The interplay of credit scores and ESG ratings on cash holdings

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PRELIMINARY AND INCOMPLETE

Abstract

We show that the information content of the "big three" credit rating agencies (Standard and Poor's, Fitch and Moody's) is crucial and affects managers' risk aversion behavior and precautionary motives. In addition, we find that the underinvestment problem dominates the precautionary effect when firms are ESG rated. We further find that firms with better ESG scores can alleviate the precautionary concerns that arise from changes in credit ratings. Interestingly we show that the government component of the ESG rating plays a crucial role in our analysis. Therefore, we uncover an interesting interplay between the information content of solicited credit scores and unsolicited ESG ratings on corporate cash holdings decision making.

Keywords: cash holdings, credit rating agencies, ESG scores, precautionary motives, underinvestment problems.

JEL Classification: C23, C26, G24, G30, G32, Q56

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1 Introduction

The information content of Environmental, Social, and Governance (ESG) ratings has drawn a lot of attention in the past few years (e.g. Berg et al., 2022; Edmans, 2022). However, how these ratings compete and compare with the existing credit rating agencies (CRAs) remains an open question. Our paper tries to fill that gap. Understanding how these two types of ratings interact is of paramount importance due to the recent trend of the major credit rating agencies to incorporate ESG factors in their rating methodology.

It is well established that CRAs provide frequently independent credit rating evaluations, measuring the long-term fundamental credit strength of issuers, based on both public and private information shared by the issuers. Thus, CRAs influence the capital markets by providing information on the level of default risk of a corporation, as well as the expected repayment in the event of default. ESG ratings measure different dimensions of the corporations focusing more on how they integrate various factors regarding the environment, society and governance.

Credit ratings of corporations play an important role in capital market by not only providing the investors with a direct and easy way to assess risk, but also by setting up a regulatory certification of classification of securities from investment grade (IG) to high yield (HY) or junk status (Bongaerts et al. 2012). The latter will affect the demand for corporate bond by insurance companies, mutual funds and banks which are subject to rating-based restrictions and the amount of risky debt that are permitted to hold on their portfolios.[1] As a result, a credit rating change towards any direction from at least one CRA may significantly affect the capital structure of this company through its access to external sources of financing and borrowing costs (Kisgen, 2006; 2009).

It has also been shown that ESG ratings affect capital markets by providing a better indication of firms' sustainability and long term performance (i.e. Edmans, 2011; Lins et al., 2017). Therefore, firms with better ESG scores should experience easier access to external financing (El Ghoul et al., 2011; Cheng et al., 2014; Asimakopoulos et al., 2023).

In our study we take as given the importance and existence of multiple CRAs[2] and

[1] Recently, using a reputation-based two-period model of rating structured products where a reputable CRA designs and rates securities, Josephson and Shapiro (2020) examine how the presence of CRAs have an impact on such products. More specifically, they argue that the rating quality constraints and the relative demand by constrained and unconstrained investors affect both the equilibrium outcome and the rating inflation.

[2] The importance of multiple credit ratings has been analysed in detail by Bongaerts et al. (2012)

we aim to initially contribute to the related literature by exploring the impact of credit rating changes (upgrades or downgrades) on corporate cash holdings considering at the same time the "big three" credit rating agencies (Moody's, Standard & Poor's and Fitch). We further contribute to the related literature with the introduction of ESG ratings and the assessment of how credit scores interact with ESG ratings when it comes to corporate cash holdings.

This paper offers a novel analysis on the combined impact of multiple credit and ESG rating changes (upgrades or downgrades) on corporate cash holdings. Even though there are some similarities among the "big three" credit rating agencies, they rate the creditworthiness of an issuer differently relying on different sources of information and they disclosure different signals to the market. For example, S&P and Fitch ratings measure the probability of default, while Moody's ratings seek to measure the expected losses in the event of a default (White, 2010). These different sources of information and different signals are captured in our study by the use of all "big" rating agencies.[3]

Similar arguments can be put forward with respect to different ESG rating agencies and their different information content, see for example Berg et al. (2022). However, it is rather difficult to obtain ESG ratings from various sources and keep a large enough sample for an empirical analysis. In this version of the paper we only use one source of ESG rating, but we leave the exploration of more sources as a future work.

Our key findings show that: i) Credit ratings affect cash holdings, as we find consistent and statistical significant evidence of cash hoarding following credit rating downgrades; ii) There is an asymmetric effect of upgrades and downgrades to the level of cash holdings; iii) Better ESG scores lead to higher level of cash holdings; iv) Firms that are ESG rated or have higher ESG score can overcome the negative effects of a credit rating downgrade.

providing three explanations based on a variety of empirical implications that exploit the "information production", "rating shopping", and "regulatory certification" hypotheses.

[3]A similar argument has been provided by Cornaggia et al. (2017) but in a different setup and with a different focus. In particular, they argue that credit ratings have different meanings across various asset classes.

2 Literature Review and Hypothesis Development

2.1 Why do firms hold cash?

Following Keynes (1936) that cash holdings may be beneficial to firms with limited access to external capital markets, many studies have been emerged proposing three key theoretical justifications of why firms alter their cash reserves. These are the trade-off theory, the pecking order theory, and the free cash flow theory.

The trade-off theory states that firms tend to balance out the marginal costs and benefits to define the optimal level of cash holdings. The costs are the opportunity costs of the capital invested in liquid assets, while the benefits steam from the transaction and precautionary motives (Opler et al., 1999; Almeida et al., 2004; and Bates et al., 2009). Specifically, the transaction motive indicates that firms lower transaction costs associated with acquiring external funds or disposing assets. The precautionary motive gives the ability for firms to fund projects if alternative financing sources become too expensive. In addition, the precautionary motive shows that firms with better growth opportunities tend to hold more cash because the adverse shocks and financial instability are more costly to them (Bates et al., 2009).

The pecking order theory, proposed by Myers and Majluf (1984), suggests that a firm uses its financing sources starting from internal financing, followed by debt, with equity being the last step. In other words, the pecking order theory recognizes that different types of capital have varying costs. According to the pecking order theory, firms use cash as a buffer between retained earnings and investment needs, instead of defining a target cash level (Dittmar et al., 2003).

Regarding the free cash flow theory, Jensen (1986) argues that managers have an incentive to accumulate cash reserves rather than pay them out to shareholders. However, this agency motive and behaviour may generate agency concerns and increase information asymmetry because excess cash reduces pressure on good performance and allows managers to invest in projects based on their own interests (i.e. Harford, 1999; and Dittmar and Mahrt-Smith, 2007).

2.2 Credit Rating Agency (CRA)

The credit rating agencies (CRAs) measure firms' long-term fundamental credit strength and provide independent credit rating evaluations. These credit ratings play an important role in financial markets by influencing the decisions and actions of both investors and bond issuers. In terms of the former, the credit rating restricts prospective investment and contracts for investors. For example, rating levels determine whether institutional investors, such as banks or pension funds, are allowed to invest in the company's securities. Credit ratings also have an impact on the capital requirements of banks and issuers when they invest in a particular company. In terms of the latter, Graham and Harvey (2001) document that credit ratings are the second most important factor affecting a firm's capital structure. Moreover, due to the fact that financial frictions are associated with credit ratings, they are a major concern to a firm manager when making decisions (Kisgen, 2006).

Firms' performances are influenced not only by the "level" of credit ratings, but also by the "changes" of ratings. For instance, securities' prices respond to rating changes, which tend to vary over the past several decades. Although early papers record a negligible price response to credit rating changes (Weinstein, 1977; Pinches and Singleton, 1978), recent surveys of financial markets show that the market's response to upgrades and downgrades of credit rating have an asymmetric reaction. The lower credit ratings lead to a reduction in stock price during the same period, but upgrades are usually related to smaller and insignificant changes (Hand et al., 1992; Choy et al., 2006; Jorion and Zhang, 2007). Besides, the change of credit rating levels may affect the relationship between customers and employees and company's operation capabilities, such as maintaining a long-term contract. Due to these significant spill-over effects, companies appear to react to downgrade by reducing debt issuance and leverage (Kisgen, 2009).

