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Titolo della tesi

Essays on ESG factors in financial markets and institutions

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Introduction

During recent years the firms' social responsibility, identified in environmental, social, and governance (ESG) activities, has been recognized by researchers as a key factor in maximizing both stakeholders' and shareholder' value.

For quite some time now, this evidence has also attracted the practitioners and public regulators, finally taking the view that ESG activities can be considered as a risk and profit hedging strategy, especially during financial market turmoil.

Nevertheless, how ESG practices affect the financial industry, and the long-term economic value creation is an open question. Moreover, the role played by political structure and institutional pressure on ESG practices adoption has only recently been investigated, thus require a deeper analysis. Finally, understanding the main forces affecting ESG practices adoption plays a strategical role toward a more sustainable business transition.

Therefore, to fill this gap, this thesis is composed of three empirical essays aimed at investigating the motives and consequences of ESG engagement on financial markets and institutions.

Specifically, the first essay investigates the impact of ESG factors on banks' stability in Europe. Therefore, we use a sample of European banks over 2005–2017, finding that ESG score, reduces bank fragility during periods of financial distress. Additionally, we confirm this relationship by running a differences-in-differences (DID) analysis built around the introduction of the EU 2014 Non-Financial Reporting Directive (NFRD). Taken together, our results reveal that, in times of financial turmoil, the longer the duration of ESG disclosures, the greater the benefits on stability. Overall, we support the European regulatory efforts in enhancing the disclosure of non–financial information, especially among financial intermediaries. This essay is published in *the European Journal of Finance*.

In the second chapter, we investigate if ESG investments may be considered not only as a useful risk-management strategy but also as a tool to enhance the long-term economic value creation, measured

by firms' Total Factor Productivity (TFP). Consistently, we focus on non-financial firms operating in Europe, over 2002–2018, providing robust evidence that total ESG scores are associated with higher levels of Total Factor Productivity (TFP). Moreover, we show that the ESG-TFP link is stronger during the post- financial crisis economic slowdown, confirming this result in a Difference in Difference setting, built around the adoption of the 2015 'Paris Agreement'.

The final chapter investigates if although the documented positive impact of ESG investments for firms' risk management and productivity, other forces may explain the engagement on ESG practices. More precisely, in the third essay, I study if the political and institutional framework where firms operate affects businesses' sustainability involvement. Specifically, I show the consequences for UK firms' sustainability of the 2016 UK choice to leave the EU, few years after the issuing of the EU Directive on Non-Financial Reporting. By applying a Difference in Difference (DID) methodology I observe a decrease in UK firm's environmental and social performance after 2016. Moreover, I find that after a positive effect of the 2014 EU Non-financial reporting directive on ESG engagement, UK firms experienced a reduction in ethical, diversity, and inclusion policies, in the post-Brexit years. Overall, these results unbox the effects arising from an unintended "CSR deregulation", caused by exiting from the EU's strong regulatory approach, in terms of greater exposure of UK firms to future climate and social changes. At the same time, it reveals the importance of institutional regulatory efforts in achieving a stronger firms' sustainability engagement, which may not be encouraged only by the documented benefit of such practices. Taken together, this thesis reveals the need for a stronger action towards a business sustainability adoption, especially among institutions and regulatory authorities. At the same time, it suggests the positive long-term implications of ESG engagement both for banks and non-financial firms, making the financial system more resilient and productive.

Essay 1:

Do ESG strategies enhance bank stability during financial turmoil? Evidence from Europe[1][2]

[1] Published in The European Journal of Finance.

[2] This paper received the "best paper award" at the 3rd Social Impact Investments International Conference of University of Rome "La Sapienza".

Do ESG strategies enhance bank stability during financial turmoil? Evidence from Europe

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ABSTRACT

This paper investigates the joint and separate effects of Environmental (E), Social (S), and Governance (G) scores on bank stability. Using a sample of European banks operating in 21 countries over 2005–2017, we find that the total ESG score, as well as its sub-pillars, reduces bank fragility during periods of financial distress. This stabilizing effect holds strongly for banks with higher ESG ratings. These results are confirmed by a differences-in-differences (DID) analysis built around the introduction of the EU 2014 Non-Financial Reporting Directive (NFRD). Our evidence also reveals that, in times of financial turmoil, the longer the duration of ESG disclosures, the greater the benefits on stability. Finally, we show that the ESG–bank stability linkages vary significantly across banks' characteristics and operating environments. Our findings are robust to selection bias and endogeneity concerns. Overall, they support the regulatory effort in requiring an enhanced disclosure of non–financial information.

Keywords: Corporate Social Responsibility (CSR), Environmental Social Governance (ESG) Scores; Non-Financial Reporting; European Banking; Bank Stability; Financial Crisis.

***JEL* Classification:** G01, G21.

1. Introduction

The global financial and European sovereign debt crises renewed the interest on firms' engagement in Corporate Social Responsibility (CSR).[3] The recent literature on its effectiveness in enhancing firms' performance is rich, although results tend to be mixed (e.g. Lee and Faff, 2009; Margolis et al., 2009; Oikonomou et al., 2012; Albertini, 2013; Dixon-Fowler et al., 2013; Friede et al., 2015). In addition, only a few studies focus on risk (Luo and Bhattacharya, 2009; Bouslah et al., 2018) and for banks these typically examine single CSR aspects, such as the environmental dimension (Gangi et al., 2019) and governance (Berger et al., 2016 and Anginer et al., 2018).

Two main views explain the relationship between CSR and risk (Bouslah et al., 2018)[4]: (i) the risk mitigation; and (ii) the overinvestment view. The former derives from a risk management argument based on the stakeholder theory and the value created by moral capital (Godfrey et al., 2009; Luo and Bhattacharya, 2009). The latter originates from the agency theory and focuses on opportunistic managerial behaviour: managers may improve sustainability scores for the sake of their own reputation as responsible social citizens (Barnea and Rubin, 2010). The two views offer opposite predictions: negative in the risk mitigation view, by decreasing the probability of adverse events firms obtain greater resilience during shocks (such as a crisis and an economic downturn); and positive in the overinvestment view due to managerial entrenchment.

In recent years, banks have increasingly perceived sustainability as a means to increase their reputation, and also to promote trust and credibility (Maden et al., 2012; Schultz et al., 2013; Park et al., 2014). Whether this ultimately mitigates the effect of the financial crisis has not yet been tested

[3] There is no unique definition of CSR (McWilliams and Siegel, 2001; Hill et al., 2007; Dahlsrud, 2008): the European Commission (2001) defines it as 'the responsibility of enterprises for the impact on society […] to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders'.

[4] For many years, the debate in the literature around CSR was mainly theoretical and based either i) on the shareholder view of the firm (Friedman, 1970) that considers CSR activities as a cost; or ii) the stakeholder view (Freeman, 1984) that sees them primarily as an ethical obligation (see also Garriga and Melé, 2004).

in the banking literature. In this study we conjecture that the channel through which this may occur is via bank stability, measured by default risk.

This paper provides three main contributions to this stream of literature. First, despite several studies have addressed the relationship between CSR and firm risk, ours is the first to consider the European banking sector and to use a market-based measure of default risk (Distance to Default). The focus on Europe is especially relevant, since many countries in this region pioneered sustainability practices, with EU banks leading compared to those headquartered elsewhere (Ho et al., 2012). In addition, from a regulatory perspective, major steps have been taken to enhance disclosures on non–financial information and diversity.

In 2014 the EU adopted the Non-Financial Reporting Directive (2014/95/EU) that required certain large companies, including banks, to disclose information on the way they operate and manage social and environmental challenges. More recently, the EU has demonstrated a strong commitment to step up efforts to addressing these issues.[5] In addition, in October 2020, the European Banking Authority (EBA) issued a discussion paper on the management and supervision of ESG risks for credit institutions and investment firms (EBA, 2020). In November 2020, the European Central Bank announced, after a public consultation, that banking stress tests that will be held in 2022 will also include consideration of climate-related risks (ECB, 2020). Similar initiatives are currently under way also outside the European Union or are even developed at the global level by the banking industry itself. For example, the Climate Biennial Exploratory Scenario (CBES) in the UK, that assesses the resilience of the financial system to climate risks (Bank of England, 2021a);[6] and the "Principles for

[5] In 2017 the European Commission adopted detailed non-binding guidelines on the disclosure of non-financial information to improve business transparency on social and environmental matters and ensure consistency and comparability across companies (2017/C 215/01). Sustainability reporting is also at the heart of the so-called "European Green Deal" that is an action plan of the European Commission with the objective to make Europe the world's first climate-neutral continent by 2050.

[6] Specifically, an online document (Bank of England, 2021b) that summarises the key elements of the UK 2021 biennial exploratory scenario states that: "The financial risks from climate change affect the safety and soundness of firms the

Responsible Banking", that are a voluntary framework ensuring that banks' strategy and practice align with the vision society has set out for its future in the UN Sustainable Development Goals and the Paris Climate Agreement. The Principles are currently signed by 235 banks from 69 countries, representative of 60 trillion USD total assets.

Our second contribution to the literature is that we use the whole set of information provided by Environmental, Social and Governance (ESG) scores as a proxy for CSR performance (Chang et al., 2014; Eccles et al., 2014; Kim et al., 2014; Sassen et al., 2016). ESG scores are aggregate variables resulting from weighting several heterogeneous indexes: Environmental (E), that includes sustainable use of resources, emissions and innovation in reducing environmental footprints; Social (S), that comprises for example, job satisfaction, workplace health and safety, diversity, equality and human rights; and Governance (G) activities, that includes for example compliance with best practices, equal treatment of shareholders, integration of non–financial objectives in strategic and managerial decisions.

Thirdly, this paper explores the relationship between ESG scores and bank stability over a relatively long period (2005–2017) that covers the global financial sub-prime and European sovereign debt crises. By means of an interaction term, confirmed by the results of a series of robustness checks based on alternative measures, we verify whether the effect on bank stability is affected by the economic cycle. To our knowledge, this is the first study to provide a similar evidence.

We postulate that the ESG–bank stability linkage may reward higher scores, especially during crisis times. This expectation is tested using a differences-in-differences (DID) framework built around the introduction in 2014 of the EU's Non-Financial Reporting Directive. Additionally, the relatively long-time span allows us to investigate the impact of the duration of ESG disclosures for each entity: this is the first empirical evidence on this measure of banks' ESG commitment. Finally,

Bank regulates and the stability of the wider financial system that it oversees. Climate-related financial risks therefore have a direct impact on the delivery of the Bank's macroprudential and microprudential policy objectives […]"

by adopting a heterogeneous cross–country sample of European banks, we can assess whether the ESG–bank risk relationship is driven by other firms' characteristics (e.g., size) and a different operating environment (financial system orientation and per-capita income levels).

Our empirical results show that, when considering aggregated ESG scores, engagement in CSR practices is associated with higher stability (i.e. lower default risk) during crises years. It also seems to encourage more prudent banking activities, fostering more stable relationships with the financial community and enhancing reputation. These aspects are crucial in mitigating the potential adverse impact of negative events that typically occur during a crisis. We also find that all ESG sub–pillars participate to this association: the development of environmental technologies and processes optimizing the use of resources; the fair treatment of the workforce; banks' responsibility to produce quality goods and services integrating the customers' health, safety, integrity and data privacy; a bank's capacity to guarantee equal treatment of all shareholders and promoting anti-takeover devices. Thus, bank management strategies that combine these practices seem able to mitigate bank instability during financial slowdowns. Our results are robust to selection bias and endogeneity concerns. In addition, we show that the stabilizing effect observed in crisis years holds strongly for banks with higher ESG scores, through a differences-in-differences setting. We also find that the longer the duration of ESG disclosures, the greater are the benefits, implying that both the level and the commitment of a bank's engagement matter, even if disclosures become mandatory.

Interestingly, our evidence indicates that the composite ESG score exerts a different impact on financial stability depending on banks' characteristics and on differences in the operating environment. More specifically, we observe that only the largest European banking groups subject to the EBA's stress tests experience improvements in financial stability during crisis periods. Finally, we find that ESG strategies are more beneficial in more bank–oriented financial systems and in countries with higher per-capita income levels.

In terms of policy, our results support the European regulatory commitment on mandatory

disclosures on non–financial reporting for larger entities: how to improve such benefits and extend them also to smaller institutions are open questions for both policy-makers and academic research.

The remainder of the paper is organised as follows. Section 2 reviews the literature and formulates our hypotheses. Sections 3 describes the empirical methodology, the sample and the variables used. Section 4 discusses the main results. Additional analyses and robustness checks are presented in Section 5. Finally, Section 6 concludes and offers some policy implications.

2. Literature Review and Hypotheses Development

Over the past two decades, CSR received a growing interest from researchers, practitioners, and regulators. Most published empirical studies focused on its role in terms of enhanced performance, assessing its impact within and outside firms and measuring its multi–dimensional components. Evidence is not definitive and is subject to several methodological difficulties (Margolis et al., 2009). Most empirical works tend to use proxies that typically focus only on one aspect, such as employee satisfaction (Edmans, 2011, 2012; Edmans et al., 2014); environmental protection (Dowell et al., 2000; Konar and Cohen, 2001); corporate philanthropy (Seifert et al., 2004, Masulis and Reza, 2015, Liang and Renneboog, 2016); or consumer satisfaction (Luo and Bhattacharya, 2006; Servaes and Tamayo, 2013). Only recently, research begun to exploit the greater level of cross–firm and industry data availability and scope offered by ESG disclosure scores (Liang and Renneboog, 2017).

Many studies analyse the implications of sustainable practices primarily within non–financial corporations (Margolis and Walsh, 2003; Barnett and Salomon, 2012; Santis et al., 2016, Godfrey et al. 2020). Yet, several works have emphasised that the role played by banks in allocating capital and fostering economic growth should encourage more research (Beck et al., 2010; Levine, 2005), beyond financial performance. Despite a growing body of evidence points to the positive impact of sustainable practices on banking profitability (Wu and Shen, 2013; Cornett et al., 2016; Gangi et al., 2019; Nizam et al., 2019; among others), whether and how ESG activities affect bank risk remains a

fundamental and open question.

To the best of our knowledge, there are no published studies on this topic in a broader ESG context and with a focus on bank stability or risk-taking. Existing papers examine only one ESG aspect: for example, Anginer et al. (2018) find that a subset of corporate governance (shareholder friendliness) leads to higher stand-alone and systemic risks, especially for larger banks or with stronger safety nets, while Gangi et al. (2019) argue that more environmentally engaged banks exhibit less risk. Given this gap in the literature and the importance of the issue, a key contribution of this paper is hence to link bank stability and all ESG dimensions by searching for robust evidence of a risk reduction channel, in the specific context of financial crises. Moreover, we aim at providing findings that are robust from issues of reverse causality and endogeneity, that frequently affect the analysis of CSR effects on risk and performance (Bénabou and Tirole, 2010).

The theoretical literature on the link between CSR and risk provides two main views. The "risk mitigation view", within the stakeholder theory, posits that greater investments in CSR act as insurance for firms that create moral capital or goodwill among stakeholders (Godfrey, 2005; Godfrey et al. 2009; El Ghoul et al., 2017). This may prove to be a considerable advantage during periods of financial turmoil and economic decline. Instead, the "overinvestment view" considers CSR investments as a waste of resources and implies a positive association with firm risk derived from managerial entrenchment. Managers may seek to overinvest in CSR for their private benefit or personal reputation (Barnea and Rubin, 2010), or to gain support from activists (Cespa and Cestone, 2007). Closely connected with the risk mitigation view, one should also consider the risk implications of the relationship between social performance and expected returns (Bouslah et al., 2018), through the effects of idiosyncratic risk in asset pricing (Boutin-Durfresne and Savaria, 2004; Lee and Faff, 2009), hence predicting a negative relationship between CSR and risk.[7]

[7] Several studies find that improvements in CSR can benefit firms' relationships with stakeholders, lower the vulnerability to reputational risks and enhance the long-term business sustainability (Branco and Rodrigues, 2006; Bhattacharya et al.,

If CSR is associated with a perceived lower risk from market participants, this should also lower the cost of capital, reduce agency and asymmetric information issues (El Ghoul et al., 2011) and reduce capital constraints hence leading to better access to finance (Cheng et al. 2014). Additionally, CSR has also been found to enhance bank earnings quality (García-Sánchez and García-Meca, 2017). In the non–financial sector, CSR activities seem to reduce losses in market shares for high levels of leverage (Bae et al., 2018), to be negatively correlated with stock price crash risks (Kim et al., 2014) and to improve credit ratings (Attig et al., 2013): similar effects may be present also in the banking industry. Finally, sustainability may be used strategically by managers as a risk mitigating tool towards adverse consequences of negative events (Godfrey et al., 2009; Attig et al., 2013; McCarthy et al., 2017). Consistently, recent evidence underlines an insurance-like role of sustainable practices during the global financial crisis (Lins et al., 2017), especially against idiosyncratic risk (Godfrey et al. 2009).

We hypothesize that higher ESG scores may be associated with more prudent and sustainable banking activities, reducing the overall risk. Moreover, this effect should be stronger when negative events occur, especially during crisis years: benefits for companies from CSR engagement strongly emerge when unexpected declines in trust occur. Consistently with recent findings on non-financial enterprises (Lins et al., 2017), we conjecture a positive role played by ESG scores in enhancing market trust and stability for banks during financial turmoil. Our prediction is based on the moral capital theory, which sees CSR as an insurance-like strategy for shareholders value maximization, by mitigating stakeholders' conflict in the event of a crisis (Bouslah et al., 2018).

H1. Banks with higher ESG scores are less risky, especially during a financial crisis.

2009; Becchetti et al., 2018). The commitment to CSR can be used as an alternative risk hedging and mitigation tool (Peloza, 2006). Swanda (1990), for example, views the results of moral behaviour as a capital asset and emphasizes the strategic importance of preserving and advancing a firm's moral capital.

Most studies focus on proxies related to one ESG dimension (Berget et al., 2016; Anginer et al., 2018; Gangi et al., 2019). We differentiate our study from previous research by examining the ESG–bank risk linkage disaggregating all its components. Due to the heterogeneity of CSR activities, reflected also in ESG measurement methodologies (Liang and Renneboog, 2017)[8], there are significant interconnections across its components (Galbreath, 2013). Nonetheless, the existing literature has suggested that each pillar of ESG should play a significant role on banks' stability.

In general, one could anticipate a weak link between the Environmental pillar and banks, in contrast with non–financial firms. Evidence from the latter shows that environmentally pro–active corporations experience a reduction in perceived riskiness from investors (Feldman et al., 1997) and that environmentally–friendly activities are associated with better stakeholder engagement (Cheng et al., 2014). Bouslah et al. (2013) argue that on one side this effect arises from reduced compliance costs for environmental regulations (less likely to impact banks), but also from improved image and loyalty of key stakeholders (potentially holding also in the banking sector). Gangi et al. (2019) document a robust negative association between environmental friendliness of banks and their risk. The authors argue that there are direct and indirect effects at work derived from different channels on the costs or stability of funding: the lending channel, operational efficiency, reputation, and loyalty of customers. Furthermore, environmental performances directly link to stakeholder confidence by strengthening the moral dimension of firms, and thus enhanced reputation (Goodfrey 2005). Therefore, in line with the moral capital theory, we explore environmental banks practices role in restoring trust during exogenous confidence downturns, such as financial crises.

[8] In recent years, a variety of ESG indices measuring firm-level CSR performance have been constructed using different rating methodologies (e.g., some are based on a box-ticking approach – 'compliance', while others are based on interpretative analysis – 'engagement').

H2. Environmental activism reduces bank risk-taking, especially during a financial crisis.

With reference to the Social component, we expect that more attention on the improvement of human rights and employee relations and generally promoting workforce conditions and morale, could encourage a better culture and more effective screening and monitoring of loans, ultimately reducing banks' overall risks. However, this risk-mitigating effect may not be as explicit as financial derivatives in shielding banks from market shocks (Buston, 2016). A positive link between workforce-related social aspects and stability is advanced by several scholars (see Bauer et al., 2007 in terms of commitment, loyalty and cost of litigation; Kane et al., 2005 on cooperation and trust). Bouslah et al. (2018), argue that firms with higher social performance have also higher moral capital, turning into a higher valuation of performance from stakeholders. Additionally, most interactions with stakeholders occur through incomplete contracts, that an exogenous shock may jeopardise. Therefore, high social capital during a crisis could mitigate this concern (Lins et al., 2017), leading to superior bank stability. For our purposes, high social engagement enhances bank stability by strengthening stakeholder trust and market participants confidence.

