Dividend smoothing and credit rating changes

Panagiotis Asimakopoulos[*], Stylianos Asimakopoulos[†], Aichen Zhang[‡]

Abstract

This paper examines the impact of credit rating changes on firms' dividend smoothing behavior, considering for the first time the "big three" credit rating agencies (Standard and Poor's, Fitch and Moody's). Using a hand collected sample of credit rating changes for firms listed at the S&P500 that are involved in dividend payments, we implement the traditional Lintner's (1956) model and we initially verify the fact that firms smooth their dividend payments. Then we consider the effect of credit rating changes on smoothing behavior and we show the presence of an asymmetric impact on credit rating changes to dividend smoothing behavior. In particular, on average, a credit rating downgrade among any of the three credit rating agencies forces firms to engage in less smoothing, whereas a credit rating upgrade has only a marginal positive effect on dividend smoothing. Finally, our key results remain valid for firms with high level of financial pressure and under various robustness checks.

Keywords: dividend smoothing, credit ratings, financial pressure

JEL Classification: C23, G24, G3, G35

[*] *Loughborough University, School of Business and Economics; Email: p.asimakopoulos@lboro.ac.uk*

[†] *Corresponding author, University of Bath, Department of Economics; Email: s.asimakopoulos@bath.ac.uk*

[‡] *University of Bath, Department of Economics; Email: a.zhang@bath.ac.uk*

1 Introduction

The aim of this paper is to assess the effect of credit rating changes (upgrades or downgrades), among the "big three" credit rating agencies (Moody's, Standard & Poor's and Fitch), on firm's dividend smoothing pattern.

On the one hand, Black (1976) said that: "The harder we look at dividend picture, the more it seems like puzzle with pieces that just do not fit together". In addition, payout policy is related to and interacts with most of the firm's financial and investment decisions (i.e. Brav et al., 2005). On the other hand, credit ratings not only guarantee the proper functioning of the financial system but they also help investors to measure and assess their risk bearing. Credit rating evaluations, provided by credit rating agencies (CRAs), measure the long-term fundamental credit strength of issuers. In particular, Graham and Harvey (2001) state that credit ratings are the second most important factor affecting firm's capital structure. Credit ratings are a major concern to managers when making financing and investment decisions as changes in credit ratings affect company's financial frictions.[1] As a result, a change of the existing credit rating from at least one credit rating agency (CRA) towards any direction will probably affect firm's capital structure triggering alterations to its targeted dividend and smoothing behavior.

As a consequence, any observed change to the smoothing pattern of the firm, following a change to its credit ratings, would be crucial to firm's value and corporate decision making. This would be opposite to Lintner's (1956) observation that dividend smoothing is a common fact for the majority of the firms as their main concern is the stabilization of dividend payments avoiding to cut dividends disclosing a bad signal to the market or to rise dividends to levels that they cannot sustain in future. Therefore, we should expect that firms' dividend smoothing behavior is neutral to any credit rating changes by any CRA. However, a credit rating downgrade would probably force firms to adjust the contribution of their current

[1] For example, credit ratings determine whether institutional investors such as banks or pension funds are allowed to invest in the company's securities.

earnings to dividend payments in an effort to keep them stable, without foregoing potential investment opportunities, as the cost of borrowing and the access to capital markets might be affected.

The empirical results of this study show that there is an asymmetric effect of credit rating changes to firms' smoothing behavior. In particular, on average, the impact of a credit rating downgrade is more pronounced than that of a credit rating upgrade to firms' dividend smoothing pattern. A credit rating downgrade forces firms to revise their smoothing pattern as they rely less on lagged dividends, whereas a credit rating upgrade affects smoothing only marginally. Therefore, investigating dividend smoothing and credit rating changes simultaneously, improves our theoretical and empirical knowledge formulating fundamental relationships between them.

1.1 Related literature

Each mentioned channel (credit ratings and dividend smoothing) has been examined separately to identify the potential effects on firm performance, finance and investment policy, stockholders' and investors' reactions, as well as capital structure decisions. Regarding dividend smoothing, since the seminal study by Lintner (1956) the phenomenon of dividend smoothing has been widely documented in the literature. A common acceptance of smoothing behavior is that dividend changes respond slowly to earnings changes and managers are willing to increase the dividends only when they feel that the higher level of dividends will be maintained through a permanent increase in future profitability and earnings. Moreover, managers are ready to bear significant costs by avoiding to reduce the past dividend due to its potential negative signal that will be disclosed to the market.[2] These findings hold for many firms located on different countries and time periods (e.g., Fama and Babiak, 1968; Brav et al., 2005; Aivazian et al., 2006; Leary and Michaely, 2011; and Khieu and Pyles,

[2] Brav et al. (2005) argue that managers are willing either to abandon profitable investment opportunities with positive net present value (NPV) or to raise new capital from external market instead of reducing dividend payments. In addition, Larkin et al. (2016) reports that market is willing to pay a premium to the shares of firms that pay a dividend consistently.

2016).

Existing theoretical studies argue that dividend smoothing is a corporate governance device and more specifically a means either to mitigate asymmetric information, or signaling firm's "true" quality, or to resolve agency problems. In the case where insiders (managers) have better information about the firm's future cash flows and investment opportunities, smoothing behavior will be more pronounced among firms for which the benefit of signaling is substantial. Kumar (1988), Kumar and Lee (2001) and Guttman et al. (2010) using asymmetric information models show that there is a positive relationship between dividend smoothing and cash flow volatility, equity risk and growth prospects of the available investment opportunity set. DeMarzo and Sannikov (2008) argue that dividend smoothing behavior is generated by information asymmetry between the owners and the managers of the firm into consideration.

According to agency theory, persistent distribution of cash disciplines managers and reduces the extent of agency conflicts between managers and shareholders. Thus, shareholders will prefer a smoothing behavior trying to diminish the available cash that management controls in order to constrain them from excessive (unmonitored) spending. Easterbrook (1984) and Jensen (1986) argue that firms' commitment of high dividend distribution concurrently with high smoothing leads firms to seek for external source of financing to meet their financing needs. This exposure to the scrutiny of external financial markets reduces agency costs. Consistent with this argument, Fudenberg and Tirole (1995) and Allen et al. (2000) indicate that the payment of stable and predictable dividends is a way of mitigating agency conflicts between shareholders and managers.

Although both surveys[3] and empirical[4] evidences propose that the basic element of payout policy is dividend smoothing, there is little understanding of why firms smooth their dividends or what determines firms' tendency to follow a smoothing behavior. Leary and

[3]See Lintner (1956), Baker et al. (1985), and Brav et al. (2005).

[4]See Brav et al. (2005), Skinner (2008), Leary and Michaely (2011), Lambrecht and Myers (2012) and Larkin et al. (2016).

Michaely (2011) report that dividend smoothing is more prevalent among financially unconstrained firms with stable cash flows, low growth rate, weaker corporate governance and low levels of asymmetric information, supporting agency-based models of free cash flow in favor of dividend smoothing. Similarly, Javakhadze et al. (2014) examine the extent to which asymmetric information theories and agency-based models could justify dividend smoothing behavior without a clear winner.

The information content of credit ratings has also drawn a lot of attention in the literature. Partnoy (2002) argue that credit ratings are designed to provide valuable information to investors and help them make wise decisions on the purchase or sale of bonds. Kisgen (2006) show that companies that take into account credit rating upgrades or downgrades have fewer debts than companies that do not pay attention to credit rating changes. Moreover, Kisgen (2009) examining the relation between credit ratings and capital structure indicates company's aversion towards a lower credit rating.

Instead of examining each CRA as substitutes, Bongaerts et al. (2012) explore the economic role of multiple credit rating agencies in the corporate bond market. Using a variety of empirical implications they examine three existing theories about multiple ratings: information production, rating shopping, and regulatory certification.[5] Their empirical results support the regulatory certification hypothesis. Moreover they justify in detail the important role of credit ratings in capital markets as credit ratings affect the demand for corporate bond by insurance companies, institutions, and banks because all of them are subject not only to rating-based restrictions but also to the amount of risky debt that are permitted to hold. They also report that there are important differences across multiple credit ratings of the same bond issue at the same time interval and Fitch gives on average more positive ratings

[5] In short, the "information hypothesis" postulates that multiple ratings add value-relevant information. If CRAs do not perfectly agree or there is uncertainty about credit quality, while issuers have more accurately information about their own credit quality, according to the "shopping hypothesis", the issuers will solicit for extra rating only if they are sure about the improvement to their average ratings. The "regulatory certification" hypothesis points out issuers will solicit for extra rating due to precautionary motives, only in case there is fear to experience a future downgrade to high yield status. In this case the extra CRA will play the role of tiebreaker (see Bongaerts et al. (2012) for more details).

compared to Moody's and S&P without providing extra credit information than what it is already contained in Moody's and S&P ratings.[6] Finally, Bongaerts et al. (2012) argue that Fitch plays the role of a "third opinion" for large bond issues or it is the "tiebreaker" that decides the final status the issue falls considering the most prevalent institutional rule for classifying rated bonds.[7]

Asimakopoulos and Asimakopoulos (2019) take as given the existence of multiple credit rating agencies and they explore the impact of credit rating changes on corporate cash holdings considering at the same time the "big three" CRAs (Moody's, Standard & Poor's and Fitch). Their results support the information content of credit ratings as they find consistent evidence of cash hoarding behavior following multiple credit rating changes.

The above analysis indicates that a potential change to the credit value of the issuer firm may alter its payout policy and smoothing behavior due to the effect on its existing access to external sources of financing and borrowing costs (Kisgen 2006, 2009). Since firms are traded under imperfect capital markets and operate with frictions and financial flexibility issues, managers must ensure that they retain sufficient cash so as to take advantage of unanticipated investment opportunities and to overcome unforeseen problems.[8]

1.2 Hypotheses development

The goal of this study is to assess whether the established dividend smoothing behavior of the firms is affected by credit rating changes from any of the "big three" credit rating agencies (Moody's, Standard & Poor's and Fitch).

The starting point of the analysis is based on the seminal work of Lintner (1956) consider-

[6] Asimakopoulos et al. (2017) show that a different information hypothesis (regarding the time dimension) matters for the investors and policy makers via a more detailed monitoring of the market, albeit in a different setup.

[7] For further details see the National Association of Insurance Commissioners (NAIC) guidelines or the Basel II Accord.

[8] Opler et al. (1999), Gao et al. (2013) and Asimakopoulos et al. (2019) have shown that firms' financial policies have a significant role in corporate cash management policies particularly, in maintaining the optimal level of cash.

ing that dividend smoothing still applies to managers' dividend policy.[9] This indicates that managers are primarily concerned with stabilizing dividend payments and thus committing to a dividend smoothing behavior. In other words, managers do not follow a residual policy nor leave their dividend distributions to chance. In fact, dividend changes react slowly to earnings changes, and managers are prepared to bear substantial expenses to prevent dividend reductions because they believe that: "investors prefer a stable dividend rate and that the market puts a premium on stability and gradual growth", according to Lintner (1956).[10]

Nonetheless, the stability of dividends may be unsustainable because there may have been changes to other factors rather than the earnings. Considering the argument of Graham and Harvey (2001) that credit rating changes are the second most important factor that affects capital structure,[11] we assume that, among other factors, managers consider a change in credit rating to any direction as a significant external factor that could lead to deviations from the established dividend smoothing behavior. This line of thought is based on the fact that payout policy is important, not only because of the amount of money involved, but also because payout policy is related to and interact with the financial and investment decisions firms make on a recurring basis. For example, Dittmar et al. (2003) argue that firms use cash as a buffer mechanism between retained earnings and investment needs, instead of defining a target cash level. Understanding how credit rating changes affect payout policy may also help us to recognize how firms set up capital structure, financing or even capital budgeting decisions. All of these are relied on how and why firms distribute cash to shareholders or retain them in the firm.

