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Reputational shocks and the information content of credit ratings☆

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ABSTRACT

We investigate how shocks to the reputation of credit rating agencies and the subsequent introduction of stricter regulation affect investors' reaction to rating signals. We focus on three major episodes of reputational distress: the Enron/WorldCom scandals, the subprime crisis and the lawsuit against Standard & Poor's. We document a stronger response of stock investors to downgrades in the aftermath of reputational shocks, which is not, however, accompanied by an improvement in rating quality. Our results are consistent with a scenario where, following evidence of misrating, market investors conclude that ratings are generally overstated and infer greater negative information from downgrades. The effect is stronger for the investment-grade segment, where rating errors have a wider reputational impact. The introduction of new regulatory measures such the SOX Act, the CRA Reform Act and the Dodd-Frank Act, seems instead to improve rating quality and soften investors' response.

1. Introduction

> *"Considerations regarding fees, market share, profits, and relationships with issuers improperly influenced Standard & Poor's rating criteria and models,"*
> U.S. Department of Justice against Standard and Poor's (2013).

Since the bond rating business first started in the U.S. early in the twentieth century, credit rating agencies (CRAs) have acquired increasing prominence in financial markets. Over the years they became the first port of call for corporate issuers, investors and financial institutions for assessing credit risk and determining compliance with regulatory requirements. However, in the last two decades, CRAs have come under the spotlight a number of times for assigning inflated ratings not aligned with the credit quality of issuers and securities. Notable examples in this respect include the corporate failures of Enron in 2001 and WorldCom in 2002, and the subprime crisis of 2007–2008, which culminated in a civil lawsuit filed in 2013 by the U.S. government against Standard & Poor's (S&P).

Those episodes raised significant concerns about CRAs' business models and the quality of credit ratings. Numerous studies document how the adoption of the issuer-pays model led to poor governance, conflicts of interest, rating shopping and, in turn, to an overoptimistic assessment of risk.[1] The special status granted to "Nationally Recognized Statistical Ratings Organization" (NRSRO) and the excessive regulatory emphasis on credit ratings came also under scrutiny (White, 2010).

One aspect that is left unexplored by the existing literature is how shocks to CRAs' reputation are ultimately perceived by market investors. In particular, we ask whether the investors' response to rating signals changes when CRAs' reputation is at stake and what explains those changes.

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[1] See, among others, Benmelech and Dlugosz (2009), Jiang et al. (2012), Strobl and Xia (2012). A number of related studies including Becker and Milbourn (2011) and Bolton et al. (2012) discuss the effect of competition on rating shopping and rating inflation.

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The impact of CRAs' reputational shocks on the market's perception of rating signals is not obvious, *a priori*. The main role of CRAs is to act as information intermediaries, by reducing the information asymmetry between issuers and investors, and providing investors with reliable signals concerning the credit quality of issuers. When valid alternative sources of information on issuers' creditworthiness exist, we may expect market participants to turn to those sources and assign lower information content to credit ratings upon disclosure of severe rating errors made by CRAs. If this is the case, the reduced informativeness of ratings should translate into a weaker investors' reaction to rating actions.[2] However, reputational concerns are also consistent with the opposite effect. First, effective alternatives to credit ratings issued by CRAs may not be readily available, particularly in a context of rating-contingent regulation (White, 2010; Bongaerts et al., 2012; Opp et al., 2013). This produces a mechanistic reliance on ratings, which is unlikely to diminish following CRAs' reputational concerns. Second, episodes of reputational distress tend to simultaneously affect all major rating agencies, rather than one at a time, thus leaving investors short of alternative sources of information on issuers' credit quality. Because of CRAs' reputational shocks, investors become aware of rating inflation but cannot turn away from credit ratings. As a result, they infer a stronger (negative) signal about the credit quality of issuers when their ratings are finally downgraded.[3] In this scenario, the investors' response to rating downgrades strengthens when CRAs' reputation is under scrutiny. A stronger reaction is also consistent with an increase in the fundamental information content of credit ratings. This occurs when rating agencies promptly react to criticism by increasing rating quality in order to preserve their reputation (Mathis et al., 2009; Bar-Isaac and Shapiro, 2013). Following this view, investors discount the efforts that CRAs will undertake to improve ratings, and perceive rating actions in the aftermath of a reputational shock to be more informative than before. Ultimately, whether and how the investors' perception of ratings is affected by rating scandals remains an empirical question.

We investigate this question by analyzing how market investors react to announcements of rating changes. Specifically, we estimate and compare the stock price response to announcements of downgrades and upgrades in U.S. investment-grade and speculative-grade corporate issuer ratings from the leading CRAs (Moody's, S&P and Fitch) before and after the start of an episode of reputational distress. We distinguish between investment-grade and speculative-grade issuers as errors in rating investment-grade firms are likely to carry a wider reputational impact for CRAs. We look at the three most significant reputational shocks experienced by CRAs on the U.S. market over the last decades: The Enron/WorldCom failures of 2001–2002, the subprime crisis of 2007–2008, and the consequent S&P lawsuit filed by the U.S. government in 2013. While the Enron/WorldCom scandals were directly associated with rating mistakes in the corporate segment, the subprime crisis and the S&P lawsuit were triggered by misrating practices in complex products. However, those episodes exposed broader issues that undermine the quality and credibility of all types of credit ratings and, as such, are likely to affect the way investors assess corporate ratings.[4]

We find that the stock price response to downgrades strengthens significantly in the aftermath of a reputational shock, which suggests that market investors attach more weight than before to negative rating revisions. In two cases—the Enron/WorldCom bankruptcies and the subprime crisis—the stronger price reaction to downgrades is associated with investment-grade issuers. Instead, we do not observe significant changes in the response to upgrades.

A potential criticism to our analysis is that our findings may not be the direct result of CRAs' reputational losses, but of the regulatory measures introduced by the supervisory authorities to help market investors regain trust in credit ratings. If stricter regulation leads to more accurate and timely ratings, we may expect rating changes to carry a higher information content than before. The stronger investors' response to downgrades may then be the effect of the regulatory measures implemented over the years to improve rating quality: The Sarbanes–Oxley (SOX) Act was passed on July 25, 2002 after Enron's and WorldCom's filings for Chapter 11, the Credit Rating Agency Reform Act was passed on September 29, 2006 to foster transparency and competition in the rating industry, and the Dodd-Frank Wall Street Reform and Consumer Protection Act was passed on July 22, 2010 following the subprime crisis. To assess whether our findings can be explained by new regulations, we repeat the analysis around the passages of the SOX Act, the CRA Reform Act, and the Dodd-Frank Act. We observe that the stock price reaction to rating downgrades becomes, in fact, weaker (and not stronger) following a tightening in regulation.

Further, we explore to what extent changes in the investors' response to rating signals are associated with changes in rating quality. To this end, we derive and compare rating accuracy curves before and after episodes of reputational distress as well as before and after the introduction of new regulatory measures. We observe that rating quality remains essentially unchanged right in the aftermath of reputational shocks, while it increases following the implementation of stricter rules.

Taken together, our results indicate that the stronger reaction to rating downgrades observed in times of CRAs' reputational distress cannot be explained with a fundamental increase in rating quality. Rather, it seems to be consistent with the argument that investors infer from reputational shocks that ratings are, on average, overstated and will be inclined to react more to future downgrades given the uncertainty surrounding the real value of the firms being downgraded. Likewise, a softer response to downgrades after the intervention of regulators is consistent with investors realizing that ratings are less biased.

The findings are robust to the inclusion of a set of variables that are commonly viewed as standard determinants of stock abnormal returns around rating announcements. We also control for contemporaneous events that could have driven our results. At the market level, we control for a number of concurrent factors that may have altered investors' decisions, namely: (i) the market volatility (VIX); (ii) the 2001 economic downturn that occurred before the Enron/WorldCom episodes; (iii) the 2007–2009 recession that followed the onset of the subprime crisis; (iv) the Michigan Consumer Sentiment index; (v) the flows of funds into U.S. corporate equity; (vi) the slope of the yield curve. At a firm level, we derive a non-contaminated sample which excludes any event where firm-specific news (other than the rating change) that may potentially impact stock prices appear during the event window. Controlling for market-wide and firm-specific contamination does not change our results.

Our paper contributes to the literature on the information content of credit ratings. The first papers in this area are by Holthausen and Leftwich (1986), who find that investors react negatively to downgrades and positively but weakly to upgrades, and Hand et al. (1992) who find significantly negative stock and bond abnormal

[2] In the accounting literature, this prediction has been formalized by Holthausen and Verrecchia (1988) and largely tested in the context of auditors' reputational losses or analysts' forecast errors.

[3] This prediction rests on the assumption that a sufficiently high fraction of investors are naïve and take ratings at face value until CRAs' mispractices are revealed (see Bolton et al., 2012).

[4] Jiang et al. (2012), Strobl and Xia (2012) document the distortive effects of the issuer-pays model in the corporate segment, and the resulting inflation in corporate ratings.

returns around downgrades and negative credit watches. Goh and Ederington (1993) argue that not all downgrades are informative. Dichev and Piotroski (2001) report significant long-term stock price reactions to downgrades. The papers most closely related to ours look at changes in the investors' reaction to rating signals around specific events. Jorion et al. (2005) provide evidence of an increase in the response to downgrades and upgrades following the introduction of Regulation Fair Disclosure (FD), which enabled CRAs to retain access to nonpublic information on the issuer. Iannotta et al. (2013) argue that the information content of ratings deteriorates when the debt market is more opaque. Dimitrov et al. (2015) document a decrease in the stock price response to downgrades following the introduction of the Dodd-Frank Act. Jankowitsch et al. (2017) record a mixed reaction to rating changes in the prices and liquidity of financial and non-financial bonds after the financial crisis and the passage of the Dodd-Frank Act. To the best of our knowledge, we are the first to investigate how CRAs' reputational scandals affect the investors' perception of ratings. To single out the effect of reputation, we control for the impact of concurrent factors such as the business cycle and changes in the regulatory framework. We achieve this by looking at three different episodes of reputational distress over a 15-year period, where each episode is characterized by: (i) different market conditions in terms of business cycle, housing market growth, development of the credit market and of structured finance products, etc.; (ii) a heterogeneous response from the regulatory authorities. We find consistent results across all episodes.

Our results on the rating accuracy around reputational shocks add to the scarce empirical literature that studies the effect of reputational incentives on corporate rating quality. Alp (2013) and Baghai et al. (2014) document a tightening in corporate rating standards over time, and interpret their findings as consistent with the reputation argument. Bae et al. (2015) find that increased competition in the rating industry does not necessarily lead to rating inflation and explain their findings with CRAs' efforts to preserve their reputation. In this respect, we offer a more direct assessment of the impact of reputation on rating quality, and suggest that rating tightening seems more likely to be the result of stricter regulation than of reputational concerns. More in general, we contribute to the empirical literature on reputational risk in the financial industry (see Fiordelisi et al., 2013, 2014 for the impact of reputational losses in the banking sector).