What is the economic role of multiple credit rating upgrades or downgrades? The Standard & Poors Global Ratings (S&P), Moody's Investors Service (Moody's), and Fitch Ratings Inc. (Fitch) are called "big three" of CRAs which control about 95% of the rating business. The importance of multiple credit ratings has been analysed in detail by Bongaerts et al., (2012) providing three explanations based on a variety of empirical implications that exploit the "information production", "rating shopping", and "regulatory certification" hypotheses. To investigate the impact of credit rating changes

on cash policy, at least one credit rating agency should be considered and used. However, due to the easy access of S&P credit rating data, most of the related literature uses only the S&P credit rating data (Kisgen, 2006, 2009; Khieu and Pyles, 2012; Hasan et al., 2021). One exemption here is the recent work of Hasan et al., (2021) that examines the effect of credit rating disagreements between S&P and Moody's on merger and acquisition decisions. It needs to point that the use of one or two out of the big three CRAs might lead to misleading results since most of the firms always solicit and pay for multiple ratings. Therefore, in this paper, we examine the effects of any credit rating changes from the big three on firms' cash holdings.

2.3 Environmental, Social and Governance (ESG) rating

The Environmental, Social, and Governance (ESG) rating refers to how firms and investors integrate the environment, society, and governance three perspectives into their operations.

Prior literature shows interests in examining why firms engage in ESG activities and correspond consequences. The reasons could origin from market situations (Cai et al., 2016; Liang and Renneboog, 2017), the preference and help of customers and investors (Dai et al., 2021), ownership types (McGuinness et al., 2017; Abeysekera and Fernando, 2020; Hsu et al., 2021), and managers' characteristics (Borghesi et al., 2014; Cronqvist and Yu, 2017; Hegde and Mishra, 2019). Regarding the ESG corporate impact, it consists of the effects on firm financial performance (Edmans, 2011; Flammer, 2015; Gao and Zhang, 2015; Lins et al., 2017; Albuquerque et al., 2019), firm risks (Oikonomou et al., 2012; Lins et al., 2017), and media coverage (Cahan et al., 2015).

In addition to above effects, ESG plays a more significant role in firms' financing behaviours, including both external and internal funding. Regarding raising external capital, firms with superior ESG performance have easier access to external financing markets, obtain lower funding costs, and face looser conditions (Sharfman and Fernando, 2008; Goss and Roberts, 2011; El Ghoul et al., 2011; Cheng et al., 2014; Ng and Rezaee, 2015), and maintain a lower debt ratio compared to firms without ESG ratings (Asimakopoulos et al., 2023). Regarding the internal funding, ESG rated firms tend to hold more cash through the systematic risk channel (Cheung, 2016). Firms with high ESG risks also hold more cash (Hasan et al., 2022).

2.4 Hypothesis

2.4.1 CRAs and cash holdings

In the case of a credit rating upgrade, the access to financial market will improve alleviating any future liquidity concerns of the managers leading to lower cash holdings today. In the case of a credit rating downgrade firms should hold more cash balances to fulfill short-term needs and potential investment opportunities as the cost of borrowing will perhaps increase and the access to capital markets might deteriorate. The suggested three hypotheses of Bongaerts et al. (2012) argue that an extra rating in agreement with existing ratings reduces credit quality uncertainty and asymmetric information. Therefore, cross credit rating changes towards the same direction should exhibit an asymmetric relationship with cash holdings. As a result, we expect, a negative (positive) relationship between credit upgrades (downgrades) and the level of cash holdings driven mainly by the precautionary motives of the manager.

Hypothesis 1: The CRAs upgrade (downgrade) is negatively (positively) related to cash holdings.

2.4.2 ESG and cash holdings

According to the precautionary motive, firms hold more cash to mitigate the uncertainty and reverse risks of external financing environment. Correspondingly, firms with fewer difficulties in external financing are supposed to obtain less cash reserves. Previous literature shows that ESG-rated firms have a broader investor base. For example, investors with social taste hope to satisfy their social preferences and to improve their social images by investing in socially responsible firms, even if it indicates paying higher management fees and forgoing financial returns (Riedl and Smeets, 2017). Simultaneously, ESG-rated firms face less financing constraints and requirements from the lenders (El Ghoul et al., 2011; Cheng et al., 2014; Ng and Rezaee, 2015, Asimakopoulos et al., 2023). In summary, ESG-rated firms have easier access to multiple external funding so that they are predicted to obtain less cash as a buffer to overcome disadvantaged financing environment.

Hypothesis 2a: Based on the precautionary motive, ESG rated firms obtain *lower* cash than non-rated firms.

The underinvestment problem is considered by firms when they make financing decisions. Myers (1977) suggests that firms with higher growth opportunities should constrain the use of debt to avoid the underinvestment problem resulting from high leverage ratio. ESG-rated firms face higher growth opportunities (Lins et al., 2017) so that these firms should maintain a lower level of leverage ratio to overcome the debt-overhang problem. Due to the external financing and internal financing being substitutes, we provide the following hypothesis.

Hypothesis 2b: According to the underinvestment problem, ESG rated firms hold *more* cash compared to non-rated firms.

2.4.3 ESG and CRA interactions and cash holdings

Depending on whether the precautionary motive or the underinvestment problem drive the ESG effects on cash holdings, the interaction with the credit scores might lead to different results. Following the recent paper of Asimakopoulos et al., (2023) that have shown that ESG rated firms face better access to financial markets, we hypothesize that having an ESG that is higher than the other firms in the sector should overcome the precautionary motives from holding more cash in a credit rating downgrade. Similarly, having a better ESG score should lead holding more cash under a credit rating upgrade to pursue future investment opportunities. Therefore, we formulate the following two hypotheses regarding the interaction of ESG and credit ratings:

Hypothesis 3a: Given ESG scores, firms with upgrade CRAs hold *more* cash.

Hypothesis 3b: Given ESG scores, firms with downgrade CRAs hold *less* cash.

3 Data

3.1 Data construction and sources

Our dataset merges various sources. We initially collect historical credit rating data from Mergent Fixed Income Securities Database (FISD) for the period 1980-2021. This source provides credit ratings issued by all three major agencies (Standard & Poor's, Fitch and Moody's) for US listed firms. We then merge this dataset with data from CRSP-Compustat Fundamentals Annual so as to match the firms with available ratings to their balance sheet and financial data for the same period. We further merge our dataset with

Refinitic ESG data.[4] 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) from our sample ending up with an unbalanced panel of 18,523 firm-year observations the period 1980-2021.

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, 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.

For ESG scores we use three variables. We firstly use a dummy *ESG* that takes the value of 1 when a firm is ESG rated in period t. We also consider the natural logarithm of 1 plus the actual ESG score of the firm in period t defined as *LESG*. Finally, we introduce the growth rate of ESG as the log differences of ESG scores defined as *LESG_diff*

Throughout our analysis we include the following firm characteristics and balance sheet variables, similar to the related literature (see for example, Gao et al., 2013, Almeida et al., 2017 and Kahle and Stulz, 2017). *Cash_TA* is the ratio of cash and marketable securities over total assets. *TAssets* denotes the natural logarithm of total assets. *CF_TA* is the cash flow defined as the operating income before depreciation minus interest and minus taxes, divided by lagged assets. *CFV* is the cash flow volatility calculated using the standard deviation of *CF* over the past two-years. *SalesGrowth* is the change in the natural logarithm of sales. *Lev_TA* is leverage over total assets, where leverage is defined as the long-term debt. *NWC_TA* is the net working capital over total assets, where net working capital is defined as current assets minus current liabilities minus cash. *CapEx* is capital expenditures scaled by lagged assets. *Div_TA* is the annual cash dividends on ordinary stock divided by lagged assets. *RDexp_TA* denotes the ratio of Research

[4]The ESG data are only available from 2002 until 2021. Therefore, in our empirical analysis we treat the missing observations carefully so as to be able to keep a long enough dataset and assess how firms change their behaviour when they become rated.

and Development (R&D) expenditure over lagged assets. *Inv_TA* denotes the ratio of inventories to total assets. In addition, *LAge* is the natural logarithm of firm's age having set as a starting point the first time that the firm entered CRSP-Compustat's records. Finally, we winsorize our dataset at the 1% and 99% levels.