In particular, since a change in the creditworthiness of the issuer will affect the access

[9] Despite Lintner's (1952) work is so old, his findings still hold for many firms and more recent time periods (e.g., Fama and Babiak (1968), Brav et al. (2005), Leary and Michaely (2011)).

[10] Brav et al. (2005) argue that managers are prepared to raise external capital or even forego profitable investments in order to avoid cutting dividends.

[11] Similarly, according to Kisgen (2006) because financial frictions are associated with credit ratings, they are a major concern to a firm manager when making decisions. As a result, the inclusion of credit ratings at the capital structure framework can improve the understanding and accuracy of capital structure behavior. He points out that companies that take into account credit rating upgrades or downgrades have fewer debts than companies that do not pay attention to credit rating changes.

to capital markets and the cost of borrowing,[12] we expect that financial managers who go beyond the dividend stickiness and consider what drives the ability of their firms to generate cash available for dividends distribution to react appropriately. Therefore, they should change the dividend smoothing behavior in such a way that the information content of credit rating changes is distorted in favor of firm's perspective. The latter is partially related to the investors' perception that the levels of dividends indicate the financial future of the firm and, in turn, the investment potential of the stock. For example, firms being downgraded by any among the "big three" credit rating agencies should probably smooth less their dividends to be able to fulfill short-term needs and potential investment opportunities as the cost of borrowing will increase and the access to capital markets might deteriorate. But, firm's response to credit rating changes depends on the presence of market frictions which in turn will affect the availability of precautionary funds and firm's level of access to external funds and the cost of external financing, respectively. Thus, upgrading or downgrading a firm's creditworthiness affects not only its payout policy but also its financing and investment decisions. The above arguments lead us to our first hypothesis.

Hypothesis 1: Dividend smoothing is affected by credit rating changes by any CRA.

If Hypothesis 1 is valid, then we expect that a credit rating change toward any direction will trigger an asymmetric reaction to the adopted dividend smoothing behavior of the firms. More specifically, we anticipate that the effect of a credit rating downgrade should be more pronounced forcing firms to engage in less dividend smoothing compared to a credit rating upgrade. This leads to our second hypothesis.

Hypothesis 2: A credit rating change will lead to an asymmetric dividend smoothing adjustment.

The above hypothesis is in line and in fact derived from the existing literature that

[12] Denis (2011) claim that firms with costly external financing can undertake valuable investments opportunities only by keeping larger cash reserves and as a consequence they alter their dividend smoothing behavior.

examines the potential impact of credit rating changes on stocks and bonds. The majority of this literature (i.e. Hand et al., 1992; Dichev and Piotroski, 2001; Jorion et al., 2005) uncovers an asymmetric market response to credit rating changes, as credit rating downgrades are associated with significant negative abnormal returns with almost little or no significant effect on stock returns following credit rating upgrades. This counteraction is suggested by the literature to occur from the lower probability of having downgrades relative to upgrades. Thus, investors are less likely to expect more downgrades than upgrades.

Following the same argument, we also believe that there will be an asymmetric market reaction of credit rating changes to firms smoothing behavior. Alsakka and Gwilym (2010), for example, claim that a credit downgrade announcement is typically more informative than favorable ones due to the more severe adverse reputational. As a result, we anticipate that managers are willing to engage to less smoothing in order to mitigate the negative effects of credit rating downgrades because any downgrade is perceived as a bad signal by market participants. This downgrade will force lenders to lose their assurance about the borrowers' credit risk and the latter will increase the cost of the firm's borrowings and investment funding injections. Contrary to that, a credit rating upgrade should not trigger any alteration to managers dividend smoothing behavior because the later should be able to sustain the same dividend level in the future. Therefore, credit rating upgrades are associated with less valuable information.

The above two hypotheses are enhanced if we also take into account the fact that credit rating agencies: i) serve as an information intermediary reducing the asymmetric information between managers and outside investors (Kliger and Sarig, 2000); ii) provide a signal regarding the creditworthiness of the issuer and its ability to fulfill debt obligations (Thompson and Vaz, 1990); and iii) reveal private information such as internal reports, capital budget forecasts and outlooks, current and future investment strategies, as well as assessments about the quality of the managers.

1.3 Our contribution

Many cross-sectional determinants of dividend smoothing have been investigated with an emphasis on agency costs, asymmetric information, ownership structure, legal protection available to investors, national tax system and the nature of national cultures. However, the possible impact of credit rating changes on dividend smoothing behavior is still unexploited. The only exception in the literature is the paper of Aivazian et al. (2006) who find a significant interaction between dividend smoothing and the type of rating debt. More specifically, using an augmented Lintner model they indicate a preference in favor of dividend smoothing from firms that have access to public debt and are bond rated, than firms that are not rated and follow as a consequence a residual dividend policy. Nevertheless, they do not examine how a credit rating change among any of the CRAs could affect the observable dividend smoothing behavior since their main focus was on the existence or not of bond rating.

Therefore, the primary aim of this paper is to exploit, for the first time, the potential impact of credit rating changes, towards any direction, on the company's adapted smoothing behavior. We use unique and hand-collected long-term domestic issuer ratings for 283 U.S. firms listed in S&P500 from three big credit rating agencies (Moody's, S&P and Fitch) for the period 1951-2017. Applying the classical Lintner's (1956) model to estimate the degree of dividend smoothing, our empirical findings show: i) an asymmetric effect of credit rating changes on dividend smoothing behavior; ii) a negative relationship between credit ratings downgrade and dividend smoothing; iii) that financial pressure contributes to the asymmetric effect on smoothing behavior; and iv) the reluctance of managers to cut dividends.

Moreover, an important characteristic of our study that provides unexploited results in the literature is the fact that we examine all the available CRAs without considering the presence of them as interchangeable. Credit rating is a highly concentrated industry where the "big three" CRAs (Moody's, Standard & Poor's and Fitch) control about 95% of the rating business.[13] There are some similarities among their rating philosophy, but they rate

[13] Alessi (2013) and Duff and Einig (2007) argue that Moody's and S&P jointly control 80% of the global

the creditworthiness of an issue or issuer differently, relying on different kinds of information and disclosure different signals to the market. For example, S&P's and Fitch's ratings measure the probability whether a security will default or not, while Moody's ratings seek to measure the expected losses in the event of a default, reflecting dispersion in expected loss (White, 2010). Thus, we use rating data from these rating agencies to assess the impact of the change of credit ratings of at least one CRA on firm's smoothing behavior. The importance of this exercise is further enhanced if we consider the fact that firms always solicit and pay for multiple ratings so as to reduce potential uncertainty about both their credit quality and default probability.

Our findings complement existing theories of dividend smoothing and provide direction for future theoretical work. Given that we use three different CRAs, we are also able to analyze the dividend smoothing behavior of the company from a microcosmic perspective and focus on their possible strategic response to each credit rating change event considering its impact on dividend smoothing. Our paper has broad economic and policy implications, which extend beyond firms' payout policy. Any potential observed pattern of credit rating scores and dividend smoothing fuels ongoing debate over whether it is optimal for the issuer firm to solicit for credit scores.

The remainder of the paper is structured as follows: In Section 2 we analyze the data-set and discuss some sample characteristics. In section 3 we discuss our methodology and present the empirical results. Section 4 provides several robustness checks. Section 5 concludes the paper and provides policy implications.

market and Fitch further controls 15%.

2 Data

2.1 Data construction and sources

We initially hand collect historical data from Datastream regarding credit ratings issued by all three major agencies (Standard & Poor's, Fitch and Moody's) for the firms currently listed at the S&P500. We then merge this dataset with data from Compustat Fundamentals Annual so as to match the firms with available ratings to their balance sheet and financial data. Following Opler et al. (1999) and Gao et al. (2013), we exclude financial institutions (with Standard Industrial Classification (SIC) codes 6000-6999) and utilities (with SIC codes 4900-4999). We also winsorize our dataset at the 1% and 99% levels. Following Larkin et al. (2016) and because we examine the impact of credit rating changes on dividend smoothing and not on dividend levels, we consider only firms that pay dividends consistently,[14] excluding zero dividend distributions. In line with the argument of Larkin et al. (2016), firms that do not pay dividends have a constant dividend stream of zero, which mechanically assigns them to the top smoothing group and the behavior of those firms is fundamentally different from the behavior of firms that pay constant and positive dividends. Therefore, we end up with an unbalanced panel of 409 unique firms leading to 9,339 firm-year observations for the period 1951-2017.[15]

Regarding the credit rating agencies (CRAs) data, we first identify the upgrades and downgrades for each agency separately via transforming the letter ratings to numbers. In particular, we assume that for each CRA the highest possible score gets the value of 1 and then all the subsequent scores are numbered accordingly. For example, AAA score by Fitch gets the value of 1, AA+ the value of 2, AA the value of 3 and so on. The last rating for S&P and Fitch stops at C and for Moody's stops at Ca. We exclude firms already in default,

[14] A firm is assumed to pay dividends consistently when it pays a positive dividend every consecutive year for the period that it is included in our sample. Therefore, if a firm in our sample does not pay a dividend every year then it is excluded from our empirical analysis. However, we also checked our sample, before excluding firms that do not pay dividends every year consistently, and we could not find any firms that stopped paying dividends in a given year and then resumed their dividend payments in a later year.

[15] We also show in the appendix a figure with the evolution of unique firms over time in our sample.

rated as D for S&P and Fitch or C for Moody's, due to the imposed restrictions to these firms. From the above procedure we define as an upgrade (downgrade) of a firm's credit rating the decrease (increase) in the credit rating numerical value from period $t-1$ to period t.[16]

2.2 Sample characteristics

The related dividend smoothing literature has used a variety of proxies for both agency conflicts issues and asymmetric information prospects (see for example Aivazian et al., 2006; Chay and Suh, 2009; Leary and Michaely, 2011; Farre-Mensa et al., 2014; and Larkin et al., 2016).

It is shown that firms with more free cash flows (FCF) should pay more dividends, minimizing the cash available to manager for self-interest fulfillment and reducing agency cost between manager and shareholders (e.g. Fama and French, 2002; and Jensen, 1986). We measure FCF as the ratio of operating income before depreciation minus capital expenditure scaled by total assets and we except a positive relation between FCF and dividend smoothing.

We also estimate two different measures of firm's profitability: $Profits$ measured as net income divided by total assets; and $Tobin's\ Q$ measured as the book value of assets minus book value of common equity plus the market value of common equity scaled by total assets. Taking into account cash flow perspective and agency motives, we expect a positive relation between profitability and dividend smoothing.

Moreover the market-to-book ($M-B$) ratio is used as a proxy for growth opportunities. Firms with more growth opportunities have a greater need for cash and capital infusion reducing their agency costs, as they face less free cash flow problems (Chay and Suh, 2009; and Firth et al., 2016). As a consequence we expect a negative relationship between $M-B$

[16] We would like to note that in our sample we the mean value of institutional ownership is at about 69.6% with 13.5% standard deviation. This indicates clearly that our firms experience high levels of institutional ownership and as a result we do not expect that ownership structure affects our dividend smoothing results.

ratio and dividend smoothing.[17] The same relationship is expected with tangible assets and investment. Following Aivazian et al. (2006) and Leary and Michaely 2011, we measure *tangibility* as the ratio of net property, plant and equipment scaled by total assets, whereas we measure *investment* as the ratio of capital expenditures over lagged net fixed assets.

