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Chaire Desjardins
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par

Amos Sodjahin
Claudia Champagne
Frank Coggins
Roland Gillet

Leading or Lagging indicators of risk? The informational content of extra-financial performance scores

CAHIER DE RECHERCHE

UNIVERSITÉ DE SHERBROOKE

Préambule

La gestion financière responsable vise la maximisation de la richesse relative au risque dans le respect du bien commun des diverses parties prenantes, actuelles et futures, tant de l'entreprise que de l'économie en général. Bien que ce concept ne soit pas en contradiction avec la définition de la théorie financière moderne, les applications qui en découlent exigent un comportement à la fois financièrement et socialement responsable. La gestion responsable des risques financiers, le cadre réglementaire et les mécanismes de saine gouvernance doivent pallier aux lacunes d'un système parfois trop permissif et naïf à l'égard des actions des intervenants de la libre entreprise.

Or, certaines pratiques de l'industrie de la finance et de dirigeants d'entreprises ont été sévèrement critiquées depuis le début des années 2000. De la bulle technologique (2000) jusqu'à la mise en lumière de crimes financiers [Enron (2001) et Worldcom (2002)], en passant par la mauvaise évaluation des titres toxiques lors de la crise des subprimes (2007), la fragilité du secteur financier américain (2008) et le lourd endettement de certains pays souverains, la dernière décennie a été marquée par plusieurs événements qui font ressortir plusieurs éléments inadéquats de la gestion financière. Une gestion de risque plus responsable, une meilleure compréhension des comportements des gestionnaires, des modèles d'évaluation plus performants et complets intégrant des critères extra-financiers, l'établissement d'un cadre réglementaire axé sur la pérennité du bien commun d'une société constituent autant de pistes de solution auxquels doivent s'intéresser tant les académiciens que les professionnels de l'industrie. C'est en mettant à contribution tant le savoir scientifique et pratique que nous pourrons faire passer la finance responsable d'un positionnement en périphérie de la finance fondamentale à une place plus centrale. Le développement des connaissances en finance responsable est au cœur de la mission et des intérêts de recherche des membres du Groupe de Recherche en Finance Appliquée (GReFA) de l'Université de Sherbrooke.

La littérature scientifique suggère généralement que les meilleures entreprises en matière environnementale, sociale et de gouvernance (facteurs ESG) présentent des niveaux de risque plus faibles que celles qui négligent ces facteurs. Ce constat ne précise cependant pas si les agences de notation s'ajustent aux nouvelles financières de type ESG, ayant ainsi un rôle en réaction, ou si elles anticipent plutôt les risques liés à ces facteurs, ayant un rôle plus proactif dans la formation des prix des titres financiers. La présente étude analyse ces relations en vérifiant explicitement si les variations des notations ESG proposées par MSCI-KLD anticipent les changements de risque financier ou l'inverse. Nos résultats suggèrent en général que les variations de notation, en particulier les variations négatives, sont suivies par une augmentation des risques financiers de l'entreprise, et par conséquent par une hausse de leur espérance de rendement. À l'opposé, les variations de risque financier des entreprises ne semblent pas précéder les variations des notations. Ces résultats suggèrent donc que les agences de notation ont un rôle informatif dans la formation des prix des titres financiers.

LEADING OR LAGGING INDICATORS OF RISK? THE INFORMATIONAL CONTENT OF EXTRA-FINANCIAL PERFORMANCE SCORES

Amos Sodjahin[a], Claudia Champagne[b], Frank Coggins[c], Roland Gillet[d]

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Abstract

This study investigates the informational content of extra-financial agency scoring by examining the relationship between firm beta and extra-financial performance score upgrades and downgrades. Specifically, we study the variations in the extra-financial score of 266 Canadian corporations between 2007 and 2012 with a conditional model. We find no evidence that changes in firm beta precedes changes in extra-financial scores. Rather, our results suggest that a firm's systematic risk increases following a downgrade of its extra-financial performance. In terms of score upgrades, the overall effect is not significant. However, score upgrades for firms with already-high scores predict higher systematic risk, while score upgrades for firms with low scores predict lower systematic risk. These results suggest that extra-financial scores are informational and can be useful to portfolio managers, notably for their risk management strategies.

JEL Classifications: G10, G14, M14

Key words: Corporate social responsibility, extra-financial performance, informational content, systematic risk, conditional model.

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[a] Professor of Finance, Accounting department, Business Faculty, Université de Moncton and GReFA, amos.sodjahin@umoncton.ca

[b] Professor of Finance, Department of Finance, Business School, Université de Sherbrooke and GReFA, Claudia.Champagne@Usherbrooke.ca

[c] Professor of Finance, Department of Finance, Business School, Université de Sherbrooke, CIRPÉE and GReFA, Frank.Coggins@Usherbrooke.ca

[d] Professor of Finance, Université Paris1 Panthéon-Sorbonne, PRISM, GReFA, roland.gillet@univ-paris1.fr

1. Introduction

Firm spending in Corporate Social Responsibility (CSR) activities has substantially increased in recent years. According to Hong, Kubik, and Scheinkman (2012), CSR spending amounts to hundreds of millions of dollars annually. One reason for this renewed interest for socially responsible investments (SRI) is that investors, including institutional investors, are becoming more concerned with the extra-financial consequences of corporate decisions. Firms that neglect this aspect may therefore face greater financial risk due to possible actions by regulators and activists that will affect their profitability (see for e.g. Baron and Diermeier (2007), and Lyon and Maxwell (2011)).

Growing enthusiasm for SRI has led to a surge in rating agencies that specialize in social and environmental rating and scoring (e.g. MSCI ESG STATS[1] in the US; EIRIS[2] in the UK; Thomson Reuter's ASSET4[3] and Sustainalytics[4] which operate globally). In addition to their main role of providing investors with information on CSR strategies, some agencies also publish extra-financial performance scores.[5] Our study examines whether variations in extra-financial scores affect financial markets, similar to what changes in credit ratings do (eg. Jorion and Zhang (2007), Holthausen and Leftwic (1986), and Weinstein (1977)). Specifically, we investigate the information content of extra-financial scores by examining their relationship to firms' systematic risk (beta). We address the following two questions: (1) is beta related to extra-financial performance scores and, (2) if so, do extra-financial performance score changes (upgrades and downgrades) lead or lag indicators of beta?

[1] Formerly KLD Research & Analytics, Inc.
[2] Ethical Investment Research and Information Service (http://www.eiris.org/)
[3] ASSET4 provides investment research information on economic, environmental, social, and governance (ESG) aspects of corporate performance (http://extranet.datastream.com/data/ASSET4%20ESG/Index.htm).
[4] Sustainalytics was formed from the merger between the Dutch firm "Sustainalytics" and the Canadian firm "Jantzi Research Inc" in August 2009 (http://www.sustainalytics.com/).
[5] We use the term "extra-financial" performance to include all types of non-financial performance that are deemed "responsible". These include the social, governance and environmental performances of firms.

Knowing whether firm beta varies before or following extra-financial performance changes is an important practical question. Specifically, if extra-financial performance changes predict systematic risk changes, then extra-financial rating agencies' scores can be an excellent risk management tool, particularly for institutional investors. In theory, extra-financial performance scores can be leading indicators of corporate systematic risk if extra-financial rating agencies are able, through their analysis of a company's environment, social or governance (ESG) criteria, to predict future losses or risk events such as operational or reputational losses. If, however, rating agencies are mostly reacting to corporate events that are related to extra-financial performance, then extra-financial performance score changes will lag beta variations. In this case, extra-financial agencies' scores would be less useful as predicting tools.

Our study contributes to the literature in several ways. Firstly, while previous studies investigate the impact of extra-financial performance score *levels* on financial risk (see, for e.g., Kim et al. (2014), Bouslah et al. (2013), Oikonomou et al. (2012)), our research focuses on the impacts of extra-financial performance score *changes* on systematic risk and by distinguishing between the effects of score upgrades and downgrades. From a risk manager's point of view, score changes are fundamentally different from score levels, as they are related to *new* information about a firm's risk. For instance, a firm can experience a score downgrade and still maintain a high score, or experience a positive change in its extra-financial score and still have a low score.