Lastly, our analysis carries some interesting policy implications. A stronger reaction to rating downgrades in times of reputational distress not accompanied by an improvement in rating quality suggests an over-reliance on ratings, consistent with rating-contingent regulation. In the aftermath of the financial crisis, both academic scholars and regulatory authorities have highlighted the detrimental effects of rating-based regulation on financial stability in terms of inflated ratings, underestimation of risk and increased risk-taking. While most studies document over-reliance on credit ratings in the context of sophisticated securities, we provide evidence of its distortive effects in the context of basic investment tools such as corporate shares. In this vein, our findings speak in favor of the ongoing regulatory efforts to reduce reliance on ratings issued by CRAs (Financial Stability Board, 2010, 2012).

2. Data and sample selection

To investigate the impact of CRAs' reputational issues on investors' perception of rating signals, we follow a standard event study methodology, commonly adopted in related studies (see, among others, Jorion et al., 2005). We look at the response of stock prices of rated firms to changes in their credit ratings and we compare such reactions in the two years before the start of an episode of reputational distress (*Pre-Reputational Shock*) and in the two following years (*Reputational Shock*). If market investors perceive credit ratings as more (less) informative when CRAs' reputation is in danger, the stock price response to rating announcements should be stronger (weaker) in the *Reputational Shock* period compared to the *Pre-Reputational Shock*.

The choice of 24-month periods ensures an adequate sample size while limiting the occurrence of overlapping events that may also affect investors' response to rating actions.[5] We study the impact of rating changes on stock returns instead of bond returns or credit default swap spreads, as we believe that the higher quality of price data for corporate stocks over our sample period leads to more accurate estimates of the effect we want to investigate. The use of bond or credit default swap data presents two important shortcomings. First, good quality bond transaction data and credit default swap quotes are available only for a restricted number of firms and a limited time period. This would produce a loss in statistical power and impose restrictions on the reputational distress episodes that one could potentially analyze.[6] Second, the liquidity of the U.S. corporate bond and credit default swap markets fluctuated significantly over our sample period (Dick-Nielsen et al., 2012). Given the challenge of deriving valid liquidity measures for over-the-counter instruments at the firm level, differences in liquidity between *Pre-Reputational Shock* and *Reputational Shock* periods can yield biased estimates of the impact of CRAs' reputational shocks. Finally, we can expect the reaction of shareholders to a rating change to be in line to that of bondholders (Hand et al., 1992), with the exception perhaps of severely distressed firms where the option value of the firm's equity increases as the firm becomes riskier. As long as the proportion of such firms is homogeneous across *Pre-Reputational Shock* and *Reputational Shock* periods (which is the case in our sample), this should not distort our results.

We gather data on rating changes from Bloomberg and Moody's Default and Recovery Database. We select downgrades and upgrades in *issuer* ratings announced by the top three NRSRO: S&P, Moody's and Fitch. An issuer estimated senior rating is generally set equal to its actual senior unsecured debt rating or, if there is none, by implying it on the basis of rated subordinated or secured debt. We use LT (Long Term) Local Currency Issuer Rating for S&P, LT Estimated Senior Rating for Moody's and LT Issuer Default Rating for Fitch. An issuer credit rating (as opposed to an issue rating) represents an opinion about the obligor's overall creditworthiness rather than its ability to repay a specific liability class and, as such, we expect changes in issuer ratings to have the strongest and most direct impact on stock prices.[7] We map the alphanumeric ratings of the three agencies to a cardinal scale from 1 to 22 (AAA to D), as detailed in Table 1. We only consider U.S. issuers whose stocks are traded on either the NYSE, AMEX or NASDAQ, with daily stock prices available from the CRSP database.[8]

We look at the three most significant episodes of reputational shock experienced by CRAs on the U.S. market in the last decades:

[5] We provide robustness checks using a shorter window of 12 months in Section 6.1.

[6] The coverage of credit default swap data from the main data providers (i.e. MarkIt, CMA) starts in 2001, and the coverage of corporate bond transaction data from TRACE starts in 2004.

[7] In some instances CRAs can change the rating of selected issues, but leave the issuer rating unchanged if they have reasons to believe that the issuer's overall credit quality is unaffected. In most cases, however, both issue and issuer ratings are revised at the same time.

[8] Our sample includes financial and utility firms, as we are not aware of regulatory restrictions for holding securities based on the industry sector that may bias our results. For robustness, we re-estimate our main specifications on the subsample of rating downgrades that excludes financials (SIC codes 6000-6999) and utilities (SIC codes 4900-4999): The main findings are qualitatively unchanged, confirming that our results are not driven by regulated firms.

Table 1
Mapping of alphanumerical ratings into numerical codes.

Credit rating	Moody's	S&P	Fitch	Numerical code
Investment grade	Aaa	AAA	AAA	1
	Aa1	AA+	AA+	2
	Aa2	AA	AA	3
	Aa3	AA–	AA–	4
	A1	A+	A+	5
	A2	A	A	6
	A3	A–	A–	7
	Baa1	BBB+	BBB+	8
	Baa2	BBB	BBB	9
	Baa3	BBB–	BBB–	10
Speculative grade	Ba1	BB+	BB+	11
	Ba2	BB	BB	12
	Ba3	BB–	BB–	13
	B1	B+	B+	14
	B2	B	B	15
	B3	B–	B–	16
	Caa1	CCC+	CCC+	17
	Caa2	CCC	CCC	18
	Caa3	CCC–	CCC–	19
	Ca	CC	CC	20
	C	C	C	21
In default		D	DDD/DD/D	22

The Enron/WorldCom failures, the subprime crisis, and the subsequent civil lawsuit filed by the U.S. government against S&P. Severe criticism of the rating industry was first raised in the aftermath of the accounting scandals of Enron and WorldCom. CRAs were accused of not being aggressive enough in downgrading the companies despite clear indications of a deteriorating financial state. Enron maintained its investment-grade issuer status until four days before bankruptcy in December 2001. Similarly, WorldCom was downgraded to speculative grade only 42 days before filing for Chapter 11 in July 2002. CRAs responded to criticism by announcing changes to their rating models that would enable them to adjust ratings more quickly (The Wall Street Journal, 2002).

The strongest concerns about the informativeness of credit ratings arose during the 2007–2008 credit crisis, as a result of massive downgrades and defaults in subprime structured securities that had been granted investment-grade status. In addition to their involvement in the subprime crisis, CRAs were also criticized for being too slow in downgrading a number of severely distressed financial institutions such as Lehman Brothers and AIG. Rating agencies admitted mistakes in their structured rating models and committed to engage in intensive reviews of their internal processes (Financial Times, 2008).

In February 2013, the accusations against CRAs for their role in the financial crisis materialized into a civil lawsuit filed by the U.S. Department of Justice against S&P. The rating agency was accused of having engaged in a scheme to defraud investors in structured financial products, by issuing inflated ratings that misrepresented the true credit risk of the securities. This unprecedented measure severely hit CRAs: In two days, the stock price of McGraw Hill Financial (the parent company of S&P) dropped by 23%. While the lawsuit was filed against S&P only, the reputation of all major CRAs was affected, given the similarities in their rating practices.

For each episode of reputational distress we identify a start date. For the Enron/WorldCom scandals we choose November 28, 2001 when Moody's, Fitch and S&P downgraded Enron to junk status. For the subprime crisis we select as cutoff date July 10, 2007, corresponding to the first large-scale downgrade of residential mortgage backed securities carried out by Moody's.[9] In both cases, we use the date in which severe downgrades take place as the starting point of a reputational shock, since we interpret this moment as the CRAs' public disclosure of errors in their judgment of credit risk. For the S&P lawsuit we choose February 4, 2013, when the civil lawsuit was filed.[10]

To gain further support for our choices of identification of reputational shocks in the rating industry, we look at the news coverage of CRAs on Factiva. Specifically, we run a search for news issued by the Wall Street Journal or the Financial Times with keywords "rating" and "agencies" in the *Pre-Reputational Shock* and *Reputational Shock* subperiods around the three cutoff dates. We then restrict our selection to those news concerning either criticism to CRAs or measures undertaken by CRAs to re-establish their reputation. We find a total of 143 news. About 72% of the news appear in the *Reputational Shock* samples, which suggests that these subperiods are indeed perceived by market agents as times of reputational distress for CRAs.

Table 2 illustrates the sample of rating changes that take place before and during the three episodes of reputational distress. The number of downgrades is higher in the aftermath of a shock than before for the Enron scandal and the subprime crisis, while it is slightly lower in the case of the S&P lawsuit.[11] The number of upgrades is always lower following a reputational shock. Overall, this seems in line with the prediction that CRAs become more conservative when their reputation is at stake. Nearly half of the downgrades involve investment-grade issuers around the first two events, and about one third around the lawsuit. These issuers, however, account only for about 30–40% of the upgrades. This evidence confirms that the rating evolution of investment-grade issuers tends to be more heavily scrutinized than that of riskier firms during episodes of reputational concern.

The average magnitude of rating downgrades (measured in notches) does not differ significantly around the lawsuit episode, while it is significantly larger than before following the onset of the subprime crisis, and significantly smaller than before for the Enron case. This is consistent with the fact that the subprime reputational loss period includes the 2007–2009 economic recession and the Enron pre-reputational loss period includes the 2001 recession. Such differences in the magnitude of rating changes before and during episodes of reputational shock and, more in general, the contemporaneous presence of economic downturns could drive the difference in the stock response to rating news in the two periods and, as such, must be controlled for in a multivariate setting. The average size of rating upgrades is not significantly different around the Enron scandal and the subprime crisis, while it decreases significantly in the aftermath of the S&P lawsuit, suggesting again a more conservative behavior of CRAs.

3. Empirical setup and main results

To assess to what extent rating changes generate an abnormal response in stock prices, we need a specification for normal (i.e. expected) returns. We employ a standard market model (Campbell et al., 1997):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \quad (1)$$

where R_{it} is the raw return on the common share of issuer i on day t and R_{mt} is the daily return on the value-weighted NYSE/AMEX/NASDAQ market index. The market model is estimated on a window from −365 to −30 days relative to the event

[9] Analogous measures were undertaken by S&P on July 12, 2007 and by Fitch on August 13, 2007.

[10] Robustness checks around alternative cutoff dates are provided in Section 6.6.

[11] For the sake of brevity, and given our choice of cutoff date, from now on we refer to the Enron/WorldCom episodes as Enron.

Table 2
Summary statistics for rating changes.