Following Javakhadze et al. (2014) and Leary and Michaely (2011), we also use firm *size*, calculated as the natural logarithm of total assets, and we anticipate that firms smooth less as size increases. Larger firms will have less costly and easier access to capital markets, more stable future earnings and profitability, resulting to less asymmetric information and less smoothing behavior.[18]

We finally measure leverage as the ratio of long-term debt plus debt in current liabilities over total assets in order to examine the level of financial flexibility of the firm, as in DeAngelo and DeAngelo (2007) and Leary and Micahely (2011). Low leverage leads to better financial flexibility, but exposes firms to agency costs (Fenn and Liang, 2001; and Firth et al., 2016). Taking into account the assumption that debt and dividends are considered as substitutes in resolving agency problems, since they might be used to reduce cash flows problems, we expect a negative relationship between leverage and dividend smoothing behavior.[19]

Table 1 provides the summary statistics of several variables that will be used in our future analysis. The first set of rows presents the mean and standard deviations of our entire dataset, including firms that do not pay dividends.[20] The second set of rows show the same statistics but for the firms that pay dividends consistently over the years (i.e. dividends

[17]This line of thought does not provide any expectation about the direction of dividend changes. From one side, according to pecking order the relationship between dividends and investment opportunities could be negative due to cash flow being used to finance investments (La Porta et al., 2000; Fama and French, 2001; and DeAngelo et al., 2006). On the other side, the relationship between investment opportunities and dividends could be positive considering that managers are reluctant to cut dividend in the future since dividend cuts are perceived as a bad signal to capital providers. As a result, according to the substitute theory firms' managers with growth opportunities are willing to distribute a higher dividend to attract capital providers as they are sure that they can retain the higher dividend in the future. Thus, the effect of growth to dividends is ambiguous.

[18]In the appendix we also provide a table (Table A2) that summarizes our variable definitions.

[19]In the appendix we also provide a table (Table A1) that shows the association between credit rating changes and dividend changes as numbers of firm-year observations.

[20]We do not include any special dividends in our analysis.

per share are positive for each firm i and year t, $DPS_{i,t} > 0$) and form our basic dataset, whereas the third set of rows show the summary statistics for the firms that changed their dividends towards any direction between two consecutive years (i.e. the change of dividends per share between two consecutive periods is non-zero, $\Delta DPS_{i,t} \neq 0$), indicating a possible lower dividend smoothing behavior.

Overall, comparing the second with the third set of rows, we confirm our expectations discussed at the beginning of this section. On average (using the mean values) firms that potentially smooth less, indicated by $\Delta DPS_{i,t} \neq 0$, have larger assets (are bigger in terms of size) and higher sales compared to the mean value of the sample with firms that pay dividends (second set of rows). We also find that firms with potentially lower smoothing behavior are more profitable (for every profit indicator we used) and with higher free cash flow.[21]

Table 1 here

2.3 Factors affecting the probability of changing dividend smoothing behavior

The previous subsection indicates that dividend smoothing behavior is less pronounced for bigger firms. If these firms are less profitable and with lower cash flows, there is a larger probability of having less smoothed dividends. In addition to the impact on dividend smoothing, these factors might affect credit ratings as well. If the effect of these variables on dividend smoothing and credit rating is the same (of the same sign and magnitude), then there might be an issue of identification. For example, if profits affect the same way dividend smoothing and credit rating changes, then using Lintner's (1956) model we will not be able to clearly identify if dividend smoothing is affected by credit rating changes or changes in profits.

Therefore, in this subsection we will estimate, using Logit models, the probability of:

[21] We get even more pronounced differences between the two samples if we consider firms that changed their dividends more than a certain threshold, e.g. 30%, towards any direction. In this case we would avoid firms that change their dividends only slightly and consistently with a dividend smoothing behavior.

i) observing changes in dividends between two consecutive years, indicating lower dividend smoothing behavior, following a credit rating change;[22] and ii) of a firm experiencing a credit rating change.

Table 2 shows the results from the estimation of various logit models, following Aivazian et al. (2006). Our analysis is focused on firms that are committed to paying dividends consistently every period (i.e. $DPS_{i,t} > 0$), similar to Larkin et al. (2016). Our dependent variable in Models 1-6 is a dummy variable that represents a firm's decision to change the dividend amount in a given year.[23] Model 1 investigates the relationship between dividend changes and credit rating upgrades or downgrades from any of the "big three" CRAs. The estimated coefficient for upgrades is negative and statistical significant, whereas the estimated coefficient for downgrades is positive and statistical significant. This indicates an asymmetric and significant impact on firm's dividend policy from credit rating changes. In more detail, firms are more likely to alter their distributed dividends after a credit rating downgrade as the cost of borrowing from capital markets may increase generating higher borrowing costs. However, under a credit rating upgrade firms are more secured with respect to their future access to financial markets triggering a smoother dividend payment.

In Model 2, we move one step further and we take into account the various industry effects, similar to Aivazian et al. (2006), on dividend behavior using a dummy variable for each of the seven industries, using SIC codes, in our sample. The coefficient for downgrades (upgrades) is positive (negative) and statistical significant having a considerable predictive power over the likelihood that a firm changes the dividends in the current year. Moreover, in Model 2, which is an adjustment of the previous model, the R^2 increases significantly from 0.9% to 4.3%, which means that there is a more clear relation between credit rating changes and dividend payout changes when taking industry effects into account. Model 3

[22] In this subsection we consider any change in dividend as an indication of lower dividend smoothing. We acknowledge the fact that minor changes of dividends over time do not necessarily break the dividend smoothing behavior. We do consider this in our analysis later on when we assess specifically increases and decreases of dividends larger than a certain threshold resulted from our smoothing analysis in the next section. In this subsection we just analyze a general impact of credit rating changes on dividend behavior.

[23] Our reference to dividend changes is about dividend per share changes, $\Delta DPS_{i,t}$.

takes another step forward by including year indicators to capture a variety of year economic conditions that could affect firm's dividend policy irrespectively of the precedence of credit rating changes. The estimated outcomes of Model 3 confirm the predictions of the previous two models as the coefficients of both upgrade and downgrade rating changes exhibit the same sign and significant impact on dividend changes. A further increase of R^2 of Model 3 to 12.9% enhances the relationship between credit rating changes and dividend changes. In summary our results from Models 1-3 suggest that credit rating changes appear to be an important determinant of the probability of dividend changes towards the opposite direction of the change of credit ratings. These results are consistent with our first hypothesis that managers incorporate credit rating changes into their dividend planning.

Next we consider how other explanatory variables, which are based on firm characteristics such as profitability, investment opportunities, future growth (measured by M/B ratio) and leverage, predict a change in dividend policy. Model 4 shows that profitability, investment and growth opportunities have positive impact on dividend changes, which means that firms are more likely to change their dividend payments with respect to increases of those variables. The estimated outcome of this model supports the arguments of the existing payout literature that the probability of a firm changing the level of dividends, given the presence of market frictions, increases only when managers are sure that the new level of dividend will be satisfied in future as profitability and investments improve in case of asymmetric information issues and when growth prospects expand reducing the free cash flow problem in case of agency consideration. Moreover, leverage has negative impact on dividend changes, but it is not statistical significant as cash in that case are needed to cover the interest payments or because interest payments minimize the impact of signalling as interests and dividends are considered as substitutes (Fenn and Liang, 2001 and Fama and French, 2002).

In Model 5 we evaluate public market access by taking into account firms' total and tangible assets as additional explanatory variables. We expect a positive relationship between dividend changes and market access but this assumption is partially satisfied as only the coefficient of the total assets is positive and statistical significant whereas that of tangible asset is negative, contrary to theory, but it is insignificant. Finally, in Model 6 we add one firm's performance indicator and the free cash flow variable.[24] Similar with the profits variable, the additional firm's performance indicator and the free cash flow variable exhibit a positive relation with dividend changes. In general, our results support the results of the related literature in dividend policy and are similar with the relevant models of Aivazian et al. (2006).

In the last two columns (Models 7 and 8) the dependent variable is a dummy variable that represents credit rating changes in a given year. In these experiments we are interested in assessing if the variables that affect dividend changes also affect credit rating changes in the same way. In more detail, Model 7 shows that profitability, investment and growth opportunities have negative impact on credit rating changes, which means that CRAs are less likely to change their credit scores as those variables improve, which is opposite to what we found in Models 4-6. Furthermore, leverage is an important factor for credit rating changes since the increase on leverage increase the likelihood of a credit rating change. Model 8 extends the findings of Model 7 showing that the likelihood of a credit rating change further decreases with Tobin's Q and free cash flow.

In general, the results of Model 7 and 8 illustrate that the explanatory underlying variables that affect dividend changes do not affect credit rating changes in the same way. In fact the same variables have the opposite sign between the two cases. For example, comparing Models 5 and 7 we observe that higher levels of profits, investment and book-to-market ratio are more likely to lead to changes in dividend payments, but less likely to lead to changes in credit ratings. This indicates that changes in dividends and credit ratings are not driven by the same underlying economic characteristics and as a result there would be no identification

[24] Note that here we also drop Market-to-Book ratio due to collinearity with Tobins'Q.

issue when we analyze the impact of credit ratings on dividend smoothing.

Table 2 here

3 Dividend smoothing

The above results indicate that credit rating upgrades and downgrades affect significantly dividend payments. They also show that this relationship is not affected by the same underlying firm characteristics. We now examine if firms that experience a credit rating change (upgrade or downgrade) are more likely to follow a residual dividend policy or a smoothing behavior. We address this issue by estimating an augmented standard Lintner (1956) model, similarly to Aivazian et al. (2006).[25]

3.1 Methodology

Following Lintner (1956) and Aivazian et al. (2006), dividend smoothing behavior of the firms is given by the following equation:

$$D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \varepsilon_i \tag{1}$$

where $i = 1, 2, \ldots N$ indicates firms and $t = 1, 2, \ldots, T$ indicates the year. $D_{i,t}$ denotes actual dividend payments per share and $E_{i,t}$ denotes earnings per share. In equation (1), a_1 is the dividends adjustment coefficient, a_0 is a fixed time-series intercept and ε_i is a random error term.

In more detail, Lintner (1956) estimated a coefficient for lagged dividends equal to 0.70 and for current earnings equal to 0.15, indicating a speed of adjustment equal to $(1-a_1) = 0.3$ with an optimal dividend payment at $a_2/(1 - a_1) = 50\%$.

[25] Note that we take as given the established payout policy of each firm, focusing on dividend smoothing behavior instead.

In our paper we are interested in assessing how credit rating changes affect dividend smoothing behavior. To that end and similar to Aivazian et al. (2006), we initially augment equation (1) with an interaction term of credit rating changes and lagged dividends as shown below:

$$D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \beta_1 CRA^{up}_{i,t} D_{i,t-1} + \beta_2 CRA^{down}_{i,t} D_{i,t-1} + \varepsilon_i \qquad (2)$$

where CRA^{up}_{it} and CRA^{down}_{it} are dummy variables that take the value of one in case of any credit rating upgrade or downgrade respectively. In this case, dividend smoothing under a credit rating upgrade is given by $a_1 + \beta_1$, whereas dividend smoothing under a credit rating downgrade is given by $a_1 + \beta_2$. Of course, in the case without any credit rating changes dividend smoothing is given by a_1.