Secondly, while most studies agree on the existence of a relationship between extra-financial performance and financial risk, as evidenced by Orlitzky and Benjamin's (2001) meta-analysis, the question of the direction of the relationship between the two variables is not yet settled. Some authors argue that systematic risk is a determinant of CSR, as managers in lower-risk companies have access to more stable cash flows, allowing them to improve

their extra-financial performance (Hasseldine et al. (2005), Roberts (1992), McGuire et al. (1988)). Furthermore, Krüger (2015) shows that the occurrence of firm-specific events related to environmental, social or governance risks, has an important influence on KLD′s scorings. Specifically, he shows that KLD's scores are updated to account for information on events that have already occurred. Others believe that an improvement in a firm's extra-financial performance is likely to be rewarded by the market in terms of improved risk perception, and thus by a lower beta (e.g. Oikonomou and al. (2012), Salama and al. (2011), Sharfman and Fernando (2008)). Further, the previous studies do not address the basic question of whether a firm's financial risk is low (high) because of its high (low) CSR or whether its CSR is high (low) because of its low (high) financial risk? The mere observation of a negative correlation between some annual CSR measure and financial risk is consistent with at least two different interpretations: either more responsible firms tend to be less risky or, alternatively, less risky firms tend to channel more resources into projects that increase their CSR. Our extra-financial performance data allow us to test whether beta variations occur before or following changes in firms' extra-financial performance. Specifically, we use Sustainalytics database, which constantly updates corporate extra-financial performance scores, and thus has the advantage of providing information for a specific time frame, therefore allowing us to input extra-financial performance score changes in a conditional model and measure their informational content.

Thirdly, our study addresses the omnipresent issue of over-investment and managerial opportunism (e.g. McWilliams and Siegel (2001) and Preston and O'Bannon (1997)), which suggests that, under certain circumstances, extra-financial performance can be a potential source of risk, for instance because of overinvestment (McWilliams and Siegel (2001)). To do so, we examine whether extra-financial performance score upgrades for firms with already-high scores predict higher systematic risk. Finally, in order to reflect the qualitative

differences across the dimensions of extra-financial performance, we separately analyze each of the three components of extra-financial performance (i.e. environment, social and governance) as well as in an aggregate measure of performance.

Our results show no significant evidence that extra-financial score changes lag beta variations. Rather, we observe that systematic risk increases following extra-financial score downgrades. The overall predictive power of score upgrades is not significant. Therefore, extra-financial performance scores are not simply reacting to market information but are, particularly downgrades, leading indicators of firm systematic risk variations. Further, we show that extra-financial score upgrades for firms with already-high scores predict higher systematic risk while they predict lower systematic risk for firms with low extra-financial scores. This result suggests that, for firms with already-high extra-financial scores, further improvements can be counterproductive and lead to an increase in long-term risk, possibly because of costs that investors feel are too high and inopportune. By contrast, systematic risk decreases when firms with low extra-financial scores make an effort to improve their social image. Regarding score downgrades, we find that they predict higher systematic risk only for firms with low extra-financial scores.

The rest of the study is structured as follows. Section 2 presents a summary of the literature on the impact of extra-financial performance on shareholder wealth (return and risk). Section 3 presents the theoretical framework and research hypotheses. Section 4 describes the data and the methodology used in order to test our hypotheses. Section 5 presents and discusses our empirical results, and finally, section 6 concludes the paper.

2. Prior research on the impact of extra-financial performance on financial risk

Unlike the abundant literature on the impact of extra-financial performance on firm financial performance, there are few studies that examine the relationship between financial

risk and extra-financial performance. These few studies analyze different measures of financial risk, such as variance and its components (idiosyncratic risk, and systematic risk). Some studies suggest that extra-financial performance affects only idiosyncratic risk because extra-financial performance is firm specific. For example, using data between 1995 and 1999 from the "Canadian Social Investment database", Boutin-Dufresne and Savaria (2004) find a negative relationship between CSR and firm idiosyncratic risk. This observation is confirmed by Lee and Faff (2009), who study the impact of CSR on financial risk for firms listed in the Dow Jones Sustainability Index. The authors demonstrate that socially responsible firms are less risky than their socially irresponsible counterparts. Using Fortune's MAC data between 2002 and 2003 as a measure of CSR, Luo and Bhattacharya (2009) show that CSR decreases a firm's idiosyncratic risk and provides insurance against the volatility of the firm's future cash-flows. Mishra and Modi (2012) and Bouslah et al. (2013) confirm this result by using KLD data as a principal proxy for extra-financial performance. Mishra and Modi (2012) observe that CSR has a significant effect on idiosyncratic risk over the period spanning from 2000-2009, with positive CSR scores reducing risk and negative CSR scores increasing it. Bouslah et al. (2013) focus their analysis on the individual components of extra-financial performance. They find that financial risk (measured by idiosyncratic risk as well as stock return volatility) is negatively related to two CSR components, namely employee relations and human rights, while other CSR components do not affect financial risk.

Several studies argue that investigating the effects of CSR on systematic risk is more relevant because, in the absence of market imperfections, only systematic risk is priced; idiosyncratic risk can be eliminated through diversification. McGuire et al. (1988) find that CSR, proxied by firm ranking in Fortune's list of America's most admired companies (MAC), is negatively related to market risk loadings over the period 1983-1985. In this study, beta is a lagged independent variable, so that low financial risk is theorised to create the planning

certainty that facilitates investment in CSR. Unlike McGuire et al. (1988) Luo and Bhattacharya (2009) consider systematic risk as the dependent variable and simultaneously control for small cap and book-to-value effects in their systematic and idiosyncratic risk estimations. The authors conclude that a firm's extra-financial performance, as evaluated by Fortune magazine, is negatively correlated with beta measures. Salama et al. (2011) address this issue in the UK by examining firm activity from 1994 to 2006. They also consider systematic risk as the dependent variable and predominantly focus on environmental responsibility. Their results do not stray too far from those related to CSR in the American context and attest that the environmental performance of UK firms is inversely related to systematic risk. Jo and Na (2012) find that a firm' overall CSR engagement alleviates not only total risk, but also systematic risk and sensitivities to market fluctuations, particularly for controversial industries in the US Also in the US context, Oikonomou et al. (2012) present a longitudinal study that analyzes the relationship between corporate extra-financial performance and systematic risk between 1992 and 2009 using the KLD database and find that CSR is negatively related to systematic risk. The authors find a negative (positive) relation between systematic risk and a measure of aggregate extra-financial strengths (concerns). However, they also find that only community, employment, and environmental concerns are significantly and positively related to systematic risk. The authors also note that the impact of ESG criteria on firm risk varies according to the economic context measured with market volatility. Lastly, Kim et al. (2014) show that if socially responsible firms commit to a high standard of transparency they would have lower crash risk. However, if managers engage in CSR to cover up bad news and divert shareholder scrutiny, CSR would be associated with higher crash risk.

3 Theoretical framework and research hypotheses

There are two major theoretical arguments that link corporate extra-financial performance to financial risk. The first posits that a high extra-financial performance brings about extra operating costs and potential sacrifices and, hence, puts firms with high extra-financial performance scores into a risk disadvantage. The second argument, based on the stakeholder theory, contends that although increasing its extra-financial performance can be costly for a firm, it can reduce other costs and/or improve revenues and thereby decrease financial risk.

3. 1 Stakeholder theory

Stakeholder theory states that every modern firm has explicit and implicit relationships with a variety of stakeholders who have the power to determine its success or failure (e.g. Jones (1995), Wijnberg (2000)).

The advantages of adopting a CSR approach that takes into account stakeholders' interest are multiple and go with the principles of a risk management system whose main objective is to prevent or avoid the disruption, loss or damage to business operations. For example, the fact that all stakeholders (including shareholders) feel more involved in the decision-making process reduces information asymmetry (see, for e.g., Waddock and Graves (1997)) and uncertainty about future cash flows (see, for e.g., McGuire et al. (1988)). Sharfman and Fernando (2008) argue that risk management of social or environmental issues is theoretically synonymous with strategic risk management because it reduces potential risks (e.g. accidents, labor disputes, consumer boycotts, damage to brand image and reputation), lowers favorable investor recognition and, consequently, reduces the number of potential claimants on a firm's cash flows (e.g., potential fines, compliance cost, etc.). Sharfman and Fernando (2008) conclude that, when potential litigations are reduced, cash flows are more

stable and a firm's resources can be dedicated to strategic decisions and investments that contribute to reducing the financial risk perceived by the market (i.e. systematic risk).

However, the failure of firms to meet the claims of implicit stakeholders can result in costly explicit claims (e.g. lawsuits, regulatory intervention etc.) to force their hands. Investors can anticipate this situation and consider investment in these firms as risky (see, for e.g., Stern (2006) and Porter and Kramer (2006)). Assuming that stakeholder claims are of similar nature across all firms , these collective claims might lead to a systematic event, such as a downturn in the economic cycle or a change in the legislative framework and can have systematic effects on all firms or common groups of firms.

Our study attempts to test the informational content of extra-financial rating agency scorings by examining the relationship between firm betas and extra-financial performance score changes. Following the above discussion, we expect that downgrades (upgrades) in extra-financial performance scores are related to increases (decreases) in firms' systematic risk. This is summarized in our first research hypothesis:

H1: Extra-financial performance score changes are related to firms' systematic risk variations.