Period	Downgrades			Upgrades		
	Number	Size	% IG	Number	Size	% IG
Enron						
Pre-Reputational Shock	1288	1.659	47.9	408	1.270	42.4
Reputational Shock	1515	1.531	45.1	372	1.247	29.3
Total	2803	1.590	46.4	780	1.259	36.2
Difference Test		*3.386****	*1.458*		*0.401*	*3.804****
Subprime crisis						
Pre-Reputational Shock	804	1.391	47.0	794	1.198	39.7
Reputational Shock	1662	1.504	45.5	429	1.198	33.6
Total	2466	1.467	46.0	1223	1.198	37.5
Difference Test		*−3.058****	*0.713*		*−0.011*	*2.105***
S&P Lawsuit						
Pre-Reputational Shock	486	1.276	37.6	632	1.150	24.4
Reputational Shock	413	1.295	32.3	621	1.087	36.1
Total	899	1.285	35.4	1253	1.119	30.2
Difference Test		*−0.424*	*1.550*		*2.150***	*−4.509****

This table reports summary statistics for rating changes that take place before and during episodes of CRAs' reputational distress. The rating actions include downgrades and upgrades of U.S. issuers by S&P, Moody's and Fitch. *Size* indicates the average number of notches (in absolute value) corresponding to the rating downgrade/upgrade. *%IG* indicates the proportion of downgrades/upgrades involving issuers rated investment grade. The *Pre-Reputational Shock* period covers two years before the start of an episode of reputational distress. The *Reputational Shock* period covers two years following the start of the episode of reputational distress. The cutoff dates are November 28, 2001 for the Enron failure, July 10, 2007 for the Subprime crisis, and February 4, 2013 for the S&P lawsuit. The *Difference Test* is a two-sample *t*-test for difference in means for *Size* and a *z*-test for difference in proportions for *%IG*. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

date.[12] We obtain daily abnormal stock returns AR_{it} as the difference between the raw return and the return estimated from the market model:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad (2)$$

We derive cumulative abnormal returns (CARs) for issuer i around each event date by aggregating AR_{it} over the three days centered on the announcement date, i.e. $CAR_i(-1, 1) = \sum_{t=-1}^{+1} AR_{it}$. We retain CARs only for issuers with non-missing returns on all three days.[13]

We investigate the stock price response to rating downgrades and upgrades separately, in accordance with previous research that shows how stock prices typically react to downgrades but not to upgrades (e.g. Holthausen and Leftwich, 1986; Hand et al., 1992; Ederington and Goh, 1998). In what follows, we first present and discuss univariate results and then perform multivariate regressions controlling for other determinants of CARs.

Table 3 reports mean and median CARs around rating downgrades and upgrades that take place before and during episodes of CRAs' reputational distress. Panel A reports CARs for the entire sample of issuers, while Panel B and Panel C report CARs only for firms rated investment grade and high yield, respectively.

To start with, our findings confirm how, in general, rating downgrades trigger a significant negative reaction in stock prices, which seem instead to remain insensitive to rating improvements. When looking at CARs for the entire sample of issuers, we observe a stronger reaction to rating downgrades in the aftermath of the subprime scandal and of the S&P lawsuit, while no significant difference in CARs seems to emerge around the Enron episode. However, when splitting the issuer sample according to credit quality, we uncover the heterogeneous impact of downgrades on stock prices of investment-grade and high-yield firms. Following Enron's failure and the subprime crisis, we observe a stronger stock price response to rating downgrades for investment-grade firms.

Our preliminary results suggest some interesting observations. First, a shock to CRAs' reputation is mostly followed by a stronger stock price reaction to rating downgrades. Second, in two cases (Enron and subprime), such stronger market reaction is more pronounced for firms of high credit quality. In essence, investors find rating downgrades—and in particular downgrades of investment-grade firms—to be more revealing in the aftermath of a reputational shock.

To assess to what extent episodes of CRAs' reputational damage affect the impact of rating changes on stock prices, we need to control for a number of variables that may also affect CARs. Hence, we estimate multivariate regressions of CARs on our indicators of reputational shock and on a set of controls that previous literature found to be significant determinants of abnormal returns (e.g. Holthausen and Leftwich, 1986; Hand et al., 1992; Jorion et al., 2005). We perform the analysis separately for downgrades and upgrades, and for each episode of reputational concern.

Our first specification is as follows:

$$CAR_i = \alpha_0 + \alpha_1 NOTCHES_i + \alpha_2 WATCH_i + \alpha_3 HYIG_i + \alpha_4 \log(DAYS_i) + \alpha_5 REPSHOCK_i + \alpha_6 VIX_i + \epsilon_i \quad (3)$$

where for firm i, *NOTCHES* is the cardinal value of the new rating minus the cardinal value of the old rating of the same issuer (1 for rating AAA, 22 for rating D); *WATCH* is a dummy variable that equals one if the issuer was put under negative (positive) watch before the downgrade (upgrade); *HYIG* is a dummy variable that equals one if, following the downgrade (upgrade), the issuer has moved from investment-grade to high-yield (from high-yield to investment-grade); *log(DAYS)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade (upgrade) performed by another rating agency and the event date[14]; *REPSHOCK* is an indicator variable that equals one if

[12] An estimation window of 11 months helps reduce parameter estimation errors. Our results are robust to shorter estimation windows of nine and six months. We opt for a simple specification such as the standard market model, as Kothari and Warner (2007) show that short-horizon event studies are not very sensitive to the benchmark specification.

[13] To verify the accuracy of the announcement dates in our sample we compare them with actual press release dates retrieved from Factiva for a random sample of 100 rating changes. In 93% of the cases the press release date coincides with the announcement date in the sample and in the remaining cases it falls within our event window (−1,1).

[14] In line with Hand et al. (1992), days are set equal to 60 if both agencies change on the same date, if the previous change by the other agency was in the opposite

Table 3
Stock price response to rating changes before and during episodes of CRAs' reputational shock.

Period	Downgrades			Upgrades		
	Number	Mean CAR	Med. CAR	Number	Mean CAR	Med. CAR
Panel A: Full sample						
Enron						
Pre-Reputational Shock	1288	-4.918***	-1.482***	408	0.084	-0.176
Reputational Shock	1515	-3.434***	-1.363***	372	0.460*	0.229
Difference Test		*−1.400*	*−0.075*		*−0.938*	*−1.154*
Subprime crisis						
Pre-Reputational Shock	804	-1.225***	-0.471	794	0.169	-0.092
Reputational Shock	1662	-3.698***	-2.289***	429	0.581	0.084
Difference Test		*3.182***	*7.921***		*−0.743*	*−0.210*
S&P Lawsuit						
Pre-Reputational Shock	486	-1.813***	-0.706	632	0.215	-0.108
Reputational Shock	413	-3.405***	-0.789***	621	0.398**	0.144
Difference Test		*1.849**	*1.130*		*−0.683*	*−0.918*
Panel B: Investment-grade issuers						
Enron						
Pre-Reputational Shock	617	-1.566***	-0.283	173	0.313	0.203
Reputational Shock	684	-3.266***	-0.644***	109	0.033	0.316*
Difference Test		*2.621****	*2.086***		*0.684*	*−0.077*
Subprime crisis						
Pre-Reputational Shock	378	-0.539**	-0.306**	315	0.001	-0.114
Reputational Shock	756	-4.751***	-2.098***	144	0.052	0.152
Difference Test		*7.501****	*6.538****		*−0.049*	*−0.007*
S&P Lawsuit						
Pre-Reputational Shock	183	-0.050	-0.693	154	-0.163	-0.176
Reputational Shock	135	-0.139	-0.315	224	0.277	0.320**
Difference Test		*0.258*	*−1.750**		*−1.623*	*−1.671**
Panel C: Speculative-grade issuers						
Enron						
Pre-Reputational Shock	671	−8.001***	−3.874***	235	−0.085	−0.466
Reputational Shock	831	−3.572**	−2.435***	263	0.636*	0.126
Difference Test		*−2.370***	*−2.218***		*−1.231*	*−1.487*
Subprime crisis						
Pre-Reputational Shock	426	−2.791***	−0.673***	479	0.280	−0.058
Reputational Shock	906	−2.819**	−2.569***	285	0.848	0.047
Difference Test		*0.022*	*3.316****		*−0.878*	*0.241*
S&P Lawsuit						
Pre-Reputational Shock	303	−2.946***	−1.538***	478	0.336	−0.061
Reputational Shock	518	−4.766***	−1.648***	397	0.467*	0.005
Difference Test		*1.745**	*0.213*		*−0.352*	*−0.165*

This table reports mean and median cumulative abnormal returns (CAR) surrounding credit rating changes that take place before and during episodes of CRAs' reputational distress. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades and upgrades of U.S. issuers by S&P, Moody's and Fitch. The *Pre-Reputational Shock* period covers two years before the start of an episode of reputational loss. The *Reputational Shock* period covers two years following the start of the episode of reputational loss. The cutoff dates are November 28, 2001 for the Enron failure, July 10, 2007 for the Subprime crisis, and February 4, 2013 for the S&P lawsuit. Panel A reports CAR for the entire sample of issuers, while Panel B and Panel C report CAR only for firms rated investment grade and speculative grade, respectively. Mean and median returns are shown as percentages. The *Difference Test* is a two-sample *t*-test for difference in means and a two-sample Wilcoxon test for difference in medians. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

the event date falls in the 24 months following the cutoff date for the specific reputational distress episode (November 28, 2001 for the Enron scandal; July 10, 2007 for the subprime crisis; February 4, 2013 for the S&P lawsuit); *VIX* is the volatility index level that represents the conventional measure of perceived volatility in the stock market. In all specifications, we cluster standard errors at the 2-digit SIC codes to account for potential correlation across CAR residuals around re-ratings within the same industry group.

Our variable of interest is the coefficient of *REPSHOCK*, which measures the impact of the CRAs' reputational shock on the stock price reaction to a rating change. If rating signals are perceived to become more informative following a reputational scandal, the price reaction to a rating change increases (in absolute terms) and, therefore, the coefficient of *REPSHOCK* will be negative (positive) for downgrades (upgrades). If, instead, rating signals are valued less by investors when CRAs are caught misrating, then we would expect the price reaction to a rating change to become weaker and, therefore, a positive (negative) sign of the coefficient for downgrades (upgrades).

We expect *NOTCHES* to be a significant determinant of CARs, as stronger stock price reactions are typically associated with rating changes of larger magnitude. In particular, we predict a negative coefficient for both rating downgrades and upgrades, for which *NOTCHES* takes a positive and a negative sign, respectively. Rating actions preceded by a rating watch may have a weaker impact on stock prices, given the anticipation effect. We then expect a positive (negative) coefficient on *WATCH* for rating downgrades (upgrades). Rating changes that move the issuer out of or into the investment-grade class may have a stronger price response, hence we may predict a negative (positive) coefficient on *HYIG* for downgrades

direction, or if the previous change by the other agency was more than 60 days earlier.