H3. Bank instability is inversely related to the level of social engagement, especially during a financial crisis.

Concerning Governance, the link with stability is generally consistent with regulation and supervision (Dell'Atti et al., 2017). Several banking crises have been associated, at least partially, with poor governance or conduct of management (Dowling, 2006). However, this link is not always confirmed empirically (Stulz, 2016). The extensive literature survey on the relationship between governance and bank risk-taking provided by Berger et al. (2016) and Anginer et al. (2018) shows how relevant and complex is this relationship. The latter document how a shareholder-friendly

governance increases both stand-alone and systemic risks in banks, and this behaviour is different than in non–financial firms due to the presence of explicit and implicit safety nets. Similarly, a greater shareholder orientation seems to be associated with greater losses during the crisis (Beltratti and Shultz, 2012; Leung et al., 2019). Mollah and Liljeblom (2016) find that banks with more powerful CEOs performed better and reduced their asset risk during the sovereign debt crisis than during the credit crisis, despite accepting higher insolvency risk. Their results also suggest that board independence is associated with greater bank solvency.

According to the stakeholder view, the governance pillar should be positively associated with bank stability due to the lower incentive to pass–through risks (Kirkpatrick, 2009). Stakeholder-oriented corporate governance may be pivotal in strengthening social purposes and boosting bank moral capital. In this paper, we explore the relevance of stakeholder-oriented corporate governance in enhancing bank resilience, during a period of lack of trust, such as the global financial crisis. However, the relationship between governance and bank stability is particularly complex to disentangle. Gaganis et al. (2020) explore in detail this issue for a large cross-country sample, concluding that the positive impact of corporate governance on bank stability emerges when macroprudential policies increase. The role of these policies appears particularly strong in reducing the likelihood and severity of financial crises.

H4. Fair governance practices positively affect bank stability, especially during a financial crisis.

As discussed in the introduction, CSR engagement does not fall outside the scope of regulation: particularly in recent years regulators have been pushing for more controls and action on sustainable

finance and banking. In 2014 the EU adopted the Non-Financial Reporting Directive (NFRD), that emphasised the importance of disclosure requirements for firms to include environmental and other non-financial performance; in 2018 the European Commission published an action plan that sets out an EU strategy on sustainable finance and a roadmap for future work across the financial system (EC, 2018). In 2021, the EC also adopted a broad set of measures aimed at fostering the funding of sustainable activities and achieve climate neutrality by 2050 (EC, 2021).

Literature on the consequences of such norms on banks is scant. Chen et al. (2018) investigate firms' reaction to China's 2008 requirement to disclose CSR activities, documenting an increasing of firm sustainable engagement at the expense of performances. Grewal et al. (2019), by examining the equity market reaction to passage of the EU 2014 NFRD, show a negative association for EU firms. The documented reaction appears to be less negative for firms with higher pre-directive non-financial performance and non-financial disclosure levels.

In a recent study, Jackson et al. (2020) find that the effect of mandatory social responsibility behaviour led to a significant increase in the CSR engagement in firms operating in 24 OECD countries, although this did not translate in lower corporate irresponsibility. Similarly, a pilot study by Fiechter et al. (2020) provide evidence that EU firms increased their CSR activities immediately after the adoption of the 2014 EU NFRD, thus confirming that, at least in Europe, regulation was the right institutional answer to stakeholders' recent call for more corporate socially responsible behaviour. Specifically, the EU Parliament, adopted a mandatory "comply or explain" approach which obliges firms to identify and justify any areas of non-compliance.

In this paper, we rely on the structural importance of the 2014 EU NFRD and aim at testing whether more ESG engaged banks were affected differently by the directive compared to others. We expect therefore to find two possible consequences; (i) an increase in compliance costs for banks, which negatively affect their performance (Chen et al 2018); (ii) a rewarding effect for banks more engaged in ESG practices, which is reflected by a positive impact on their performance (Bouslah et

al 2018), consistently with the moral capital theory framework.

H5: The EU 2014 Non-Financial Reporting Directive (NFRD) rewarded banks more engaged in CSR practices.

3. Methodology and data

3.1 Empirical strategy

Our methodology consists of two steps. In the first step, we empirically investigate the relationship between CSR engagement (proxied by ESG scores) and bank stability in a setting that is robust to potential endogeneity issues. We follow Wintoki et al. (2012) using the improved system version of the generalized method of moments (GMM) estimator proposed by Blundell and Bond (1998) and built on the work of Arellano and Bover (1995). Moreover, to better control for the issue of reverse causality, we run the instrumental variables (IV) two-stage least squares (2SLS) regression estimator (see Section 5).

Banks with better financial performance could be simultaneously more stable and more inclined to invest in CSR strategies (Bénabou and Tirole, 2010; Chih et al., 2010). The consistency of the system GMM model depends on the assumption that the error term is not autocorrelated and on the validity of the instruments used. Two specification tests are reported. The first is the Hansen test of overidentifying restrictions, which examines the validity of the instruments by analysing the sample analogue of the moment conditions used in the estimation procedure. The second test examines the hypothesis of no autocorrelation in the error term. The presence of first-order autocorrelation in the differenced residuals does not imply that the estimates are inconsistent; however, the presence of second-order autocorrelation does.

We employ the two-step system GMM estimator (or linear dynamic panel data) with

Windmeijer corrected standard errors.[9] Lagged non-binary explanatory variables are used to address endogeneity. Second and higher-order lags and differences of the dependent variable are used as instruments to avoid the endogeneity concern occurring from the inclusion of the lagged dependent variable. In all specifications the number of instruments employed is smaller than the group under investigation (Roodman, 2009). The lagged dependent variable is treated as endogenous while all the remaining explanatory variables are exogenous. We use the following equation for the model:

$$DTD_{it} = c + DTD_{i,t-1} + \beta_1 ESG_{i,t-1} + \beta_2 ESG_{i,t-1} * D\_CRISIS + \beta_3 D\_CRISIS + \sum_{b=1}^{B} \beta_4 BankControls_{i,t-1} + \sum_{c=1}^{C} \beta_5 CountryControls_{i,t-1} + v_i + \mu_{it} \quad (1)$$

where the one-year Merton's Distance to Default (DTD) is the stability measure of bank *i* at time *t* (the year in progress), that we employ as a market-based measure following Hassan et al. (2019) and Anginer et al. (2018).

We collect probability of default (PD) data from Bloomberg and we estimate Distance to Default as the inverse standard normal cumulative distribution function of the PD (Jessen and Lando, 2015). The higher are DTD values, the lower is the risk of bank default.[10] To mitigate the effects of outliers, the dependent variable is winsorized at the 1% of each tail.

In line with previous research (Galbreath, 2013; Kim et al., 2014; Crifo et al., 2015; Sassen et al., 2016; among others), we proxy the CSR engagement (our target variable) through ESG scores. We have different variables of interest (see Section 3.3), because we also disaggregate ESG scores om pillars and constituents (e.g., emissions, environmental product innovation, human rights,

[9] To further assess the robustness of our results with respect to the estimation methods, we also employ a bank fixed-effects panel data regression model with clustered standard errors at the bank level and results, unreported and available upon request, are broadly confirmed.

[10] For robustness, we also used an alternative market-based bank risk measure, i.e. the one-year Merton's probability of default (PD). Results are qualitatively similar and available upon request.

shareholders, etc.). Each target variable is interacted with the crisis years dummy (D_CRISIS), that equals 1 during the global financial and European sovereign debt crises periods (2008–2012) and 0 otherwise (2005–2007 and 2013–2017).[11] This econometric approach allows us to verify whether ESG scores' effect on bank stability depends on economic cycles (Lins et al., 2017).[12]

Moreover, consistently with studies examining the relationship between CSR and firm risk (Bouslah et al., 2013; Sassen et al., 2016; Gupta and Krishnamurti, 2018), we control for additional variables that may affect bank stability, both bank-specific (namely size, capitalization, credit risk, efficiency, profitability, liquidity, income diversification, ECB's unconventional liquidity injections proxied by the Very Long–Term Refinancing Operations, VLTROs[13]), and country-specific (industry concentration, economic growth, strength of capital regulation and supervision).

Table 1 defines our variables, data sources and expected signs. To mitigate the effect of outliers, accounting-based control variables (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, and DIV) are winsorized at the 1% level on both tails.

Standard errors are clustered at the bank-level. Finally, c is a constant term, the variable v_i is the unobserved bank-specific-effect and μ_{it} is the idiosyncratic error.

[Insert Table 1 about here]

[11] As a robustness test, we perform our analysis also using a dummy crisis variable that ends in 2013 rather than 2012. The results are qualitatively similar and available upon request. Due to the limited number of observations, it was not feasible to divide our sample period (2005–2017) into sub-periods (pre–crisis, crisis, post–crisis).

[12] As a potential alternative to the interaction term, sample splitting could bias the results due to sub-sample specific covariates that can obfuscate the treatment effect and may also reduce the number of observations. However, in an unreported test, we verify the consistency of our results by running the baseline model without the interaction term and results are broadly confirmed.

[13] The VLTROs are considered the ECB's largest liquidity injections ever, with more than one trillion Euro introduced in the Eurozone banking system in two tranches (VLTRO1 in 2011Q4, VLTROs in 2012Q1, both ended in 2015Q1).

The second step involves exploiting the effects of the Non-Financial Reporting Directive (NFRD), issued in late 2014 (Directive 2014/95/EU), in a differences-in-differences (DID) setting. All banks in our sample are listed, with more than 500 employees, so they were affected by the NFRD, yet they differ in their CSR engagement at the time of enforcing the directive.

More specifically, the NFRD requires certain large public-interest entities to disclose their performance on a range of non-financial dimensions alongside their accounts, on a "comply or explain" basis. These dimensions, despite being labelled differently ("respect for human rights" or "diversity on board of directors"), are all within the scope of ESG scores. Therefore, having only firms within the scope of the directive in our sample (EU-based large listed banks that are those for which consistent ESG scores are available), allows us to further analyse the relationship between ESG and bank stability by comparing their performance before and after 2014, and in particular focus on the behaviour of entities that already achieved higher ESG scores before the Directive.

This represents the ideal setting to investigate our fifth hypothesis (*H5*), both an ordinary least square (OLS) and a panel data with and without fixed-effects models, over the period 2012-2017:

$$DTD_{it} = c + \beta_1 D\_SHOCK + \beta_2 D\_TREATED + \beta_3 D\_SHOCK*D\_TREATED + \sum_{b=1}^{B} \beta_4 BankControls_{i,t-1} + \sum_{c=1}^{C} \beta_5 CountryControls_{i,t-1} + v_i + \mu_{it} \quad (2)$$

where the dummy D_SHOCK representing the introduction of the NFRD that takes value 1 for post-treatment years (2015–2017) and 0 otherwise. The dummy D_TREATED takes value of 1 for banks above average values of ESG scores in the year of the shock (2014) and 0 otherwise, and D_SHOCK*D_TREATED represents their interaction. Therefore, the coefficient of D_SHOCK*D_TREATED is our target variable. We further control for a set of bank and country characteristic, as well for the same fixed effects employed in our baseline model (see Equation 1).

To address the potential bias arising from treated and control groups heterogeneity (banks above

or below average values of ESG scores), we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983). This procedure requires the following steps. To identify the control group, we first run a logit model to calculate propensity scores of being a high-ESG bank, employing all non-binary bank-level control variables (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, and DIV) and including bank fixed-effects (Bhandari et al., 2017) for the period before the introduction of the Directive (2012-2014). We then match, without replacement, each treated bank to a control bank using the Nearest Neighbour matching (see e.g., Chang et al., 2019). Finally, we run the DID regression on the resulting matched sample and carry out a battery of robustness checks, as detailed in Section 5.

3.2 Sample Description

The analysis focuses on banks headquartered in European countries, with data available from Thomson Reuters' Refinitiv on ESG scores (our variable of interest), both at composite and individual levels during the period 2005–2017 (the last data available).[14] These scores are designed to transparently and objectively measure a company's relative ESG performance, commitment and effectiveness across 10 main themes (emissions, environmental product innovation, human rights, shareholders, etc.) based on company–reported information (e.g. annual reports, non-governmental organizations websites, and media outlets). The database provides ESG scores data on approximately 1,000 companies (mainly U.S. and European) as of 2002.

These criteria significantly restrict our sample, despite the Heckman two-step model confirms the absence of sample selection bias (see Section 5). Firstly, non–financial disclosures became mandatory in 2014 and only for large firms (Directive 2014/95/EU). Additionally, firms can decide

[14] Thomson Reuters' Refinitiv is an enhancement and replacement to the Thomson Reuters' ASSET4 ratings, which has been widely used in previous CSR studies (Cheng et al., 2014; Eccles et al., 2015; El Ghoul et al., 2017; among others). We start our sample in 2005 due to the low coverage on ESG scores in previous years.

not to report ESG scores to Thomson Reuters' Refinitiv database.[15] Finally, since Thomson Reuters does not specify the reason for missing values on ESG scores, it would be biased to compare banks that do not disclose this information with those that do.

The final sample consists of 84 banks that cover 21 European countries[16] belonging to Eastern (5), Western (6), Northern (6) and Southern (4) Europe (Table A.3). All banks are listed. In addition, half of our sample banks are included in the EBA's stress tests for large banks. We concentrate on Europe for the following reasons. Firstly, ESG is particularly relevant in this area: according to the literature, European companies lead if compared to others (Ho et al., 2012). Secondly, the European Union passed the Directive 2014/95/EU fostering the role of non-financial information disclosure of firms. Finally, there is limited research linking ESG to risk within the EU.

The data collected are year-end observations over a relatively long period (2005–2017) that includes the global financial and European sovereign debt crises. By means of an interaction term, we investigate whether the effect on stability depends on economic and/or financial conditions. Data is available only yearly: we are therefore unable to conduct the analysis with higher frequency.

3.3 Measurement of ESG Variables

ESG terminology first appeared in the United Nations Principles for Responsible Investment (PRI)

[15] The same issue occurs when collecting ESG scores data from Bloomberg database. In this case, the level of coverage is lower and, more importantly, less granular information on ESG constituents is present. However, as robustness tests, we perform our analysis also using Bloomberg as a data source: our results hold also in this setting (see Section 5). Moreover, although widely used in previous related studies on corporate social performance (e.g., Jiao, 2010; El Ghoul et al., 2011; among others), it was not possible to use the Morgan Stanley Capital International (MSCI) ESG database (formerly known as Kinder, Lyndenberg, and Domini Research and Analytics Inc. (KLD) database), because, except for the most recent years, it does not provide data on European countries (Sassen et al., 2016).

and then in several companies' CSR reports (Davis and Stephenson, 2006). Although there is no univocal identification of this concept yet, ESG scores have already been extensively used by consulting firms, financial advisors, and asset managers. Bassen and Kovacs (2008) argue that ESG scores monitoring and disclosures play a key role in developing CSR strategies and allow investors to assess firms' risks and opportunities. Therefore, ESG scores are currently the leading proxies of CSR engagement (Liang and Renneboog, 2017).

The granularity of information provided by Thomson Reuters' Refinitiv database allows us to extend the analysis beyond the overall composite score, including its three pillars as well as their individual components. Table A.1 in the Appendix summarises the taxonomy of ESG scores, their definition, calculation, and weights used for computation accordingly to Thomson Reuters' methodology. All ESG scores range between 0 and 1, with higher values indicating stronger performance in sustainability practices.

To verify *H1*, on the joint effects of Environmental, Social, and Governance scores on bank stability, we use the ESG composite score (ESG). It captures a balanced view of the banks' performance in the three areas (ENV, SOC, and GOV) through an explicit weighted combination of a series of firm-specific indicators that proxy results towards sustainability practices. We hypothesize a positive relationship with our dependent variable (DTD): higher total ESG scores are expected to be linked with more prudent banking activities (especially due to a long-term perspective and a stakeholder-based view) and decrease bank risk.

Since each ESG dimension bears its own identity (Oikonomou et al., 2012; Bouslah et al., 2013; Cai et al., 2016), our analysis is repeated by breaking down composite scores, firstly into its three pillars and then into its sub-components (see the Appendix for further details), to avoid confounding the effects of individual dimensions (Griffin and Mahon, 1997; Johnson and Greening, 1999).

The second target variable is the Environmental score (ENV), resulting from the weighted average of three constituents: *Resource Use*; *Emissions* and *Innovation*. Based on our second

hypothesis (*H2*), we expect a positive sign, because banks may be (or perceived) less risky if they integrate environmental issues in their lending policies (Goss and Robert, 2011), by excluding borrowers more exposed to changes in environmental regulation; could improve their operational efficiency (Fiordelisi et al., 2011; Clarkson et al., 2015; Gangi et al., 2019); through improvements in their reputation (Ruiz et al., 2016; Aramburu and Pescador, 2017), or not being associated with controversial firms. We expect this relationship to hold also when performing the baseline model on the three distinct components at the same time.

To test for *H3*, we focus on the Social score (SOC), based on the following four indicators: *Workforce*; *Human rights*; *Community* and *Product Responsibility*. We expect a positive sign on both the total SOC score and its four constituents. This because lending and investing activities could provide greater stability, if loans are granted, assets are selected and portfolios are monitored through strengthened processes (Allen et al., 2011), including those pertaining to the Social dimension, especially the workforce and product responsibility.

To verify *H4*, we concentrate on the Governance score (GOV) and its three constituents: *Management*; *Shareholders* and *CSR Strategy*. We again hypothesize a positive relationship with our dependent variable (Dowling, 2006; Dell'Atti et al., 2017): improved corporate governance should represent a key tool in managing risks and maintaining stability. In general, these positive relationships should strengthen during periods of distress, such as the global financial and the European sovereign debt crises. For this reason, we interact each target variable with a crisis–specific dummy variable.

3.4 Descriptive Statistics

Table 2 reports the summary statistics and tests for differences in means between the crisis and non-crisis periods for all variables, excluding the VLTROs dummy. As expected, during the crisis years the Distance to Default significantly decreased, reaching the average value of 2.688 over the period

2008–2012 compared to 2.898 in the normal years. The ESG score (ESG), as well as each of its pillars (ENV, SOC, and GOV) show a decline during the crisis. The average mean of the composite score decreases (from 61.1% to 59%), mainly driven by the negative change displayed by the GOV pillar (from 54.3% to 51%). We argue that during the crisis, banks could be more focused on financial strength or profitability, rather than sustainability, consistently with Cornett et al. (2016).

About bank-specific characteristics, CIR and ROAE are the variables showing the most significant changes over the sample period, followed by SIZE and DIV. Operational efficiency worsened during the crisis years (due to the decline in operating income): the CIR grew from 65% to 69.4% and, simultaneously, the ROAE decreased from 8% to 4.5%. The variable SIZE grew moderately from 9.052 in the non-crisis period to 9.069 in the crisis period: possibly this is the result of consolidation processes occurring as a by-product of bank rescues. At the same time, the mean DIV decreased from 10.90% to 9.80%, indicating a lower capability of exploiting diverse income sources during crisis years.

With reference to macroeconomic factors, only GDP growth (GDP_GRW) and the supervisory strength (SUP_PWR) varied significantly. More specifically, GDP_GRW exhibited a considerable decline in crisis years (0.20%) compared to the non-crisis period (2.40%), due to the expected hoarding effect of the contraction in demand. Similarly, SUP_PWR decreased significantly (from 10.08 to 9.91), corroborating the European Commission's call for strengthening banking supervision after it showed a limited effectiveness in ensuring bank stability.

The difference in means between the two sub-periods, reveals that, with only a few exceptions (namely size, cash to total assets, strength of capital regulations and market concentration), all variables (including our target ones) show a statistically significant difference during crisis years. Table A.2 in Appendix shows that although most pairwise correlation coefficients are statistically significant, the magnitudes are relatively low.