As mentioned previously, while there seems to be consensus on the relationship between extra-financial performance and financial risk, as evidenced by Orlitzky and Benjamin (2001), the direction of the causal link between the two variables is still an empirical issue. Roberts (1992) and Hasseldine et al. (2005) argue that systematic risk is a determinant of CSR, as managers in lower-risk companies have access to more stable cash flows, allowing them to improve their extra-financial performance. Others believe that the improvement of extra-financial performance is likely to be rewarded by the market in terms of improved risk perception, and thus by a lower beta (see, for e.g., Oikonomou and al. (2012), Salama and al. (2011), Sharfman and Fernando (2008)). To address this dual link, we

decompose *H1* into two testable sub-hypotheses (*H1a* and *H1b*). If extra-financial rating agencies are able, through their analysis of a company's ESG criteria, to predict future losses or risk events (such as operational or reputational losses), then extra-financial scores should be leading indicators of systematic risk. This is highlighted in sub-hypothesis *H1a*:

H1a: Extra-financial performance scores are leading indicators of systematic risk.

If, however, rating agencies are mostly reacting to corporate events that are related to extra-financial performance, then extra-financial performance scores will be lagging indicators of systematic risk. This is summarized in sub-hypothesis *H1b*:

H1b: Extra-financial performance scores are lagging indicators of systematic risk.

We anticipate the relationship between extra-financial performance and financial risk to be asymmetrical. As argued by some authors (see, for e.g., Mattingly and Berman (2006) or Oikonomou et al. (2012)), it is unreasonable to assume that stakeholders will react to responsible and irresponsible behavior in opposite yet symmetrical manners. Furthermore, there is recent empirical evidence that CSR and corporate social *irresponsibility* affect a firm's bottom line to differing magnitudes (Krüger (2015)). This is summarized in the second research hypothesis:

H2: The informational content of extra-financial performance score downgrades is higher than score upgrades.

3.2 Over-investment and managerial opportunism theories

Over-investment and managerial opportunism theories (see, for e.g., McWilliams and Siegel (2001) and Preston and O'Bannon (1997)) support a positive relationship between extra-financial performance and financial risk. According to the proponents of these theories, managers may choose to improve their firm's extra-financial performance score at the

expense of shareholders by over-investing in CSR activities in order to build their own personal reputation as good social citizens (Barnea and Rubin (2010)) or to generate support from social and environmental activists, local communities, politicians, NGOs, etc. in order to reduce the probability of their replacement in a future period (Cespa and Cestone (2007)) or even to hide bad management (Hemingway and Maclagan (2004)). This strategy, if known, would be sanctioned by a higher financial risk. Lastly, McWilliams and Siegel (2001) believe that there is an optimal level of extra-financial performance, beyond which it is less likely to shield the firm against the uncertainty and vulnerability of future cash flows.

At very high levels of extra-financial performance, the disadvantages of CSR in the context of a firm's economic purposes may outweigh its benefits, thus likely inducing more unstable future profits and less insurance-like protection against stock return risk. This is summarized in our risk-related third research hypothesis:

H3: The relationship between extra-financial performance and financial risk is stronger for firms with already-high extra-financial performance scores.

4. Data and methodology

4.1 Data

We use corporate social ratings data from the Sustainalytics database. Sustainalytics specialises in the measurement of corporate extra-financial performance against a predetermined set of criteria, as shown in Appendix I, and is principally used by institutional investors. Unlike MSCI ESG, which evaluates CSR based on seven qualitative criteria, Sustainalytics scores firms on over 100 proprietary indicators for the three ESG criteria. Furthermore, unlike MSCI ESG, which assigns positive and negative ratings (i.e. strengths and concerns), Sustainalytics' extra-financial performance scores range from 0 (worst) to 10

(best). Scores are weighted to reflect the importance of each indicator for a particular industry. The agency updates its data on a more or less continuous basis. Daily returns and macro-economic variables used herein are collected from the Canadian Financial Markets Research Center (CFMRC) and Bloomberg databases.

Our final sample consists of 266 publicly traded firms listed on the Toronto Stock Exchange for which there are at least two observations from January 2007 to December 2012 in the Sustainalytics database. In total, 2,213 extra-financial score changes are studied, consisting of 1,312 upgrades and 901 downgrades. Table I presents descriptive statistics on extra-financial score levels and changes for the firms in our sample. Score changes and levels are presented for the aggregate score and by dimension (environmental, social and governance). Extra-financial performance changes appear to be asymmetric, as evidenced by the skewness coefficients reported in Panel A of Table I. Specifically, score changes are negatively skewed for the environment and social dimensions and positively skewed for the governance dimension as well as for the aggregate score. The Jarque-Bera statistics are significant for all series and confirm that an assumption of normality is not verified. In addition, the t-test rejects the null hypothesis of mean and median at the 1% levels of significance.

From Panel B, which shows score change statistics for upgrades and downgrades, we note that score upgrades are more frequent than score downgrades, as evidenced by the higher number of observations in the first case.

[Insert Table I here]

4.2 Methodology

Both theoretical developments and empirical evidence suggest that systematic risk is not constant, but changes over time (see, for e.g., Ferson and Schadt (1996), Christopherson

and al. (1998) and Champagne et al. (2015)). These changes are related to predetermined information variables. Our empirical model extends the conditional modeling approach suggested by Christopherson and al. (1998), by adding extra-financial performance score changes.[6] Formally, similar to the methodology used by Champagne et al. (2015), our conditional model incorporates changes in extra-financial scores as well as publicly available economic instruments into financial performance estimation to account for the possibility of time variation in betas and abnormal performance (alpha). After integrating Fama-French's (1993) factors, our empirical model is of the form:

$$\begin{aligned} R_{it} - R_{ft} = {} & \alpha_{it}(\delta_{Et}, Z_{n,t-1}) + \beta_{it}(\delta_{Et}, Z_{n,t-1})(R_{it} - R_{ft}) \\ & + \beta_{1i} SMB_t + \beta_{2i} HML_t + \beta_{3i} Jan_t + \beta_{4i} Mon_t + \varepsilon_{it} \end{aligned} \quad (1)$$

where $R_{it} - R_{ft}$ is the excess daily return of firm *i* on day *t*. R_{it} and R_{ft} respectively designate the return for firm *i* and the risk-free rate (i.e. the daily yield on a 90-day maturity government bond) on day *t*. Market portfolio return R_{mt} is the value-weighted stock return of the S&P-TSX index. Risk factors HML_t and SMB_t respectively represent the book-to-market ratio effect and the size effect (Fama and French, 1993). Jan_t and Mon_t are binary variables that control for the January and Monday effects, respectively, and equal 1 for the control period and 0 otherwise. δ_{Et} is a dummy variable that equals 1 if day *t* is included in the event window (i.e. when we observe a change in firm *i*'s extra-financial score), and 0 otherwise. Vector $Z_{n,t-1}$ with $n = 1, 2, ..., 5$, includes the five[7] macroeconomic information variables that condition beta, $\beta_{it}(\delta_{Et}, Z_{n,t-1})$. ε_{it} is the error term for firm *i* and $\varepsilon_{it} \sim N(0, \sigma)$.

[6] Christopherson and al. (1998) show that a conditional approach, using time-varying measures of risk (beta) and abnormal performance (alpha), is better able to predict future performance than conditional beta models that consider only time-varying measures of risk (Ferson and Schadt (1996)).

[7] We follow a two-step methodology to select the variables that reflect the Canadian economy. In the first step, based on the literature (eg. Ferson and Qian (2004)), which mainly focuses on the U.S. economy, we identify

Conditional beta for firm *i* is defined as follows:

$$\beta_{it}(\delta_{Et}, Z_{n,t-1}) = b_{0i} + b_{Ei}\delta_{Et} + \sum_{n=1}^{5} b_{ni} z_{n,t-1} \quad (2)$$

where $z_{n,t}=Z_{n,t}-E(Z_n)$ is a vector of the deviations of $Z_{n,t}$ from the unconditional means. b_{0i} measures the average conditional beta unrelated to score changes and macroeconomic information variables. Parameters b_{ni} (for n = 1,..,5) measure conditional beta's sensitivity to the five macroeconomic information variables, $Z_{n,t-1}$. $b_{E,}$ represents beta variations associated with extra-financial performance score changes (upgrades or downgrades). More specifically, b_{Ei} measures the difference between beta estimated with the model that takes into account the changes in extra-financial firms scores and beta estimated without taking these changes into account. Formally, since:

for $\delta_{Et}=1, \quad \beta_{it}(1, Z_{n,t-1}) = b_{0i} + b_{Ei}.1 + \sum_{n=1}^{5} b_{ni} z_{n,t-1}$

and for $\delta_{Et}=0, \quad \beta_{it}(0, Z_{n,t-1}) = b_{0i} + b_{Ei}.0 + \sum_{n=1}^{5} b_{ni} z_{n,t-1}$,

we obtain:

$$b_{Ei} = \beta_{it}(1, Z_{n,t-1}) - \beta_{it}(0, Z_{n,t-1}) = (b_{0i} + b_{Ei}.1 + \sum_{n=1}^{5} b_{ni} z_{n,t-1}) - (b_{0i} + b_{Ei}.0 + \sum_{n=1}^{5} b_{ni} z_{n,t-1}). \quad (3)$$

We estimate *t*-stats for the models using the heteroskedasticity-consistent estimation techniques of Newey and West (1987).

