, this requirement was not enforced. Before 2007, only about 5% of German firms that were obliged to publish annual financial statements actually disclosed their financial statements to the public (Ballwieser and Häger, 1991; Bernard, 2016; Bundesanzeiger, 2011; Theile and Nitsche, 2006).

When Germany implemented the Electronic Registers for Commerce, Companies and Associations Bill (EHUG) to comply with EU directive 2003/58/EC, it also began enforcing the disclosure of financial statements. This led to a massive increase in available financial statements through a web-based platform. If a firm does not file its financial statements within one year after the end of the fiscal year, the Federal Office of Justice initiates an administrative procedure that results in fines ranging from €2500 to €25,000. Firms continue to be subject to fines every six weeks until their financial statements are available in the electronic register. This robust change in enforcement practice proved to be highly effective. Publication rates increased from approximately 5% to over 90% two years after the law change (Bundesanzeiger, 2011). More than 1 million financial statements are now published annually and are readily accessible through the Bundesanzeiger website.

Table 1
Overview of treated and control groups.

	Treatment Effect	Firm Characteristics		
	Public Disclosure	Credit analyst	Firm size	Legal form
Treated group				
German Limited	No disclosure before 2007, disclosure after 2007	German regional offices	Small and large	Limited
Control groups				
German Unlimited	No disclosure before 2007, no disclosure after 2007	German regional offices	Small and large	Unlimited
Austrian Limited	Disclosure before 2007, disclosure after 2007	Austrian regional offices	Small and large	Limited
German Limited (voluntary disclosure)	Disclosure before 2007, disclosure after 2007	German regional offices	Mainly Large	Limited

Notes: This table summarizes the main similarities and differences between our treated and control groups.

Importantly, the enforcement change did not significantly increase compliance costs for firms as accounting and tax reporting are strongly aligned in Germany. In addition, firms typically already had financial statements readily available and disclosed them through private channels to stakeholders upon request, including to CRAs.[3] The main shift for credit analysts was that financial information became publicly available. An open question remains, however, as to whether the disclosure reform impacted the CRA business model and the demand for credit ratings. Descriptive evidence from old snapshots of Creditreform's website (accessed through archive.org) indicates that prices of credit reports remained relatively stable, ranging from €58 in 2005 to €64.90 in 2012. The price is the same for every company, regardless of whether or not it publicly discloses financial statements. Our database shows that the number of available credit ratings has remained relatively constant over time as well.[4] This suggests that credit reports are still considered valuable resources by many banks and companies today, even though more and easier-to-access public information is available.[5] However, the annual reports of Creditreform reveal a slight decline in its number of clients, from 128,000 in the period 2002–2006 to 125,000 in 2008–2012. This decline suggests that, at least for some clients, publicly available financial statements may serve as an adequate alternative for assessing a firm's creditworthiness. We discuss this topic in greater detail in section 3.5 Economic Relevance, where we empirically assess the relationship between credit ratings and debt provision.

2.3. Identification strategy

To identify the causal impact of financial information disclosure on credit ratings, we employ a DiD research design. Our treated group comprises German limited liability firms with the legal forms GmbH and GmbH Co. KG. These firms did not disclose financial statements to the public before the law change but were required to – and effectively did so – from 2007 onwards (i.e., approximately 95% of all limited liability firms operating in Germany). We compare this set of treated firms with three distinct control groups: (1) German unlimited liability firms; (2) Austrian limited liability firms, and (3) German limited liability firms that had already voluntarily disclosed their financial statements before the enforcement change.

Following prior research, our most preferred control group consists of unlimited liability firms (e.g., Breuer et al., 2022; Breuer et al., 2023). These firms serve as a natural control group because both before and after the regulatory change, they were not required to publicly disclose financial statements. We specifically focus on unlimited liability firms with the legal forms OHG and KG because they exhibit similar firm characteristics regarding sales, employees, and productivity, and they operate in the same industries and regions as their limited liability counterparts. In addition, firms in both groups regularly collaborate with various suppliers and banks, giving them similar incentives to provide information to business partners and CRAs. Despite differences in their legal status, owners of both unlimited liability and limited liability firms often need to provide personal collateral to obtain loans, thereby increasing the comparability between the two groups of firms (Cerqueiro and Penas, 2017).

In our empirical design, we compare limited and unlimited liability firms that operate in the same region and industry. As explained in the institutional setting section 2.2, each of the 130 credit rating offices of the CRA has the exclusive right to sell ratings for firms operating in its respective region and employs its own analysts. By incorporating county-year and industry-year fixed effects in our analyses, we essentially ensure that treated and control firms were rated by the same analyst.

To assess the robustness of our findings, we employ two alternative control groups. The first consists of Austrian limited liability firms that share the same legal forms as their German counterparts (GmbH and GmbH Co. KG). The law change affecting German firms did not change the requirements for firms operating in Austria. Austria has mandated public financial statement disclosure for limited liability firms since 1996 (Eierle, 2008). Furthermore, Creditreform is also the market leader in Austria, and it uses the same methodology to construct its ratings for Austrian and German firms (Creditreform, 2007). Regional differences between Austria and

[3] For example, in our database, we observe that from 2002 to 2007, the CRA obtained financial information for approximately 1 million firms annually through private channels. See the Online Appendix for more information about the MEP.

[4] The number of firms for which a credit rating was requested by banks and suppliers steadily increased from 1.3 million firms in 2002 to 1.5 million firms in 2012, largely reflecting the growth in the number of companies during the same period.

[5] The credit reports contain detailed private information about the company, including payment behavior and order outlook. Such private information is not readily observable in the financial statements of private firms. Furthermore, the Basel II agreements mandate that banks use credit ratings when assessing credit risk. Banks either directly rely on ratings from external CRAs or purchase credit reports to include non-public information as an input for their own credit models.

Germany are arguably negligible since both countries are long-term EU members, allowing for the free movement of capital, labor, and goods between the member states. Together with Germany, Austria forms a common market, as evidenced by parallel trends in their GDP growth (see Online Appendix Figure A1).

The second alternative control group includes German limited liability firms that voluntarily disclosed their financial statements to the public before the enforcement change (~5% of all limited liability firms in Germany). Similar to the control group of Austrian firms, this group of firms also has limited liability and has disclosed financial statements to the public over the entire sampling period. These two alternative control groups allow us to assess the robustness of our results – for example, by verifying that our results using the main control group of unlimited liability firms are not merely driven by differences in legal form. We summarize the similarities and differences between treated and control firms in Table 1.

Under the assumption that the treated and control groups are subject to the same macroeconomic influences and market-wide shocks (i.e., factors that are concurrent but unrelated to the regulatory change), we can identify the causal impact of mandatory financial statement disclosure on credit ratings using DiD estimations. We examine the plausibility of these assumptions in section 3.2.3.

2.4. Sample construction

We focus on credit ratings of firms released five years before and five years after the law change in 2007. This results in a panel dataset covering the period 2002 to 2012. The sample ends in 2012 because from 2013 onward, a large fraction of firms became eligible to disclose less information to the public. In section 3.2.4, we discuss this deregulation reform in greater detail and use it as an alternative identification strategy.

Our baseline sample comprises treated and control firms as outlined above. To mitigate potentially confounding selection effects, we restrict our sample to firms that are observable before and after the law change and that did not change their legal form over time.[6] In addition, we keep only observations with no missing information on all the variables that credit analysts use to construct ratings. Hence, we retain only firms that disclose all the requested information to the CRA (either through private or public channels). This approach allows us to rule out that changes in credit ratings are driven by changes in information provision (e.g., Breuer et al., 2022).[7] Hence, the variation that we exploit is that financial statement information exogenously switches from private availability to public availability in 2007 for the treated firms. For the firms in the control groups, the same set of information is either always available through private channels or, alternatively, always available through public channels.

To enhance comparability, we further exclude the largest 1% of firms from our sample.[8] Next, we omit German and Austrian limited liability firms that did not disclose to the public when they were required to do so. Similarly, we remove unlimited liability firms that voluntarily disclose financial statements to the public.[9] The final sample consists of 1,854,434 firm-year observations, comprising 205,947 treated firms and 55,104 control firms (including 4152 unlimited liability firms, 8672 Austrian limited liability firms, and 42,280 German limited liability firms). A detailed selection table is provided in Online Appendix Table A1, and a breakdown by year appears in Table A2.

3. Results

3.1. Descriptive statistics

Table 2 presents descriptive statistics for treated and control firms. The size of treated firms and unlimited liability firms is comparable, with around 22 versus 24 employees on average. Austrian limited liability and German limited liability firms that voluntarily disclosed are about twice as large (42 and 43 employees, respectively). The average treated firm is 21 years old, which is about the same average age as Austrian limited liability firms and German limited liability firms that voluntarily disclosed to the public (22 and 24 years old, respectively) and about half the age of the average German unlimited liability firm (38 years old). The median labor productivity, measured by total sales per employee, is comparable across all samples. Similarly, treated and control firms show comparable payment behavior to suppliers, a similar number of orders from clients, and equivalent business development prospects.

[6] In our sample, we find that less than 0.3% of all firms switch legal forms. These firms do not significantly alter the results when they remain in the sample.