[Insert Table 2 about here]

4. Main Results

4.1 Baseline Analysis

Table 3 reports the results of the baseline model described in Equation (1) for our sample banks over the period 2005–2017. This model is based on a two-step system GMM estimator and includes the Hansen test, Hansen p-value (confirming the validity of the instruments) and AR(2) – second-order autocorrelation tests (confirming that there is no second order serial correlation in the error terms). We use alternatively, as target variables, the composite ESG score (column I) and its constituents (columns II, III, and IV).

[Insert Table 3 about here]

Each variable of interest (ESG, ENV, SOC, and GOV) is interacted with the dummy crisis (D_CRISIS) to verify whether the contribution of ESG strategies to bank stability varies over time. We also include control variables related to bank–specific and country–specific factors.

Focusing on the results for the total ESG score, column (I) of Table 3 displays a significant relationship with our dependent variable (Distance to Default), but only when interacted with the dummy crisis and showing the expected positive sign. In other words, we find that the overall engagement in sustainability practices has explanatory power for stabilisation during periods of financial distress, as hypothesized (*H1*) and consistently with the moral capital theory. This implies that banks with higher ESG scores seem less prone to insolvency during periods of financial distress. In line with Peloze (2006), engaging in sustainability practices encourages more prudent banking, fosters more stable relations with the financial community and enhances reputation.

Our results confirm the "risk mitigation view", deriving from the stakeholder theory, seeing

CSR as an insurance-like mechanism towards stakeholders (Godfrey, 2005; Godfrey et al. 2009; El Ghoul et al., 2017). The same holds true when we look at the individual constituents of ESG scores (columns II, III, and IV of Table 3): only in times of crisis, each ESG pillar (ENV, SOC, and GOV) is explanatory over bank stability, supporting our hypothesis (*H2*, *H3*, and *H4*).

With reference to the ENV–stability linkage, Table 3 shows that environmentally-active banks benefit in terms of stability during crisis periods (Ducassy, 2013). This outcome is broadly in line with previous studies (e.g. Feldman et al., 1997; Bouslah et al., 2013; Cheng et al., 2014; Gangi et al. 2019). For example, Feldman et al. (1997) found that engagement in environmental practices implies a reduction in perceived riskiness from investors. Cheng et al. (2014)'s results suggest that environmentally–friendly activities are associated with better stakeholder engagement. Gangi et al. (2019) show that banks should assume environmental responsibility not only to generate spillover benefits to the community, but also to achieve their own strategic goals and address the pressures of strengthening regulatory requirements. We find that SOC positively affects bank stability only during crisis year. A possible explanation for this result is that more active lending and monitoring activities due to increased employee satisfaction should strengthen stability.

Finally, a significant and positive sign is found also for GOV, but again only during times of crisis. Previous studies find more shareholder-oriented banks incurred greater losses (Anginer et al, 2018) especially during the crisis (Beltratti and Shultz, 2012). However, unlike Anginer et al. (2018), our evidence suggests that improved corporate governance seems to provide benefits in terms of stability. Our results are therefore in line with literature exploring the link between stakeholder-oriented governance and bank stability (Dell'Atti et al., 2017; Leung et al., 2019).

Overall, our findings on ESG target variables show that, during periods of financial distress, the integration of ESG practices into banks' internal processes seems to be beneficial in reducing bank fragility.

However, bank stability is also related to other bank- or country-specific factors. Table 3 shows

that the proxies for bank capital (ETA), asset quality (LLR_GL), income diversification (DIV) and ECB's unconventional liquidity injections (D_VLTRO) are relevant.

As expected, the ETA and LLR_GL variables show a positive and a negative sign, respectively. Overall, we find that banks that are more capitalized and with a sound asset quality tend to be more stable. For DIV and D_VLTRO, the negative sign prevails, suggesting that increasing diversification reduces bank stability. Indeed, diversification is not always beneficial for banks, for instance when it extends to businesses or geographical areas poorly understood by managers or when activities, despite diverse, remain highly correlated. Moreover, the negative sign for D_VLTRO means that the ECB unconventional liquidity injections seem to have contributed to a lower stability for banks that obtained them. This result confirms those of Tabak et al. (2012), who find that banks with more liquidity appear farther from the stability frontier. Such evidence is intuitively reasonable since high levels of liquidity may encourage banks to put in place risk-taking behaviour that can determine a decrease in their resilience (although the contrary may be also true, see e.g. Bias et al., 2016).

With reference to macroeconomic factors, Table 3 reveals statistically significant coefficients only for the variable targeting supervisory powers (SUP_PWR) at the country level, but the sign is not as expected (negative rather than positive), implying a decrease in bank stability. We therefore find that the strength of supervision is limited in ensuring bank stability. Although this result confirms recent findings in the literature (Chiaramonte et al., 2015), it should be interpreted with caution. In other words, instead of signalling that more supervisory power lowers stability, the variable is more likely supportive of the recent European effort in fostering improvements in supervision, especially after 2011 and above all through the creation of a banking union.

Finally, as expected, we find a significant negative sign for the crisis dummy (D_CRISIS). However, this result should be read jointly with the interaction term. Considered alone, the financial crisis dummy suggests that financial turmoil leads to a generalized reduction in the distance-to-default (i.e. worsening stability). But ESG scores (including individual pillars), during the same years (i.e.

the interaction term) invert this trend through an increase in the distance-to-default. The magnitude of the latter effect is stronger than the former (for the overall ESG score and the Social and Governance pillars), or slightly smaller (for the Environmental pillar).

4.2 Tests for Disentangled ESG components

We re-estimate our baseline model using, as target variables, the following ESG components: *Resource Use score*, *Emission score*, and *Environmental Innovation score* for the first pillar ENV; *Workforce score*, *Human Rights score*, *Community score*, and *Product Responsibility score* for the second pillar SOC; and finally, *Management score*, *Shareholders score*, and *CSR Strategy score* for the pillar GOV (see Table A.1 in Appendix). Due to multicollinearity issues across sub-components of the same ESG pillar, we centred them with their averages. Results are presented in Table 4.

We find that the ESG–bank stability linkage is mainly driven by the following four sub-components: *Environmental Innovation score*, *Workforce score*, *Product Responsibility score*, and *Shareholders score*. These are significant only when interacted with the dummy crisis, showing a positive relationship with our proxies for bank stability. One possible empirical channel could be through lending if banks with higher ESG scores are those that account more for environmental and social components in their loan origination and pricing policies (see e.g., Chen et al., 2020 and Zhou et al., 2021). It is reasonable to expect that on average such banks will benefit in terms of more stability (i.e. less risk) in a credit-driven financial crisis.

We find that the beneficial effects of sustainability practices on bank stability, occur only during periods of financial distress, and is attributable to a variety of factors. These include: the development of new environmental technologies and processes that optimize the use of resources; the fair treatment of the workforce; the banks' responsibility to produce quality goods and services integrating the customer's health, safety, integrity, and data privacy; the banks' ability to guarantee equal treatment of shareholders and to enforce anti-takeover devices. All these findings reinforce the expectations

included in our hypothesis (*H2, H3* and *H4*), adding more insights to the categories of ESG scores that appear more strongly associated to financial stability of banks during financial crisis.

[Insert Table 4 about here]

4.3 Effects of the 2014 EU Non-Financial Reporting Directive

We also examine the impact of the EU NFRD of 2014 for banks with higher or lower ESG scores, in a DID regression model. Our sample includes European countries (Norway, Russia, Switzerland) outside the geographical scope of the NFRD. Additionally, some countries (Denmark, France) implemented comparable regulations before 2014. Therefore, we performed the DID setting excluding Russia, Switzerland, France, Norway, and Denmark. Other countries (i.e. Greece, Finland, Luxembourg, and Sweden) implemented more restrictive thresholds based on the number of employees, total assets and/or net turnover, however, they all applied the NFRD to listed companies. Since our sample is entirely constituted by listed banks, with more than 500 employees the comparability of results is ensured.

Panel A of Table 5 shows the result of the logit model employed to calculate propensity scores through non-binary bank-level controls and bank fixed-effects. Panel B confirms that there are no significant differences between targets and their matches in our sample. In other words, our methodological approach allows us to conduct our DID comparison on control banks that are very similar to treatment banks, reducing individual differences and the related potential bias. Finally, Panel C shows the results of the DID, confirming the robustness of our baseline results. More specifically, they confirm that the stabilizing effect of ESG scores is present for banks with higher levels of ESG ratings after the reform of 2014, consistently with our *H5*.

[Insert Table 5 about here]

The results of the DID model support the recent increasing effort of European regulators towards a mandatory enhanced disclosure of non-financial information. More specifically, we interpret the results of the DID regression considering the moral capital theory (Bouslah et al., 2018). It is reasonable to assume that since the introduction of the NFRD, banks' stakeholders and shareholders have recognized the higher moral capital accumulated by high-ESG banks, which by creating relational wealth among stakeholders, reduce uncertainty on future cash flows and improve market-based stability measures.

Figure A.1 in the Appendix shows that, in absence of the shock occurred in 2014, the trend for the bank stability measure (DTD) is similar for both the treatment and the control groups, hence providing visual support to the parallel trends assumption. The robustness of this finding is furtherly checked in the following section on a relevant subsample of countries.

5. Additional analyses and robustness checks

To strengthen the validity of our findings, we run a set of further analyses and robustness checks. Firstly, accounting for the ESG score level as well as the duration of ESG disclosures, in Table 6 we test two-step system GMM regressions using alternatively, as variables of interest, the ESG rating level (columns I) and the number of years of the bank's ESG disclosure (ESG_Nyears, columns II). For ESG rating levels we split our sample in two groups: below or above the sample mean of the ESG score. Each target variable is interacted with the dummy crisis. This approach allows us to test if previous results were prone to the non-random introduction of the legislative shock (Directive 2014/95/EU). We confirm the stabilizing effect of ESG scores in periods financial distress for banks with higher ESG scores, whereas for the subsample with lower ESG scores statistical significance is weak. In addition, we find that, in times of financial turmoil, the longer the duration of ESG disclosures, the higher are the benefits in terms of bank stability. Therefore, it seems that

stability benefits from both a greater and a longer engagement in ESG activities.

[Insert Table 6 about here]

To control for the sample selection bias originated by the criteria used to create our sample banks (see Section 3.2), we also run the Heckman (1978)'s two-step method (Wu and Shen, 2013; Shen et al., 2016; McGuinness et al., 2017) as follows. In the first step (Panel A of Table 7) we estimate the decision equation using a multinomial probit model, whose parameters are used to calculate the Inverse Mills Ratio (IMR), where the dependent variables are dummies (D_ESG) equal to 1 from the year in which a bank of our sample started to be involved in ESG practices and 0 before. The second step (see Panel B of Table 7) employs the IMR as the additional explanatory variable in the performance equation, in our case the stability regression (Li and Prabhala, 2007). Results stress the strength and unbiasedness of our baseline regression and confirm the significant and positive role of our ESG target variables in supporting bank stability only during financial crisis.

[Insert Table 7 about here]

Moreover, we verify the robustness of results to potential endogeneity bias stemming from reverse causality, omitted variables and measurement error. For instance, companies with better financial performance or more stable, may be inclined to engage more in CSR (Bénabou and Tirole, 2010; Chih et al., 2010). Our results may be sensitive to the measures used for both bank stability and the ESG scores. We alleviate these concerns using both the instrumental variables (IV) two-stage least squares (2SLS) estimator (Table 8) and the two-step system GMM model based on an alternative definition of bank stability (Table 9) and ESG scores (Table 10).

For the IV 2SLS, in the first stage we estimate the goodness, as an instrument for our target

variable, of the political orientation of each country (Cheung, 2016; Hasan et al., 2018). The dummy variable *Political_orient* is equal to 1 for firms headquartered in countries that voted for democrats or progressive political parties and 0 otherwise. The rationale behind the selection of this instrument is that democrats or progressive political parties are more likely to exert pressure on firms to adopt green and sustainable practices, while republican or conservators are not. Therefore, political orientation of a country should be correlated with CSR (Cheung, 2016; Hasan et al., 2018) but is unlikely to have a significant effect on bank risk. To obtain the information about the country political orientation in Europe, we employ the Chapel Hill Expert Survey (CHES) database (Polk et al., 2017).

As shown in Panel A of Table 8, these are all positively and significantly correlated with all instrumented target variables. The Cragg-Donald F-test statistics are all higher than the critical value of 16.38, with p-values smaller than 0.01 in all specifications. The weak instrument hypothesis test (i.e. testing for the relevance of the IV in the first stage) and the higher F-test (lower p-values) indicate a rejection of the null: our IVs are strongly correlated with our endogenous variables, supporting their validity. In the second stage (Panel B of Table 8), the coefficients of our target variables (ESG, ENV, SOC, GOV) are all positive and statistically significant during financial turmoil, confirming our baseline findings (Table 3).

[Insert Table 8 about here]

Adopting only one market-based risk indicator (the distance to default) could be considered as a partial view on our target relationship. Hence, we perform our estimations using as dependent variable the Z-score (Panel A of Table 9), as well as its individual components (Panel B) as in Lepetit et al. (2008); Doumpos et al. (2015).

The Z–score is a widely used and reliable accounting-based alternative bank stability measure (Beck and Laeven, 2006, Demirgüç-Kunt and Huizinga, 2010; Beck et al., 2013; Bartholdy and

Justesen, 2020, among others), calculated as the sum of equity to total assets (ETA) and return on average assets (ROAA), scaled by the three–year standard deviation of ROAA. Data for its computation is collected from Thomson Reuters and it measures the number of standard deviations that profits can fall before a bank fails (Beck and Laeven, 2006). Higher Z–score values indicate a lower probability of insolvency and thus greater bank stability. Since the Z–score is highly skewed, we use its natural logarithm (Laeven and Levine, 2009). Table 9 shows how results are consistent with our main findings.

[Insert Table 9 about here]

We further test the consistency of our results using an alternative ESG score definition, provided by a different provider (Bloomberg), in a two-step system GMM setting. The alternative ESG variables (BESG, BENV, BSOC and BGOV) are built with a different methodology: the focus is on the level of transparency of information disclosed by reporting entities. In Table 10, model (I) refers to BESG, the score capturing the overall score, model (II) on BENV (carbon emissions, climate change effects, pollution waste disposal, renewable energy and resource depletion), model (III) on BSOC (supply chain, discrimination, political contributions, diversity, human rights and community relations), and model (IV) on BGOV (cumulative voting, executive compensation, shareholders' rights, takeover defence, staggered boards and independent directors). We find again support for our baseline findings.

[Insert Table 10 about here]

Since our analysis relies on a heterogenous cross–country sample of European banks, we further test its robustness by performing several additional analyses in our baseline econometric setting on

specific sub-samples, to assess whether the ESG–bank risk linkage varies significantly due to banks' characteristics or different operating environments.

As shown in Table 11, we find that only the largest European banking groups subject to the periodic EBA stress testing exercise show the association between stability and ESG scores during crisis periods. This result is supportive of the European regulatory effort towards both listed and larger entities (including banks) in enhancing non-financial disclosures.

[Insert Table 11 about here]

Our evidence also indicates that, in times of crisis, ESG strategies play a beneficial role for financial stability only in bank-oriented financial systems, where systemic risks could pose a greater threat (Table 11). A possible explanation is that ESG practices are of particular relevance in providing several competitive advantages, such as enhancing a bank's reputation, which is a crucial factor in withstanding both financial turmoil and the potential lack of trust arising from it. On the other side, a market-oriented system could be able to provide market discipline more frequently and gradually through pricing effects, showing a limited response during financial turmoil.

Furthermore, we observe (Table 11) that ESG scores have a positive association with financial stability only for those banks located in European countries with higher income levels based on average GDP per capita. This result could be an additional evidence on the greater sensitivity towards sustainability that is achieved at higher levels of economic development (even if we do not consider emerging countries). At the same time, richer countries engage in ESG activities sooner than others, achieving already a sufficient level to obtain stability benefits before the financial crisis hit. However, this result should be interpreted with caution since we do not investigate the cause-effect direction of this relationship.

Additionally, we run our baseline model using Country-Level Index of Financial Stress

(CLIFS) and its annual variation (ΔCLIFS) as alternative measures of the financial crisis. The CLIFS index is composed by six market-based financial stress measures, aimed at capturing equities, bonds and foreign exchange co-movements during financial turmoil. The CLIFS index is provided on a monthly frequency by the ECB: we annualized it by taking the 12-month average values to adapt it to the yearly frequency of our dataset. Following Hollo et al. (2012) and Duprey et al. (2017), the CLIFS is standardized using the empirical cumulative density function (CDF) over a 10-year window to ensure both cross-country comparability and a sufficient cover of financial stress events. Table 12 reports the results of this additional test. The coefficients of interest *ESG*CLIFS* and *ESG*ΔCLIFS* are statistically significant and strongly positively correlated with bank stability, also when including time and country fixed effects. Overall, this additional analysis furtherly corroborates our baseline results.

[Insert table 12 about here]

As we are interested in testing the effect of ESG scores on banks' stability during financial turmoil in Europe, it is useful to disentangle if the relationship differs for: i) the subprime crisis, which took place in 2008-2009; ii) the European sovereign debt crisis, which took place from 2010 to 2012. To this aim, we create two dummy variables: the SUB_CRISIS, which takes the value of 1 for years 2008-2009 and 0 otherwise, and the SOV_CRISIS, which equals 1 for years 2010-2012, and 0 otherwise. Then, we interact these variables with banks' ESG scores. Results are provided in Table 13.

[Insert Table 13 about here]

As expected, we find significant negative associations between ESG and DTD that seems slightly stronger during the subprime crisis, as demonstrated by the magnitude of the coefficients.

This evidence could be related to fact that, by differentiating loan spreads between firms more or less exposed to environmental issues (as demonstrated by e.g., Chen et al. 2020), banks with higher responsibility could benefit from lower risks (see e.g Zhou et al., 2021), especially when the turmoil originates in the credit market.

Finally, a question arises as to whether there are potential non-linearities in our relationships of interest. Similarly to Azmi et al. (2020)'s study on ESG and bank performance in emerging markets, we run several additional tests to check for potential non-linear effects during the crisis period and found no evidence of them.[17] However we believe that more research is needed in this area as the differences across our data sample both in terms of time span and countries under investigation, do not allow a direct comparison.

6. Conclusions

This paper empirically investigates the joint and separate effects of environmental, social, and governance scores (ESG) on bank stability for the European banking sector. The long sample period (2005-2017) includes the global financial and European sovereign debt crises and allows us to verify whether the effect on bank stability depends on the economic cycle, while controlling for bank- and country-specific variables. We hypothesize that, during a financial crisis: (i) banks with higher ESG scores are less risky; (ii) environmental activism reduces bank risk-taking; (iii) bank instability is inversely related to the level of social engagement; (iv) fair governance practices positively affect bank stability; and (v) the EU 2014 Non-Financial Reporting Directive rewarded banks more engaged in CSR practices.

We find that both the composite ESG score and its individual pillars reduce bank fragility, with a higher impact for the *social* dimension. This effect emerges during crises periods and is robust to

[17] We thank an anonymous reviewer for suggesting this analysis. Results are not reported but are available with the authors.

selection bias and endogeneity issues. Our evidence is supportive of the predictions of the stakeholder theory and supports the idea that moral capital creates value and resilience for firms.

When we further disentangle the components of each ESG pillar, our results show that greater effects are attributable to environmental innovation, the fair treatment of the workforce, product responsibility and the equal treatment of shareholders. We also show that the positive ESG-bank stability linkage holds especially for banks with higher ESG scores, both by splitting our sample, as well as exploiting the EU 2014 NFRD as a shock in a differences-in-differences setting. Additionally, we find that the effect is stronger the longer the duration of disclosures. These results imply that the benefits of sustainability practices are contingent on the level of a bank's engagement in ESG practices, but also on a longer commitment.