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seven macro-financial information variables intended to reflect the state of the economy: i) short-term interest rates, ii) interest rate volatility, iii) term structure of interest rates, iv) term structure concavity, v) stock market performance, vi) stock market (implied) volatility, and vii) credit spread. In the second step, we use stepwise regression techniques to identify those information variables that have a predictive power on financial performance and beta. In the end we identify five information variables, $Z_{n,t,}$ that are used throughout: i) short-term interest rates, ii) term structure of interest rates, iii) stock market performance, iv) stock market (implied) volatility, and v) credit spread.

To test *H1a* and *H1b*, we estimate the average coefficient b_{Ei} around changes in extra-financial performance scores. More specifically, we estimate this average coefficient on analysis periods of 60 days and 120 days before changes in extra-financial scores (i.e. [-60; 0], [-120; 0]), and on analysis periods of 60 days, 120 days and 250 days following changes in extra-financial scores (i.e. [0; +60], [0; 120] and [0; +250]).

5. Empirical results and discussion

5.1 Preliminary results.

We first examine whether the conditional model framework commonly used in the US context is appropriate in this study which focuses on the Canadian context. To do so, we estimate models (1) and (2) without the term $b_{Ei}\delta_{Et}$ over the [-500; 250] window, which corresponds to the 250 days following changes in extra-financial scores. Table 2 shows the results of these regressions. We note that our augmented conditional Fama-French model is relevant. Specifically, the coefficients for both HML and SMB are positive and significant. Further, while the January (Jan) effect is not clear, the Monday (Mon) effect is relevant with a positive and significant coefficient. Finally, coefficients for macroeconomic information variables (Z_t) are highly significant, which indicate that systematic risk (beta) is a function of the economic context. The use of a conditional model is therefore justified to disentangle the impact of the economic context from the impact of extra-financial score changes on corporate financial risk. Because extra-financial performance and macroeconomic factors are known to co-vary (see, for e.g., Albuquerque et al. (2014), Oikonomou (2012) or Chen et al. (2010)), the ability to separate the two effects is crucial. The fact that our sample period covers the period from 2007 to 2012, which is characterized by financial turmoil, provides an even stronger case for the use of a conditional model.

[Insert Table II here]

5.2 Beta variations around changes in extra-financial performance

Table III presents the mean values for coefficients b_{Ei} that measure beta variations around changes in firms' extra-financial performance scores (see model (2)) for both the unconditional model (estimated without the information variables, $Z_{n,t}$) and conditional model.[8] Results show extra-financial score changes are negatively related to systematic risk, irrespective of the model used. Specifically, score upgrades are related to beta decreases and score downgrades are related to beta increases. Significant relationships are observed almost exclusively for the post-score-changes periods, supporting the hypothesis that extra-financial performance scores are leading indicators of systematic risk (*H1a*). Further, the leading effect is mostly associated with score downgrades, as opposed to upgrades (with the exception of score upgrades for the governance dimension), that are leading indicators of beta decreases. Specifically, we can observe that downgrades for almost all extra-financial scores are followed by significant increases in betas. For example, under the conditional model, governance performance score downgrades are followed by beta increases of 0.014 (t = 2.38), 0.021 (t = 3.74) and 0.017 (t = 1.94) for the [0; +60], [0; +120] and [0; +250] periods following score changes, respectively. The pattern is similar for downgrades in the social and environmental dimensions, as well as for the aggregate score. These results are consistent with an asymmetrical relationship between extra-financial performance and systematic risk (*H2*).

Oikonomou et al (2012) examine the association between corporate social performance and financial risk for S&P 500 companies between the years 1992 and 2009 and also find that CSR is negatively but weakly related to systematic firm risk and that corporate social *irresponsibility* is positively and strongly related to financial risk. Their results, as well

[8] The other parameters in model (2) are estimated and included in the regressions, but are not reported.

as ours, are consistent with the stylized fact according to which financial markets react more strongly to bad news. For example, De Bondt and Thaler (1985) show that investors "overreact" to unexpected and dramatic news events. Avouyi-Dovi and Neto (2004) observe that the asymmetric reaction to the signs of shocks can be explained by market participants' long positions on equity markets that would make them more sensitive to negative shocks.

[Insert Table III here]

The observed leading effect is strongest for downgrades in the environment dimension. For example, under the conditional model, environment score downgrades are related to beta increases of 0.049 (t = 7.09) for the 120-day period following score downgrades, and related to increases of 0.016 (t = 1.93), 0.021 (t=3.74) and 0.011 (t = 1.90) when downgrades involve social, governance and aggregate scores, respectively. Increasing betas following extra-financial performance score downgrades (i.e. negative stakeholder information) is consistent with the view that there is a substantial and non-negligible cost associated with social irresponsibility.

Overall, we find that beta variations following extra-financial performance score changes are economically and statistically significant. These results validate hypothesis *H1a*, which postulates that extra-financial performance scores are leading indicators of systematic risk. Further, the leading effect is asymmetrical, as most significant relationships are observed following score downgrades, which is consistent with hypothesis *H2*.

5.3 Conditioning on the current extra-financial performance of the firm

One of the problems with focusing on average beta variations estimated over the full sample is that it can conceal cases or special circumstances for which extra-financial score upgrades (i.e. positive stakeholder information) are related to beta increases. For instance, as

previously outlined, we could observe that, dependent on certain conditions (e.g., overinvestment), CSR projects can increase systematic risk. To explore this conditionality further, we separate the firms in our sample into quintiles according to their extra-financial scores. We then estimate model (2) on a sub-sample of highly-scored firms, defined as firms in the highest quintile in terms of extra-financial performance, and on a sub-sample of lowly-scored firms, defined as firms in the lowest quintile in terms of extra-financial performance.

Table IV provides results for highly-scored firms, which show that extra-financial score upgrades for firms with already-high score predict higher systematic risk, particularly for the environmental and social dimensions, as well as for the aggregate score. In contrast, score downgrades have no significant impact on beta, except for the governance dimension for which score downgrades are related to beta increases in the 250-day period following score changes. These results support hypothesis *H3* and suggest that, for firms with already-high extra-financial performance, further improvements can be counterproductive and lead to an increase in systematic risk, possibly because of costs that investors feel are too high and inopportune. Our results also suggest that extra-financial irresponsibility (with the exception of the governance dimension) is not related to any future systematic risk increase if the firm already has a high extra-financial score.

Our results corroborate those from previous studies, including McWilliams and Siegel (2001) who determine that an optimal level of social performance exists beyond which it is less likely to shield the firm against the uncertainty and vulnerability of future cash flows. At extremely high levels of social performance, the drawbacks (costs) of CSR programs may outweigh the advantages (Handelman and Arnold (1999) and Smith (2003)), eventually leading to an increase in systematic risk for those firms. Other studies take an agency-cost perspective and express a negative view on the managerial motivations for pursuing CSR (see, for e.g., Jensen and Meckling (1976), Friedman (1970), McWilliams et al. (2006) or

Krüger (2015)). These studies argue that managers may opportunistically use CSR to advance their careers or other personal agenda. Hemingway and Maclagan (2004) argue that one motivation for companies to adopt CSR is to cover up corporate misbehavior. The infamous firm *Enron*, for example, was widely viewed as a model of CSR and won several national awards for its environmental and community programs while at the same time engaging in massive accounting frauds that lead to its collapse in 2001 (Bradley (2009)). If firms use CSR as a tool to disguise bad news and divert shareholder scrutiny, CSR may then be associated with higher financial risk.

[Insert Table IV here]

By contrast, according to Table V, which provides results for firms with low extra-financial performance, we see that score upgrades are associated with lower systematic risk while score downgrades predict higher systematic risk. The leading effect of score upgrades for low-score firms is also greater in terms of magnitude and significance than for the full sample of firms. These results suggest that the efforts of low-score firms to improve their social image are related to future decreases in their systematic risk, while their social irresponsibility is related to increases in their systematic risk.

[Insert Table V here]

5.4 Robustness Tests

Three robustness tests are conducted to ensure the validity of our results in different circumstances. The first test examines the impact of extra-financial performance changes on risk on a sub-sample of firms that are not contaminated by any firm-specific event. The second test examines the potentially different impact of extra-financial performance score upgrades and downgrades on risk according to the nature of the firm's business. The third test

investigates the potentially different impact of extra-financial performance score upgrades and downgrades on risk depending on market conditions.