Table 4
CRAs' reputational shocks and stock price response to rating downgrades.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
# Notches change	−0.030**	−0.027*	−0.012	−0.012	−0.049***	−0.045***
	(0.014)	(0.014)	(0.008)	(0.008)	(0.014)	(0.014)
Negative watch	0.007	0.004	0.022**	0.023**	0.027**	0.020*
	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.012)
Across HY-IG	−0.013	−0.031*	−0.006	−0.007	0.043**	0.014
	(0.021)	(0.018)	(0.012)	(0.012)	(0.018)	(0.018)
Log(days)	−0.002	−0.002	−0.002	−0.002	−0.012	−0.010
	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)	(0.008)
Vix	−0.206***	−0.213***	−0.020	−0.027	−0.130	−0.137
	(0.042)	(0.042)	(0.044)	(0.044)	(0.119)	(0.119)
Enron rep. shock (a)	0.012	0.041*				
	(0.013)	(0.022)				
Inv. grade		0.063***		0.036***		0.030***
		(0.013)		(0.011)		(0.011)
Inv. grade × Enron (b)		−0.060***				
		(0.022)				
Subprime rep. shock (a)			−0.019*	0.010		
			(0.011)	(0.016)		
Inv. grade × Subprime (b)				−0.058***		
				(0.018)		
Lawsuit rep. shock (a)					−0.022**	−0.027**
					(0.011)	(0.013)
Inv. grade × Lawsuit (b)						0.020
						(0.016)
F-test (a)+(b)=0		6.96		10.50		0.27
p-Value		(0.01)		(0.00)		(0.60)
# Observations	2803	2803	2466	2466	899	899
Adj *R*-squared (%)	2.18	2.59	1.44	1.69	7.10	8.32

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P, Moody's and Fitch. Models (1) and (2) include rating downgrades in the two 24-month periods before and after November 28, 2001. Models (3) and (4) include rating downgrades in the two 24-month periods before and after July 10, 2007. Models (5) and (6) include rating downgrades in the two 24-month periods before and after February 4, 2013. *# Notches change* is the unit increase in the numerical rating following the downgrade (positive number). *Negative watch* is a dummy variable that equals one if the issuer was put under negative watch before the downgrade. *Across HY-IG* is a dummy variable that equals one if, following the downgrade, the issuer has lost his investment-grade status. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. Standard errors clustered at 2-digit SIC codes in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

(upgrades). The variable *log(DAYS)* controls for the possibility that rating changes that follow similar actions undertaken by other rating agencies may have a reduced information content and, as such, trigger a weaker price response. If this is the case, we expect the coefficient of *log(DAYS)* to be positive (negative) for rating downgrades (upgrades). The variable *VIX* captures the potential impact that general financial market conditions may have on CARs. On the one hand, during volatile markets, investors may be more pessimistic and overreact to negative news. On the other hand, negative news become much more frequent (and expected) during such periods and this may weaken the stock price response to rating actions. Either way, we must control for the state of financial markets before and/or during our reputational shock subsamples to disentangle the reputational impact from business cycle effects. We choose to control for market volatility, instead of business cycle indicators, as financial markets can experience high volatility also in times of expansion. For robustness, in Section 6.2 we replicate the analysis using additional business cycle indicators.

Table 4 Columns (1), (3), (5) report regression results for the CARs originated from rating downgrades around the three episodes of reputational damage. In line with the findings from the univariate analysis, we find evidence of a stronger investors' reaction to rating downgrades after a reputational shock. The stock price response strengthens significantly following the subprime shock and the S&P lawsuit, as indicated by the negative coefficients of *Subprime rep. shock* in Column (3) and *Lawsuit rep. shock* in Column (5). No significant difference seems to arise around the Enron episode.

We now enrich the original model by conditioning the effect of the reputational distress on the credit quality of the issuer. As discussed, a reputational concern is more likely to arise when CRAs erroneously assign high ratings to issuers that subsequently default. The second specification that we adopt is the following:

$$CAR_i = \alpha_0+\alpha_1 NOTCHES_i+\alpha_2 WATCH_i+\alpha_3 HYIG_i+\alpha_4 \log(DAYS_i) +\alpha_5 REPSHOCK_i+\alpha_6 VIX_i+\alpha_7 IG_i+\alpha_8 IG_i \cdot REPSHOCK_i+\epsilon_i \quad (4)$$

where $IG \cdot REPSHOCK$ is the interaction between the investment-grade status of the issuer (before the rating change) and the occurrence of a reputational shock. The variables of interest are now the coefficient of *REPSHOCK* which measures the impact of the reputational damage on the stock price reaction for all firms and the coefficient of $IG \cdot REPSHOCK$ which captures the extra impact of the reputational damage on the stock price reaction for investment-grade firms. We also add *IG*, an indicator variable for the investment-grade status of the firm, to control for the possibility that, in general, firms with better credit quality tend to be less affected by downgrades and upgrades than firms with lower credit quality, due to the stronger (and non-linear) funding constraints that characterize riskier firms.

Table 5
CRAs' reputational shocks and stock price response to rating upgrades.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
# Notches change	0.003	0.003*	−0.027**	−0.027**	−0.003	−0.003
	(0.002)	(0.002)	(0.013)	(0.013)	(0.004)	(0.004)
Positive watch	0.001	0.001	−0.003	−0.003	0.002	0.002
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Across HY-IG	0.008	0.009	−0.002	−0.002	0.004	0.003
	(0.007)	(0.007)	(0.005)	(0.006)	(0.004)	(0.004)
Log(days)	−0.004	−0.004	0.002	0.002	−0.002	−0.002
	(0.002)	(0.002)	(0.004)	(0.004)	(0.002)	(0.002)
Vix	−0.020	−0.018	−0.030	−0.030	0.048	0.047
	(0.039)	(0.039)	(0.042)	(0.042)	(0.042)	(0.042)
Enron rep. shock (a)	0.004	0.008				
	(0.004)	(0.007)				
Inv. grade		0.005		0.001		−0.003
		(0.007)		(0.003)		(0.002)
Inv. grade × Enron (b)		−0.012				
		(0.009)				
Subprime rep. shock (a)			0.009	0.010		
			(0.006)	(0.007)		
Inv. grade × Subprime (b)				−0.005		
				(0.005)		
Lawsuit rep. shock (a)					0.005	0.005
					(0.003)	(0.004)
Inv. grade × Lawsuit (b)						0.001
						(0.004)
F-test (a)+(b)=0		0.76		0.87		3.38
p-Value		(0.39)		(0.35)		(0.06)
# Observations	780	780	1223	1223	1253	1253
Adj *R*-squared (%)	−0.14	−0.16	4.97	4.84	0.05	−0.04

This table reports regression results for issuers' CAR surrounding rating upgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (-1, 1), where day 0 is the date of a rating change. The rating actions include upgrades of U.S. issuers by S&P, Moody's and Fitch. Models (1) and (2) include rating upgrades in the two 24-month periods before and after November 28, 2001. Models (3) and (4) include rating upgrades in the two 24-month periods before and after July 10, 2007. Models (5) and (6) include rating upgrades in the two 24-month periods before and after February 4, 2013. *# Notches change* is the unit decrease in the numerical rating following the upgrade (negative number). *Positive watch* is a dummy variable that equals one if the issuer was put under positive watch before the upgrade. *Across HY-IG* is a dummy variable that equals one if, following the upgrade, the issuer has achieved investment-grade status. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating upgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. Standard errors clustered at 2-digit SIC codes in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4 Columns (2), (4), (6) report regression results for the CARs from rating downgrades estimated according to the second specification. Consistently with the results from the univariate analysis, we find a stronger price response to rating cuts in the aftermath of the Enron scandal and of the subprime crisis for investment-grade issuers: The coefficient of $IG \cdot REPSHOCK$ is negative and significant in both episodes, as well as the sum of the coefficients of *REPSHOCK* and $IG \cdot REPSHOCK$, as indicated by the F-test. As predicted, the coefficient of *IG* is always positive and significant, indicating that the stock price response to a rating downgrade is less severe for investment-grade than for high-yield issuers.[15]

Table 5 reports the corresponding results for the CARs associated with rating upgrades. Neither our variables of interest nor the control variables are significant. This is consistent with prior studies that document weak a market reaction to upgrades. Given the lack of statistical significance we limit the following analyses and robustness checks to downgrades only.

In summary, our results indicate that, following an episode of CRAs' reputational damage, market investors react more strongly to rating downgrades. Such effect tends to be more pronounced for investment-grade firms, as ratings inflation is generally believed to be higher in this segment, and corrective actions are expected to be larger.

4. The effect of regulation

A potential critique to our findings is that we may not be capturing the effect of CRAs' reputational shocks *per se* but, rather, the effect of the regulatory measures put in place in the aftermath of episodes of reputational distress to monitor the quality of credit ratings. Three of such regulatory measures were introduced during our sample period.

After Enron's and WorldCom's filings for Chapter 11, the Sarbanes–Oxley Act (SOX Act) was enacted in an attempt to restore confidence in capital markets. Section 702 (b) of the SOX Act requires the Securities and Exchange Commission (SEC) to strictly monitor the role and function of CRAs in securities markets and, therefore, has a direct impact on rating agencies. In addition, the U.S. Congress conducted a series of hearings on the structure of the rating industry and initiated a review process which led to the adoption of the Credit Rating Agency Duopoly Relief Act (CRA Reform Act). The Act simplifies the process of approving rating agencies as NRSRO to foster competition in the rating industry. Finally, following the subprime crisis, the Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) which, among other measures, outlines a series

[15] We omit to control for the rating level before the rating change, as it is highly correlated with the *IG* dummy. Estimates for an equivalent specification which includes the starting rating level are essentially unchanged.

Table 6
CRAs' reputational shocks and stock price response to rating downgrades: controlling for regulation.

	SOX Act		CRA Reform Act		Dodd-Frank Act	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
# Notches change	−0.027*	−0.023	−0.019**	−0.018*	−0.010	−0.010
	(0.015)	(0.015)	(0.009)	(0.009)	(0.010)	(0.010)
Negative watch	0.006	0.004	0.014*	0.013	0.025*	0.025*
	(0.011)	(0.010)	(0.008)	(0.009)	(0.014)	(0.014)
Across HY-IG	−0.016	−0.035*	0.015*	0002	−0.026	−0.021
	(0.021)	(0.019)	(0.009)	(0.013)	(0.020)	(0.020)
Log(days)	−0.002	−0.002	−0.000	−0.001	−0.003	−0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Vix	−0.222***	−0.230***	−0.452***	−0.457***	−0.045	−0.049
	(0.043)	(0.043)	(0.170)	(0.169)	(0.036)	(0.037)
SOX Act (a)	0.032*	0.049*				
	(0.018)	(0.026)				
Inv. grade		0.044***		0.027***		−0.017
		(0.011)		(0.009)		(0.013)
Inv. grade × SOX (b)		−0.036				
		(0.024)				
CRA Reform Act (a)			0.019**	0.025*		
			(0.009)	(0.015)		
Inv. grade × CRA Reform (b)				−0.013		
				(0.015)		
Dodd-Frank Act (a)					0.005	−0.017
					(0.007)	(0.012)
Inv. grade × Dodd-Frank (b)						0.049***
						(0.014)
F-test (a)+(b)=0		1.22		3.58		23.82
p-Value		(0.27)		(0.06)		(0.00)
# Observations	2736	2736	1765	1765	1869	1869
Adj *R*-squared (%)	1.31	1.52	0.34	0.38	0.24	0.31

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P, Moody's and Fitch. Models (1) and (2) include rating downgrades in the two 24-month periods before and after July 25, 2002. Models (3) and (4) include rating downgrades in the two 24-month periods before and after September 29, 2006. Models (5) and (6) include rating downgrades in the two 24-month periods before and after July 22, 2010. *# Notches change* is the unit increase in the numerical rating following the downgrade (positive number). *Negative watch* is a dummy variable that equals one if the issuer was put under negative watch before the downgrade. *Across HY-IG* is a dummy variable that equals one if, following the downgrade, the issuer has lost his investment-grade status. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *SOX* is a dummy variable that equals one if the event date is in the 24 months following July 25, 2002. *CRA Reform* is a dummy variable that equals one if the event date is in the 24 months following September 29, 2006. *Dodd-Frank* is a dummy variable that equals one if the event date is in the 24 months following July 22, 2010. Standard errors clustered at 2-digit SIC codes in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

of broad reforms to the CRA market. Those reforms aim at giving more power to the SEC to impose sanctions on CRAs and to bring claims against them for fraud, and make CRAs more liable for misrating. Most provisions were implemented with immediate effect, while others were finalized and adopted at a later stage.