3.2 Descriptive statistics and correlations

Table 1 provides the summary statistics of our sample. In particular, we present the number of observations, the mean and standard deviation, and min-max values of our entire dataset.

Table 1 here

Tables 2 and 3 split the sample to CRAs upgrades/downgrades (by any of the three CRAs) and ESG rated/non-rated firms respectively. The aim to have a preliminary screen of the firms' differences according to these key characteristics. The last column shows the p-values from the t-tests of mean differences between the variables in the CRA upgrade and downgrade samples, for Table 2, and ESG rated and non-rated firms for Table 3.

Overall, we observe that firms which experienced a credit rating upgrade within a year hold on average less cash compared to the ones that experienced a credit rating downgrade within a year. Interestingly, the upgraded firms will have lower ESG scores and higher leverage. When it comes to ESG rated vs. non-rated firms, we find that ESG rated firms hold more cash, have lower cash flow volatility and lower leverage positions.

Tables 2-3 here

Table 4 shows the correlations between the key variables in our sample, credit rating changes and ESG scores. We find that the three credit rating agencies exhibit, in general, high level of correlation on the upgrades and downgrades. However, they all appear to be uncorrelated with the ESG indicators.

Table 4 here

4 Methodology

We begin our empirical analysis with the estimation of the impact of credit rating changes (upgrades and downgrades) on corporate cash holdings using the following model:

$$Cash_TA_{i,t} = \beta_0 + \beta_1 CRA_{i,t}^{up} + \beta_2 CRA_{i,t}^{down} + B^{'}\mathbf{X}_{i,t} + Year\ and\ Ind.\ FEs + \epsilon_{i,t} \quad (1)$$

where $i = 1, 2, \ldots N$ denotes the firms and $t = 1, 2, \ldots, T$ indicates years. The variables $CRA_{i,t}^{up}$and $CRA_{i,t}^{down}$ are dummy variables that take the value of one in case of a credit rating upgrade or downgrade respectively by any of our three credit rating agencies. Finally, $X_{i,t}$ is a vector of various firm control variables.

We also include industry and year fixed effects (FEs) to control for the effect of time-varying industry factors on cash policies, following Gao et al. (2013). Finally, the error term includes a firm-specific time-invariant component.

One of the contributions of this paper is the assessment of all the three credit rating agencies at the same time and their impact on firm cash policies. It has been shown in the related literature that credit ratings have an asymmetric effect on cash holdings but these papers focus only on S&P ratings due to their data availability. In our paper we will also use Moody's and Fitch rating agencies. Therefore, equation (1) will simply illustrate the average effect of a credit rating change by any of our CRAs. In our empirical analysis we further assess the impact of credit rating changes by each one of the three rating agencies separately.

Next we assess the impact of ESG scores on corporate cash holdings estimating the following equation:

$$Cash_TA_{i,t} = \gamma_0 + \gamma_1 ESG_{i,t} + \Gamma^{'}\mathbf{X}_{i,t} + Year\ and\ Ind.\ FEs + \eta_{i,t} \quad (2)$$

Similarly to equation 1, in equation 2 we introduce only the ESG indicators instead of the credit rating changes, controlling for various firms characteristics and firm/year fixed effects. This equation will help us isolate the effects of ESG scores on cash holdings.

In order to assess how credit rating changes might interact with the fact that a firm

is also ESG rated or has a good ESG score, we estimate the following two equations:

$$Cash_TA_{i,t} = \theta + c_1 CRA_{i,t}^{up} + \theta_2 CRA_{i,t}^{down} + \theta_3 ESG_{i,t} + \Theta' \mathbf{X}_{i,t} + Year\ and\ Ind.\ FEs + \upsilon_{i,t} \tag{3}$$

$$\begin{aligned} Cash_TA_{i,t} = \delta + \delta_1 CRA_{i,t}^{up} + \delta_2 CRA_{i,t}^{down} + \delta_3 ESG_{i,t} + \delta_4 CRA_{i,t}^{up} * ESG_{i,t} \\ + \delta_5 CRA_{i,t}^{down} * ESG_{i,t} + \Delta' \mathbf{X}_{i,t} + Year\ and\ Ind.\ FEs + \nu_{i,t} \end{aligned} \tag{4}$$

Equation 3 simply merges equations 1 and 2. However, in equation 4 we further include an interaction term between credit rating changes and ESG scores. This interaction term will be the key variable for our empirical analysis that will show the combined effect of CRAs and ESGs on corporate cash holdings.

5 Results

5.1 Benchmark estimations

Table 5 shows the results from the estimation of equation 1 with credit rating changes by any CRA in column 1. In the remaining columns we re-estimated equation 1 taking into account one CRA at a time.

We find that credit rating upgrades (downgrades) are negatively (positively) related to cash holdings. This confirms our first hypothesis and it shows that in the case of a credit rating upgrade the managers are less concerned about future liquidity issues, leading to lower cash holdings. However, in the case of a credit rating downgrade the managers increase the cash holdings as a precautionary motive and in order to be able to fulfil short-term needs.

The results further indicate that only S&P upgrades lead to statistically significant lower cash holdings. However, both S&P and Moody's downgrades have a significant impact on the increase of cash holdings. Fitch does not appear to have any statistically significant effect, mainly due to its lower coverage.

Table 5 here

Table 6 indicates the impact of ESG scores on cash holdings. Specifically, column 1 shows that when a firm becomes ESG rated they tend to hold more cash. This result

remains consistent even if we use the actual ESG score instead (column 2). Finally, in column 3 we find that an increase in the ESG rate leads to higher cash holdings. In economic terms, a one standard deviation increase in the ESG growth rate leads to about 10% increase in the mean value of cash holdings.

These results verify our hypothesis *2b* and show that the underinvestemnt problem is stronger than the precautionary motive and thus managers will tend to hold more cash when they become ESG rated or when their ESG score improves. This result is also in line with Lins et al., (2017) Asimakopoulos et al., (2023) that show that ESG rated firms have better access to financial markets along with better growth opportunities.

Table 6 here

In Table 7 we combine the CRA and ESG ratings and in Table 8 we further introduce their interaction terms. The main results in Table 7 remain consistent with the previous tables where we estimated the CRA and ESG effects on cash holdings separately. Please note that here we focus on any CRA changes and we do not focus on a specific rating agency.

Table 8 provides the results from the interaction terms between CRA changes and ESG indicators. Our findings in column 1 show that when a firm experiences a credit rating upgrade and are also ESG rated, then their cash holdings will tend to increase. This verifies our hypothesis *3a* and shows that the underinvestment problem is stronger than the precautionary motive. Furthermore, when the firm experiences a credit rating downgrade we find that the increase in cash holdings due to precautionary motive is mitigated by the existence of ESG score. These results remain consistent even if we consider the actual ESG score instead of the dummy variable (column 2). When we consider the changes in the ESG score (column 3) we still find that the precautionary motives from the credit ratings are mitigated in both the upgrades and downgrades, but now the positive effect on the interaction term of ESG and CRA upgrades is not statistically significant. Overall, these results show that ESG-rated firms tend to hold more cash and that the underinvestment consideration dominates the precautionary motive.

Tables 7-8 here

6 Additional results

6.1 Comparing to the industry ESG mean score

So far we have mainly focused on whether firms are ESG rated or not. It is also important though to examine if the ESG score that the firms receive is better or worse compared to the other firms in the same industry.

In Table 9 we assess if the ESG score that the firm received is above or below the industrial mean ESG score. To that end, we introduce dummy variables that take the value of one when the ESG score of the firm is above or below the industrial average score, *ESG_high_ind* and *ESG_low_ind* respectively. The results show that the underinvestment consideration is stronger when the firm receives an ESG score that is higher the average ESG score of the other firms in the same industry that period.

Table 9 here

6.2 Firm heterogeneity

We further split our sample of firms according to size, growth opportunities, alternative use of assets and financial pressure[5].

Table 10 shows that the effect of credit rating changes on cash holdings are mainly significant for larger firms, firms with low growth opportunities, high alternative use of assets and for those that experience low financial pressure. Regarding the ESG score, we find statistically significant results only for large firms. This shows that our key findings reagrding the ESG score do not depend on certain firm characteristics.