[7] In addition, this procedure rules out the possibility that our analyses are confounded by the GmbH Law reform that occurred in 2008 (MoMiG), which introduced a new legal form, Unternehmergesellschaft (UG), into the German corporate landscape (see Bracht et al., 2022). Unlike our treated firms, this new type of limited liability company has no minimum capital requirements. Given our focus on companies that we observe both before and after 2007, these newly founded firms do not appear in our sample.

[8] Specifically, we remove firms with over 5000 employees and sales exceeding €130,000,000 from our sample. According to German Corporate Law, unlimited liability firms surpassing these thresholds are required to publicly disclose financial information. Our results remain consistent when including these larger firms in the sample.

[9] We identify these firms by comparing the availability of financial statement data in the MEP database with the historical records of the Orbis database. The Orbis database only includes financial information about firms that have publicly available financial statements.

Table 2
Descriptive statistics.

Variables	Treated Group					Control Groups														
	Limited (Germany)					Unlimited (Germany)					Limited (Austria)					Limited (Germany) Voluntary Disclosure				
	N: 1,438,019					N: 30,449					N: 46,547					N: 339,419				
	Mean	SD	Min	Median	Max	Mean	SD	Min	Median	Max	Mean	SD	Min	Median	Max	Mean	SD	Min	Median	Max
Credit Rating Index	10.52	2.47	1	10	21	9.13	2.5	1	9	21	11.20	3.02	1	11	21	9.78	2.57	1	9	21
Credit Analyst Opinion	2.41	0.61	1	2	5	2.31	0.55	1	2	5	2.56	0.70	1	2	5	2.31	0.61	1	2	5
Employees	22.16	59.73	1	9	4300	24.04	65.05	1	8	3100	41.64	88.88	1	13	2344	42.9	92.22	1	16	3510
Age	21.19	24.58	0	14	901	38.07	38.94	0	24	372	22.85	29.21	0	16	812	24.18	25.81	0	16	681
Equity(x 100,000)	1.58	8.92	0.00	0.26	2556	3.12	25.13	0.00	0.03	990	3.15	11.53	0.00	0.36	310	3.71	13.91	0.00	0.50	970
Productivity(x 100,000)	11.34	47.36	0.00	1.50	1253	4.29	19.24	0.00	1.47	350	25.07	72.98	0.00	2.14	610	5.85	29.38	0.00	1.41	1270
Sales(x 100,000)	50.64	110.85	0.00	15.75	1300	50.21	119.26	0.00	12.40	1300	119.94	181.84	0.01	38.00	1291	75.59	134.63	0.00	26.00	1300
Payment Behavior	2.05	0.48	1	2	5	2.02	0.52	1	2	5	2.29	0.59	1	2	5	2.03	0.54	1	2	5
Order Situation	2.40	1.22	0	3	6	2.55	1.10	0	3	5	1.72	1.60	0	2	6	2.49	1.09	0	3	6
Business Development	2.24	1.29	0	3	6	2.42	1.18	0	3	5	1.56	1.56	0	2	6	2.32	1.19	0	3	6

Notes: This table presents descriptive statistics for the subsamples of treated and control firms. Treated firms are limited liability firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. We have three control groups: (1) German unlimited liability firms with the legal forms OHG or KG that not required either before or after 2007 to disclose financial statements; (2) limited liability firms operating in Austria that were required to disclose from 1996 onward; (3) German limited liability firms that voluntarily disclosed before 2007. The credit rating index ranges from 1 (AAA) to 21 (C). Variable definitions are provided in the Appendix.

Table 3
Reporting regulation and credit ratings.

Outcome	Credit Rating Index					
Control Group	Unlimited (Germany)		Limited (Austria)		Limited (Germany)	
Column	(1)	(2)	(3)	(4)	(5)	(6)
Treated x Post	0.177***	0.229***	0.098*	0.103*	0.604***	0.327***
	(0.040)	(0.034)	(0.056)	(0.059)	(0.034)	(0.018)
Treated	1.312***		−0.716***		0.479***	
	(0.049)		(0.130)		(0.067)	
Post	0.169***		0.248***		−0.258***	
	(0.049)		(0.043)		(0.051)	
Firm FE	No	Yes	No	Yes	No	Yes
Year-Industry FE	No	Yes	No	Yes	No	Yes
Year-County FE	No	Yes	No	No	No	Yes
Observations	1,468,247	1,468,247	1,484,391	1,484,391	1,777,360	1,777,360
Clusters (County)	443	443	543	543	444	444
R-squared	0.011	0.696	0.007	0.677	0.018	0.694

In addition, credit analysts' opinions about the firms' creditworthiness are, on average, the same for the treated and control groups.[10] To compare credit ratings across groups, we follow prior literature and assign a numerical value to each rating on a notch basis as follows: AAA = 1, AA+ = 2, AA = 3, AA− = 4, A+ = 5, A = 6, A− = 7, BBB+ = 8, BBB = 9, BBB− = 10, BB+ = 11, BB = 12, BB− = 13, B+ = 14, B = 15, B− = 16, CCC+ = 17, CCC = 18, CCC− = 19, CC = 20, C = 21. The credit rating index thus ranges from 1 to 21.[11]

Firms in our sample have, on average, an investment grade (i.e., BBB- or better). Unlimited liability firms and limited liability firms that have voluntarily disclosed have, on average, a one-notch better rating (BBB) compared to the treated firms (BBB-), while Austrian limited liability firms have a one-notch worse rating (BB+).

3.2. Impact of disclosure regulation on credit ratings

3.2.1. Impact on credit ratings

To systematically examine the impact of financial statement disclosure on credit ratings, we employ DiD regressions. Following Jiang et al. (2012), Baghai et al. (2014), and Xia (2014), we utilize an OLS regression model with the following specifications[12]:

$$Credit\ Rating\ Index_{it} = \beta_1 \cdot Treated_i \times Post_t + \beta_2 \cdot Treated_i + \beta_3 \cdot Post_t + \varepsilon_{it} \quad (1)$$

We estimate this model on three different samples. Each sample consists of the treated group along with one of the three control groups outlined in section 2.3 Identification Strategy.

$Credit\ Rating\ Index_{it}$ is the credit rating of firm i in year t. It ranges from 1 to 21 (i.e., AAA to C ratings). $Treated_i$ is a dummy indicating whether the firm started to publicly disclose financial statements after 2007; it is zero if the firm does not change its disclosure strategy. $Post_t$ is a dummy that equals one from 2008 onward, when the first financial statements became publicly available. Standard errors are clustered at the county level.

In an alternative specification, we also include firm fixed effects (f_i) in our model to control for (unobserved) time-invariant heterogeneity across firms (e.g., different legal forms), and we also include county-year fixed effects (α_{ct}) and industry-year fixed effects (δ_{st}) to control for macroeconomic differences across years, counties, and industries. This leads to the following specifications:

$$Credit\ Rating\ Index_{it} = \beta_1 \cdot Treated_i \times Post_t + f_i + \alpha_{ct} + \delta_{st} + \varepsilon_{it} \quad (2)$$

Under the assumption that treated and control firms follow similar trends absent disclosure regulation, β_1 captures the causal impact of financial statement disclosure on credit ratings in our models. We expect to find a positive β_1 coefficient, meaning that public disclosure of financial statements leads, on average, to lower ratings.

Table 3 displays the results. Across the different samples, we consistently find that firms receive, on average, more conservative ratings after disclosure regulation. Our results are also qualitatively similar when we include firm and year fixed effects. The average of the marginal effects suggests that approximately one in four firms experiences a one-notch downgrade after being mandated to

[10] This categorical variable ranges from 1 (best classification) to 6 (worst classification), with distinct meanings for each category. For example, Category 2 of the payment behavior variable indicates that a company pays within the agreed timeframe. For detailed definitions, see the Online Appendix. The maximum value for payment behavior and credit analyst opinions is 5 as 6 is exclusively assigned to firms that have defaulted.

[11] The original ratings from Creditreform range from 100 (best credit score) to 500 (worst credit score), with a separate category of 600 for defaulted companies. The accompanying credit report converts ratings to the widely recognized S&P credit rating index, ranging from AAA (prime rating) to D (in default). We use the S&P index to enable comparison with prior literature.

[12] We employ Ordinary Least Squares (OLS) as the primary analytical method throughout this paper due to the extensive fixed effects we employ in our analyses.

publicly disclose financial statements.[13] This indicates an economically meaningful effect. For example, it is about three times the size of the competition effect identified by Xia (2014), who finds a one-notch rating downgrade in S&P ratings for approximately one out of twelve firms in response to new competition from an investor-paid CRA.

To further assess the economic significance, we conduct two additional tests. First, we examine the impact of disclosure regulation on the likelihood that a firm receives a speculative grade. We use the same specifications as in equations (1) and (2), but use *Speculative Grade*$_{it}$ as the outcome variable. *Speculative Grade*$_{it}$ is a dummy variable that equals one when firms receive a non-investment rating (i.e., a rating of BB + or lower), and zero otherwise. The results in Online Appendix Table A3 show that the likelihood of securing an investment-grade rating decreases by approximately 4.2 percentage points following the disclosure regulation (i.e., a 9.35% higher likelihood of receiving a speculative grade (0.042/0.449)). This indicates that disclosure regulation has significant implications for a substantial set of firms since a shift from an investment grade to a speculative grade often entails significant changes in borrowing costs and access to capital.

