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Integrating corporate social responsibility criteria into executive compensation and firm innovation: International evidence

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ABSTRACT

Using a large sample of firms from 30 countries, we find that the integration of corporate social responsibility (CSR) criteria into executive compensation is associated with greater innovation output in countries around the world. We also find that this positive association is stronger in countries with weak stakeholder orientation, countries with weak legal environments, and countries without mandatory CSR reporting requirements. These findings suggest that CSR contracting can compensate for institutional voids and high stakeholder demand for CSR, and thereby foster firm innovation. The results of the channel analyses suggest that a greater level of employee innovation productivity, enhanced managerial risk-taking, and greater responsiveness of firms' R&D investment to their investment opportunities play a significant role in the association between CSR contracting and innovation. Overall, our study demonstrates in a global context the importance of linking executive compensation to nonfinancial criteria in addition to financial criteria, and it documents the heterogeneity in the effect of CSR contracting on firm innovation in different countries.

1. Introduction

Integrating corporate social responsibility (CSR) criteria into executive compensation schemes (i.e., CSR contracting) has become increasingly common for companies worldwide.[1] These performance metrics generally include various nonfinancial performance

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[1] This emerging compensation practice is commonly referred to as "CSR contracting," "CSR-based compensation," and "pay for social and environmental performance" by practitioners and academics (Flammer et al., 2019). In this study, we use these terms interchangeably. Survey evidence suggests that linking nonfinancial environmental and social objectives to executive compensation has become a global trend. For example, in a survey of the constituents of the 11 global market indices, such as the U.S., the U.K., Australia, France, Germany, and the Netherlands, 42% of the companies studied integrate nonfinancial performance targets into their executive compensation design (Glass Lewis, 2012). The 2013 KPMG Survey of Corporate Responsibility Reporting indicates that more than 10% of the world's largest companies (G250) clearly explain in their CSR reporting how remuneration is linked to CSR criteria (see "Linking CSR performance with pay sends clear sustainability signal," available at https://www.theguardian.com/sustainable-business/linking-csr-pay-sustainability). Supporting the growing prevalence of CSR contracting and using a comprehensive global sample, we show that although less than 2% of firms explicitly used CSR contracting in 2004, this percentage increased to more than 24% in 2015.

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targets, such as employee health and safety, CO_2 emission/water pollution targets, product safety, reduced injury rates, and energy efficiency (Hong et al., 2016; Flammer et al., 2019).[2] This practice is generally considered a way to incentivize management to implement future-oriented CSR initiatives by rewarding CEOs for implementing CSR initiatives, and it represents a new type of executive compensation. Anecdotal evidence suggests that many companies view the practice of incorporating CSR criteria into executive compensation as a good corporate governance practice because it encourages executives to sacrifice short-term payoffs for long-term gains (Flammer et al., 2019).

Although the effects of incorporating financial performance targets into executive compensation are well examined in the literature (e.g., Gibbons and Murphy, 1992; Lerner and Wulf, 2007; Baranchuk et al., 2014; Flammer and Bansal, 2017; Mao and Zhang, 2018), relatively little is known about how managerial behavior is affected by the integration of nonfinancial CSR performance targets into executive compensation. The limited research on CSR contracting predominantly focuses on the U.S. and reports mixed findings on the relation between CSR contracting and corporate outcomes.[3] Whether the global trend of CSR contracting affects the long-term growth of firms around the world remains unexplored. This is surprising because relative to traditional pay-for-financial-performance compensation schemes that typically combine forward-looking features with earnings or stock price targets, CSR contracting can emphasize long-term strategies more explicitly and with less measurement noise (Bushman et al., 1996; Ittner et al., 1997; Matějka et al., 2009). Using a large sample of 17,855 firm-year observations from 30 countries worldwide, we fill this gap by addressing two important but unanswered questions: How do CSR contracting affect firm innovation worldwide? How do country-level institutions affect the role of CSR contracting in firm innovation?

We focus on innovation because it is recognized as a key driver of both organizations' long-term success and national economic growth (e.g., Holmström, 1989; Grossman and Helpman, 1990; Hall et al., 2005).[4] Moreover, investment in innovation has become even more important for firms amid increasingly competitive domestic and global markets (e.g., Aghion et al., 2005, 2014). However, innovation activities are generally risky and long-term, and although shareholders generally demand that firms engage in innovation activities to maximize long-term value, managers typically have short-term decision horizons and avoid future-oriented investments (Narayanan, 1985; Holmström, 1989; Flammer and Bansal, 2017).[5] Thus, alleviating this agency conflict and motivating managers to undertake more future-oriented innovation activities is important both theoretically and practically.

Research suggests that country-level institutional characteristics play an important role in motivating CSR initiatives and in influencing their effects (Dhaliwal et al., 2012; Ioannou and Serafeim, 2012; Dhaliwal et al., 2014; El Ghoul et al., 2017; Marano et al., 2017; Liao et al., 2021). Thus, to the extent that country-level institutional characteristics have the potential to influence firms' CSR performance and/or incentives, we posit that the effect of linking CSR criteria to executive compensation varies by country. In other words, we predict that country-level institutional characteristics significantly influence the effect of CSR contracting on various corporate outcomes. More importantly, although firms in many countries have begun linking executive compensation to CSR criteria (Glass Lewis, 2012), potential country-level variations in the role of CSR contracting have not been examined. This is not surprising given the lack of systematic data on CSR criteria in executive compensation for many firms globally. We aim to fill this gap with our study.

Using an international CSR contracting dataset from Thomson Reuters ASSET4 that consists of firms domiciled in 30 countries, we examine the effect of CSR contracting on firm innovation and the firm- and country-level characteristics that may help explain the heterogeneity of the effect. After controlling for year, industry, and country fixed effects and factors that can potentially affect innovation, we find a significantly positive relation between CSR contracting and firm innovation as measured by patent and citation counts, innovation efficiency, and patent value.

More importantly, we explore whether and how this positive relation varies with country-level institutional characteristics. Research suggests that country-level institutional variables, such as stakeholder orientation and legal system stringency, can significantly affect CSR performance (e.g., Dhaliwal et al., 2012; Ioannou and Serafeim, 2012; Dhaliwal et al., 2014; Liao et al., 2021). Consistent with the literature, we find that the effect on innovation of linking nonfinancial criteria to compensation is stronger in countries with weaker stakeholder orientation and in countries with weaker legal environments. In addition, mandatory CSR reporting requirements substantially increase CSR commitments (e.g., Manchiraju and Rajgopal, 2017; Chen et al., 2018). Therefore, we also use country-level CSR reporting regulations as exogenous shocks to firms' CSR initiatives and find that a country's adoption of mandatory CSR reporting requirements weakens the positive relationship between CSR contracting and firm innovation.

As CSR contracting and CSR performance are both likely to be positively related to firm innovation, in additional tests, we further explore whether and how CSR contracting and CSR performance interact in their effect on firm innovation. Our results indicate that the effect of CSR contracting on innovation is more pronounced for firms with low CSR performance, especially for firms with low

[2] See Appendix A for an example of CSR contracting.

[3] For example, although some studies suggest a positive relation between CSR contracting and CSR performance (e.g., Hong et al., 2016; Flammer et al., 2019), other studies (e.g., Maas, 2018) show that integrating CSR performance targets into executive compensation does not lead to better CSR performance.

[4] Innovation is found to be important for improving long-term financial performance (e.g., Bloom and Van Reenen, 2002; Matolcsy and Wyatt, 2008; Kim et al., 2021), increasing firm value (e.g., Hall et al., 2005), and developing competitive advantages (e.g., Porter, 1992, 1998). Although research suggests that CSR performance is another major corporate outcome associated with CSR contracting, relative to innovation, CSR performance tends to have a weaker and/or less direct influence on firm value (Awaysheh et al., 2019).

[5] Anecdotal evidence supports this argument. For example, Graham et al. (2005) find that 78% of surveyed executives would sacrifice future-oriented projects with a positive net present value to meet their financial performance targets in the short term.

employee well-being.

We next explore plausible channels through which CSR contracting affects innovation. We show that firms that implement CSR contracting experience improvements in employee well-being and employee innovation productivity, enhanced managerial risk-taking (as proxied by the volatility of a firm's accounting returns and stock returns), as well as increased responsiveness of firms' R&D investment to their investment opportunity set. Overall, the channel tests suggest that CSR contracting can improve the well-being of employees, who are the most important human capital in the innovation process (Hall, 2002), promote managerial risk-taking, and reduce the agency cost of innovation, leading to increased managerial and employees' incentive to innovate.

To ensure the robustness of our results, we repeat our main tests using data from the Sustainalytics database in addition to ASSET4 (both provide global CSR contracting data), and we still find a significantly positive relation between CSR contracting and innovation. We also test whether the positive effect is driven by a change in CEO, non-CSR-related compensation schemes, or corporate governance attributes that are heterogeneous across firms and again find our inference unaffected. We address endogeneity concerns in terms of unobserved firm characteristics by controlling for firm fixed effects to account for any time-invariant and firm-specific factors, and we use the difference-in-differences (DID) method to account for any temporal variations in innovation not caused by the adoption of CSR contracting. A Heckman-type correction is also performed using a two-stage Heckman model to mitigate any potential sample selection bias. Our results are robust to numerous other tests as well, including using truncation-adjusted patent and citation counts, excluding U.S. firms, and using a weighted least squares (WLS) estimation model.

Our study makes several contributions to the literature. First, it adds to the literature on the effect of managerial compensation schemes on corporate policies and outcomes. Previous studies predominantly focus on the role of long-term financial and equity-based executive incentives in lessening managerial myopia and incentivizing managerial risk-taking in the U.S. (e.g., Dechow and Sloan, 1991; Gibbons and Murphy, 1992; Holthausen et al., 1995; Lerner and Wulf, 2007; Xue, 2007; Low, 2009; Francis et al., 2011; Manso, 2011; Sheikh, 2012; Flammer and Bansal, 2017; Mao and Zhang, 2018). Recognizing nonfinancial measures are better predictors of long-term financial performance (Banker et al., 2000), there has been growing global interest in incorporating nonfinancial measures into executive incentive contracts in recent years. However, little is known about the impact of this relatively new compensation practice for firms around the world. We advance the literature by studying the *global* effect of *nonfinancial* executive incentives on managerial and employees' incentive to innovate. Our study is the first to document international evidence that incorporating nonfinancial performance criteria into executive incentive contracts can foster firm innovation. In a related recent study, Flammer et al. (2019) find that the adoption of CSR contracting is positively associated with the quantity of green patents for a sample of large U.S. firms that are in the Standard & Poor's 500 index. Our study extends the literature by documenting the role of CSR contracting in promoting the overall quantity and quality of firm innovation after considering the effect of firms' CSR performance, and more importantly, the cross-national differences in the effect of CSR contracting. Further, we provide the first evidence on the channels through which CSR contracting can foster innovation, including improved employee well-being and innovation productivity, enhanced managerial risk-taking, and increased sensitivity of R&D to a firm's investment opportunity set. Our findings further the understanding of how managerial compensation should be structured to incentivize managers and employees to innovate and promote long-term growth.

Second, we contribute to the growing literature on various determinants of innovation. Previous studies have identified various firm-level characteristics (e.g., Sørensen and Stuart, 2000; Golovko and Valentini, 2011; Lyandres and Palazzo, 2016) and country-level institutional features (e.g., Furman et al., 2002) that may affect innovation (see He and Tian, 2018, for a review of innovation studies). Our research bridges the two strands of literature by studying how country-level institutions affect the role of nonfinancial executive incentive contracts in firm innovation. Our evidence shows that the effect of CSR contracting on innovation varies with country-level institutional characteristics. We add to the literature by documenting that CSR contracting can compensate for institutional voids and high stakeholder demand for CSR, and thereby foster firm innovation.

Finally, our study has practical implications for business practitioners, such as controlling shareholders and boards of directors, in terms of the design of executive compensation. CSR contracting is an emerging corporate governance mechanism that can be used to stimulate innovation, particularly for firms with few future-oriented initiatives and those domiciled in countries with weak stakeholder orientations or legal environments. The evidence we present is also consistent with instrumental stakeholder theory, which asserts that although CSR initiatives are primarily aimed at providing stakeholders with more benefits, they can ultimately benefit shareholders (Jones, 1995).

The remainder of this paper is organized as follows. Section 2 develops our hypotheses on the relation between CSR contracting and firm innovation. Section 3 describes the research design, including the sample selection, model specification, and variable construction. Section 4 presents the sample distribution, summary statistics, and empirical results and robustness checks. Section 5 and Section 6 report our channel analysis and additional tests. Finally, Section 7 concludes the study.

2. Hypothesis development

Sustainability is increasingly accepted as an important driver of business value, and many firms now integrate nonfinancial CSR criteria into their executive compensation packages to effectively embed sustainability in the organization (Ernst and Young, 2010; GreenBiz, 2015). Through this practice, executive compensation is linked to the nonfinancial performance of a wide range of stakeholder-friendly initiatives, and managerial performance targets focus on the interests of various non-shareholder stakeholders, such as employees, customers, the community, and the environment.[6] Because corporate executives are important decision makers for firms, their compensation schemes can play an important role in regulating their incentives and corporate strategies (Manso, 2011).