Finally, we find that ESG ratings exert a different impact on stability depending on the characteristics of banks and their operating environments. Only the largest European banking groups seem to obtain benefits on financial stability during crisis periods. This result is supportive of the recent European regulatory requirement on enhanced non-financial disclosures enforced for public-interest institutions, including banks. We also find that, in times of crisis, ESG strategies play a beneficial role for financial stability in bank-oriented financial systems, where systemic risks may pose a greater threat, as well as in European countries with higher income levels, that could be more sensitive to sustainability issues or may have engaged in related practices earlier.

This paper provides evidence that ESG strategies could act as an insurance-like risk mitigation device for banks during periods of financial distress. A possible explanation is that engaging in environmental, social, and corporate governance practices seems to be associated with more prudent banking activities, fostering a more stable relationships with reference communities and enhancing a bank's reputation. Hence, our findings confirm that enhancing ESG engagement in the banking sector is not only beneficial in terms of its impact on the environment and the society but is also able to strengthen the resilience of the banking sector when a financial crisis occurs.

Overall, our evidence reveals that, beyond the traditional regulatory approach, focusing on ESG issues matters in the banking sector and corroborates the proposal, advanced by the European Banking Authority, to include ESG considerations within supervisory frameworks. Additionally, integrating sustainability practices into banks' internal processes to enhance stability should constitute an interesting suggestion also for a sound management of credit institutions.

In terms of policy implications, our results suggest that sustainability practices require strong efforts and relatively long periods of time before they provide a benefit on stability. How to improve such benefits or how to extend them to smaller institutions, are open questions for policymakers that should be addressed in future academic research.

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Table 1 - Variable definitions and expected relationships vs bank stability

This table describes the variables used in our model and summarizes their hypothesized relationships with our dependent variables (bank stability).

Variable name	Definition	Source	Expected sign
DEPENDENT VARIABLE			
DTD	The Merton's Distance to Default, computed as the inverse standard normal cumulative distribution function of the probability of default (PD).	Bloomberg database (Authors' calculation)	/
TARGET VARIABLES			
ESG	Environmental Social Governance (ESG) score is an overall company score based on the self-reported information in the Environmental (ENV), Social (SOC) and corporate Governance (GOV) pillars. See Table A.1 in Appendix for further details.	Thomson Reuters' Refinitiv database (Authors' calculation)	Positive
ENV	Environmental score is an overall company score based on the weighted average of self-reported information in the *Resource Use score*, *Emissions score* and *Environmental Innovation score*. See Table A.1 in Appendix for further details.		Positive
SOC	Social score is an overall company score based on the weighted average of self-reported information in the *Workforce score*, *Human rights score*, *Community score* and *Product Responsibility score.* See Table A.1 in Appendix for further details.	Thomson Reuters' Refinitiv database (Authors' calculation)	Positive
GOV	Governance score is an overall company score based on the weighted average of self-reported information in the *Management score*, *Shareholders score*, *Corporate Social Responsibility (CSR) Strategy score*. See Table A.1 in Appendix for further details.		Positive
D_SHOCK	Dummy for the publication of the Non-financial Reporting Directive 2014/95/EU: equals 1 for years 2015–2017 and 0 otherwise.	Authors' calculation	Negative
D_TREATED	Dummy equal to 1 for banks above mean ESG values in the year of the shock (2014) and 0 otherwise.	Authors' calculation	Negative
BANK CONTROLS			
SIZE	Natural logarithm of total assets.	Thomson Reuters database (Authors' calculation)	Positive/Negative
ETA	Equity to total assets.		Positive
LLR_GL	Loan loss reserves to gross loans.		Negative
CIR	Cost-income ratio.		Negative
ROAE	Return on average Equity.		Positive
CASH_TA	Cash to total assets		Positive
DIV	Non-interest income to net operating revenue.		Positive/Negative
D_VLTRO	Dummy equals to 1 for the period in which the European Central Bank (ECB) provided liquidity to a specific bank through the Very Long-Term Refinancing Operations (VLTRO) and 0 otherwise.	Bloomberg database	Positive/Negative
COUNTRY CONTROLS			
GDP_GRW	Annual Gross Domestic Product (GDP) growth rate.	World Bank Financial Development database	Positive
HHI	The Herfindahl-Hirschman Index calculated as the sum of the squared market share value (in terms of total asset) of all banks in the country.	Thomson Reuters database (Authors' calculation)	Positive/Negative
CAP_REG	The strength of capital regulation at the country level.	World Bank (Barth et al., 2008)	Positive
SUP_PWR	The strength of supervision at the country level.		Positive
D_CRISIS	Dummy equals to 1 for years 2008–2012 and 0 otherwise (2005–2007 and 2013–2017).	Authors' calculation	Negative

Table 2 – Summary statistics

This table reports the summary statistics (mean, standard deviation, minimum and maximum values) of our variables in (I) crisis years (2008–2012) and (II) non-crisis periods (2005–2007 and 2013–2017). Variable definitions are provided in Table 1. All control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. ***, **, and * denote statistical significance at 1%, 5% and 10% levels for test of differences in means between crisis-period (I) and Non-crisis periods (II).

	Crisis period (I)		Non-crisis periods (II)		Difference in
Variables	Mean (Std. Dev.)	Min.-Max.	Mean (Std. Dev.)	Min.-Max.	means (I) – (II)
Dependent variable					
DTD	2.688 (0.535)	0.940-4.689	2.898 (0.488)	0.801-3.897	-0.209***
Target variables					
ESG	0.590 (0.194)	0.166–0.913	0.611 (0.187)	0.159–0.931	-0.021**
ENV	0.651 (0.255)	0.138–0.966	0.668 (0.241)	0.098–0.973	-0.017**
SOC	0.594 (0.222)	0.082–0.980	0.614 (0.210)	0.077–0.971	-0.019**
GOV	0.516 (0.220)	0.084–0.952	0.543 (0.211)	0.044–0.916	-0.026**
Control variables					
SIZE	9.069 (2.428)	3.263–14.763	9.052 (2.370)	2.688–14.733	0.017
ETA	0.093 (0.065)	0.018–0.449	0.100 (0.059)	0.018–0.449	-0.007**
LLR_GL	0.038 (0.038)	0–0.261	0.046 (0.060)	0–0.317	-0.008***
CIR	0.694 (0.236)	0.273–1.619	0.650 (0.188)	0.273–1.619	0.044***
ROAE	0.045 (0.147)	-0.690–0.520	0.080 (0.125)	-0.689–0.495	-0.035***
CASH_TA	0.116 (0.115)	0–0.636	0.121 (0.114)	0–0.636	-0.005
DIV	0.098 (0.159)	-0.058–0.802	0.109 (0.154)	-0.058–0.802	-0.011*
GDP_GRW	0.002 (0.032)	-0.151–0.083	0.024 (0.023)	-0.098–0.255	-0.022***
HHI	0.336 (0.232)	0–1.000	0.329 (0.207)	0–1.000	0.007
CAP_REG	6.479 (1.872)	3–9	6.493 (1.697)	3–9	-0.014
SUP_PWR	9.911 (2.110)	5–14.5	10.08 (2.093)	5–14.5	-0.169**

Table 3 – Baseline model

This table reports the estimates of the two-step system GMM model during the period 2005–2017. The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. The variables of interest are: the ESG score - see model (I); and its three components (ENV, SOC and GOV score) - see models (II), (III), and (IV), respectively. Each target variable is interacted with the dummy crisis (D_CRISIS). Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	DTD			
	ESG score	ESG score components		
	(I)	(II)	(III)	(IV)
DTD (-1)	0.669***	0.669***	0.662***	0.673***
	(0.122)	(0.134)	(0.124)	(0.110)
ESG (-1)	-0.120			
	(0.146)			
ESG (-1)*D_CRISIS	0.286***			
	(0.085)			
ENV (-1)		-0.104		
		(0.223)		
ENV (-1)*D_CRISIS		0.217***		
		(0.075)		
SOC (-1)			-0.203	
			(0.135)	
SOC (-1)*D_CRISIS			0.319***	
			(0.080)	
GOV (-1)				-0.031
				(0.128)
GOV (-1)*D_CRISIS				0.296***
				(0.094)
D_CRISIS	-0.250***	-0.226***	-0.275***	-0.263***
	(0.064)	(0.081)	(0.067)	(0.072)
SIZE (-1)	-0.006	-0.006	-0.004	-0.010
	(0.013)	(0.012)	(0.012)	(0.009)
ETA (-1)	2.989**	3.523**	2.480*	2.112*
	(1.392)	(1.657)	(1.385)	(1.218)
LLR_GL (-1)	-2.344**	-2.454**	-2.323**	-1.926*
	(1.070)	(1.142)	(1.037)	(1.036)
CIR (-1)	0.057	0.079	0.038	0.022
	(0.178)	(0.168)	(0.179)	(0.176)
ROAE (-1)	-0.176	-0.206	-0.188	-0.193
	(0.256)	(0.241)	(0.250)	(0.254)
CASH_TA (-1)	0.461	0.392	0.620*	0.648
	(0.534)	(0.534)	(0.351)	(0.546)
DIV (-1)	-0.216*	-0.220	-0.211*	-0.253**
	(0.117)	(0.139)	(0.113)	(0.104)
D_VLTRO	-0.014	-0.016	-0.013	-0.007
	(0.058)	(0.059)	(0.056)	(0.067)
GDP_GRW (-1)	-0.941	-1.046	-0.743	-0.996
	(0.842)	(1.246)	(0.799)	(1.194)
HHI (-1)	0.047	0.034	0.014	0.054
	(0.101)	(0.105)	(0.095)	(0.089)
CAP_REG (-1)	0.010	0.012	0.013	0.008
	(0.013)	(0.013)	(0.012)	(0.011)
SUP_PWR (-1)	-0.021*	-0.019**	-0.021*	-0.020**
	(0.012)	(0.007)	(0.011)	(0.010)
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	439	439	439	439
Hansen p-value	0.894	0.893	0.896	0.896
AR(2)	0.394	0.422	0.367	0.430

Table 4 – Estimation results for disentangled ESG score components

This table reports the estimates of the two-step system GMM model obtained disentangling the ESG score components. Model (I) is referred to the ENV component and includes the following categories: *Resource use score*, *Emissions score*, and *Environmental Innovation score*. Model (II) is referred to the SOC component and includes the following categories: *Workforce score*, *Human Rights score*, *Community score*, and *Product Responsibility score*. Model (III) is referred to the GOV component and includes the following categories: *Management score*, *Shareholders score*, and *CSR Strategy score*. Each target variable is interacted with the dummy crisis (D_CRISIS). The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. All bank and country controls are included. Variable definitions are provided in Tables 1 and A.1 (in Appendix). The sample period observed is 2005–2017. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	DTD		
Variables	ENV	SOC	GOV
	(I)	(II)	(III)
DTD (-1)	0.720***	0.680***	0.663***
	(0.140)	(0.126)	(0.107)
Resource use score (-1)	0.283		
	(0.337)		
Resource use score (-1)*D_CRISIS	-0.537		
	(1.431)		
Emissions score (-1)	0.088		
	(0.187)		
Emissions score (-1)*D_CRISIS	-0.563		
	(0.583)		
Environmental Innovation score (-1)	-0.119		
	(0.144)		
Environmental Innovation score (-1)*D_CRISIS	0.294***		
	(0.089)		
Workforce score (-1)		-0.154	
		(0.121)	
Workforce score (-1)*D_CRISIS		0.242**	
		(0.109)	
Human Rights score (-1)		0.137	
		(0.191)	
Human Rights score (-1)*D_CRISIS		-0.481	
		(0.551)	
Community score (-1)		-0.009	
		(0.094)	
Community score (-1)*D_CRISIS		-0.053	
		(0.232)	
Product Responsibility score (-1)		-0.089	
		(0.133)	
Product Responsibility score (-1)*D_CRISIS		0.372*	
		(0.221)	
Management score (-1)			0.058
			(0.099)
Management score (-1)*D_CRISIS			-0.075
			(0.201)
Shareholders score (-1)			-0.041
			(0.082)
Shareholders score (-1)*D_CRISIS			0.220**
			(0.098)
CSR Strategy score (-1)			0.191
			(0.181)
CSR Strategy score (-1)*D_CRISIS			-0.345
			(0.327)
D_CRISIS	-0.252***	-0.243***	-0.222***
	(0.074)	(0.084)	(0.068)
Control variables (-1)	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes
N. of obs.	439	439	439
Hansen p-value	0.895	0.899	0.899
AR(2)	0.333	0.469	0.579

Table 5 – Effects of the 2014 EU Non-Financial Reporting Directive

This table provides the results of our differences-in-differences strategy based on the Directive 2014/95/EU. Firstly (Panel A) we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983) to reduce the potential bias arising from heterogeneity of treated (T) and control (C) groups, employing all non-binary bank-level controls (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV). The dependent variable (D_HIGH_ESG) equals 1 for banks above average values of ESG scores (treated) and 0 otherwise. Panel B provides the univariate statistics on the effectiveness of the PSM procedure. Panel C shows the results of the DID estimation for both an OLS (I) and a panel data estimation (II). Finally, Panel D shows the DTD difference between treated and control entities before and after the Directive. The dependent variable is the one-year Merton's Distance to Default (DTD) as a proxy for stability. Target variables are: D_SHOCK, equal to 1 for years 2015–2017 (after the shock, i.e. the publication of the Directive) and 0 otherwise; D_TREATED, that takes value of 1 for banks above mean values of ESG scores in the year of the shock (2014), and 0 otherwise; the interaction term D_SHOCK*D_TREATED. Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% level of each tail. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – Logit Model: identifying propensity scores

Variables	D_HIGH_ESG
SIZE (-1)	0.0812
	(0.0502)
ETA (-1)	-13.59***
	(2.810)
LLR_GL (-1)	-3.202**
	(1.605)
CIR (-1)	-0.104
	(0.398)
ROAE (-1)	21.24**
	(9.509)
CASH_TA (-1)	-2.029*
	(1.135)
DIV (-1)	-1.237
	(0.866)
Bank FE	Yes
Cluster SE	Yes
Bank	Yes
N. of obs.	326

Panel B – Univariate Statistics: effectiveness of matching

Variables	Treated (T)	Control (C)	Difference (T-C)	P-value
SIZE	10.496	10.559	-0.063	0.590
ETA	0.098	0.098	0	0.900
LLR_GL	0.056	0.056	0	0.298
CIR	0.652	0.641	0.011	0.380
ROAE	0.001	-0.002	0	0.200
CASH_TA	0.100	0.100	0	0.100
DIV	0.098	0.088	0.010	0.190

Panel C – Difference in Difference (DID) estimation

	DTD	
Variables	(I)	(II)
D_SHOCK	-0.119	-0.186**
	(0.094)	(0.085)
D_TREATED	-0.121	-2.146
	(0.121)	(1.673)
D_SHOCK*D_TREATED	0.243*	0.203**
	(0.126)	(0.137)
Control variables (-1)	Yes	Yes
Bank FE	No	Yes
Cluster SE Bank	Yes	Yes
N. of obs.	159	159

Panel D - Univariate Statistics: DTD Before and After the Directive

	Before the Directive		Difference	After the Directive		Difference
Variable	Treated (T)	Control (C)	(T-C)	Treated (T)	Control (C)	(T-C)
DTD	2.80	2.70	0.10	2.96	2.81	0.15**

Table 6 – Accounting for ESG disclosure duration and ESG score level

This table reports the estimates of the two-step system GMM model obtained using as target variable in model (I) the ESG score level (below vs above the sample mean of ESG score); and in model (II) the number of years of the bank's ESG score disclosure (ESG_Nyears). Each target variable is interacted with the dummy crisis (D_CRISIS). The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. All bank and country control variables are included in the model. Variable definitions are provided in Table 1. The sample period observed is 2005–2017. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	DTD		
Variables	Below mean ESG score	Above mean ESG score	N. of years of ESG score disclosure
	(I)		(II)
DTD (-1)	0.691***	0.771***	0.652***
	(0.106)	(0.165)	(0.078)
ESG (-1)	-0.147	-0.067	
	(0.341)	(0.179)	
ESG (1)*D_CRISIS	0.408**	0.310***	
	(0.172)	(0.089)	
ESG_Nyears (-1)			-0.025
			(0.020)
ESG_Nyears (-1)*D_CRISIS			0.021***
			(0.005)
D_CRISIS	-0.189	-0.265***	-0.303**
	(0.122)	(0.079)	(0.063)
Control variables (-1)	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes
N. of obs.	156	288	439
Hansen p-value	1.000	0.851	0.921
AR(2)	0.157	0.908	0.495

Table 7 – Heckman two-step estimation results

This table reports the results obtained from the Heckman two-step model over the period 2005–2017, with Panel A showing the first step and Panel B the second one. The first step estimates the decision equation using a multinomial probit model, whose parameters are used to calculate the Inverse Mills Ratio (IMR). In this setting the dependent variables are dummies (D_ESG) equal to 1 from the year in which a bank of our sample started to be involved in ESG practices; and 0 in the previous years. The second step estimates the stability regression with the Inverse Mills Ratio (IMR) generated by the first step. The dependent variable used in the second step is the one-year Merton's Distance to Default (DTD) which measures bank stability. The variables of interest in Panel B are: the ESG score - see model (I); and its three components (ENV, SOC and GOV score) - see models (II), (III), and (IV), respectively. Each target variable is interacted with the dummy crisis (D_CRISIS). Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – First step of the Heckman two-step model

Variables	D_ESG
D_CRISIS	0.018
	(0.210)
SIZE (-1)	0.387***
	(0.085)
ETA (-1)	-7.339**
	-3.599
LLR_GL (-1)	-2.682
	-2.852
CIR (-1)	0.252
	(0.598)
ROAE (-1)	0.500
	-1.305
CASH_TA (-1)	-6.028***
	-1.777
DIV (-1)	-0.735
	(0.956)
D_VLTRO	0.369
	(0.454)
GDP_GRW (-1)	-9.100***
	-2.721
HHI (-1)	-0.486
	(0.618)
CAP_REG (-1)	0.128**
	(0.057)
SUP_PWR (-1)	-0.113*
	(0.068)
Bank FE	Yes
Cluster SE Bank	Yes
N. of obs.	608

Panel B – Second step of the Heckman two-step model

Variables	DTD			
	ESG score	ESG score components		
	(I)	(II)	(III)	(IV)
ESG (-1)	-0.434			
	(0.284)			
ESG (-1)*D_CRISIS	0.193**			
	(0.098)			
ENV (-1)		0.088		
		(0.194)		
ENV (-1)*D_CRISIS		0.111*		
		(0.065)		
SOC (-1)			-0.438	
			(0.285)	
SOC (-1)*D_CRISIS			0.159*	
			(0.092)	
GOV (-1)				0.025
				(0.158)
GOV (-1)*D_CRISIS				0.245***
				(0.087)
D_CRISIS	-0.294***	-0.244***	-0.257***	-0.288***
	(0.066)	(0.049)	(0.064)	(0.057)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	608	608	608	608
IMR	0.410	0.129	0.395	0.347
	(0.279)	(0.168)	(0.270)	(0.237)

Table 8 – IV 2SLS estimation results

This table reports the results of the instrumental variables (IV) two-stage least squares (2SLS) estimator model over the period 2005–2017. In Panel A we report the results of the first stage of the IV 2SLS estimator, where we instrument each of our target variables (the ESG score and its three components) with country political orientation (*Political_orient*) (Cheung, 2016; Hasan et al., 2018), showing their correlations and goodness (the Cragg-Donald weak instruments F-test statistics) with reference to the original target variable being instrumented (ESG, ENV, SOC and GOV scores). The dependent variables for the first stage are: ESG, ENV, SOC, and GOV scores in columns (I), (II), (III), (IV), respectively. Panel B provides the results of the second stage of the IV 2SLS where we replace the potentially endogenous interest variables with the results of the first stage, including the Sargan test (Sargan p-value) of over-identifying restrictions. The dependent variable for the second stage is the one-year Merton's Distance to Default (DTD) which measures bank stability. Variable definitions are provided in Table 1. All bank and country control variables are included in the model. All non-binary independent variables are lagged by one year with respect to the dependent variable. Accounting-based control variables (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – First stage of the IV 2SLS model

