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Are socially responsible companies harder to arbitrage?
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¿Son las empresas socialmente responsables más difíciles de arbitrar?

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Résumé de l'article

Nous étudions comment la responsabilité sociale des entreprises (RSE) affecte les limites à l'arbitrage. En utilisant un échantillon d'entreprises du S&P 500 (2002-2020), nous montrons que les entreprises socialement responsables sont associées à un degré plus élevé de limites à l'arbitrage. Ces résultats sont confirmés lorsque l'on utilise uniquement les dimensions sociales et environnementales, et lorsque l'on teste séparément la relation entre la RSE et chaque composante des limites à l'arbitrage. Nos résultats sont validés lorsque l'on utilise une mesure alternative des limites à l'arbitrage et sont robustes aux contrôles d'endogénéité. Notre étude suggère que la RSE rend l'activité d'arbitrage plus difficile et plus risquée, conduisant à une mauvaise évaluation des prix des actions.

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ABSTRACT

We examine how corporate social responsibility (CSR) affects limits to arbitrage. Using a sample of S&P 500 firms from 2002 to 2020, our findings indicate that firms with high CSR performance are associated with a higher degree of limits to arbitrage. Those findings are confirmed when using only social and environmental dimensions, and when testing the relationship between CSR and each limits-to-arbitrage component separately. Our findings hold when using an alternative measure of limits to arbitrage and are robust to endogeneity checks. Our study suggests that CSR makes arbitrage activity harder and riskier, thereby leading to mispricing.

Keywords: Limits to arbitrage, Information uncertainty, Transactions costs, Idiosyncratic risk, Corporate social responsibility, Efficient markets hypothesis

Résumé

Nous étudions comment la responsabilité sociale des entreprises (RSE) affecte les limites à l'arbitrage. En utilisant un échantillon d'entreprises du S&P 500 (2002-2020), nous montrons que les entreprises socialement responsables sont associées à un degré plus élevé de limites à l'arbitrage. Ces résultats sont confirmés lorsque l'on utilise uniquement les dimensions sociales et environnementales, et lorsque l'on teste séparément la relation entre la RSE et chaque composante des limites à l'arbitrage. Nos résultats sont validés lorsque l'on utilise une mesure alternative des limites à l'arbitrage et sont robustes aux contrôles d'endogénéité. Notre étude suggère que la RSE rend l'activité d'arbitrage plus difficile et plus risquée, conduisant à une mauvaise évaluation des prix des actions.

Mots-Clés : Limites à l'arbitrage, incertitude informationnelle, coûts de transaction, risque spécifique, responsabilité sociale de l'entreprise, hypothèse d'efficience des marchés

Resumen

Examinamos cómo la responsabilidad social corporativa (RSC) afecta a los límites al arbitraje. Utilizando una amplia muestra de empresas del S&P 500 (2002-2020), nuestros resultados indican que las empresas socialmente responsables están asociadas a un mayor grado de límites al arbitraje. Estos resultados se confirman cuando se utilizan únicamente las dimensiones social y medioambiental, y cuando se comprueba la relación entre la RSC y cada componente de los límites al arbitraje. Nuestros resultados se mantienen cuando se utiliza una medida alternativa de los límites al arbitraje y son firmes a las comprobaciones de endogeneidad. Nuestro estudio indica que la RSC dificulta la actividad de arbitraje y la hace más arriesgada, lo que conduce a la fijación de precios erróneos.

Palabras Clave: Límites al arbitraje; Incertidumbre informativa; costes de transacción; riesgo idiosincrático; responsabilidad social corporativa; hipótesis del mercado eficiente

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Arbitrage in its purest form is defined as the risk-free activity of buying and selling simultaneously a security in two different markets for advantageously different prices (Shleifer and Vishny, 1997). In reality, arbitrage is often a risky activity and involves committing capital to take advantage of perceived mispricing, i.e., differences between market price and fundamental value. Such activity is a key element in achieving market efficiency. However, arbitrageurs face costs and non-hedgeable risks that prevent them from taking advantage of all mispricing opportunities (Shleifer and Vishny, 1997). More precisely, the finance literature suggests that mispricing[1] persists and inefficiencies are more pronounced when limits to arbitrage are more severe (e.g., Barberis *et al.*, 1998).

A rich literature has investigated why arbitrageurs do not exploit mispricing opportunities and identified the following limits to arbitrage: information uncertainty which refers to *"value ambiguity or the degree to which a firm's value can be reasonably estimated by even the most acknowledged investors at reasonable costs"* (Jiang *et al.*, 2005, p.185), transaction costs since they make arbitrage activity costly and less attractive, and arbitrage risk measured by the idiosyncratic risk (Pontiff, 2006). Pontiff (2006) explains that arbitrageurs care about idiosyncratic risk because they are unable to diversify their portfolios. Arbitrageurs who have sufficient arbitrage resources tend to be highly specialized in trading few assets, and therefore face the risk of under-diversification.

Our paper contributes to the limits-to-arbitrage literature from a new perspective: corporate social responsibility (CSR, henceforth). CSR could be related to limits to arbitrage and impact mispricing as a result. In fact, CSR may affect the restrictions that bound arbitrageurs' hands and thus influence the potential divergence between market prices and fundamental values.

Before delving into theoretical developments, it is important to define what CSR is. CSR engagement involves going beyond pure economic interests to consider the effect of a firm's actions on society as a whole. From existing definitions[2], CSR relates to a company's voluntary and non-legal commitment to integrate economic, social and environmental concerns in the implementation of its operations and in the interaction with stakeholders[3] by maximizing synergies within the "triple bottom line" concept (Elkington, 1997). Corporate governance is frequently considered as an additional dimension of CSR (Murphy and McGrath, 2016). The use of environmental, social, and governance (ESG) dimensions to assess a company's CSR performance is widely accepted by both researchers (Jiraporn *et al.*, 2014) and capital market participants (Bassen and Senkl, 2011).

There are two schools of thought regarding the financial impact of CSR on firms which, if expanded, could result in two different associations with limits to arbitrage. One view argues that CSR should bring relevant information to financial markets, and as a result, be incorporated in a firm's stock price to properly reflect its fundamental value. The stakeholder value maximization view[4] asserts that CSR activities have a positive impact on firm value through improved corporate reputation (Godfrey *et al.*, 2009) and product differentiation strategies (Bagnoli and Watts, 2003), which lead to decreased cash flow volatility (Gruca and Rego, 2005). This, in turn, may decrease the information uncertainty surrounding firm value and therefore make arbitrage less risky and less costly. Furthermore, socially responsible firms are more likely to have a higher degree of corporate disclosure (Gelb and Strawser, 2001), thereby increasing market liquidity. High stock liquidity and trading volume decrease the costs of arbitrage and accelerate price convergence to fundamental value. Furthermore, the risk mitigation view (Goss and Roberts, 2011) suggests that firms lower their idiosyncratic risk by engaging in CSR initiatives. Because strong CSR performance by firms may generate "insurance-like" characteristics linked to moral capital[5] (Godfrey *et al.*, 2009), CSR actions may result in more stable financial performance and lower firm specific risk. Theoretically, Pontiff (2006) argues that idiosyncratic volatility prevents rational arbitrageurs from correcting the mispricing immediately. As a consequence, this line of reasoning points towards a negative association between CSR performance and the degree of limits to arbitrage.

On the other hand, the relationship between CSR and fundamental value may not be so clear cut. As stated previously, there is ambiguity surrounding the concept of CSR and its financial implications. Specifically, the question of whether CSR benefits or hurts the firm may increase investors' psychological biases. As a result, CSR-related ambiguity could increase information uncertainty. When facing a high degree of information uncertainty, arbitrageurs become less willing to take risky positions. Because of these impediments, market mispricing can persist and hamper market efficiency, at least temporarily. According to this rationale, CSR firms' stocks could be harder to arbitrage. Expanding the shareholder expense view (Friedman, 1970) and the overinvestment view (Barnea and Rubin, 2010) would suggest CSR to be positively related to limits to arbitrage. CSR may prevent resources from being invested in profitable investment opportunities (Aupperle *et al.*, 1985), resulting in lower firm-level allocation efficiency (Bhandari and

1. Stambaugh *et al.* (2015) define mispricing as *"the difference between the observed price and the price that would otherwise prevail in the absence of arbitrage risk and all arbitrage impediments"* (p.5).

2. To bring a clear and unbiased definition of the concept of CSR is a rough task. After decades of research on CSR, there is still uncertainty and confusion on how CSR should be defined.

3. Stakeholders are "those groups without whose support organization would cease to exist" (Freeman, 1983). Stakeholders group includes "Employees, natural environment, diversity, consumers products/ safety, community, strategy." (Berman *et al.*, 1999)

4. The stakeholder value maximization view explains that CSR has a positive effect on shareholder wealth because focusing on the interests of different stakeholders increases their willingness to support a firm's operations (Bardos *et al.*, 2020).

5. Moral capital is an intangible asset that influences investors' beliefs toward the firm (Luo and Bhattacharya, 2009) and may result in the creation of a competitive advantage.

Javakhadze, 2017). Suboptimal resource allocation and added costs could in turn lead to a more pronounced variability of future performance, increasing earnings volatility and thus firm risk (Alexander and Buchholz, 1978). Moreover, CSR may also deter traders from taking arbitrarily large positions by decreasing stock liquidity through the disclosure of lower-quality financial information. According to the agency logic, opportunistic managers may use CSR activities strategically to engage in real earnings management (Prior *et al*., 2008), leading market operators to widen the bid-ask spreads in order to protect themselves (Chung *et al*., 2009). Because of managers' potential empire building tendencies, CSR may also increase firm risk as managers may choose to overinvest in CSR activities for personal gains at the expense of shareholders (Barnea and Rubin, 2010). CSR actions could thus favor managerial entrenchment and hurt shareholder through decreased profitability and increased volatility (Utz, 2017). Additionally, Becchetti *et al*. (2015) find that reduced flexibility in responding to productive shocks via the reduction of stakeholder well-being lead CSR firms to exhibit higher idiosyncratic volatility. This, in turn, would tend to indicate a positive relationship between CSR and arbitrage risk. As a consequence, these views point towards a positive association between CSR performance and the degree of limits to arbitrage.

In this paper, we extend the above strand of research by examining the impact of CSR on limits to arbitrage. To do so, we compile data from the Thomson Reuters (formerly Asset4) ESG database to assess the CSR performance of firms and Thomson Reuters Datastream and Factset to retrieve financial variables for S&P 500 firms from 2002 to 2020. We use nine limits to arbitrage measures following Lam and Wei (2011).