From the agency theory perspective (Jensen and Meckling, 1976), CSR contracting is expected to mitigate the agency problems associated with innovation arising from the conflict of interests between shareholders and corporate managers. Although innovation can improve long-term financial performance and shareholder value (Hall et al., 2005; Matolcsy and Wyatt, 2008), risk-averse managers typically underinvest in innovation activities because of their long investment horizons and high failure rate (Baysinger et al., 1991; Holmström, 1989, 1999; Frederick et al., 2002; Ferreira et al., 2014). This short-termism and self-interest (Narayanan, 1985; Stein, 1989; Degeorge et al., 1999) can lead managers to focus on projects with short-term payoffs rather than valuable innovation activities with long investment horizons and high failure rates, even if the latter could potentially yield higher returns for shareholders. Explicit CSR metrics are believed to be less noisy forward-looking measures than financial measures and can provide additional information about managerial efforts and progress toward long-term goals (Banker et al., 2000; Dikolli and Vaysman, 2006). Therefore, incorporating CSR measures into executive compensation contracts could incentivize managers to focus more on long-term value creation, to increase risk-taking and tolerance for short-term failure, and thereby to engage more in innovation activities.

From the lens of the stakeholder theory, corporate responsibility extends beyond traditional fiduciary interests to a broad range of stakeholders to thereby obtain their support, which is crucial to a firm's long-term success (Freeman, 1984; Ernst and Young, 2010; Clarkson, 1995; Edmans, 2012). Research finds that various pressures can result in symbolic, rather than substantive, corporate responses to external demands (Okhmatovskiy and David, 2012). Such a concern is especially pronounced in CSR dimensions for which symbolic strategies are much harder to monitor (Marquis and Qian, 2014). Therefore, using CSR contracting to encourage future-oriented CSR engagement (Matějka et al., 2009; Flammer et al., 2019) presumably signals firms' substantive commitment to CSR engagement (Maas, 2018), which can help firms create a socially responsible image, thereby attracting and retaining talented employees, promoting their job satisfaction, and increasing their commitment to work (Sheridan, 1992; Turban and Greening, 1997). Such talented, satisfied, and dedicated employees tend to be more involved in innovation processes and to make more valuable contributions to successful innovation (Oldham and Cummings, 1996; Chen et al., 2016; Mao and Weathers, 2019).

However, one could also argue that CSR-based compensation may be merely symbolic and have no significant influence on managers' behavior (Westphal and Zajac, 1994; Zajac and Westphal, 1995).[7] For example, executives with influence over their boards may use CSR contracting to enhance the legitimacy of their compensation contracts and improve their reputations in the eyes of shareholders (Tedeschi and Reiss, 1981; Schlenker, 1980). Enhanced stakeholder engagement may even further entrench the roles of executives and employees (Harjoto and Jo, 2011), thus reducing their incentives for innovation. In line with this view, Berrone and Gomez-Mejia (2009) argue that firms that are unwilling to invest in substantive CSR initiatives are likely to introduce explicit environmental pay policies in response to growing demands for CSR from various stakeholders. In either case, the adoption of CSR contracting is unlikely to significantly affect firm innovation.

These discussions suggest that the effect of integrating CSR criteria into executive compensation on firm innovation is an empirical question. We therefore formally state the first hypothesis as follows:

Hypothesis 1. Integrating CSR criteria into executive compensation does not affect firm innovation.

Research suggests that the influence of CSR is conditional on country-level institutions (Rodriguez et al., 2006; El Ghoul et al., 2016). Examining the potential heterogeneity between countries in the relation between CSR contracting and firm innovation is therefore important. Thus, we investigate whether and how this relation varies according to country-level institutions. We focus on stakeholder orientation and legal environment because these two institutional factors tend to reflect national stakeholder protections and significantly affect firms' CSR activities (e.g., Dhaliwal et al., 2012; Ioannou and Serafeim, 2012; Dhaliwal et al., 2014; Liao et al., 2021).

Research suggests that firms are less likely to invest in CSR in countries with low levels of stakeholder orientation, as in these countries the legal environment in protecting stakeholders (e.g., labor rights and benefits) is typically weak, and the public and managerial awareness of CSR tends to be low (Dhaliwal et al., 2012). Thus, CSR-based compensation potentially contributes more to

[6] For example, the Netherlands' international energy enterprise Shell PLC links 20% of its executives' annual bonuses and 10% of their long-term incentive plans to sustainable development, particularly carbon reduction (Royal Dutch Shell Plc, 2018). Similarly, the U.S. multinational retail corporation Walmart Inc. links its executives' annual incentives to diversity/inclusion and ethics/compliance goals (Walmart Inc., 2019). Xcel Energy links its executives' annual incentive awards to environmental (e.g., greenhouse gas reduction goals) and social metrics (e.g., employee safety) (Xcel Energy, 2011).

[7] Executive compensation mainly comprises a fixed salary with contingent payments linked to a firm's financial performance, and CSR contracting may represent only a small proportion of the total and may be too trivial to influence managers' business decisions or effectively divert their attention toward long-term investments in areas such as innovation.

improving substantive CSR performance and stakeholder engagement in such countries. Specifically, the adoption of CSR-based compensation in less stakeholder-oriented countries could more effectively increase CSR initiatives and protection of the rights and welfare of stakeholders (e.g., employees), which could thereby mitigate managers' and stakeholders' short-termism, promote their tolerance of short-term failure and uncertainty about the development of new products and technologies, and encourage their engagement in innovative process, which are especially important for fostering innovation (Bogers et al., 2010).

Countries also differ in terms of their ability to protect stakeholders' interests and limit the self-serving activities of managers or firms, which have the potential to harm the interests of stakeholders.[8] In countries with weak legal environments, stakeholders tend to be less protected against adverse situations by formal legislative institutions, and in turn have shorter time orientation and less tolerance for uncertainty (Flammer and Kacperczyk, 2016); hence, they are less willing to accept or engage in risky innovation initiatives. In this condition, the voluntary adoption of CSR contracting may contribute to filling the institutional void of weak legal environments by inducing management's commitment to CSR and stakeholders, thereby promoting stakeholders' tolerance for the uncertainty that is inherent in innovation and increasing their engagement in innovative process.

The above discussion suggests that in countries with low levels of stakeholder orientation or weak legal environments, integrating CSR criteria into executive compensation is likely to be more effective in fostering CSR engagement and a long-term orientation and to thereby have a stronger effect on firm innovation. Therefore, we predict a stronger positive association between CSR contracting and firm innovation in such countries.

Hypothesis 2. The association between the integration of CSR criteria into executive compensation and firm innovation varies with country-level stakeholder protection/legal environment.

3. Research design

3.1. Sample selection and data collection

We first obtain information about firms' executive compensation policies and CSR performance from the Thomson Reuters ASSET4 database and merge it with the Worldscope database, which provides global accounting and financial information on publicly listed firms. We collect the patent and citation data for our innovation measures from the BvD Orbis patent database.[9]

Following previous studies, we calculate the total number of patents filed and citations received by a patent owner in a year and assign a value of zero to all firm-year observations without patent or citation information. For firm-years that do not disclose R&D expenditures, we assign a value of zero to R&D expenditures.[10] Data on country-level stakeholder orientation are obtained from Dhaliwal et al. (2012). Country-level GDP and rule of law data are collected from the World Bank website (https://www.worldbank.org). We exclude firm-years with missing data and remove countries with fewer than 50 observations, and we obtain a final sample comprising 17,855 firm-year observations from 30 countries between 2004 and 2015.

3.2. Model specification

To examine whether and how CSR contracting is associated with corporate innovation, we estimate the following regression model:

$$INNOVATION_{ijt+1} = \beta_0 + \beta_1 CSRContracting_{ijt} + \beta_2 CSRPerf_{ijt} + All\ Other\ Controls + YearFE + IndustryFE + CountryFE + \varepsilon_{ijt} \quad (1)$$

where *i* indexes the firm, *j* the country, and *t* the fiscal year. The variable of interest is CSR contracting (*CSRContracting*), an indicator variable that equals 1 if CSR (e.g., environmental, health and safety, or sustainability) performance targets are included in the firm's executive compensation contracts in that year and 0 otherwise. The coefficient of interest β_1 captures the role of CSR contracting in corporate innovation, in addition to the effects of a firm's current level of CSR engagement. We use 1-year forward innovation measures to account for the time to complete innovation projects.[11] All standard errors are clustered at the firm level to account for possible correlations in the error terms. The variable definitions are provided in Appendix B.

We construct two patent-based innovation measures following the literature (Hall et al., 2005; Flammer and Kacperczyk, 2016;

[8] Supporting this view, Liao et al. (2021) show that the effect of country-level corporate governance reform on firms' CSR performance depends strongly on country-level institutional factors related to the legal and regulatory environments. Similarly, El Ghoul et al. (2016) find that CSR initiatives are a more important determinant of firm value in countries with weak legal institutions.

[9] This database contains patent and citation information on around 300 million firms globally. It provides more comprehensive coverage of global firms over a longer period than other widely used patent databases, such as the National Bureau of Economic Research patent database and the Harvard Patent Network Database, enabling the construction of a larger sample.

[10] Prior studies (e.g., Koh and Reeb, 2015; Koh et al., 2017) suggest that because of the discretionary nature of firm R&D reporting, a significant proportion of firms have patent activities but do not report R&D expenditures. Hence, to examine whether our finding is robust to the method of dealing with missing R&D information, we follow the literature (e.g., Koh and Reeb, 2015; Koh et al., 2017) and use three alternative approaches as robustness checks: (1) excluding firm-years with missing R&D expenditures; (2) replacing missing R&D with country-industry-year average R&D expenditures; and (3) replacing missing R&D expenditures with zero for firm-years with no patent activities and replacing missing R&D with country-industry-year average R&D expenditures for firm-years with patent activities. The results using these alternative approaches are consistent with our main results in Table 3. In the interest of brevity, we do not tabulate these results.

[11] Using 2-year forward innovation measures does not change our inference.

Francis et al., 2018). The first is patent count (*PATENT*), which is defined as the natural logarithm of 1 plus the number of patents filed by a firm in a given year that are eventually granted. We use the patent application year, which captures the actual timing of the patented innovation more accurately than the grant year (Griliches et al., 1986). Although a simple patent count can represent innovation quantity, it does not differentiate between impactful breakthrough inventions and incremental technological discoveries. Therefore, we take the number of patent citations received (*CITATION*) as the second proxy, which reflects the technological and economic significance of the patented innovations and thus addresses variations in innovation quality (Hall et al., 2005). *CITATION* is defined as the natural logarithm of 1 plus the number of citations received by all patents applied for in a given year that are eventually granted.

In our study, corporate innovation is measured using output-oriented measures (i.e., patents and citations) instead of input-oriented measures (i.e., R&D expenditure and R&D capital) to account for the inconsistencies in R&D accounting across countries. As our study is conducted in an international context, the differences in accounting standards between countries could lead to substantially inconsistent accounting treatments for R&D activities. For example, ASC 730 of U.S. GAAP mandates that all R&D spending be expensed as incurred except in some specific cases (e.g., software development costs), whereas IAS 38 of the IFRS requires that all research costs be expensed and that part of the development cost be capitalized when certain criteria are met (KPMG, 2017). These inconsistencies in accounting standards indicate that differences in reported R&D expenditures do not necessarily represent differences in innovation effort. Supporting this argument, Koh and Reeb (2015) show that even firms that do not report R&D expenditures may still engage in innovation and acquire patents.

We use the following two measures to capture country-level stakeholder protection to explore the moderating effect of the country-level institutional environment on the relationship between CSR contracting and firm innovation (Hypothesis 2): national stakeholder orientation (*Stakeholder_Orientation*) and legal environment (*Rule_of_Law*). Specifically, the first measure, *Stakeholder_Orientation*, measures the level of stakeholder engagement from four dimensions: (1) the stringency of the legal environment in protecting labor rights and benefits, (2) the degree of mandatory CSR disclosure requirements, (3) public awareness of CSR issues, and (4) country-level attitudes of corporate executives toward CSR engagement (Dhaliwal et al., 2012). The second measure, rule of law (*Rule_of_Law*), focuses directly on the legal environment. It measures "the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police and judiciary" (Kaufmann et al., 2009). A higher value of the rule of law index represents that specific laws 'on the books' designed to protect particular stakeholder interests will be more likely to be enforced.[12] Research suggests that country-level rule of law plays an influential role in the effect of firms' CSR initiatives (El Ghoul et al., 2016; Liao et al., 2021). A higher *Stakeholder_Orientation* (*Rule_of_Law*) value indicates stronger stakeholder protection (a more stringent legal environment) in that country. To test Hypothesis 2, we split the sample into two subsamples using the medians of these two measures and rerun Eq. (1).

Following the literature (e.g., Hall and Ziedonis, 2001; Chen et al., 2016; Flammer and Kacperczyk, 2016; Francis et al., 2018; Flammer et al., 2019), we control for a set of firm-, industry-, and country-level variables that may affect innovation output. First, CSR performance may positively impact firm innovation (e.g., Cook et al. 2019), so we include a firm-year's overall CSR performance (*CSRPerf*) in the model. *CSRPerf* is defined as the firm-year's average social and environmental performance scores based on the data from ASSET4, with values ranging between 0 and 100 and a higher value indicating better CSR performance. Second, we control for long-term financial targets in executive compensation (*Comp_LongtermFin*) because the literature (e.g., Gibbons and Murphy, 1992) suggests that this type of compensation can increase corporate innovation by encouraging managers to focus on long-term value creation. Third, as R&D intensity is positively related to innovation output (e.g., Bradley et al., 2017), we include R&D intensity (*R&D*) as a control, which is constructed as R&D expenditure scaled by total assets.