Finally, the interaction term appears to be significant and positive for firms with low growth opportunities and highe alternative use of assets. This indicates that firms that can improve their growth will benefit more from an ESG score. Similarly, firms with high alternative use of assets should face better investment opportunities and can benefit more from an ESG score that can improve their investment opportunities.

Table 10 here

[5]Financial pressure is defined as the ratio of cash flow to interest payments, following Acharya et al. (2012)

7 Endogeneity tests

7.1 Reverse Causality

Our results presented in the previous section might suffer from endogeneity. Therefore, in this section we assess the potential issue of reverse causality between ESG ratings and cash holdings.

Table 11 estimates the reverse causality between ESG scores and cash holdings. In column 1, the changes in cash holdings from year $t-1$ to t are regressed on the changes in ESG between year $t-1$ and t, year $t-2$ and $t-1$, year $t-3$ and $t-2$. In column 2, ESG and cash holdings switch their role, everything else equal. All other control variables are in first differences.

We find that prior ESG rating changes affect cash holing changes, while past cash holding changes have no effect on current ESG rating changes. Therefore, there is no reverse causality issue between ESG scores and cash holdings.

Table 11 here

7.2 Matched sample

Another concern in our analysis might be the heterogeneity of the firms with and without ESG scores. To address this issue we perform a propensity score matching approach. Specifically, we match each ESG rated firm-yer observation with non-ESG rated firm-year observation according to their balance sheet characteristics. We also perform a second propensity score matching of ESG rated and non-ESG rated firms focusing on firm characteristics across time.

The results are presented in Table 12. We find that our benchmark estimations remain valid and do not depend on the heterogeneity amongst the ESG rate and non-ESG rated firms.

Table 12 here

7.3 2SLS with IVs

To further alleviate any remaining endogeneity concerns, we perform a two-stage least square estimation with instrumental variables. The instrumental variable we implement is the natural logarithm of the industrial average ESG score. The results are presented in Table 13 and indicate that the benchmark estimated results remain valid, as well as the interaction effects of upgrade CRAs and ESG ratings.

Table 13 here

8 Robustness checks

8.1 ESG elements

In this section we assess the importance of each one of the ESG elements. Therefore, we split our ESG indicator to E, S and G to assess the environmental, social and governance items on cash holdings separately.

Table 14 shows that the key components of the results are the S and G factors. The fact that the government component matters for managers' decision on cash holdings is novel and means that when a firm performs well in that dimensions, then agency costs are reduced and managers are able to hold more cash for the benefit of the firm.

Table 14 here

8.2 Investment grade and high yield firms

As a final robustness check we extend our analysis by assessing the impact of a credit rating changes that lead to a classification change. Kisgen (2006) and Bongaerts et al. (2012) find that being classified as IG leads to better access to financial markets and lower borrowing costs. This means that precautionary motives should not be as strong for these firms.

However, firms classified as HY are facing difficulties in raising external funds leading to a shortage of cash and increasing borrowing costs which may affect both their operating activities and their investment opportunity set, influencing, as a consequence, the viability

of the firm into consideration. This type of firms should exhibit stronger precautionary motives, similarly to the financially constraint firms discussed in the previous subsection.

To test this argument we are going to assess the impact of credit rating changes on firms that "push" firms to change classification. We find that our key results do not depend on such credit rating changes.

Table 15 here

9 Conclusion

We examined the impact of CRAs changes (upgrades or downgrades) and ESG scores on corporate cash holdings, taking into account at the same time the "big three" credit rating agencies (Moody's, Standard & Poor's and Fitch). We used a sample of US listed firms for the period 1980-2021. We initially verified the asymmetric impact of credit ratings on cash holdings. Credit rating upgrades (downgrades) are negatively (positively) related to cash holdings, which are mainly driven by S&P and Moody's changes. Furthermore, we found that ESG-rated firms tend to hold more cash, suggesting that the underinvestment consideration dominates the precautionary motive.

Regarding firms with ESG ratings and credit rating upgrades, we found that they tend to hold more cash. This indicated that the ESG underinvestment effect dominates the precautionary motive of CRA changes. We also found that the interaction outcome is more pronounced for firms with superior ESG performance and higher growth opportunities. Interestingly we found that social and governance considerations are the key drivers of these results.

Our paper contributes to the related literature in a number of ways. First we contribute to the ESG and CRA literature showing that those two ratings need to be considered in combination and not in isolation. Second, we show the importance of an unsolicited rating, such as the ESG rating on corporate decision making. Finally, we contribute to the growing literature on cash holdings by providing an additional key determinant.

References

[1] Abeysekera, A.P. and C.S. Fernando, 2020. Corporate social responsibility versus corporate shareholder responsibility: A family firm perspective. Journal of Corporate Finance, 61, 101370.

[2] Albuquerque, R., Y. Koskinen, and C. Zhang, 2019. Corporate social responsibility and firm risk: Theory and empirical evidence. Management Science, 65(10), 4451–4469.

[3] Almeida, H., M. Campello and M.S. Weisbach, 2004. The cash flow sensitivity of cash. The Journal of Finance, 59, 1777-1804.

[4] Almeida, H., I. Cunha, M. Ferreira and F. Restrepo, 2017. The real effects of credit ratings: The sovereign ceiling channel. The Journal of Finance, 72, 249-290.

[5] Asimakopoulos, P., S. Asimakopoulos and X. Li, 2023. The combined effects of Economic Policy Uncertainty and Environmental, Social, and Governance ratings on leverage. European Journal of Finance, forthcoming.

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

[7] Berg, F., J.F. Kölbel and R. Rigobon, 2022. Aggregate Confusion: The Divergence of ESG Ratings. Review of Finance, 26(6), 1315–1344.

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

[9] Borghesi, R., J.F. Houston, and A. Naranjo, 2014. Corporate socially responsible investments: CEO altruism, reputation, and shareholder interests. Journal of Corporate Finance, 26,164–181.

[10] Cahan, S. F., C. Chen, L. Chen, and N.H. Nguyen, 2015. Corporate social responsibility and media coverage. Journal of Banking & Finance, 59, 409–422.

[11] Cai, Y., C.H. Pan, and M. Statman, 2016. Why do countries matter so much in corporate social performance? Journal of Corporate Finance, 41,591–609.

[12] Cheng, B., I. Ioannou, and G. Serafeim, 2014. Corporate social responsibility and access to finance. Strategic Management Journal, 35(1),1–23.

[13] Cheung, A., 2016. Corporate social responsibility and corporate cash holdings. Journal of Corporate Finance, 37, 412-430.

[14] Choy, E., S. Gray and V. Ragunathan, 2006. Effect of credit rating changes on Australian stock returns. Accounting & Finance, 46, 755-769.

[15] Cornaggia, J.N., K.J. Cornaggia and J.E. Hund, 2017. Credit ratings across asset classes: A long-term perspective. Review of Finance, 21, 465-509.

[16] Cronqvist, H. and F. Yu, 2017. Shaped by their daughters: Executives, female socialization, and corporate social responsibility. Journal of Financial Economics, 126(3),543–562.

[17] Dai, R., H. Liang, and L. Ng, 2021. Socially responsible corporate customers. Journal of Financial Economics, 142(2),598–626.

[18] 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.

[19] Dittmar, A. and J. Mahrt-Smith, 2007. Corporate governance and the value of cash holdings. Journal of Financial Economics, 83, 599-634.

[20] Edmans, A., 2011. Does the stock market fully value intangibles? employee satisfaction and equity prices. Journal of Financial Economics, 101(3), 621–640.

[21] Edmans, A., 2022. The end of ESG. Financial Management, forthcoming.

[22] El Ghoul, S., O. Guedhami, C.C. Kwok, and D.R. Mishra, 2011. Does corporate social responsibility affect the cost of capital? Journal of Banking & Finance, 35(9), 2388–2406.

[23] Flammer, C. 2015. Does corporate social responsibility lead to superior financial performance? a regression discontinuity approach. Management Science, 61(11), 2549–2568.

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

[25] Gao, L. and J.H. Zhang, 2015. Firms' earnings smoothing, corporate social responsibility, and valuation. Journal of Corporate Finance, 32, 108–127.