As an alternative approach to assess the economic significance of our findings, we utilize data on the amount of trade credit recommended by the CRA. Within each credit report, the CRA suggests to suppliers and banks the maximum amount of credit that could be offered given a particular credit rating. Using this data, we find that the CRA recommends a 13% lower credit volume when the average firm in our sample receives a one-notch lower credit rating.[14]

Taken together, our results show that disclosure regulation leads to a substantial reduction in credit ratings. Firms, on average, are assigned worse credit ratings when they are required to disclose information to the public. Given that we find consistent results across the different control groups, both in the current and in subsequent analyses, we report tabular results only for our preferred control group (German Unlimited) in the following sections. Results using the alternative control groups are available in the Online Appendix.

3.2.2. Change in assessment by credit analysts or change in fundamentals?

The previous results are consistent with the idea that credit analysts provide more conservative ratings after disclosure regulation due to reputational concerns. However, another potential explanation for the change in credit ratings is that disclosure regulation (or concurrent events around the law change) has real negative economic consequences for firms, leading in turn to real changes in firms' creditworthiness. If this is the case, we may err in attributing the estimated change in credit ratings to the reputational concerns of the credit analysts. For example, Breuer et al. (2023) demonstrate that disclosure regulation can negatively impact firms' incentives to innovate, potentially jeopardizing their future profits and thus indirectly contributing to lower credit ratings.[15] Lower ratings would then be justified because of changes in firm fundamentals. The reputational concerns hypothesis, however, would predict that credit ratings would change regardless of changes in firm fundamentals. To determine whether our results are driven by changes in firm characteristics or are solely related to a more conservative assessment by the credit analyst, we estimate the following three specifications:

$$Credit\ Analyst\ Opinion_{it} = \beta_1 \cdot\ Treated_i \times Post_t + f_i + \alpha_{ct} + \delta_{st} + \varepsilon_{it} \tag{3}$$

$$\begin{aligned} Credit\ Rating\ Index_{it} = {} & \beta_1 \cdot\ Treated_i \times Post_t + \beta_2 \cdot Credit\ Analyst\ Opinion_{it} \\ & + \beta_3 \cdot Credit\ Analyst\ Opinion_{it} \times Post_t + f_i + \alpha_{ct} + \delta_{st} + \varepsilon_{it} \end{aligned} \tag{4}$$

$$\begin{aligned} Credit\ Rating\ Index_{it} = {} & \beta_1 \cdot Treated_i \times Post_t + \beta_2 \cdot Other\ Rating\ inputs_{it} \\ & + \beta_3 \cdot Other\ Rating\ inputs_{it} \times Post_t + f_i + \alpha_{ct} + \delta_{st} + \varepsilon_{it} \end{aligned} \tag{5}$$

Specification (3) examines the impact of disclosure regulation on the personal judgment of analysts about firms' creditworthiness (*Credit Analyst Opinion*$_{it}$). The personal judgment of analysts is one of the main elements that determines the final credit rating and is supposed to take into account all available private and public information. Similar to other CRAs, the personal judgment of the analysts explains approximately 25% of the variability in firms' credit ratings (Fracassi et al., 2016). If reputational concerns drive the credit rating downgrades, we expect to find that credit analysts provide more conservative opinions after disclosure regulation.

Specification (4) tests whether changes in credit analysts' opinions determine the change in the credit rating index. If the personal judgment of analysts drives our prior results, documented in Table 3, we expect to find that the increase in credit rating downgrades will be muted once we control for any changes that might occur in analysts' personal judgments.

Specification (5) tests whether any other element used in the credit rating model of Creditreform changes the impact we documented in Table 3. Hence, the last specification controls for all other available credit rating inputs that, according to Creditreform, are

[13] (0.177 + 0.229+0.098 + 0.103+0.604 + 0.327)/6 ≈ 0.256 ≈ 1/4.

[14] The Credit Rating Index and the recommended amount of trade credit have a correlation of 0.706. Credit reports reveal that the average recommended amount of trade credit to a supplier is €28,356 for firms with an average rating of BBB and €24,586 for firms with a one-notch lower rating (BBB-), or a 13% reduction in the recommended amount of trade credit ((€24,586-€28,356)/€28,356). In Section 3.5 Economic Relevance, we will examine in more detail how creditors react to disclosure-induced changes in ratings.

[15] Similarly, Germany introduced a corporate tax code reform (UntStRefG) in 2008 that reduced limited liability and unlimited liability firms' tax rates. If tax rates for unlimited liability firms had been reduced more drastically, this might have served as an indirect explanation for the change in ratings. We note, however, that the reform favored limited liability companies more. Hence, if anything, the more favorable tax rates for limited liability companies would work against our findings. This is also inconsistent with our findings that the main driver of the change in credit ratings is a shift in credit analysts' opinions rather than changes in firm fundamentals.

Table 4
Reporting regulation and credit analyst OPINION.

Outcome	Credit Analyst Opinion	Credit Rating Index	Credit Rating Index
Column	(1)	(2)	(3)
Treated x Post	0.098***	−0.076***	0.382***
	(0.011)	(0.018)	(0.041)
Log (Sales +1)			−0.374***
			(0.031)
Log (Age)			−0.540***
			(0.022)
Log (Equity +1)			−0.142***
			(0.007)
Log (Productivity +1)			0.414***
			(0.032)
Log(Employees +1)			0.286***
			(0.036)
Firm FE	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes
Year-County FE	Yes	Yes	Yes
Credit Analyst Opinion FE	No	Yes	No
Payment Behavior FE	No	No	Yes
Order Situation FE	No	No	Yes
Business Development FE	No	No	Yes
Covariates x Post	No	No	Yes
Observations	1,468,247	1,468,247	1,468,247
Clusters (County)	443	443	443
R-squared	0.620	0.908	0.838

Notes: This table presents OLS regressions on credit analysts' opinions and firms' credit ratings. Treated firms are limited liability firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. The control group consists of German unlimited liability firms with the legal forms OHG or KG that were not required before or after 2007 to disclose financial statements. *Post* is a dummy variable equal to 1 for all firms for the years after 2007, i.e., when the financial statements of treated firms became publicly available. The credit analyst opinions range from 1 (best possible opinion) to 5 (worst opinion). The credit rating index ranges from 1 (AAA) to 21 (C). A positive (negative) coefficient indicates that the credit rating/opinion gets worse (better). Results using the two alternative control groups are reported in Online Appendix Table A4. Variable definitions are provided in the Appendix. Heteroscedasticity-robust standard errors are clustered at the county level and are presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

used: sales, employees, age, productivity, equity, payment behavior, order situation, and business development. Since we include firm fixed effects in our regression, we also control for other aspects, such as legal form, industry, and regional differences that are time invariant. In addition, we interact all controls with the post-time dummy to take into account that our controls might have a differential impact on credit ratings after the regulatory reform. All continuous control variables are log(X+1) transformed. Dummy variables are added for each value of the categorical variables that the CRA uses (e.g., payment behavior).[16] If the reputational concerns hypothesis drives our main finding in Table 3, the inclusion of these additional variables in specification 5 should not downward bias the β_1 coefficient.

Table 4 summarizes the results. For brevity's sake, we report only the results for our main control group, unlimited liability firms. Results for the other control groups are in line with those in Table 4 and are available in the Online Appendix (Table A4). Column 1 in Table 4 shows that credit analysts provide a worse credit opinion about firms in response to increased corporate financial transparency. In Column 2, we control for changes in analysts' opinions when estimating the impact of disclosure regulation on credit ratings. As the coefficient of our DiD estimator considerably declines, it seems that the change in the personal assessments of the credit analysts drives the less favorable credit ratings that we documented in Table 3. The sign of the coefficient even switches from positive to negative, suggesting that credit ratings would have improved due to disclosure regulation if analysts had not revised their personal opinions in the opposite direction. In Column 3 of Table 4, we do not control for the credit analysts' opinions but do control for all other information that Creditreform uses to construct the ratings. In this specification, we observe that the disclosure effect is comparable to our baseline results in Table 3. If anything, the coefficient of our DiD estimator becomes more positive once we consider changes in firm characteristics. Hence, the positive coefficient documented in Table 3 cannot be explained by changes in the other credit rating inputs. Taken together, these results suggest that the estimated rating reduction is driven by changes in the credit analysts' personal assessments, and not by changes in firm fundamentals.

3.2.3. Matched sample, effects over time, and parallel trends assumption

To further increase confidence in the identification, we test our models based on a matched sample of treated firms that are comparable to the control group firms across all control variables, including industry and regional differences. This exercise addresses concerns that treated firms might be clustered in regions or industries where disclosure regulation had particularly pronounced effects.

[16] Our results are unaltered if we also include all accounting items available in the financial statements as additional controls.