We control for capital intensity (i.e., the capital-labor ratio) using *CapitalIntensity*. Hall and Ziedonis (2001) demonstrate that capital-intensive firms typically patent more aggressively to avoid costly litigation and improve their negotiating position with other patent owners. Older firms typically generate more innovations because they have more innovation experience than younger enterprises (Sørensen and Stuart, 2000). Thus, we also include firm age (*Age*) in the model. The literature shows that firm size, profitability, growth opportunities, capital structure, and access to external financing can also affect firms' engagement in costly, risky, and long-term innovation projects (e.g., Wies and Moorman, 2015; Lyandres and Palazzo, 2016). Thus, we control for various corporate characteristics, including firm size (*Size*), return on assets (*ROA*), market-to-book ratio (*MTB*), sales growth (*SalesGrowth*), leverage ratio (*Leverage*), cash holdings (*Cash*), and access to external financing (*ExternalFinance*). In addition, we control for the percentage of foreign sales (*ForeignSales*) because exposure to foreign markets can positively affect firm innovation (Golovko and Valentini, 2011). We also include the percentage of closely held shares (*InsiderOwnership*) because this may influence managerial incentives to innovate (e.g., Choi et al., 2011).

Aghion et al. (2005) show that the relation between market competition and innovation takes an inverted-U shape at the industry level, so we control for the degree of product market competition using the Herfindahl–Hirschman index (*HHI*), which is calculated as the sum of the squared market shares of the firms in an industry, with industries classified according to the three-digit SIC codes in each country. The squared term of the Herfindahl–Hirschman index (HHI^2) is also included to mitigate the potential nonlinear relationship between industry competition and corporate innovation. We control for GDP per capita (*LNGDP*) to capture aggregate technological

[12] The rule of law index is one of the six governance indicators from the World Bank's WGI dataset. In their World Bank policy research paper, Kaufmann et al. (2009) explain that "the WGI are based exclusively on subjective or perceptions-based data on governance reflecting the views of a diverse range of informed stakeholders, including tens of thousands of household and firm survey respondents, as well as thousands of experts working for the private sector, NGOs, and public sector agencies."

sophistication at the country level (Furman et al., 2002). Finally, year, industry, and country fixed effects (*YearFE*, *IndustryFE*, and *CountryFE*) are included to control for variations in patenting and citation intensities over time, by industry, and between countries.

4. Empirical results

4.1. Sample distribution

Panel A of Table 1 gives the sample distribution and summary statistics by country.[13] The variations in the number of observations, the percentage of CSR contracting adopters, and innovation output across the 30 countries are extensive. As is common in international studies, U.S. firms comprise the largest proportion of the sample (34.11%). Firm-years in which there is CSR contracting account for 15.84% of the sample. Australia has the highest percentage of CSR contracting (39.85%), followed by Norway (36.89%) and South Africa (35.45%). The most innovative country in our sample is Japan, where firms average 219.44 patents and 138.12 citations, followed by South Korea, Finland, Germany, and the U.S.

Panel B of Table 1 presents the sample distribution and summary statistics over time. During the sample period, the number of firms in the sample gradually increases from 855 in 2004 to 2523 in 2015, reflecting the increasing coverage of ASSET4. The adoption of CSR contracting over the sample period also increases, from 1.87% of firms in 2004 to 32.29% in 2014, although there is a slight drop to 24.73% in 2015. This overall rising trend also reflects the recent practice of linking CSR criteria to executive incentive schemes, which further highlights the need for research into CSR contracting.

In terms of innovation output, the data show a significant decrease in the average annual number of patents applied for and granted in the last few years of the sample period. The significant time lag between a patent application and the patent being granted (Fang et al., 2014) may explain this, as we only observe the information for a patent after it has been granted. Thus, some patents applied for in the last few years of the sample period may still be under review and hence are not included in the database or our sample. Citation data are subject to a similar truncation bias because patents granted in the later years of the sample period typically have fewer citations than those granted in the early years. In our robustness tests, we use truncation-adjusted patent and citation counts to address concerns about truncation bias in our patent and citation data.

Panel C of Table 1 reports the sample distribution and summary statistics by industry. The three industries with the highest proportions of CSR contracting are the extractive (29.91%), mining/construction (26.12%), and chemicals (20.19%) industries, all of which are among the world's most polluting industries according to a report by international nonprofit organizations Pure Earth and Green Cross (2016). This suggests that CSR contracting is more prevalent in less eco-friendly industries, probably because they seek to reduce their environmental impact and gain social license to operate. The industry with the lowest proportion of CSR contracting is the miscellaneous manufacturing sector (3.71%). The three most innovative industries are electrical equipment manufacturing, transportation equipment manufacturing, and computers, which is consistent with the intuition that firms in these industries perceive innovative technologies and products as important means to secure a competitive advantage. Firms in the retail industries tend to be less innovative.

4.2. Summary statistics

Table 2 provides the descriptive statistics of all of the variables used in the main regression analyses. All of the continuous variables are winsorized at the 1st and 99th percentiles to reduce the potential effect of outliers. In our sample, firms average 43 patents and 45 citations,[14] and their distributions show a high degree of right-skewness, with the median being much smaller than the corresponding mean, which suggests that a very small portion of observations have substantially higher patent quantity and quality as found in other studies (Griliches et al., 1986). Thus, we follow the literature and use the log transformation of the patent and citation data in our regression analysis to correct the skewness of these variables. The mean of *CSRContracting* is 0.158, indicating that 15.8% of the firm-year observations in the sample include CSR-related criteria in their executive compensation schemes.

4.3. Main results for H1

The main regression results (testing Hypothesis 1) are presented in Table 3. We find a significantly positive relation between *CSRContracting* and firms' patent counts ($\beta = 0.106$, $p < 0.01$ in Column 1) and citation counts ($\beta = 0.133$, $p < 0.001$ in Column 2), suggesting that CSR contracting has a positive effect on firm innovation. From an economic perspective, these results indicate that when controlling for other factors, linking executive compensation to CSR targets increases the average numbers of patents and citations by 11% and 13%, respectively. Notably, in all of the models, we find that CSR contracting fosters innovation to a greater extent than firms' CSR initiatives. This finding suggests that CSR contracting tends to influence managerial risk-taking behavior beyond firms' CSR performance. The signs of the coefficients on the control variables are generally consistent with our predictions and with the

[13] As a large proportion of the firm-year observations are not associated with a patent or citation, we also provide the summary statistics for the innovation output of firms with at least one patent (i.e., the patent subsample) or citation (i.e., the citation subsample).

[14] The average patent and citation counts in the sample are larger than those reported by Francis et al. (2018), who also conducted an international study on innovation, mainly because our sample includes firms from Japan and South Korea. Firms in these countries generate significantly more patents and citations than those in other countries.

Table 1
Sample distribution.

Panel A: Sample distribution and statistics by country

Country	N	% of full sample	% of CSR contracting adopters within country	Patent (Full Sample)	Citation (Full Sample)	Patent (Patent Subsample)	Citation (Citation Subsample)
			N = 17,855	N = 17,855	N = 17,855	*N* = 6350	*N* = 4663
1. Australia	823	4.61	39.85	1.00	1.69	13.56	43.47
2. Austria	77	0.43	6.49	2.38	0.94	5.72	5.14
3. Belgium	95	0.53	16.84	11.19	6.49	23.62	20.57
4. Brazil	119	0.67	14.29	0.95	0.15	5.14	4.50
5. Canada	1008	5.65	24.70	0.38	0.47	4.51	11.46
6. China	303	1.70	0.66	1.21	0.45	14.12	7.61
7. Denmark	142	0.80	14.79	36.15	29.80	64.16	70.53
8. Finland	241	1.35	11.62	32.32	48.24	63.84	163.73
9. France	536	3.00	16.79	9.80	5.34	30.71	30.12
10. Germany	438	2.45	7.31	28.52	42.38	63.41	128.02
11. Greece	59	0.33	5.08	0.00	0.00	0.00	0.00
12. Hong Kong	533	2.99	2.25	0.14	0.02	4.17	2.60
13. India	300	1.68	6.33	4.46	2.26	12.75	16.14
14. Indonesia	96	0.54	11.46	0.00	0.00	0.00	0.00
15. Ireland	128	0.72	12.50	0.00	0.00	0.00	0.00
16. Italy	160	0.9	14.38	3.09	1.86	10.53	11.92
17. Japan	2562	14.35	1.48	219.44	138.12	254.73	201.40
18. Malaysia	61	0.34	3.28	0.00	0.00	0.00	0.00
19. Mexico	84	0.47	10.71	0.13	0.00	2.75	0.00
20. Netherlands	227	1.27	26.43	4.58	3.88	28.08	41.90
21. Norway	122	0.68	36.89	1.68	1.20	8.91	14.60
22. Singapore	105	0.59	11.43	0.01	0.00	1.00	0.00
23. South Africa	330	1.85	35.45	0.04	0.00	1.75	0.00
24. South Korea	314	1.76	7.64	114.89	52.83	143.73	115.21
25. Spain	176	0.99	9.66	0.79	0.13	3.86	3.29
26. Sweden	339	1.9	10.03	3.72	3.14	18.01	24.20
27. Switzerland	331	1.85	8.46	5.23	2.70	24.03	20.79
28. Turkey	72	0.40	6.94	3.64	0.08	18.71	2.00
29. United Kingdom	1983	11.11	25.37	1.03	1.24	16.16	32.81
30. United States	6091	34.11	17.44	22.34	63.10	54.68	194.42
Overall	*17,855*	*100.00*	*15.84*	*43.49*	*44.88*	*122.29*	*171.84*

Panel B: Sample distribution and statistics by year

Year	N	% of full sample	% of CSR contracting adopters within year	Patent (Full Sample)	Citation (Full Sample)	Patent (Patent Subsample)	Citation (Citation Subsample)
			N = 17,855	N = 17,855	N = 17,855	N = 6350	N = 4663
1. 2004	855	4.79	1.87	70.77	148.51	145.44	328.96
2. 2005	1053	5.90	2.09	76.27	132.71	150.97	283.45
3. 2006	1036	5.80	3.57	76.57	124.00	150.24	267.63
4. 2007	1064	5.96	3.48	75.03	98.19	151.77	217.65
5. 2008	1258	7.05	4.21	59.46	70.28	121.83	159.31
6. 2009	1426	7.99	5.54	60.88	58.73	126.00	133.58
7. 2010	1612	9.03	10.79	52.98	37.16	113.57	91.17
8. 2011	1701	9.53	16.11	48.71	24.03	107.05	61.76
9. 2012	1759	9.85	22.68	42.97	10.46	99.07	30.88

(*continued on next page*)

Table 1 (*continued*)

Panel B: Sample distribution and statistics by year

Year	N	% of full sample	% of CSR contracting adopters within year	Patent (Full Sample)	Citation (Full Sample)	Patent (Patent Subsample)	Citation (Citation Subsample)
			N = 17,855	N = 17,855	N = 17,855	N = 6350	N = 4663
10. 2013	1580	8.85	29.81	14.67	3.69	38.95	13.70
11. 2014	1988	11.13	32.29	15.73	1.83	39.42	7.05
12. 2015	2523	14.13	24.73	6.60	0.31	16.01	1.22
Overall	*17,855*	*100.00*	*15.84*	*43.49*	*44.88*	*122.29*	*171.84*

Panel C: Sample distribution and statistics by industry

Industry	N	% of full sample	% of CSR contracting adopters within country	Patent (Full Sample)	Citation (Full Sample)	Patent (Patent Subsample)	Citation (Citation Subsample)
			N = 17,855	N = 17,855	N = 17,855	N = 6350	N = 4663
1. Mining/Construction	1734	9.71	26.12	4.31	0.52	49.48	14.33
2. Food	990	5.54	12.73	7.48	4.93	24.44	12.08
3. Textiles/Print/Publish	896	5.02	14.84	19.73	8.97	72.16	30.89
4. Chemicals	1065	5.96	20.19	80.35	28.18	138.02	46.44
5. Pharmaceuticals	698	3.91	10.46	38.19	46.45	64.07	64.68
6. Extractive	1364	7.64	29.91	5.09	3.28	30.96	109.91
7. Manf: Rubber /Glass/Etc.	583	3.27	13.38	62.70	24.39	127.36	35.76
Manf: Metal	803	4.50	16.94	41.45	15.91	98.19	68.70
8. Manf: Machinery	965	5.40	10.57	79.68	72.72	133.04	55.07
9. Manf: Electrical Equipment	631	3.53	8.40	217.46	259.54	292.57	150.90
10. Manf: Transport Equipment	845	4.73	16.45	115.56	98.41	208.20	414.60
11. Manf: Instruments	913	5.11	10.41	74.37	83.32	122.35	222.34
12. Manf: Misc.	135	0.76	3.70	74.70	70.58	114.60	172.10
13. Computers	1807	10.12	8.97	88.41	155.91	141.63	146.58
14. Retail: Wholesale	663	3.71	9.80	2.83	1.45	18.95	301.00
15. Retail: Misc.	1519	8.51	12.05	0.36	0.95	5.26	19.61
16. Retail: Restaurant	211	1.18	19.91	0.32	0.82	6.18	24.03
17. Services	1932	10.82	17.75	1.55	3.39	11.58	19.22
18. Others	101	0.57	16.83	0.18	0.00	3.00	46.81
Overall	*17,855*	*100.00*	*15.84*	*43.49*	*44.88*	*122.29*	*171.84*

Note: This table presents the sample distribution. Panel A reports the sample distribution by country. Panel B reports the sample distribution by year. Panel C reports the sample distribution by industry following the industry classification in Barth et al. (2005). The sample comprises 17,855 firm-year observations from 30 countries from 2004 to 2015.