[26] Goss, A. and G.S. Roberts, 2011. The impact of corporate social responsibility on the cost of bank loans. Journal of Banking & Finance, 35(7), 1794–1810.

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

[28] Hand, J.R., R.W. Holthausen and R.W. Leftwhich, 1992. The effect of bond rating agency announcements on bond and stock prices. The Journal of Finance, 47, 733-752.

[29] Harford, J., 1999. Corporate cash reserves and acquisitions. The Journal of Finance, 54, 1969-1997.

[30] Hasan, I. H. Huang and T. Y.Tob, 2021. Are credit rating disagreements priced in the M&A market? Journal of International Financial Markets, Institutions and Money, 72, 101335.

[31] Hasan, M.M., A. Habib, and R. Zhao, 2022. Corporate reputation risk and cash holdings. Accounting & Finance, 62(1), 667–707.

[32] Hegde, S.P. and D.R. Mishra, 2019. Married CEOs and corporate social responsibility. Journal of Corporate Finance, 58,226–246.

[33] Hsu, P.-H., H. Liang, and P. Matos, 2021. Leviathan inc. and corporate environmental engagement. Management Science, forthcoming.

[34] Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. The American Economic Review, 76, 323-329.

[35] Jorion, P. and G. Zhang, 2007. Good and bad credit contagion: Evidence from credit default swaps. Journal of Financial Economics, 84, 860-883.

[36] Josephson, J. and J. Shapiro, 2020. Credit ratings and structured finance. Journal of Financial Intermediation, 41, 100816.

[37] Kahle, K.M. and R.M. Stulz, 2017. Is the US public corporation in trouble? Journal of Economic Perspectives, 31, 67-88.

[38] Keynes, J.M., 1936. The general theory of money, interest and employment. Reprinted in The Collected Writings of John Maynard Keynes, 7.

[39] Khieu, H.D. and M.K. Pyles, 2012. The influence of a credit rating change on corporate cash holdings and their marginal value. Financial Review, 47, 351-373.

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

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

[42] Liang, H. and L. Renneboog, 2017. On the foundations of corporate social responsibility. The Journal of Finance, 72(2), 853–910.

[43] McGuinness, P.B., J.P. Vieito, and M. Wang, 2017. The role of board gender and foreign ownership in the csr performance of chinese listed firms. Journal of Corporate Finance, 42,75–99.

[44] Myers, S. C. 1977. Determinants of corporate borrowing. Journal of financial economics, 5(2), 147–175.

[45] Myers, S.C. and N.S. Majluf, 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13, 187-221.

[46] Ng, A. C. and Z. Rezaee, 2015. Business sustainability performance and cost of equity capital. Journal of Corporate Finance, 34, 128–149.

[47] Oikonomou, I., C. Brooks, and S. Pavelin, 2012. The impact of corporate social performance on financial risk and utility: A longitudinal analysis. Financial Management, 41(2), 483–515.

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

[49] Pinches, G.E. and J.C. Singleton, 1978. The adjustment of stock prices to bond rating changes. The Journal of Finance, 33 , 29-44.

[50] Riedl, A. and P. Smeets, 2017. Why do investors hold socially responsible mutual funds? The Journal of Finance, 72(6), 2505–2550.

[51] Sharfman, M.P. and C.S. Fernando, 2008. Environmental risk management and the cost of capital. Strategic management journal, 29(6), 569–592.

[52] Weinstein, M.I., 1977. The effect of a rating change announcement on bond price. Journal of Financial Economics, 5, 329-350.

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

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Up_CRA	18,523	0.188	0.391	0	1
Down_CRA	18,523	0.174	0.379	0	1
Up_SPR	17,356	0.131	0.337	0	1
Down_SPR	17,356	0.112	0.315	0	1
Up_MR	17,267	0.126	0.331	0	1
Down_MR	17,267	0.103	0.304	0	1
Up_FR	5,191	0.133	0.340	0	1
Down_FR	5,191	0.105	0.307	0	1
ESG	18,523	0.277	0.447	0	1
LESG	18,523	1.040	1.699	0	4.539
LESG_diff	18,523	0.013	0.135	-2.309	2.993
Cash_TA	18,523	0.102	0.119	0.000	0.942
TAssets	18,523	8.104	1.517	2.357	10.893
CF_TA	18,523	0.096	0.084	-0.766	0.399
CFV	18,523	0.033	0.045	0.002	0.663
SalesGrowth	18,523	0.055	0.217	-1.291	1.737
Lev_TA	18,523	0.296	0.186	0	0.874
NWC_TA	18,523	0.045	0.140	-0.666	0.557
CapEx	18,523	0.065	0.071	0	0.576
Div_TA	18,523	0.015	0.022	0	0.127
RDexp_TA	18,523	0.023	0.046	0	0.655
Inv_TA	18,523	0.112	0.111	0	0.638
LAge	18,523	2.772	0.662	0.693	3.714

Notes. This table shows the descriptive statistics of all necessary variables. It consists of CRA change trend variables, ESG indicators, and firm financial characteristics. Obs, Std. dev, Min, and Max denote the number of observations, standard deviation, minimum, and maximum respectively.

Table 2: T-test by CRAs change

	Full sample			CRAs Upgrade			CRAs Downgrade			T-test
Variable	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	P-value
ESG	18,523	0.277	0.447	3,478	0.267	0.442	3,215	0.299	0.458	0.007
LESG	18,523	1.040	1.699	3,478	1.004	1.682	3,215	1.117	1.729	0.015
LESG_diff	18,523	0.013	0.135	3,478	0.011	0.137	3,215	0.017	0.144	0.101
Cash_TA	18,523	0.102	0.119	3,478	0.084	0.096	3,215	0.098	0.109	0.000
TAssets	18,523	8.104	1.517	3,478	8.324	1.442	3,215	8.391	1.287	0.018
CF_TA	18,523	0.096	0.084	3,478	0.066	0.092	3,215	0.113	0.081	0.000
CFV	18,523	0.033	0.045	3,478	0.039	0.052	3,215	0.036	0.048	0.020
SalesGrowth	18,523	0.055	0.217	3,478	0.000	0.248	3,215	0.102	0.218	0.000
Lev_TA	18,523	0.296	0.186	3,478	0.359	0.189	3,215	0.316	0.183	0.000
Nwc_TA	18,523	0.045	0.140	3,478	0.021	0.151	3,215	0.036	0.125	0.000
CapEx	18,523	0.065	0.071	3,478	0.059	0.064	3,215	0.077	0.090	0.000
Div_TA	18,523	0.015	0.022	3,478	0.013	0.020	3,215	0.012	0.020	0.005
RD_TA	18,523	0.023	0.046	3,478	0.015	0.036	3,215	0.019	0.045	0.000
Inv_TA	18,523	0.112	0.111	3,478	0.103	0.104	3,215	0.102	0.107	0.392
LAge	18,523	2.772	0.662	3,478	2.790	0.689	3,215	2.783	0.661	0.869

Notes. This table compares the main variables' statistics according to the change direction of CRAs. CRAs upgrade and CRAs downgrade refer to all credit rating agencies and take into account upgrade/downgrade to any of them. The last column shows the p-value of the t-test statistics for the equality of means between CRAs upgrade and downgrade.