Our results show that CSR is positively linked to limits to arbitrage. This may come from the fact that CSR creates ambiguity among market participants whose opinions diverge about the concept of CSR and its implications. CSR may be perceived as an agency cost related to opportunistic behavior and linked to aggressive accounting practices. Such behavior would mitigate the relevance and reliability of the information disclosed and lead to larger spreads and transaction costs, and thus more limits to arbitrage. Similarly, we find that both the environmental and social dimensions of CSR also have a positive impact on limits to arbitrage when examined separately, while the governance dimension does not seem to matter. We further show that CSR positively impacts each limits-to-arbitrage component. Our results are robust to endogeneity checks and to using an alternative measure of limits to arbitrage based on principal component analysis.

We contribute to the literature linking CSR to financial markets. Our study adds to research works supporting the shareholder expense view of CSR (Friedman, 1970), the agency perspective and the overinvestment view (e.g., Aupperle *et al*., 1985; Barnea and Rubin, 2010;) from a different viewpoint. This article is the first to assess the impact of CSR on limits to arbitrage through its different financial implications. Moreover, by uncovering a significant relationship between CSR and limits to arbitrage, our study is useful for tests of market efficiency. Therefore, it extends and complements the literature on mispricing and the efficient markets hypothesis by suggesting a new factor that makes arbitrage activity harder and riskier.

The remainder of this paper is structured as follows. We discuss the theoretical background in the next section. In the third section, we describe the data and methodological approach. We report the empirical results in the fourth section and robustness checks in the fifth section. The sixth section concludes.

Literature review

Limits to arbitrage

Theoretically, arbitrage activity requires no capital outlay and entails no risk. More importantly, it plays a fundamental role in achieving market efficiency because arbitrage aims to bring prices to fundamental value and correct for stock mispricing. In reality, the situation is more complex as arbitrageurs may face various constraints (Shleifer and Vishny, 1997).

Information uncertainty[6] is one of the major factors driving limits to arbitrage. Information uncertainty, as defined by Jiang *et al*. (2005), does not equate to information asymmetry, such that some agents know more about a firm's value than others, but instead refers to *"value ambiguity, or the degree to which a firm's value can be reasonably estimated by even the most knowledgeable investors at reasonable costs."* (p.185). According to this definition, it is harder to determine the true fundamental value of firms showing a high degree of information uncertainty. Consequently, arbitrage will be more difficult to implement among these firms as arbitrageurs face higher information acquisition and processing costs (Shleifer and Vishny, 1997). Especially, when fundamental value is uncertain, the process of price convergence tends to be protracted (Frankel and Lee, 1998). Indeed, informational cascades[7] are more likely to appear in high information uncertainty environments. Furthermore, when the valuation of the firm is hard and uncertain, rational arbitrageurs would rely less on their private signals and their transactions would follow the direction of other traders. Rational arbitrageurs will then engage in a positive feedback (De Long *et al*., 1990), driving prices away from their fundamental value instead of correcting the mispricing.

Limits to arbitrage also include transactions costs since they increase the execution cost of arbitrage activity and make it less attractive. The illiquidity of a stock prevents rational investors from exploiting mispricing opportunities. For example, Mashruwala *et al*. (2006) suggest that transactions costs create further barriers to exploiting the accruals mispricing anomaly. The empirical literature has identified various determinants of transaction costs. Ball *et al*. (1995) show that arbitrage impediments are more salient in low-priced stocks because share prices are inversely related to transaction costs as proxied by bid-ask spreads (Bhardwaj and Brooks, 1992). Bhushan (1994) finds that liquidity matters as stocks with higher trading volume are associated with lower transactions costs. Lam and Wei (2011) find that stocks widely held by institutional investors are indeed associated with lower transaction costs as these stocks feature low short-sale constraints[8].

Finally, the last major limit to arbitrage is idiosyncratic volatility, as it makes arbitrage risky (Pontiff, 2006)[9]. Why should idiosyncratic risk matter for arbitrageurs given that

6. Studies explaining the impact of information uncertainty on the predictability of stock returns were initiated by Jiang *et al*. (2005) and Zhang (2005).

7. Information cascades correspond to the phenomenon of traders following the behavior of other traders when investors receive a low precise private signal (Bikchandani *et al*., 1992).

8. It is easier for short-sellers to borrow shares of stocks that feature a high degree of institutional ownership.

9. Pontiff (2006) explains how arbitrageurs care about idiosyncratic risk through "the parable of the Sahara free ace coupon" example.

it can be diversified away as predicted by the diversification theory and capital asset pricing model? The answer is that arbitrageurs do care about idiosyncratic risk because they only have access to small projects (Shleifer and Vishny, 1997). Pontiff (2006) claims that "*To specialized arbitrageurs, both systematic and idiosyncratic volatility matters. In fact, idiosyncratic volatility probably matters more, since it cannot be hedged, and arbitrageurs are not diversified. In reality, arbitrage resources are heavily concentrated in hands of few investors that are highly specialized in trading a few assets and are far from diversified. As a result, these investors care about total risk, and not just systematic risk*." (p.42). Furthermore, He adds that "*Idiosyncratic risk represents a holding cost since dividend payments are negatively associated to holding costs*" (p.38). Holding costs deter rational arbitrageurs from exploiting mispricing opportunities and they increase stock mispricing in a similar way than transaction costs.

Corporate social responsibility and limits to arbitrage

CSR may contribute to firm financial performance through different channels (Godfrey, 2005). Assuming market efficiency, one should thus expect CSR to be integrated in stock prices to properly reflect fundamental value. A recent study by Bardos *et al*. (2020) shows that CSR has a positive impact on firm value through its effect on product market perception. CSR activities may therefore help firms improve their image and reputation. By potentially signaling a firm's product quality, CSR may be seen as a product differentiation strategy (Bagnoli and Watts, 2003) that contributes to market power and helps firms generate profits. This conjecture seems to be validated by the ability of high CSR firms to sell more products and/or sell their products at a higher price (Auger *et al*., 2003). We are particularly interested in explaining the link between CSR performance and its different dimensions with limits to arbitrage. CSR dimensions may have different effects on limits to arbitrage, due to their roles in shaping firm value, risk, and corporate transparency. First, CSR dimensions may help firms achieve lower cash flow volatility, leading to lower information uncertainty. Increased stability in future cash flows may result from customers perceiving CSR engagement positively and showing a higher degree of satisfaction about socially responsible firms (Currás-Pérez *et al*., 2018). CSR can also have a positive impact on employee sentiment. By increasing the loyalty of customers and employees, firms may be able to mitigate the variability of future cash flows and reduce their idiosyncratic risk (Luo and Bhattacharya, 2009). This view is complemented by the CSR risk management perspective (Godfrey *et al*., 2009) according to which CSR generates moral capital and goodwill among stakeholders, resulting in a more stable financial performance and more favorable risk profile (Stellner *et al*., 2015). Moral capital related to CSR activities creates value to shareholders and produces "insurance-like" protection (Godfrey *et al*., 2009). Moreover, environmental performance, defined as "*the firm's environmentally friendly behavior, specified in issues of how to make optimum use of natural resources, improve waste management, minimize eco-logical externalities in production processes, and promote eco-friendly products*" (Currás-Pérez *et al*., 2018, p. 735), also decreases firm risk through mitigating the likelihood of strong scrutiny from local communities, regulators, and environmental pressure organizations that expect companies to reduce such impacts. Environmentally friendly processes and products therefore help firms dampen real financial shocks to cash flows through an increase in operations flexibility resulting from the relation between the firm and its stakeholders (Zhang, 2005).

Second, to guarantee better investor relations practices, socially responsible firms are more likely to feature a higher degree of corporate disclosure (Gelb and Strawser, 2001). Dhaliwal *et al*. (2012) show that social related disclosure is associated with greater analyst coverage, improved forecast accuracy and a reduction in forecast dispersion. Utz (2017) further demonstrates that CSR helps predict the distribution of stock returns through increasing the availability of firm specific information, which leads to a reduction of uncertainty and idiosyncratic risk. Higher corporate transparency will make valuation easier through a reduction in cash flows forecast errors, which in turn mitigates information uncertainty, and therefore contributes to market efficiency.

Finally, CSR companies are expected to provide credible and comprehensive information (Du *et al*., 2015) which enhance earnings quality. Prior studies (e.g, Kim *et al*., 2012) have documented that CSR-oriented firms are less likely to manage earnings through discretionary accruals. High financial reporting quality reduces information asymmetry between managers and investors. Cho *et al*. (2013) provide evidence for positive and negative CSR disclosures to be negatively associated with the bid-ask spread. Because of that, CSR disclosure may help reduce transaction costs that increase the cost of arbitrage strategy and make it less attractive. In addition, Nofsinger *et al*. (2019) find an asymmetric pattern in the relationship between CSR and institutional investors. They show that institutional investors seem to be indifferent to the presence of positive CSR information but underweight stocks with negative CSR scores. Stocks widely held by institutional investors are associated with lower transaction costs as these stocks feature less short-sale constraints[10] (Lam and Wei, 2011). Because of these expected negative impacts of CSR on information uncertainty, transaction costs, and idiosyncratic risk, it would make sense to expect a negative association between CSR and limits to arbitrage.

However, from a theoretical point of view, there are also reasons that could lead us to believe CSR could exacerbate limits to arbitrage because of increased information uncertainty, transaction costs, and idiosyncratic risk. It is indeed possible that CSR could in fact generate noise in financial markets. It will be the case if CSR happens to be not systematically related to firms' fundamentals but instead be associated with social and institutional dynamics unrelated to fundamentals. Arguably, CSR definitions are malleable and highly variable. Some see CSR as mere philanthropy while others consider socially responsible firms as eco-friendly firms that try to reduce their harmful impact upon ecosystems or the environment. CSR may be perceived as activities with local communities or initiatives aimed at improving employee welfare. This translates a theoretical uncertainty an ambiguity surrounding the concept of CSR. Further, the question of whether CSR benefits or hurts firms is still open (Margolis *et al*., 2009). CSR disclosure is still voluntary in many countries and is not subject to sanctions and effective controls, which makes it subject to manipulations and opportunistic behavior (Laufer, 2003). From this point of view, CSR signals may not be relevant and be difficult to interpret, making it harder for investors to assess its implications. As such, the ambiguity surrounding the concept of CSR may generate noise in financial markets, thereby increasing investors' psychological biases. Many studies on behavioral finance (e.g, Hirshleifer *et al*., 2004) demonstrate that strong psychological biases amplify information uncertainty

10. It is easier for short-sellers to borrow shares of stocks that feature a high degree of institutional ownership.

that prevent arbitrageurs from exploiting mispricing opportunities. Baker and Wurgler (2007) suggest that the hard-to-value stocks, which are more influenced by sentiment, tend to be harder to arbitrage. From this perspective, CSR could not only increase stock mispricing, but also prevent arbitrageurs from exploiting market inefficiencies.