Table 2
Summary statistics.

Variable	N	Mean	S.D.	25%	Median	75%
$PATENT_{t+1}$*(raw) Patent Subsample*	6350	122.29	227.81	5.000	28.00	124.00
$PATENT_{t+1}$*(raw) Full Sample*	17,855	43.492	147.93	0.000	0.000	8.000
$PATENT_{t+1}$(ln) *Full Sample*	17,855	1.211	1.951	0.000	0.000	2.197
PATENT_Efficiency	10,377	0.174	0.415	0.000	0.011	0.140
PATENT_Value	17,855	−0.003	0.644	−25.137	0.000	0.000
$CITATION_{t+1}$*(raw) Citation Subsample*	4663	171.84	354.62	6.000	29.00	141.00
$CITATION_{t+1}$*(raw) Full Sample*	17,855	44.876	196.3	0.000	0.000	1.000
$CITATION_{t+1}$*(ln) Full Sample*	17,855	0.92	1.826	0.000	0.000	0.693
$CSRContracting_t$	17,855	0.158	0.365	0.000	0.000	0.000
$CSRPerf_t$	17,855	51.694	27.922	30.775	45.38	78.69
$Comp\_LongtermFin_t$	17,855	0.103	0.304	0.000	0.000	0.000
$R\&D_t$	17,855	0.021	0.04	0.000	0.002	0.024
$ExternalFinance_t$	17,855	0.006	0.093	−0.032	−0.002	0.029
$Size_t$	17,855	8.365	1.325	7.526	8.334	9.197
MTB_t	17,855	3.115	3.416	1.279	2.159	3.651
$InsiderOwnership_t$	17,855	0.225	0.228	0.020	0.152	0.363
$CapitalIntensity_t$	17,855	4.466	1.576	3.460	4.285	5.243
$SalesGrowth_t$	17,855	0.073	0.224	−0.030	0.047	0.147
$ForeignSales_t$	17,855	0.422	0.327	0.108	0.410	0.696
Age_t	17,855	3.443	0.111	3.367	3.466	3.555
$Leverage_t$	17,855	0.525	0.197	0.393	0.533	0.659
ROA_t	17,855	0.061	0.096	0.023	0.056	0.100
$Cash_t$	17,855	0.144	0.134	0.05	0.103	0.194
HHI_t	17,855	0.364	0.303	0.122	0.256	0.524
HHI_t^2	17,855	0.224	0.318	0.015	0.065	0.274
$LnGDP_t$	17,855	10.56	0.646	10.569	10.75	10.848

Note: This table reports the summary statistics for the key variables used in the main regression analyses. See Appendix B for detailed variable definitions.

literature (e.g., Sørensen and Stuart, 2000; Hall and Ziedonis, 2001; Furman et al., 2002; Lyandres and Palazzo, 2016).

In addition to using main innovation output measures based on firms' patent and citation counts, we follow the literature (Becker-Blease, 2011; Hirshleifer et al., 2013) and use innovation efficiency as our first alternative innovation measure. We define *PATENT_Efficiency* (*CITATION_Efficiency*) as the number of patents (citations) granted in a year divided by R&D capital (*RDC*), where *RDC* is computed as $R\&D_t + 0.8 \times R\&D_{t-1} + 0.6 \times R\&D_{t-2} + 0.4 \times R\&D_{t-3} + 0.2 \times R\&D_{t-4}$ (Hirshleifer et al., 2013).[15] The results are presented in Columns 3 and 4 of Table 3.[16]

The second alternative measure of firm innovation is *PATENT_Value*, which measures the economic value of innovation outcomes. Following Kogan et al. (2017), we calculate this as the change in the market value of a firm (adjusted by the average market return during the same measurement window) in the 3-day window following a patent grant announcement. Column 5 of Table 3 reports the results. Our results using the alternative innovation measures show that CSR contracting enhances the efficiency and economic value of innovation outputs, consistent with our main finding that CSR contracting encourages innovation.

4.4. Main results for H2—country-level stakeholder orientation and legal institutions

The results for the tests of Hypothesis 2 are presented in Tables 4 and 5. Table 4 shows the influence of country-level stakeholder orientation on the relation between CSR contracting and firm innovation. Using the median of *Stakeholder_Orientation* for the countries in our sample as a cut-off point, we split the sample into two subsamples: firms in countries with strong and weak stakeholder orientation. The coefficients on *CSRContracting* are significantly positive for countries with weak stakeholder orientation ($\beta = 0.142$, $p < 0.05$ in Column 2 for the patent model; $\beta = 0.112$, $p < 0.05$ in Column 4 for the citation model) and positive but insignificant for countries with high stakeholder orientation. A test of the differences in the coefficients indicates that the coefficient on *CSRContracting* for the high stakeholder orientation group is significantly more positive than that for the low stakeholder orientation group. (See Table 4).

Table 5 focuses on the moderating effect of country-level legal environment and shows the results for the sample divided according to the median of *Rule of Law* for the countries in our sample. The coefficients on *CSRContracting* are significantly positive only for the

[15] *RDC* is calculated using 5-year cumulative R&D expenditures and assuming a 20% annual depreciation rate (Lev et al., 2005). Missing R&D expenditures are set to 0 for the calculation of *RDC*. We find similar results (untabulated) using alternative approaches to deal with missing R&D expenditures.

[16] The control variable *R&D* is removed from this regression because of the mechanical relation between innovation efficiency (scaled by R&D investment) and *R&D*. The results remain quantitatively and statistically similar when we include *R&D* as a control in the regressions.

Table 3
CSR contracting and innovation.

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	$PATENT_{t+1}$	$CITATION_{t+1}$	$PATENT\_Efficiency_{t+1}$	$CITATION\_Efficiency_{t+1}$	$PATENT\_Value_{t+1}$
CSRContracting$_t$	**0.106***	**0.133***	**0.064***	**0.065***	**0.023***
	(0.009)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.079)**
CSRPerf$_t$	0.006***	0.004***	0.001	−0.001**	−0.001
	(0.000)	(0.000)	(0.853)	(0.028)	(0.472)
Comp_LongtermFin$_t$	0.099*	0.033	0.022**	−0.042*	0.016**
	(0.096)	(0.565)	(0.040)	(0.066)	(0.033)
R&D$_t$	12.409***	12.352***			−0.326
	(0.000)	(0.000)			(0.100)
ExternalFinance$_t$	−0.168	−0.261**	0.079**	0.121*	−0.030
	(0.142)	(0.041)	(0.023)	(0.091)	(0.577)
Size$_t$	0.215***	0.182***	−0.028***	−0.027***	−0.004
	(0.000)	(0.000)	(0.000)	(0.002)	(0.410)
MTB$_t$	0.005	0.001	0.003**	0.002	0.002**
	(0.343)	(0.878)	(0.045)	(0.414)	(0.025)
InsiderOwnership$_t$	−0.236**	−0.108	0.067	0.099**	−0.035
	(0.012)	(0.232)	(0.193)	(0.017)	(0.247)
CapitalIntensity$_t$	0.016	0.019	0.015**	0.019	0.005
	(0.333)	(0.208)	(0.024)	(0.108)	(0.258)
SalesGrowth$_t$	0.007	−0.113*	0.055**	0.028	0.014
	(0.892)	(0.052)	(0.050)	(0.495)	(0.610)
ForeignSales$_t$	0.275***	0.188***	−0.000	0.081**	0.027
	(0.000)	(0.004)	(0.993)	(0.013)	(0.106)
Age$_t$	1.028	1.195	−0.259	0.606**	0.021
	(0.256)	(0.121)	(0.565)	(0.015)	(0.460)
Leverage$_t$	−0.068	−0.142	0.017	−0.134**	−0.002
	(0.588)	(0.254)	(0.672)	(0.016)	(0.940)
ROA$_t$	0.153	0.041	0.165**	0.153*	0.048
	(0.347)	(0.818)	(0.021)	(0.095)	(0.437)
Cash$_t$	0.312*	0.373**	−0.053	0.174	−0.040
	(0.079)	(0.045)	(0.258)	(0.109)	(0.373)
HHI$_t$	0.038	−0.043	0.295**	0.128	0.105
	(0.912)	(0.898)	(0.035)	(0.398)	(0.179)
HHI$_t^2$	0.065	0.124	−0.210**	−0.027	−0.021
	(0.825)	(0.655)	(0.038)	(0.820)	(0.764)
LNGDP$_t$	1.294***	0.940***	0.241***	−0.095	−0.045
	(0.000)	(0.000)	(0.000)	(0.178)	(0.372)
Constant	−18.73***	−14.54***	−1.671	−0.476	0.358
	(0.000)	(0.000)	(0.291)	(0.657)	(0.513)
Observations	17,855	17,855	10,377	10,377	17,855
R-squared	0.637	0.503	0.304	0.173	0.031
Year fixed effects	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES

Note: This table presents the regression results for the effect of CSR contracting on firm innovation. The dependent variables in Columns 1 and 2 are *PATENT* and *CITATION*, respectively, which are our main innovation measures. The dependent variables in Columns 3–5 are *PATENT_Efficiency*, *CITATION_Efficiency*, and *PATENT_Value*, respectively, which are the alternative innovation measures. All of the variables are defined in Appendix B. *p*-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

subsample of countries with weak law enforcement ($\beta = 0.137, p < 0.01$ in Column 2 for the patent model and $\beta = 0.210, p < 0.001$ in Column 4 for the citation model). Again, a test of the differences in the coefficients indicates that the coefficient on *CSRContracting* for the high law enforcement group is significantly more positive than that for the low law enforcement group. These results are again consistent with our prediction that the association between CSR contracting and firm innovation varies with country-level legal institutions.

4.5. Main results for H2—mandatory CSR reporting requirement

Studies suggest that firms' commitment to CSR initiatives increases substantially if CSR is required or if CSR reporting requirements are in place (e.g., Manchiraju and Rajgopal, 2017; Chen et al., 2018). Therefore, as a further analysis, we regard country-level CSR reporting regulations as an exogenous shock and examine the role of CSR reporting mandates in the effect of CSR contracting on innovation. During our sample period, CSR disclosure was mandated by law in five countries, namely China (2008), Denmark (2009), India (2013), Malaysia (2007), and South Africa Ernst and Young (2010), according to Ioannou and Serafeim (2019). Thus, we introduce *POST_CSRRMandate*, which is an indicator variable that equals 1 for the year mandatory CSR reporting is adopted in a

Table 4
CSR contracting, firm innovation, and stakeholder orientation.

	(1)	(2)	(3)	(4)
	Stakeholder Orientation (SO)			
	HIGH SO	LOW SO	HIGH SO	LOW SO
Dep. Var.	$PATENT_{t+1}$	$PATENT_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$
$\boldsymbol{CSRContracting_t}$	**0.028**	**0.142****	**0.045**	**0.112****
	(0.493)	**(0.025)**	**(0.150)**	**(0.012)**
$CSRPerf_t$	0.003***	0.004***	0.002**	0.003***
	(0.002)	(0.000)	(0.030)	(0.000)
$Comp\_LongtermFin_t$	0.015	0.131	−0.009	0.108**
	(0.813)	(0.124)	(0.872)	(0.028)
$R\&D_t$	9.257***	9.943***	7.172***	12.068***
	(0.000)	(0.000)	(0.000)	(0.000)
$ExternalFinance_t$	−0.317**	−0.008	−0.221*	−0.133
	(0.012)	(0.962)	(0.061)	(0.474)
$Size_t$	0.166***	0.157***	0.104***	0.189***
	(0.000)	(0.000)	(0.000)	(0.000)
MTB_t	0.009	0.001	0.003	0.003
	(0.210)	(0.834)	(0.633)	(0.556)
$InsiderOwnership_t$	−0.182	−0.288**	−0.148	−0.209***
	(0.102)	(0.020)	(0.109)	(0.006)
$CapitalIntensity_t$	0.048***	0.006	0.029**	0.011
	(0.001)	(0.807)	(0.022)	(0.338)
$SalesGrowth_t$	0.068	0.000	−0.002	−0.086
	(0.238)	(0.999)	(0.967)	(0.232)
$ForeignSales_t$	0.051	0.455***	0.023	0.269***
	(0.438)	(0.000)	(0.685)	(0.000)
Age_t	0.573	1.426	0.824	0.794
	(0.507)	(0.253)	(0.243)	(0.238)
$Leverage_t$	−0.389***	0.098	−0.324***	0.122
	(0.010)	(0.499)	(0.009)	(0.142)
ROA_t	0.105	0.284	0.170	0.050
	(0.561)	(0.260)	(0.302)	(0.806)
$Cash_t$	0.663***	0.313	0.372*	0.491***
	(0.003)	(0.145)	(0.055)	(0.000)
HHI_t	−0.530	0.585	−0.578*	0.825***
	(0.168)	(0.155)	(0.075)	(0.000)
HHI_t^2	0.512	−0.451	0.509*	−0.649***
	(0.124)	(0.231)	(0.066)	(0.000)
$LNGDP_t$	0.006	0.990***	−0.242	1.493***
	(0.965)	(0.000)	(0.146)	(0.000)
Constant	−3.094	−15.033***	−0.431	−17.206***
	(0.328)	(0.000)	(0.881)	(0.000)
Observations	9009	8247	9009	8247
R-squared	0.378	0.667	0.312	0.584
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES
Test of differences in coefficients				
H_0: (1) = (2)	chi2(1) = 5.38; p = 0.020			
H_0: (3) = (4)	chi2(1) = 4.31; p = 0.038			

Note: This table reports the regression results estimating the moderating role of stakeholder orientation in the effect of CSR contracting on firm innovation. *Stakeholder Orientation* is the principal factor of the following four proxies: (1) *STAKELAW*, which measures the stringency of a country's legal environment in protecting labor rights and benefits; (2) *CSRLAW*, which measures the degree of a country's mandatory CSR disclosure requirements; (3) *PUBAWARE*, which assesses a country's public awareness of CSR issues; and (4) *PUBAWARE1*, which assesses the country-level attitudes of corporate executives toward CSR engagement. The threshold for the sample split is the median of *Stakeholder Orientation*. The tests of the coefficient differences between the high and low groups are conducted based on seemingly unrelated regressions. All of the variables are defined in Appendix B. *p*-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

country and any year after and 0 otherwise. We then follow the studies (e.g., Acharya and Subramanian, 2009; Brown and Martinsson, 2019) examining the effect of exogenous regulatory shocks on corporate outcomes and adopt a staggered triple DID design that includes firm fixed effects[17]:

[17] We exclude firms from mandated CSR reporting countries for which there are no premandate firm-years in our sample.