Table 3: T-test by ESG ratings

	Full sample			ESG rated firms			ESG non-rated firms			T-Test
Variable	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	P-value
Up_CRA	18,523	0.188	0.391	5,125	0.181	0.385	13,398	0.190	0.393	0.149
Down_CRA	18,523	0.174	0.379	5,125	0.188	0.391	13,398	0.168	0.374	0.002
Cash_TA	18,523	0.102	0.119	5,125	0.116	0.116	13,398	0.096	0.120	0.000
TAssets	18,523	8.104	1.517	5,125	9.095	1.120	13,398	7.724	1.477	0.000
CF_TA	18,523	0.096	0.084	5,125	0.117	0.065	13,398	0.088	0.089	0.000
CFV	18,523	0.033	0.045	5,125	0.027	0.038	13,398	0.035	0.047	0.000
SalesGrowth	18,523	0.055	0.217	5,125	0.039	0.180	13,398	0.061	0.229	0.000
Lev_TA	18,523	0.296	0.186	5,125	0.270	0.156	13,398	0.306	0.195	0.000
NWC_TA	18,523	0.045	0.140	5,125	0.024	0.116	13,398	0.054	0.148	0.000
CapEx	18,523	0.065	0.071	5,125	0.050	0.051	13,398	0.071	0.077	0.000
Div_TA	18,523	0.015	0.022	5,125	0.022	0.024	13,398	0.012	0.020	0.000
RDexp_TA	18,523	0.023	0.046	5,125	0.025	0.047	13,398	0.022	0.046	0.000
Inv_TA	18,523	0.112	0.111	5,125	0.103	0.094	13,398	0.115	0.116	0.000
LAge	18,523	2.772	0.662	5,125	3.236	0.378	13,398	2.595	0.662	0.000

Notes. This table compares the main variables' statistics according to whether firms have ESG ratings across all years. All firms are divided into two groups based on if they are ESG rated, and we show the data information for those two groups separately. The last column shows the p-value of the t-test statistics for the equality of means between these two groups.

Table 4: Pearson Correlation Matrix

	Up_CRA	Down_CRA	Up_SPR	Down_SPR	Up_MR	Down_MR	Up_FR	Down_FR	ESG	LESG	LESG_diff
Up_CRA	1										
Down_CRA	-0.087	1									
Up_SPR	0.783	-0.111	1								
Down_SPR	-0.097	0.750	-0.138	1							
Up_MR	0.764	-0.103	0.490	-0.060	1						
Down_MR	-0.090	0.723	-0.059	0.347	-0.129	1					
Up_FR	0.689	-0.130	0.424	-0.068	0.434	-0.084	1				
Down_FR	-0.097	0.621	-0.061	0.265	-0.075	0.303	-0.135	1			
ESG	-0.011	0.023	-0.035	-0.004	-0.035	0.007	-0.038	-0.021	1		
LESG	-0.010	0.021	-0.035	-0.008	-0.036	0.006	-0.039	-0.025	0.990	1	
LESG_diff	-0.008	0.012	-0.013	0.012	-0.003	-0.004	0.010	0.021	0.160	0.185	1

Notes. This table reports the Pearson correlation coefficients between CRA and ESG indicators. Specifically, CRA indicators show the upgrades and downgrades of individual S&P ratings, Moody's ratings, Fitch ratings, and overall CRAs. ESG indicators are ESG, LESG, and LESG_diff.

Table 5: The regression of cash holdings on credit rating changes

	(1) Any CRAs	(2) SPR	(3) MR	(4) FR
Up_CRA	-0.004***			
	(-2.936)			
Down_CRA	0.006***			
	(3.934)			
Up_SPR		-0.007***		
		(-4.030)		
Down_SPR		0.006***		
		(3.258)		
Up_MR			-0.002	
			(-1.178)	
Down_MR			0.007***	
			(3.924)	
Up_FR				-0.000
				(-0.102)
Down_FR				0.004
				(1.551)
TAssets	-0.028***	-0.029***	-0.027***	-0.019***
	(-7.838)	(-8.024)	(-7.419)	(-3.693)
CF_TA	0.035	0.039*	0.038*	0.067**
	(1.611)	(1.720)	(1.702)	(2.091)
CFV	0.079***	0.073***	0.081***	0.092**
	(3.251)	(3.027)	(2.967)	(2.394)
SalesGrowth	-0.014***	-0.014***	-0.014***	-0.011*
	(-3.280)	(-3.160)	(-3.548)	(-1.739)
Lev_TA	-0.035***	-0.022*	-0.045***	-0.039**
	(-2.709)	(-1.777)	(-3.412)	(-2.306)
NWC_TA	-0.085***	-0.095***	-0.076***	-0.156***
	(-5.053)	(-5.383)	(-4.390)	(-6.071)
CapEx	-0.093***	-0.095***	-0.085***	-0.139***
	(-4.541)	(-4.545)	(-3.876)	(-3.957)
Div_TA	0.156**	0.121	0.108	0.134
	(1.967)	(1.492)	(1.372)	(1.362)
RDexp_TA	-0.200**	-0.196**	-0.157	-0.037
	(-2.141)	(-2.026)	(-1.363)	(-0.431)
Inv_TA	-0.383***	-0.349***	-0.361***	-0.128**
	(-9.298)	(-9.138)	(-8.479)	(-2.189)
LAge	-0.015**	-0.015**	-0.010	-0.012
	(-2.437)	(-2.341)	(-1.600)	(-1.198)
Intercept	0.267***	0.363***	0.253***	0.286***
	(11.279)	(12.751)	(10.250)	(5.876)
Firm & Year FEs	Yes	Yes	Yes	Yes
N	18,523	17,356	17,267	5191
Adj.R^2	0.133	0.128	0.133	0.125

Notes. This table shows the relations between cash holdings and credit rating changes. In the first column, Up_CRA and Down_CRA indicate any credit rating increase or decrease respectively. For the next three columns, we focus on changes in individual credit ratings, i.e. S&P, Moody's, and Fitch. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 6: The regression of cash holdings on ESG scores

	(1) Cash_TA	(2) Cash_TA	(3) Cash_TA
ESG	0.008**		
	(1.995)		
LESG		0.002**	
		(2.188)	
LESG_diff			0.008**
			(2.018)
TAssets	-0.029***	-0.029***	-0.028***
	(-8.082)	(-8.076)	(-7.936)
CF_TA	0.042*	0.042*	0.042*
	(1.901)	(1.888)	(1.917)
CFV	0.078***	0.078***	0.079***
	(3.180)	(3.172)	(3.201)
SalesGrowth	-0.013***	-0.013***	-0.013***
	(-3.085)	(-3.079)	(-3.130)
Lev_TA	-0.038***	-0.038***	-0.037***
	(-2.904)	(-2.926)	(-2.897)
NWC_TA	-0.083***	-0.083***	-0.083***
	(-4.985)	(-4.972)	(-4.981)
CapEx	-0.091***	-0.090***	-0.091***
	(-4.442)	(-4.421)	(-4.430)
Div_TA	0.143*	0.139*	0.150*
	(1.801)	(1.755)	(1.892)
RDexp_TA	-0.201**	-0.200**	-0.202**
	(-2.145)	(-2.140)	(-2.154)
Inv_TA	-0.383***	-0.383***	-0.384***
	(-9.311)	(-9.308)	(-9.340)
LAge	-0.014**	-0.014**	-0.016**
	(-2.222)	(-2.147)	(-2.481)
Intercept	0.273***	0.273***	0.270***
	(11.556)	(11.529)	(11.379)
Firm & Year FEs	Yes	Yes	Yes
N	18,523	18,523	18,523
Adj.R^2	0.132	0.132	0.132

Notes. This table shows the relations between cash holdings and ESG ratings. ESG ratings are denoted by ESG, LESG, and ESG_diff. In detail, ESG is a dummy variable showing whether a firm has ESG combined scores. LESG is the natural logarithm of one plus ESG combined scores. LESG_diff shows the difference of LESGC between period t and period t-1. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 7: The regression of cash holdings on CRAs and ESG scores

	(1) Cash_TA	(2) Cash_TA	(3) Cash_TA
Up_CRA	-0.004***	-0.004***	-0.004***
	(-2.829)	(-2.818)	(-2.935)
Down_CRA	0.006***	0.006***	0.006***
	(4.002)	(4.001)	(3.925)
ESG	0.008**		
	(1.974)		
LESG		0.002**	
		(2.162)	
LESG_dif			0.008**
			(1.989)
TAssets	-0.029***	-0.029***	-0.028***
	(-7.999)	(-7.993)	(-7.852)
CF_TA	0.035	0.035	0.035
	(1.594)	(1.582)	(1.607)
CFV	0.079***	0.079***	0.080***
	(3.241)	(3.233)	(3.265)
SalesGrowth	-0.014***	-0.014***	-0.014***
	(-3.244)	(-3.238)	(-3.290)
Lev_TA	-0.035***	-0.036***	-0.035***
	(-2.723)	(-2.745)	(-2.709)
NWC_TA	-0.085***	-0.085***	-0.085***
	(-5.071)	(-5.058)	(-5.071)
CapEx	-0.093***	-0.093***	-0.093***
	(-4.546)	(-4.525)	(-4.537)
Div_TA	0.150*	0.147*	0.157**
	(1.892)	(1.847)	(1.980)
RDexp_TA	-0.200**	-0.199**	-0.201**
	(-2.138)	(-2.133)	(-2.146)
Inv_TA	-0.382***	-0.382***	-0.383***
	(-9.282)	(-9.279)	(-9.310)
LAge	-0.014**	-0.014**	-0.015**
	(-2.191)	(-2.118)	(-2.449)
Intercept	0.271***	0.271***	0.267***
	(11.473)	(11.444)	(11.293)
Firm & Year FEs	Yes	Yes	Yes
N	18,523	18,523	18,523
Adj.R^2	0.134	0.134	0.133