CSR companies could be harder to arbitrage if CSR engagement increases the variability of future firm performance and the uncertainty to which the business fortune is subjected. As suggested by Friedman (1970), CSR firms are likely to be at a competitive disadvantage compared to firms with less or no CSR activities since they handle superior costs that could be avoided by a lower level of environmental and social investments (Barnett and Salomon, 2006). Friedman (1970) argues that CSR destroys shareholders value as it represents a misuse of valuable resources that would be better used on value-adding investment projects. According to Aupperle *et al*. (1985), CSR is a resource-consuming task and engaging in social initiatives should lead to a lower financial performance because of additional costs (Ullmann, 1985). For instance, the costs of being green could be superior to their economic benefits. Environmental expenditures such as pollution abatement and end-of-pipe technologies might place the firm at a vulnerable position because they are considered to be nonproductive investments, which would undermine financial performance (Lahouel *et al*., 2021). Various empirical studies support this view[11]. Bhandari and Javakhadze (2017) show that CSR reduces firm-level capital allocation efficiency since CSR requires valuable firm resources. Added costs generated by CSR initiatives may be value destroying and increase earnings volatility and consequently firm risk (Alexander and Buchholz, 1978). Becchetti *et al*. (2015) explore the link between CSR and idiosyncratic volatility. Their findings suggest that idiosyncratic volatility is positively correlated with CSR. Their main hypothesis is that CSR companies "*have reduced flexibility in responding to negative productivity shocks with a reduction of the well-being of* [...] *other stakeholders in order to maintain their target earnings* [...] *The consequence is that their earnings are less predictable or less likely to follow stock market dynamics common to the majority of non-CSR oriented companies*." (p.4).

Moreover, from an agency theory perspective, CSR may increase firm risk as it can be related to empire building tendencies. For example, managers may contribute corporate resources through high charitable contributions to achieve high social status and to gain with the approval of board members by contributing to their favorite causes or to further their own ideological preferences (Barnard, 1996). On the empirical side, Goss and Roberts (2011) find a positive relationship between CSR and firm risk due to managerial entrenchment. In order to appear as good citizens and create a "warm-glow" effect, managers tend to improve their CSR engagement at the expense of shareholders wealth (Barnea and Rubin, 2010). McCarthy *et al*. (2017) also propose that CSR can be used as a hedging tool by opportunistic managers to hide the negative impact of managerial decisions on firm value. If CSR engagement is aimed at improving managers' reputation at the expense of shareholders, it will decrease profitability and cause a rise in volatility (Utz, 2017).

Opportunistic managers may also use CSR strategically by engaging in real earnings management (Prior *et al*., 2008) which will increase market illiquidity and make arbitrage ineffective. Such behavior mitigates the reliability of the information provided by high CSR firms and increases the information asymmetry between investors and managers. As greater earnings management signals aggressive accounting practices, market operators may react by widening the bid-ask spreads in order to protect themselves, resulting in lower liquidity and higher transaction costs (Chung *et al*., 2009), which prevents arbitrageurs from exploiting mispricing opportunities. Following this second line of reasoning, CSR would be expected to be positively linked to information uncertainty, transaction costs, and idiosyncratic risk, pointing to a positive association between CSR and limits to arbitrage.

The nature of the impact of CSR on limits to arbitrage is therefore an empirical question. We address this question in the remainder of this paper.

Research design

Data and sample selection

Our goal is to test whether CSR reinforces or reduces limits to arbitrage. To do so, we retrieve firm financial data from Thomson Reuters Datastream and Factset[12]. CSR ratings data come from the Thomson Reuters (formerly Asset4) ESG database. Our sample consists of all companies listed in the S&P500 index. The sample period ranges from 2002 to 2020. This translates into an unbalanced panel dataset of 5,947 firm-year observations.

Corporate social responsibility measure

Following prior studies (e.g., Stellner *et al*., 2015), we proxy for CSR using the Thomson Reuters (formerly Asset4) ESG score. The Thomson Reuters ESG database covers around 7,000 companies around the world and is a particularly reliable data source because of its diverse sources and news coverage, and its frequent updates from different media sources. Trained research analysts collect about 900 evaluation points per firm based on objective and publicly available data such as annual reports, companies' websites, NGOs' websites, CSR reports, news sources and stock exchange filings to provide an objective, relevant, comprehensive and up to date ESG score. ESG scores are available since 2002 for approximately 1,000 US and European companies. The score is structured based on 178 company-level ESG measures, which have been carefully selected and considered to be relevant and comparable field to enhance the overall company scoring methodology. Those 178 company-level measures are then grouped into 10 categories. The category scores are aggregated into three principal pillar scores: environmental, social and corporate governance.

Limits to arbitrage measure

We follow Lam and Wei (2011) and use the nine most used limits-to-arbitrage measures. Detailed definitions of these limits-to-arbitrage measures are provided in Appendix A. We use three proxies of information uncertainty. Analyst coverage (COV), which is defined as the number of analysts following the firm, is our first measure. Hong *et al*. (2000) used analyst coverage as a proxy for the rate of information flow. Financial analysts represent the number of channels through which investors learn about the firm performance. They participate actively in the information distribution process and impact

11. See for example Bauer *et al*. (2005) and Brammer *et al*. (2006).

12. We used Factset database specifically to collect the institutional investors data.

investors decisions. Therefore, the higher analyst coverage is, the more investors will obtain accurate and relevant information for firm valuation and thus equity misevaluation will normally decrease (Li, 2020). Our second measure is the dispersion in analysts' earnings forecasts (DISP) which is widely used to proxy for the uncertainty about future earnings or the degree of consensus among different market participants (Zhang, 2006). According to Johnson (2004), it is also a proxy of unsystematic risk about firms' fundamentals. Johnson (2004) explains that the negative relationship between forecast dispersion and subsequent returns is supportive of a story in which costly arbitrage leads to mispricing when agents have different beliefs. Dispersion in analyst's forecasts is defined as the standard deviation of earnings-per-share forecasts divided by the closing stock price. Cash flow volatility (CFVOL) is the third measure of information uncertainty since it captures the volatility of firm fundamental value. As suggested by Zhang (2006), the two main sources of information uncertainty, i.e., the ambiguity with respect to the implications of new information on firm value, are the volatility of a firm's underlying fundamentals and poor information. Cash flow volatility is measured as the standard deviation of cash flow from operations. Dechow and Dichev (2002) show that accruals are more likely to occur in firms with high cash flow volatility. In addition, Zhang (2006) proves that the momentum anomaly is stronger when cash flow is more volatile.

We adopt five measures of transactions costs. The first measure is stock price (PRICE). Bhardwaj and Brooks (1992) show that round trip commissions and bid-ask spreads are inversely related to stock price. The second measure is the effective bid-ask spread (BIDASK), which is computed as two times the difference between the transaction price and the average of the bid price and the ask price divided by the transaction price. Liquid markets are characterized by narrow spreads, while illiquid markets exhibit wide spreads. Liquidity is a major determinant of arbitrageurs' activity because illiquid markets complicate the completion of trades and make arbitrage both riskier and costlier. BIDASK is used to measure *"the trading expenses for arbitrageurs who have to compensate dealers for making markets and providing liquidity"* (Lam and Wei, 2011, p.130). According to theory, mispricing persists since arbitrageurs are financially constrained (Shleifer and Vishny, 1997). Illiquidity reduces the profitability of arbitrage transactions and makes arbitrage less attractive. Arbitrageurs incur important losses when the asset becomes highly underpriced because *"to meet investor redemptions and satisfy margin requirements or leverage targets, arbitrageurs are forced to sell the asset"* (Hombert and Thesmar, 2014, p.26). In this situation, the lack of market liquidity following the lack of buyers—as all arbitrageurs are in the same positions—makes asset prices decrease further. The third measure of transactions costs is institutional ownership (IO), which represents the percentage of outstanding shares held by institutional investors. In the presence of short-sale constraints, stocks can become overpriced if some investors are too optimistic (Miller, 1977). First, short selling constraints depend on the actions of stockholders. Nagel (2005) explains that when a stock gets overpriced, sophisticated investors will sell it. However, the stock could become overpriced if the existing stockholders are not sufficiently sophisticated. Institutional investors are likely to be more sophisticated than individual investors, and as a result, short sales impediments tend to affect stocks which are owned—to a larger extent—by individual investors. Second, short selling may be costly. Nagel (2005) adds that, in order to short sell, an investor must pay to borrow shares from other investors who are willing to lend them. A lack of loan supply may generate significant fees for short sellers. D'avolio (2002) shows that institutional investors are the main suppliers of stock loans and low institutional ownership stocks are more expensive to borrow. The fourth measure is the Amihud illiquidity ratio (AMIH), which is defined as the average of daily absolute stock return to dollar volume ratios. Amihud (2002) defines illiquidity as reflecting *"the discount that a seller concedes or the premium that a buyer pays when executing a market order that results from adverse selection costs and inventory costs"* (p. 33). The final measure of transactions costs is trading volume (TVOLU), which is the number of shares traded multiplied by the stock price. Trading volume is a proxy for the inverse of indirect costs of trading as consistent with the literature (Bushman *et al*., 2004).

Finally, we use idiosyncratic volatility (IVOL) to proxy for arbitrage risk. We measure idiosyncratic volatility as the standard deviation of the residual values from the following Fama and French (1993) three-factor model, using monthly data:

$$R_{i,t} = \beta_0 + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ is the return of firm *i* in month *t*, SMB_t is the return of small minus big capitalizations and HLM_t is the return of high market-to-book ratio minus low market-to-book ratio. Idiosyncratic volatility represents a holding cost which creates an impediment that decreases the ability of arbitrageurs to trade against mispricing (Pontiff, 2006). Pontiff (2006) explains that holding costs[13] will lead to losses if the mispricing does not dissipate quickly enough. In the same context, Cao and Han (2016) add that arbitrage involves risk if the rational investors are not able to perfectly hedge the fundamental value. Non-hedgeable fundamental risk imposes a cost. Therefore, they need to make a tradeoff between the expected profit from an arbitrage position and its idiosyncratic risk. Similarly, the empirical evidence of Stambaugh *et al*. (2015) shows that high volatility stocks are more likely to be overpriced.

We then construct a score which is a composite rank based on the nine limits to arbitrage following the approach introduced by Stambaugh *et al*. (2015) to construct their score of mispricing. All limits to arbitrage are combined to produce a single measure. For each limit to arbitrage, we attribute a rank to each stock reflecting the ranking of the limit to arbitrage variable. Stocks with the highest composite ranking are qualified as "harder to arbitrage" while stocks with the lowest ranking are qualified as "easier to arbitrage". The composite rank is then the arithmetic average of its ranking percentile for each of the 9 limits to arbitrage.