We further augment equation (2) with an interaction term of credit rating changes and earnings as shown below:

$$\begin{aligned} D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \beta_1 CRA^{up}_{i,t} D_{i,t-1} + \beta_2 CRA^{down}_{i,t} D_{i,t-1} \\ + \gamma_1 CRA^{up}_{i,t} E_{i,t} + \gamma_2 CRA^{down}_{i,t} E_{i,t} + \varepsilon_i \end{aligned} \qquad (3)$$

In this case, dividend smoothing is still given as in equation (2). However, now the reaction of current dividend payments to earnings under a credit rating upgrade is given by $a_2 + \gamma_1$, whereas under a credit rating downgrade is given by $a_2 + \gamma_2$.

The above interaction terms capture the average effect of any credit rating change, by any credit rating agency, on dividend smoothing behavior. Our sample though consists of three CRAs and as a result we are in the position to examine the impact of each CRA separately. To perform this analysis we replace the dummy variables in the interaction terms in equations (2) and (3) with credit rating changes by at least one agency at a time.

As a result we obtain the following equations:

$$
\begin{aligned}
D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \beta_1 SP^{up}_{i,t} D_{i,t-1} + \beta_2 SP^{down}_{i,t} D_{i,t-1} \\
+ \gamma_1 SP^{up}_{i,t} E_{i,t} + \gamma_2 SP^{down}_{i,t} E_{i,t} + \varepsilon_i
\end{aligned} \tag{4}
$$

$$
\begin{aligned}
D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \beta_1 Fitch^{up}_{i,t} D_{i,t-1} + \beta_2 Fitch^{down}_{i,t} D_{i,t-1} \\
+ \gamma_1 Fitch^{up}_{i,t} E_{i,t} + \gamma_2 Fitch^{down}_{i,t} E_{i,t} + \varepsilon_i
\end{aligned} \tag{5}
$$

$$
\begin{aligned}
D_{i,t} = a_0 + a_1 D_{i,t-1} + a_2 E_{i,t} + \beta_1 Moody^{up}_{i,t} D_{i,t-1} + \beta_2 Moody^{down}_{i,t} D_{i,t-1} \\
+ \gamma_1 Moody^{up}_{i,t} E_{i,t} + \gamma_2 Moody^{down}_{i,t} E_{i,t} + \varepsilon_i
\end{aligned} \tag{6}
$$

where equation (4) examines the impact of a credit rating changes by Standard and Poor's, equation (5) examines the changes made by Fitch, while equation (6) examines the changes made by Moody's.

3.2 Dividend smoothing results

In Table 3 we examine the smoothing behavior of firms that pay dividends by estimating the coefficients of both $D_{i,t-1}$ and $E_{i,t}$ based on the basic Lintner (1956) model, presented in equation (1), using different econometric techniques. The first approach, which is the simplest model, shows a high persistence between current and lagged dividend payments as the coefficient on $D_{i,t-1}$ is equal to about 0.72 and statistical significant at 1%. This result is in favour of a smoothing pattern that has been found in the existing literature[26] and points out the stickiness of dividends as managers are reluctant to proceed to any dividend changes if they are not confident that they will keep the new level constant in the future knowing

[26] See Lintner (1956), Fama and Babiak (1968), Brav et al. (2005), Farre-Mensa et al. (2014) among others.

that a dividend cut reveals negative signal to the market. In addition, Model 1 shows that the estimated coefficient on earnings ($E_{i,t}$) is equal to 0.07, statistical significant at 1%, and it is half of the estimated coefficient comparing to Lintner (1956) and Aivazian et al. (2006), but slightly higher than that of Chen et al. (2012) for the post war period. As a result, the optimal (target) payout ratio is equal to 25%. This value is within the limits of our sample and contrary to the proposed puzzling payout ratio of higher than 100% estimated by Aivazian et al. (2006).

Next, Model 1 is modified by including both industry and year effects. Comparing with the first model, in Model 2 the coefficient of lagged dividends and current earnings are nearly the same, with the expected sign and both remain highly significant supporting the smoothing pattern of dividends revealed by Model 1. Model 3 takes into account firms' individual effect without any important difference to the smoothing behavior and target payout ratio compared to the previous models. A similar smoothing pattern, with the coefficient of $D_{i,t-1}$ at about 0.69 and that of $E_{i,t}$ at 0.07, can be also observed in Model 4 that it is thought to be, according to Aivazian et al. (2006), the most accurate model in comparison to the other three because it is adjusted for potential econometric problems related to unbalanced panel data with autocorrelated errors.

In general, we could say that the smoothing behavior is verified by all alternative models that we implemented in Table 3, as the coefficient of lagged dividends (smoothing parameter) exhibits a little fluctuation ranging from 0.686 to 0.724, with a consistent high statistical significance. Moreover, the target payout ratio remains stable and within the sample boundaries, as it marginally fluctuates between 22.3% and 24.7%. These results are consistent with the survey by Brav et al. (2005), in which managers are aware of the importance of keeping stable the level of distributed dividend throughout the years and show little willingness to engage in unpredictable changes of dividend payments.

Table 3 here

3.3 Dividend smoothing and the impact of credit rating changes

Having verified the smoothing behavior of firms in our sample using different econometric methodologies presented in Table 3 and since we know that credit rating changes could trigger variations in firms' dividend payout policies based on our logit regression outcomes in Table 2, we now examine how firms' smoothing pattern could be affected by credit rating changes. Table 4 shows the results from using the classical Lintner's (1956) model with the addition of interaction terms between credit rating upgrades/downgrades with both $D_{i,t-1}$ and $E_{i,t}$. This allows both coefficients on lagged dividends and on current earnings to vary depending on whether there is an upgrade or downgrade to the firms' credit ratings. The interaction term is equal to $D_{i,t-1}$ or $E_{i,t}$ times a dummy variable, which is 1 if there is a rating upgrade/downgrade and 0 otherwise. Considering the dividend stickiness due to the reluctance of managers to reduce dividend levels quickly, even when internal funds are insufficient for good investment opportunities, the null hypothesis is that the interaction terms, for both credit rating upgrades and downgrades, are statistically insignificant and that firms continue to keep the same smoothing behavior, contradicting our first hypothesis.

All the results presented in Table 4 are estimated using fixed effects with autocorrelated errors estimated over a sample of firms that pay dividends consistently over time. Due to the fact that U.S. credit market is highly concentrated by three rating agencies and because firms solicit for multiple ratings due to the "information production", the "rating shopping" and the "regulatory certification" hypotheses, we consider each one of the "big three" CRAs. We first present the results adding the interaction term on $D_{i,t-1}$ and then we augment the same model with the interaction term on $E_{i,t}$.

The first two columns in Table 4 illustrate the results form credit rating upgrades and downgrades from any of the three CRAs. The results show a statistically significant and marginally positive effect of credit rating upgrades on lagged dividends and a statistically significant negative strong effect of credit ratings downgrades. This indicates that firms are likely to increase dividend smoothing behavior with credit rating upgrades and vice versa.

More specifically, the coefficient of $D_{i,t-1}$ in case of a credit rating upgrade increases to 0.696 (i.e. 0.659+0.037) and declines to 0.437 (i.e. 0.689-0.222) in the case of a credit rating downgrade. This result confirms our first hypothesis that dividend smoothing is affected by credit rating changes as firms are likely to engage in more (less) smoothing following a credit rating upgrade (downgrade). This smoothing behavior is even more pronounced once we take into account the interaction term of rating changes (upgrades/downgrades) with $E_{i,t}$, as shown in column 2. In this case under a credit rating upgrade the interaction term for the lagged dividend almost doubles to 0.076 indicating an even larger impact on dividend smoothing as the combined coefficient on lagged dividend rises to 0.735 (i.e. 0.659+0.076). In addition, the earnings interaction term is significantly negative at -0.034 indicating that when there is an upgrade of the rating firms adjust their dividend much more slowly in response to increased earnings. However, under a credit rating downgrade firms reduce even further their dividend smoothing to 0.339 (i.e. 0.653-0.314) with current dividend payments becoming more sensitive to increased earnings to 0.114 (i.e. 0.077+0.037). These results further confirm our first hypothesis and illustrate an important shift on dividend smoothing to a direction similar to the change of credit ratings indicating the strong impact of the later on dividend smoothing.

Next, we break down the "big three" CRAs to individual rating agencies and we assess how credit rating changes being occurred by at least one of the CRAs into consideration affect dividend payout policy. In fact, we would like to examine if there is a symmetric impact of the CRAs changes on dividend behavior.

The illustrated results in columns 3, 5 and 7 of Table 4 indicate that there is an asymmetric reaction to dividend smoothing as only in the case of credit rating downgrades from any of the three CRAs leads to less smoothing. By observing the columns 3, 5 & 7 it is clear that there is a negative effect on firms' smoothing behavior after a credit rating downgrade indicating the importance of a downgrade rating change in payout policy. It is quite interesting that firms' smoothing behavior after a Fitch downgrade is significantly reduced.

In particular, the smoothing parameter in this case declines to 0.188 and it is statistically significant at 1% level, which in fact means a no-smoothing dividend policy, contrary to the results of the existing literature. In the other two cases, the smoothing parameter declines at a much smaller magnitude to about 0.638 in case of S&P downgrade and 0.570 in case of Moody's downgrade.

It is worth noting that Fitch ratings are in general more optimistic than S&P's and Moody's and, in more cases, play the role of a tiebreaker that reduces the threat of a future downgrade, even below investable grade (IG) status (see e.g. Bongaerts et al., 2012).

Regarding the credit rating upgrades, the impact on dividend smoothing is not straightforward for all rating agencies as there is a positive increase to smoothing behavior in case of Fitch and Moody's credit rating upgrades but not in the case of S&P. These results are not so unexpected, since in this case the cost of a dividend increase to a higher level than the past dividend, triggered by the easier access to capital markets or less costly borrowing, as a result of credit upgrades, outweighs the benefits of this higher dividend due to the negative signal that will be generated by a future cut if firms are unable to satisfy this higher level of cash distributions (i.e. Brav et al., 2005). The above verify our second hypothesis.[27]

In general, the important added value of this table to the dividend literature is the fact that an important explanatory variable that may affect dividend smoothing is the credit rating changes and especially the case of downgrades. In addition to the negative signal that credit rating downgrades reveals to the market, firms' need for cash flow will increase due to precautionary motives (i.e. Asimakopoulos and Asimakopoulos, 2019), the cost of borrowing will rise and the entrance in capital market will be limited, leading firms in engaging in less smoothing.[28] Furthermore, our results are in line with Aivazian et al. (2006) who show that rated firms follow a smoothing dividend policy, distributing part of the current earnings in

[27] Following Becker and Milbourn (2011) arguments we have reduced our sample for Fitch on a sub-sample from 2000-2017 and we re-estimated equation (5). Our key results, as reported in Table A3 in the Appendix, remain robust.