Notes. This table shows the relations between cash holdings, credit rating changes, and ESG scores. Based on Table 5 column 1, we add ESG ratings that are denoted by ESG, LESG, and LESG_diff separately. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 8: The regression of cash holdings on the interactions of CRAs and ESG scores

	(1) ESG	(2) LESG	(3) LESG_diff
Up_CRA	-0.006***	-0.006***	-0.004***
	(-3.450)	(-3.469)	(-2.890)
Down_CRA	0.006***	0.007***	0.006***
	(3.515)	(3.558)	(4.001)
ESG	0.007*	0.002*	0.010*
	(1.743)	(1.951)	(1.866)
Up_CRAs*ESG	0.006*	0.002*	-0.004
	(1.803)	(1.835)	(-0.594)
Down_CRAs*ESG	-0.001	-0.000	-0.009
	(-0.349)	(-0.409)	(-1.079)
TAssets	-0.028***	-0.029***	-0.028***
	(-7.973)	(-7.963)	(-7.854)
CF_TA	0.035	0.035	0.035
	(1.586)	(1.576)	(1.607)
CFV	0.079***	0.079***	0.080***
	(3.237)	(3.230)	(3.272)
SalesGrowth	-0.014***	-0.014***	-0.014***
	(-3.250)	(-3.246)	(-3.292)
Lev_TA	-0.036***	-0.036***	-0.035***
	(-2.744)	(-2.767)	(-2.709)
NWC_TA	-0.085***	-0.085***	-0.085***
	(-5.087)	(-5.074)	(-5.079)
CapEx	-0.094***	-0.093***	-0.093***
	(-4.575)	(-4.557)	(-4.536)
Div_TA	0.150*	0.147*	0.156**
	(1.898)	(1.855)	(1.969)
RDexp_TA	-0.199**	-0.199**	-0.201**
	(-2.136)	(-2.132)	(-2.147)
Inv_TA	-0.382***	-0.382***	-0.383***
	(-9.286)	(-9.279)	(-9.317)
LAge	-0.014**	-0.013**	-0.015**
	(-2.182)	(-2.106)	(-2.450)
Intercept	0.270***	0.270***	0.268***
	(11.465)	(11.435)	(11.297)
Firm & Year FEs	Yes	Yes	Yes
N	18,523	18,523	18,523
Adj.R^2	0.134	0.134	0.133

Notes. This table shows the relations between cash holdings and the interactions between credit rating changes and ESG ratings. According to Table 7, we introduce the interactions between credit rating upgrade/downgrade and ESG ratings to capture the interaction effects of these two variables. We use ESG, LESG, and LESG_diff as ESG indicators for column 1 to column 3 separately. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 9: Firm heterogeneity – Industry ESG mean

	(1) Cash_TA
Up_CRA	-0.006***
	(-3.461)
Down_CRA	0.006***
	(3.540)
LESG*ESG_high_ind	0.002*
	(1.946)
LESG*ESG_low_ind	0.002
	(0.732)
Up_CRA*LESG*ESG_high_ind	0.002*
	(1.957)
Up_CRA*LESG*ESG_low_ind	-0.004
	(-1.222)
Down_CRA*LESG*ESG_high_ind	-0.000
	(-0.514)
Down_CRA*LESG*ESG_low_ind	0.004
	(1.021)
TAssets	-0.029***
	(-7.965)
CF_TA	0.035
	(1.572)
CFV	0.079***
	(3.227)
SalesGrowth	-0.014***
	(-3.249)
Lev_TA	-0.036***
	(-2.763)
NWC_TA	-0.085***
	(-5.067)
CapEx	-0.093***
	(-4.556)
Div_TA	0.147*
	(1.847)
RDexp_TA	-0.199**
	(-2.126)
Inv_TA	-0.382***
	(-9.283)
LAge	-0.013**
	(-2.105)
Intercept	0.271***
	(11.460)
Firm & Year FEs	Yes
N	18,523
Adj.R^2	0.134

Notes. This table examines the firm heterogeneity based on superior/inferior ESG performance. LESG*ESG_high_ind and LESG*ESG_low_ind measure firms' ESG scores are higher or lower than the mean of industry ESG scores, where ESG_high_ind and ESG_low_ind are dummy variables. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 10: Other firm_heterogeneity

	Up_CRA	Down_CRA	LESG	Up_CRA*LESG	Down_CRA*LESG
Panel A: Size					
Low	-0.009***	0.006**	0.001	-0.001	-0.001
	(-3.856)	(2.387)	(0.551)	(-0.370)	(-0.242)
High	-0.002	0.008***	0.002*	0.001	-0.001
	(-0.774)	(3.519)	(1.828)	(1.148)	(-1.179)
Panel B: M/B ratio					
Low	-0.005***	0.005**	0.001	0.002*	-0.000
	(-2.620)	(2.306)	(0.783)	(1.685)	(-0.355)
High	-0.002	0.005	0.002	0.001	-0.000
	(-0.731)	(1.635)	(1.603)	(1.126)	(-0.241)
Panel C: Alternative uses of assets					
Low	-0.003	0.006**	0.001	0.001	-0.001
	(-1.551)	(2.564)	(0.802)	(0.789)	(-0.630)
High	-0.009***	0.005*	0.002	0.003**	0.000
	(-3.246)	(1.864)	(1.470)	(2.233)	(0.370)
Panel D: Financial pressure					
Low	-0.005***	0.008***	0.001	0.002	-0.001
	(-2.799)	(3.686)	(0.780)	(1.454)	(-0.951)
High	-0.006*	0.005*	0.001	0.001	0.000
	(-1.721)	(1.834)	(1.097)	(1.149)	(0.174)
Controls	Yes	Yes	Yes	Yes	Yes
Firm & Year FEs	Yes	Yes	Yes	Yes	Yes

Notes. This table examines the firm heterogeneity based on firm size, Market-to-Book ratio, the alternative uses of assets, and financial pressure. Firms are divided into two groups according to whether their above firm characteristics are lower or higher than the mean of those firm characteristics. We control other firm financial indicators, firm fixed effects, and year fixed effects. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 11: The examination of reverse causality

	(1) Changes in cash (t-1,t)	(2) Changes in ESG (t-1,t)
Change in ESG between year t-1 and year t	0.003	
	(0.904)	
Change in ESG between year t-2 and year t-1	0.001	
	(0.429)	
Change in ESG between year t-3 and year t-2	-0.009**	
	(-2.349)	
Change in cash holdings between year t-1 and year t		0.014
		(0.669)
Change in cash holdings between year t-2 and year t-1		-0.000
		(-0.024)
Change in cash holdings between year t-3 and year t-2		-0.004
		(-0.205)
Change in Up_CRA (t-1,t)	-0.001	-0.003
	(-0.922)	(-1.196)
Change in Down_CRA (t-1,t)	0.003***	-0.002
	(3.023)	(-0.631)
Change in TAssets (t-1,t)	-0.011***	0.022***
	(-2.652)	(3.954)
Change in CF_TA (t-1,t)	0.073***	-0.017
	(3.756)	(-0.814)
Change in CFV (t-1,t)	0.030	-0.012
	(1.058)	(-0.308)
Change in SalesGrowth (t-1,t)	-0.015***	-0.006
	(-4.164)	(-1.136)
Change in Lev_TA (t-1,t)	-0.002	-0.021
	(-0.136)	(-1.508)
Change in NWC_TA (t-1,t)	-0.160***	0.039**
	(-8.717)	(2.196)
Change in CapEx (t-1,t)	-0.097***	-0.022
	(-4.793)	(-0.835)
Change in Div_TA (t-1,t)	-0.020	0.059
	(-0.336)	(0.485)
Change in RDexp_TA (t-1,t)	-0.195***	0.050
	(-4.597)	(0.788)
Change in Inv_TA (t-1,t)	-0.514***	0.039
	(-12.793)	(0.854)
Change in LAge (t-1,t)	-0.024	-0.183***
	(-1.131)	(-5.590)
Intercept	0.027***	0.075***
	(3.743)	(4.961)
Firm & Year FEs	Yes	Yes
N	14,091	16,606
Adj.R^2	0.133	0.433