Variables	ESG	ENV	SOC	GOV
	(I)	(II)	(III)	(IV)
Political_orient (-1)	0.063**	0.059*	0.055*	0.076***
	(0.025)	(0.033)	(0.031)	(0.027)
D_CRISIS	(-0.021	(-0.019	(-0.025	(-0.021
	(0.017)	(0.026)	(0.022)	(0.020)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	547	547	547	547
F-Cragg Donald test	474.0***	2851.32***	400.36***	468.27***

Panel B – Second stage of the IV 2SLS model

Variables	DTD			
	ESG score	ESG score components		
	(I)	(II)	(III)	(IV)
ESG (-1)	-0.077			
	(0.195)			
ESG (-1)*D_CRISIS	0.183**			
	(0.091)			
ENV (-1)		1.538		
		(1.264)		
ENV (-1)*D_CRISIS		0.132*		
		(0.078)		
SOC (-1)			-0.094	
			(0.179)	
SOC (-1)*D_CRISIS			0.219**	
			(0.093)	
GOV (-1)				0.166
				(0.173)
GOV (-1)*D_CRISIS				0.183*
				(0.094)
D_CRISIS	-0.313***	-0.340***	-0.328***	-0.292***
	(0.052)	(0.062)	(0.053)	(0.050)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	445	445	445	445
Sargan p-value	0.100	0.101	0.931	0.414

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Table 9 – Baseline model with an alternative bank stability measure

This table reports the estimates of the two-step system GMM model during the period 2005–2017 substituting the market-based bank stability measure (DTD) with an accounting-based widely used alternative (Z-Score) (Panel A) and its components (Panel B). It is calculated as the sum of equity to total assets (ETA) and return on average assets (ROAA), scaled by the three–year standard deviation of ROAA (STD_ROAA). Since the Z-score is highly skewed, we use its natural logarithm (Laeven and Levine, 2009; Liu et al., 2013). Data for its computation is collected from Thomson Reuters. The variables of interest are the ESG score (see model (I)), and its three components (ENV, SOC and GOV score) (see models (II), (III), and (IV)), respectively. Each target variable is interacted with the dummy crisis (D_CRISIS). All bank and country control variables are included in the model. Variable definitions are provided in Tables 1 and A.1 (in Appendix). The sample period observed is 2005–2017. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A: The Z-Score

Variables	Z-score			
	ESG score	ESG score components		
	(I)	(II)	(III)	(IV)
Z-score (-1)	0.849***	0.825***	0.827***	0.800***
	(0.078)	(0.088)	(0.091)	(0.088)
ESG (-1)	0.046			
	(0.392)			
ESG (-1)*D_CRISIS	0.791***			
	(0.284)			
ENV (-1)		0.090		
		(0.465)		
ENV (-1)*D_CRISIS		0.721***		
		(0.235)		
SOC (-1)			0.065	
			(0.577)	
SOC (-1)*D_CRISIS			0.782***	
			(0.258)	
GOV (-1)				0.081
				(0.365)
GOV (-1)*D_CRISIS				0.824***
				(0.262)
D_CRISIS	-0.680***	-0.668***	-0.658***	-0.649***
	(0.202)	(0.199)	(0.202)	(0.187)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	469	469	469	469
Hansen p-value	0.867	0.866	0.881	0.878
AR(2)	0.543	0.537	0.595	0.433

Panel B: Z-Score components

Variables	STD_ROAA	ROAA	ETA
	(I)	(II)	(III)
Dependent Variable (-1)	0.721***	0.347***	3.089
	(0.037)	(0.073)	(4.904)
ESG (-1)	0.001	-0.001	-0.007
	(0.001)	(0.001)	(0.049)
ESG (-1) * D_CRISIS	-0.001**	0.002***	0.012
	(0.0003)	(0.001)	(0.037)
D_CRISIS	-0.312***	-0.288***	-0.292***
	(0.093)	(0.093)	(0.081)
Control variables (-1)	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes
N. of obs.	481	504	504
Hansen p-value	0.959	0.999	0.880
AR(2)	0.290	0.338	0.949

Table 10 – Baseline model with an alternative ESG score definition

This table reports the estimates of the two-step system GMM model obtained using an alternative definition of ESG score provided by Bloomberg database. In model (I) BESG is the ESG score that captures the transparency level of information disclosed about sustainable practices on Environmental, Social and Governance aspects. In model (II) BENV consists of corporate rating about the level of disclosed information on the following issues: carbon emission, climate change effect, pollution waste disposal, renewable energy, and resource depletion. In model (III) BSOC consists of corporate rating about the level of disclosed information on the following issues: supply chain, discrimination, political contributions, diversity, human rights, and community relations. In model (IV) BGOV consists of corporate rating about the level of disclosed information on the following issues: cumulative voting, executive compensation, shareholder's right, takeover defence, staggered boards, and independent directors. Each target variable is interacted with the dummy crisis (D_CRISIS). The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. All bank and country control variables are included in the model. Variable definitions are provided in Table 1. The sample period observed is 2005–2017. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	DTD			
	BESG score	BESG score components		
	(I)	(II)	(III)	(IV)
DTD (-1)	0.593***	0.624***	0.633***	0.614***
	(0.102)	(0.115)	(0.112)	(0.116)
BESG (-1)	-0.026			
	(0.155)			
BESG (-1)*D_CRISIS	0.397***			
	(0.154)			
BENV (-1)		-0.198		
		(0.164)		
BENV (-1)*D_CRISIS		0.481***		
		(0.170)		
BSOC (-1)			-0.195	
			(0.179)	
BSOC (-1)*D_CRISIS			0.368***	
			(0.141)	
BGOV (-1)				-0.031
				(0.180)
BGOV (-1)*D_CRISIS				0.354***
				(0.115)
D_CRISIS	-0.268***	-0.276***	-0.275***	-0.280***
	(0.053)	(0.056)	(0.058)	(0.056)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	316	316	316	316
Hansen p-value	0.983	0.991	0.987	0.980
AR(2)	0.509	0.704	0.747	0.704

Table 11 – Baseline model for different sub-samples

This table reports the estimates of two-step system GMM model tested employing different sub-samples that control for: the bank size (banks subjected to the EBA stress testing 2014 exercise vs those that are not subjected); the orientation of the financial system (below vs above the sample mean of the ratio of domestic credit provided by banking sector to GDP); and the income level of the country (below vs above the sample mean of GDP per capita). The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. The target variable is the ESG score. It is interacted with the dummy crisis (D_CRISIS). All bank and country control variables are included in the model. Variable definitions are provided in Table 1. The sample period is 2005–2017. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorised at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are included in all specifications. Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	DTD					
	EBA Banks (I)	No-EBA Banks (II)	Market-oriented financial systems (III)	Bank-oriented financial systems (IV)	Below mean GDP pre-capita (V)	Above mean GDP per-capita (VI)
DTD (-1)	0.892***	0.064	1.533	0.702***	0.625***	0.601***
	(0.165)	(0.449)	(1.246)	(0.125)	(0.178)	(0.177)
ESG (-1)	-0.086	-0.643	-2.943	-0.031	-0.127	-0.341
	(0.197)	(0.909)	(8.437)	(0.244)	(0.309)	(0.626)
ESG (-1)*D_CRISIS	0.415***	0.066	-5.203	0.277***	0.222*	0.375***
	(0.106)	(0.339)	(6.520)	(0.101)	(0.131)	(0.138)
D_CRISIS	-0.284***	-0.220*	-0.418	-0.328***	-0.207	-0.328***
	(0.089)	(0.122)	(0.381)	(0.059)	(0.139)	(0.071)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	299	140	113	326	253	186
Hansen p-value	0.590	0.997	0.874	0.880	0.972	0.543
AR(2)	0.666	0.523	0.885	0.960	0.122	0.132

Table 12- Alternative measure of the crisis: The Country-Level Index of Financial Stress (CLIFS)

This table reports the estimates of the two-step system GMM model during the period 2005–2017 by using the Country-Level Index of Financial Stress (CLIFS) as alternative measure of financial market turmoil. The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. The variables of interest are the ESG score and its interaction with either the level (CLIFS) or the annual variation of the index (ΔCLIFS). Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorised at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are always included, whereas year and country FE are either included or excluded in columns from (I) to (VI). Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	DTD					
Variables	(I)	(II)	(III)	(IV)	(V)	(VI)
DTD (-1)	0.722***	0.691***	0.682***	0.840***	0.800***	0.800***
	(0.077)	(0.051)	(0.069)	(0.072)	(0.067)	(0.067)
ESG (-1)	-0.098	-0.123	-0.0705	0.00890	0.0211	0.0211
	(0.126)	(0.077)	(0.123)	(0.112)	(0.111)	(0.111)
ESG * CLIFS (-1)	0.869**	0.674**	0.730*			
	(0.417)	(0.322)	(0.407)			
ESG * ΔCLIFS (-1)				0.182***	0.172***	0.172***
				(0.053)	(0.052)	(0.052)
CLIFS (-1)	-0.959***	-0.914***	-1.027***			
	(0.256)	(0.160)	(0.247)			
ΔCLIFS (-1)				-0.144***	-0.153***	-0.153***
				(0.033)	(0.033)	(0.033)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
Country FE	No	No	Yes	No	No	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	368	368	368	368	368	368
Hansen p-value	0.989	0.891	0.880	0.150	0.765	0.795
AR(2)	0.401	0.827	0.817	0.467	0.525	0.535

Table 13- Subprime vs Sovereign crisis

This table reports the estimates of the two-step system GMM model during the period 2005–2017. The dependent variable is the one-year Merton's Distance to Default (DTD) which measures bank stability. The variables of interest are: the ESG score (see model (I), (II), and (III)), respectively, and its interaction with the following dummy variables: 1) the SUB_CRISIS which takes the value of 1 for the year 2008-2009 and 0 otherwise; 2) the SOV_CRISIS which takes the value of 1 for the years 2010-2012 and 0 otherwise. Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. The control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorised at the 1% of each tail. The Hansen p-value is that of the Hansen test statistic of over-identifying restrictions, while AR(2) are the p-value of the first and second-order autocorrelation test statistic. Bank fixed-effects (FE) are always included, whereas year and country FE are either included or excluded in columns from (I) to (III). Bank clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

		DTD	
Variables	(I)	(II)	(III)
DTD (-1)	0.714***	0.726***	0.717***
	(0.140)	(0.127)	(0.084)
ESG (-1)	-0.041	-0.017	-0.016
	(0.246)	(0.178)	(0.167)
ESG (-1) * SUB_CRISIS	0.591***	0.506**	0.504**
	(0.213)	(0.225)	(0.207)
ESG (-1) * SOV_CRISIS	0.228**	0.211**	0.229***
	(0.099)	(0.094)	(0.080)
SUB_CRISIS	-0.271***	-0.269***	-0.269***
	(0.083)	(0.097)	(0.069)
SOV_CRISIS	-0.312***	-0.288***	-0.292***
	(0.093)	(0.093)	(0.081)
Control variables (-1)	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
Country FE	No	No	Yes
Cluster SE Bank	Yes	Yes	Yes
N. of obs.	439	439	439
Hansen p-value	0.959	0.999	0.880
AR(2)	0.290	0.338	0.949

Appendix

Table A.1 – Calculation of ESG score and its components

This table summarize the category scores and their weights used by Thomson Reuters' Refinitiv database to compute the ESG score and its three components (ENV, SOC, and GOV). The 'Category Weights' are determined by the number of indicators (so-called 'Indicators in Rating') that make up each category in comparison to all indicators used in the Thomson Reuters' Refinitiv ESG Score framework. This means that higher weight is assigned to themes that are more mature in terms of disclosure and the relative performance scores of companies is calculated with a higher degree of confidence. As a result, categories that contain multiple issues with relatively higher transparency like Management (composition, diversity, independence, committees, compensation, etc.) and companies reporting more information across these topics will have higher weight than lighter and less reported categories, such as Human Rights or CSR Strategy. The 'Sum of Category Weights' is obtained by summing each category weight of respective pillars. The 'New Category Weights' are computed by dividing category weights to the sum of category weights of respective pillar.

Pillar	Category	Category definition	Indicators in Rating	Category Weights	Sum of Category Weights	New Category Weights	ESG score components
Environmental	*Resource Use score*	Resource use category score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.	19	0.110 (=19/178)	0.3400 (=0.110+0.120 +0.110)	0.3235 (=0.110/0.340)	ENV = *Resource Use score**0.3235 + *Emission score**0.3529 + *Environmental Innovation score**0.3235
	Emissions score	Emission category score measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.	22	0.120 (=22/178)		0.3529 (=0.120/0.340)	
	Innovation score	Environmental innovation category score reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.	20	0.110 (=20/178)		0.3235 (=0.110/0.340)	
Social	*Workforce score*	Workforce category score measures a company's effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.	29	0.160 (=29/178)	0.3550 (=0.160+0.045 +0.080+0.070)	0.4507 (=0.160/0.3550)	SOC = *Workforce score**0.4507 + *Human Rights score**0.1268 + *Community score**0.2254 + *Product Responsibility score**0.1972
	Human Rights score	Human rights category score measures a company's effectiveness towards respecting the fundamental human rights conventions.	8	0.045 (=8/178)		0.1268 (=0.045/0.3550)	
	Community score	Community category score measures the company's commitment towards being a good citizen, protecting public health and respecting business ethics.	14	0.080 (=14/178)		0.2254 (=0.080/0.3550)	
	Product Responsibility score	Product responsibility category score reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy.	12	0.070 (=12/178)		0.1972 (=0.070/0.3550)	
Governance	*Management score*	Management category score measures a company's commitment and effectiveness towards following best practice corporate governance principles.	34	0.190 (=34/178)	0.3050 (=0.190+0.070 +0.045)	0.6230 (=0.190/0.3050)	GOV = *Management score**0.6230 + *Shareholders score**0.2295 + *CSR Strategy score**0.1475
	Shareholders score	Shareholders category score measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.	12	0.070 (=12/178)		0.2295 (=.070/0.3050)	
	CSR Strategy score	CSR strategy category score reflects a company's practices to communicate that it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes.	8	0.045 (=8/178)		0.1475 (=0.045/0.3050)	
TOTAL			178	1.00	1.00		**ESG = (ENV*0.3400)+(SOC*0.3550)+(GOV*0.3050)**

Note: For further information, see the detailed description on ESG scores available at the following website: https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/esg-scores-methodology.pdf.

Table A.2 – Correlation Matrix

This table shows the correlation matrix of the variables used in the empirical analysis over the period 2005–2017. Variable definitions are provided in Tables 1 and A.1 (in Appendix). All control variables based on accounting data (SIZE, ETA, LLR_GL, CIR, ROAE, CASH_TA, DIV) are winsorized at the 1% of each tail. The symbol * indicates statistically significance at the 5% level.

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	DTD	1													
2	Z-score	0,2408*	1												
3	ESG	-0,1738*	0,0396	1											
4	ENV	-0,2728*	-0,0124	0,8935*	1										
5	*Resource use*	-0,0051	-0,0209	0,5447*	0,5722*	1									
6	*Emission*	0,0264	0,0144	0,4946*	0,5812*	0,6668*	1								
7	*Innovation*	-0,0783*	-0,0652	0,3452*	0,3701*	0,4149*	0,3716*	1							
8	SOC	-0,1716*	-0,0215	0,8901*	0,7857*	0,4960*	0,4092*	0,2914*	1						
9	*Workforce*	-0,1368*	0,0118	0,7507*	0,6657*	0,4141*	0,3624*	0,2141*	0,8709*	1					
10	*Human Rights*	0,0052	-0,0751*	0,4465*	0,3709*	0,5011*	0,4059*	0,4064*	0,4203*	0,2718*	1				
11	*Community*	0,0462	-0,0087	0,4635*	0,3617*	0,5095*	0,4367*	0,2642*	0,5462*	0,2997*	0,3545*	1			
12	*Product Resp.*	-0,0288	-0,0968*	0,4350*	0,3270*	0,4780*	0,3321*	0,3446*	0,5398*	0,2996*	0,3983*	0,5117*	1		
13	GOV	0,0586	0,1504*	0,6584*	0,3437*	0,2373*	0,1844*	0,1703*	0,3614*	0,2697*	0,3035*	0,2195*	0,1906*	1	
14	*Management*	0,0221	-0,0215	0,4386*	0,1847*	0,2757*	0,1923*	0,1868*	0,2423*	0,1498*	0,3563*	0,2900*	0,2651*	0,7203*	1
15	*Shareholders*	0,0168	0,0277	0,0241	-0,0631	-0,1204*	-0,0769*	-0,0546	-0,0945*	-0,0412	0,0082	-0,1494*	-0,1843*	0,2553*	0,0529
16	*CSR strategy*	-0,0649	0,0482	0,7007*	0,6762*	0,4505*	0,4012*	0,3168*	0,6251*	0,5221*	0,3534*	0,3424*	0,3220*	0,3961*	0,2347*
17	SIZE	0,0307	-0,0397*	0,3629*	0,3432*	0,2716*	0,2377*	0,2348*	0,3689*	0,2808*	0,3228*	0,2512*	0,2570*	0,1618*	0,1882*
18	ETA	0,2156*	0,0227	-0,2635*	-0,3222*	-0,0749*	-0,0638	-0,0741*	-0,2798*	-0,2451*	-0,1083*	-0,0153	-0,1235*	-0,0112	-0,0763*
19	LLR_GL	-0,1180*	-0,3935*	-0,0459	0,0077	-0,0163	-0,0601	-0,0289	-0,0397	-0,0734	-0,0457	-0,0031	-0,0371	-0,0929*	-0,0591
20	CIR	-0,2895*	-0,2729*	0,0601	0,0965*	0,0328	-0,0087	0,0715*	0,0641	0,0136	0,0614	-0,0037	0,0621	-0,0272	0,0340
21	ROAE	0,2878*	0,1850*	0,0443	-0,0215	0,0306	0,0429	-0,0438	0,0636	0,0701*	0,0037	0,0972*	0,0225	0,0788*	0,0339
22	CASH_TA	0,1236*	-0,0808*	-0,0098	0,0062	-0,0110	0,0616	-0,0311	-0,0154	0,0258	-0,0417	-0,0390	-0,0123	-0,0181	-0,0614
23	DIV	-0,0132	-0,1160*	-0,0243	0,0124	-0,0595	-0,0407	-0,0656	0,0164	0,0160	-0,0490	-0,0458	-0,0507	-0,1045*	-0,1170*
24	GDP_GRW	0,2581*	0,1411*	-0,0737*	-0,1301*	0,0015	0,0020	0,0008	-0,0644	-0,0720*	0,0020	0,0029	0,0021	0,0316	0,0013
25	HHI	-0,0070	0,1106*	0,1616*	0,1157*	-0,0025	-0,0030	-0,0004	0,1514*	0,1330*	-0,0002	-0,0050	-0,0055	0,1349*	-0,0028
26	CAP_REG	-0,1285*	0,0461*	0,0576	0,0118	0,0054	0,0060	-0,0019	0,0326	0,0050	0,0055	0,0017	-0,0007	0,1096*	-0,0015
27	SUP_PWR	0,0949*	0,0384*	-0,1209*	-0,0744*	-0,0003	0,0007	-0,0014	-0,1412*	-0,1627*	0,0004	-0,0025	-0,0029	-0,0838*	-0,0018

	Variables	15	16	17	18	19	20	21	22	23	24	25	26	27
15	*Shareholders*	1												
16	*CSR strategy*	-0,1217*	1											
17	SIZE	-0,0589	0,3738*	1										
18	ETA	0,0974*	-0,2962*	-0,4311*	1									
19	LLR_GL	-0,0222	-0,0961*	-0,0814*	0,2583*	1								
20	CIR	-0,0470	0,0299	-0,0727*	-0,0282	0,1376*	1							
21	ROAE	0,0223	0,0512	0,0520*	-0,0028	-0,1697*	-0,5334*	1						
22	CASH_TA	0,0307	0,0106	-0,1691*	0,2048*	0,1338*	0,1475*	0,0129	1					
23	DIV	-0,0235	0,0005	-0,0058	0,1165*	0,0195	0,1734*	-0,0646*	0,1499*	1				
24	GDP_GRW	-0,0016	0,0036	0,0026	0,0594*	-0,1051*	-0,0769*	0,0005	0,0496*	0,0140	1			
25	HHI	0,0056	0,0216	0,0020	0,0466*	-0,1152*	-0,1217*	0,0017	0,0233	-0,0090	0,0281	1		
26	CAP_REG	-0,0021	-0,0183	-0,0001	0,0036	0,0933*	-0,0187	-0,0019	-0,0265	-0,0101	-0,0332*	0,1607*	1	
27	SUP_PWR	0,0000	-0,1570*	-0,0018	0,0501*	0,0779*	0,0870*	-0,0015	0,1312*	-0,0398*	0,0800*	-0,1315*	0,1521*	1

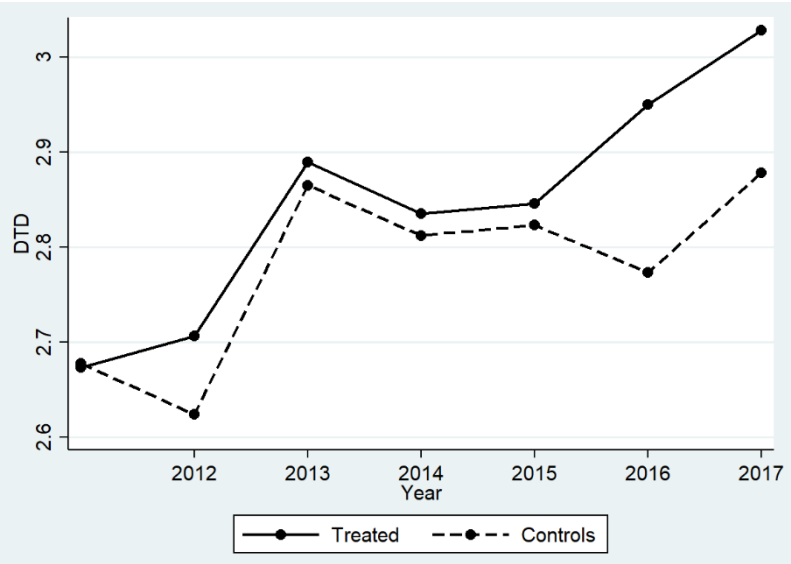
Table A.3 Sample description by Country

This table describes our sample by providing the breakdown of observations at the country level.