[28] Firms may hold cash instead to distribute them in the form of cash dividends, to protect themselves against the adverse cash flow shocks that might force them to miss investment opportunities due to costly external finance (Bates et al., 2000; and Gao et al., 2013).

dividends. However, we extend these results showing that not all rated firms behave in the same way under a credit rating change.[29]

Table 4 here

4 Robustness checks

4.1 The role of financial pressure on cash decisions

We further extend our analysis by assessing if an announced upgrade or downgrade of one or more CRAs has a different impact on firms with high level of financial pressure compared with those with low level of financial pressure. We take into account the role of financial pressure on firms' dividend smoothing behavior after a credit rating change among any of the "big three" CRAs. Acharya et al. (2012) argue that U.S. firms with higher levels of financial pressure hold more cash as a buffer mechanism.[30] In order to exploit that, we assess whether the condition of firms' financial pressure affects differently smoothing behavior in case of credit rating upgrades and downgrades. To measure financial pressure we use the ratio of interest payments to profits after taxes plus depreciation and we split our sample into high and low financial pressure firms based on the bottom and the top quarter of the distribution, following Acharya et al. (2012).

The results of Table 5 indicate that the statistical significant and negative effect of a downgrade on dividend smoothing by any of the CRAs, we found in the previous section, is mainly associated with firms at the top 25% (high) level of financial pressure. After a credit rating downgrade the dividend smoothing behavior of firms at the top 25% almost disappeared as the smoothing parameter reduces to 0.227 (0.663-0.436). Moreover, the importance of the tiebreaker credit rating agency, Fitch, is also revealed on this table since

[29] Note that these results remain consistent even if we use the modified Lintner model as in Chen et al. (2012).

[30] In addition, Benito and Young (2007) and Guariglia and Yang (2016) show that financial pressure in the form of debt-servicing costs has a negative effect on firms' employment and investment decisions.

when Fitch downgrades the rating quality of the issuer company the interaction coefficient of a downgrade on dividends is the highest (-0.549 and significant at 1% level) compared to the other two CRAs in the case of downgrades minimizing the reliance and stickiness to the lagged dividend at 0.122.

In general, the results of this table illustrate the concurrent importance of both financial pressure and credit rating downgrades to firms' management decisions. Downgrading under high financial pressure leads firms to engage in less dividend smoothing. This is probably driven by the need of those firms to retain higher levels of cash holdings for precautionary purposes to protect themselves against the adverse cash flow shocks that might force them to miss investment opportunities due to costly external finance (Bates et al., 2009; Gao et al.,2013) as a consequence of a credit downgrade.[31]

Table 5 here

4.2 Matching sample of firms with dividend changes

As a robustness check, we employ a matching sample procedure to support the power of our empirical results in favor of asymmetric reaction of dividend smoothing, contrary to dividend stickiness, between an upgrade and downgrade of credit rating changes. The matching procedure controls for the selection of firms based on the observable firm characteristics. In order to make the sample of firms that experience a credit rating change, either upgrade or downgrade, more comparable with the firms that do not experience any credit rating change, we implement a propensity score-matching procedure based on total assets and market to book ratio.[32] In particular, we use the nearest neighbor matching for the two control variables utilizing the analytical standard errors as in Abadie and Imbens (2006).[33]

[31] Denis (2011) claims that firms with costly external financing can undertake valuable investments opportunities only by keeping larger cash reserves.

[32] We have also experimented with different control variables and the results remain unaffected.

[33] We need to use the nearest neighbor matching approach for total assets and market-to-book ratio because it is impossible to find two firms with the exact same level of assets and market-to-book ratio.

Table 6 shows the results from the estimation of equation (3.3) using the matched sample. The main results of our analysis remain consistent. Table 6 supports the important impact of credit rating changes in the specific sample, and more specifically of downgrades, on dividend smoothing as indicating in column 1 where the interaction coefficient of a downgrade on $D_{i,t-1}$ is -0.222 and significant at 1% level, whereas the relative coefficient on upgrades is only 0.030 and significant at 1% level. Moreover, Table 6 verifies the strong effect of Fitch downgrades to the smoothing behavior relative to the other two CRAs, as in that case the interaction coefficient of rating downgrades with the $D_{i,t-1}$ is equal to -0.380, highly significant at 1% level, leading to a total smoothing adjustment equal to 0.405 (=0.785-0.380) that is the lowest comparing to 0.649 and 0.581 in the case of S&P and Moody's downgrades respectively. These results further support the importance of multiple credit ratings as a Fitch, which on average offers more favorable ratings compared to the other two credit rating agencies, downgrade of the credit quality of an issuer affects firm's cash flow and capital structure (Kisgen 2006; 2009). Firm's managers appear to be in favor of altering their dividend policy by engaging in less smoothing so as to fulfill both the current and the future dividend payments, even if they recognize that this alteration will affect the investment preferences of its investors.

Table 6 here

4.3 The timing effect

In this subsection we assess if there is any delayed effect of credit rating changes on dividend smoothing. Our aim is to identify if dividend smoothing reacts only to contemporaneous changes in credit ratings. Since in our data we use annual dividends and we also do not know the exact date of the announcement of the credit rating change, we are going to analyze if dividend smoothing reacts to past credit rating changes.

Therefore, we re-estimate equations (3)-(6), as in Table 4, with the only difference that the interaction terms include the *lagged* (once) credit rating changes.[34] Table 7 indicates that there is no significant effect from any past credit rating changes on dividend smoothing.[35] As a result there is no delayed effect from past credit rating changes on current dividend smoothing.[36]

Table 7 here

4.4 Different time periods

Since our sample period is about 67 years long (1951-2017), there might be a scope to assess if our key results mentioned in the previous section remain valid in a more reduced sample.

Therefore, we initially reduce our sample to include only the observations after the first oil crisis to assess if there is any fundamental change on firms' dividend smoothing behavior in the more recent years (1976-2017). Next we reduce our sample even further by excluding the years after the recent financial crisis (1976-2007). Finally, we reduce our sample even further by excluding all the observations before the second oil crisis (1983-2007).

Table 8 shows the impact on dividend smoothing from a credit rating change (upgrade or downgrade) by any of the three CRAs using the various reduced samples.[37] We observe that the key results provided in Table 4 remain valid.

Table 8 here

[34] We also experiment with two lags on credit rating changes at the interaction terms and the results are similar with Table 7.

[35] The lagged dividend interaction term with the lagged credit rating change is not statistically signifcant in any Model of Table 7.

[36] We acknowledge the fact that some credit rating changes in our sample might happen towards the end of the year and after the announced dividends. However, our result do not seem to be affected by the existence of this possible time incosistency showing that on average past credit rating changes do not affect current dividend smoothing. In addition, our main results are also confirmed via appropriate causality tests.

[37] We also tested the impact of individual CRAs changes on dividend smoothing under different time periods and the results remain valid. However, we do not show the results here to save space.

4.5 Assessing the direction of dividend changes

Our analysis so far has shown that credit rating downgrades lead to less dividend smoothing behavior. This means that managers will tend to change their dividend when their firm experiences a reduction to its credit score. We believe that this novel result leads to many more interesting questions. For example, will the managers increase their dividend to counteract the negative signal from the credit rating downgrade or they will cut dividends to avoid future cash shortages due to a more difficult access to external capital markets and higher borrowing costs?

This line of questions requires a very detailed analysis that falls beyond the scope of this paper. Therefore, in this subsection we only perform a preliminary analysis regarding the impact of credit rating changes on the direction of dividend changes (increase or decrease) and we assess the probability of: i) increasing dividends as a reaction to credit rating changes (upgrades or downgrades); and ii) decreasing dividends in response to credit rating changes.

Table 9 shows the results from the estimation of various logit models, similar to those of Section 2, with the difference that now the depended variable in Models 1-4 is a dummy variable that represents a firm's decision to increase the dividend amount in a given year by more than 30%. In Models 5-8 the dependent variable is a dummy variable that represents a firm's decision to decrease its dividend in a given year by more than 30%. We use the 30% threshold value motivated by our estimated speed of adjustment, using Lintner (1956) model presented in Table 3, and in order to avoid considering small deviations of dividend payments that are still consistent with a dividend smoothing behavior.[38]

The results show on average a statistically significant and positive likelihood of observing an increase in dividend by more than 30% under a credit rating downgrade (Model 1). This result is carried through to S&P and Fitch but not to Moody's (Models 2-4). We also observe that it is less likely for firms to increase their dividends after an upgrade to

[38] We have also experimented with different threshold values (i.e. 25% or 35%) and our key results remain consistent.

their credit rating (Models 1-4). In addition, the importance of a rating that reveals the probability of default, especially in case of a downgrade and the signal that conveys to the market, is clearly indicated by observing Models 1-4 in Table 9 as the coefficient at S&P and Fitch downgrade is higher and statistically significant than the relative coefficient of Moody's. When at least one of the S&P or Fitch downgrades the credit score of issuer firm, the managers of that firm anticipate the strong negative signal that will be revealed in the market by a downgrade and they try to cancel out the negative impact of that valuation by increasing their dividend payments even though they might be needed to re-adjust those payments in the future.

When we consider the impact of credit rating changes on dividend cuts, we do not find any significant effect (Models 5-8). Moody's is the only CRA that seems to have a marginally significant impact on dividend decreases under a downgrade, possibly due to the fact that Moody's measure the cost of default and not the probability of default as the other two CRAs. This affects managers' risk aversion behavior and precautionary motives leading to higher cash holdings, as in Asimakopoulos and Asimakopoulos (2019). In that case managers probably follow a residual dividend policy and distribute whatever remains in the form of cash having firstly increased their cash reserves to either mitigate the negative financial shock or regain their pre-downgrade credit rating or even for precautionary reasons ensuring that they will be able to respond effectively and timely to unforeseen changes in firm's cash flow pattern or future investment opportunities.

Overall, these results confirm our findings in Table 4 supporting the asymmetric effect of credit rating changes to smoothing behavior, where a credit rating downgrade leads to less dividend smoothing behavior. Nevertheless, we show here that mangers tend to react to a reduction in their credit score by increasing their dividends payments in an effort to change investors' perspective and to mitigate the negative signal of a credit downgrade. The attempt to manipulate their true image by an increase in dividend payments, deviating from their smoothing behavior, is both risky considering the dividend stickiness due to the reluctance of managers to cut dividends and temporary, because their true value will be revealed soon. This requires further investigation that is beyond the scope of this paper.

Table 9 here

5 Conclusion

Dividend payments are regarded as a measure of cash flow to investors and both investors and managers consider them as highly significant. Therefore, understanding the potential impact of credit rating changes on dividend smoothing behavior is essential and improves our awareness of how dividend policy is formulated by the managers. Despite that these two different channels, dividend smoothing and credit rating changes, are extensively researched there is, surprisingly, no research that combines them together and examines them concurrently.

Our study aimed at closing this gap by examining the effect of a credit rating change among the "big three" CRAs on firms' dividend smoothing. We initially verified the fact that firms smooth their dividend payments. When we considered the effect of credit rating changes on smoothing behavior we found an asymmetric impact of credit rating changes on dividend smoothing. Firms engaged in less smoothing behavior following a downgrade on their credit scores, whereas we observed only a marginal positive impact on firms' smoothing behavior after a credit rating upgrade. This observed impact is crucial if we take into account the fact that managers are in favor of smoothing dividend payments according to Lintner (1965) and Brav et al. (2005).

We also found that the asymmetric impact of credit ratings on dividend smoothing remained valid even when we considered the occurred credit rating changes by at least one of the CRAs. Taking into account that Fitch's ratings are in general more optimistic than the other two CRAs and that, in more cases, has the role of a tiebreaker that reduces the threat of a future downgrade, it is worth noting that our results indicated that Fitch downgrades had a strong negative impact on firms' dividend smoothing behavior.

Moreover, we found that firms' smooth their dividends less when they perform under financial pressure and receive a credit rating downgrade. This is driven by firms' desire to secure their normal operation by holding more cash for precautionary purposes instead of following a dividend smoothing policy. Our results also indicated that managers are reluctant to cut dividends and that they are more likely to increase their dividends under a credit rating downgrade so as to counteract the negative effect from their lower credit score.