Table 5
CSR contracting, firm innovation, and legal institutions.

	(1)	(2)	(3)	(4)
	Rule of Law (RL)			
	HIGH RL	LOW RL	HIGH RL	LOW RL
Dep. Var.	$PATENT_{t+1}$	$PATENT_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$
$\boldsymbol{CSRContracting_t}$	**0.072**	**0.137***	**0.041**	**0.210***
	(0.114)	**(0.005)**	**(0.220)**	**(0.000)**
$CSRPerf_t$	0.002*	0.005***	0.001	0.003***
	(0.051)	(0.000)	(0.222)	(0.001)
$Comp\_LongtermFin_t$	−0.007	0.128	−0.022	0.058
	(0.918)	(0.116)	(0.660)	(0.477)
$R\&D_t$	5.450***	9.821***	5.603***	11.585***
	(0.000)	(0.000)	(0.000)	(0.000)
$ExternalFinance_t$	0.011	−0.090	−0.012	−0.258
	(0.933)	(0.540)	(0.910)	(0.161)
$Size_t$	0.100***	0.128***	0.083***	0.163***
	(0.000)	(0.000)	(0.001)	(0.000)
MTB_t	0.005	0.001	0.007	0.004
	(0.496)	(0.908)	(0.290)	(0.575)
$InsiderOwnership_t$	−0.181	−0.086	−0.130	0.075
	(0.137)	(0.464)	(0.239)	(0.560)
$CapitalIntensity_t$	0.011	0.033	−0.006	0.036*
	(0.492)	(0.102)	(0.706)	(0.079)
$SalesGrowth_t$	0.078	0.030	0.012	−0.018
	(0.157)	(0.632)	(0.831)	(0.826)
$ForeignSales_t$	0.223***	0.235***	0.059	0.146
	(0.003)	(0.003)	(0.348)	(0.109)
Age_t	−1.072***	1.639	−1.783***	1.320
	(0.000)	(0.144)	(0.000)	(0.290)
$Leverage_t$	−0.393**	0.130	−0.355**	0.097
	(0.026)	(0.353)	(0.019)	(0.529)
ROA_t	0.195	0.063	0.269	−0.073
	(0.277)	(0.766)	(0.124)	(0.782)
$Cash_t$	0.202	0.472**	0.039	0.374
	(0.333)	(0.021)	(0.825)	(0.116)
HHI_t	−0.870**	0.443	−0.706**	0.584
	(0.036)	(0.258)	(0.048)	(0.162)
HHI_t^2	0.705**	−0.282	0.536*	−0.394
	(0.049)	(0.426)	(0.074)	(0.282)
$LNGDP_t$	0.236*	0.725***	0.416***	0.837***
	(0.054)	(0.000)	(0.006)	(0.000)
Constant	0.380	−14.266***	1.257	−14.739***
	(0.751)	(0.000)	(0.373)	(0.001)
Observations	5315	9778	5315	9778
R-squared	0.316	0.660	0.266	0.559
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES
Test of differences in coefficients				
H_0: (1) = (2)	chi2(1) = 5.11; p = 0.024			
H_0: (3) = (4)	chi2(1) = 14.97; p = 0.0001			

Note: This table reports the regression results estimating the moderating role of national legal environment in the effect of CSR contracting on firm innovation. *Rule of Law* is a proxy for the overall level of enforcement of a country's legal and regulatory systems (i.e., the stringency of country-level legal and regulatory environments), which measures the extent to which agents have confidence in and abide by the rules of society. The threshold for the sample split is the median of *Rule of Law*. The tests of the coefficient differences between the high and low groups are conducted based on seemingly unrelated regressions. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

$$INNOVATION_{ijt+1} = \beta_0 + \beta_1 CSRContracting_{ijt} + \beta_2 POST\_CSRRMandate_{ijt} + \beta_3 CSRContracting_{ijt} \times POST\_CSRRMandate_{ijt} + All\ Controls + YearFE + FirmFE + \varepsilon_{ijt} \tag{2}$$

In Eq. (2), β_3 is the DID estimator, which captures the differential impact that CSR contracting has on innovation for firms from

Table 6
CSR contracting, firm innovation, and mandatory CSR reporting requirement.

	(1)	(2)
	CSRR mandate	
Dep. Var.	$PATENT_{t+1}$	$CITATION_{t+1}$
***CSRContracting*$_t$**	**0.082*** **	**0.143*** **
	(0.000)	**(0.000)**
***POST_CSRRMandate*$_t$**	**0.047**	**0.256*** **
	(0.388)	**(0.000)**
***CSRContracting*$_t$ × *POST_CSRRMandate*$_t$**	**−0.161* **	**−0.309* **
	(0.093)	**(0.055)**
$CSRPerf_t$	0.001***	0.000
	(0.000)	(0.503)
$Comp\_LongtermFin_t$	0.066***	0.022
	(0.002)	(0.602)
$R\&D_t$	1.901***	2.197***
	(0.000)	(0.008)
$EXTFIN_t$	−0.066	−0.186**
	(0.243)	(0.042)
$LNSIZE_t$	0.075***	0.088***
	(0.000)	(0.003)
MTB_t	−0.001	−0.004
	(0.749)	(0.344)
$InsiderOwnership_t$	0.036	0.176**
	(0.394)	(0.011)
$CAPINT_t$	0.025*	0.003
	(0.058)	(0.886)
$SalesGrowth_t$	−0.062**	−0.163***
	(0.012)	(0.000)
$ForeignSales_t$	−0.237***	−0.450***
	(0.000)	(0.000)
$LNAGE_t$	−0.736	−2.395**
	(0.392)	(0.012)
LEV_t	−0.055	−0.184*
	(0.325)	(0.091)
ROA_t	−0.222***	−0.506***
	(0.001)	(0.000)
$CASH_t$	−0.078	−0.272**
	(0.279)	(0.043)
HHI_t	0.225	0.208
	(0.379)	(0.649)
HHI_t^2	−0.200	−0.174
	(0.325)	(0.617)
$LNGDP_t$	1.177***	0.702***
	(0.000)	(0.000)
Constant	−9.155***	1.635
	(0.001)	(0.617)
Observations	17,202	17,202
R-squared	0.946	0.829
Year fixed effects	YES	YES
Firm fixed effects	YES	YES

Note: This table presents the regression results examining the impact of a CSR reporting mandate on the effect of CSR contracting. The dependent variable in Columns 1 and 2 are *PATENT* and *CITATION*, respectively. *POST_CSRRMandate* is an indicator variable that equals 1 for the year mandatory CSR reporting is adopted in a country and any year after and 0 otherwise. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

countries with a mandatory CSR reporting requirement relative to firms from countries without such a requirement.[18]

Table 6 shows that the interaction term *CSRContracting* × *POST_CSRRMandate* is significantly negative for both the patent and citation models, whereas the coefficients on *CSRContracting* remain significantly positive. This suggests that the positive relation between CSR contracting and firm innovation is attenuated (more pronounced) for firms from countries with (without) mandatory CSR reporting requirements. This finding further supports our conjecture that the effect of CSR contracting on firm innovation is particularly important for firms from countries with weak protections for stakeholders' interests.

[18] The variable *POST_CSRRMandate* in our staggered DID setting is equivalent to the *POST* × *TREATMENT* term in a traditional 2 × 2 DID setting. Therefore, the interaction term *CSRContracting* × *POST_CSRRMandate* is equivalent to a three-way interaction term in a traditional 2 × 2 DID setting.

Table 7
CSR contracting, firm innovation, and CSR performance.

Panel A. Dependent variable: $PATENT_{t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$
CSRPerf =	*Overall*	*EMP*	*EMP_EQ*	*EMP_HS*	*EMP_TD*	*EMP_DO*
$CSRContracting_t$	**0.364*** **	**0.569*** **	**0.636*** **	**0.664*** **	**0.364*** **	**0.495*** **
	(0.000)	**(0.010)**	**(0.006)**	**(0.000)**	**(0.002)**	**(0.003)**
$CSRPerf_t$	**0.006*** **	**0.027*** **	**0.016*** **	**0.018*** **	**0.011*** **	**0.019*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
$CSRContracting_t \times CSRPerf_t$	**−0.004*** **	**−0.009** **	**−0.010** **	**−0.010*** **	**−0.005** **	**−0.007** **
	(0.002)	**(0.024)**	**(0.029)**	**(0.002)**	**(0.024)**	**(0.023)**
Observations	17,855	17,855	17,855	17,855	17,855	17,855
R-squared	0.637	0.642	0.634	0.640	0.636	0.640
All other controls	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES

Panel B. Dependent variable: $CITATION_{t+1}$

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dep. Var.	**$CITATION_{t+1}$**	**$CITATION_{t+1}$**	**$CITATION_{t+1}$**	**$CITATION_{t+1}$**	**$CITATION_{t+1}$**	**$CITATION_{t+1}$**
***CSRPerf* =**	***CSRPerf***	***EMPPerf***	***EMP_EQ***	***EMP_HS***	***EMP_TD***	***EMP_DO***
$CSRContracting_t$	**0.533*** **	**0.696*** **	**0.741*** **	**0.455** **	**0.394*** **	**0.752*** **
	(0.000)	**(0.001)**	**(0.001)**	**(0.010)**	**(0.000)**	**(0.000)**
$CSRPerf_t$	**0.005*** **	**0.018*** **	**0.012*** **	**0.012*** **	**0.007*** **	**0.013*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
$CSRContracting_t \times CSRPerf_t$	**−0.007*** **	**−0.011*** **	**−0.011*** **	**−0.006* **	**−0.005** **	**−0.012*** **
	(0.000)	**(0.003)**	**(0.007)**	**(0.054)**	**(0.013)**	**(0.000)**
Observations	17,855	17,855	17,855	17,855	17,855	17,855
R-squared	0.505	0.506	0.503	0.505	0.503	0.506
All other controls	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES

Note: This table presents the regression results examining the substitutive/complementary role of CSR contracting and CSR performance in their effects on firm innovation. The dependent variables in Panels A and B are *PATENT* and *CITATION*, respectively. *EMPPerf* is the overall performance of a firm in relation to its employees. It can be further divided into four sub-categories, which are: (1) employment quality (*EMP_EQ*); (2) workforce health and safety (*EMP_HS*); (3) training and development (*EMP_TD*); and (4) diversity and opportunity (*EMP_DO*). All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4.6. CSR contracting, firm innovation, and CSR performance

In this section, we explore whether and how CSR contracting and firm-level CSR performance interact in their effect on firm innovation. We conjecture that a greater level of employee innovation productivity is likely to be a key factor contributing to the positive relation between CSR contracting and innovation. In line with this view, research shows that positive employee treatment enhances firm innovation by promoting a learning climate and facilitating the exchange and absorption of knowledge and ideas (Mao and Weathers, 2019).

To test this conjecture, in addition to the overall CSR performance score (*CSRPerf*), we focus on firms' CSR performance related to employees specifically, measured by five dimensions.[19] Table 7 shows that all of the interaction terms between *CSRContracting* and *CSRPerf* are negatively and significantly related to firm innovation, which indicates that the effect of CSR contracting on firm innovation is more pronounced for firms with low CSR performance, especially CSR measures related to employees, which leaves more room for CSR contracting to affect innovation.

5. Channel analysis

In this section, we explore the potential channels through which CSR contracting promotes innovation.

[19] The five measures of employee-related CSR performance are (1) employee well-being (*EMP*) and its four dimensions: (2) employment quality (*EMP_EQ*), (3) workforce health and safety (*EMP_HS*), (5) training and development (*EMP_TD*), and (5) diversity and opportunity (*EMP_DO*).

Table 8
The effect of CSR contracting on employee well-being and employee innovation productivity.