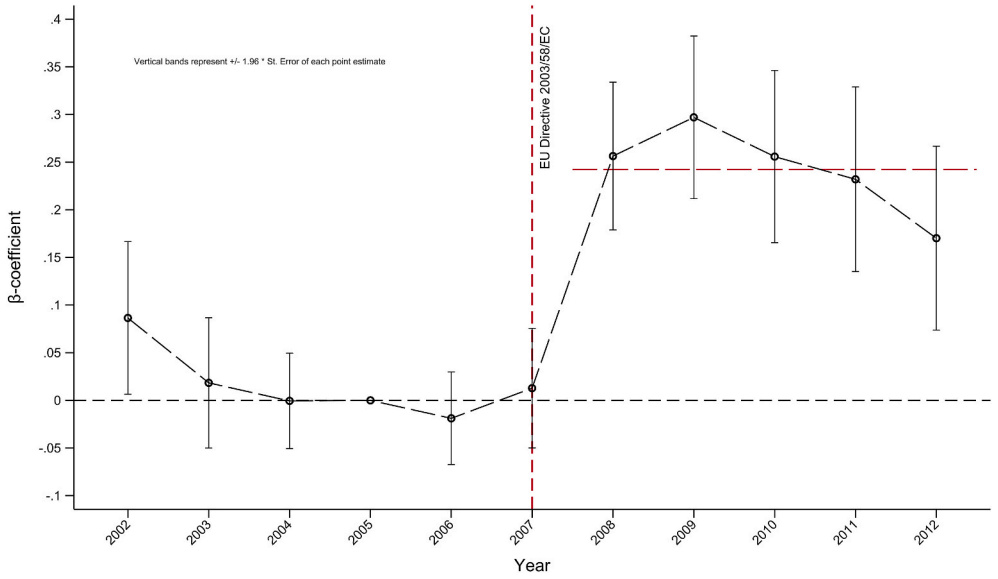

Fig. 1. Average difference in credit ratings between treated and control group over time.

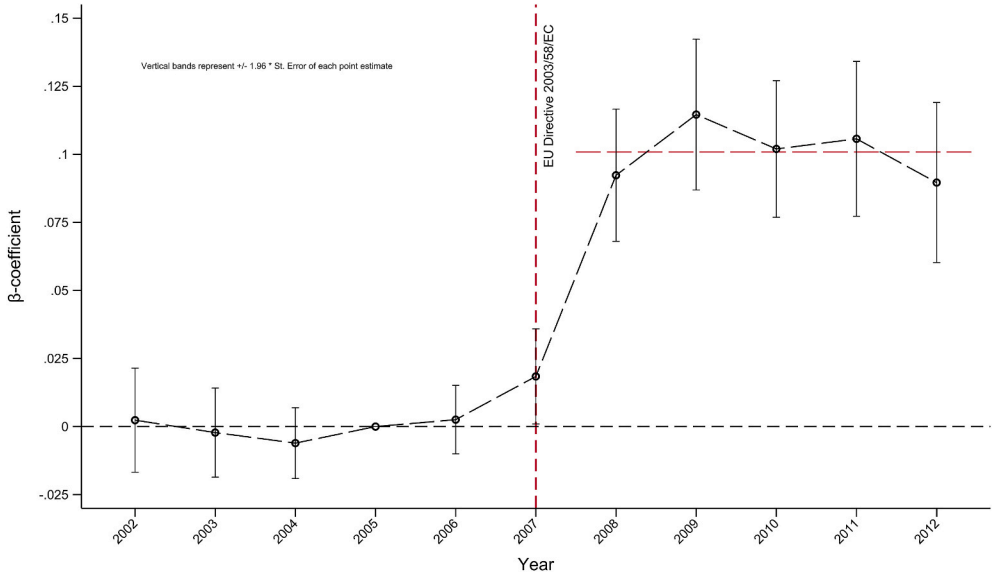

Fig. 2. Average Difference in Analyst opinion between Treated and Control Group Over Time.

Specifically, we employ Mahalanobis nearest-neighbor matching, where we only consider treated firms that are most comparable to a given control group firm. Re-estimating our baseline models on the matched sample reveals consistent results (see Table A5 in the Online Appendix).

If changes in reputational concerns among analysts were driving our results, we would also expect the effect to remain constant over time. We empirically examine the impact over time by re-estimating our DiD model with coefficients β_t separately added for each year before and after the regulatory change.

Fig. 1 through 4 illustrate the results, showing that after the reform, the estimated impact stays relatively constant over time.[17] In all models, we also find economically insignificant differences between the treated and non-treated firms before 2007, supporting the parallel trends assumption. We do note, however, a minor uptick in Figs. 2 and 4 for the year 2007. Although this could be interpreted as a breach of parallel trends, it more likely indicates early voluntary compliance by a subset of treated firms (Bernard et al., 2021).

[17] Online Appendix Figures A2 to A7 present similar graphs using the matched sample and for our two alternative control groups.

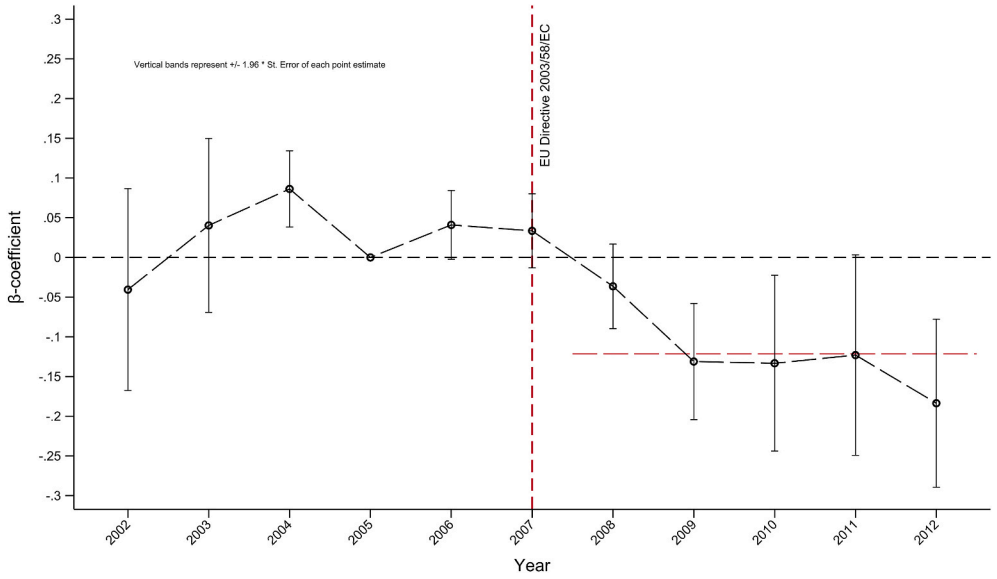

Fig. 3. Average difference in credit ratings between treated and control group over time controlling for credit analylst opinion.

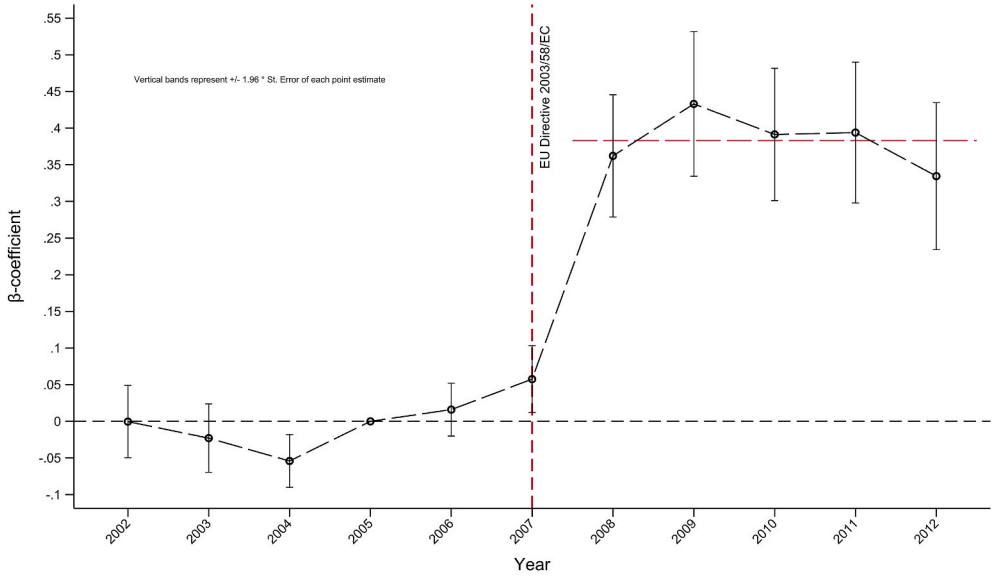

Fig. 4. Average difference in credit ratings between treated and control group over time controlling for other credit rating information inputs.

This interpretation is in line with the German practitioner literature, which reports that despite the typical one-year delay between the fiscal year-end and the filing of financial statements by German firms, a portion of German private firms had already proactively filed their financial statements in the latter half of 2007 (Henselmann and Kaya, 2009).