Country of Headquarter	N. of Obs.	Percent
Austria	15	3%
Belgium	17	4%
Czech Republic	10	2%
Denmark	13	3%
Finland	11	3%
France	26	6%
Germany	8	2%
Greece	36	8%
Ireland	27	6%
Italy	46	10%
Netherlands	4	1%
Norway	11	3%
Poland	61	14%
Portugal	11	3%
Russia	23	5%
Spain	50	11%
Sweden	32	7%
Switzerland	6	1%
United Kingdom	32	7%
Total	439	100%

Figure A.1 – Parallel Trends

This figure illustrates the behaviour of the average one-year Merton's Distance to Default (DTD) before and after the shock or treatment (i.e. the publication of the Non-financial Reporting Directive 2014/95/EU in October 2014) for both the treated and the control group. The treated (control) group is represented by banks above (below) the average values of ESG scores in the year of the shock (2014).



Essay 2:
Do responsible practices lead to higher firm productivity? Evidence from Europe[18]

[18] This paper received the "Best paper award" at the 4th Social Impact Investments International Conference of University of Rome "La Sapienza".

Do responsible practices lead to higher firm productivity? Evidence from Europe

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Abstract

This study examines the combined and individual effects of the Environmental, Social, and Governance (ESG) dimensions of Corporate Social Responsibility (CSR) on firm productivity. We focus on a sample of non-financial firms operating in 15 European countries over nearly two decades (2002–2018), and provide evidence that total ESG scores, as well as their three sub-pillars, are associated with higher levels of Total Factor Productivity (TFP). We analyse the relationship through various angles addressing potential endogeneity and selection concerns. Our evidence reveals that the ESG-TFP link is stronger during the post- financial crisis economic slowdown and that the effect is mainly led by firms' environmental performance. We confirm this result in a quasi-natural experiment setting, built around the adoption of the international treaty on climate change adopted in Paris in 2015 (the 'Paris Agreement'). Our results offer precious insight to policymakers and regulators on the potential productivity advantages deriving from firm sustainable practices adoption.

Keywords: Corporate Social Responsibility; Environmental Social and Governance Scores; Paris Agreement; Total Factor Productivity European Firms.

JEL Classification Codes: G34; D24; G30; H4.

1. Introduction

During the last few decades, stakeholders' attention on firms' sustainable practices has placed increasing pressure on companies' social value creation. At the same time, the scale and scope of firms' sustainable engagement has raised fundamental questions about the relationship between Corporate Social Responsibility (CSR) and Corporate Financial Performance (CFP) (e.g., Hasan et al. 2018, Margolis et al., 2009). Defining CSR practices is not straightforward; the European Commission (2001), for example, describes them as: 'the responsibility of enterprises for the impact on society […] to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders'. Consistently, Environmental, Social and Governance engagement (ESG) scores, one of the most common measures of firms' CSR performance, has been extensively used by consulting firms, asset managers and researchers to identify firms' sustainable practices.

CSR activities can be viewed as a firm's investment (Kitzmueller and Shimshack, 2012), a risk hedging strategy (Cheung, 2016) or as a mean to enhance firm value (Servaes and Tamayo, 2013) and productivity (Hasan et al., 2018). Jiao (2010) explains how a positive effect of CSR on corporate performance is consistent with the view that CSR represents an investment in intangible assets, such as reputation and human capital, that contributes to enhancing firms' competitiveness. These issues are increasingly relevant, especially for firms that perceive CSR as a key factor to better allocate resources and social capital (Russo and Perrini, 2010). However, in the literature it is possible to identify two alternative outcomes derived from the relationship between stakeholder welfare and value that largely depend on the conjectures they make about the former. If stakeholder welfare is viewed as investments' intangibles such as reputation and human capital (e.g., Zingales, 2000), the relationship with value is positive; in contrast, if stakeholder welfare derives from managers' personal interests, the relationship with value is negative (Cespa and Cestone, 2007).

Several studies (e.g., Porter, 1991) show that CSR investments are actions that address environmental or social impact that at the same time can improve the quality of the private products offered, increase the productivity of related processes, and ultimately benefit a firm's or industry's competitiveness. Firm-level productivity is usually measured as Total Factor Productivity (TFP), that is defined as the firms' efficiency level to produce economic output by combining capital, labour, and intermediate inputs. A recent study by

Hasan et al. (2018) finds that TFP is one of the key drivers in explaining firms' value. Nevertheless, the literature is mixed around whether CSR impairs it or enhances it; in addition, there are different ways to measure firms' productivity. One shared reason why firms invest in CSR is that doing so enhances their profitability and value, a relationship often referred to as "doing well by doing good" (Dowell et al 2000; Guenster et al., 2011).

This paper provides several important contributions to the extant literature. First, we are the first to empirically investigate the link between the environmental, social and governance components of CSR on firms' TFP. The literature on CSR and firms' TFP is scant and is mainly focused on firms' value and financial performance. To the best of our knowledge, only a handful of studies exist on the relationship between sustainability and firm total productivity, but they usually concentrate only on single aspects such as Antonietti and Marzucchi (2014) for the environment; and Parrotta et al. (2016) for labour diversity. Hasan et al. (2018) is the only study that we are aware of, that uses the CSR-TFP relationship as a moderating role in explaining the CSR-Tobin Q link, using a model where TFP mediates the relationship between corporate social and financial performances. Therefore, our study contributes to this emerging strand of literature using European firms' data to investigate the relationship between ESG, its single environmental (ENV), social (SOC) and governance (GOV) components, and TFP.

Second, this study uncovers the ESG-TFP nexus, investigating if it can be considered as a strategic factor in enhancing firms' productivity, especially during periods of relatively low economic growth. More precisely, by disentangling ESG components, we shed light on the changing impact of environmental (ENV), social (SOC) and governance (GOV) factors especially in periods of economic recession. We test if and under which conditions the relationship is valid during the post-crisis productivity slowdown that characterised the aftermath of the global financial crisis (GFC). In Europe, productivity differences across countries have amplified especially after 2012 (ECB, 2017) as the eurozone experienced the sovereign debt crisis that affected member states in different ways. Some authors (Hall, 2015; Reifschneider et al., 2015) interpret the decline in productivity as an endogenous consequence of the global financial crisis; others observe that the productivity slowdown that followed it, was a consequence of suboptimal levels of R&D that led to a contraction of demand both in the US (Anzoategui et al., 2019) and European firms (Chiacchio et al., 2018). A report by ECB (2017)

reveals that, in addition to the persistent absence of adequate investment capital, the productivity slowdown post financial crisis was also due to the joint effect of a concentration of the recovery in consumer-driven sectors characterized by low capital-labour substitution and lack of liquidity. Therefore, understanding the dynamics of the CSR-TFP nexus becomes increasingly important given with recent evidence that documents a significant deceleration of TFP in the euro-area after the global financial crisis (Van Ark, 2014).

Third, the focus on the European Union (EU) countries allows us to examine in detail firms' productivity responsiveness to the adoption of the 2015 Paris Climate Agreement, a legally binding international Treaty on climate change, that aims to keep global warming well below 2℃. Using a Differences-In-Differences (DID) framework, we explore the environmental engagement-productivity nexus after the adoption of the 2015 Paris Agreement by firms operating in European countries. As far as we know, this has not been done before in the literature and it is of particular interest in Europe as there have been several important developments over the past few years. These include an ambitious policy agenda on sustainable finance, that encompasses an action plan on financing sustainable growth (EC, 2018) and a roadmap known as the 2019 European Green Deal. Similarly, in 2021, the European Commission adopted a broad set of policy aimed at strengthening the transition to sustainable activities to achieve a climate neutrality by 2050 (EC, 2021).

Our findings support the literature showing that ESG practices create economic value by better allocating scarce firm resources to activities addressing the demands of key stakeholders (Porter and Kramer, 2006). Specifically, by considering TFP as a collection of productive intangibles, and in the spirit of Hasan et al. (2018), it appears that CSR practices act as a channel through which firms' stakeholders enhance the accumulation of such intangibles, ultimately leading to an increase in TFP. The increase in firms' productivity through sustainable practices appears crucial during the post-crisis productivity slowdown period, confirming not only the ESG-TFP nexus but also the link between sustainability practices and resilience. Additionally, we find that environmental performance is the ESG component that is most correlated to firms' productivity, suggesting the need for more environmental engagement from EU firms. This is confirmed also by results related to the Difference-in-Difference analysis built around the adoption of the 2015 Paris Agreement; higher productivity is reached for firms more aware engaged on environmentally friendly activities.

In terms of policy implications, overall, our evidence supports the regulatory commitment on environmental and social engagement for European companies. It also provides important indications for credit institutions for their loan origination process, given their critical role in facilitating the transition of businesses towards sustainability particularly in the period of recovery from the Covid-19 pandemic.

The remainder of this paper is organised as follows: Section 2 reviews the literature and summarizes the main hypotheses. Sections 3 describes the methodology, data and variables used in the empirical analysis. Section 4 discusses the main results and section 5 provides the robustness checks. Section 6 concludes and provides the main policy implications.

2. Literature review and hypothesis development

2.1 CSR engagement and overall firm performance

The literature on the relationship between firms' CSR engagement and performance finds its roots on the dominant paradigm recognized as stakeholder theory (Margolis and Walsh, 2003) which poses its assumptions on a strong moral basis (Freeman et al., 2010). More precisely, managers receive pressure from different stakeholder groups such as customers, employees and the community, to be actively engaged on CSR activities (McWilliams and Siegel, 2011). Consistently, firms are aware that their stakeholders can affect directly or indirectly firms' revenues and therefore, returns to shareholders (Berman et al., 1999). In addition, the literature shows a positive relationship between CSR practices and the creation of moral capital (Godfrey et al. 2005) and the social legitimacy, which ultimately positively affects the stakeholder well-being, widely defined as investments intangibles such as reputation and human capital (e.g., Zingales, 2000).

A relatively large stream of research has focused on CSR's role in terms of effects on firm performance and risk, exploring its impact within and outside the firm. Cheng et al. (2014) finds that better CSR performance is associated with superior stakeholder engagement that ultimately lowers agency and transaction costs and increases the revenue or profit- generating potential of the firm. However empirical evidence is not unambiguous and is subject to several methodological limitations (Margolis et al., 2009). A rich body of literature emphasizes the implications of sustainable practices within financial (see e.g., Humphrey et al., 2012) and non–financial corporations (Margolis and Walsh, 2003), mainly in terms of risk hedging strategies

(Cheung 2016), firm value maximization (Hasan et al., 2018, Zolotoy et al.,2019), cost of debt (La Rosa et al., 2018) and equity reduction (see e.g Ng and Rezaee, 2015).

Jiao (2010) argues that a positive effect of CSR on corporate performance is consistent with the view that CSR represents an investment in intangible assets, such as reputation and human capital, that contributes to enhancing firms' competitiveness. Additionally, the sustainability of an organization is strictly related to the economic, social and ecological aspects, so that they can become integrated into the design of new products, process and organization structure (Rennings, 2000). For example, considering the labour-oriented policies side of firms' CSR practices, among the main benefits derived from employees' wellbeing programmes are the greater potential of workforce loyalty, lower absenteeism, boosting firm productivity, and, finally, increasing market valuation (Falaye and Trahan 2011).

2.2 The CSR-TFP nexus

At a macro level, Total Factor Productivity (TFP) has been recognized as one of the most important variables in generating and predicting economic growth (Saliola and Seker, 2011). Specifically, TFP was found to be strongly positively connected to openness to trade and production chains (Grossman and Helpman, 1991), in the presence of foreign direct investment (FDI) and R&D investments (see e.g Chiacchio et al., 2018). During the post-crisis productivity slowdown years in Europe, and especially after 2012, the productivity differences amongst countries of otherwise similar levels of economic development have amplified (ECB, 2017). At a micro level, according to e.g., Foster et al. (2013) after the financial crisis of 2007-08, European firms engaging in innovative practices, have achieved better productivity performance. This evidence is strongly supported by the European Commission, that by adopting in 2010 the "Europe 2020 strategy" for a smart, sustainable and inclusive growth, has tried to achieve greater innovation by managing resources more efficiently (European Commission 2010).

There are several reasons why it is interesting to investigate the CSR-TFP nexus. First, if CSR practices lower the cost of capital, by reducing the agency costs and asymmetric information issues (El Ghoul et al., 2011), more CSR should lead to a better allocation of saved resources. At the same time, firms more engaged in CSR practices experienced significantly lower capital constraints (Cheng et al., 2014) by raising funds from

debtholders at a lower cost (Oikonomou et al., 2014). Secondly, socially responsible practices allow firms to build strong relationships with key stakeholders, improving the capacity to create new technologies, develop new products, and explore new markets (Branco and Rodrigues, 2006) as well as enhancing workforce loyalty, lower absenteeism, and therefore boosting firm productivity (Falaye and Trahan, 2011). Thirdly, corporate sustainable practices influence demand fluctuations, stimulate consumer demand, and ultimately positively affect the firm production function (see e.g., McWilliams and Siegel, 2001), confirming the assumption by which CSR activities positively affect the trust of stakeholders at all levels (Lins et al., 2017). As argued by Sapienza and Zingales (2012) "the decision to invest in stocks requires not only an assessment of the risk-return trade-off given the existing data, but also an act of faith (trust) that the data in our possession are reliable and that the overall system is fair", making CSR of vital importance to restore, strength and improve firms' image after and during crisis periods (Lins et al., 2017). Finally, investing in social responsibility can help to increase efficiency processes, leverage fundamental intangible resources, attract better employees finally increasing firms' labour productivity (Branco and Rodrigues, 2006).

A vast amount of literature related to CSR emphasises its primary role as an effective corporate governance mechanism to alleviate conflicts among various stakeholders and reduce agency costs (Freeman, 1984, El Ghoul et al., 2011). In fact, according to the stakeholder theory, high-quality relationships with key stakeholder's positively affect firm productivity, reduce transaction costs (Cheng et al., 2014), firm's debt (see e.g., La Rosa et al., 2018) and thus firm's equity financing (see e.g., Ng and Rezaee, 2015). Falaye and Trahan (2011), studying the impact of labour-friendly policies on productivity and profitability of Fortune list US firms from 1998 to 2005, reach similar conclusions on the benefit of such policies on the measured Cobb-Douglas TFP. Moreover, the authors show the managerial self-interest reasons in firms' labour-friendly practices, concluding that firms adopting such policies are associated to higher long term TFP and positive market reactions. Cho et al. (2013), by focusing on US listed firms from 2003 to 2009, empirically prove the role played by CSR in reducing information asymmetries. Specifically, by using the bid-ask spread as a proxy, they argue that both positive and negative CSR practices seem to reduce the information asymmetry among investors. Moreover, negative CSR scores seem to be more effective in explaining the information asymmetry changes, implying that the market participants are particularly concerned about low CSR practices. Equally,

investors and in general all stakeholders may leverage CSR information to avoid adverse selection problems and thus enhancing information efficiency, especially among less-informed investors (Cho et al., 2013).

Overall, thanks to its direct impact on stakeholders involved in the production process, CSR seem to act as a mean to boost firm productivity. Based on this evidence, in this paper we investigate the role of CSR and its components in enhancing firm productivity in Europe, especially during a period of productivity slowdown. To the best of our knowledge, only a handful of papers explore the role of CSR in enhancing firm productivity, but mainly focus on a single aspect of CSR. For example, Antonietti and Marzucchi (2014), focus on the pre-crisis period 2001-2006 and find a positive impact of Italian manufacturing firms' green investment strategies on productivity calculated using a Cobb-Douglas functional form. The authors argue that their results stem from the reduction of three cost factors: sunk costs related to export practices (such as compliance and regulation costs); possible stakeholders' litigation costs; material and energy use. Looking at the social aspect of the CSR principles, such as the labour diversity, inclusion and firm productivity relationship, Parrotta et al. (2016) find mixed result about ethnical inclusion issues and TFP. By investigating Danish firms' productivity from 1980 to 2005, they find a negative correlation between ethnic diversity and TFP. On the other side, they find a positive association between educational and demographic diversity and firms' productivity.

Similarly, Hasan et al. (2018) focus on productivity and CSR using a broader concept. The authors examine on the mediating role of TFP on strengthening firm value, shedding light on the commonly recognized link between CSR and firm performance. Using a sample of publicly traded US firms from 1992 to 2009, they find that firm productivity moderates the positive relationship between corporate social and financial performance. However, the authors find that the CSR-TFP link strictly depend on the firms' operating economic context.

Last but not least, Darrough et al. (2019) explore the existing relationship between corporate welfare policies and firm-level TFP measured using a semi-parametric regression model as in Olley and Pakes (1996). By focusing on listed US companies from 2003 to 2013 they reveal the pivotal role played by CSR in managing moral hazard problems connected to unemployment insurance benefits, by reducing its negative effects on firm productivity. Therefore, their results confirm the assumption that good corporate behaviour, by helping firms' employees, enhances firm productivity.

Consistent with recent findings in the literature we hypothesise a positive role played by the CSR score and its environmental, social and governance components, in enhancing the efficient allocation of production input factors, and thus firms' TFP. Our prediction is based on the stakeholder theory, which supports the creation of moral capital and social legitimacy ultimately affecting the wellbeing of firms' stakeholders. Hence our first hypothesis can be formulated as follows:

H1: Firms' ESG scores and its individual pillars positively affect firms' TFP

As discussed above, the global financial crisis impacted on consumer and investor trust on the financial system (Sapienza and Zingales, 2012). In turn, a decline in trust can impact both shareholders' and stakeholders' investments decisions, thereby leading to a contraction in consumer demand: the former are immediately affected through a reduction of the credibility of firm financial information that ultimately exacerbate asymmetries. Similarly, the lack of trust affects stakeholders (e.g., employees, customers etc.) due to their interaction with the firm through implicit or incomplete contracts that during periods of low firm trustworthiness could not be honoured (Lins et al., 2017).