Panel A: Employee well-being

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	EMP_{t+1}	EMP_EQ_{t+1}	EMP_HS_{t+1}	EMP_TD_{t+1}	EMP_DO_{t+1}
$CSRContracting_t$	**2.151*** **	**1.774*** **	**2.359*** **	**2.800*** **	**1.650*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
$CSRPerf\_ExclEMP_t$	0.252***	0.127***	0.286***	0.372***	0.223***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	17,488	17,486	17,482	17,482	17,482
R-squared	0.595	0.332	0.534	0.514	0.425
All other controls	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES

Panel B: Employee innovation productivity

	(1)	(2)
Dep. Var.	***$PATENT\_EmployeeProd_{t+1}$***	***$CITATION\_EmployeeProd_{t+1}$***
$CSRContracting_t$	**0.056*** **	**0.077*** **
	(0.000)	**(0.000)**
Observations	13,766	13,766
R-squared	0.635	0.492
All other controls	YES	YES
Year fixed effects	YES	YES
Industry fixed effects	YES	YES
Country fixed effects	YES	YES

Note: This table presents the regression results for the effect of CSR contracting on employee well-being (Panel A) and employee innovation productivity (Panel B). In Panel A, *EMP*, *EMP_EQ*, *EMP_HS*, *EMP_TD*, and *EMP_DO* denote the overall employee-related CSR performance score, the employment quality score, the workforce health and safety score, the workforce training and development score, and the workforce diversity and opportunity score, respectively. In Panel B, *PATENT_EmployeeProd* (*CITATION_EmployeeProd*) measures employee innovation productivity with respect to the patent (citation) count, which is calculated as the natural logarithm of 1 plus the number of patents (citations) divided by the number of employees in thousands in a given year. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.1. Effect of CSR contracting on employee well-being and employee innovation productivity

As discussed in Section 2, using CSR contracting to encourage future-oriented CSR engagement can presumably signal firms' substantive commitment to CSR engagement, and thereby attracting and retaining talented employees and incentivize them to innovate. To test this plausible channel, we first directly examine whether the adoption of CSR contracting indeed improves employee well-being. Similar to Section 4.6, we measure employee well-being using five proxies: *EMP*, *EMP_EQ*, *EMP_HS*, *EMP_TD*, and *EMP_DO*. The results are presented in Panel A of Table 8. *CSRContracting* is significantly and positively related to all five measures of 1-year forward employee well-being, demonstrating that CSR contracting effectively increases future employee-oriented CSR initiatives.

We further explore whether CSR contracting improves employees' innovation productivity. If improved employee well-being following the adoption of CSR contracting incentivizes employees to innovate, we expect to observe a positive effect of CSR contracting on employees' innovation productivity. To test this, we measure employees' innovation productivity using two measures, namely *PATENT_EmployeeProd* and *CITATION_EmployeeProd*, which are calculated as the natural logarithm of 1 plus the number of patents and citations per 1000 employees, respectively. The results are presented in Panel B of Table 8. For both models, we find that CSR contracting consistently leads to a significant increase in employee innovation productivity.

Overall, the results in this section suggest that the positive effect of CSR contracting on innovation is partially attributable to enhanced employee innovation productivity, which is spurred by increased employee well-being following the adoption of CSR contracting.

5.2. Effect of CSR contracting on managerial risk-taking

Another potential channel through which CSR contracting may influence innovation is by encouraging managerial risk-taking. As an enhanced long-term orientation following the adoption of CSR contracting can alleviate managerial short-termism and promote

Table 9
The effect of CSR contracting on managerial risk-taking and the sensitivity of R&D to the investment opportunity set.

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	$ROA\_Volatility_{t+1,t+3}$	$ROA\_Volatility_{t+1,t+5}$	$Stock\_Return\_Volatility_{t+1,t+3}$	$Stock\_Return\_Volatility_{t+1,t+5}$	$R\&D_{t+1}$
$CSRContracting_t$	**0.624*** **	**0.629*** **	**0.002*** **	**0.002*** **	**−0.006*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
$Tobin\_Q_t$					**0.005*** **
					(0.000)
$CSRContracting_t \times Tobin\_Q_t$					**0.002*** **
					(0.005)
$CSRPerf_t$	−0.004***	−0.005***	−0.000***	−0.000**	0.000***
	(0.009)	(0.001)	(0.001)	(0.012)	(0.000)
$Comp\_LongtermFin_t$	−0.134	−0.184	−0.000	0.000	0.005***
	(0.331)	(0.202)	(0.757)	(0.384)	(0.000)
$R\&D_t$	11.610***	9.752***	−0.005	−0.013***	
	(0.000)	(0.000)	(0.253)	(0.007)	
$ExternalFinance_t$	−0.567	−0.276	0.009***	0.010***	−0.014***
	(0.301)	(0.623)	(0.000)	(0.000)	(0.000)
$Size_t$	−0.646***	−0.758***	−0.005***	−0.005***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MTB_t	0.021	0.029*	−0.001***	−0.001***	0.000**
	(0.165)	(0.055)	(0.000)	(0.000)	(0.020)
$InsiderOwnership_t$	0.176	−0.013	0.003***	0.002***	−0.007***
	(0.408)	(0.952)	(0.000)	(0.004)	(0.000)
$CapitalIntensity_t$	0.360***	0.435***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$SalesGrowth_t$	0.398*	0.715***	0.005***	0.007***	0.006***
	(0.068)	(0.001)	(0.000)	(0.000)	(0.000)
$ForeignSales_t$	0.541***	0.517***	0.003***	0.002***	0.010***
	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)
Age_t	6.825***	8.846***	−0.005	0.003	0.031***
	(0.002)	(0.000)	(0.579)	(0.776)	(0.000)
$Leverage_t$	−0.415	−0.264	0.014***	0.016***	−0.008***
	(0.139)	(0.360)	(0.000)	(0.000)	(0.000)
ROA_t	−7.308***	−7.338***	−0.055***	−0.053***	−0.087***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	2.637***	3.837***	0.011***	0.011***	0.060***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HHI_t	−0.180	0.072	−0.007***	−0.007***	−0.006*
	(0.750)	(0.902)	(0.001)	(0.002)	(0.059)
HHI_t^2	−0.090	−0.279	0.005***	0.005***	0.005**
	(0.856)	(0.587)	(0.007)	(0.006)	(0.049)
$LNGDP_t$	0.987**	1.210***	0.008***	0.011***	0.004*
	(0.012)	(0.003)	(0.000)	(0.000)	(0.055)
Constant	−23.630***	−30.220***	0.017	−0.025	−0.147***
	(0.003)	(0.001)	(0.602)	(0.468)	(0.000)
Observations	17,258	17,279	17,733	17,733	17,855
R-squared	0.168	0.202	0.373	0.333	0.472
Year fixed effects	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES

Note: This table reports the results for the effect of CSR contracting on managerial risk-taking (Columns 1 to 4) and the sensitivity of a firm's R&D to its investment opportunity set (Column 5). $ROA\_Volatility_{t+1,t+3}$ ($ROA\_Volatility_{t+1,t+5}$) is calculated as the standard deviation of industry-adjusted return on assets during the period from $t+1$ to $t+3$ ($t+5$), where return on assets is calculated as earnings before interest and taxes divided by total assets. $Stock\_Return\_Volatility_{t+1,t+3}$ ($Stock\_Return\_Volatility_{t+1,t+5}$) is calculated as the standard deviation of weekly stock returns over the period from $t+1$ to $t+3$ ($t+5$). *Tobin_Q* reflects the market's valuation of a firm's assets relative to their book value. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

tolerance for failure, we expect CSR contracting to encourage managerial risk-taking and thereby foster innovation. Following prior studies (Wright et al., 2007; Acharya et al., 2011), we assess managerial risk-taking propensities using the volatility of a firm's accounting returns ($ROA\_Volatility_{t+1,t+3}$ and $ROA\_Volatility_{t+1,t+5}$) and stock returns ($Stock\_Return\_Volatility_{t+1,t+3}$ and $Stock\_Return\_Volatility_{t+1,t+5}$).[20] The results are reported in Columns 1 to 4 of Table 9. Across all four risk-taking measures, we find consistent

[20] $ROA\_Volatility_{t+1,t+3}$ ($ROA\_Volatility_{t+1,t+5}$) is calculated as the standard deviation of industry-adjusted return on assets during the period from $t+1$ to $t+3$ ($t+5$), where return on assets is calculated as earnings before interest and taxes divided by total assets. $Stock\_Return\_Volatility_{t+1,t+3}$ ($Stock\_Return\_Volatility_{t+1,t+5}$) is calculated as the standard deviation of weekly stock returns over the period from $t+1$ to $t+3$ ($t+5$).

evidence that CSR contracting increases managerial risk-taking.

5.3. Effect of CSR contracting on the sensitivity of R&D to a firm's investment opportunity set

We also investigate whether CSR contracting spurs innovation by increasing the responsiveness of a firm's R&D investments to its investment opportunity set. If better innovation outcomes and higher innovation efficiency are attributable to CSR contracting mitigating the agency cost of innovation and facilitating a more efficient allocation of R&D capital, the capital should be invested in more promising investment opportunities and hence increase the sensitivity of a firm's R&D expenditures to its investment opportunity set. To test this potential channel, similar to Zhong (2018), we use Tobin's Q (*Tobin_Q*) as a proxy for the investment opportunity set (Skinner, 1993) and regress R&D investments (*R&D*) in $t+1$ on *CSRContracting*, *Tobin_Q*, and the interaction between *CSRContracting* and *Tobin_Q*. The coefficient on the interaction term captures the sensitivity of R&D to the investment opportunity set. The results are presented in Column 5 of Table 9. The coefficient on the interaction term *CSRContracting* × *Tobin_Q* is significantly positive, confirming that adopters of CSR contracting exhibit greater R&D sensitivity to their investment opportunity set and hence allocate R&D capital more efficiently, which improves innovation outputs and efficiency.

6. Additional analyses and robustness tests

6.1. Alternative measure of CSR contracting

In our main tests, we use international CSR contracting data from ASSET4. We test the robustness of our findings using CSR contracting data from Sustainalytics data. Specifically, we generate a new CSR contracting variable, *CSRContracting_Alt*, which is an indicator variable that equals 1 if a firm's executive compensation is explicitly tied to CSR performance targets and 0 otherwise.[21] The results are presented in Column 1 of Table 10.[22] The coefficients on *CSRContracting_Alt* in both the patent (Panel A) and citation (Panel B) models are significantly positive and quantitatively similar to those for *CSRContracting* in our main tests in Table 3. Again, this finding suggests the importance of policies linking CSR criteria to executive compensation for affecting managerial behavior and corporate outcomes.

6.2. Addressing truncation bias

The patent counts are truncated because of the significant time lag between the application and granting of a patent (Fang et al., 2014). Although *PATENT* measures the number of patents a firm applies for in a given year that are eventually granted, some of those applied for in the later years of the sample period may remain under review and are therefore not in the BvD database. This truncation results in underreported patent counts toward the end of the sample period. Following Hall et al. (2005), we use adjustment factors to address the truncation bias and compute truncation-adjusted patent counts.[23] Similarly, the citation counts are also subject to truncation as firms can accumulate more citations over time. Column 2 of Table 10 reports the results. Our inference of a positive relationship between CSR contracting and innovation remains unchanged after accounting for potential truncation bias.

6.3. Mitigating large sample bias

As shown in Panel A of Table 1, our sample is dominated by U.S. firms, which account for about 34% of the sample. Large sample bias can be a concern if many firms are from a single country, so we perform a robustness check by excluding U.S. firms from the sample and rerunning the main regression. The results are presented in Column 3 of Panels A and B of Table 10. Consistent with the main results, the coefficients on *CSRContracting* remain positive and significant ($\beta = 0.163$, $p < 0.001$ for the patent model; $\beta = 0.234$, $p < 0.001$ for the citation model). In addition, we assess whether heterogeneity in the number of firm-years across countries affects our results by applying a WLS model in which the weight is the inverse of the number of observations per country. Column 4 of Table 10 reports the results of the WLS regressions for *PATENT* and *CITATION*. The coefficients on *CSRContracting* are 0.154 ($p < 0.001$) and 0.153 ($p < 0.001$) for the patent and citation models, respectively. Thus, our robustness tests demonstrate that the positive relation between CSR contracting and innovation is not driven by countries with a larger presence in the sample.

[21] Sustainalytics provides worldwide CSR data on firms' policies, programs, and preparedness for CSR risk management. *CSRContracting_Alt* is constructed based on Sustainalytics' data item G.2.6, "which provides an assessment of whether a part of executive remuneration is explicitly linked to sustainability performance targets, such as health and safety targets, environmental targets, etc."

[22] The subsample in this table is significantly reduced to 4411 firm-years because the Sustainalytics database starts from 2009 and covers a much smaller sample of international firms than ASSET4.

[23] First, we estimate the application–grant lag distribution (W_s) for the first half of the sample period from 2005 to 2010. This is calculated as the percentage of patents applied for in a given year that are granted in s years. Then, we compute truncation-adjusted patent numbers for 2011 to 2015 by applying the adjustment factors to the raw patent numbers. The truncation-adjusted patent counts are $P_{adj} = \frac{P_{raw}}{\sum_{s=0}^{2016-t} W_s}$, where P_{raw} is the raw (unadjusted) number of patent applications at year t and $2011 \leq t \leq 2016$.

Table 10
CSR contracting and innovation—additional analyses.