These findings indicate strongly that the provision of a credit rating change reduces the asymmetric information between managers and investors revealing significant information regarding the value and future prospects of the issuer firms, affecting the market demand respectively. Thus, it is important to pay attention to dividend smoothing behavior and credit ratings concurrently. The need of a viable rating industry will enhance this channel and further improve our understanding regarding the complex corporate decision making.

This paper relates to a growing body of literature that attempts to model payout policy, corporate capital structure and investments jointly. It is well known that a firm's payout policy is determined in conjunction with its investment activities and financing decisions. Given the dividend stickiness and the unexploited asymmetric reaction of smoothing behavior after a credit rating change as presented in that paper, future theoretical and empirical work should therefore take into account the importance of information provided by the various credit rating agencies in understanding the joint determination of investment, financing and dividend policies. The rigidity in the dividend payout policy creates a friction in the cash flow allocation of the firm. If a firm is financially constrained with limited access to external funds and the costs associated with adjusting smoothing behavior are sufficiently large, then the adjustment of smoothing after a credit rating disclosure affects both investment decisions and cash holding reserves within firms. Even financially unconstrained firms with easy and unrestricted access to capital markets can incur the additional cost of altering their smoothing behavior after a credit rating change if they decide to do so primarily because of a credible threat of retaliation posed by unhappy investors. Brav et al. (2005) argue that some managers are willing to sell off assets, borrow money, or forgo positive-NPV projects, before they decide to cut dividends. Therefore, taking into consideration the relationship we uncovered between credit rating changes and dividend smoothing, it would be interesting to assess the potential spillover effects to the stylized dividend smoothing behavior relationship with capital expenditure allocations and investment activities.

References

[1] Abadie, A. and Imbens, G. (2006). Large sample properties of matching estimators for average treatment effects, Econometrica 74(1), 235-267.

[2] Acharya, V., Davydenko, S.A. and Strebulaev, I.A. (2012) Cash holdings and credit risk, Review of Financial Studies 25, 3572–3609.

[3] Aivazan, V., Booth, L. and Cleary, S. (2006) Dividend Smoothing and Debt Ratings, Journal of Financial and Quantitative Analysis 41, 439–453.

[4] Alessi, C., Wolverson, R. and Sergie, M.A. (2013) The credit rating controversy, Council on Foreign Relations.

[5] Allen, F., Bernardo, A. E., and Welch, I. (2000) A Theory of Dividends Based on Tax Clienteles, Journal of Finance 55, 2499–2536.

[6] Alsakka, R., and Gwilym, O. (2010) Leads and lags in sovereign credit ratings, Journal of Banking & Finance 34, 2614–2626.

[7] Asimakopoulos, P. and Asimakopoulos, S (2019) A tale of two tails: Cross credit ratings and cash holdings. Working Paper.

[8] Asimakopoulos, P., Asimakopoulos, S. and Fernandes, F.D.S. (2019) Cash holdings of listed and unlisted firms: New evidence from the euro area, European Journal of Finance, 25 (17), 1708-1729.

[9] Asimakopoulos, P., Asimakopoulos, S., Kourogenis, N. and Tsiritakis, E. (2017) Time-disaggregated dividend-price ratio and dividend growth predictability in large equity markets, Journal of Financial and Quantitative Analysis, 52 (5), pp.2305-2326.

[10] Baker, H. K., Farrelly, G.E., and Edelman, R.B. (1985) A Survey of Management Views on Dividend Policy, Financial Management 14, 78– 84.

[11] Bates, T.W., Kahle, K.M. and Stulz, R.M. (2009) Why do US firms hold so much more cash than they used to? The Journal of Finance 64(5), 1985-2021.

[12] Becker, B and Milbourn, T (2011) How did increased competition affect credit ratings? Journal of Financial Economics 101(3), 493-514.

[13] Benito, A. and Young, G. (2007) Financial pressure and balance sheet adjustment by firms, Oxford Bulletin of Economics and Statistics 69, 581-602.

[14] Black, F. (1976) The dividend puzzle, Journal of Portfolio Management 2, 5-8.

[15] Bongaerts, D., Cremers, K.J. and Goetzmann, W.N. (2012) Tiebreaker: Certification and multiple credit ratings, The Journal of Finance 67(1), 113-152.

[16] Brav, A., Graham, J., Harvey, C., and Michaely, R. (2005) Payout policy in the 21st century, Journal of Financial Economics 77, 483–527.

[17] Chay, J.B., and Suh, J. (2009) Payout policy and cash-flow uncertainty, Journal of Financial Economics 93, 88-107.

[18] Chen, L., Da, Z. and Priestley, R. (2012) Dividend Smoothing and Predictability, Management Science 58(10), 1834-1853.

[19] DeAngelo, H., and DeAngelo, L. (2007) Capital Structure, Payout Policy, and Financial Flexibility, Working Paper, University of Southern California.

[20] DeAngelo, H., DeAngelo, L. and Stulz, R.M. (2006) Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory, Journal of Financial Economics 81, 227-254.

[21] DeMarzo, P. and Sannikov, Y. (2008) Learning in Dynamic Incentive Contracts, Working Paper, Stanford University.

[22] Denis, D. J. (2011) Financial flexibility and corporate liquidity, Journal of Corporate Finance 17, 667-674.

[23] Dichev, I., and Piotroski, J. (2001) The Long-Run Stock Returns following Bond Rating Changes, The Journal of Finance 54, 173–203.

[24] Dittmar, A., J. Mahrt-Smith and H. Servaes (2003) International corporate governance and corporate cash holdings, Journal of Financial and Quantitative Analysis 38, 111-133.

[25] Duff, A. and Einig S. (2007) Credit Rating Agencies: Meeting the Needs of the Market? Institute of Chartered Accountants of Scotland, Edinburgh.

[26] Easterbrook, F. H. (1984) Two Agency-cost Explanations of Dividends, American Economic Review 74, 650–59.

[27] Fama, E. and Babiak, H. (1968) Dividend Policy: An Empirical Analysis, Journal of the American Statistical Association 63, 1132–1161.

[28] Fama, E.F. and French, K.R. (2001) Disappearing dividends: changing firm characteristics or lower propensity to pay? Journal of Financial Economics 60, 3-43.

[29] Fama, E.F. and French, K.R. (2002) Testing trade-off and pecking order predictions about dividends and debt, Review of Financial Studies 15, 1-33.

[30] Farre-Mensa, J., Michaely, R. and Schmalz, M. (2014) Payout policy, Annual Review Financial Economics 6, 75-134.

[31] Fenn, G.W. and Liang, N. (2001) Corporate payout policy and managerial stock Incentives, Journal of Financial Economics 60, 45–72.

[32] Firth, M., Gao, J., Shen, J. and Zhangac, Y. (2016) Institutional stock ownership and firms' cash dividend policies: Evidence from China, Journal of Banking and Finance 65, 91-107.

[33] Fudenberg, D., and Tirole, J. (1995) A Theory of Income and Dividend Smoothing Based on Incumbency Rents, Journal of Political Economy 103, 75–93.

[34] Gao, H., J. Harford. and Li K. (2013) Determinants of corporate cash policy: Insights from private firms, Journal of Financial Economics 109, 623–639.

[35] Graham, J.R. and Harvey, C.R. (2001) The theory and practice of corporate finance: Evidence from the field, Journal of Financial Economics 60(2-3), 187-243.

[36] Guariglia, A. and Yang J. (2016) A balancing act: Managing financial constraints and agency costs to minimize investment inefficiency in the chinese market, Journal of Corporate Finance 36, 111-130.

[37] Guttman, I., Kadan, O. and Kandel, E. (2010) Dividend stickiness and strategic pooling, Review of Financial Studies 23, 4455–95.

[38] Hand, R., Holthausen, R., and Leftwich, R. (1992) The effect of bond rating agency announcements on bond and stock prices, Journal of Finance 47, 733–752.

[39] Jagannathan, M., Stephens, C.P., andWeisbach, M.S. (2000) Financial flexibility and the choice between dividends and stock repurchases. Journal of Financial Economics, 355–384.

[40] Javakhadze, D., Ferris, S.P., and Sen, N. (2014) An international analysis of dividend smoothing, Journal of Corporate Finance 29, 200-220.

[41] Jensen, M. C. (1986) Agency Costs of Free Cash Flow, Corporate finance, and takeovers, American Economic Review 76, 323–29.

[42] Jorion, P., Liu, Z., and Shi, C. (2005) Informational effects of regulation FD: Evidence from rating agencies, Journal of Financial Economics 76, 309–330.

[43] Khieu, H.D. and Pyles, M.K. (2016) The influence of a credit rating change on dividend and investment policy interactions, Financial Review 51, 579-611.

[44] Kisgen, D.J. (2006) Credit ratings and capital structure, The Journal of Finance 61(3), 1035-1072.

[45] Kisgen, D.J. (2009) Do firms target credit ratings or leverage levels? Journal of Financial and Quantitative Analysis 44(6), 1323-1344.

[46] Kliger, D., and Sarig, O. (2000) The information value of bond ratings, Journal of Finance 55, 2879–2902.

[47] Kumar, P. (1988) Shareholder-manager Conflict and the Information Content of Dividends, Review of Financial Studies 1, 111–36.

[48] Kumar, P., and Lee, B. (2001) Discrete Dividend Policy with Permanent Earnings, Financial Management 30, 55–76.

[49] La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R.W. (2000) Agency problems and dividend policies around the world, Journal of Finance 55, 1-33.

[50] Lambrecht, B., and Myers, S. (2012) A Lintner Model of Payout and Managerial Rents, Journal of Finance 67, 1761-1810.

[51] Larkin, Y., Leary, M.T., and Michaely, R. (2016) Do investors value dividend-smoothing stocks differently? Management Science 63, 4114-4136.

[52] Leary, M. T. and Michaely, R. (2011) Determinants of dividend smoothing: empirical evidence, Review of Financial Studies 24, 3197-3249.

[53] Lintner, J. (1956) Distribution of Incomes of Corporations among dividends, retained earnings and Taxes, American Economic Review 46, 97–113.

[54] Opler, T., Pinkowitz, L., Stulz, R. and Williamson, R. (1999) The determinants and implications of corporate cash holdings, Journal of Financial Economics 52(1), 3-46.

[55] Partnoy, F. (2002) The paradox of credit ratings. In Ratings, rating agencies and the global financial system (pp. 65-84). Springer, Boston, MA.

[56] Skinner, D. (2008) The evolving relation between earnings, dividends, and stock repurchases, Journal of Financial Economics 87, 582–609.

[57] Thompson, R., and Vaz, P. (1990) Dual bond ratings: A test of the certification function of rating agencies, The Financial Review 25, 457–471.

[58] White, L.J. (2010) Markets: The credit rating agencies, Journal of Economic Perspectives 24(2), 211-26.