Notes. This table estimates the reverse causality between ESG scores and cash holdings. In column 1, the changes in cash holdings from year t-1 to t are regressed on the changes in ESG between year t-1 and t, year t-2 and t-1, year t-3 and t-2. In column 2, the changes in ESG scores from year t-1 to t are regressed on the changes in cash holdings between year t-1 and t, year t-2 and t-1, year t-3 and t-2. All other control variables are first difference from the prior year. We use the changes o The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and *

Table 12: Matched sample

	(1) Matched_1	(2) Matched_2
Up_CRA	-0.007***	-0.007***
	(-3.413)	(-3.365)
Down_CRA	0.003	0.005***
	(1.500)	(2.964)
LESG	0.002*	0.001
	(1.703)	(1.373)
Up_CRA *LESG	0.002**	0.002**
	(1.981)	(2.118)
Down_CRA *LESG	0.001	0.000
	(0.849)	(0.358)
TAssets	-0.033***	-0.033***
	(-8.639)	(-8.531)
CF_TA	0.075***	0.065**
	(2.813)	(2.122)
CFV	0.063*	0.061**
	(1.921)	(2.034)
SalesGrowth	-0.014***	-0.016***
	(-2.963)	(-3.488)
Lev_TA	-0.057***	-0.053***
	(-4.349)	(-3.794)
NWC_TA	-0.132***	-0.144***
	(-6.952)	(-6.982)
CapEx	-0.195***	-0.169***
	(-5.287)	(-5.956)
Div_TA	0.138	0.148*
	(1.641)	(1.805)
RDexp_TA	-0.125	-0.201**
	(-1.638)	(-2.531)
Inv_TA	-0.343***	-0.367***
	(-8.883)	(-10.011)
LAge	-0.002	-0.009
	(-0.354)	(-1.435)
Intercept	0.425***	0.422***
	(12.815)	(12.886)
Firm & Year FEs	Yes	Yes
N	13,294	13,647
Adj.R^2	0.166	0.180

Notes. This table uses matched sample to regress cash holdings on credit rating changes and ESG scores. In column 1, we match each ESG rated firm-year observation with non-ESG rated firm-year observation having similar firm-year characteristics, i.e. focus on firm-year observations. In column 2, we match ESG rated firms with non-ESG rated firms by matching their specific firm characteristics across time, i.e. focus on firms. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 13: 2SLS-IV approach

	First stage			Second Stage
	LESG	Up_CRA*LESG	Down_CRA*LESG	Cash_TA
LESGC_IND_avg	0.795***	-0.052***	-0.060***	
	(25.596)	(-2.624)	(-2.996)	
Up_CRA* LESGC_IND_avg	-0.015	0.944***	-0.006	
	(-0.827)	(48.200)	(-0.586)	
Down_CRA* LESGC_IND_avg	-0.051***	-0.016	0.925***	
	(-2.861)	(-1.521)	(47.214)	
Up_CRA				-0.008***
				(-3.391)
Down_CRA				0.006***
				(2.599)
LESG				-0.003
				(-1.116)
Up_CRA*LESG				0.002*
				(1.749)
Down_CRA*LESG				-0.002
				(-1.165)
Controls	Yes	Yes	Yes	Yes
Firm & Year FEs	Yes	Yes	Yes	Yes
N	13,038	13,038	13,038	13,038
F test of excluded instruments	222.21	796.64	775.70	

Notes. This table examines the interaction effects of credit ratings and ESG on cash holdings by using two-stage least squares (2SLS) with instrumental variables approach. The instrumental variable is the natural logarithm of industrial average ESG scores. We control firm characteristics, firm fixed effects, and year fixed effects.

Table 14: E-S-G

	(1) Environment	(2) Social	(3) Governance
Up_CRA	-0.006***	-0.006***	-0.006***
	(-3.322)	(-3.494)	(-3.496)
Down_CRA	0.006***	0.007***	0.006***
	(3.587)	(3.577)	(3.548)
LE/S/G	0.002	0.002*	0.002*
	(1.549)	(1.839)	(1.651)
Up_CRA*LE/S/G	0.001	0.002*	0.002*
	(1.523)	(1.825)	(1.910)
Down_CRA* LE/S/G	-0.000	-0.000	-0.000
	(-0.235)	(-0.442)	(-0.379)
TAssets	-0.028***	-0.029***	-0.028***
	(-7.857)	(-7.958)	(-7.957)
CF_TA	0.035	0.035	0.035
	(1.575)	(1.575)	(1.582)
CFV	0.079***	0.079***	0.079***
	(3.221)	(3.226)	(3.237)
SalesGrowth	-0.014***	-0.014***	-0.014***
	(-3.252)	(-3.254)	(-3.240)
Lev_TA	-0.036***	-0.036***	-0.036***
	(-2.778)	(-2.772)	(-2.755)
NWC_TA	-0.085***	-0.085***	-0.085***
	(-5.042)	(-5.075)	(-5.074)
CapEx	-0.092***	-0.093***	-0.094***
	(-4.490)	(-4.557)	(-4.565)
Div_TA	0.146*	0.148*	0.149*
	(1.846)	(1.863)	(1.880)
RDexp_TA	-0.198**	-0.199**	-0.199**
	(-2.122)	(-2.129)	(-2.133)
Inv_TA	-0.382***	-0.382***	-0.382***
	(-9.277)	(-9.289)	(-9.283)
LAge	-0.014**	-0.013**	-0.014**
	(-2.133)	(-2.106)	(-2.185)
Intercept	0.269***	0.271***	0.270***
	(11.313)	(11.437)	(11.432)
Firm & Year FEs	Yes	Yes	Yes
N	18,523	18,523	18,523
Adj.R^2	0.134	0.134	0.134

Notes. This table estimates the interaction effects of ESG components and credit rating changes on cash holdings. From column 1 to column, we respectively use environmental scores, social scores, and governance scores to measure firms' ESG levels. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.

Table 15: IG_HY

	(1) Cash_TA
Up_CRA	-0.006***
	(-3.259)
Down_CRA	0.007***
	(3.547)
LESG	0.002*
	(1.951)
Up_CRA*LESG	0.001*
	(1.664)
Down_CRA*LESG	-0.001
	(-0.772)
Grade_up	-0.002
	(-0.538)
Grade_down	-0.002
	(-0.538)
Grade_up* LESG	0.003
	(1.430)
Grade_down* LESG	0.002
	(0.790)
TAssets	-0.029***
	(-7.971)
CF_TA	0.035
	(1.585)
CFV	0.078***
	(3.213)
SalesGrowth	-0.014***
	(-3.241)
Lev_TA	-0.036***
	(-2.764)
NWC_TA	-0.085***
	(-5.073)
CapEx	-0.093***
	(-4.560)
Div_TA	0.148*
	(1.858)
RDexp_TA	-0.199**
	(-2.130)
Inv_TA	-0.382***
	(-9.278)
LAge	-0.013**
	(-2.114)
Intercept	0.271***
	(11.461)
Firm & Year FEs	Yes
N	18,523
Adj.R^2	0.134

Notes. This table examines the effects of credit rating changes on cash holdings. Particularly, we focus on whether the credit rating changes from investment grade (IG) to high yield (HY), or from high yield (HY) to investment grade (IG) affect firms' cash holdings decisions. The numbers in parentheses are robust t-statistics. 1%, 5%, 10% significance levels are denoted by ***, **, and * respectively.