Empirical models

To examine the impact of CSR on limits to arbitrage, we run the following regression:

$$LTA_{i,t} = \beta_0 + \beta_1 CSR_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $LTA_{i,t}$, is our dependent variable measured as the composite rank based on the nine limits to arbitrage previously introduced. Our main independent variable is the

13. Based on a survey of empirical findings in the literature, Pontiff (2006) concludes that *"A common theme that unifies this literature is that the primary source of arbitrage costs occurs from holding costs, and in particular, idiosyncratic risk. All of the above papers that simultaneously estimate the impact of idiosyncratic risk and transaction costs on mispricing, find that the impact of idiosyncratic risk on mispricing dwarfs the impact of transaction costs on mispricing."*

CSR score. $X_{i,t}$ is a set of control variables documented in the literature and that have been shown to be related to limits to arbitrage.

Further, given that CSR is a complex multidimensional construct, the impacts of CSR dimensions may differ from its overall effect (Galema *et al*., 2008). Social performance aspects in terms of customer satisfaction and employee welfare might have a more direct influence on limits to arbitrage —because of their direct impact on company success— than environmental protection aspects such as green technologies and pollution prevention. Moreover, there are significant differences in investors opinions and how they perceive and assess the relevance of each CSR dimension for business activity, leading to different market reactions to CSR aspects. The differing relevance may be also due to different levels of measurability. Social, environmental and governance dimensions are incorporated in firm's fundamental value differently as not all the information is quantifiable, and they don't have the same impact on financial performance. For that reason, we test the impact of the social, environmental and governance individual scores on limits to arbitrage by running the three following regressions:

$$LTA_{i,t} = \beta_0 + \beta_1 SOC_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$LTA_{i,t} = \beta_0 + \beta_1 ENV_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$LTA_{i,t} = \beta_0 + \beta_1 GOV + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (5)$$

Appendix B provides the definitions of the control variables we include i $X_{i,t}$. Firm size (SIZE) is our first control variable. Small firm size results in higher transactions costs, which make arbitrage harder. Zhang (2006) uses firm size as a proxy for information uncertainty. Large firms are more diversified and disclose more information to the market than small firms. Small firms may also have fewer stakeholders such as customers, suppliers, or shareholders, and are not able to bear high disclosure costs.

Second, we control for firm age (AGE) which is similarly used by Zhang (2006) as a measure of information uncertainty. Firms with a long history tend to have more information available in the financial markets as suggested by Barry and Brown (1985).

We further control for volatility (VOLA). According to Baker and Wurgler (2006), volatile stocks are harder to value, and arbitrage tends to be especially risky and costly for those stocks. High volatility makes arbitrage less attractive and volatile stocks exhibit greater mispricing (Shleifer and Vishny, 1997). When exposed to volatility, arbitrageurs bear the risk of losses and the need to liquidate the portfolio under pressure.

Our fourth control variable is trading volume (VOLU). The trading volume should increase liquidity and then help mitigate arbitrage costs, which prevent arbitrageurs from causing convergence of prices to their fundamental values. Lam and Wei (2011) argue that illiquidity makes arbitrage opportunities more difficult to exploit. By reducing the profitability of arbitrage trades, illiquidity costs constitute a significant barrier for arbitrageurs seeking to exploit mispricing.

Our next control variable is price momentum (MOM). The momentum anomaly is stronger when information is more uncertain. In fact, Zhang (2006) shows that price momentum is more pronounced for firms with less analyst coverage and more volatile cash flows. Verardo (2009) shows that price momentum is significantly larger for portfolios characterized by higher heterogeneity of beliefs. Consequently, when noise traders provide profits opportunities or when arbitrage capital is scarce and few traders compete, momentum profits will be higher.

We also control for the Book-to-Market ratio (BTM). The Book-To-Market anomaly is due to systematic biases in investors' expectations who tend to underestimate future earnings of firms with high BTM ratios and overestimate future earnings of low BTM firms. The BTM anomaly persists since arbitrage is risky and costly, and arbitrage costs may exceed arbitrage benefits. Shleifer and Vishny (1997) argue that arbitrage returns volatility is likely to be an important reason why the BTM anomaly exists. Consistent with the mispricing explanation, Ali *et al*. (2003) find that the BTM effect is greater for stocks with high volatility, high transactions costs and stocks with less institutional investor ownership.

Our last control variable is firm-level investor sentiment (FLIS). Behavioral finance suggests that investors rely on psychological biases, heuristics, computational shortcuts, frame dependence and intuition when making investment decisions in a complicated world with market frictions (Kahneman *et al*., 1982). Investor sentiment leads prices to deviate from their intrinsic value because they reflect changes not related to market fundamentalsand such mispricing can persist if there are limits to arbitrage (Barberis *et al*., 1998). Finally, we include sector controls based on 2-digit SIC industry codes.

Main findings

Descriptive statistics and correlations

Table 1 reports summary statistics for our sample variables. The average value of the limits-to-arbitrage score (LTA) is 121,746 with a minimum value of 2,667 and a maximum value of 322,778. The CSR score varies from 0.927 to 96,737 with a mean value of 52,777. Our sample includes firms of varying sizes in terms of market capitalization with a mean log market value of 9,535. The mean firm age is 60,217. Average volatility is 0.079, while the average of log trading volume is 17,809 with a minimum of 9,022 and maximum of 22,391. The average firm in our sample has a momentum of 4,827, a BTM ratio of 0.402 and a firm-level investor sentiment score of 0.517.

Table 2 presents the sample distribution by year and industry. The sample distribution by industry shows that the manufacturing industry constitutes the largest part of the sample, accounting for 38.83%. Then, we find the Finance, Insurance and Real Estate industry with 1,017 observations or 17.10% of our sample. Finally, the construction sector is the least represented in our sample with only 96 observations (1.62% of our sample).

We report Person correlation coefficients in Table 3. All correlation coefficients among control variables are lower than 50%, mitigating potential multicollinearity concerns. Furthermore, we compute variance inflation factors (VIFs). As shown in Table 1, VIFs do not exceed 2 for all the variables, confirming the likely absence of multicollinearity. Correlations among CSR variables are high, which means that companies tend to perform similarly in all CSR dimensions.

TABLE 1

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Q1	MEDIAN	Q3	Max	VIF
LTA	7,102	121..746	60.644	2.667	75.444	117.889	164	322.778	-
CSR	7,596	52..777	19,191	0.927	38,373	53,315	67,633	96,737	1.44
SOC	9,476	41.409	28.794	0	17.060	42.950	64.960	97.950	1.75
ENV	8,027	48,884	24,766	0	30,820	50,280	68,040	97,950	1 .46
GOV	8,028	52,038	24,615	0	35,155	55,005	71,680	99,550	1.11
SIZE	8,461	9,535	1,256	2,868	8,739	9,490	10,281	14,619	1.62
AGE	9,500	60,217	49,822	0	21	43	97	229	1.07
VOLA	8,185	0.079	0.048	0	0.050	0.067	0.093	0.684	1.17
VOLU	8,592	17,809	1,381	9,022	16,990	17,881	18,685	22,391	1.22
MOM	8,777	4,827	14,481	-34,699	-1,062	2,780	9,224	68,812	1.32
BTM	8,398	0.402	0.293	-0.087	0.199	0.339	0.543	1,515	1.16
FLIS	7,118	0.517	0.228	0.054	0.351	0.469	0.641	1,752	1.04

This table presents descriptive statistics for our sample variables. LTA is the limits to arbitrage score computed based on nine limits to arbitrage following Lam and Wei (2011). We proxy for CSR using the Thomson Reuters (formerly Asset4) ESG score. See Appendix B for control variables definitions. The table also reports variance inflation factors (VIFs).

TABLE 2

Sample distribution by Year and Industry Year

Year	N	Industry	N
2002	151	Mining	194
2003	179	Construction	96
2004	220	Manufacturing	2,309
2005	256	Transportation, Communications, Electric, Gas and Sanitary Service	821
2006	255	Wholesale Trade	145
2007	272	Retail Trade	528
2008	295	Finance, Insurance and Real Estate	1,017
2009	322	Services	837
2010	331		
2011	339		
2012	339		
2013	347		
2014	358		
2015	388		
2016	397		
2017	394		
2018	396		
2019	398		
2020	310		
Total	**5,947**	**Total**	**5,947**

This table reports the sample distribution by year and industry.

TABLE 3

Correlations

	CSR	SOC	ENV	GOV	SIZE	AGE	VOLA	VOLU	MOM	BTM	FLIS
CSR	1,000										
SOC	**0.938**	1.000									
ENV	**0.939**	**1,000**	1,000								
GOV	**0.705**	**0.555**	**0.555**	1,000							
SIZE	**0.476**	**0.605**	**0.491**	**0.245**	1,000						
AGE	**0.209**	**0.255**	**0.170**	**0.131**	**0.198**	1,000					
VOLA	**-0.102**	**-0.182**	**-0.093**	**-0.088**	**-0.307**	**-0.145**	1.000				
VOLU	**-0.114**	**-0.110**	**-0.109**	**-0.070**	**0.106**	0.015	**0.105**	1,000			
MOM	0.016	**0.080**	**0.059**	**0.023**	**0.226**	**-0.062**	**-0.297**	**-0.226**	1,000		
BTM	**-0.023**	-0.020	**-0.044**	**0.043**	**-0.138**	**0.087**	**0.129**	**0.143**	**-0.300**	1,000	
FLIS	**-0.101**	**-0.148**	**-0.097**	**-0.054**	**-0.146**	**-0.032**	**0.129**	**0.120**	**-0.122**	**0.064**	1,000

This table presents correlations for our sample variables. See Appendix B for variables definitions. Bold denotes significance at the 5% level or lower.

Preliminary analysis

To examine the relationship between CSR and limits to arbitrage, we conduct a double-sorted portfolio analysis by constructing two portfolios based on CSR score (Low CSR and High CSR), forming two categories. The first category contains firms whose CSR score is less than the median while the second category comprises firms whose CSR score is higher than the median. Then, we sort independently by each limit to arbitrage proxy (PRICE, BIDASK, IO, AMIH, TVOLU, COV, DISP, CFVOL, IVOL), again forming two categories. We next construct four portfolios for each limit to arbitrage measure defined by the intersection of this 2X2 sort and we compute the average value of each of our limits to arbitrage measure within each portfolio in Table 3.

Most of the average values for the bid-ask spread, the Amihud illiquidity ratio, the dispersion in analyst forecasts, the cash flow volatility and the idiosyncratic volatility, which are all positively related to the limits-to-arbitrage score, are higher for the firms that have a CSR score higher than the median. High CSR firms thus seem to exhibit a higher degree of limits to arbitrage than low CSR firms. Most of the average values for stock price, institutional ownership, trading volume and analyst coverage, which are inversely related to limits to arbitrage, are lower for high CSR firms. This supports the hypothesis according to which high CSR firms have a higher degree of limits to arbitrage than low CSR firms. The results are statistically significant for all measures of limits to arbitrage.

This double-sorted portfolio analysis thus gives preliminary evidence that arbitrage is riskier for high CSR firms than for low CSR firms. In the next section, we conduct further analyses to test whether the positive relationship between CSR and limits to arbitrage holds in a multivariate framework.