5.4.1 Impact of extra-financial performance score changes on risk on a sub-sample of uncontaminated firms

Long-term studies are sensitive to the presence of confounding effects because other value-relevant events, which are not necessarily related to CSR, can occur throughout a given year. To ensure that our results are not attributable to other firm-specific events, we re-estimate model (2) on a sub-sample of firms for which no important event takes place during the analysis period. To do so, we use Bloomberg data to estimate differences between quarterly earnings announcements for firms in the TSX and market expectations prior to these announcements. Following the literature (see, for e.g., Mendenhall (2004)), we normalize these differences by their standard deviation over the period under study and select events with the largest absolute value as proxies for potentially contaminating events. This approach removes approximately 15% of our observations. Results for the estimation of model (2) on the remaining uncontaminated observations are available in table VI and are very similar, even stronger, than results obtained previously.

[Insert Table VI here]

5.4.2 Impact of extra-financial performance score upgrades and downgrades on risk conditional on the firm's business sector

In this section, we consider the possibility that the relationship between extra-financial performance and systematic risk is heterogeneous across industries.[9] Specifically, there is empirical evidence suggesting that firm risk varies by industry (Fama and French (1997),

[9] The authors would like to thank an anonymous referee for this suggestion.

Gebhardt et al. (2001)). In addition, some studies show that extra-financial performance varies significantly across sectors (see, for e.g., Carroll (1979), Griffin and Mahon (1997), Brammer et al. (2006) or Godfrey et al. (2008)). To verify if the impact of extra-financial performance depends on the business sector of the firm, we examine the impact of score upgrades and downgrades on systematic risk for each of the 10 industrial sectors in our sample, based on the Global Industry Classification Standard (GICS) of each firm. Specifically, we estimate model (2) separately for each of the 10 industries. Table VII reports the estimates for b_{Ei} for each industry for the [0; +250] period. Results for are available in Table VII. We first note that score downgrades are strongly related to increases in systematic risk (beta) for all industries. Secondly, there is no clear evidence that the impact of extra-financial performance differs according to the firm's business sector. For instance, for the aggregate score, conditional model coefficients range from 0.011 to 0.027. We nevertheless note that the effect of environmental-dimension score downgrades on beta is highest for the following industries: i) Energy (conditional model coefficient of 0.059), which includes the oil and gas sector, ii) Materials (0.057), which includes the metals and mining sector, and iii) Industrials (0.055), which includes the airline, marine, road and rail sector. The fact that these industries are particularly exposed to environmental issues may explain the relatively stronger effect for the environmental dimension of extra-financial performance. In a similar matter, we observe that the effect of social-dimension score downgrades seems slightly stronger for industries related to retail and light manufacturing such as Consumer Discretionary (conditional model coefficient of 0.035) and Consumer Staple (0.038). One potential explanation is that employee relations and human rights issues are very important for these labor-intensive industries.

In terms of score upgrades, there is weak evidence, mostly for the unconditional model, that score upgrades are associated with beta changes. However, some industries do appear to be more affected than others by extra-financial performance changes. For instance, only the two retail industries, namely Consumer Discretionary and Consumer Staple, experience a significant reduction in systematic risk following social-dimension score upgrades (for the conditional model). Similarly, only four industries are affected by governance-dimension extra-financial performance changes: Financials, Energy, Industrials and Materials. In the four cases, systemic risk is lower following score upgrades.

[Insert Table VII here]

5.4.3 Impact of extra-financial performance score upgrades and downgrades on risk conditional on the economic context.

With our third robustness test, we wish to investigate whether market conditions can mitigate or amplify the impact of extra-financial performance score upgrades and downgrades on risk. Recent studies (see, for e.g., Albuquerque et al. (2014), Oikonomou (2012) or Chen et al. (2010)) show that extra-financial performance and macro-economic factors can co-vary[10]. Further, our earlier results suggest that systematic risk is a function of the economic context. It is therefore possible that extra-financial performance changes have a different impact on risk depending on market conditions. This analysis is particularly interesting since the period covered by our study, from 2007 to 2012, is marked by the subprime financial crisis.

[10] Given the cost of fulfilling ESG criteria during difficult economic times, firms may reduce their investments in CSR initiatives (Albuquerque et al. (2014)) and thereby appear to be less observant of CSR criteria which may negatively affect their extra-financial performance score. On the other hand, some authors (see, for e.g., Oikonomou et al. (2012)) believe that a higher extra-financial performance score should be expected during periods of economic uncertainty when firms may be more inclined to implement good practices, including socially responsible ones, to reduce risk (Chen et al. (2010)).

To test whether the impact of extra-financial performance score changes on risk depends on market conditions, we split our sample into two sub-periods: i) the 2007-2009 sub-period, which corresponds to the financial crisis, and ii) the 2010-2012 sub-period, which corresponds to the post-crisis relatively stable period.[11] We estimate model (2) for each sub-period. Results in Table VIII show that the estimates of coefficient b_{Ei} are remarkably stable over time, suggesting that there is very little significant evidence that the impact of extra-financial performance varies according to market conditions. We nevertheless note that the effect of governance score changes, especially score downgrades, are greater for the 2007-2009 sub-period than for the 2010-2012 sub-period. This suggests that, during times of economic uncertainty, governance-dimension downgraded firms experience higher systematic risk, but governance-dimension upgraded firms are not rewarded, at least in terms of systematic risk, by the market. Corporate governance therefore appears to be a greater concern for investors during a financial crisis.

[Insert Table VIII here]

6. Conclusions

This study investigates the informational content of extra-financial performance scores by examining the relationship between extra-financial score changes (upgrades and downgrades) and systematic risk (beta) variations. Our work is based on changes in Sustainalytics' extra-financial performance scores for a sample of 266 Canadian corporations between 2007 and 2012 and provides important empirical findings. First, we find no significant evidence that changes in extra-financial performance scores lag beta variations. Rather, we find that systematic risk increases follow extra-financial score downgrades.

[11] As in Aloui et al. (2011), we choose the sub-period 2007-2009 as representative of the financial subprime crisis. As highlighted by Longstaff (2010), the subprime crisis actually began in early 2007. Moreover, this period includes the period of contraction from December 2007 to June 2009, as identified by NBER.

Extra-financial scores therefore do not appear to be established a posteriori on the basis of stock market information but rather appear to be leading indicators of systematic risk variations.

Our results also show that score upgrades for firms with already-high scores predict higher systematic risk, while score upgrades predict lower systematic risk for lower-scored firms. This result suggests that, for firms with already-high extra-financial scores, improvements can be counterproductive and lead to an increase in systematic risk, possibly because of costs that investors feel are too high and inopportune. However, systematic risk decreases when firms with low extra-financial scores make an effort to improve their social image. Finally, while score downgrades are not related to beta variations for firms with high extra-financial scores, they are related to higher systematic risk for firms with low extra-financial scores.

Overall, this study provides evidence of the usefulness of extra-financial agencies' scorings for managers in the development of their risk management strategies. Investors may limit their exposure to systematic risk by following changes in firms' ESG ratings. They can also build investment strategies based on the changes in corporate extra-financial performance score. Our results also imply that it may be appropriate to include an irresponsibility risk factor in a general asset pricing model. We leave this question and tests to future research.

One of limitations of this study is that Sustainalytics from which the scores are collected, may be one of the largest providers of corporate social responsibility intelligence in Canada, but is nonetheless only one agency among many.

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Appendix I: Sustainalytics's ESG metrics

Environment		Social		Governance	
Operations	Formal Environmental Policy	**Employees**	Policy on Freedom of Association	**Business Ethics**	Policy on Bribery and Corruption
	Environmental Management System		Formal Policy on the Elimination of Discrimination		Signatory to UN Global Compact
	External Certification of EMS		Programmes to Increase Workforce Diversity		Tax Transparency
	Environmental Fines and Non-monetary Sanctions		Percentage of Employees Covered by Collective Bargaining Agreements		Business Ethics Related Controversies or Incidents
	Participation in Carbon Disclosure Project (CDP)		Employee Turnover Rate	**Reporting, Transparency and Oversight**	CSR Reporting Quality
	Scope of Corporate Reporting on GHG Emissions		Top Employer Recognition		External Verification of CSR Reporting
	Programmes and Targets to Reduce Direct GHG Emissions		Employee Related Controversies or Incidents		Disclosure of Directors' Remuneration
	Programmes and Targets to Increase Renewable Energy Use	**Supply Chain**	Scope of Social Supply Chain Standards		Oversight of ESG Issues
	Carbon Intensity		Contractors & Supply Chain Related Controversies or Incidents		Executive Compensation Tied to ESG Performance
	Carbon Intensity Trend	**Tenants**	Public Position Statement on Responsible Marketing		Board Diversity
	% Primary Energy Use from Renewables		Customer Related Controversies or Incidents		Separation of Board Chair and CEO Roles
	Operations Related Controversies or Incidents	**Community and Philanthropy**	Activities in Sensitive Countries		Board Independence
Supply Chain	Formal Policy or Programme on Green Procurement		Policy on Human Rights		Audit Committee Independence
	Contractors & Supply Chain Related Controversies or Incidents		Society & Community Related Controversies or Incidents		Governance Related Controversies or Incidents
Products & Services and Sustainability	Sustainability Related Products & Services		Guidelines for Philanthropic Activities and Primary Areas of Support	**Public Policy**	Transparency on Payments to Host Governments
	Products & Services Related Controversies or Incidents		Corporate Foundation		Public Policy Related Controversies or Incidents

Table I: Descriptive statistics on extra-financial performance scores

This table presents descriptive statistics for the extra-financial performance scores for a sample of 266 Canadian firms between 2007 and 2012. Statistics are presents for the aggregate score and for each extra-financial score dimension: Environment, Social and Governance. Panel A presents statistics for score levels and changes, while Panel B shows statistics for score upgrades and downgrades. N is the number of observations used to estimate the statistics.
*The rejection of the null hypotheses of mean, median and normality at the 1% levels of significance for statistical tests (t-test for mean and median and Jarque-Berra test for normality).