Panel A. Dependent variable: $PATENT_{t+1}$

	(1)	(2)	(3)	(4)
Model	Alternative measure of CSR contracting	Truncation-adjusted patent	Excluding U.S. firms	WLS regression
Dep. Var.	$PATENT_{t+1}$	$PATENT\_Adj_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$
CSRContracting_Alt$_t$	**0.151****			
	(0.050)			
ExecutivePerf_CSRtarget$_t$	**−0.096**			
	(0.208)			
CSRContracting$_t$		**0.096****	**0.163*****	**0.154*****
		(0.029)	**(0.000)**	**(0.000)**
Observations	4411	17,855	11,764	17,855
R-squared	0.606	0.639	0.711	0.678
All other controls	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES

Panel B. Dependent variable: $CITATION_{t+1}$

	(1)	(2)	(3)	(4)
Model	Alternative measure of CSR contracting	Truncation-adjusted citation	Excluding U.S firms	WLS regression
Dep. Var.	$CITATION_{t+1}$	$CITATION\_Adj_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$
CSRContracting_Alt$_t$	**0.138***			
	(0.073)			
ExecutivePerf_CSRtarget$_t$	**−0.005**			
	(0.946)			
CSRContracting$_t$		**0.143*****	**0.234*****	**0.153*****
		(0.000)	**(0.000)**	**(0.000)**
Observations	4411	17,855	11,764	17,855
R-squared	0.506	0.425	0.560	0.486
All other controls	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES

Note: This table presents the regression results of the additional analyses. The dependent variables in Panels A and B are *PATENT* and *CITATION*, respectively. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6.4. Pre- and post-CSR contracting analysis using difference-in-differences models

To address endogeneity concerns when comparing heterogeneous firms, we use a DID method to compare the changes in innovation over time between firms with CSR contracting and those without. We follow other studies that examine the effect of a staggered adoption of laws and regulations (e.g., Fauver et al., 2017; Bourveau et al., 2018; Hu et al., 2020) and use a staggered DID model that includes both firm and year fixed effects:

$$INNOVATION_{ijt+1} = \beta_0 + \beta_1 POST\_CSRContracting_{ijt} + All\ Controls + YearFE + FirmFE + \varepsilon_{ijt} \tag{3}$$

where *POST_CSRContracting* is an indicator variable that equals 1 for the year in which a firm adopts CSR contracting and any year after and 0 otherwise. β_1 is the DID estimator, which captures the incremental change (from pre- to post-adoption) in innovation for firms that adopt CSR contracting (the treatment group) relative to the change in innovation for firms that do not (the control group) during the same period.[24] The results using the staggered DID method are reported in Columns 1 and 2 of Table 11. The coefficients on *POST_CSRContracting* are 0.062 ($p = 0.019$) for the patent model and 0.133 ($p = 0.008$) for the citation model, both of which are positive and statistically significant.

In addition, we perform a trend analysis using a dynamic DID model to explore the dynamic effect of CSR contracting on innovation. We replace *POST_CSRContracting* in the baseline DID model (Eq. (3)) with eight year indicators, namely *Year − 3*, *Year − 2*, *Year − 1*, *Year 0*, *Year 1*, *Year 2*, *Year 3*, and *Year 4 & After*, which indicate the year relative to the CSR contracting adoption year (*Year*

[24] By focusing on the cross-temporal differences in innovation between the treatment and control groups before and after the adoption of CSR contracting, the DID method controls for unobservable cross-temporal trends in firm innovation and eliminates the influence of temporal variations in innovation that are not caused by the adoption of CSR contracting and thereby helps address issues related to unobserved heterogeneity and endogeneity (Bertrand et al., 2004).

Table 11
Pre- and post-CSR contracting analysis using difference-in-differences models.

	(1)	(2)	(3)	(4)
Model	DID model		Dynamic DID model	
Dep. Var.	$PATENT_{t+1}$	$CITATION_{t+1}$	$PATENT_{t+1}$	$CITATION_{t+1}$
POST_CSRContracting	**0.062****	**0.133*****		
	(0.019)	**(0.008)**		
Year − 3			−0.013	0.05
			(0.639)	(0.359)
Year − 2			0.029	0.071
			(0.387)	(0.275)
Year − 1			0.058	0.082
			(0.120)	(0.259)
Year 0			**0.081****	**0.186****
			(0.044)	**(0.022)**
Year 1			**0.098****	**0.250*****
			(0.037)	**(0.006)**
Year 2			**0.117****	**0.308*****
			(0.024)	**(0.002)**
Year 3			**0.128****	**0.317*****
			(0.036)	**(0.009)**
Year 4 & After			**0.195****	**0.527*****
			(0.011)	**(0.000)**
Observations	13,766	13,766	12,350	12,350
R-squared	0.962	0.883	0.962	0.880
All other controls	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES

Note: This table presents the results of the trend analysis using a baseline difference-in-differences (DID) model (Columns 1 and 2) and a dynamic DID model (Columns 3 and 4). The dependent variable in Columns 1 and 3 (Columns 2 and 4) is *PATENT* (*CITATION*). *POST_CSRContracting* is an indicator variable that equals 1 for the year CSR contracting is adopted and any year after and 0 otherwise. *Year − 3*, *Year − 2*, *Year − 1*, *Year 0*, *Year 1*, *Year 2*, *Year 3*, and *Year 4 & After* are indicator variables indicating the number of years before and after CSR contracting is adopted, with *Year 0* indicating the adoption year. Industry and country fixed effects are not included because they are subsumed by firm fixed effects. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

0). The results using the dynamic DID approach are presented in Columns 3 and 4 of Table 11. The coefficients on all of the pre-treatment year indicators (i.e., *Year − 3*, *Year − 2*, and *Year − 1*) in both columns are insignificant, indicating no significant difference in innovation between CSR contracting adopters and non-adopters before the adoption. The results validate the parallel trend assumption underlying the DID approach; that is, there is no statistically significant difference in the outcome variables between the treatment and control groups in the absence of the treatment. Moreover, the coefficients on all of the posttreatment year indicators (i.e., *Year 0*, *Year 1*, *Year 2*, *Year 3*, and *Year 4 & After*) are significantly positive in both the *PATENT* and *CITATION* models, indicating that CSR contracting enhances innovation and that the effect is long-lasting.

6.5. Alternative measurement window for innovation

To investigate whether the findings are robust to the choice of measurement windows, we restrict the sample to a $[t-3, t+3]$ window (with t denoting the year in which a firm adopts CSR contracting for the first time) to measure patent outputs and rerun the regression. A firm must be observable during the pre- and post-CSR contracting periods to be included in the subsample for this test. This additional requirement reduces the potential influence of differences in firm composition and sample years during the pre- and post-adoption periods. Column 1 of Panels A and B of Table 12 shows that the coefficients on *CSRContracting* remain significantly positive ($\beta = 0.081$, $p < 0.001$ for the patent model; $\beta = 0.101$, $p = 0.005$ for the citation model).

6.6. Controlling for firm fixed effects

We also rerun Eq. (1) using the full sample and include firm fixed effects in the regressions to capture time-invariant unobservable firm characteristics. If these characteristics, which are correlated with both CSR contracting and innovation, are constant over time, controlling for firm fixed effects will address concerns about omitted variables. The results of the regressions that include firm fixed effects are reported in Column 2 in Panels A and B of Table 12. The coefficients on *CSRContracting* remain significantly positive ($\beta = 0.087$, $p < 0.001$ for the patent model; $\beta = 0.140$, $p < 0.001$ for the citation model).

6.7. Addressing potential sample selection bias

As all of the firms in our sample are in the ASSET4 database, a potential concern is that our results may be subject to sample

Table 12
CSR contracting and innovation—additional sensitivity tests.

Panel A. Dependent variable: $PATENT_{t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Model	Year [$t-3$, $t+3$]	With firm fixed effects	Heckman Second-stage Regression	Excl. firms experienced CEO change	Control for *Comp_LongtermStock*	Control for *Comp_Shareholder Return*	Control for *BoardIndep & CEODuality*
Dep. Var.	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$	$PATENT_{t+1}$
$CSRContracting_t$	**0.081*****	**0.087*****	**0.105****	**0.091****	**0.101****	**0.104****	**0.108*****
	(0.000)	**(0.000)**	**(0.011)**	**(0.041)**	**(0.014)**	**(0.010)**	**(0.008)**
$Mills_t$			−0.047				
			(0.753)				
Comp_LongtermStock					0.042		
					(0.324)		
Comp_ShareholderReturn						0.014	
						(0.740)	
BoardIndependence							−0.001
							(0.420)
CEODuality							−0.172***
							(0.000)
Observations	15,098	17,855	16,942	7566	17,855	17,855	17,855
R-squared	0.953	0.946	0.637	0.729	0.637	0.637	0.607
All other controls	YES	YES	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES	YES	YES
Industry fixed effects	NO	NO	YES	YES	YES	YES	YES
Country fixed effects	NO	NO	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	NO	NO	NO	NO	NO

Panel B. Dependent variable: $CITATION_{t+1}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Model	Year [$t-3$, $t+3$]	With firm fixed effects	Heckman Second-stage Regression	Excl. firms experienced CEO change	Control for *Comp_Longterm Stock*	Control for *Comp_Shareholder Return*	Control for *BoardIndep & CEODuality*
Dep. Var.	$CITATION_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$	$CITATION_{t+1}$
$CSRContracting_t$	**0.101*****	**0.140*****	**0.140*****	**0.184*****	**0.098****	**0.129*****	**0.119*****
	(0.005)	**(0.001)**	**(0.000)**	**(0.001)**	**(0.038)**	**(0.000)**	**(0.001)**
$Mills_t$			−0.009				
			(0.957)				
Comp_LongtermStock					0.053		
					(0.307)		
Comp_ShareholderReturn						0.041	
						(0.381)	
BoardIndependence							−0.001
							(0.348)
CEODuality							−0.171***
							(0.000)
Observations	15,098	17,855	16,942	7566	17,855	17,855	17,855
R-squared	0.861	0.829	0.507	0.591	0.457	0.503	0.471
All other controls	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
Industry fixed effects	NO	NO	YES	YES	YES	YES	YES
Country fixed effects	NO	NO	YES	YES	YES	YES	YES
Firm fixed effects	YES	YES	NO	NO	NO	NO	NO

Note: This table presents the results of additional sensitivity tests of the effect of CSR contracting on firm innovation. The dependent variables in Panels A and B are *PATENT* and *CITATION*, respectively. In Columns 1–2, industry and country fixed effects are not included because they are subsumed by firm fixed effects. All of the variables are defined in Appendix B. p-values based on robust standard errors adjusted for clustering by firm are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

selection bias, if the decision on whether to include a firm in the database is not random. We therefore follow the literature (e.g., El Ghoul et al., 2017) and perform a Heckman-type correction using a two-stage Heckman model. We merge the ASSET4 sample with the Worldscope data and distinguish the firms in ASSET4 from the others by generating the indicator variable *ASSET4 Sample*, which equals 1 if an observation is in ASSET4 and 0 otherwise. In the first-stage regression, we estimate a probit model by regressing the dependent variable, *ASSET4 Sample*, on a set of explanatory variables that may have affected the decision to include a firm in ASSET4 in that year. Using this model, we obtain the inverse Mills ratio (*Mills*). In the second stage, we add *Mills* to Eq. (1) to control for sample selection bias.[25] The second-stage results presented in Column 3 of Table 12 show that the coefficients on *CSRContracting* remain statistically and economically similar to our main results.

Furthermore, because less than 20% of the firms in our sample appear to link executive compensation to CSR performance, we address potential self-selection bias by adopting an additional research design. Specifically, we treat firms that contract on CSR as treatment firms and create a control group by matching according to the propensity of a firm to undertake CSR activities (following the model outlined by Lys et al., 2016). Thus, any difference in firms' innovation outcomes between these two groups will lead to a more credible inference about the role of CSR contracting in fostering better outcomes. The untabulated results are consistent with our prediction.

6.8. Addressing possible alternative explanations

6.8.1. CEO changes

Our results may be explained by factors such as executive turnover, which is likely to influence both corporate innovation strategies and outputs. To ensure that our findings are not driven by CEO changes, we exclude all firms that experience any CEO change during our sample period. As reported in Column 4 of Panels A and B of Table 12, the coefficients on *CSRContracting* remain significantly positive and quantitatively similar to the main results.

6.8.2. Other compensation incentives

Studies suggest that the long-term equity-based components of executive compensation, such as restricted stocks and stock options, can potentially motivate innovation by alleviating managerial myopia and motivating managers to consider longer-term value creation (e.g., Lerner and Wulf, 2007; Flammer and Bansal, 2017). Thus, we include *Comp_LongtermStock* in our model, which is an indicator variable that measures whether a firm has recently distributed long-term equity incentives to its executives. In addition, managerial compensation based on stock performance targets rather than accounting earnings can positively affect innovation (e.g., Gibbons and Murphy, 1992). We therefore include an additional variable for stock performance–oriented compensation (*Comp_ShareholderReturn*), which is an indicator variable that equals 1 if an executive compensation scheme is linked to total shareholder returns in that year and 0 otherwise. We again find that our inferences are unchanged (Columns 5 & 6 of Table 12).

6.8.3. Corporate governance attributes

Good corporate governance practices are likely to mitigate agency conflicts, improve transparency, and optimize the allocation of investment capital (Fauver et al., 2017), which may enhance the adoption of CSR contracting and a firm's engagement in innovation. Therefore, following Chen et al. (2016), we add two corporate governance factors to our model: board independence (*BoardIndependence*) and CEO duality (*CEODuality*).[26] The results are reported in Column 7 of Table 12. Our inferences are unchanged after the addition of these corporate governance variables.