TABLE 4

Arbitrage limits measures in low CSR firms versus high CSR firms: Independently double-sorted portfolios

	LOW CSR	HIGH CSR	Difference
LOW COV	10,228	13,084	2,856***
HIGH COV	24,444	22,513	-1,931***
LOW DISP	0.015	0.022	0.007***
HIGH DISP	0.183	0.178	-0.005***
LOW CFVOL	277,339.165	817,605.720	540,266.555***
HIGH CFVOL	2, 218,167.977	7, 834,202.486	5,616,034.509***
LOW PRICE	23,790	31,951	8,161***
HIGH PRICE	132,814	97,716	-35,098***
LOW BID-ASK	-0.007	-0.004	0.003***
HIGH BID-ASK	0.028	0.019	-0.009***
LOW IO	75,411	70,624	-4,787***
HIGH IO	94,660	90,901	-3,759***
LOW AMIH	0.004	0.004	0.000***
HIGH AMIH	0.063	0.152	0.089***
LOW TVOLU	25,723,469.852	17,099,717.304	-8,623,752.548***
HIGH TVOLU	248,075,903.793	251,897,052.257	3,821,148.464***
LOW IVOL	0.035	0.032	-0.003***
HIGH IVOL	0.067	0.082	0.015***

This Table reports the average of each arbitrage limit (PRICE, BID-ASK, IO, AMIH, TVOLU, COV, DISP, CFVOL, IVOL) score within low and high CSR portfolios. The two portfolios are formed by sorting on CSR and then on each limit to arbitrage measure. The first group represents firms with CSR scores below the median and the second group represents firms with CSR scores above the median. T-test for equal means are reported. ***, ** and * indicate statistical significance of the means at the 1, 5 and 10% levels, respectively.

CSR and limits to arbitrage

Table 5 reports the results of our multivariate regression analysis. As can be seen, the coefficient on the CSR aggregated score (0.050) is positive and statistically significant at the 5% level, indicating that CSR is positively related to limits to arbitrage. Moreover, the relationships between the social (Panel B) and environmental (Panel C) pillars and limits to arbitrage remain statistically significant. However, the coefficient on the governance pillar (Panel D) is positive but not significant. Our finding are thus attributable to two specific aspects of CSR confirming that social and environmental dimensions are harder to incorporate in firm's fundamental value, while governance aspects are more directly related to firm fundamentals. Further, the fixed-effect regression results continue to support a positive association between CSR and limits to arbitrage with a statistically significant (at the 5% level) coefficient of 0.046 (Panel E), suggesting that CSR contributes to corporate misevaluation. Arguably, investors who trade rationally or irrationally on CSR noise generate mispricing because not all market information about CSR actions is equal in terms of information value. In other terms, CSR information is not completely related to economic fundamentals and some part of it simply reflects social dynamics and institutional forces unrelated to fundamental economic variables. The more investors rely on CSR information in their investment decision-making, the more stock prices deviate from their intrinsic values. On top of that, according to behavioral finance theory, investors psychological biases increase information uncertainty that prevent arbitrageurs from exploiting mispricing opportunities. Thus, socially responsible companies appear to be harder to arbitrage. We can presume that CSR may induce added costs resulting in a reduction in firm value (Bauer *et al.*, 2005; Brammer *et al.*, 2006), increased earnings volatility (Alexander and Buchholz, 1978) and increased firm idiosyncratic risk (Becchetti *et al.*, 2015), which will in turn amplify information uncertainty. Additionally, CSR engagement may lead opportunistic managers to engage in earnings management practices resulting in poor information quality. Such behavior would mitigate the reliability of the information provided by high CSR firms and increase the information asymmetry between investors and managers. Insofar as greater earnings management signals aggressive accounting practices, investors will tend to widen the bid-ask spreads in order to protect themselves, resulting in lower liquidity and higher transactions costs. Regarding the ambiguity of the CSR concept and the role of CSR in lowering stock liquidity and increasing firm risk, socially responsible firms may therefore exhibit a higher degree of information uncertainty, greater transactions costs and a higher degree of arbitrage risk. If CSR makes arbitrage harder and riskier, as our results suggest, mispricing will persist in stock markets and prices will not necessarily converge to fundamental values. By slowing the process of correcting mispricing, CSR may constitute an additional arbitrage impediment, increase market inefficiencies and create inadequacies in asset pricing models.

In our model, we control for other potential factors influencing limits to arbitrage. All our control variables coefficients are statistically significant at the 1% level except age which is not significant. Results show that size is negatively related to limits to arbitrage as predicted by the literature. Smaller firm size results in higher transactions costs, which increases arbitrage impediments. Similar to Baker and Wurgler (2006), we find that volatility is positively related to limits to arbitrage. More volatile stocks are harder to value, and arbitrage tends to be especially risky and costly for those stocks. Market liquidity as proxied by trading volume has a negative impact on limits to arbitrage as evidenced by previous studies. Illiquidity costs constitute a significant barrier for arbitrageurs seeking to exploit mispricing. Momentum is positively related to our dependent variable, which confirms the argument according to which information uncertainty makes arbitrageurs rely more on momentum strategies. The positive coefficient on BTM is consistent with the findings of Ali *et al.* (2003) who suggest that the BTM effect is greater for stocks with high volatility, high transactions costs and stocks with less institutional investors. Finally, investor sentiment has a positive effect on limits to arbitrage. Our results line up with behavioral finance theory, which argues that mispricing appears due to the irrationality of investors and persists due to arbitrage limits that deter arbitrageurs from exploiting mispricing opportunities.

TABLE 5

Regression analysis of the effect of CSR on limits to arbitrage

	PANEL A OLS LTA	PANEL B OLS LTA	PANEL C OLS LTA	PANEL D OLS LTA	PANEL E FIXED EFFECT LTA
CSR	0.050**				0.046**
	(2.51)				-2.3
SOC		0.028*			
		(1.85)			
ENV			0.042**		
			(2.41)		
GOV				0.018	
				(1.37)	
SIZE	-1,099***	-1,075***	-1,102***	-1,087***	-11,298***
	(-20.35)	(-23.96)	(-20.35)	(-20.20)	(-20.69)
AGE	-0.084	-0.082	-0.084	-0.082	0.561
	(-1.41)	(-1.37)	(-1.41)	(-1.36)	(0.97)
VOLA	2.955***	2.885***	2.952***	2.958***	29.627***
	(41.22)	(43.13)	-(1.17)	-(1.25)	(41.36)
VOLU	-0.790***	-0.812***	-0.795***	-0.785***	-8,830***
	(-8.22)	(-8.79)	(-8.27)	(-8.16)	(-8.70)
MOM	0.033***	0.031***	0.033***	0.033***	0.034***
	(3.75)	(3.61)	(3.73)	(3.77)	(3.89)
BTM	0.919***	0.871***	0.919***	0.915***	9,059***
	(8.14)	(8.10)	(8.13)	(8.10)	(8.02)
FLIS	0.785***	0.865***	0.783***	0.782***	7,818***
	(7.71)	(8.96)	(7.69)	(7.68)	(7.70)
YEAR DUMMY	Yes	Yes	Yes	Yes	Yes
INDUSTRY DUMMY	Yes	Yes	Yes	Yes	
N	5,947	6,489	5,946	5,947	5,947
R^2	0.427	0.419	0.427	0.427	0.427

This table displays the OLS regression analysis of the effect of CSR aggregated score on limits to arbitrage for the 9,538 firm-year observations over the 2002–2020 period. The dependent variable is LTA. The variables of interest are CSR in panel A, SOC in Panel B, ENV in Panel C and GOV in Panel D. This table displays as well Fixed-Effect regression results in Panel E. Robust t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Limits to arbitrage components

Since our measure of limits to arbitrage is a composite rank of many proxies, we attempt to test the relationship between CSR performance and each component of limits to arbitrage. Specifically, we attempt in this section to assess whether CSR 1) mitigates the variability of future cashflows and the uncertainty surrounding firm value, 2) comes with high or low corporate disclosure which influences market liquidity and trading volume and 3) results in more stable financial performance which lowers firm idiosyncratic risk. To do so we use the same methodology we used to construct our limits to arbitrage index and compute a single index of information uncertainty (IU) and transaction costs (TC). We construct a score which is a composite rank based on the measures of each component of limits to arbitrage. All the proxies are then combined to produce a single measure. For each limit-to-arbitrage component, we attribute a rank to each stock reflecting the ranking of the limit-to-arbitrage component variable. Stocks with the highest composite ranking are qualified respectively as "stocks with high information uncertainty" and "stocks with higher transaction costs". Regarding the third limit to arbitrage, we directly use take idiosyncratic risk as our measure of arbitrage risk (AR). Thus, we perform the following regressions:

$$IU_{i,t} = \beta_0 + \beta_1 CSR_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$TC_{i,t} = \beta_0 + \beta_1 CSR_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$AR_{i,t} = \beta_0 + \beta_1 CSR + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (8)$$

IU is our information uncertainty index computed based on its three measures, namely COV, DISP and CFVOL. TC is the transactions costs score computed using the five measures of market liquidity (PRICE, BIDASK, IO, AMIH and TVOLU). Finally, AR represents arbitrage risk measured by idiosyncratic volatility. Our main independent variable is the CSR score. is a set of control variables documented in the literature that have been shown to be related to limits to arbitrage components.

Our results are presented in Table 6. As shown in Panel A, B and C, for information uncertainty, transaction costs and arbitrage risk, the coefficient on CSR is significantly positive at the 1% level, indicating that CSR positively impacts each component of limits to arbitrage. These results add consistency to our main regression analysis and suggest that CSR amplifies the uncertainty surrounding firm value, reduces market liquidity and increases firm specific risk, making arbitrage harder and riskier.

Endogeneity

In this section, we check for potential endogeneity issues. Unobservable factors may simultaneously affect both CSR and limits to arbitrage. To address such concern, we apply the instrumental variable approach by using two-stage least square regression (2SLS) and Dynamic Generalized Method of Moments (GMM).

Two-stage least square (2sls) Regressions

Obviously, we cannot deny the possibility that some omitted variables drive the positive relationship between CSR performance and limits to arbitrage. To alleviate this concern, we consider the instrumental variable (IV) estimation approach. As explained by Moffitt (1999), the IV method consists in identifying the appropriate variable (or variables) that influences the first-stage CSR variable, but which is uncorrelated with the error term in the second-stage regression. We adopt the industry-year mean CSR score as our instrumental variable in the spirit of Arouri *et al.* (2019). We expect industry-year mean CSR to be uncorrelated with the firm-specific error terms and a company's limits to arbitrage but correlated with the CSR scores of the company. Arguably, CSR is subject to industrial influence. The cluster effect manifests itself, as individual companies tend to demonstrate strong CSR performance when the average CSR rating in an industry is high (Cao *et al.*, 2019). The relevance and the exogeneity of the instrument variable are tested for the models and reported in the endogeneity results table.