Our main findings can thus be summarized as follows: Firms receive a significantly worse credit rating once they start to disclose to the public (Fig. 1). A similar effect is observed when we examine the impact on credit analysts' opinions, which is one of the main inputs influencing the final credit rating (Fig. 2). Once we control for changes in credit analysts' opinions, our model suggests that credit ratings would actually have improved (Fig. 3). In other words, firms receive, on average, more conservative ratings after public disclosure regulation, and this effect is entirely driven by changes in analysts' personal assessments of firms' creditworthiness. Fig. 4 further confirms our main findings. If we control for all other information used to construct the final rating, this does not explain the change in credit rating conservatism illustrated by Fig. 1. Taken together, these results suggest that the change in credit ratings is not driven by changes in firm fundamentals but by changes in the subjective opinions of the analysts.

Table 5
Reporting regulation and credit rating accuracy.

Outcome	Default		Payment Behavior		Type II Error		
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated x Post	−0.026***	−0.007**	−0.004	−0.015*	0.0427***	0.0496***	−0.0107**
	(0.003)	(0.003)	(0.007)	(0.008)	(0.008)	(0.011)	(0.005)
Log (Sales +1)		0.008*		−0.030***		−0.0394***	−0.0234**
		(0.004)		(0.009)		(0.012)	(0.009)
Log (Age)		0.158***		−0.040***		−0.3010***	−0.2785***
		(0.004)		(0.005)		(0.006)	(0.006)
Log (Equity +1)		0.001		0.003		−0.0136***	−0.0227***
		(0.001)		(0.002)		(0.002)	(0.001)
Log (Productivity +1)		−0.011**		0.028***		0.0509***	0.0340***
		(0.004)		(0.009)		(0.012)	(0.010)
Log (Employees +1)		−0.019***		0.006		0.0327**	0.0308***
		(0.005)		(0.010)		(0.014)	(0.011)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit Analyst Opinion FE	No	No	No	No	No	No	Yes
Payment Behavior FE	No	Yes	No	No	No	Yes	Yes
Order Situation FE	No	Yes	No	Yes	No	Yes	Yes
Business Development FE	No	Yes	No	Yes	No	Yes	Yes
Additional Controls x Post	No	Yes	No	Yes	No	Yes	Yes
Observations	1,767,631	1,767,631	1,767,631	1,767,631	1,767,631	1,767,631	1,767,631
Clusters (County)	444	444	0.589	0.598	444	444	444
R-squared	0.342	0.376	443	443	0.575	0.633	0.692

Notes: This table presents OLS regressions on defaults and type II errors. Treated firms are limited liability firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. The control group consists of German unlimited liability firms with the legal forms OHG or KG that were not required before or after 2007 to disclose financial statements. *Post* is a dummy variable equal to 1 for all firms for the years after 2007, i.e., when the financial statements of treated firms became publicly available. Default is equal to 1 if the firm defaults in the next year and 0 otherwise. Payment behavior ranges from 1 (lowest credit risk) to 6 (highest credit risk). Type II Error equals 1 when an analyst provides a speculative rating (i.e., credit rating of BB + or worse) but the firm does not default in the next year; it equals 0 otherwise. Results using the two alternative control groups are reported in Online Appendix Table A7. Variable definitions are provided in the Appendix. Heteroscedasticity-robust standard errors are clustered at the county level and are presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

3.2.4. *Alternative quasi-natural experiment: MicroBilg*

To address remaining concerns regarding the specific timing of the EU disclosure directive, we rerun our analyses using an alternative quasi-natural experiment. As discussed in the institutional setting section 2.2, Germany enacted another change in its disclosure regulation for a large share of firms at the end of 2012. The Small Capital Companies Accounting Law Amendment Act (MicroBilg) allowed the smallest firms within the economy to disclose less information to the public (e.g., fewer notes and less detailed balance sheet information). This change significantly impacted the number of publicly available financial statements (see Gassen and Muhn, 2023, for more details). In this setting, we would thus expect findings that were the opposite of what our results showed. Following disclosure deregulation, we expect that firms would receive more favorable opinions from analysts.

Table A6 in the Online Appendix reports our results. In summary, we find that firms that are eligible to reduce public disclosure experience an upgrade in credit ratings and receive more favorable opinions from analysts compared to firms that remained subject to more stringent reporting requirements. Importantly, we observe that the effect of deregulation on credit ratings becomes less pronounced once we control for the credit analysts' opinions in our analyses. Overall, we find consistent evidence across different settings and when using multiple control groups, all of which support the idea that analysts issue more conservative credit ratings when firms are mandated to disclose information to the public.

3.3. *Accuracy of credit ratings*

As discussed earlier, an additional consequence of the reputational concerns hypothesis is that the accuracy of ratings declines. Evidence of reduced accuracy would further rule out the notion that changes in analysts' opinions and the observed rating downgrades are justified.

To empirically examine changes in rating accuracy following disclosure regulation, we adopt the approach of Baghai et al. (2014). Specifically, we examine the impact of disclosure regulation on defaults and on firms' payment behavior toward suppliers. Should we observe a decrease in defaults and improvement in payment behavior, it would further support the argument that credit analysts provide overly conservative ratings that are not justified relative to firms' objective default risk. In contrast, an increase in defaults would suggest that the lower ratings might be justified by correctly updated beliefs about the actual creditworthiness of the firm.

As an alternative test, we follow Cheng and Neamtiu (2009) and Dimitrov et al. (2015) and examine how the likelihood of type I and type II errors changes after financial statements become publicly available. If the disclosures lead to an improvement of credit

Table 6
The use of positive private information and negative public information by credit analysts.

Outcome	Positive Credit Opinion when Positive Private Information is Received		Negative Credit Opinion when Negative Public Information is Received	
Column	(1)	(2)	(3)	(4)
Treated x Post	−0.068***	−0.082***	0.054***	0.070***
	(0.010)	(0.014)	(0.007)	(0.008)
Log (Sales +1)		0.037***		−0.069***
		(0.009)		(0.014)
Log (Age)		0.040***		0.146***
		(0.007)		(0.009)
Log (Equity +1)		−0.012***		0.008***
		(0.002)		(0.001)
Log (Productivity +1)		−0.038***		0.011
		(0.010)		(0.014)
Log(Employees +1)		−0.016		0.003
		(0.011)		(0.016)
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
Year-County FE	Yes	Yes	Yes	Yes
Payment Behavior FE	No	Yes	No	Yes
Order Situation FE	No	Yes	No	Yes
Business Development FE	No	Yes	No	Yes
Additional Controls x Post	No	Yes	No	Yes
Observations	1,468,247	1,468,247	1,468,247	1,468,247
Clusters (County)	443	443	443	443
R-squared	0.638	0.654	0.445	0.470

analysts' creditworthiness assessments, we expect both error types to decline. Following prior literature, we define type II errors as when a firm receives a speculative rating (i.e., a credit rating of BB + or worse) but the firm does not default in the next year. Type I errors occur when an analyst provides an investment rating (i.e., a credit rating of BBB- or better) but the firm defaults in the next year. If the reputational concerns hypothesis holds, we expect that type II errors will increase.

Table 5 supports the idea that the disclosure-induced credit rating downgrades are unwarranted. Firms that disclose financial statements are less likely to default (Columns 1 and 2) despite documented declines in their ratings (see Table 3 above). If anything, the payment behavior of firms also seems to improve (Columns 3 and 4). These findings reinforce the notion that credit analysts provide overly conservative ratings after disclosure regulation.

Our findings are further supported by an increase in type II errors. Columns 5 and 6 show that type II errors are 9% more likely to occur for treated firms after the law change (an average absolute marginal change of 4.27 percentage points).[18] Column 7 reveals that once we control for the analysts' opinions in our analyses, the direction of the disclosure effect reverses. These results confirm that credit analysts' more conservative opinions drive the increase in type II errors. In Online Appendix Table A7, we report the impact of financial statement disclosure on type I errors. The evidence of the effects on type I errors is mixed and depends on the specification (see Table A7 Panels E and F). Results using the alternative control groups and alternative outcome variables (e.g., a more stringent definition of type I and type II errors or a firm's order outlook) are reported in Online Appendix Table A7. These results largely corroborate our main results.[19]

Taken together, our accuracy tests support the notion that the estimated rating downgrades are not justified by changes in firms' creditworthiness. Indeed, our findings indicate that firms' creditworthiness improves due to disclosure regulation (e.g., improvement in payment behavior and lower default rates). This is consistent with prior literature documenting various capital market benefits of improved disclosure regulation (Leuz and Wysocki, 2016). These benefits, however, do not seem to manifest themselves in better ratings because the negative impact of reputational concerns outweighs the positive effects.

3.4. Underlying mechanisms

3.4.1. Crowding out private information

Next, we examine the underlying mechanism behind the finding that analysts tend to err on the side of being overly conservative in their ratings. As previously highlighted, theoretical models predict that public disclosure of information can have adverse effects

[18] The average type II error in our sample is 0.4522. The likelihood thus increases by 0.0427/0.4522 ≈ 9%.

[19] Across all control groups and in nearly all specifications used to measure credit rating accuracy, we consistently find the same sign for the coefficients of interest as reported in Table 5. One exception exists when comparing treated firms with German limited liability firms that voluntarily disclosed information before the reform. In this specific case, we observe an increased likelihood of default that diverges from the overarching trends in the data. However, it is important to note that other key metrics, such as type II errors or alternative measures (e.g., a firm's order outlook), remain consistent with our general findings. We suspect that the rarity of default occurrences in this particular control group may be driving this inconsistency in default likelihood.