If a stricter regulation leads to more accurate and timely ratings, we would expect rating changes to carry a higher information content than before and, as such, to trigger a larger response in stock prices. Some of our findings might then be ascribed not directly to the reputational shocks, but to the regulatory measures implemented to restore CRAs' reputation. To assess whether this is the case, we repeat the analysis around the passage of the SOX Act, the CRA Reform Act and the Dodd-Frank Act. We choose as cutoff dates July 25, 2002 (passage of the SOX Act), September 29, 2006 (passage of the CRA Reform Act) and July 22, 2010 (passage of the Dodd-Frank Act) and we consider, as before, rating changes that take place in the two years before and in the two years after the cutoff dates. We re-estimate the specifications in (3) and (4) by substituting the indicator variable *REPSHOCK* with a dummy variable that equals one if the rating change takes place in the two years following the introduction of a regulatory measure.

We report the results in Table 6. Contrary to the above predictions, we observe that the stock price reaction to rating downgrades becomes weaker following a tightening in legal and regulatory penalties for misrating. This effect is general to all firms after the introduction of the SOX Act and the CRA Reform Act and is instead specific to investment-grade issuers following the adoption of the Dodd-Frank Act.[16] We can therefore rule out the argument that the stronger reaction to rating announcements documented in Section 3 is due to the introduction of regulatory measures aimed at re-establishing CRAs' reputation.

5. Controlling for rating quality

The results in Section 3 suggest that investors attach more weight to rating downgrades following episodes that undermine CRAs' reputation. This is consistent with two alternative explanations. First, rating agencies react to those episodes by improving the quality of credit ratings in order to preserve their reputational capital. The "fundamental" information content of ratings then increases and market investors take this into account when responding to rating signals. Second, the quality of credit ratings remains unchanged but, because of CRAs' reputational shocks, investors become aware of rating inflation and infer greater (negative) evidence on the issuer's creditworthiness than before when a downgrade takes place.

[16] Dimitrov et al. (2015) document similar results following the approval of the Dodd-Frank, and argue that CRAs assign lower ratings, give more false warnings, and issue downgrades that are less informative.

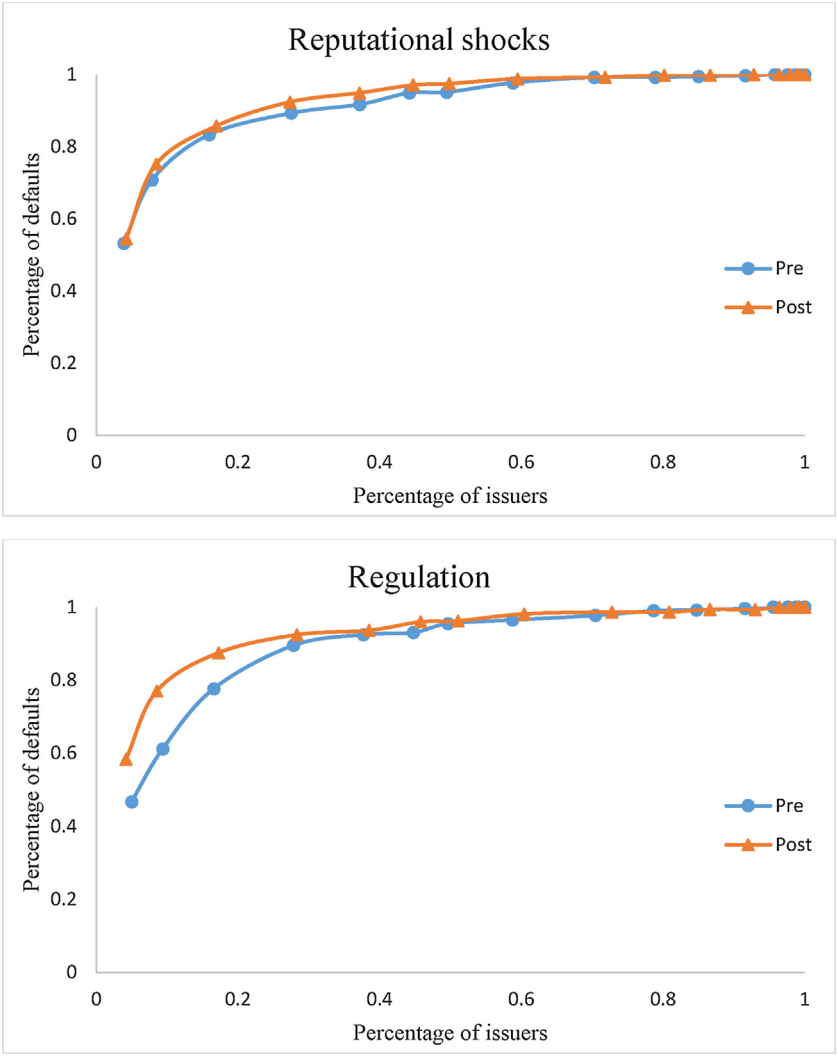

Fig. 1. Cumulative accuracy profiles curves. The plots show average cumulative accuracy profiles curves for Moody's, S&P and Fitch for the periods before (*Pre*) and after (*Post*) shocks to CRAs' reputation (top panel) and the introduction of new regulatory measures (bottom panel). The curves are obtained by plotting, for each rating category, the proportion of firms with the same or lower rating that will default by the end of the year against the proportion of all firms with the same or lower rating at the beginning of the year.

To test whether our findings are associated with an improvement in rating quality, we derive and compare cumulative accuracy profile (CAP) curves before and after episodes of CRAs' reputational loss. CAP curves are obtained from cumulative default frequencies and represent a standard method employed by rating agencies to gauge the relative performance of rating models. According to this measure, ratings are considered more accurate if issuers that have lower ratings at the start of a time period (typically a year) prove to be on average more likely to default by the end of the period than issuers that have better ratings.

We compute yearly CAP rates across Moody's, S&P and Fitch for the two years before and the two years after the start of an episode of reputational distress (according to the cutoff dates defined in Section 2) and take the average of the cumulative frequencies across the three episodes. The average CAP rates for the periods before (*Pre*) and after (*Post*) shocks to CRAs' reputation are shown in the top panel of Fig. 1.

The curves are obtained by plotting, for each rating category, the proportion of firms with the same or lower rating that will default by the end of the year (*Percentage of defaults*) against the proportion of all firms with the same or lower rating at the beginning of the year (*Percentage of issuers*). To ensure a sufficient sample size for each rating category, we group together rating codes from CCC+/Caa1 to C in the lowest rating category. To illustrate, the second point from the left in the subplot *Reputational Shocks* indicates that companies rated level 16 (i.e. B−/B3) and below represent about 7.88% (8.46%) of all the rated issuers and 70.74% (75.19%) of the defaulting issuers in the *Pre* (*Post*) period. The closer a curve approaches the upper left corner, the greater the accuracy of credit ratings, as the proportion of defaulted firms that can be accounted for by the lowest rating categories is higher. The closer a curve is to the 45-degree line, the lower the rating accuracy.

The *Pre* and *Post* accuracy curves indicate that, on average, rating quality has remained essentially unchanged in the aftermath of episodes that expose CRAs' misrating practices. The most likely explanation to our findings on the stronger response to rating downgrades in the *Post* period is then that investors learn that ratings are generally biased upwards and react more strongly when firms are eventually downgraded.[17] This explanation is also con-

[17] These results are in line with the predictions formulated by rational models of learning like the ones reviewed by Pastor and Veronesi (2009). In a context of Bayesian updating of investors' beliefs, when uncertainty concerning asset value is large (as it is the case when CRAs are caught misrating), price revisions following the disclosure of new information (such as a rating downgrade) are also larger.

Table 7
CRAs' reputation and regulation and stock price response to rating downgrades: full sample.

	Reputation		Regulation		Combined	
	(12 months)		(12 months)		(12 months)	
	(1)	(2)	(3)	(4)	(5)	(6)
# Notches change	−0.024***	−0.022***	−0.024***	−0.022***	−0.024***	−0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Negative watch	0.017***	0.015***	0.017***	0.015**	0.017***	0.015**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Across HY-IG	−0.000	−0.012	−0.001	−0.013	−0.000	−0.012
	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)
Log(days)	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Vix	−0.065***	−0.065***	−0.061***	−0.062***	−0.063***	−0.062***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)
Rep. shock (a)	−0.013**	−0.006			−0.016***	−0.010
	(0.005)	(0.010)			(0.006)	(0.010)
Inv. grade		0.022***		0.021***		0.024***
		(0.006)		(0.006)		(0.006)
Inv. grade × Rep. shock (b)		−0.016				−0.014
		(0.015)				(0.016)
Regulation (a)			0.022**	0.030	0.025**	0.031
			(0.012)	(0.021)	(0.012)	(0.022)
Inv. grade × Regulation (b)				−0.016		−0.014
				(0.020)		(0.021)
F-test (a) + (b)=0		6.63		10.78		7.25
p-Value		(0.01)		(0.00)		(0.01)
						10.70
						(0.00)
# Observations	7134	7134	7134	7134	7134	7134
Adj *R*-squared (%)	2.11	2.25	2.19	2.32	2.27	2.42

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (-1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P, Moody's and Fitch over the period November 1999 - February 2015. *# Notches change* is the unit increase in the numerical rating following the downgrade (positive number). *Negative watch* is a dummy variable that equals one if the issuer was put under negative watch before the downgrade. *Across HY-IG* is a dummy variable that equals one if, following the downgrade, the issuer has lost his investment-grade status. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Rep. shock* is a dummy variable that equals one if the event date is in the 12 months following November 28, 2001, July 10, 2007 or February 4, 2013. *Regulation* is a dummy variable that equals one if the event date is in the 12 months following July 25, 2002, September 29, 2006 or July 22, 2010. Standard errors clustered at 2-digit SIC codes in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

sistent with the asymmetric results documented for downgrades and upgrades. We expect a change in the fundamental information content of ratings to affect the investors' response to both downgrades and upgrades in a similar way. On the contrary, a change in investors' confidence in ratings not accompanied by a revision in rating quality is likely to translate into a different response to downgrades and upgrades. Specifically, if investors learn that ratings are generally inflated, it is reasonable to expect a strong reaction to downgrades and a mild (or no reaction) to upgrades to adjust for the positive bias.