TABLE 6
Limits to arbitrage components

	PANEL A IU	PANEL B TC	PANEL C AR
CSR	0.096*** (3.05)	0.169*** (8.28)	0.566*** (5.94)
SIZE	0.452*** (5.25)	-1,694*** (-30.05)	-0.318 (-1.53)
AGE	-0.013 (-0.18)	0.754*** (12.19)	-0.221*** (-3.98)
VOLA	1.734* (1.77)	-1.695*** (-2.71)	1.182*** (36.950)
VOLU	-0.305*** (-5.24)	-0.498*** (-12.13)	-0.416 (-0.32)
MOM	0.044*** (2.93)	0.008 (0.85)	0.111** (2.28)
BTM	1,547*** (8.55)	0.575*** (4.92)	2,346 (0.42)
FLIS	-0.568 (-0.35)	-0.442*** (-4.30)	-1,927 (-0.35)
YEAR DUMMY	Yes	Yes	Yes
INDUSTRY DUMMY	Yes	Yes	Yes
N	6,255	6,116	6,393
R^2	0.164	0.243	0.374

This table displays the OLS regression analysis of the effect of CSR aggregated score on each component of limits to arbitrage for the 9,538 firm-year observations over the 2002–2020 period. The dependent variables are respectively, information uncertainty (IU), transaction costs (TC) and arbitrage risk (AR) in panel A, B and C. Robust t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

We conduct the following two-stage least square analysis (2sls):

First-stage:

$$CSR_{i,t} = \beta_0 + \beta_1 MEAN\_CSR + \sum_{j=2}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (9)$$

Second-stage:

$$LTA_{i,t} = \gamma_0 + \gamma_1 \widehat{CSR} + \sum_{j=2}^{n} \gamma_j X_{i,t} + \varepsilon_{i,t} \quad (10)$$

In the first-stage, we regress CSR on our instrument variable which is the industry-year mean CSR score. In the second-stage, we use the predicted values estimated from the first-stage and run our regression. A first-stage F test is performed to confirm the choice of our instrument. Table 7 shows the results of both first-stage and second-stage 2sls model. The coefficient of our instrumental variable, industry-year mean CSR score, is statically significant at the 1% level. In the second-stage model, we find a positive and significant coefficient of the predicted CSR on limits to arbitrage equals to 0.693 (p value = 0.005). Furthermore, the F-statistics of the first-stage regression is larger than 10 (215,120), which means that our instrumental variable satisfies the strength requirement and the Kleibergen-Paap rk LM-statistic is also significant at 1% level (p value= 0.000) suggesting our industry-year mean CSR is well identified.

GMM System Dynamic Model

As discussed above, there might exist an endogenous relationship between CSR performance and limits to arbitrage. To further alleviate endogeneity concerns, we use the Dynamic Panel System Generalized Method of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). Specifically, we employ the two-step GMM system. The GMM technique enables us to use lags of our dependent variable as explanatory variables and fixed effects to account for the dynamic relationship between CSR and limits to arbitrage and time-invariant unobservable heterogeneity, respectively. In GMM model, endogenous variables are classified as the instrumented variables and all the exogenous explanatory variables are grouped into the instrument variable group. To determine if the equation has used enough variables to measure the difference, we run Hansen and Sargan overidentifying restrictions tests, with the null hypothesis that all the instruments are exogenous, to confirm the validity of our instruments. In addition, we present the serial correlation test to make sure that the error terms of the differenced equation are not serially correlated. Therefore, we estimate the following GMM model:

$$LTA_{i,t} = \lambda_0 + \lambda_1 CSR_{i,t} + \sum_{j=2}^{n} \lambda_j X_{i,t} + \varkappa_1 LTA_{i,t-1} + \varkappa_2 LTA_{i,t-2} + \eta_i + \varepsilon_{i,t} \quad (11)$$

We report the results of one-step and two-step GMM systems in Table 6. Results confirm that the positive association between CSR performance and limits to arbitrage persists after controlling for endogeneity using GMM techniques. The first-order and second-order serial correlation tests show that AR(1) is serially correlated. Hansen and Sargan overidentification test confirm that our instrumental variable is valid, and therefore uncorrelated with the error term.

Robustness checks

Alternative measure of limits to arbitrage

In this section, we check the robustness of our results by using an alternative measure of limits to arbitrage. We construct an additional index for limits to arbitrage from principal component analysis (PCA) based on our nine limits-to-arbitrage proxies. Proxies are constructed in such a way that a higher value corresponds to a higher degree of limits to arbitrage. Specifically, we use the reciprocals of stock price, analyst coverage, trading volume and institutional ownership since they are inversely related to limits to arbitrage. Stocks with the highest score are qualified as "stocks with more limits to arbitrage" and stocks with the lowest score are qualified as "stocks with less limits to arbitrage." To test whether our results are robust to using this alternative measure of limits to arbitrage, we estimate the following model:

$$LTA\_2_{i,t} = \beta_0 + \beta_1 CSR_{i,t} + \sum_{j=1}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (12)$$

We further examine whether our findings hold when using CSR pillars through the following regressions:

$$LTA\_2_{i,t} = \beta_0 + \beta_1 SOC_{i,t} + \sum_{j=1}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (13)$$

$$LTA\_2_{i,t} = \beta_0 + \beta_1 ENV_{i,t} + \sum_{j=1}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (14)$$

$$LTA\_2_{i,t} = \beta_0 + \beta_1 GOV_{i,t} + \sum_{j=1}^{n} \beta_j X_{i,t} + \varepsilon_{i,t} \quad (15)$$

TABLE 7

Regression analysis to address endogeneity concerns

	PANEL A: 2SLS		PANEL B: GMM	
	First-Stage CSRG	Second-stage LTA	One-step system LTA	Two-step system LTA
CSR			0.092*** (3.01)	0.096*** (2.65)
MEAN_CSR	0.319*** (14.67)			
Instrumented CSR		0.693*** (2.79)		
SIZE	8,721*** (36.39)	-11,039*** (-4.23)	-0.430*** (-3.31)	-0.231 (-1.52)
AGE	0.042*** (9.45)	-0.182*** (-8.93)	-0.027 (-1.54)	0.003 (0.17)
BTM	3,787*** (3.28)	16,048*** (4.15)	0.019* (1.75)	0.006 (0.45)
VOLU	-1,577*** (-7.79)	-3,639*** (-3.40)	0.001 (0.16)	0.014 (1.64)
VOLA	13.639** (2.38)	79.114*** (3.43)	0.155*** (8.41)	0.115*** (5.55)
MOM	-0.047*** (-3.79)	0.100*** (3.26)	0.007 (1.26)	0.002 (0.39)
FLIS	-2,428** (-2.52)	2,398 (0.70)	0.032*** (2.95)	0.030** (2.06)
LTA_{t-1}			0.383*** (8.67)	0.412*** (8.75)
LTA_{t-2}			0.219*** (5.74)	0.271*** (6.19)
_cons	-1,010 (-0.20)	262,822*** (14.95)	3,031*** (6.16)	1,696
Observations	5,646	5,646	3,675	3,675
Industry and Year fixed effect	Yes	Yes		
Adjusted R^2		0,151		
Weak Identification test (F-statistics)	215.120 ***	215,116***		
Under identification test (LM-Statistics)	203.620 ***	203,615***		
AR(1) (p value)			0.000	0.000
AR(2) (p value)			0.380	0.683
Sargan test overidentification (p value)			0.329	0.329
Hansen test overidentification (p value)			0.735	0.735

This table presents the analysis to address endogeneity concerns on the effect of CSR performance limits to arbitrage. Panel A displays the two-stage least square estimation and Panel B presents the dynamic panel system GMM regressions for the sample over 2002–2020. The dependent variable is limits to arbitrage score LTA and the variable of interest is CSR score. Regarding the 2sls estimation, in the first-stage, we regress CSR score on our instrumental variable which is the Industry-year mean CSR (CSR_MEAN). A value of the F test of weak identification smaller than 10 indicates the presence of a weak instrument. Kleibergen-Paap rank LM statistic test for under identification tests the null hypothesis that the instruments have insufficient explanatory power to predict the endogenous variable(s) in the model for identification of the parameters. For the GMM system, we present the first-order AR(1) and the second-order AR(2) serial correlation tests under the null hypothesis of no serial correlation. The Sargan and Hansen tests of overidentification are tests with the joint null hypothesis that the instrumental variables are valid, i.e., not correlated with the error term. Robust t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

The results reported in Table 8 show that the positive impact of CSR on limits to arbitrage holds when using our alternative measure of limits to arbitrage. We find a positive and statistically significant coefficient on the aggregated CSR, social and environmental scores with our new measure of limits to arbitrage. The governance coefficient is not significant with our alternative measure of limits to arbitrage as we found in our principal analysis. Regarding our control variables, they exhibit the same relationship as with our previous measure of limits to arbitrage.

TABLE 8

Robustness test: Alternative measure of limits to arbitrage

	PANEL A LTA_2	PANEL B LTA_2	PANEL C LTA_2	PANEL D LTA_2
CSR	0.001*** (3.60)			
SOC		0.002*** (5.15)		
ENV			0.001*** (3.89)	
GOV				0.000 (1.26)
SIZE	-0.329*** (34.76)	-0.422*** (42.59)	-0.330*** (-34.47)	-0.323*** (-34.67)
AGE	0.000 (0.16)	0.000 (0.49)	0.000 (0.13)	0.000 (0.41)
BTM	0.252*** (11.15)	0.214*** (8.40)	0.252*** (11.14)	0.252*** (11.15)
VOLU	0.273*** (23.68)	0.318*** (24.24)	0.272*** (23.61)	0.275*** (23.92)
VOLA	0.848*** (6.03)	1.009*** (6.79)	0.841*** (5.98)	0.859*** (6.11)
MOM	0.002*** (10.91)	0.003*** (12.15)	0.002*** (10.90)	0.002*** (10.86)
FLIS	-0.045** (-2.10)	-0.063** (-2.56)	-0.046** (-2.14)	-0.047** (-2.15)
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
N	5,988	6,539	5,987	5,988
R^2	0.476	0.486	0.476	0.474

This table presents the analysis using alternative measure of limits to arbitrage based on the principal component analysis of nine limits to arbitrage proxies. Panel A reports the results of the effect of CSR on our alternative measure of limits to arbitrage. Panel B, C and D present respectively the effect of social, environmental and governance scores on limits to arbitrage. Robust t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Conclusion

In this paper, we relate CSR to limits to arbitrage. A large body of research has examined the impact of CSR on various financial outcomes. While results are ambiguous, there are two lines of thought that lead to opposite predictions regarding the relationship between CSR and limits to arbitrage. On the one hand, the value maximization and risk mitigation views relate CSR to a strong and stable financial performance, a more favorable risk profile and a higher transparency, which can enhance arbitrage activity. On the other hand, the shareholder expense view, the agency perspective and the overinvestment view suggest CSR to be a costly engagement that increases the variability of future earnings, idiosyncratic risk and transactions costs, which in turn may deter arbitrageurs from exploiting arbitrage opportunities.