Table 7
Quantile regressions.

Outcome	Credit Rating Index				
Quantile	Quantile 20	Quantile 40	Quantile 50	Quantile 60	Quantile 80
Column	(1)	(2)	(3)	(4)	(5)
Treated x Post	−0.090	0.132***	0.425***	0.605***	0.249***
	(0.096)	(0.039)	(0.041)	(0.068)	(0.063)
Treated	3.109***	1.148***	1.074***	1.171***	1.378***
	(0.140)	(0.037)	(0.054)	(0.072)	(0.061)
Log (Sales +1)	−1.214***	−1.229***	−1.444***	−1.384***	−1.111***
	(0.035)	(0.079)	(0.108)	(0.142)	(0.127)
Log (Age)	−0.301***	−0.364***	−0.408***	−0.452***	−0.413***
	(0.008)	(0.013)	(0.019)	(0.017)	(0.012)
Log (Equity +1)	−0.198***	−0.141***	−0.121***	−0.119***	−0.164***
	(0.005)	(0.007)	(0.006)	(0.007)	(0.006)
Log (Productivity +1)	1.163***	1.157***	1.308***	1.223***	1.036***
	(0.034)	(0.079)	(0.100)	(0.139)	(0.113)
Log(Employees +1)	1.087***	1.029***	1.184***	1.064***	0.831***
	(0.042)	(0.089)	(0.105)	(0.166)	(0.139)
Constant	4.290***	6.338***	6.694***	7.033***	6.979***
	(0.174)	(0.199)	(0.425)	(0.239)	(0.183)
Year FE	Yes	Yes	Yes	Yes	Yes
Payment Behavior FE	Yes	Yes	Yes	Yes	Yes
Order Situation FE	Yes	Yes	Yes	Yes	Yes
Business Development FE	Yes	Yes	Yes	Yes	Yes
Observations	1,468,247	1,468,247	1,468,247	1,468,247	1,468,247
Clusters (County)	443	443	443	443	443
R-squared	0.540	0.556	0.556	0.553	0.559

Notes: This table presents quantile regressions of credit ratings. Treated firms are limited liability firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. The control group consists of German unlimited liability firms with the legal forms OHG or KG that were not required before or after 2007 to disclose financial statements. *Post* is a dummy variable equal to 1 for all firms for the years after 2007, i.e., when the financial statements of treated firms became publicly available. The credit rating index ranges from 1 (AAA) to 21 (C). A positive (negative) coefficient indicates that the credit rating gets worse (better). Results using the two alternative control groups are reported in Online Appendix Table A9. Variable definitions are provided in the Appendix. Heteroscedasticity-robust standard errors are clustered at the county level and presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

because it crowds out the effective usage of private information. This occurs because informed professionals care about their reputations with uninformed decision makers (Scharfstein and Stein, 1990; Morris, 2001; Ottaviani and Sørensen, 2006). Credit analysts may be reluctant to use their private information because rating failures based on private information are more likely to be attributed to alleged misclassifications than rating failures based on public information (Mariano, 2012). Given that credit analysts are penalized more heavily for overly optimistic ratings than for overly pessimistic ratings (Bolton et al., 2012; Dimitrov et al., 2015; Xia, 2014), we expect that analysts will be less likely to use private information that positively deviates from public information in their assessments.

To test this prediction, we draw on information that analysts receive through private or public channels and examine how positive and negative information from these sources affects their credit opinions. We construct two indicators. The first is equal to one if analysts provide a positive opinion when they receive a positive private signal; it equals zero otherwise. We define a positive private signal as information received from suppliers or banks upon a firm's timely repayment of its debt. Second, we construct a variable to measure how negative public information influences analysts' credit opinions. Hence, we create an indicator variable that is equal to one if an analyst provides a negative opinion upon receiving a negative public signal and zero otherwise. A negative public signal is measured by a dichotomous variable that equals one when revenue decreases compared to the prior year and zero otherwise. In alternative tests, we measure negative public signals by negative employment and productivity growth rates. Our results are robust to these alternative specifications (see Online Appendix A8).

Table 6 shows the results using our baseline DiD design. We find that analysts are, on average, 13.14% less likely to provide a positive opinion about a company when they observe a positive private signal (in Column 2, a decrease of 0.082 from the sample average of 0.624) and 31.53% more likely to provide a negative opinion when they observe a negative public signal (in Column 4, an increase of 0.070 from the sample average of 0.222). These results are consistent with the idea that analysts are less likely to use private information that positively deviates from public information in their risk assessments because they are concerned about receiving complaints should a rating failure occur. These findings align with the predictions of herding models and more recent theoretical models suggesting that public information may crowd out the effective usage of private information (e.g., Goldstein and Yang, 2017; Morris and Shin, 2002).

3.4.2. Reputational concerns

In Tables 3 and 4, we show that on average, analysts err on the side of giving overly conservative ratings. We would expect a more pronounced effect where reputational damage is more likely to occur. As explained earlier, analysts are particularly concerned about missing a default (Bolton et al., 2012; Xia, 2014). Reputational concerns are thus particularly likely to manifest when there is a realistic

Table 8
Reporting regulation and career concerns.

Outcome	Credit Expert Opinion		Credit Rating Index	
Column	(1)	(2)	(3)	(4)
Treated x Post x Past Errors	3.554***	3.624***	9.999***	9.990***
	(0.601)	(0.618)	(2.470)	(2.114)
Treated x Post	0.081***	0.098***	0.180***	0.335***
	(0.011)	(0.014)	(0.035)	(0.041)
Post x Past Errors	−3.008***	−3.149***	−8.472***	−8.962***
	(0.578)	(0.604)	(2.395)	(2.096)
Log (Sales +1)		−0.051***		−0.374***
		(0.010)		(0.031)
Log (Age)		−0.035***		−0.540***
		(0.007)		(0.022)
Log (Equity +1)		0.013***		−0.142***
		(0.003)		(0.007)
Log (Productivity +1)		0.054***		0.414***
		(0.011)		(0.032)
Log(Employees +1)		0.031***		0.286***
		(0.012)		(0.036)
Firm FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
Year-County FE	Yes	Yes	Yes	Yes
Payment Behavior FE	No	Yes	No	Yes
Order Situation FE	No	Yes	No	Yes
Business Development FE	No	Yes	No	Yes
Additional Controls x Post	No	Yes	No	Yes
Observations	1,468,247	1,468,247	1,468,247	1,468,247
Clusters (County)	443	443	443	443
R-squared	0.620	0.669	0.696	0.838

Notes: This table presents OLS regressions on credit analysts' opinions. Treated firms are limited firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. The control group consists of German unlimited liability firms with the legal forms OHG or KG that were not required before or after 2007 to disclose financial statements. *Post* is a dummy variable equal to 1 for all firms for the years after 2007, i.e., when the financial statements of treated firms became publicly available. The credit analyst opinions range from 1 (best possible opinion) to 5 (worst opinion). The credit rating index ranges from 1 (AAA) to 21 (C). A positive (negative) coefficient indicates that the credit rating/opinion gets worse (better). Results using the two alternative control groups are reported in Online Appendix Table A10. Variable definitions are provided in the Appendix. Heteroscedasticity-robust standard errors are clustered at the county level and are presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

possibility that a default will occur. Therefore, it is likely that the effects documented earlier will be weaker or even muted for AAA-rated companies because these companies are highly unlikely to default within a year. Similarly, if a company already received a highly speculative rating (e.g., CCC rated or worse), this would likely already serve as sufficient protection for the analyst's reputation. In such cases, analysts may not feel pressured to further downgrade a rating. Hence, we expect to find a more pronounced effect for firms that have a rating around the investment/speculative grade cutoff, while firms in the tails of the rating distribution are likely to be unaffected.

To evaluate whether we observe varying effects across the credit rating distribution, we estimate quantile regressions based on the methods of Meyer and Viscusi (1995) and Parente and Santos Silva (2016). Table 7 reports quantile regressions for quantiles 20, 40, 50, 60, and 80 using our main control group. We find an insignificant effect for firms with superior credit ratings (Column 1, firms with approximately A ratings). The effect gradually increases as we move down the rating scale and seems to be most pronounced for firms around quantile 60 (i.e., firms with approximately BBB- ratings). When we go even further down the rating scale, the impact of public disclosure on credit rating conservatism becomes less pronounced again (Column 5, firms with approximately BB- ratings). Online Appendix Table A9 reports the results for our alternative control groups and reveals similar patterns across the credit rating distribution. The effect even becomes insignificant in quantile 80 when using Austria Limited Companies as an alternative control group. Due to the rarity of AAA and CCC ratings (see Baghai et al., 2014), we cannot compute the impact for these specific quantiles. Overall, our empirical results strongly support the notion that analysts strategically provide more conservative ratings to firms for which they are most likely to expect complaints about rating failures.

3.4.3. Career concerns

Next, we examine whether credit analysts who have provided inaccurate credit ratings in the past are more inclined to issue more conservative opinions after the disclosure mandate. We expect that this particular group of analysts faces pressure to provide more conservative ratings as they might fear losing their jobs if any additional clients complain about their inaccurate ratings.