Table 1: Summary statistics

	Div/ EBIT	DPS/ EPS	DPS	EPS	Total Sales ($mil.)	Total Assets ($mil.)	Size	Profit	Market-to-Book	Invest	Debt Ratio	Tangib.	Free cash flow	Tob'Q
Total Sample	0.123	0.292	0.892	2.550	10.573	12.290	7.726	0.068	2.093	0.297	0.193	0.328	0.100	2.093
$(N = 11,948)$	0.121	0.387	0.939	6.665	22.585	28.001	2.158	0.072	1.768	0.422	0.143	0.214	0.095	1.768
Sample with $DPS_{i,t} > 0$	0.155	0.372	1.138	2.952	12.072	13.709	7.920	0.074	1.955	0.253	0.186	0.341	0.108	1.955
$(N = 9,339)$	0.109	0.402	0.920	2.445	24.406	29.981	2.072	0.049	1.085	0.176	0.126	0.211	0.080	1.085
Sample with $\Delta DPS_{i,t} \neq 0$	0.156	0.363	1.131	3.054	13.007	14.592	8.008	0.079	2.037	0.258	0.186	0.337	0.114	2.037
$(N = 7,459)$	0.109	0.366	0.902	2.416	25.546	31.253	2.051	0.049	1.125	0.198	0.129	0.206	0.079	1.126

Table 1 reports sample means (first row) and standard deviations (second row) for all the variables for the total sample (first two rows), for the firms that pay dividends consistently (3^{rd} and 4^{th} row) and for the firms that changed their dividends between two consecutive years (5^{th} and 6^{th} row).

Table 2: Predicting dividend and credit rating changes

	Dividend changes (1 = yes; 0 = no)						Rating changes (1 = yes; 0 = no)	
Model type	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
CRA^{up}	-0.529***	-0.530***	-0.619***					
	(-4.72)	(-4.71)	(-5.62)					
CRA^{down}	0.597***	0.601***	0.344**					
	(3.97)	(4.01)	(2.31)					
Profits				9.727***	9.849***	7.309***	-1.985***	-0.936
				(8.33)	(8.47)	(5.33)	(-3.49)	(-1.54)
Investment				0.820**	0.780**	1.320***	-0.400*	-0.631**
				(2.40)	(2.30)	(3.06)	(-1.94)	(-2.53)
M-B ratio				0.461***	0.496***		-0.106**	
				(3.83)	(4.10)		(-2.36)	
Debt ratio				-0.499	-0.415	-0.398	1.863***	1.886***
				(-0.84)	(-0.69)	(-0.66)	(6.21)	(6.34)
Log(Assets)					0.153*	0.161*	0.279***	0.276***
					(1.84)	(1.93)	(7.01)	(6.96)
Tangibility					-0.539	-0.207	-0.332	-0.494*
					(-1.03)	(-0.38)	(-1.21)	(-1.79)
Tobins Q						0.450***		-0.083*
						(3.64)		(-1.81)
FCF						3.198***		-1.595**
						(2.62)		(-2.26)
Constant	1.798***	0.653***	0.123	-2.093***	-2.567***	-2.897***	-4.053***	-3.947***
	(17.67)	(4.35)	(0.30)	(-4.15)	(-3.33)	(-3.61)	(-7.75)	(-7.59)
Observations	9,243	9,243	9,243	8,164	8,163	8,162	9,908	9,907
Signif IND FE	NO	5/7	6/7	4/7	4/7	4/7	1/7	1/7
Signif YEAR FE	NO	NO	30/66	46/55	39/55	40/55	22/48	21/48
R-squared	0.9%	4.3%	12.9%	30.7%	31.9%	32.8%	27.1%	27.7%

The dependent variable for Models 1-6 equals 1 for a dividend change and 0 otherwise. For Models 7 and 8, the dependent variable equals one under a credit rating change and 0 otherwise. All specifications are estimated using Logit model and restrict the sample to firms that pay dividends consistently. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Industry and year dummies are included in some models. Pseudo R^2 is reported in the last row. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3: Lintner model regression estimates

Model type	Model 1 Basic	Model 2 Industry & Year indic.	Model 3 Fixed Effects	Model 4 F.E. & AR
D_{t-1}	0.724***	0.710***	0.710***	0.686***
	(18.53)	(17.16)	(17.29)	(95.58)
E_t	0.068***	0.065***	0.069***	0.070***
	(10.20)	(9.65)	(10.19)	(33.20)
Constant	0.136***	0.102	0.144***	0.164***
	(4.77)	(0.92)	(4.18)	(18.38)
Opt. Payout	24.7%	22.3%	23.8%	22.4%
Observations	9,201	9,201	9,201	8,952
adj R-squared	0.7950	0.8002	0.7948	0.7983

We estimate equation (1), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E). Every specification is estimated for the firms that pay dividends consistently The model in the last column corrects for autocorrelation. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4: Augmented Lintner model regression estimates with credit rating changes

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{t-1}	0.659***	0.653***	0.684***	0.676***	0.647***	0.637***	0.684***	0.684***
	(85.25)	(79.60)	(93.80)	(90.60)	(82.57)	(78.17)	(94.85)	(94.57)
E_t	0.076***	0.077***	0.071***	0.077***	0.074***	0.074***	0.071***	0.072***
	(34.37)	(30.50)	(33.06)	(32.11)	(33.94)	(31.81)	(33.34)	(33.14)
$\text{CRA}_t^{\text{up}} \times D_{t-1}$	0.037***	0.076***						
	(3.04)	(5.35)						
$\text{CRA}_t^{\text{down}} \times D_{t-1}$	-0.222***	-0.314***						
	(-16.43)	(-17.06)						
$\text{CRA}_t^{\text{up}} \times E_t$		-0.034***						
		(-6.09)						
$\text{CRA}_t^{\text{down}} \times E_t$		0.037***						
		(7.10)						
$\text{SP}_t^{\text{up}} \times D_{t-1}$			0.019	0.057***				
			(1.37)	(3.63)				
$\text{SP}_t^{\text{down}} \times D_{t-1}$			-0.046***	0.001				
			(-2.65)	(0.04)				
$\text{SP}_t^{\text{up}} \times E_t$				-0.030***				
				(-4.92)				
$\text{SP}_t^{\text{down}} \times E_t$				-0.016**				
				(-2.51)				
$\text{Fitch}_t^{\text{up}} \times D_{t-1}$					0.038*	0.072***		
					(1.83)	(3.14)		
$\text{Fitch}_t^{\text{down}} \times D_{t-1}$					-0.459***	-0.561***		
					(-21.99)	(-22.89)		
$\text{Fitch}_t^{\text{up}} \times E_t$						-0.028***		
						(-3.59)		
$\text{Fitch}_t^{\text{down}} \times E_t$						0.055***		
						(7.60)		
$\text{Moody}_t^{\text{up}} \times D_{t-1}$							0.049*	0.070**
							(1.79)	(2.24)
$\text{Moody}_t^{\text{down}} \times D_{t-1}$							-0.114***	-0.088
							(-2.95)	(-1.42)
$\text{Moody}_t^{\text{up}} \times E_t$								-0.023
								(-1.39)
$\text{Moody}_t^{\text{down}} \times E_t$								-0.008
								(-0.53)
Constant	0.188***	0.186***	0.164***	0.157***	0.203***	0.212***	0.164***	0.163***
	(21.49)	(21.20)	(18.35)	(17.47)	(23.47)	(24.67)	(18.42)	(18.27)
Observations	8,952	8,952	8,952	8,952	8,952	8,952	8,952	8,952
Adj R-squared	0.801	0.802	0.798	0.799	0.804	0.804	0.798	0.798

We estimate equations (2)-(6), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of credit rating changes with lagged dividends and earning per share. All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5: Augmented Lintner model taking into financial pressure

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Financial Pressure	High	Low	High	Low	High	Low	High	Low
D_{t-1}	0.663*** (27.66)	0.648*** (43.42)	0.562*** (26.95)	0.657*** (44.38)	0.671*** (28.85)	0.664*** (45.22)	0.573*** (28.59)	0.651*** (43.69)
E_t	0.044*** (6.14)	0.133*** (22.62)	0.054*** (7.92)	0.129*** (22.11)	0.047*** (7.58)	0.126*** (22.06)	0.046*** (7.99)	0.131*** (22.81)
$\text{CRA}_t^{\text{up}} \times D_{t-1}$	-0.019 (-0.58)	0.354*** (7.22)						
$\text{CRA}_t^{\text{down}} \times D_{t-1}$	-0.436*** (-11.75)	-0.131** (-2.29)						
$\text{CRA}_t^{\text{up}} \times E_t$	-0.024* (-1.93)	-0.085*** (-4.11)						
$\text{CRA}_t^{\text{down}} \times E_t$	0.088*** (5.57)	0.009 (0.64)						
$\text{SP}_t^{\text{up}} \times D_{t-1}$			0.039 (1.12)	0.322*** (5.24)				
$\text{SP}_t^{\text{down}} \times D_{t-1}$			0.010 (0.16)	0.001 (0.02)				
$\text{SP}_t^{\text{up}} \times E_t$			-0.032** (-2.36)	-0.062** (-2.52)				
$\text{SP}_t^{\text{down}} \times E_t$			0.024 (1.15)	-0.012 (-0.67)				
$\text{Fitch}_t^{\text{up}} \times D_{t-1}$					-0.011 (-0.22)	0.318*** (3.41)		
$\text{Fitch}_t^{\text{down}} \times D_{t-1}$					-0.549*** (-13.51)	-0.054 (-0.35)		
$\text{Fitch}_t^{\text{up}} \times E_t$					-0.028* (-1.71)	-0.093** (-2.48)		
$\text{Fitch}_t^{\text{down}} \times E_t$					0.021 (0.96)	-0.012 (-0.49)		
$\text{Moody}_t^{\text{up}} \times D_{t-1}$							-0.259*** (-3.01)	0.420*** (6.34)
$\text{Moody}_t^{\text{down}} \times D_{t-1}$							-0.148 (-0.34)	-0.327*** (-3.25)
$\text{Moody}_t^{\text{up}} \times E_t$							0.016 (0.42)	-0.162*** (-3.08)
$\text{Moody}_t^{\text{down}} \times E_t$							0.044 (0.44)	0.036 (1.23)
Constant	0.237*** (8.98)	0.001 (0.02)	0.286*** (10.77)	0.007 (0.31)	0.221*** (8.45)	0.006 (0.28)	0.305*** (11.68)	0.003 (0.16)
Observations	1,639	1,921	1,639	1,921	1,639	1,921	1,639	1,921
R_squared	0.602	0.841	0.560	0.840	0.622	0.841	0.559	0.840

We re-estimate equations (2)-(6), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of credit rating changes with lagged dividends and earning per share. All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 6: Augmented Lintner regression estimates using marginal propensity score matching