We empirically examine this question by using a sample of 5,947 firm-year observations over the 2002–2020 period. We find that CSR increases limits to arbitrage, arguably by creating ambiguity in investors' opinions, which drives high information uncertainty. Our results are confirmed while using social and environmental dimensions, when testing separately the impact of CSR on each limit-to-arbitrage component, and after addressing endogeneity concerns using 2SLS and dynamic GMM methods. They are also robust to using an alternative measure of limits to arbitrage. Overall, our results suggest that a better CSR performance may be associated with a higher degree of mispricing. CSR can thus be perceived as an arbitrage impediment that deters arbitrageurs from exploiting mispricing opportunities, leading to market inefficiency.

Our study has interesting practical implications. To the extent that CSR may complicate stock price discovery, a case could be made for regulators to homogenize CSR reporting. Increased homogeneity of CSR information could reduce the divergence of opinions among investors and help them have a clearer vision of CSR and its financial implications. As for accounting standards, standardization of the information disclosed in extra financial reports could potentially mitigate the discretionary power of opportunistic managers and improve information quality, leading to higher stock liquidity and lower transaction costs.

Obviously, our research has some limitations, which offer avenues for further research. First, we have used CSR scores provided by Thomson Reuters Asset4, and thus our results depend on these ratings. Moreover, our sample is constrained by the availability of these scores which remain—to some extent—subjective despite a scoring methodology defined to ensure objectivity (Chatterji and Levine, 2006). Consequently, it could be judicious to conduct further studies by relying on different CSR ratings to check if alternative measures of CSR do not lead to different results.

Also, in our work we rely on a specific sample that includes only American firms. It could be interesting to take a worldwide perspective and examine the relationship between CSR and limits to arbitrage on an international sample to bring more general conclusions about our research question. In addition, because the S&P 500 index is a basket of large capitalizations, we cannot be sure our results would be the same if we focused on smaller firms. As such, it would be interesting to extend our work to small capitalizations (e.g., the Russell 2000 index).

Furthermore, there are many fruitful directions for future research on the impact of CSR on market anomalies. For instance, we propose a future study that would establish the relationship between CSR and short-term return reversal by addressing the role of CSR in shaping stock liquidity. Such investigation may provide an insight on the effect of CSR on market anomalies and add consistency to our findings. Finally, another future study may be conducted to test the relationship between investor perceived CSR level, which differs from CSR performance, and limits to arbitrage. Such research work may bring new insights to the CSR literature.

References

Alexander, G. J., Buchholz, R. A., 1978. Corporate social responsibility and stock market performance. Academy of Management Journal 21, p. 479-486.
Google Scholar https://doi.org/10.5465/255728

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68, p. 29-51.
Google Scholar https://doi.org/10.1016/0304-4076(94)01642-D

Ali, A., Hwang, L.-S., Trombley, M. A., 2003. Arbitrage risk and the book-to-market anomaly. Journal of Financial Economics 69, p. 355-373.
Google Scholar https://doi.org/10.1016/S0304-405X(03)00116-8

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets 5, p. 31-56.
Google Scholar https://doi.org/10.1016/S1386-4181(01)00024-6

Arouri, M., Gomes, M., Pukthuanthong, K., 2019. Corporate social responsibility and M&A uncertainty. Journal of Corporate Finance, 56, p. 176-198.
Google Scholar https://doi.org/10.1016/j.jcorpfin.2019.02.002

Auger, P., Burke, P., Devinney, T. M., Louviere, J. J., 2003. What will consumers pay for social product features? Journal of Business Ethics 42, p. 281-304.
Google Scholar https://doi.org/10.1023/A:1022212816261

Aupperle, K. E., Carroll, A. B., Hatfield, J. D., 1985. An empirical examination of the relationship between corporate social responsibility and profitability. Academy of Management Journal 28, p. 446-463.
Google Scholar https://doi.org/10.5465/256210

Bagnoli, M., Watts, S. G., 2003. Selling to socially responsible consumers: Competition and the private provision of public goods. Journal of Economics & Management Strategy 12, p. 419-445.
Google Scholar https://doi.org/10.1111/j.1430-9134.2003.00419.x

Baker, M., Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. The Journal of Finance 61, p. 1645-1680.
Google Scholar https://doi.org/10.1111/j.1540-6261.2006.00885.x

Ball, R., Kothari, S. P., Shanken, J., 1995. Problems in measuring portfolio performance: An application to contrarian investment strategies. Journal of Financial Economics 38, p. 79-107.
Google Scholar https://doi.org/10.1016/0304-405X(94)00806-C

Barberis, N., Shleifer, A., Vishny, R., 1998. A model of investor sentiment. Journal of Financial Economics 49, p. 307-343.
Google Scholar https://doi.org/10.1016/S0304-405X(98)00027-0

Bardos, K. S., Ertugrul, M., Gao, L.S., 2020. Corporate social responsibility, product market perception, and firm value. Journal of Corporate Finance 62, 101,588.
Google Scholar https://doi.org/10.1016/j.jcorpfin.2020.101588

Barnard, J.W., 1996. Corporate philanthropy, executives' pet charities and the agency problem. NYLS Law Review, 41, 1147.
Google Scholar

Barnea, A., Rubin, A., 2010. Corporate social responsibility as a conflict between shareholders. Journal of Business Ethics 97, p. 71-86.
Google Scholar https://doi.org/10.1007/s10551-010-0496-z

Barnett, M. L., Salomon, R.M., 2006. Beyond dichotomy: The curvilinear relationship between social responsibility and financial performance. Strategic Management Journal 27, p. 1101-1122.
Google Scholar https://doi.org/10.1002/smj.557

Bassen A, Senkl D, 2011. ESG—environmental, social, governance issues. Die Betriebswirtschaft 71: p. 506-509.
Google Scholar

Bauer, R., Koedijk, K., Otten, R., 2005. International evidence on ethical mutual fund performance and investment style. Journal of Banking & Finance 29, p. 1751-1767.
Google Scholar https://doi.org/10.1016/j.jbankfin.2004.06.035

Becchetti, L., Ciciretti, R., Hasan, I., 2015. Corporate social responsibility, stakeholder risk, and idiosyncratic volatility. Journal of Corporate Finance 35, p. 297-309.
Google Scholar https://doi.org/10.1016/j.jcorpfin.2015.09.007

Bhandari, A., Javakhadze, D., 2017. Corporate social responsibility and capital allocation efficiency. Journal of Corporate Finance 43, p. 354-377.
Google Scholar https://doi.org/10.1016/j.jcorpfin.2017.01.012

Bhardwaj, R. K., Brooks, L. D., 1992. The January anomaly: Effects of low share price, transaction costs, and bid-ask bias. The Journal of Finance 47, p. 553-575.
Google Scholar https://doi.org/10.1111/j.1540-6261.1992.tb04401.x

Bhushan, R., 1994. An informational efficiency perspective on the post-earnings announcement drift. Journal of Accounting and Economics 18, p. 45-65.
Google Scholar https://doi.org/10.1016/0165-4101(94)90018-3

Bikhchandani, S., Hirshleifer, D., Welch, I., 1992. A theory of fads, fashion, custom, and cultural change as informational cascades. Journal of political Economy, 100(5), p. 992-1026.
Google Scholar https://doi.org/10.1086/261849

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87, p. 115-143.
Google Scholar https://doi.org/10.1016/S0304-4076(98)00009-8

Brammer, S., Brooks, C., Pavelin, S., 2006. Corporate social performance and stock returns: UK evidence from disaggregate measures. Financial Management 35, p. 97-116.
Google Scholar https://doi.org/10.1111/j.1755-053X.2006.tb00149.x

Cao, J., Han, B., 2016. Idiosyncratic risk, costly arbitrage, and the cross-section of stock returns. Journal of Banking and Finance, 73, p. 1-15.
Google Scholar https://doi.org/10.1016/j.jbankfin.2016.08.004

Cao, J., Liang, H., Zhan, X., 2019. Peer effects of corporate social responsibility. Management Science, 65(12), p. 5487-5503.
Google Scholar https://doi.org/10.1287/mnsc.2018.3100

Cho, S.Y., Lee, C., Pfeiffer Jr, R.J., 2013. Corporate social responsibility performance and information asymmetry. Journal of Accounting and Public Policy 32, p. 71-83.
Google Scholar https://doi.org/10.1016/j.jaccpubpol.2012.10.005

Chung, H., Sheu, H.-J., Wang, J.-L., 2009. Do firms' earnings management practices affect their equity liquidity? Finance Research Letters 6, p. 152-158.
Google Scholar https://doi.org/10.1016/j.frl.2009.03.003

Currás-Pérez, R., Dolz-Dolz, C., Miquel-Romero, M.J., Sánchez-García, I., 2018. How social, environmental, and economic CSR affects consumer-perceived value: Does perceived consumer effectiveness make a difference?. Corporate Social Responsibility and Environmental Management, 25(5), p. 733-747.
Google Scholar https://doi.org/10.1002/csr.1490

D'avolio, G., 2002. The market for borrowing stock. Journal of Financial Economics, 66(2-3), p. 271-306.
Google Scholar https://doi.org/10.1016/S0304-405X(02)00206-4

De Long, J.B., Shleifer, A., Summers, L.H., Waldmann, R.J., 1990. Noise trader risk in financial markets. Journal of Political Economy 98, p. 703-738.
Google Scholar https://doi.org/10.1086/261703

Dechow, P. M., Dichev, I. D., 2002. The quality of accruals and earnings: The role of accrual estimation errors. The Accounting Review 77, p. 35-59.
Google Scholar https://doi.org/10.2308/accr.2002.77.s-1.35

Dhaliwal, D. S., Radhakrishnan, S., Tsang, A., Yang, Y. G., 2012. Nonfinancial disclosure and analyst forecast accuracy: International evidence on corporate social responsibility disclosure. The Accounting Review 87, p. 723-759.
Google Scholar https://doi.org/10.2308/accr-10218

Fama, E. F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, p. 3-56.
Google Scholar https://doi.org/10.1016/0304-405X(93)90023-5

Friedman, M., 1970. A Friedman doctrine: The social responsibility of business is to increase its profits. The New York Times Magazine 13, p. 32-33.
Google Scholar

Galema, R., Plantinga, A., Scholtens, B., 2008. The stocks at stake: Return and risk in socially responsible investment. Journal of Banking and Finance, 32(12), p. 2646-2654.
Google Scholar https://doi.org/10.1016/j.jbankfin.2008.06.002

Gelb, D. S., Strawser, J. A., 2001. Corporate social responsibility and financial disclosures: An alternative explanation for increased disclosure. Journal of Business Ethics 33, p. 1-13.
Google Scholar https://doi.org/10.1023/A:1011941212444