7. Conclusion

The inclusion of financial performance targets in executive compensation schemes is effective in motivating firm innovation, but the understanding of how the integration of nonfinancial CSR criteria into executive compensation policies influences firm innovation is limited. This research question is particularly important in the international setting because countries are characterized by substantial variations in their institutions and these differences may explain the heterogeneity of managerial behavior.

Using a large sample of firms from 30 countries, we explore the effect of integrating CSR criteria into executive compensation on firm innovation, and further, we investigate firm- and country-level characteristics that have the potential to explain the heterogeneity of this effect. We first find robust evidence that the integration of CSR criteria into executive compensation policies has a positive effect on firm innovation even after controlling for firms' CSR performance. We observe the same finding regardless of whether U.S. firms are included in our sample, suggesting that the finding of a positive relation between CSR contracting and innovation can be generalized to firms globally.

We further find that CSR contracting tends to have a stronger effect on firm innovation in countries with a lower level of stakeholder orientation, countries with less stringent legal institutions, and countries without a mandatory CSR requirement. We also present evidence that the effect of CSR contracting on firm innovation is more pronounced for firms with low levels of CSR performance. The results of the channel analyses suggest that CSR contracting spurs innovation by enhancing employee innovation productivity, encouraging managerial risk-taking, and increasing the responsiveness of firms' R&D investment to their investment opportunity set. Overall, these findings support our argument that directly integrating CSR criteria into executive compensation with the aim of cultivating firms' long-term orientation can foster firm innovation.

Our study contributes to the literature on the relation between executive compensation and managerial risk-taking by revealing the role of CSR-based compensation in incentivizing future-oriented investments in areas such as innovation. Although the use of CSR

[25] The results of the first-stage regression are reported in Appendix C.

[26] A board with greater independence or without CEO duality is widely regarded as having good corporate governance. *BoardIndependence* is calculated as the proportion of independent directors on the board in a given year. *CEODuality* is an indicator variable that equals 1 if the CEO also serves as the chairperson of the board and 0 otherwise.

contracting has increased globally in recent years, no study has explored the country-level heterogeneity in the effect of CSR contracting on innovation. Thus, our study contributes a novel finding to the literature.

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Appendix A. An example of CSR contracting

The international gold producer Newmont Mining Corporation links "employee health and safety" and "sustainability and external relations" to its executives' annual bonuses, and they account for 20% and 5%, respectively, of these bonuses. Moreover, the company's annual report shows that the executives' annual bonuses comprise 70% of their annual incentives (Newmont Mining Corporation, 2019), so the CSR-based bonuses comprise a substantial proportion of the executives' overall compensation. The table below is extracted from the company's 2019 proxy statement (p. 71).[27]

The structure and results of the Corporate Performance Bonus for 2018 are provided in the table below:

				Performance Objectives			2018 Results		
Component		Metrics	Weight	Min	Target	Max	Result	Outcome	Payout
20% Health & Safety	Fatality risk management (leading)	Execution	5%	90%	100%	100%	100%	170%	8.5%
		Leadership	3%	50%	65%	95%	50.6%	25%	0.75%
	Health risk management (leading)	Exposure reduction	4%	20%	50%	75%	69%	177%	7.1%
	Total injury rates (lagging)	TRIFR	8%	0.46	0.39	0.31	0.40	25%	2.0%
60% Operational Excellence	Value creation	EBITDA per share	30%	$3.31	$3.86	$5.37	$4.47	115%	34.6%
		ROCE	10%	5%	9%	15%	10.5%	139%	13.9%
	Efficiency	Cash Sustaining Costs (CSC per GEO)	20%	$1000	$949	$814	$948	101%	20.2%
15% Growth	Project execution	Progress & Spend	8%	20%	100%	200%	–	101%	8.1%
		Project Advancement	2%	20%	100%	200%	–	146%	2.9%
	Exploration success	Reserves per 1000 shares	2.5%	2.6	7.5	11.81	5.11	61%	1.5%
		Resources	2.5%	3.01	5.04	9.49	7.0	144%	3.6%
5% Sustainability & External Relations	Access (public targets)	Water strategy	1.5%	80%	100%	120%	158%	200%	3.0%
		Closure & reclamation	1.5%	80%	100%	120%	120%	200%	3.0%
	Reputation	Dow Jones Sustainability Index	2%	within 1% of industry leader			Leader	200%	4.0%
Total Result								113.2%	

Appendix B. Variable definitions and data sources

Variable	Definition	Data Source
Innovation measures		
PATENT	The natural logarithm of 1 plus the patents filed by a firm in a given year that are eventually granted.	Orbis
PATENT_Adj	The natural logarithm of 1 plus the truncation-adjusted number of patents filed by a firm in a given year that are eventually granted.	Orbis
PATENT_Efficiency	Innovation efficiency measured as patent counts divided by R&D capital (*RDC*), where *RDC* is computed as $R\&D_t + 0.8 \times R\&D_{t-1} + 0.6 \times R\&D_{t-2} + 0.4 \times R\&D_{t-3} + 0.2 \times R\&D_{t-4}$ (R&D is annual research and development expenditures in millions).	Orbis, Worldscope
PATENT_Value	The economic value of innovation, calculated as the change in a firm's market value in a 3-day window following a patent grant announcement (adjusted by the market's average return during the same window).	Orbis, Capital IQ
CITATION	The natural logarithm of 1 plus the number of citations received by patents applied for in a given year that are eventually granted.	Orbis

(*continued on next page*)

[27] A proxy statement is a document that all publicly listed U.S. firms are required to file with the U.S. Securities and Exchange Commission (SEC) before shareholder meetings. It covers material firm matters relevant to shareholders' voting decisions. According to the SEC, a proxy statement must disclose executives' compensation schemes, which include salary, bonuses, equity awards, any deferred compensation, and other perks.

(*continued*)

Variable	Definition	Data Source
CITATION_Adj	The natural logarithm of 1 plus the truncation-adjusted number of citations for all patents filed by a firm in a given year.	Orbis
CITATION_Efficiency	Innovation efficiency measured as citation counts divided by R&D capital (*RDC*).	Orbis, Worldscope
PATENT_EmployeeProd	The natural logarithm of 1 plus the number of patents filed by a firm in a given year that are eventually granted divided by the number of employees (in thousands) in that year.	Orbis, Worldscope
CITATION_EmployeeProd	The natural logarithm of 1 plus the number of citations received by patents applied for in a given year that are eventually granted divided by the number of employees (in thousands) in that year.	Orbis, Worldscope
CSR contracting		
CSRContracting	An indicator variable that equals 1 if senior executives' compensation is linked to CSR/H&S (Health and Safety)/sustainability targets (CSR contracting) in the year and 0 otherwise. According to ASSET4, this data item is derived using the underlying data item "Senior Executive CSR Sustainability Compensation Incentives" (this question is answered Yes/No for every executive in the company). If the answer is "Yes" for any executive, the Sustainability Compensation Incentives indicator is "Yes."	ASSET4
POST_CSRContracting	An indicator variable that equals 1 for the year CSR contracting is adopted and any year after and 0 otherwise.	Own construction
CSRContracting_Alt	An alternative measure of CSR contracting that is an indicator variable that equals 1 if the firm's executive compensation is explicitly tied to ESG performance targets and 0 otherwise. The variable is constructed based on Sustainalytics' data item G.2.6.	Sustainalytics
Country-level institutions		
Stakeholder_Orientation	The principal factor of the following four proxies: (1) *STAKELAW*, which measures the stringency of a country's legal environment in protecting labor rights and benefits; (2) *CSRLAW*, which measures the degree of a country's mandatory requirements for CSR disclosure; (3) *PUBAWARE*, which assesses a country's public awareness of CSR issues; and (4) *PUBAWARE1*, the attitudes of corporate executives toward CSR engagement at the country level.	Dhaliwal et al. (2012)
Rule_of_Law	A proxy for the overall enforcement level of a country's legal and regulatory systems, which measures the extent to which agents are confident in and abide by the rules of society.	World Bank
Compensation variables		
Comp_LongtermFin	An indicator variable that equals 1 if management and board members' remuneration is partly linked to financial objectives or targets that are more than two years forward looking and 0 otherwise.	ASSET4
Comp_LongtermStock	An indicator variable that equals 1 if the company's most recently granted stocks or stock options vest in a 3-year period at minimum and 0 otherwise.	ASSET4
Comp_ShareholderReturn	An indicator variable that equals 1 if senior executives' compensation is linked to total shareholder returns in the year and 0 otherwise.	ASSET4
ExecutivePerf_CSRtarget	An indicator variable that equals 1 if CSR targets are used to evaluate executive performance but no such reference is made in the remuneration policy and 0 otherwise. The variable is constructed based on Sustainalytics' data item G.2.5.	Sustainalytics
Board characteristics		
BoardIndep	The percentage of independent directors serving on a company's board in the year.	ASSET4
CEODuality	An indicator variable that equals 1 if the company's CEO and board chair are the same person and 0 otherwise.	ASSET4
CSR performance		
CSRPerf	The average of *SOCPerf* and *ENVPerf* defined below.	ASSET4
SOCPerf	Social performance score that ranges between 0 and 100, with a higher value indicating better performance.	ASSET4
ENVPerf	Environmental performance score that ranges between 0 and 100, with a higher value indicating better environmental performance.	ASSET4
EMP	Employee-related performance score that ranges between 0 and 100, with a higher value indicating better employee performance.	ASSET4
EMP_EQ	The workforce/employment quality score.	ASSET4
EMP_HS	The workforce/health and safety score.	ASSET4
EMP_TD	The workforce/training and development score.	ASSET4
EMP_DO	The workforce/diversity and opportunity score.	ASSET4
Other controls		
R&D	Research and development expenditures scaled by total assets.	Worldscope
ExternalFinance	The sum of a firm's net equity issues (scaled by total assets) over a rolling 5-year window ending in the current fiscal year.	Worldscope
Size	The natural logarithm of the book value of total assets, measured at the end of the fiscal year in millions.	Worldscope
MTB	A firm's market value of equity divided by its book value of equity.	Worldscope
InsiderOwnership	The number of closely held shares as a percentage of the number of shares outstanding.	Worldscope
CapitalIntensity	Net property, plant, and equipment divided by the number of employees.	Worldscope
SalesGrowth	The annual change in net sales scaled by beginning total assets.	Worldscope

(*continued on next page*)

(*continued*)

Variable	Definition	Data Source
ForeignSales	Foreign sales scaled by total sales.	Worldscope
Age	The natural logarithm of 1 plus the number of years a firm has been listed on Worldscope.	Worldscope
Leverage	A firm's total liabilities scaled by its total assets.	Worldscope
ROA	A firm's net income before extraordinary items scaled by its beginning total assets.	Worldscope
Cash	A firm's cash holdings scaled by its total assets.	Worldscope
HHI	Industry Herfindahl–Hirschman index based on all firms in each country, with industries defined by three-digit SIC code.	Worldscope
HHI^2	The squared term of the HHI.	Worldscope
LNGDP	The natural logarithm of gross domestic product per capita.	World Bank
Other variables used in the additional analysis		
POST_CSRRMandate	An indicator variable that equals 1 for the year mandatory CSR reporting is adopted in a country and any year after and 0 otherwise.	Ioannou and Serafeim (2019)
$ROA\_Volatility_{t+1,t+3}$ ($ROA\_Volatility_{t+1,t+5}$)	The standard deviation of industry-adjusted return on assets during the period from $t+1$ to $t+3$ ($t+5$), where return on assets is calculated as earnings before interest and taxes divided by total assets.	Worldscope
$Stock\_Return\_Volatility_{t+1,t+3}$ ($Stock\_Return\_Volatility_{t+1,t+5}$)	The standard deviation of weekly stock returns over the period from $t+1$ to $t+3$ ($t+5$).	Worldscope
Tobin_Q	The market's valuation of a firm's assets relative to their book value, calculated as follows: book value of assets + (market value of equity − book value of equity)/book value of assets.	Worldscope
The Heckman two-stage model		
ASSET4 Sample	An indicator variable that equals 1 if the observation is covered in ASSET4 and 0 otherwise.	Own construction
Mills	The inverse Mills ratio, which measures the predicted likelihood of the observation being covered in ASSET4. It controls for sample selection bias in the second stage of the two-stage Heckman model.	Own construction

Appendix C. The first-stage regression of the Heckman two-stage model

Variable	Coefficient
$R\&D_t$	2.526***
	(0.000)
$Size_t$	0.885***
	(0.000)
$SalesGrowth_t$	−0.404***
	(0.000)
$Leverage_t$	−0.630***
	(0.000)
ROA_t	1.155***
	(0.000)
$LNGDP_t$	1.122***
	(0.000)
Stakeholder Orientation	1.101***
	(0.000)
Rule of Law	−0.006***
	(0.000)
Constant	−17.042***
	(0.000)
Observations	29,148
Year fixed effects	YES
Industry fixed effects	YES
Country fixed effects	YES

Note: This table presents the results of the Heckman first-stage regression. The dependent variable is *ASSET4 Sample*, which is an indicator variable that equals 1 if the observation is in ASSET4 and 0 otherwise. For the explanatory variables in this first-stage model, we adopt the model specification of El Ghoul et al. (2017) and include firm characteristics (*Size*, *ROA*, *Leverage*, *R&D*, and *SalesGrowth*) as well as country characteristics (*LNGDP* and *Rule of Law*). In addition, we add the control for country-level stakeholder orientation developed by Dhaliwal et al. (2012). Year, industry, and country indicators are also included in the model. All of the variables are defined in Appendix B. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

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