Panel A: Descriptive statistics for extra-financial performance score levels and changes

Extra-financial performance (Score /10)	Level							Change								Obs.
	Mean	Std	Min	Max	Med.	Skew.	Kurt.	Mean	Std	Min	Max	Med.	Skew.	Kurt.	Jarque-Berra	
Aggregate	5.467	0.837	2.700	7.954	5.400	-0.258	0.300	0.022*	1.282	-6.708	6.780	0.023*	0.065	3.010	837.13*	2213
Environment	5.387	1.000	2.929	8.900	5.301	0.313	0.013	0.023*	1.317	-7.657	5.932	0.024*	-0.016	3.012	709.34*	1876
Social	5.458	1.479	1.000	9.586	5.510	-0.280	-0.013	0.031*	1.406	-6.277	7.602	0.030*	-0.075	2.981	538.80*	1451
Governance	6.493	1.065	3.500	9.686	6.500	0.050	-0.629	-0.005*	1.421	-6.577	6.612	-0.005*	0.088	2.978	640.33*	1727

Panel B: Descriptive statistics for extra-financial performance score upgrades and downgrades

Extra-financial performance (Score /10)	Score upgrades							Score downgrades						
	Mean	Std	Min	Max	Med.	Observations		Mean	Std	Min	Max	Med.	Observations	
						N	# of Firms						N	# of Firms
Change														
Aggregate	0.206*	0.210	0.002	2.074	0.534*	1312	236	-0.141*	0.159	-2.400	-0.002	-0.530*	901	244
Environment	0.565*	0.598	0.002	3.547	0.581*	1104	254	-0.457*	0.573	-5.031	-0.014	-0.430*	772	235
Social	0.713*	0.680	0.000	5.172	0.735*	930	252	-0.498*	0.493	-3.093	-0.004	-0.696*	521	221
Governance	0.572*	0.552	0.004	4.360	0.524*	867	232	-0.693*	0.667	-4.360	-0.088	-0.523*	860	254

Table II: Conditional model and time-varying beta

This table presents the regression results from the estimation of a different specification of model (1) in which the score change components have been removed. The coefficients for the remaining four variables, SMB, HML, Jan and Mon are presented in the top part of the table (variables are defined in section 4). The bottom part of the table shows the results for the specification of model (2) in which the score change component has been removed. The coefficients for b0, which represents the average conditional beta, and for each of the five macroeconomic variables (Zt) (i.e. the short-term interest rates, the term structure slope, the stock market return, the stock market (implied) volatility and the credit spread) are presented in the bottom part of the table. The analysis period is [-500; 250] days. Models are estimated on a sub-sample of score upgrade observations and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Our sample includes 266 Canadian corporations from January 2007 to December 2012. The estimated coefficients' mean values are presented, with t-statistics in parentheses. t-stats are estimated using the heteroskedasticity-consistent estimation techniques of Newey and West (1987). Numbers in bold indicate significance at the 10% level.

Variable	Score upgrades				Score downgrades			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
SMB	**0.1824** (7.32)	**0.1980** (9.66)	**0.2052** (6.23)	**0.1999** (8.81)	**0.1799** (8.70)	**0.2236** (6.72)	**0.2190** (9.51)	**0.1671** (8.63)
HML	**0.1358** (5.85)	**0.1240** (5.26)	**0.1147** (4.17)	**0.1260** (4.19)	**0.1092** (5.27)	**0.1318** (5.38)	**0.1192** (5.35)	**0.1399** (5.14)
Jan	-0.0001 (-1.26)	0.0001 (0.52)	**-0.0002** (-1.77)	-0.0002 (-1.61)	0.0000 (0.02)	0.0000 (0.17)	-0.0001 (-0.31)	-0.0001 (-0.40)
Mon	**-0.0004** (-6.36)	**-0.0004** (-4.39)	**-0.0004** (-4.49)	**-0.0005** (-5.88)	**-0.0003** (-3.29)	**-0.0003** (-3.03)	**-0.0004** (-2.96)	**-0.0003** (-2.86)
b_0	0.0003 (1.46)	**0.0005** (1.85)	0.0002 (0.58)	0.0000 (-0.03)	0.0002 (0.77)	0.0003 (1.00)	0.0004 (1.01)	0.0003 (0.972)
Short term rate	**-0.0372** (-4.64)	**-0.0290** (-3.01)	**-0.0430** (-3.76)	**-0.0329** (-3.07)	**-0.0315** (-2.95)	**-0.0253** (-2.14)	**-0.0768** (-4.97)	**-0.0082** (-2.01)
Term Structure slope	**0.0272** (5.43)	**0.0233** (5.68)	**0.0272** (2.63)	**0.0264** (2.87)	**0.0271** (4.20)	**0.0290** (6.85)	**0.0279** (4.82)	**0.0233** (5.80)
Stock market return	**0.0368** (4.22)	**0.0385** (4.90)	**0.0318** (3.11)	**0.0273** (2.47)	**0.0321** (3.07)	**0.0340** (3.16)	**0.0299** (2.98)	**0.0249** (1.98)
Stock market implied volatility	**0.0209** (2.42)	**0.0263** (2.68)	**0.0254** (2.78)	**0.0264** (3.87)	**0.0215** (3.20)	**0.0239** (4.53)	**0.0247** (2.63)	**0.0251** **(1.91)**
Credit spread	**0.0447** (10.34)	**0.0551** (10.40)	**0.0593** (10.40)	**0.0468** (8.61)	**0.0573** (10.22)	**0.0732** (11.86)	**0.0354** (4.79)	**0.0535** (8.90)
Adj- R^2	0.228	0.236	0.238	0.229	0.231	0.237	0.237	0.224
F-stat	7092.45	5426.44	4266.14	4281.57	4649.01	4122.91	2513.37	3402.86
Obs.	1312	1104	930	867	901	772	521	860

Table III: Impact of extra-financial performance changes on systematic risk

This table presents the results for the estimation of model (2). . Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Analysis period	Score upgrades								Score downgrades							
	Unconditional model				Conditional model				Unconditional model				Conditional model			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
[-120; 0]	-0.002	0.004	-0.001	-0.001	-0.003	0.017	-0.002	-0.042	0.012	0.035	0.004	0.001	0.010	0.022	0.002	0.004
	(-0.29)	(0.13)	(-0.00)	(-0.32)	(-0.21)	(0.48)	(-0.26)	(-0.09)	(0.48)	(0.91)	(0.11)	(0.06)	(0.65)	(1.06)	(1.01)	(0.35)
[-60; 0]	-0.006	0.008	-0.001	-0.003	-0.004	-0.003	-0.002	-0.013	0.009	0.042	0.006	**0.012**	0.008	0.039	0.003	**0.009**
	(-0.15)	(0.63)	(-0.07)	(-0.01)	(-0.46)	(-0.33)	(-0.17)	(-0.38)	(0.82)	(1.59)	(0.34)	(1.89)	(1.11)	(1.47)	(1.04)	(1.72)
[0; +60]	-0.006	0.001	-0.014	**-0.016**	-0.007	-0.011	-0.011	**-0.009**	**0.013**	**0.038**	0.002	**0.018**	**0.010**	**0.035**	0.006	**0.014**
	(-1.23)	(0.09)	(-1.47)	(-1.88)	(-1.19)	(-1.42)	(-1.01)	(-1.71)	(1.92)	(3.83)	(0.48)	(2.61)	(1.97)	(2.38)	(0.84)	(2.38)
[0; +120]	-0.004	-0.023	-0.018	**-0.015**	-0.005	-0.002	-0.021	**-0.013**	**0.018**	**0.062**	**0.020**	**0.023**	**0.011**	**0.049**	**0.016**	**0.021**
	(-0.26)	(-1.60)	(-1.50)	(-4.71)	(-1.55)	(-0.26)	(-1.38)	(-4.11)	(2.33)	(8.41)	(2.74)	(4.11)	(1.90)	(7.09)	(1.93)	(3.74)
[0; +250]	-0.003	-0.005	-0.028	**-0.011**	-0.004	-0.002	-0.023	**-0.009**	**0.011**	**0.041**	**0.027**	**0.015**	**0.008**	**0.036**	**0.023**	**0.017**
	(-1.43)	(-1.11)	(-1.33)	(-2.46)	(-1.29)	(-1.14)	(-1.33)	(-2.58)	(2.49)	(5.92)	(5.62)	(1.82)	(1.72)	(4.29)	(5.02)	(1.94)
Obs.	1312	1104	930	867	1312	1104	930	867	901	772	521	860	901	772	521	860