Godfrey, P.C., Merrill, C.B., Hansen, J.M., 2009. The relationship between corporate social responsibility and shareholder value: An empirical test of the risk management hypothesis. Strategic Management Journal 30, p. 425-445.
Google Scholar https://doi.org/10.1002/smj.750

Goss, A., Roberts, G. S., 2011. The impact of corporate social responsibility on the cost of bank loans. Journal of Banking and Finance 35, p. 1794-1810.
Google Scholar https://doi.org/10.1016/j.jbankfin.2010.12.002

Gruca, T. S., Rego, L.L., 2005. Customer satisfaction, cash flow, and shareholder value. Journal of Marketing 69, p. 115-130.
Google Scholar https://doi.org/10.1509/jmkg.69.3.115.66364

Hirshleifer, D., Hou, K., Teoh, S. H., Zhang, Y., 2004. Do investors overvalue firms with bloated balance sheets? Journal of Accounting and Economics 38, p. 297-331.
Google Scholar https://doi.org/10.1016/j.jacceco.2004.10.002

Hombert, J., Thesmar, D., 2014. Overcoming limits of arbitrage: Theory and evidence. Journal of Financial Economics, 111(1), p. 26-44.
Google Scholar https://doi.org/10.1016/j.jfineco.2013.09.003

Hong, H., Lim, T., Stein, J. C., 2000. Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies. The Journal of Finance 55, p. 265-295.
Google Scholar https://doi.org/10.1111/0022-1082.00206

Jiang, G., Lee, C. M., Zhang, Y., 2005. Information uncertainty and expected returns. Review of Accounting Studies 10, p. 185-221.
Google Scholar https://doi.org/10.1007/s11142-005-1528-2

Jiraporn, P., Jiraporn, N., Boeprasert, A., Chang, K., 2014. Does corporate social responsibility (CSR) improve credit ratings? Evidence from geographic identification. Financial Management, 43(3), p. 505-531.
Google Scholar https://doi.org/10.1111/fima.12044

Johnson, T. C., 2004. Forecast dispersion and the cross section of expected returns. The Journal of Finance, 59(5), p. 1957-1978.
Google Scholar https://doi.org/10.1111/j.1540-6261.2004.00688.x

Kahneman, D., Slovic, S. P., Slovic, P., Tversky, A., 1982. Judgment under uncertainty: Heuristics and biases. Cambridge university press.
Google Scholar

Kim, Y., Park, M.S., Wier, B., 2012. Is earnings quality associated with corporate social responsibility? The Accounting Review 87, p. 761-796.
Google Scholar https://doi.org/10.2308/accr-10209

Lahouel, B.B., Zaied, Y.B., Song, Y., Yang, G.L., 2021. Corporate social performance and financial performance relationship: A data envelopment analysis approach without explicit input. Finance Research Letters, 39, p. 101,656.
Google Scholar https://doi.org/10.1016/j.frl.2020.101656

Lam, F.E.C., Wei, K.J., 2011. Limits-to-arbitrage, investment frictions, and the asset growth anomaly. Journal of Financial Economics 102, p. 127-149.
Google Scholar https://doi.org/10.1016/j.jfineco.2011.03.024

Li, K., 2020. Does information asymmetry impede market efficiency? Evidence from analyst coverage. Journal of Banking and Finance, 118, p. 105,856.
Google Scholar https://doi.org/10.1016/j.jbankfin.2020.105856

Luo, X., Bhattacharya, C. B., 2009. The debate over doing good: Corporate social performance, strategic marketing levers, and firm-idiosyncratic risk. Journal of Marketing 73, p. 198-213.
Google Scholar https://doi.org/10.1509/jmkg.73.6.198

Margolis, J. D., Walsh, J. P., 2003. Misery loves companies: Rethinking social initiatives by business. Administrative Science Quarterly 48, p. 268-305.
Google Scholar https://doi.org/10.2307/3556659

Mashruwala, C., Rajgopal, S., Shevlin, T., 2006. Why is the accrual anomaly not arbitraged away? The role of idiosyncratic risk and transaction costs. Journal of Accounting and Economics 42, p. 3-33.
Google Scholar https://doi.org/10.1016/j.jacceco.2006.04.004

McCarthy, S., Oliver, B., Song, S., 2017. Corporate social responsibility and CEO confidence. Journal of Banking and Finance 75, p. 280-291.
Google Scholar https://doi.org/10.1016/j.jbankfin.2016.11.024

McGuire, J. B., Sundgren, A., Schneeweis, T., 1988. Corporate social responsibility and firm financial performance. Academy of Management Journal 31, p. 854-872.
Google Scholar https://doi.org/10.5465/256342

Merrick Jr, J.J., 1988. Hedging with mispriced futures. Journal of Financial and Quantitative Analysis, p. 451-464.
Google Scholar https://doi.org/10.2307/2331083

Miller, E. M., 1977. Risk, uncertainty, and divergence of opinion. The Journal of Finance, 32(4), p. 1151-1168.
Google Scholar https://doi.org/10.2307/2326520

Moffitt, R. A., 1999. New developments in econometric methods for labor market analysis, in: Handbook of Labor Economics. Elsevier, p. 1367-1397.
Google Scholar https://doi.org/10.1016/S1573-4463(99)03005-9

Murphy, D., McGrath, D., 2016. Australian class actions as a potential motivator for environmental, social and governance (ESG) reporting. Working paper.
Google Scholar

Nagel, S., 2005. Short sales, institutional investors and the cross-section of stock returns. Journal of Financial Economics, 78(2), p. 277-309.
Google Scholar https://doi.org/10.1016/j.jfineco.2004.08.008

Nofsinger, J. R., Sulaeman, J., Varma, A., 2019. Institutional investors and corporate social responsibility. Journal of Corporate Finance 58, p. 700-725.
Google Scholar https://doi.org/10.1016/j.jcorpfin.2019.07.012

Pontiff, J., 2006. Costly arbitrage and the myth of idiosyncratic risk. Journal of Accounting and Economics 42, p. 35-52.
Google Scholar https://doi.org/10.1016/j.jacceco.2006.04.002

Prior, D., Surroca, J., Tribó, J.A., 2008. Are socially responsible managers really ethical? Exploring the relationship between earnings management and corporate social responsibility. Corporate Governance: An International Review 16, p. 160-177.
Google Scholar https://doi.org/10.1111/j.1467-8683.2008.00678.x

Shleifer, A., Vishny, R. W., 1997. The limits of arbitrage. The Journal of finance 52, 35-55.
Google Scholar https://doi.org/10.1111/j.1540-6261.1997.tb03807.x

Stambaugh, R.F., Yu, J., Yuan, Y., 2015. Arbitrage asymmetry and the idiosyncratic volatility puzzle. The Journal of Finance 70, p. 1903-1948.
Google Scholar https://doi.org/10.1111/jofi.12286

Stellner, C., Klein, C., Zwergel, B., 2015. Corporate social responsibility and Eurozone corporate bonds: The moderating role of country sustainability. Journal of Banking and Finance 59, p. 538-549.
Google Scholar https://doi.org/10.1016/j.jbankfin.2015.04.032

Ullmann, A. A., 1985. Data in search of a theory: A critical examination of the relationships among social performance, social disclosure, and economic performance of US firms. Academy of Management Review 10, p. 540-557.
Google Scholar https://doi.org/10.5465/amr.1985.4278989

Verardo, M., 2009. Heterogeneous beliefs and momentum profits. Journal of Financial and Quantitative Analysis 44, p. 795-822.
Google Scholar https://doi.org/10.1017/S0022109009990214

Utz, S., 2017. Over-investment or risk mitigation? Corporate social responsibility in Asia-Pacific, Europe, Japan, and the United States. Review of Financial Economics, 36(2), p. 167-193.
Google Scholar https://doi.org/10.1016/j.rfe.2017.10.001

Zhang, L., 2005. The value premium. The Journal of Finance 60, p. 67-103.
Google Scholar https://doi.org/10.1111/j.1540-6261.2005.00725.x

Zhang, X. F., 2006. Information uncertainty and stock returns. The Journal of Finance 61, p. 105-137.
Google Scholar https://doi.org/10.1111/j.1540-6261.2006.00831.x

APPENDIX A
Definition of limits to arbitrage variables

Variable	Description	Source
PRICE	Measured as the closing stock price at the end of year t.	Thomson Reuters Datastream
BIDASK	One-year average of, 2 x [price—(bid + ask)/2] /price, ending at year t. Price is the closing share price at the end of year t.	Thomson Reuters Datastream
IO	Institutional ownership, which is the percentage of outstanding shares held by institutional investors at the end of year t.	Factset
AMIH	The Amihud (2002) illiquidity measure, which is the time series average of the absolute value of monthly returns divided by the monthly trading volume over the past year using data ending at December year t.	Thomson Reuters Datastream
TVOLU	Time series average of monthly trading volume multiplied by monthly share price over the past 12 months ending at year t.	Thomson Reuters Datastream
COV	Analyst coverage, which is the number of analysts following the firm.	Thomson Reuters Datastream
DISP	Dispersion in analysts' forecasts, which is the standard deviation of analysts' forecasts on earnings-per-share.	Thomson Reuters Datastream
CFVOL	Cash flow volatility, which is the standard deviation of cash flow from operations in the past 5 years ending at year t.	Thomson Reuters Datastream
IVOL	Idiosyncratic volatility which is measured as the standard deviation of the residual values from the (Fama and French, 1993) three factor model using monthly data.	

APPENDIX B
Definitions of control variables

Variable	Description	Source
SIZE	Logarithm of market value.	Thomson Reuters Datastream
AGE	Number of years since the firm was created.	Thomson Reuters Datastream
VOLA	Measured at the end of month t as the standard deviation of monthly returns from month t-5 to month t.	Thomson Reuters Datastream
VOLU	Measured as the log of yearly trading volume.	Thomson Reuters Datastream
MOM	The momentum for a given month is the difference of stock price over 12 months with a one-month lag between M-13 and M-1.	Thomson Reuters Datastream
BTM	Book-To-Market ratio.	Thomson Reuters Datastream
FLIS	Firm-level investor sentiment measured as the residual from the regression of the investor sentiment index computed based on principal component analysis[14] on excess market return[15].	

14. Following Baker and Wurgler (2006) we use principal component analysis of four—level sentiment proxies developed in the literature: The relative strength index, the psychological line index, the adjusted turnover rate and the trading volume.

15. We use the residual $\varepsilon_{i,t}$ from the following regression:
$IS_{i,t} = \beta_0 + \beta_1 RMRF_t + \varepsilon_{i,t}$
Where $IS_{i,t}$: is the investor sentiment index constructed based on the principal component analysis of our four sentiment proxies (RSI, PLI, ATR, LTV).
$RMRF_t$: is the market excess return.