The bottom panel of Fig. 1 shows the average CAP curves for the two years before (*Pre*) and the two years after (*Post*) the introduction of the regulatory measures aimed at disciplining the rating industry, namely the SOX Act, the CRA Reform Act and the Dodd-Frank Act. The accuracy curves reveal an increase in rating quality following the implementation of stricter measures, in line with the regulators' intention. Our findings are in line with those of Cheng and Neamtiu (2009), who show how rating timeliness and accuracy increased in the aftermath of the SOX implementation and deHaan (2017) who finds an increase in the performance of corporate credit ratings after the Dodd-Frank Act. The increase in rating accuracy may seem in contrast with the weaker investors' reaction to downgrades following a tightening in regulation, as discussed in Section 4. We advance two possible explanations. First, a weaker stock price response to rating actions can be expected if the new regulation includes measures aimed at reducing regulatory reliance on credit ratings. The Dodd-Frank Act took significant steps precisely in this direction, by requiring the SEC to remove regulatory references to credit ratings and to amend the Regulation FD to eliminate the exemption for disclosures made to CRAs.[18] Second, the channel that operates in the aftermath of a reputational shock is reversed: Investors now realize that ratings are no longer biased and soften their reaction to downgrades accordingly.

6. Robustness checks and additional findings

6.1. Alternative time windows

Throughout our study, we use 24-month windows around reputational shocks/regulation cutoff dates: This choice ensures a sufficient sample size that enables us to conduct individual analyses around each episode. The obvious advantage of this approach is that it provides accurate and distinctive estimates for the different episodes. However, one potential concern is that a 24-month window may be too long and encompass additional events—beyond the episode under scrutiny—that may affect investors' response to rating signals. A shorter time window would be desirable, but unfeasible, as it would severely reduce both sample size and statistical power in our current setting.

To assess whether our main findings persist when choosing a shorter window of one year, in place of two years, we refocus our analysis from individual subsamples to the entire sample. In detail, we estimate specifications (3) and (4) for issuers' CARs over the whole sample period (November 1999–February 2015) and define

[18] Opp et al. (2013) develop a theoretical framework to model how rating-contingent regulation can increase or decrease the informativeness of credit ratings.

Table 8
CRAs' reputational shocks and stock price response to rating downgrades: controlling for the business cycle.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
Vix	−0.390***	−0.400***	−0.027	−0.029	−0.142	−0.151
	(0.098)	(0.096)	(0.061)	(0.060)	(0.149)	(0.150)
Flows into US equity	−0.051	−0.052	0.027	0.035	0.040	0.012
	(0.048)	(0.048)	(0.072)	(0.071)	(0.109)	(0.111)
MCSI	−0.003**	−0.003**	−0.001	−0.001	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Slope yield curve	−0.540	−0.531	−0.337	−0.472	0.711	0.674
	(0.639)	(0.633)	(1.043)	(1.068)	(0.754)	(0.765)
2001 recession	−0.027	−0.023				
	(0.017)	(0.017)				
2007–2009 recession			0.008	0.007		
			(0.011)	(0.012)		
Enron rep. shock (a)	−0.011	0.021				
	(0.019)	(0.024)				
Inv. grade × Enron (b)		−0.061***				
		(0.023)				
Subprime rep. shock (a)			−0.026**	0.004		
			(0.013)	(0.016)		
Inv. grade × Subprime (b)				−0.058***		
				(0.018)		
Lawsuit rep. shock (a)					−0.021*	−0.027**
					(0.013)	(0.014)
Inv. grade × Lawsuit (b)						0.020
						(0.016)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
F-test (a)+(b)=0		3.75		12.43		0.21
p-Value		(0.05)		(0.00)		(0.65)
# Observations	2803	2803	2466	2466	899	899
Adj *R*-squared (%)	2.26	2.67	1.31	1.56	6.92	8.17

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P, Moody's and Fitch. Models (1) and (2) include downgrades in the two 24-month periods before and after November 28, 2001. Models (3) and (4) include downgrades in the two 24-month periods before and after July 10, 2007. Models (5) and (6) include downgrades in the two 24-month periods before and after February 4, 2013. *Vix* is the volatility index. *Flows into US equity* denotes US corporate equity flows. *MCSI* is the Michigan Consumer Sentiment Index. *Slope yield curve* is the 10-year minus 3-month Treasury constant maturity spread. *2001 recession* is a dummy variable that equals one if the event date falls between March and October 2001. *2007–2009 recession* is a dummy variable that equals one if the event date falls between December 2007 and May 2009. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. All specification include the additional control variables reported in Table 4. Standard errors clustered at 2-digit SIC codes in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Rep. shock as an indicator variable that equals one if the rating downgrade takes place in the 12 months following any of the reputational cutoff dates (November 28, 2001, July 10, 2007, or February 4, 2013). The coefficient of *Rep. shock* now captures a more general effect of reputational concerns involving CRAs over the entire period. Again, to exclude that the findings are driven by new regulatory measures, we re-estimate the model by substituting the indicator variable with a dummy variable *Regulation* that equals one if the rating downgrade takes place in the 12 months following the passage of the SOX Act, the CRA Reform Act or the Dodd-Frank Act. The new estimates are reported in Table 7: Columns (1) and (2) display the effect of reputation, Columns (3) and (4) highlight the impact of regulation and Columns (5) and (6) combine the two to ensure that our results are not driven by multicollinearity. The findings confirm the validity of our previous results: When CRAs' reputation is at stake, stock investors react more strongly to rating downgrades. On the contrary, we observe a milder reaction to rating downgrades following the adoption of a more stringent regulation.

6.2. Controlling for the business cycle

Reputational concerns regarding the quality and timeliness of credit rating signals often arise in times of high market volatility. Hence, we must avoid associating a strong negative reaction to rating downgrades to the occurrence of a reputational shock, when it may simply be due to a more general overreaction of market agents to negative news in nervous markets. To this end, we control for the level of the VIX in all our specifications. However, one may argue that market volatility is only one of the factors that can affect investors' reactions in times of economic distress.

To better control for general economic conditions and potential changes in investors' decisions, we add to our baseline specifications (3) and (4) a set of additional variables. First, we include an indicator variable that equals one if the event date falls into a period of economic recession, according to the NBER business cycle indicators (Mar 01–Oct 01 for the 2001 recession, Dec 07–May 09 for the 2007–2009 recession). Second, we add the monthly Michigan Consumer Sentiment index, which is a standard indicator of consumers' expectations on the economy and a predictor of their future spending and saving behavior. Third, we add the slope of the yield curve, measured as the spread between the 10-year and the 3-month constant maturity Treasury bonds, as a predictor of the economic cycle. Fourth, we include the (natural logarithm of) aggregate quarterly flows of funds into U.S. corporate equity, as an indicator of investors' attitude to invest in risky assets. All variables are taken from the Federal Reserve Economic Data.

The estimates are reported in Table 8 and confirm that controlling for additional factors that may affect investors' behavior and decisions in different economic conditions does not explain away our findings: Stock price reactions to downgrades are stronger fol-

Table 9
CRAs' reputational shocks and stock price response to rating downgrades: S&P versus Moody's/Fitch.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
Panel A: S&P downgrades						
Enron rep. shock (a)	0.025	0.066*				
	(0.026)	(0.040)				
Inv. grade × Enron (b)		−0.087**				
		(0.037)				
Subprime rep. shock (a)			−0.015	0.001		
			(0.016)	(0.022)		
Inv. grade × Subprime (b)				−0.036*		
				(0.022)		
Lawsuit rep. shock (a)					−0.024**	−0.033**
					(0.012)	(0.014)
Inv. grade × Lawsuit (b)						0.021
						(0.021)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1275	1275	1058	1058	459	459
Panel B: Moody's and Fitch downgrades						
Enron rep. shock (a)	−0.001	0.018				
	(0.007)	(0.015)				
Inv. grade × Enron (b)		−0.037**				
		(0.019)				
Subprime rep. shock (a)			−0.022	0.017		
			(0.016)	(0.019)		
Inv. grade × Subprime (b)				−0.074***		
				(0.023)		
Lawsuit rep. shock (a)					−0.020	−0.020
					(0.016)	(0.018)
Inv. grade × Lawsuit (b)						0.014
						(0.020)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1528	1528	1408	1408	440	440

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P (Panel A), and Moody's and Fitch (Panel B). Models (1) and (2) include rating downgrades in the two 24-month periods before and after November 28, 2001. Models (3) and (4) include rating downgrades in the two 24-month periods before and after July 10, 2007. Models (5) and (6) include rating downgrades in the two 24-month periods before and after February 4, 2013. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. All specification include the additional control variables reported in Table 4. Standard errors clustered at 2-digit SIC codes in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

lowing CRAs' reputational shocks and the effect is more pronounced for high-quality firms in the aftermath of the Enron scandal and the subprime crisis.

Two additional elements help us support the claim that our findings are not driven by general economic conditions. First, recessions occurred in the period *before* the Enron scandal and in the period *after* the onset of the subprime crisis, yet the findings are comparable in both episodes. Second, the entire period surrounding the S&P lawsuit is free from economic downturns, hence we do not expect the corresponding results to be affected by market-based contamination.

6.3. S&P versus Moody's/Fitch

The above analysis highlights a positive feature of the S&P lawsuit episode, i.e. the absence of any overlap with economic crises. An additional feature that makes this event especially appropriate for testing the effect of CRAs' reputational shocks is that, at least in theory, it directly affected one rating agency only.

In practice, while the lawsuit was filed against S&P only, it hit the reputation of all major rating agencies and initiated a number of concurrent investigations by U.S. authorities into their behavior.[19] As a matter of fact, the stock price of Moody's (the only other publicly traded CRA) dropped by 19% in the two days following the filing of the lawsuit against S&P. Nonetheless, it seems reasonable to expect a higher reputational damage for S&P than for the competitors around this period.

Hence, for our purposes, it is worth investigating whether our findings around the lawsuit are mainly driven by downgrades initiated by S&P. To this end, we replicate our baseline estimations (3) and (4) for the S&P lawsuit episode on the subsamples of downgrades announced by S&P and by Moody's or Fitch. The results are reported in Columns (5) and (6) of Table 9, panels A and B, respectively. We observe that, indeed, investors' reaction to downgrades becomes significantly stronger after the lawsuit for downgrades announced by S&P, but not for those initiated by Moody's or Fitch, in line with a reputational motive.