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{t-1}	0.657***	0.650***	0.688***	0.683***	0.785***	0.792***	0.687***	0.687***
	(75.36)	(69.51)	(85.07)	(82.43)	(112.65)	(110.46)	(86.24)	(85.95)
E_t	0.068***	0.066***	0.063***	0.067***	0.058***	0.056***	0.063***	0.064***
	(29.79)	(25.02)	(28.70)	(27.24)	(29.79)	(26.67)	(29.02)	(28.77)
$\text{CRA}_t^{\text{up}} \times D_{t-1}$	0.030**	0.054***						
	(2.42)	(3.77)						
$\text{CRA}_t^{\text{down}} \times D_{t-1}$	-0.222***	-0.335***						
	(-16.38)	(-18.14)						
$\text{CRA}_t^{\text{up}} \times E_t$		-0.023***						
		(-4.17)						
$\text{CRA}_t^{\text{down}} \times E_t$		0.046***						
		(8.73)						
$\text{SP}_t^{\text{up}} \times D_{t-1}$			0.013	0.040**				
			(0.92)	(2.51)				
$\text{SP}_t^{\text{down}} \times D_{t-1}$			-0.039**	-0.011				
			(-2.24)	(-0.43)				
$\text{SP}_t^{\text{up}} \times E_t$				-0.021***				
				(-3.42)				
$\text{SP}_t^{\text{down}} \times E_t$				-0.010				
				(-1.48)				
$\text{Fitch}_t^{\text{up}} \times D_{t-1}$					0.016	0.026*		
					(0.85)	(1.75)		
$\text{Fitch}_t^{\text{down}} \times D_{t-1}$					-0.380***	-0.476***		
					(-19.05)	(-20.08)		
$\text{Fitch}_t^{\text{up}} \times E_t$						-0.011*		
						(-1.70)		
$\text{Fitch}_t^{\text{down}} \times E_t$						0.050***		
						(7.27)		
$\text{Moody}_t^{\text{up}} \times D_{t-1}$							0.041*	0.056*
							(1.71)	(1.81)
$\text{Moody}_t^{\text{down}} \times D_{t-1}$							-0.106***	-0.100*
							(-2.77)	(-1.68)
$\text{Moody}_t^{\text{up}} \times E_t$								-0.016
								(-1.00)
$\text{Moody}_t^{\text{down}} \times E_t$								-0.002
								(-0.13)
Constant	0.205***	0.211***	0.172***	0.167***	0.092***	0.089***	0.174***	0.173***
	(22.48)	(23.15)	(18.51)	(17.77)	(10.07)	(9.70)	(18.64)	(18.51)
Observations	8,031	8,031	8,031	8,031	8,031	8,031	8,031	8,031
R_squared	0.791	0.792	0.788	0.788	0.799	0.801	0.788	0.788

We re-estimate equations (2)-(6), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of credit rating changes with lagged dividends and earning per share. All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 7: Augmented Lintner model regression estimates with lagged (once) credit rating changes

Models	(1)	(2)	(3)	(4)
D_{t-1}	0.727***	0.731***	0.707***	0.707***
	(34.41)	(36.46)	(16.81)	(17.13)
E_t	0.069***	0.068***	0.071***	0.070***
	(12.11)	(12.20)	(9.79)	(10.20)
$\text{CRA}^{\text{up}}_{t-1} \times D_{t-1}$	0.025			
	(0.74)			
$\text{CRA}^{\text{down}}_{t-1} \times D_{t-1}$	-0.218			
	(-1.24)			
$\text{CRA}^{\text{up}}_{t-1} \times E_t$	-0.023			
	(-1.44)			
$\text{CRA}^{\text{down}}_{t-1} \times E_t$	0.024			
	(0.76)			
$\text{SP}^{\text{up}}_{t-1} \times D_{t-1}$		0.028		
		(0.76)		
$\text{SP}^{\text{down}}_{t-1} \times D_{t-1}$		-0.290		
		(-1.57)		
$\text{SP}^{\text{up}}_{t-1} \times E_t$		-0.028		
		(-1.24)		
$\text{SP}^{\text{down}}_{t-1} \times E_t$		0.035		
		(1.01)		
$\text{Fitch}^{\text{up}}_{t-1} \times D_{t-1}$			0.025	
			(0.41)	
$\text{Fitch}^{\text{down}}_{t-1} \times D_{t-1}$			0.095	
			(1.58)	
$\text{Fitch}^{\text{up}}_{t-1} \times E_t$			-0.010	
			(-0.67)	
$\text{Fitch}^{\text{down}}_{t-1} \times E_t$			-0.032*	
			(-1.84)	
$\text{Moody}^{\text{up}}_{t-1} \times D_{t-1}$				0.104
				(1.53)
$\text{Moody}^{\text{down}}_{t-1} \times D_{t-1}$				0.063
				(1.15)
$\text{Moody}^{\text{up}}_{t-1} \times E_t$				-0.012
				(-0.34)
$\text{Moody}^{\text{down}}_{t-1} \times E_t$				-0.045*
				(-1.76)
Constant	0.134***	0.132***	0.142***	0.143***
	(5.68)	(6.08)	(4.22)	(4.19)
Observations	8,952	8,952	8,952	8,952
Adj R-squared	0.661	0.664	0.654	0.655

We estimate the above equations similar to equations (3)-(6), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of lagged (once) credit rating changes with lagged dividends and earning per share. Every specification is estimated for the firms that pay dividends consistently All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 8: Augmented Lintner model regression estimates with credit rating changes for different time periods

Models	1976-2017	1976-2007	1983-2007
D_{t-1}	0.737***	0.658***	0.628***
	(27.95)	(18.74)	(15.19)
E_t	0.058***	0.065***	0.055***
	(9.51)	(8.74)	(7.05)
$\text{CRA}_t^{\text{up}} \times D_{t-1}$	0.048*	0.079**	0.075**
	(1.77)	(2.27)	(2.13)
$\text{CRA}_t^{\text{down}} \times D_{t-1}$	-0.312*	-0.432**	-0.443***
	(-1.83)	(-2.59)	(-2.85)
$\text{CRA}_t^{\text{up}} \times E_t$	-0.019**	-0.036***	-0.029***
	(-2.33)	(-3.44)	(-2.64)
$\text{CRA}_t^{\text{down}} \times E_t$	0.044*	0.059*	0.054*
	(1.69)	(1.74)	(1.75)
Constant	0.147***	0.163***	0.198***
	(5.76)	(5.65)	(6.11)
Observations	7,032	4,863	3,957
Adj R-squared	0.606	0.508	0.423

We estimate equation (3), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of credit rating changes with lagged dividends and earning per share for different time periods. Every specification is estimated for the firms that pay dividends consistently All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 9: Predicting dividend adjustments and credit rating changes

	Dividend increase higher than 30% (1 = yes; 0 = no)				Dividend decrease higher than 30% (1 = yes; 0 = no)			
Model type	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
CRA_t^{up}	-0.453**				0.175			
	(-2.46)				(1.16)			
CRA_t^{down}	0.617***				0.237			
	(4.27)				(1.61)			
SP_t^{up}		-0.492**				0.215		
		(-2.33)				(1.30)		
SP_t^{down}		0.716***				0.182		
		(4.98)				(1.09)		
$Fitch_t^{up}$			-0.349				0.057	
			(-1.35)				(0.75)	
$Fitch_t^{down}$			0.719***				0.055	
			(3.10)				(0.17)	
$Moody_t^{up}$				-0.813				0.443
				(-1.07)				(1.15)
$Moody_t^{down}$				0.492				0.734*
				(1.13)				(1.86)
Constant	-1.146***	-1.146***	-1.135***	-1.134***	-1.505***	-1.502***	-1.497***	-1.503***
	(-2.77)	(-2.77)	(-2.73)	(-2.72)	(-4.27)	(-4.26)	(-4.24)	(-4.29)
Observations	8,876	8,876	8,876	8,876	8,876	8,876	8,876	8,876
R-squared	18.3%	18.4%	17.7%	17.6%	11.5%	11.5%	11.6%	11.6%

The dependent variable for Models 1-4 equals 1 for a dividend increase larger than 30% and 0 otherwise. For Models 5-8 the dependent variable equals 1 for a dividend decrease larger than 30% and 0 otherwise. All specifications are estimated using Logit model and restrict the sample to firms that pay dividends consistently. The figures in parentheses report t-statistics that are asymptotically robust to heteroskedasticity. Industry and year dummies are included in every model. Pseudo R^2 is reported in the last row. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix

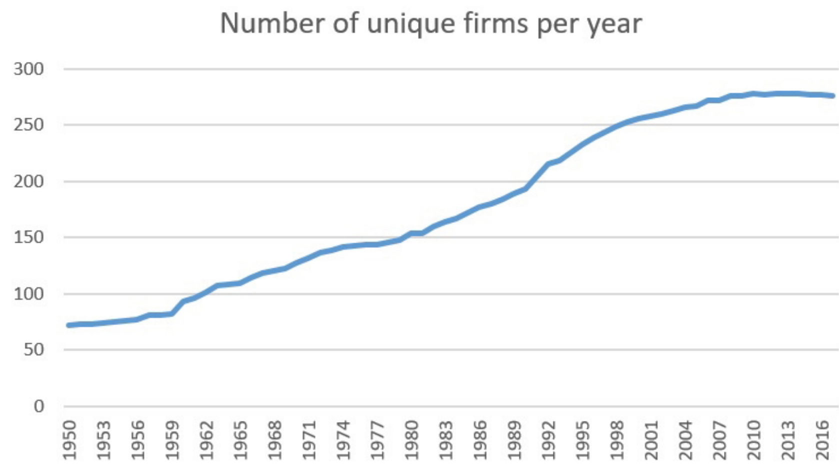

Figure 1: Illustrates the evolution of the number of unique firms in our sample over time

Table A1: Descriptive statistics for credit rating and dividend changes

	CRAs up	CRAs down	No changes in CRAs
Dividend up	338	464	5084
Dividend down	108	100	1283
No changes in Div.	196	93	2587

The above table provides the association between credit rating changes and dividends changes as numbers of firm-year observations.

Table A2: Definitions of variables

Variables	Definitions
D	dividend payments per share
E	earnings per share
CRA^{up}	dummy variable that takes the value of one in case of any credit rating upgrade
CRA^{down}	dummy variable that take the value of one in case of any credit rating downgrade
SP^{up}	dummy variable that takes the value of one in case of an upgrade by Standard and Poor's
SP^{down}	dummy variable that takes the value of one in case of a downgrade by Standard and Poor's
$Fitch^{up}$	dummy variable that takes the value of one in case of an upgrade by Fitch
$Fitch^{down}$	dummy variable that takes the value of one in case of a downgrade by Fitch
$Moody^{up}$	dummy variable that takes the value of one in case of an upgrade by Moody's
$Moody^{down}$	dummy variable that takes the value of one in case of a downgrade by Moody's
$Profits$	net income divided by total assets
$Investment$	capital expenditures over lagged net fixed assets
$M-B\ ratio$	market to book ratio (proxy for growth opportunities)
$Debt\ ratio$	long-term debt plus debt in current liabilities over total assets
$Log(Assets)$	natural logarithm of total assets
$Tangibility$	net property, plant and equipment scaled by total assets
$Tobins\ Q$	book value of assets minus book value of common equity plus the market value of common equity scaled by total assets
FCF	operating income before depreciation minus capital expenditure scaled by total assets

Table A3: Augmented Lintner model regression estimates with Fitch rating changes for a different time period

Models	Fitch benchmark	Fitch 2000-2017
D_{t-1}	0.637***	0.735***
	(78.17)	(16.82)
E_t	0.074***	0.045***
	(31.81)	(7.00)
$\text{Fitch}_t^{\text{up}} \times D_{t-1}$	0.072***	0.040*
	(3.14)	(1.84)
$\text{Fitch}_t^{\text{down}} \times D_{t-1}$	-0.561***	-0.516***
	(-22.89)	(-3.02)
$\text{Fitch}_t^{\text{up}} \times E_t$	-0.028***	-0.015*
	(-3.59)	(-1.77)
$\text{Fitch}_t^{\text{down}} \times E_t$	0.055***	0.047**
	(7.60)	(-1.98)
Constant	0.212***	0.207***
	(24.67)	(6.02)
Observations	8,952	3,577
Adj R-squared	0.804	0.780

We estimate equation (5), where the dividend per share (D) at time t is regressed against the lagged dividends and earnings per share (E) including interaction terms of Fitch rating changes with lagged dividends and earning per share. All the models allow for constant autocorrelation across the individual firm observations as well as fixed effects. The adjusted R-squared is the overall R^2 representing a simple squared correlation coefficient. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.