Anzotegui et al. (2019) maintains that one of the interpretations leading to a productivity drop in US after the recession is the contraction in demand. Like the US, the productivity gap rose during the post-crisis period (after the 2012) in Europe (Chiacchio et al., 2018), due to a joint consequence of a concentration of the recovery in consumer-driven sectors characterized by low capital-labour substitution rate, the lack of liquidity, and an absence of adequate investment capital (ECB, 2017). According to Bernabou and Tirole (2010), stronger stakeholder engagement reduces the likelihood of short-term opportunistic behaviour by managers, restoring and improving firm reputation and credibility, ultimately addressing the demand of key stakeholders (Porter and Kramer, 2006). Similarly, Godfrey (2005) argue that CSR investment generate goodwill and moral capital among stakeholder, and that finally may preserve firms' financial performance. Specifically, the moral capital creates relational wealth among different stakeholders' groups (e.g., employees, community, and regulators) providing trust and credibility on all the economic value chain, finally increasing firms' attractiveness for investors (Godfrey 2005), allowing firms' to better allocate resources (Russo and Perrini 2010) which finally boost their productivity. Overall, in line with the literature above and within the 'stakeholder theory framework', we conjecture that a firm' commitment in socially responsible practices

should lead to higher firm total factor productivity and we expect this evidence to emerge particularly during periods of productivity slowdown. Thus, the second hypothesis can be formulated as follows:

H2: The impact of firm ESG score and its single pillar, is stronger during post-crisis productivity slowdown.

With the adoption of the Paris Agreement on 12 December 2015, all 196 signatory countries are committed to limit global warming to well below 2 Celsius grades, if compared to pre-industrial levels. To reach this target they must drastically reduce the global peaking of greenhouse emissions and therefore, make pressure on the corporate sector to achieve a climate neutral position.[19] Importantly, the Paris Agreement also recognises the critical role of Climate finance, and therefore of financial and economic actors involved in the production process, because of the large-scale investments it can support. Due to its huge impact on the social and moral purposes of European financial markets (and not only), the 2015 Paris Agreement represents an unprecedented increase in public pressure on firms' climate change practices.

Godfrey (2005; 2009) argues that a socially desirable level of responsible engagement generates moral capital providing "insurance-like" protection to firms more aware of sustainability. Therefore, a government increase in socially desirable level of sustainability engagement, might have two main consequences; (i) representing a pure cost of compliance for companies and so reducing their value (Chen et al., 2018); (ii) rewarding firms more engaged in specific environmental or social practices hence enhancing their performances (Chiaramonte et al 2021). However, to the best of our knowledge, there is no empirical contribution so far emphasising the productivity consequences of such agreement among best (worst) environmental firms' practices in Europe. In this paper, we empirically test the possibility of a "rewarding effect" of the 2015 Paris Agreement on companies more engaged in environmentally friendly activities,

[19] The 2015 Paris Agreement is the first binding agreement requiring a common effort to fight climate change, that will likely bring about major social and economic transformations. After the first cycle of five years of national policy and plans, each of the signatory countries must communicate to the United Nations Framework Convention on Climate Change (UNFCCC) their plans for the development of **nationally determined contributions (NDCs). These** are non-binding national plans to take climate actions, such as climate targets for greenhouse gas emission reductions and all related public policies aimed at implementing the achievement of the global targets set out in the Paris Agreement.

confirming the prediction of the moral capital theory framework. Thus, the third hypothesis can be formulated as follows:

H3: The 2015 Paris Agreement yields a 'rewarding effect' in terms of productivity for firms more engaged in environmentally friendly practices.

3. Data and empirical methodology

3.1 Data sample

We select a sample of 560 European Union listed firms from 2002 to 2018 and the environmental (ENV), social (SOC), governance (GOV) scores (individual and aggregate) provided by Thomson Reuters' Refinitiv, as a proxy of the level of CSR (see e.g., Cheng et al., 2014; Liang and Renneboog, 2017). Therefore, we use a weighted average of ESG scores ranged from 0 to 100 (highest ESG level). Our dataset covers non-financial companies operating in 15 European Union countries (Table A.1). Table 1 reports the descriptive statistics and Table A.2 shows the correlation among variables, revealing no multicollinearity bias. Additionally, we employ alternative models and robustness checks that we have carried out to minimise endogeneity issues (Section 5). All results are qualitatively similar to our baseline model.

[Insert Table 1 about here]

Our sample spans a relatively long period starting in 2002 and including the global financial and the European sovereign debt crisis. In this paper, we test the role of CSR in enhancing firm productivity especially during time of lower growth and adopt the ECB definition (ECB, 2017) of post-crisis productivity slowdown period.[20] In the post-crisis years in Europe, productivity differences amongst economies of otherwise similar levels of economic development have amplified, especially after 2012. However, in the literature several hypotheses have been made trying to address the post-crisis productivity slowdown issue. For example, Reifschneider et al. (2015) hypotheses that the decline in productivity may be due to the decline in firms'

[20] We also run our analysis by employing an alternative definition of post-crisis period (from 2009 to 2015) (Chiacchio et al., 2018). Results are qualitatively similar and available upon request.

productive investments, such as fixed capital and intangible assets, interpreting it as an endogenous consequence of the recession. Nevertheless, European institutions have tried to fill the post-crisis TFP drop by adopting in 2010 the Europe 2020 strategy for a sustainable growth. Specifically, the Europe 2020 program is aimed at supporting the achievement of greater environmental and social innovation among firms through a more efficient resources management. Therefore, to test the role played by CSR during the post-crisis productivity drop, we split our sample into two periods: the pre-slowdown period (from 2002 to 2012); and the slowdown productivity period (from 2013 to 2018), testing the statistical significance of results

3.2 Firm-Level TFP

TFP is usually obtained as the residual from a Cobb–Douglas production function with capital, labour, materials as input factors and value added as output (Hasan et al. 2018). Consistently, it may be estimated by employing parametric and non-parametric techniques, with the second methods being widely recognized as more robust to endogeneity concerns. For example, parametric methods may suffer of reverse causality of inputs and high correlation with productivity components, which can be addressed by semi-parametric methods (Tsionas and Polemis 2019).

Therefore, in this paper, we estimate the TFP using two semi-parametric methods: the Wooldridge's (WD) TFP (2009) and the Levinsohn and Petrine (L-P) TFP (2003). The WD TFP estimation computes firm productivity with a Generalized Method of Moment (GMM) method. Unlike the fixed effect estimator (see Olley and Pakes, 1996) IV methods do not rely on strict exogeneity of the inputs for consistent estimation. However, the consistency of the IV estimator requires the satisfaction of three conditions on the instruments that: (i) need to be highly correlated with the endogenous regressors (in this case production inputs); (ii) must not be included in the production function; (iii) must not be correlated with the error term (Greene, 2008). Satisfying these three conditions to compute firm productivity is not a trivial process.

Following previous literature (Hasan et al., 2018, Yasar et al., 2018), we obtain both TFP measures as the residuals of the WD and L-P production functions where the firms' input factors are fixed capital (as proxy of capital factor), number of employees (labor factor), and the difference between total expenses minus labor expenses (material factor) as input factor. The descriptive statistics of estimated average TFP levels is reported

in Table 1. The two measures of firm productivity show a similar standard deviation but a slightly different average level of distribution.

[Insert Table 1 about here]

Figure 1 plots the trend for our two measures of firms' productivity from the 2002 to the 2018, confirming previous findings (ECB, 2017) on the decreasing behaviour of TFP in the post-crisis years (after 2012). The TFP trend it is possible to identify two main spikes: one caused by the GFC (after 2007); and the other after the 2012.

[Insert Figure 1 about here]

3.3 CSR measurement

Corporate responsibility is commonly measured through firm Environmental (ENV), Social (SOC) and Governance (GOV) reported information, usually captured by ESG rating of listed companies (Liang and Renneboog, 2017). The ESG concept firstly appeared in the UN Principles for Responsible Investment (PRI) and in several firms' non-financial reports (Davis and Stephenson, 2006), and due to the lack of alternative valid definition, it has becoming to be widely used by researchers to proxy for CSR engagement (Liang and Renneboog, 2017, Chiaramonte et al., 2021).

More precisely, ESG scores are composed by the following firm sustainable practices: Environmental (ENV) activities, that reflect firm efforts towards sustainable use of resources, emissions, and innovation in reducing environmental footprints for customers. Social (SOC) dimension, that focuses on human capital (job satisfaction, workplace health and safety, diversity, equality). Finally, Governance (GOV) aiming at compliance with best practices in corporate governance, the equal treatment of shareholders, the integration of non–financial objectives in strategic and managerial decisions. ESG data are provided to transparently measure a firm's relative performance and practices across 10 dimensions (see Table A.3) based on company self-reported information (e.g., annual reports). Table A.3 shows the taxonomy of ESG scores, their definition, calculation, and weights used for computation. All ESG scores range between 0 and 1, with higher values

indicating stronger performance. For our purposes, we expect that both aggregate and single ESG scores are positively correlated to firm total factor productivity.

Table 1 reports the descriptive statistics and shows that our target variables, the ESG, ENV, SOC and GOV score take a distribution broadly in line with previous research, both in terms of average values and variability (see e.g Liang and Renneboog 2017). More precisely, mean values range between 0.53 and 0.62 demonstrating that there is room for adopting ESG practices at firm levels and improving ESG scores further.

3.6 Empirical Methodology

Our empirical strategy is composed of two-step. The first step investigates the link between CSR practices (proxied by ESG scores) and firm TFP by employing an OLS estimator (Hasan et al., 2018) with time, industry and country fixed effects. The baseline model is shown in equation (1):

$$TFP_{it} = c + \beta_1 ESG_{i.t-1} + \boldsymbol{\beta_2}' \boldsymbol{X}_{i,t-1} + \boldsymbol{\beta_3}' \boldsymbol{Z}_{i,t-1} + \upsilon_t + \gamma_i + \delta_t + \varepsilon_{it.} \quad (1)$$

where our dependent variable is proxied by two different firm productivity variables (*TFPit)* for firm *i* at time *t* -1 (the year before). The OLS includes year, industry and country fixed effects to control for time-invariant factors. The use of fixed effects captures unobservable heterogeneity and omitted factors that are related to both ESG and firm productivity.

The second step is aimed at testing the impact of the 2015 Paris Agreement on firms' productivity employing the following difference in difference (DID) regression:

$$TFP_{it} = c + \beta_1 D\_SHOCK + \beta_2 D\_TREATED + \beta_3 D\_SHOCK*D\_TREATED + \boldsymbol{\beta_4}' \boldsymbol{X}_{i,t-1} + \boldsymbol{\beta_5}' \boldsymbol{Z}_{i,t-1} + \upsilon_t + \gamma_i + \delta_t + \varepsilon_{it.} \quad (2)$$

where the dummy D_SHOCK representing the adoption of the 2015 Paris Agreement, takes a value of 1 for

post-treatment years (2016–2018) and 0 otherwise. The dummy D_TREATED takes a value of 1 for firms above average values of ESG scores in the year before of the shock (2015) and 0 otherwise, and D_SHOCK*D_TREATED represents their interaction. Therefore, the coefficient of D_SHOCK*D_TREATED is our target variable. We further control for a set of firm and country characteristics, as well for the same fixed effects employed in our baseline model.

Following the relevant literature (see e.g Hasan et al. 2018), we include a set of firm- (**X**) and country- (**Z**) specific control variables that may have an impact on firm TFP (see Table 1 for the descriptive statistics). Specifically: asset size, measured as the natural logarithm of firms' total assets (SIZE); asset turnover, measured as sales to total asset growth ratio (SALES_GRW); and firms' indebtedness calculated as the total debt scaled by firms' total assets (LEV). At country level, we include a measure of industry competition using the Herfindahl-Hirschman index (HHI) calculated as the sum of the squared market share value (in terms of firm sales divided by industry sales) (see, e.g., Zang et al., 2010). As the level of globalization can affect firm productivity (Min and Smyth, 2014) we also control for the Kof index (KOF) of globalization provided by ETH Zurich Swiss economic institute (2019); finally, we include a measure of country economic development with the GDP growth ratio (GDP_GRW). All non-binary explanatory variables are lagged by one year to immediately start addressing potential endogeneity concerns. Moreover, we employ standard errors adjusted for heteroskedasticity and clustered at the firm-level (Cheung 2016; Anginer et al., 2018). Finally, c is a constant term and $v_i, \gamma_i, \delta_t, \varepsilon_{it}$ are, respectively, time fixed-effects, industry fixed-effects, country fixed effects and the idiosyncratic error respectively.

4. Empirical Results

4.1 Baseline results

Table 2 illustrates the joint and individual impact of ENV, SOC and GOV factors on both proxies of firm productivity (TFP WD and and TFP L-P) during the whole period under investigation estimated using equation (1). As in Becchetti et al. (2016), we interpret these results as follows: an increase of one standard deviation of ESG, is associated with an increase of 0.5 % of WD TFP and of 0.9 % of L-P TFP, with respect to their sample means. Looking at the individual CSR components, results are similar and always point to positive and significant associations. Our findings are in line with previous studies showing a positive

correlation between firms' CSR and TFP (Hasan et al., 2018). We interpret the positive impact of CSR and its components on firm TFP, as a confirmation of the validity of the stakeholder theory of firm's value maximization (e.g., Edmans, 2011) as set out in our first hypothesis (*H1*).

CSR can be considered as an effective corporate governance mechanism to solve conflicts among stakeholder groups by reducing agency costs (Cespa and Cestone, 2007). Accordingly, it can be interpreted as a concrete means to align managers' objectives with the organizational process and stakeholder demand (Freeman, 1984). From the production function perspective, inputs are not easily interchangeable and require cost-effective transformation of resources into firm-specific assets (Hasan et al., 2018). Due to the large number of stakeholders involved in the production process, such as firms' employees and all actors involved in the value chain, the governance-productivity connection became highly reliant on filling up the lack of firm-specific knowledge resources (Wang et al., 2009). Therefore, our results support previous studies stressing that superior CSR performance reduces stakeholder conflicts (Becchetti et al., 2016), which, by alleviating managerial opportunism (Benabou and Tirole, 2010) allows companies to bear more productive investments and resource maximization.

Looking at the control variables, our results show that firm productivity has a positive association with the variables SIZE, SALES_GRW, and KOF index of globalization and negative for leverage (LEV). We interpret the positive sign of firm size on TFP on the spirit of Halkos and Tzeremes (2007) who argue that size exerts an indirect impact on firms' productivity due to its positive effect on firm internal factors and end efficiency maximization. As for the sales growth, our result is consistent with the literature (Hasan et al., 2018). More profitable and more globalized firms are usually also more productive, due to greater capability and resources to allocate intermediate factors.

[Insert Table 2 about here]

4.3 Results for post-crisis productivity slowdown period

Table 3 illustrates the results obtained by splitting the sample between the pre- productivity slowdown period (2002-2012) and post-crisis slowdown period (2013-2018). We observe that the magnitude of ENV,

SOC and GOV score increases significantly from pre to during productivity slowdown. Interestingly the results are the same for the two chosen measures of productivity and suggest that in both cases, a change in one standard deviation of the ENV score is linked to a change of 0.7 % in TFP. Many observed that the financial crisis leads to a wide collapse in confidence and trust among market participants (e.g., Stiglitz, 2008). We interpret these results in light of the stakeholder theory framework, by empirically stressing the relevance of CSR practices as a mean to restore firm reputation and credibility, as well as trust among stakeholders (such as employees, community etc.) and profitable inputs allocations, especially during a period of general lack of confidence such as after the global financial crisis.

[Insert Table 3 about here]

The changing relevance of CSR components between the two sub- periods, reflects the increasing perceived sensitivity of firms' environmental awareness, and thus, consistently with previous studies, environmentally friendly activities are associated with better stakeholder engagement (Bouslah et al., 2013). Overall, we find that the beneficial effect of environmental, social and governance sustainability practices, emerges especially during periods of productivity slowdown, and this can possibly be attributed to the development of new environmental technologies, managerial processes that optimize the use of resources, and most importantly, better address the demand of key stakeholders.

4.4 Effects of the 2015 Paris Agreement

To examine the "rewarding effect" of the 2015 Paris Agreement on firm TFP levels, we employ differences-in-differences (DID) regressions, over 2011–2018, considering the sub-period 2016-2018 as the post-shock years. In this setting, our target variables include the dummy shock (D_SHOCK), that takes the value of 1 for post-treatment years (2016–2018) and 0 otherwise; the dummy treated (D_TREATED), that takes the value of 1 for firms above median values of ENV, SOC and GOV in the year of the shock (2015) and 0 otherwise; and their interaction (D_SHOCK*D_TREATED). To address the potential bias arising from treated (T) and control (C) groups' heterogeneity (i.e., firms above or below median value of ESG scores), we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983) with the set of non-

binary firm-level controls before running the DID regression. To identify the control group, we first run a logit model (Panel A of Table 4) to calculate propensity scores using the dummy variable D_HIGH_ESG respectively (equal to 1 for firms above the median values of ESG scores and 0 otherwise in the pre-shock years 2011-2015). For this purpose, we employ all non-binary firm-level control variables (SIZE, SALES_GRW, LEV, HHI, KOF, GDP_GRW) including baseline model fixed-effects (Bhandari et al., 2017). We then match, without replacement, each treated firm to a control firm using the Caliper 1% matching (see e.g Bhandari et al., 2017)[21]. Our final DID sample consists of 86 treated firms and 99 control firms.

Table 4 shows that the enhancing effect of ENV and GOV scores is stronger for more engaged in environmentally and managerial responsible practices, especially after the 2015 Paris Agreement. Furthermore, we do not find any significant association for the SOC score. Therefore, the results of the DID model support the rewarding effect of the recent increasing effort of Paris Agreement towards a reduction of climate pollution and externalities, especially during a period of productivity slowdown. Figure A.1 in the Appendix reveals that, in absence of the shock occurred in 2015, the trend in firm productivity is similar for both the treatment and the control groups, supporting the parallel trends' assumption.

[Insert Table 4 about here]

Our DID results further confirm that by increasing the attention of investors on climate change risks and opportunities, the Paris Agreement has rewarded firms engaged in stakeholder-oriented activities, which leveraged their environmental and managerial strategic positions to boost productivity. More specifically, it confirms that companies more involved in ENV and GOV practices have been rewarded by stakeholders, boosting their TFP despite the period of relatively slow economic growth.

[21] As shown in Panel B of Table 4 we find no significant difference between targets and their matches, confirming the reduction of individual differences and the related potential bias.

5. Additional tests and robustness checks

In this section, we test the validity of our findings, particularly concerning the behaviour of our ESG target variables, running a set of further analyses and robustness checks. Firstly, to overcome possible bias deriving from the sample selection bias, we run the Heckman (1978)'s two-step method (Wu and Shena, 2013).[22] Results in Table 5 confirm the significant and positive role of our target variable in supporting firm TFP thus corroborating the strength and unbiasedness of our baseline regression model.

[Insert Table 5 about here]

Secondly, unlike controlled experiments, because the complexity of business decisions is not random, estimators can be biased by overlooking unobservable confounding factors. For our empirical purposes, the strategic decision to reduce (increase) the ESG level (treatment) can be affected by some observable characteristics that also affect firms' profitability or risk. In such case, our conclusion about the treatment effect can be biased. To tackle this issue, in line with Chen et al. (2020), we employ a propensity score matching (PSM) to control for possible confounding factors affecting firms with high ESG values (above the median value of ESG score) and firms with low ESG values (below the median value of ESG score). Therefore, we match, without replacement each treated firm (high ESG firms) to a control firm using the Caliper 1% matching (low ESG firms) (see also Bhandari et al., 2017). Using this matching method, the panel B of Table 6 confirms that the impact of ESG, ENV, SOC and GOV score on firms' productivity (TFP) is consistently positive and significant. Compared to control firms, treatment firms have a higher TFP (Panel A table 6).