To assess whether this finding is specific to the lawsuit episode or rather due to a generalized stronger response to S&P downgrades, we repeat the analysis around the Enron scandal and the subprime crisis and report the findings in Columns (1)–(4) of Table 9. Contrary to the lawsuit case, the investors' response to downgrades strengthens for both S&P and Moody's/Fitch in the aftermath of these reputational episodes.

6.4. Rating-based segmentation

We document that in two episodes of reputational distress—the Enron collapse and the subprime crisis—the stronger stock price

[19] In February 2015 S&P agreed to pay $1.375 billion to settle the allegations, while the investigation on Moody's was still ongoing. Moody's finally settled federal and state claims in January 2017 for $864 million.

Table 10
CRAs' reputational shocks and stock price response to rating downgrades: controlling for rating-based segmentation.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
# Notches change	−0.024	−0.019	−0.013	−0.014	−0.058***	−0.054***
	(0.018)	(0.018)	(0.012)	(0.012)	(0.015)	(0.015)
Negative watch	0.003	0.000	0.029**	0.030***	0.026**	0.019
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Log(days)	−0.002	−0.002	−0.000	−0.000	−0.011	−0.010
	(0.004)	(0.004)	(0.004)	(0.004)	(0.009)	(0.008)
Vix	−0.141***	−0.150***	−0.022	−0.028	−0.123	−0.129
	(0.051)	(0.048)	(0.045)	(0.045)	(0.123)	(0.123)
Enron rep. shock (a)	0.020	0.042*				
	(0.015)	(0.023)				
Inv. grade		0.062***		0.030***		0.027**
		(0.014)		(0.009)		(0.010)
Inv. grade × Enron (b)		−0.051**				
		(0.021)				
Subprime rep. shock (a)			−0.010	0.010		
			(0.015)	(0.016)		
Inv. grade × Subprime (b)				−0.050***		
				(0.016)		
Lawsuit rep. shock (a)					−0.023**	−0.028**
					(0.012)	(0.013)
Inv. grade × Lawsuit (b)						0.021
						(0.016)
F-test (a)+(b)=0		1.01		6.29		0.40
p-Value		(0.32)		(0.01)		(0.53)
# Observations	2502	2502	2189	2189	848	848
Adj *R*-squared (%)	1.55	1.93	1.38	1.51	8.32	9.46

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions include downgrades of U.S. issuers by S&P, Moody's and Fitch, but exclude downgrades following which the issuer loses its investment-grade status. Models (1) and (2) include rating downgrades in the two 24-month periods before and after November 28, 2001. Models (3) and (4) include rating downgrades in the two 24-month periods before and after July 10, 2007. Models (5) and (6) include rating downgrades in the two 24-month periods before and after February 4, 2013. *# Notches change* is the unit increase in the numerical rating following the downgrade (positive number). *Negative watch* is a dummy variable that equals one if the issuer was put under negative watch before the downgrade. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. Standard errors clustered at 2-digit SIC codes in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

reaction to downgrades is associated with investment-grade issuers. We argue that this is due to the higher reputational impact of defaults of well-rated firms and the general perception of higher rating inflation in this segment. A potential critique to our interpretation is that our results could be simply driven by the subsample of investment-grade firms that are downgraded to speculative-grade.

A number of rules and regulations restrict holdings of speculative-grade securities for investors such as commercial banks, insurance companies and pension funds. As a result, the loss of the investment-grade status typically produces tighter funding constraints, higher cost of capital and downsizing in investment. We can then expect a stronger stock price reaction to downgrades that move the issuer out of the investment-grade segment. This may confound our findings for investment-grade issuers if those downgrades across the boundary are unevenly distributed around reputational shock episodes. In our specification we control for downgrades to speculative-grade with the indicator variable *HYIG* which, however, may not be sufficient to capture non-linear effects. For robustness, we re-estimate models (3) and (4) on samples that exclude all downgrades across the investment-grade boundary. The results are presented in Table 10 and confirm our previous findings. We can rule out the alternative explanation that the stronger price response for investment-grade firms is driven by those that lose their status.

6.5. Controlling for contamination

One potential issue associated with our methodology is that CARs may fail to accurately represent the information content of rating changes in case other firm-specific announcements take place in the event window (−1, 1). Such contamination will not bias our findings only if it affects events before and during episodes of reputational distress in a similar way. If, instead, contamination is more frequent in one of the two subperiods, the estimated CARs will most likely overestimate the stock market reaction associated to rating changes across that subperiod.

We control for contaminated events using the same approach adopted by Hand et al. (1992) and Jorion et al. (2005). We search the Wall Street Journal Abstract using the issuer's name, and flag as "contaminated" any event where a firm-specific (other than the rating change) news that may potentially impact stock prices appears during the event window (−1, 1). Examples of such announcements include merger and acquisitions, changes in management, debt or stock issuance, revision of financial results, etc. We report in Table 11 the percentages of contaminated rating downgrades for each of the three episodes of reputational loss. On average, the percentage of contamination is about 17%, it is very similar across the three subsamples and not significantly different in the years before and during a reputational loss. This should alleviate concerns

Table 11
Contamination – rating downgrades.

Period	Enron	Subprime	S&P Lawsuit
Pre-Reputational Shock	16.5	20.1	18.6
Reputational Shock	16.0	17.7	17.7
Total	16.2	18.5	18.1
Difference Test	*0.348*	*1.438*	*0.327*

This table reports the percentages of rating downgrades contaminated by contemporaneous news for each of the three episodes of CRAs' reputational distress. An event is classified as contaminated if a firm-specific (other than the rating change) news that may potentially impact stock prices appears in the Wall Street Journal during the event window (−1,1).

that our findings may be due to contemporaneous news unequally spread across subperiods.

For robustness, we construct a non-contaminated sample by excluding all contaminated events, and we re-estimate our two specifications on the new sample. The findings are reported in Table 12: as expected, some of the results are now weaker given that we are excluding events having multiple impact on stock prices. However, our key findings are unchanged: The reputational concerns that follow the Enron failure and the subprime crisis lead to a stronger stock market reaction to downgrades in investment-grade issuers whilst the S&P lawsuit leads to a significantly stronger stock price response for speculative-grade issuers.

6.6. Alternative cutoff dates

Throughout our analysis we use three specific dates as cutoff points to identify the start of periods of reputational distress for CRAs, and we provide arguments to support the validity of those dates in Section 2. However, a potential issue associated with this approach is whether our findings are coincidental to the selected dates. If the CRAs' reputation argument is correct, we might expect our results to be fairly robust around those dates. In particular, reputation typically evolves gradually through time, and skepticism concerning the timeliness and accuracy of credit ratings usually arises on the market before severe downgrades take place. Therefore, we can expect CRAs' reputation to start declining before the selected cutoff dates.

To assess whether our findings are robust to the choice of earlier dates, we re-estimate the specifications in (3) and (4) by selecting as cutoff date the first day of the month for each of the six months preceding the original dates. The resulting coefficients of *REPSHOCK*, together with 95% confidence intervals are reported in Fig. 2 on the left-hand side. On the right-hand side we report the sum of the coefficients of *REPSHOCK* and *IG · REPSHOCK*, together with 95% confidence intervals for the corresponding *F*-test, to measure the impact on investment-grade issuers. The plots confirm that, while our findings are stronger for the original cutoff dates, they are robust to the choice of earlier dates. This is especially the

Table 12
CRAs' reputational shocks and stock price response to rating downgrades: uncontaminated sample.

	Enron		Subprime		S&P Lawsuit	
	CAR (1)	CAR (2)	CAR (3)	CAR (4)	CAR (5)	CAR (6)
# Notches change	−0.008	−0.004	−0.012***	−0.013***	−0.039***	−0.036***
	(0.018)	(0.017)	(0.004)	(0.004)	(0.010)	(0.010)
Negative watch	0.002	−0.002	0.014**	0.014**	0.024**	0.019*
	(0.013)	(0.013)	(0.006)	(0.006)	(0.010)	(0.010)
Across HY-IG	−0.005	−0.025	−0.008	−0.009	0.022*	0.005
	(0.016)	(0.015)	(0.011)	(0.010)	(0.013)	(0.011)
Log(days)	−0.001	−0.001	−0.005	−0.005	−0.024***	−0.023***
	(0.005)	(0.006)	(0.003)	(0.003)	(0.009)	(0.009)
Vix	−0.171***	−0.179***	−0.054	−0.055*	−0.113	−0.114
	(0.061)	(0.060)	(0.033)	(0.033)	(0.123)	(0.124)
Enron rep. shock (a)	0.012	0.032				
	(0.014)	(0.025)				
Inv. grade		0.055***		0.021***		0.014
		(0.014)		(0.008)		(0.011)
Inv. grade × Enron (b)		−0.043**				
		(0.021)				
Subprime rep. shock (a)			−0.014*	−0.002		
			(0.009)	(0.012)		
Inv. grade × Subprime (b)				−0.027*		
				(0.015)		
Lawsuit rep. shock (a)					−0.022**	−0.026**
					(0.009)	(0.010)
Inv. grade × Lawsuit (b)						0.018
						(0.015)
F-test (a)+(b)=0		4.13		7.94		0.36
p-Value		(0.05)		(0.01)		(0.55)
# Observations	2349	2349	2009	2009	735	735
Adj *R*-squared (%)	1.03	1.25	1.84	1.93	7.24	7.59

This table reports regression results for issuers' CAR surrounding rating downgrades. CAR are market-adjusted stock returns aggregated over the three-day event window (−1, 1), where day 0 is the date of a rating change. The rating actions only include uncontaminated downgrades of U.S. issuers by S&P, Moody's and Fitch. Contaminated downgrades are identified by searching the Wall Street Journal using issuer's name. An observation is considered as contaminated if any firm-specific price-relevant information appears in the Wall Street Journal within the (−1,1) window surrounding the event day of rating change. *# Notches change* is the unit increase in the numerical rating following the downgrade (positive number). *Negative watch* is a dummy variable that equals one if the issuer was put under negative watch before the downgrade. *Across HY-IG* is a dummy variable that equals one if, following the downgrade, the issuer has lost his investment-grade status. *Log(days)* is the natural logarithm of the reciprocal of the number of days between the date of the last rating downgrade performed by another rating agency and the event date. *Vix* is the volatility index. *Inv. grade* is a dummy variable that equals one if the issuer is rated investment grade. *Enron rep. shock* is a dummy variable that equals one if the event date is in the 24 months following November 28, 2001. *Subprime rep. shock* is a dummy variable that equals one if the event date is in the 24 months following July 10, 2007. *Lawsuit rep. shock* is a dummy variable that equals one if the event date is in the 24 months following February 4, 2013. Standard errors clustered at 2-digit SIC codes in brackets. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