Our database lacks credit analysts' identifiers, but we can estimate prior analysts' errors at the industry-office level. Creditreform has 130 local offices in Germany, each with a regional monopoly and specialized analysts. We proxy for analyst errors by counting mistakes within each office-industry cluster (i.e., errors within county-NACE4). Given the small number of specialized analysts per

Table 9
Change in sensitivity – average marginal effects across groups.

Panel A: Sensitivity between Bank Debt and Credit Ratings (No Controls)				
				Difference Pre- and Post-Period
Control Pre:	−1.818***	Control Post:	−2.141***	−0.323
	(0.241)		(0.250)	(0.249)
Treated Pre:	−2.478***	Treated post:	−1.752***	0.727***
	(0.087)		(0.055)	(0.087)
		Difference-in-Differences in Sensitivity:		1.045***
				(0.266)
Panel B: Sensitivity between Trade Credit and Credit Rating Index (No Controls)				
				Difference Pre- and Post-Period
Control Pre:	−1.578***	Control Post:	−1.830***	−0.252
	(0.189)		(0.185)	(0.223)
Treated Pre:	−2.110***	Treated post:	−1.991***	0.119***
	(0.056)		(0.048)	(0.068)
		Difference-in-Differences in Sensitivity:		0.371
				(0.241)
Panel C: Sensitivity between Bank Debt and Credit Rating Index (With Controls)				
				Difference Pre- and Post-Period
Control Pre:	−0.524***	Control Post:	−0.639***	−0.115
	(0.108)		(0.119)	(0.120)
Treated Pre:	−0.491***	Treated post:	−0.140**	0.351***
	(0.062)		(0.067)	(0.040)
		Difference-in-Differences in Sensitivity:		0.467***
				(0.132)
Panel D: Sensitivity between Trade Credit and Credit Rating Index (With Controls)				
				Difference Pre- and Post-Period
Control Pre:	−0.316***	Control Post:	−0.451***	−0.135
	(0.080)		(0.094)	(0.097)
Treated Pre:	−0.348***	Treated post:	−0.206***	0.143***
	(0.052)		(0.053)	(0.030)
		Difference-in-Differences in Sensitivity:		0.278***
				(0.101)

Notes: This table presents sensitivity statistics between credit ratings and debt. Sensitivities across groups and time periods are calculated using the coefficients reported in Online Appendix Table A11. Panels A and B show the results using OLS models without incorporating credit rating information inputs as controls; Panels C and D include these inputs as controls. Treated firms are limited liability firms operating in Germany with the legal forms GmbH or GmbH Co. KG that were obliged to disclose financial statements after 2007. The control group consists of German unlimited liability firms with the legal forms OHG or KG that were not required before or after 2007 to disclose financial statements. *Post* is a dummy variable equal to 1 for all firms for the years after 2007, i.e., when the financial statements of treated firms became publicly available. Variable definitions are provided in the Appendix. Heteroscedasticity-robust standard errors are clustered at the county level and are presented in parentheses. ***, **, and * indicate a significance level of 1%, 5%, and 10%, respectively.

office, this should approximate individual analyst mistakes. In our DiD model, we interact this measure with our Treated and Post variables, resulting in the following specifications:

$$Credit\ Analyst\ Opinion_{it} = \beta_1 \cdot\ Treated_i \times Post_t \times \text{Past Errors}_i + \beta_2 \cdot Treated_i \times Post_t + \beta_3 \cdot Past_t \times \text{Past Errors}_i + f_i + \alpha_{ct} + \delta_{st} + \varepsilon_{it} \quad (6)$$

In equation (6), Past Errors is calculated as the sum of all the errors made prior to 2007 within an office-industry cluster, scaled by all ratings provided within that office-industry cluster in that period.[20]

Table 8 presents results that, like our main results in Table 3, show that credit analysts give more conservative opinions after disclosure regulation. However, the effect is significantly more substantial for analysts who have made prior rating mistakes. It is consistent with the idea that this group of analysts will be particularly motivated to avoid blame for future rating failures due to increased job security concerns. Overall, the results in Tables 6–8 support our hypothesis that disclosure regulation triggers reputational concerns, which lead to more conservative ratings.

[20] Specifically, we define an error as when a company received an investment grade (i.e., a BBB- or better) but defaulted within the following year. Given that this variable is time invariant, the main effect and its interaction with treated firms are omitted from the model because we include firm and year fixed effects.

3.5. Economic relevance

3.5.1. Credit ratings and their impact on firms' access to debt: an examination of sensitivity over time

Lower credit ratings typically decrease firms' ability to attract external capital (e.g., Hand et al., 1992; Kliger and Sarig, 2000). However, prior studies also suggest that debt yields are shaped by factors other than ratings (e.g., Campbell and Taksler, 2003), and market participants view rating conservatism as an additional factor to consider when pricing debt (Baghai et al., 2014). If credit providers realize that the increase in downgrades is unwarranted, they might change their reliance on credit ratings once firms are mandated to disclose financial information. As a consequence, debt providers might become more reluctant to rely exclusively on credit ratings when making lending decisions, thereby (partially) mitigating the impact of more conservative ratings on firms' access to credit. We shed light on this issue by examining the sensitivity of firms' debt to credit ratings. Since banks and suppliers buy credit reports to determine the amount of (trade) credit they provide, we expect that (a) credit ratings will be highly correlated with firms' access to debt, (b) the sensitivity will decrease over time if credit providers recognize that credit analysts provide less accurate ratings, and (c) the sensitivity of bank debt to credit ratings will decrease more strongly compared to the sensitivity of trade credit to credit ratings. This is because trade credit providers – generally small private firms – often lack the financial expertise and the resources to verify the accuracy of credit ratings. As a result, they are less likely to recognize that credit analysts are providing overly conservative ratings, and thus are inclined to authorize credit in accordance with these conservative ratings.

To assess the sensitivity between debt and credit ratings, we make use of balance sheet data that is available for German firms.[21] We estimate the following DiD model:

$$Log(Debt)_{it} = \beta_1 \cdot Treated_i \times Post_t \times \text{Log(Credit Rating Index)}_{it} + \beta_2 \cdot Treated_i \times Post_t + \beta_3 \cdot Past_t \times \text{Log(Credit Rating Index)}_{it} + \beta_4 \cdot Treated_i \times \text{Log(Credit Rating Index)}_{it} + \beta_5 \cdot Treated_i + \beta_6 \cdot Post_i + \varepsilon_{it} \quad (7)$$

where the dependent variable, $Log(Debt)_{it}$, represents either the total bank debt or the total trade credit observed on a firm i's balance sheet in year t. We take the log of the Credit Rating Index so that the coefficients can be interpreted as elasticities. We also demean the log of the Credit Rating Index to ease interpretation. The model allows us to assess how the sensitivity between debt and credit ratings changes across the treated and control groups over time. In this specification, we do not include credit rating inputs as control variables as they would essentially capture the sensitivity between debt and credit ratings that we are interested in.

In a follow-up test, we do include all control variables as well as firm and year fixed effects. This specification alters the interpretation of our main variable of interest. Specifically, it allows us to assess how changes in credit ratings affect changes in debt, conditional on keeping all credit rating inputs constant. In other words, we assess how firms access to debt changes through rating changes that cannot be explained by changes in credit rating inputs or firm fundamentals.

To ease the interpretation of our results, we use the coefficients from the regression output of equation (7) (available in Online Appendix Table A11) and calculate the sensitivity between debt and credit ratings for the treated and control groups in both the pre- and post-treatment period. Table 9 Panel A and B show that the sensitivity between credit ratings and debt is negative in all cases. Hence, worse credit ratings consistently lead to lower debt volumes for treated and control firms in both the pre- and post-period. More importantly, the sensitivity between ratings and bank debt decreases on average by 29% for treated firms (Table 9 Panel A; i.e., an increase of 0.727 from the sample average of −2.478), while the trade credit volume to credit rating sensitivity declines at a magnitude of only 6% for treated firms (Table 9 Panel B; i.e., an increase of 0.119 from the sample average of −2.110). In comparison, we do not observe any significant changes in sensitivity for our control group. Similarly, when comparing the DiD change in sensitivity between trade credit and bank debt, we observe a significantly larger decrease in sensitivity for bank debt compared to trade credit (approximately three times larger).

In Panels C and D, we present the results where we control for all credit rating inputs in our model (regression output available in Online Appendix Table A11). Conditional on all inputs, we again find that the sensitivity between credit rating and bank debt decreases more strongly as compared to the sensitivity between credit rating and trade credit. These results imply that, even if no changes occurred in firm fundamentals, firms would still receive less debt when they received an unwarranted rating downgrade. When firms are required to disclose information to the public, however, these unwarranted changes in ratings have a lower effect on access to debt (i.e., a decrease of 71% in bank debt sensitivity compared to a decrease of 41% in trade credit sensitivity for treated firms). Results using the alternative control group with available debt data are consistent with this finding (see Online Appendix Table A12).