Table IV: Beta changes around changes in extra-financial performance for highly-scored firms

This table presents the results for the estimation of model (2) on a sub-sample of highly-scored firms. Highly-score firms are defined as firms in the highest quintile in terms of extra-financial score. Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Analysis period	Score upgrades								Score downgrades							
	Unconditional model				Conditional model				Unconditional model				Conditional model			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
[-120; 0]	0.008	0.022	0.036	-0.012	0.002	0.017	0.030	-0.010	-0.011	-0.001	-0.053	0.024	0.000	-0.003	-0.046	0.020
	(0.93)	(0.33)	(0.25)	(-1.36)	(0.68)	(0.68)	(1.02)	(-1.24)	(-0.71)	(-0.00)	(-0.21)	(0.40)	(-0.00)	(-0.01)	(-0.05)	(0.24)
[-60; 0]	0.003	0.031	0.054	-0.022	0.004	0.039	0.042	-0.022	-0.009	-0.002	-0.084	0.029	-0.006	-0.001	-0.070	0.023
	(0.71)	(1.11)	(1.02)	(-1.62)	(0.24)	(1.06)	(0.55)	(-1.27)	(-0.35)	(-0.55)	(-0.20)	(1.01)	(-0.16)	(-0.41)	(-0.02)	(0.58)
[0; +60]	0.017	0.036	**0.139**	-0.023	0.016	0.022	**0.133**	-0.021	-0.004	-0.008	-0.078	0.055	-0.001	-0.005	-0.063	0.066
	(1.32)	(1.08)	(8.65)	(-1.62)	(1.51)	(1.05)	(8.02)	(-1.32)	(-0.12)	(-0.37)	(-0.99)	(0.37)	(-0.04)	(-0.31)	(-0.79)	(0.41)
[0; +120]	**0.023**	**0.044**	**0.176**	-0.014	**0.020**	**0.043**	**0.165**	-0.011	-0.005	-0.009	-0.062	0.066	-0.008	-0.006	-0.068	0.062
	(2.53)	(3.72)	(13.70)	(-1.64)	(2.29)	(3.48)	(12.59)	(-1.40)	(-0.40)	(-0.56)	(-0.80)	(1.64)	(-0.69)	(-0.06)	(-0.63)	(1.17)
[0; +250]	**0.019**	**0.030**	**0.130**	-0.017	**0.021**	**0.029**	**0.127**	-0.016	-0.034	-0.005	-0.054	**0.046**	-0.024	-0.001	-0.041	**0.045**
	(1.96)	(2.98)	(9.95)	(1.39)	(2.01)	(2.82)	(9.53)	(-1.07)	(-0.22)	(-0.34)	(-0.11)	(4.72)	(-0.19)	(-0.17)	(-0.71)	(4.63)
Obs.	261	220	185	173	261	220	185	173	180	154	103	171	180	154	103	171

Table V: Beta changes around changes in extra-financial performance for firms with low extra-financial scores

This table presents the results for the estimation of model (2) on a sub-sample of firms with low extra-financial scores. Lowly-scored firms are defined as firms in the lowest quintile in terms of extra-financial score. Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Analysis period	Score upgrades								Score downgrades							
	Unconditional model				Conditional model				Unconditional model				Conditional model			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
[-120; 0]	0,002 (0.14)	0,000 (0.00)	0,001 (0.02)	-0,002 (-0.22)	0,003 (0.23)	0,002 (0.07)	0,002 (0.09)	-0,001 (-0.04)	0,002 (0.13)	0,005 (1.07)	0,001 (0.05)	0,003 (0.12)	0,001 (0.06)	0,002 (0.83)	0,002 (0.01)	0,002 (0.03)
[-60; 0]	-0,013 (-0.15)	-0,034 (-1.12)	-0,004 (-0.01)	-0,003 (-0.01)	-0,020 (-0.99)	-0,029 (-1.11)	-0,002 (-0.17)	-0,001 (-0.01)	0,011 (1.01)	0,035 (1.03)	0,011 (0.78)	**0,018** (1.69)	0,010 (0.33)	0,029 (1.03)	0,008 (0.30)	0,012 (1.61)
[0; +60]	**-0,009** (-2.07)	-0,030 (-1.18)	**-0,018** (-2.11)	**-0,019** (-2.77)	**-0,009** (-1.95)	-0,023 (-1.51)	**-0,016** (-1.91)	**-0,013** (-2.60)	**0,019** (2.34)	**0,041** (4.28)	**0,020** (1.94)	**0,022** (3.04)	**0,015** (2.62)	**0,039** (3.02)	**0,014** (1.81)	**0,020** (2.77)
[0; +120]	**-0,008** (-2.76)	**-0,027** (-2.41)	**-0,020** (-2.74)	**-0,016** (-4.98)	**-0,006** (-2.29)	**-0,021** (-2.09)	**-0,017** (-2.41)	**-0,014** (-4.52)	**0,021** (2.99)	**0,065** (7.32)	**0,023** (2.74)	**0,026** (4.89)	**0,013** (2.03)	**0,054** (7.11)	**0,019** (2.78)	**0,023** (3.90)
[0; +250]	**-0,006** (-2.23)	**-0,021** (-1.91)	**-0,019** (-2.41)	**-0,014** (-2.68)	**-0,005** (-1.97)	**-0,019** (-1.85)	**-0,015** (-2.27)	**-0,011** (-2.61)	**0,015** (3.14)	**0,045** (6.03)	**0,032** (6.18)	**0,021** (2.28)	**0,011** (2.65)	**0,039** (5.11)	**0,027** (5.82)	**0,019** (2.04)
Obs.	263	222	187	175	263	222	187	175	181	156	105	169	181	156	105	169

Table VI: Changes in firm beta around changes in extra-financial performance scores on a sub-sample of uncontaminated firms

This table presents the results for the estimation of model (2) on a sub-sample of firms for which there are no surprises in quarterly earnings announcements during the analysis period. Surprises are defined as differences between quarterly earnings announcements for firms in the TSX and market expectations prior to these announcements as estimated by Bloomberg. Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Analysis period	Score upgrades								Score downgrades							
	Unconditional model				Conditional model				Unconditional model				Conditional model			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
[-120; 0]	-0.007	-0.002	-0.002	-0.009	-0.004	-0.001	-0.003	-0.002	0.017	0.036	0.008	0.002	0.021	0.025	0.003	0.001
	(-0.83)	(-0.47)	(-0.11)	(-0.25)	(-0.21)	(-0.83)	(-0.26)	(-0.03)	(0.73)	(1.01)	(0.14)	(0.01)	(0.99)	(1.19)	(1.13)	(0.04)
[-60; 0]	-0.001	-0.008	-0.003	-0.009	-0.008	-0.003	-0.002	-0.011	0.005	0.047	0.004	0.004	0.011	0.042	0.093	0.003
	(-0.99)	(-0.89)	(-0.07)	(-0.14)	(-0.73)	(-0.93)	(-0.28)	(-0.67)	(0.73)	(1.61)	(0.22)	(1.19)	(1.29)	(1.59)	(1.20)	(1.04)
[0; +60]	-0.006	-0.002	-0.023	**-0.011**	-0.007	-0.015	-0.019	**-0.012**	**0.014**	**0.041**	0.008	**0.021**	**0.013**	**0.037**	0.005	**0.017**
	(-1.37)	(-1.22)	(-1.49)	(-1.99)	(-1.31)	(-1.26)	(-1.36)	(-2.23)	(2.48)	(4.07)	(0.79)	(3.14)	(3.02)	(2.73)	(0.24)	(2.97)
[0; +120]	-0.044	-0.030	-0.022	**-0.018**	-0.005	-0.029	-0.021	**-0.015**	**0.019**	**0.065**	**0.022**	**0.026**	**0.013**	**0.053**	**0.018**	**0.023**
	(-1.32)	(-1.60)	(-1.61)	(-5.02)	(-1.43)	(-1.21)	(-1.42)	(-4.87)	(2.76)	(8.66)	(2.90)	(4.69)	(2.33)	(7.73)	(2.56)	(4.03)
[0; +250]	-0.004	-0.027	-0.031	**-0.014**	-0.004	-0.027	-0.033	**-0.011**	**0.015**	**0.044**	**0.029**	**0.019**	**0.011**	**0.039**	**0.023**	**0.018**
	(-1.53)	(-1.29)	(-1.39)	(-2.93)	(-1.36)	(-0.89)	(-1.36)	(-2.81)	(2.81)	(6.03)	(6.13)	(2.63)	(2.21)	(4.93)	(5.41)	(2.16)
Obs.	1105	970	866	783	1105	970	866	783	769	688	483	807	769	688	483	807