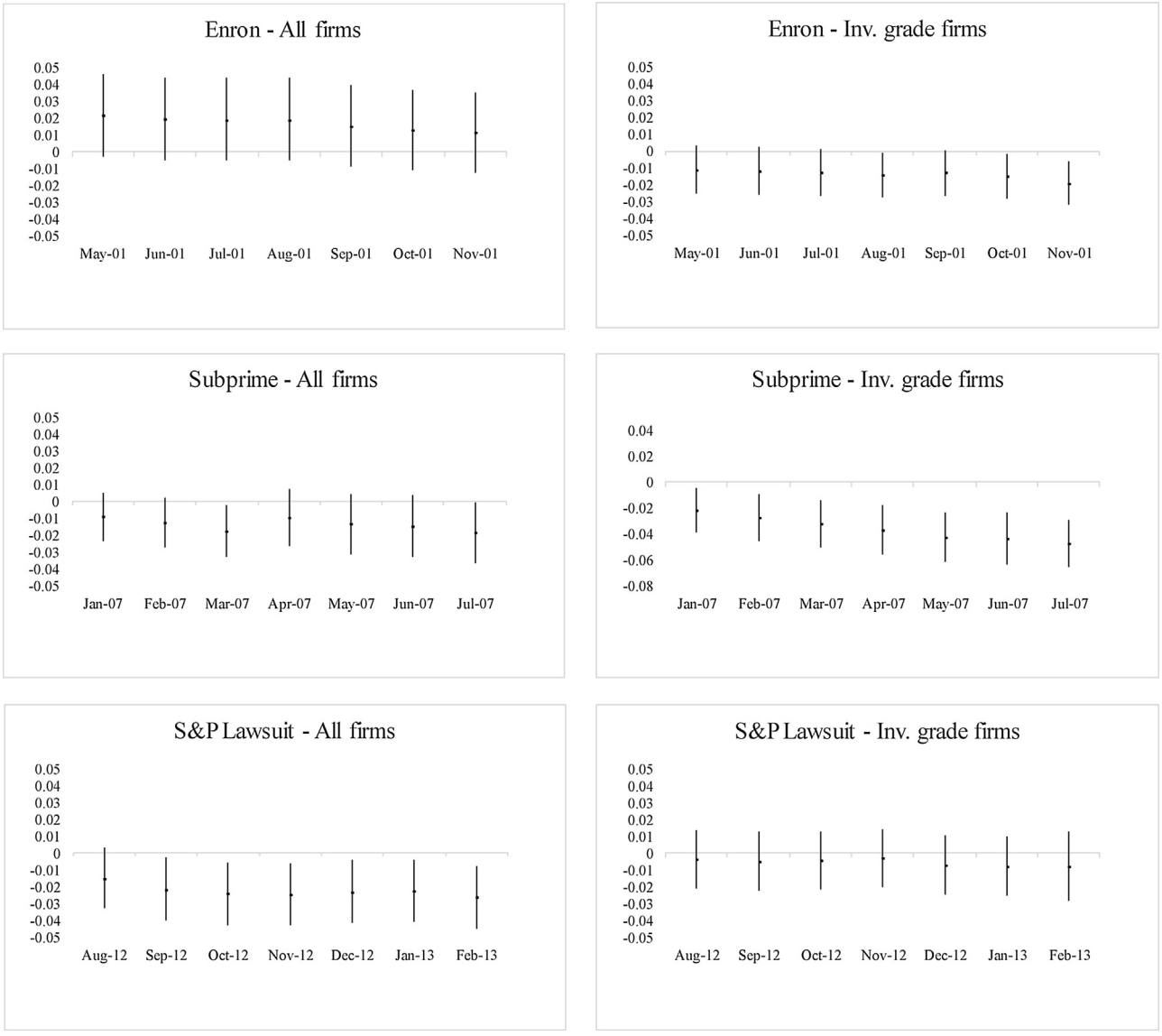

Fig. 2. Alternative cutoff dates. The plots on the left-hand side show the coefficients of *REPSHOCK*, together with 95% confidence intervals, when the cutoff date is the first day of the month for each of the six months preceding the original cutoff dates. The plots on the right-hand side report the sum of the coefficients of *REPSHOCK* and *IG* · *REPSHOCK*, together with 95% confidence intervals for the corresponding *F*-test.

case for the subprime crisis, as several subprime lenders filed for bankruptcy already in the first months of 2007, raising concerns on the accuracy of credit ratings, as well as for the S&P lawsuit, which was preceded by the release of a number of SEC reports and investigations on the credit rating industry.[20]

7. Conclusions

This paper investigates whether episodes of CRAs' reputational distress affect the way rating signals are perceived by market investors. We look at three of those instances: The Enron/Worldcom scandal, the subprime crisis, and the S&P lawsuit filed by the U.S. government. We document a stronger response of stock investors to downgrades following reputational shocks. However, such response is not accompanied by an improvement in rating quality.

Our results are consistent with a scenario where market investors: (i) conclude from rating scandals that ratings may be overstated; (ii) cannot turn away from credit ratings—because, for example, of rating-contingent regulation—and, hence, infer greater negative information from future downgrades. While over-reliance on credit ratings has been widely documented and discussed in the context of sophisticated securities, such as structured products, we provide evidence of its distortive effects in the context of basic instruments such as corporate shares.

The negative effects of rating-based regulation on financial stability in terms of delegation of due diligence and increased risk-taking have been acknowledged by regulators worldwide in the aftermath of the financial crisis. The Financial Stability Board (2010, 2012) issued a number of principles and a roadmap to reduce mechanistic reliance on credit ratings, which revolves around two main points. First, references to CRA ratings should be removed in laws and regulations. Second, alternative definitions of creditworthiness should be introduced. At the time of writing, the first step has been completed by most regulators, while the implementation of the second step is still ongoing. We leave it to future research to assess

[20] See https://www.sec.gov/ocr for a timeline of SEC reports and rulemaking on the credit rating industry.

to what extent these measures aimed at weakening rating-based regulation reduce investors' reliance on ratings and mitigate their response to rating signals issued by CRAs.

References

Alp, A., 2013. Structural shifts in credit rating standards. J. Financ. 68, 2435–2470.
Bae, K.-H., Kang, J.-K., Wang, J., 2015. Does increased competition affect credit ratings? A reexamination of the effect of Fitch's market share on credit ratings in the corporate bond market. J. Financ. Quant. Anal. 50, 1011–1035.
Baghai, R.P., Servaes, H., Tamayo, A., 2014. Have rating agencies become more conservative? Implications for capital structure and debt pricing. J. Financ. 69, 1961–2005.
Bar-Isaac, H., Shapiro, J., 2013. Ratings quality over the business cycle. J. Financ. Econ. 108, 62–78.
Becker, B., Milbourn, T., 2011. How did increased competition affect credit ratings? J. Financ. Econ. 101, 493–514.
Benmelech, E., Dlugosz, J., 2009. The credit rating crisis. NBER Working paper n. 15045.
Bolton, P., Freixas, X., Shapiro, J., 2012. The credit rating game. J. Financ. 67, 85–111.
Bongaerts, D., Cremers, M., Goetzmann, W., 2012. Tiebreaker: certification and multiple credit ratings. J. Financ. 67, 113–152.
Campbell, J., Lo, A.W., MacKinlay, A.C., 1997. The Econometrics of Financial Markets. Princeton University Press.
Cheng, M., Neamtiu, M., 2009. An empirical analysis of changes in credit rating properties: timeliness, accuracy and volatility. J. Account. Econ. 47, 108–130.
deHaan, E., 2017. The financial crisis and corporate credit ratings. Account. Rev. 92, 161–189.
Dichev, I.D., Piotroski, J.P., 2001. The long-run stock returns following bond ratings changes. J. Financ. 56, 173–203.
Dick-Nielsen, J., Feldhütter, P., Lando, D., 2012. Corporate bond liquidity before and after the onset of the subprime crisis. J. Financ. Econ. 103, 471–492.
Dimitrov, V., Palia, D., Tang, L., 2015. Impact of the Dodd–Frank act on credit ratings. J. Financ. Econ. 115, 505–520.
Ederington, L.H., Goh, J.C., 1998. Bond rating agencies and stock analysts: who knows what when? J. Financ. Quant. Anal. 33, 569–585.
Financial Stability Board, 2010. Principles for Reducing Reliance on CRA Ratings.
Financial Stability Board, 2012. Roadmap and Workshop for Reducing Reliance on CRA Ratings.
Financial Times, 2008, January. Ratings agencies move to quell critics.
Fiordelisi, F., Soana, M., Schwizer, P., 2013. The determinants of reputational risk in the banking sector. J. Bank. Financ. 37, 1359–1371.
Fiordelisi, F., Soana, M., Schwizer, P., 2014. Reputational losses and operational risk in banking. Eur. J. Financ. 20, 105–124.
Goh, J.C., Ederington, L.H., 1993. Is a bond rating downgrade bad news, good news or no news for stockholders? J. Financ. 48, 2001–2008.
Hand, J.R.M., Holthausen, R.W., Leftwich, R.W., 1992. The effect of bond rating agency announcements on bond and stock prices. J. Financ. 47, 733–752.
Holthausen, R., Verrecchia, R., 1988. The effect of sequential information releases on the variance of price changes in an intertemporal multi-asset market. J. Account. Res. 26, 82–106.
Holthausen, R.W., Leftwich, R.W., 1986. The effect of bond rating changes on common stock prices. J. Financ. Econ. 17, 57–89.
Iannotta, G., Nocera, G., Resti, A., 2013. Do investors care about credit ratings? An analysis through the cycle. J. Financ. Stab. 9, 545–555.
Jankowitsch, R., Ottonello, G., Subrahmanyam, M.G., 2017. The rules of the rating game: Market perception of corporate ratings. Working Paper, WU and New York University.
Jiang, J., Stanford, M., Xie, Y., 2012. Does it matter who pays for bond ratings? Historical evidence. J. Financ. Econ. 105, 607–621.
Jorion, P., Liu, Z., Shi, C., 2005. Informational effects of regulation FD: evidence from rating agencies. J. Financ. Econ. 76, 309–330.
Kothari, S., Warner, J., 2007. The econometrics of event studies. In: Eckbo, B. (Ed.), Handbook of Corporate Finance, vol. 1. Elsevier, North-Holland.
Mathis, J., McAndrews, J., Rochet, J.C., 2009. Rating the raters: are reputation concerns powerful enough to discipline rating agencies? J. Monetary Econ. 56, 657–674.
Opp, C.C., Opp, M.M., Harris, M., 2013. Rating agencies in the face of regulation. J. Financ. Econ. 108, 46–61.
Pastor, L., Veronesi, P., 2009. Learning in financial markets. Annu. Rev. Financ. Econ. 1, 361–381.
Strobl, G., Xia, H., 2012. The issuer-pays rating model and ratings inflation: evidence from corporate credit ratings. Working paper, University of Texas at Dallas.
The Wall Street Journal, 2002, January. Moody's and S&P, Singed by Enron, may Speed Up Credit Downgrades.
Department of Justice, U.S., 2013, February. Complaint for civil money penalties and demand for jury trial filed by the U.S. Department of Justice against Standard & Poor's., pp. 39.
White, L.J., 2010. Market: the credit rating agencies. J. Econ. Perspect. 24, 211–226.