Hence, our results reveal that the sensitivity between bank debt and credit ratings decreases significantly when firms are required to disclose financial statements. The persistently strong sensitivity of trade credit volume to credit ratings suggests that a change to more conservative ratings could lead to a decrease in the average amount of trade credit volume for these firms. However, it is important to note that our results report a slight, albeit notable, decrease in sensitivity between trade credit and ratings. This indicates that some trade credit providers do adjust their reliance on credit ratings following disclosure regulation. In addition, when examining the direct impact of disclosure regulation on trade credit and bank debt, we find that firms experience, on average, a 13% increase in trade credit

[21] In this test, we focus on firms that disclose detailed non-missing and non-zero debt data in their balance sheets. Online Appendix Table A13 shows that our prior results hold for this subsample of firms. We note that we cannot use Austrian firms as a control group for this specification. The vast majority of Austrian firms do not publicly disclose detailed debt data. In our database, and in other databases such as Orbis, such information is only available for less than 1% of Austrian firms.

and a 16% increase in bank debt after disclosure regulation (see coefficients of the variable "Treated x Post" in Online Appendix Table A11, Columns 3 and 4). Hence, consistent with prior literature, the *average* net effect of transparency on debt attraction seems to be positive (see, e.g., Deno et al., 2020). However, the relatively stronger increase in bank debt compared to trade credit suggests that bank debt financing becomes a relatively more important source of external financing for firms. This shift from trade credit to bank debt aligns with the notion that banks and trade creditors differ in their ability to accurately interpret and utilize more conservative credit ratings.

Taken together, our findings indicate that the intertwined change of public transparency and increased credit rating conservatism can lead to the deterioration of credit conditions for some firms (e.g., as a consequence of more conservative ratings) while simultaneously improving debt accessibility for others (e.g., due to transparency benefits; see Leuz and Wysocki, 2016). Those most likely to be adversely affected are firms that predominantly rely on smaller trade credit providers who are more likely to use credit ratings to determine trade credit volumes.

4. Summary and conclusion

This study demonstrated how the introduction of a mandatory disclosure regime in Germany influenced firms' credit ratings. Consistent with the idea that credit analysts become increasingly concerned about alleged rating failures following disclosure regulation, we find that analysts issue more conservative ratings. The change in ratings appears to be entirely driven by changes in the discretionary assessment of the credit analysts and not by changes in firm fundamentals. Analysts reduce the likelihood of being accused of rating failures by giving less weight to positive private information and more weight to negative public information in their risk assessments. Since these changes are not justified by changes in fundamentals (e.g., firms' payment behavior), rating accuracy declines, as evidenced by an increase in erroneous default warnings.

Professional credit providers seem to understand that the analyst-induced downgrades are not warranted. The sensitivity between credit ratings and bank debt provision declines, while unsophisticated lenders do not appear to change their reliance on credit ratings to the same extent. These results indicate that some firms might less likely receive credit in response to the analyst-induced rating downgrades, underscoring the tangible influence of disclosure regulation on financing dynamics. However, it is noteworthy that, on average, firms experience an uptick in both trade credit and bank debt following disclosure regulation. This observation suggests that the unintended impact on credit ratings is neither the only nor dominant channel through which transparency influences debt financing opportunities.

Our results call for a cautionary review of the conventional wisdom that additional disclosure of financial information unambiguously improves the information environment. It seems essential to carefully consider not only the benefits of increased corporate financial transparency but also its unintended side effects (e.g., impacts on credit ratings and unsophisticated lenders).

Given that our analysis is specific to the German institutional environment and one single CRA, more research is needed to assess the generalizability of our findings. However, since other CRAs (e.g., D&B, Experian, Credit Safe) follow a similar business model, it seems reasonable to expect similar mechanisms to apply. Future research could further explore the boundary conditions of our findings by examining the interplay among credit rating business models, levels of financial transparency, and their impact on different types of capital providers.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jacceco.2024.101676.

Variable Appendix

VARIABLE DESCRIPTION	
Treatment:	**Description**
Treated	Treated is equal to 1 for German limited-liability firms that start to disclose financial statements from 2007 onwards, 0 for firms in the control group. The control group consists of either (1) German unlimited-liability firms that were never required to disclose financial statements information to the public , (2) Austrian limited-liability companies that were already enforced to disclose financial statements from 1996 onwards, or (3) German limited-liability firms that always disclosed financial statement to the public voluntarily.
Post	Post is equal to one after 2007, 0 otherwise.

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VARIABLE	DESCRIPTION
Main Outcome:	
Credit Rating Index	Credit Rating index is the credit rating of Creditreform. The original rating ranges from 100 to 500. A rating of 600 is given to firms that defaulted. We translate the rating of Creditreform to the S&P index using the correspondence table of Creditreform. Following the prior literature, a numerical value is assigned to each rating on a notch basis as follows: AAA=1, AA+=2, AA=3, AA−=4, A+=5, A=6, A−=7, BBB+=8, BBB=9, BBB−=10, BB+=11, BB=12, BB−=13, B+=14, B=15, B−=16, CCC+=17, CCC=18, CCC−=19, CC=20, C=21. The credit rating index ranges from 1 to 21. Defaulting firms are equal to 22.
Credit Rating Inputs:	
Log (Sales + 1)	The log of sales of the firm within a year, plus 1.
Log (Age)	The log of the age of the company.
Log (Equity + 1)	The log of the total equity of the firm within a year, plus 1.
Log (Productivity + 1)	The log of the productivity of the firm within a year (measured as sales divided by employees), plus 1.
Log(Employees + 1)	The log of the number of employees within a year, plus 1.
Payment Behavior	Information from suppliers about firm's payment behavior. The payment behavior information is classified in 6 main categories. Ranging from 1, the most positive rating, to 6 which is given to firms in default. Specifically, Category 1 means that firms pay on time and utilize cash discounts; Category 2 means that firms payback within the agreed targets; Category 3 means that firms mostly pays within agreed targets, occasionally exceeding the target; Category 4 means that firms exceeded payment targets for up to 30 days; Category 5 means that firms have significant overruns of at least more than 30 days; Category 6 means that firms are in bankruptcy proceedings.
Credit Analyst Opinion	The opinion of the analysts about the creditworthiness of the firm. An analyst can classify firms in 6 main categories. Ranging from 1, the most positive rating, to 6 which is given to firms in default. Specifically, Category 1 means that business relationships and credit provision are highly recommended; Category 2 means that business relationship and credit provision are permitted; Category 3 means that Business relationship are acceptable, and credit provisions are allowed, but with limits; Category 4 means that a business relationship is acceptable, but any form of credit requires collateral; Category 5 means that any form of business relationships and credit are not advised. Category 6 means that the firm is in default, any form of business relationship and loans are rejected.
Order Situation	Information about customer orders. Firms' order situation is classified in 6 main categories. Ranging from 1, the most positive rating, to 6 the worst rating. Specifically, Category 1 means that the firm has a very good order book (growing); Category 2 means that the firm has a good order book (growing); 3 means that the situation is satisfactory (stable); 4 means that the orders are declining; 5 means that the orders are declining sharply; Category 6 is giving to firms with the worst order situation (e.g., no orders incoming, close to bankruptcy). A Category 0, exist in case the information is missing.
Business Development	Information about the general business development of the company. The business development of the company is classified in 6 main categories. Ranging from 1, the most positive rating, to 6 the worst rating. Specifically, Category 1 means that the business is expanding (growing); Category 2 means that there is a positive business development (growing); Category 3 means that the business development of the company is stable; Category 4 means that the business development of the company is stagnating; Category 5 means that the business development in is decline; Category 6 means that there is a sharp decline in the business development of the company. A Category 0, exist in case the information is missing.
Industry	The industry of the company that the firm is operating in. Certain industries have a higher risk of default compared to others, and thus receive a higher rating. In our setting, this is captured by our firm-fixed effects and year-industry fixed effects.
County	The county of the company that the firm is operating in (i.e., Kreis-level). Certain counties have a higher risk of default compared to others, and thus receive a higher rating. In our setting, this is captured by our firm-fixed effects and year-county fixed effects
Additional Variables:	
Speculative Grade	Speculative grade is equal to 1, if a firm receives a speculative grade (i.e., credit rating of BB+ or worse), 0 otherwise.
Type-Two Error	Type-Two Error is equal to 1 if the company received a speculative grade (a credit rating BB+ or worse), but do not default within the next year, 0 otherwise.
$Default_{t+1}$	Default (t+1) is equal to 1 if the company defaults the next year, 0 otherwise.
Log (Trade Credit)	The variable Log(Trade Credit) is the log of trade credit of a company. Retrieved from firms' financial statements.
Log (Bank Debt)	The variable Log(Bank Debt) is the log of bank debt of a company. Retrieved from firms' financial statements.
Past errors	The variable past errors is the number of Type-One Errors made in the period 2002 to 2006 within each 'industry - credit rating office' cluster, weighted by the number of credit ratings constructed within each 'industry - credit rating office' cluster.
Positive Credit Analyst Opinion	Positive credit analyst opinion is equal to 1 for an opinion which permits credit provisions (i.e., a score of 1 or 2 on the Credit Analyst opinion variable), 0 otherwise.
Positive Payment Behavior	Positive payment behavior is equal to 1 for all firms that pay within targets (i.e., a score of 1, 2 or 3 on the payment behavior variable), 0 otherwise.
Negative Financial statement information	Negative financial information is equal to 1 if firms experience a drop in turnover from t to t-1, 0 otherwise.

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