Table VII: Changes in firm beta around changes in extra-financial performance scores conditional on the business sector

This table presents the results for the estimation of model (2) conditional on the business sector of the firm. Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Sector	Score upgrades								Score downgrades							
	Unconditional model				Conditional model				Unconditional model				Conditional model			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
Consumer Discretionary	-0.006 (-1.53)	-0.002 (-0.11)	**-0.028** (-2.09)	-0.005 (-1.26)	-0.004 (-1.39)	-0.001 (-0.05)	**-0.025** (-1.98)	-0.003 (-0.97)	**0.016** (3.21)	**0.040** (3.91)	**0.037** (6.22)	**0.011** (3.02)	**0.015** (2.98)	**0.037** (3.42	**0.035** (6.03)	**0.010** (2.96)
Consumer Staple	-0.005 (-1.46)	-0.001 (-0.07)	**-0.029** (-2.33)	-0.003 (-1.02)	-0.004 (-1.30)	-0.001 (-0.03)	**-0.028** (-2.03)	-0.002 (-0.61)	**0.017** (3.50)	**0.041** (3.96)	**0.039** (6.53)	**0.010** (3.29)	**0.016** (3.39)	**0.039** (3.59)	**0.038** (6.23)	**0.009** (2.95)
Energy	**-0.008** (-1.66)	**-0.015** (-1.79)	-0.005 (-1.13)	**-0.012** (-3..19)	-0.006 (-1.49)	-0.012 (-1.62)	-0.004 (-1.02)	**-0.010** (-3.01)	**0.029** (5.22)	**0.062** (6.93)	**0.030** (5.69)	**0.017** (5.81)	**0.027** (5.01)	**0.059** (6.23)	**0.029** (5.32)	**0.015** (5.17)
Financials	**-0.007** (-1.68)	-0.003 (-0.11)	**-0.019** (-1.68)	**-0.017** (-4.63)	-0.006 (-1.37)	-0.002 (-0.09)	-0.017 (-1.53)	**-0.015** (-4.12)	**0.023** (3.94)	**0.037** (2.92)	**0.027** (3.91)	**0.020** (6.83)	**0.021** (3.63)	**0.036** (2.29)	**0.024** (3.72)	**0.018** (6.14)
Health Care	-0.001 (-0.13)	**-0.010** (-1.69)	-0.003 (-1.04)	-0.005 (-1.14)	-0.001 (-0.09)	-0.008 (-1.62)	-0.002 (-0.96)	-0.003 (-1.01)	**0.013** (2.19)	**0.043** (5.97)	**0.025** (3.71)	**0.010** (3.15)	**0.011** (2.09)	**0.041** (3.78)	**0.023** (3.53)	**0.009** (2.93)
Industrials	-0.005 (-1.51)	**-0.010** (-1.77)	-0.008 (-1.63)	**-0.011** (-2.10)	-0.004 (-1.41)	-0.008 (-1.60)	-0.006 (-1.51)	**-0.009** (-1.99)	**0.019** (3.44)	**0.057** (6.73)	**0.026** (3.82)	**0.015** (4.73)	**0.018** (3.39)	**0.055** (5.61)	**0.025** (3.35)	**0.014** (4.12)
Information Technology	-0.003 (-1.03)	-0.004 (-1.09)	-0.006 (-1.11)	-0.002 (-0.66)	-0.002 (-0.23)	-0.003 (-0.95)	-0.004 (-1.09)	-0.001 (-0.31)	**0.013** (2.47)	**0.038** (3.35)	**0.023** (3.22)	**0.011** (3.07)	**0.012** (2.16)	**0.036** (3.09)	**0.021** (3.10)	**0.009** (2.89)
Materials	-0.006 (-1.61)	**-0.014** (-1.83)	-0.009 (-1.41)	**-0.012** (-2.67)	-0.005 (-1.29)	-0.011 (-1.61)	-0.006 (-1.53)	**-0.011** (-2.13)	**0.022** (3.74)	**0.058** (6.83)	**0.031** (5.82)	**0.016** (4.96)	**0.020** (3.59)	**0.057** (5.69)	**0.030** (5.65)	**0.015** (4.20)
Telecommuni-cation Services	-0.003 (-1.00)	-0.003 (-0.89)	-0.003 (-1.03)	-0.005 (-1.09)	-0.002 (-0.29)	-0.002 (-0.10)	-0.002 (-0.93)	-0.003 (-0.78)	**0.015** (2.52)	**0.036** (3.14)	**0.027** (3.89)	**0.009** (2.92)	**0.012** (2.41)	**0.036** (2.97)	**0.025** (3.74)	**0.008** (2.63)
Utilities	-0.003 (-1.08)	-0.005 (-1.13)	-0.005 (-1.10)	-0.003 (-0.40)	-0.003 (-1.06)	-0.003 (-1.11)	-0.004 (-1.00)	-0.001 (-0.13)	**0.014** (2.33)	**0.035** (2.97)	**0.026** (3.81)	**0.009** (2.81)	**0.011** (2.06)	**0.034** (2.37)	**0.024** (3.69)	**0.007** (2.63)

Table VIII: Changes in firm beta around changes in extra-financial performance scores conditional on market conditions

This table presents the results for the estimation of model (2) conditional on market conditions. The sample is split into two sub-periods: 2007-2009 and 2010-2012 and model (2) is estimated for each sub-period. Mean values for b_{Ei} are shown, with t-statistics estimated using the heteroscedasticity-consistent estimation techniques of Newey and West (1987) in parentheses. Other coefficients in model (2) are estimated but not shown to save valuable space. Model (2) is estimated on a sub-sample of score upgrades and a sub-sample of score downgrades and, in each case, for the four types of score dimensions (aggregate (agg.), environment (envir.), social and governance (gov.)). Five analysis periods are considered ([-120; 0], [-60; 0], [0; +60], [0; +120] and [0; +250]), for which the estimation periods are, respectively, [-500; -120], [-500; -60], [-500; +60], [-500; +120] and [-500; +250]. The overall sample includes 266 Canadian firms from January 2007 to December 2012. Numbers in bold indicate significance at the 10% level.

Analysis period	Score upgrades (Conditional model)								Score downgrades (Conditional model)							
	2007-2009				2010-2012				2007-2009				2010-2012			
	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.	Agg.	Envir.	Social	Gov.
[-120; 0]	-0.004 (-0.98)	-0.001 (-0.11)	-0.001 (-0.13)	-0.005 (-0.03)	-0.003 (-0.09)	0.003 (0.48)	0.000 (-0.01)	-0.004 (-0.14)	0.009 (0.43)	0.027 (1.11)	0.004 (1.08)	0.002 (0.01)	0.010 (0.99)	0.023 (1.00)	0.001 (0.52)	0.001 (0.89)
[-60; 0]	-0.006 (-1.23)	-0.003 (-0.74)	-0.004 (-0.77)	-0.012 (-1.50)	-0.004 (-0.29)	-0.004 (-0.14)	-0.001 (-0.22)	-0.009 (-1.22)	0.008 (1.45)	0.040 (1.63)	0.008 (1.13)	**0.018** (2.66)	0.008 (1.59)	0.039 (1.35)	0.002 (0.98)	0.007 (1.04)
[0; +60]	-0.008 (-1.47)	-0.008 (-1.51)	-0.013 (-1.24)	**-0.013** (-3.68)	-0.006 (-1.33)	-0.010 (-139)	-0.011 (-1.30)	**-0.012** (-1.90)	**0.011** (2.97)	**0.037** (3.07)	0.0015 (1.53)	**0.025** (4.55)	**0.010** (2.03)	**0.035** (2.44)	0.008 (0.83)	**0.012** (2.63)
[0; +120]	**-0.006** (-1.67)	-0.005 (-1.27)	-0.024 (-1.41)	**-0.016** (-4.11)	-0.005 (-1.27)	-0.004 (-1.03)	-0.022 (-1.21)	**-0.014** (-2.19)	**0.012** (2.83)	**0.050** (7.74)	**0.018** (2.49)	**0.029** (4.98)	**0.011** (2.58)	**0.049** (7.17)	**0.016** (2.06)	**0.011** (2.37)
[0; +250]	-0.008 (-1.63)	-0.004 (-1.52)	-0.025 (-1.63)	**-0.012** (-4.86)	-0.006 (-1.01)	-0.003 (-1.23)	-0.020 (-1.06)	**-0.010** (-2.97)	**0.009** (2.89)	**0.037** (4.89)	**0.025** (5.49)	**0.024** (3.28)	**0.008** (2.43)	**0.035** (4.08)	**0.022** (4.96)	**0.010** (2.01)
Obs.	583	282	291	401	729	822	639	466	340	156	157	255	561	616	364	605