[22] Specifically, to estimate this model: (i) in the first step we estimate the decision equation using a multinomial probit model, whose parameters are used to calculate the Inverse Mills Ratio (IMR), where the dependent variables is a dummy (D_ESG) equal to 1 from the year in which a firm started to disclose its ESG practices and 0 otherwise (Table A.5); (ii) in the second step (Table 5) estimates the Heckman model, by including the IMR among the regressors. Full results are available upon request.

[Insert Table 6 about here]

Thirdly, we check the robustness of results to potential endogeneity bias stemming from reverse causality, omitted variables and measurement error. For instance, companies with better financial performance, being more profitable, may be prone to engage more in CSR practices (Bénabou and Tirole, 2010). We alleviate these endogeneity concerns using both the instrumental variables (IV) GMM estimator (Zolotoy et al. 2019) (Table 7), and an alternative definition of ESG scores (Table 8). For the IV (Table 7)[23] we follow the relevant literature (see e.g., El Ghoul et al. 2011, Dumitrescu and Zakriya, 2021) and employ as instruments of our target variable (ESG score) the industry peers' ESG, ENV, SOC and GOV score. The rationale behind this instrument is that it is found to be correlated with ESG scores (the instrumented variable) and is unlikely to have a significant effect on individual firms' TFP (the dependent variable).

Results indicate that the Cragg-Donald F-test statistics are all higher than the critical value of 16.38, with p-values smaller than 0.01 in all specifications (Table 7). The weak instrument hypothesis test (i.e., testing for the relevance of the IV in the first stage) and the higher F-test (lower p-values) indicate a rejection of the null: our IVs is strongly correlated with our endogenous variables, supporting their relevance. Looking at the coefficients of our target variables (ESG, ENV, SOC and GOV) in Table 7, we confirm a positive and strongly statistically significant relationship for all variables of interest.

[Insert Table 7 about here]

Further, we test the consistency of our results using two alternative CSR score definitions, provided by Thomson Refinitiv' and Bloomberg database in our baseline econometric setting. Firstly, we employ the ESG combined score (ESG COMB) a measure of firms' sustainable engagement which considers not only firms' ESG practices, but also the controversies related to it. According to Thomson Reuters Refinitiv, the ESG combined score "overlays the ESG Score with ESG controversies to provide a comprehensive evaluation on the company's sustainability impact and conduct in near real time". The aim of this score is to 'mark down'

[23] To avoid the length of the paper we show the first stage of IV regressions in the appendix (Table A.6).

the ESG performance score based on negative media stories related to bad firms' practices or scandals. Finally, we test our results by employing the Bloomberg ESG score (BESG) that it is mainly focused on the level of transparency of related sustainability information disclosed by reporting entities. As shown in table 8, results confirm the robustness of our results.

[Insert Table 8 about here]

As a final check, we test the impact of ENV, SOC and GOV score on three alternative productivity measures: i) the Capital productivity (Cap P) measured as the ratio between firms' value added and capital; ii) the Labour productivity (Lab P), computed as the ratio between firms' value added and the number of firms' employees; iii) the more traditional Olley and Pakes TFP (O-P TFP). As shown in table 9, results reveal a statistically positive effect of firms' ESG practices on capital productivity, and on TFP computed following Olley and Pakes' methodology suggesting the strategical importance of firms' sustainability practices on efficient capital allocation.c

[Insert Table 9 about here]

6. Conclusions

This paper empirically investigates the joint and separate effects of environmental, social and governance scores (ESG) on firm-level TFP. We focus on Europe over a relatively long period that includes the post-crisis productivity slowdown. Our robust results show that both the composite ESG score and its pillars lead to higher firm TFP. Moreover, we stress that the positive effect of ENV, SOC and GOV components strongly emerges during the European productivity slowdown-period. When we further explore the ESG scores' individual pillars, our results reveal that greater effects are attributable to the environmental score. This finding is confirmed also by the results obtained using a DID setting, built around the adoption of the 2015 Paris Agreement. More specifically, it confirms that during the productivity slowdown period firms more engaged in ENV and GOV practices, were rewarded by the sign of the Paris Agreement, confirming the moral capital theory assumptions.

Overall, our results suggest that engaging in environmental, social and stakeholder-oriented governance practices are associated with a more efficient firms' production input allocation, resource management and costs reduction. Thus, they confirm that engaging in CSR practices in the non-financial sector is not only beneficial in terms of its impact on society but can also strengthen the firm-level productivity. We also find that, in times of weak productivity, CSR practices play a pivotal role in enhancing productivity and this, in turn, is usually associated to benefits in terms of economic growth.

Furthermore, our evidence reveals that sustainability performances should be materially considered by regulatory authorities, as it is very useful especially during periods of productivity slowdown. In particular, our findings support the recent European approach towards enhanced environmental and socially responsible practices among listed firms. However, these regulations apply only to relatively large firms, so more research should be carried out on smaller unlisted firms to design ways to incentivise them to engage more in ESG practices and disclosure. Future research should also look at whether firms that score best in terms of ESG are also committed to reduce their "brown assets" and to select high ESG scorers in their supply chains.

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Table 1 - Summary statistics

This table reports the summary statistics of our variables in (1) total period of analysis (2002-2018). Variable definitions are provided in Table A.4.

	Mean	Median	Std. Dev	P25	P75
TFP WD	5.433	5.345	0.501	5.125	5.640
TFP L-P	3.082	2.969	0.403	2.808	3.242
ESG	0.589	0.598	0.161	0.483	0.711
ENV	0.614	0.633	0.200	0.473	0.778
SOC	0.618	0.632	0.199	0.478	0.780
GOV	0.528	0.533	0.207	0.365	0.691
SIZE (Log)	15.528	15.465	17.728	14.313	16.849
SALES_GRW	0.067	0.050	0.186	-0.016	0.129
LEV	0.258	0.246	0.161	0.147	0.350
HHI	0.089	0.067	0.064	0.052	0.091
KOF	0.873	0.882	0.028	0.865	0.892
GDP_GRW	0.016	0.019	0.025	0.010	0.027

Table 2 - Baseline results on total period

This table reports the estimates of OLS model during the period 2002–2018. The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). The target variables are the ESG, ENV, SOC and GOV score. Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	TFP WD				TFP L-P			
Variables	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
ESG (-1)	0.201***				0.184**			
	(0.064)				(0.071)			
ENV (-1)		0.148***				0.098**		
		(0.043)				(0.043)		
SOC (-1)			0.094**				0.098*	
			(0.045)				(0.053)	
GOV (-1)				0.075**				0.087**
				(0.035)				(0.041)
SIZE (-1)	0.102***	0.105***	0.109***	0.112***	-0.005	0.001	0.001	0.003
	(0.008)	(0.007)	(0.008)	(0.007)	(0.010)	(0.009)	(0.010)	(0.008)
SALES_GRW (-1)	0.132***	0.129***	0.126***	0.126***	0.125***	0.121***	0.120***	0.121***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.028)	(0.029)	(0.028)	(0.029)
LEV (-1)	-0.315***	-0.315***	-0.323***	-0.314***	-0.168**	-0.169**	-0.176***	-0.166**
	(0.061)	(0.062)	(0.062)	(0.062)	(0.065)	(0.065)	(0.065)	(0.066)
HHI (-1)	0.133	0.102	0.159	0.132	0.298	0.284	0.322	0.298
	(0.234)	(0.238)	(0.230)	(0.230)	(0.236)	(0.237)	(0.232)	(0.231)
KOF (-1)	0.022**	0.023**	0.023**	0.021*	0.027*	0.027*	0.027*	0.025*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.014)	(0.015)	(0.014)	(0.014)
GDP_GRW (-1)	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	4,182	4,182	4,182	4,182	4,182	4,182	4,182	4,182
R-squared	0.824	0.823	0.822	0.822	0.657	0.655	0.655	0.655

Table 3 - Pre and during post-crisis slowdown period

This table reports the estimates of the OLS model during the pre- slowdown period (2002–20012) and the post-crisis slowdown period (2013-2018). The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). The target variables are the ESG, ENV, SOC and GOV score. Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	TFP WD						TFP L-P					
	Pre slow down	Post slow down	Pre slow down	Post slow down	Pre slow down	Post slow down	Pre slow down	Post slow down	Pre slow down	Post slow down	Pre slow down	Post slow down
Variables	(I)	(I)	(II)	(II)	(III)	(III)	(I)	(I)	(II)	(II)	(III)	(III)
ENV (-1)	0.111**	0.181***					0.071*	0.115*				
	(0.043)	(0.062)					(0.040)	(0.066)				
SOC (-1)			0.053	0.124**					0.052	0.136*		
			(0.050)	(0.060)					(0.055)	(0.073)		
GOV (-1)					0.029	0.114**					0.028	0.137***
					(0.039)	(0.046)					(0.046)	(0.051)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,115	2,067	2,115	2,067	2,115	2,067	2,115	2,067	2,115	2,067	2,115	2,067
R-squared	0.850	0.821	0.849	0.819	0.849	0.820	0.690	0.666	0.690	0.667	0.690	0.668

Table 4 – Effects of the 2015 Paris Agreement

This table show the results of differences-in-differences regression run to verify the effects of the 2015 Paris Agreement on TFP. Firstly (Panel A) we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983) to reduce the potential bias arising from heterogeneity of treated (T) and control (C) groups, employing all non-binary firm-level controls (SIZE, SALES_GRW, LEV, HHI, KOF and GDP_GRW). The dependent variable (D_HIGH_ESG) equals 1 for firms above the median values of ESG scores (treated) and 0 otherwise. Panel B provides the univariate statistics on the effectiveness of the matching procedure; Finally, Panel C shows the results of the DID estimation. The dependent variable are: TFP Woldridge (WD) and TFP Levinshon and Petrine (L-P), which measures firm productivity. The target variables are: D_SHOCK, that takes the value of 1 for years 2016–2018 (after the shock, i.e. the sign of 2015 Paris Agreement) and 0 otherwise; D_TREATED, that takes value of 1 for firms above median values of ENV (I), SOC (II), GOV (III)scores in the year before of the shock (2015), and 0 otherwise; the interaction term D_SHOCK*D_TREATED. Variable definitions are provided in Table 1. All non-binary independent variables are lagged by one year with respect to the dependent variable. Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A

Variables	D_HIGH_ESG
SIZE (-1)	0.384***
	(0.017)
SALES_GRW (-1)	-0.098
	(0.094)
LEV (-1)	0.298**
	(0.133)
HHI (-1)	0.155
	(1.091)
KOF (-1)	0.017
	(0.057)
GDP_GRW	-0.011
	(0.011)
Time FE	Yes
Industry FE	Yes
Country FE	Yes
Cluster S.E.	Yes
N. of obs.	5318

Panel B

Variables	Treated (T)	Control (C)	Difference (T-C)	P-value
SIZE	14.758	14.922	-0.164	0.164
SALES_GRW	0.078	0.051	0.027	0.127
LEV	0.258	0.271	-0.013	0.388
HHI	0.078	0.085	-0.007	0.146
KOF	0.425	0.416	0.009	0.944
GDP_GRW	0.020	0.020	0.000	0.909

Panel C

	TFP WD			TFP L-P		
	ENV	SOC	GOV	ENV	SOC	GOV
Variables	(I)	(II)	(III)	(I)	(II)	(III)
D_SHOCK*TREATED	0.056**	0.025	0.054**	0.061**	0.030	0.047*
	(0.024)	(0.024)	(0.025)	(0.026)	(0.026)	(0.028)
D_SHOCK	0.018	0.029	0.007	0.001	0.040	0.002
	(0.029)	(0.029)	(0.030)	(0.032)	(0.033)	(0.036)
D_TREATED	0.613	0.625	0.592	0.752	0.779	0.747
	(0.594)	(0.609)	(0.606)	(0.574)	(0.581)	(0.583)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	1,489	1,489	1,489	1,489	1,489	1,489
R-squared	0.771	0.821	0.823	0.648	0.631	0.640

Table 5 - Heckman two-step model

This table reports the results of the second stage obtained from the Heckman two-stage model over the total period (2002–2018). The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). The target variables are the ESG, ENV, SOC and GOV score. The IMR is the Inverse Mills Ratio generated by the first step of Heckman model and included in the second step. Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	TFP WD				TFP L-P			
Variables	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
ESG (-1)	0.201***				0.184**			
	(0.064)				(0.071)			
ENV (-1)		0.148***				0.098**		
		(0.043)				(0.043)		
SOC (-1)			0.094**				0.098*	
			(0.045)				(0.053)	
GOV (-1)				0.075**				0.087**
				(0.035)				(0.041)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	4182	4182	4182	4182	4182	4182	4182	4182
IMR	2.77e-05	3.26e-05	3.80e-05	3.24e-05	-3.35e-05	-2.72e-05	-2.48e-05	-3.12e-05
	(9.34e-05)	(9.34e-05)	(9.56e-05)	(9.47e-05)	(9.59e-05)	(9.62e-05)	(9.67e-05)	(9.67e-05)

Table 6 - PSM weighted regression

This table reports the results of the weighted regression obtained after running the PSM over over total period (2002–2018). The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). The target variables are the ESG, ENV, SOC and GOV score. Panel A shows the matching estimation between Treatment (High ESG firms) and Control (Low ESG firms). Panel B shows the result of Regression estimation on matching sample. Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

Panel A: Matching estimation. Difference in TFP between Treatment (High ESG) and Controls (Low ESG

	Treatment	Control	Difference	p-value
TFP WD	5.433	5.339	0.094***	0.000
TFP L-P	3.098	3.057	0.040***	0.000

Panel B: Regression Estimation based on matching sample

	TFP WD				TFP L-P			
Variables	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
ESG (-1)	0.208***				0.193**			
	(0.070)				(0.081)			
ENV (-1)		0.141***				0.096*		
		(0.047)				(0.049)		
SOC (-1)			0.099*				0.109*	
			(0.052)				(0.062)	
GOV (-1)				0.092**				0.096**
				(0.040)				(0.045)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,496	2,496	2,496	2,496	2,496	2,496	2,496	2,496
R-squared	0.821	0.820	0.819	0.819	0.662	0.660	0.661	0.661

Table 7 - IV regression

This table reports the estimates of the IV GMM model over total period (2002-2018). The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). The target variables are the ESG, ENV, SOC and GOV score. Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	TFP WD				TFP L-P			
Variables	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
ESG (-1)	0.637***				0.775***			
	(0.115)				(0.120)			
ENV (-1)		0.326***				0.273***		
		(0.079)				(0.072)		
SOC (-1)			0.262***				0.303***	
			(0.074)				(0.170)	
GOV (-1)				0.265***				0.409***
				(0.048)				(0.051)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	4182	4182	4182	4182	4182	4182	4182	4182
Sargan p-value	0.990	0.977	0.640	0.585	0.751	0.603	0.219	0.476
F-Cragg Donald test	25.94***	43.94***	49.75***	22.36***	25.94***	43.94***	49.75***	22.36***

Table 8 - Alternative ESG measure

This table reports the estimates of the OLS model over the total period (2002-2018), by employing ESG Combined score (ESG COMB) and Bloomberg ESG disclosure score (BESG). The dependent variables are TFP WD and TFP L-P which measures firm's total factor productivity (TFP). Variable definitions are provided in Table A.4.Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	TFP WD		TFP L-P	
Variables	(I)	(II)	(I)	(II)
ESG COMB (-1)	0.054**		0.051*	
	(0.024)		(0.028)	
BESG (-1)		0.174***		0.174**
		(0.062)		(0.072)
Controls (-1)	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes	Yes
N. of obs.	3,288	2,552	3,288	2,552
R-squared	0.754	0.776	0.542	0.593

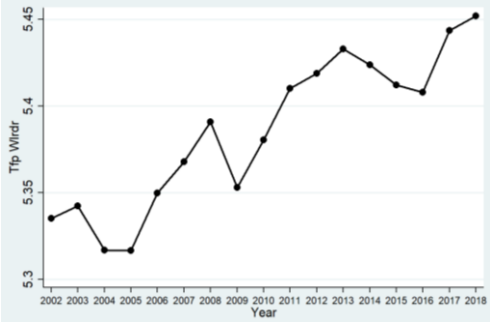
Table 9 – Alternative Productivity measure: Capital productivity, Labor productivity and Olley and Pakes TFP

This table reports the estimates of the OLS model over the total period (2002-2018), by employing alternative measure of firms' productivity: the Capital productivity (Cap P); the Labour productivity (Lab P) and Olley and Pakes TFP (O-P TFP). Variable definitions are provided in Table A.4. Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

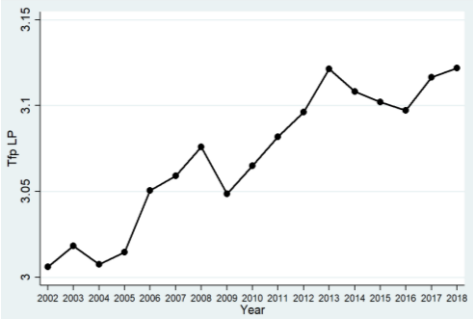
Variables	Cap P (I)	Lab P (II)	O-P TFP (III)
ESG (-1)	0.232*	-0.219	0.244**
	(0.138)	(0.162)	(0.121)
Controls (-1)	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Cluster S.E.	Yes	Yes	Yes
N. of obs.	4,324	4,618	4,229
R-squared	0.815	0.770	0.874

Figure 1: TFP trends

Panel A: TFP WD



Panel B: TFP L-P



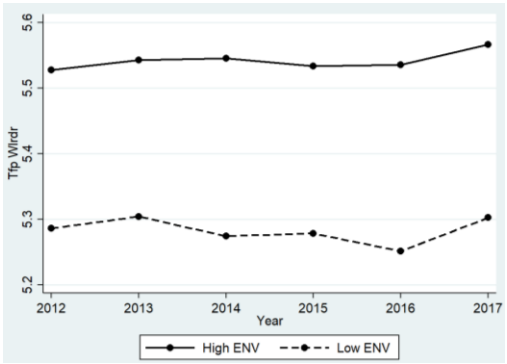
Appendix

Figure A.1 Parallel trends Paris Agreement

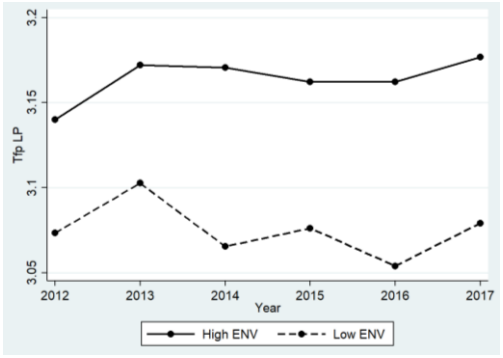
This figure illustrates the behaviour of the average TFP WD and TFP L-P before the shock or treatment (i.e., the adoption of 12 December 2015 Paris Agreement) for both the treated (High ENV, High SOC and High GOV) and the control group (Low ENV firms, High SOC and High GOV).

Panel A: High ENV vs Low ENV

TFP WD

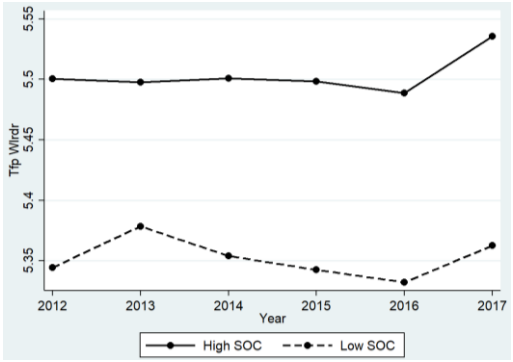


TFP L-P

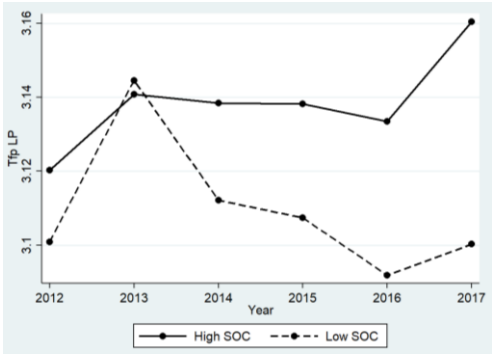


Panel B: High SOC vs Low SOC

TFP WD

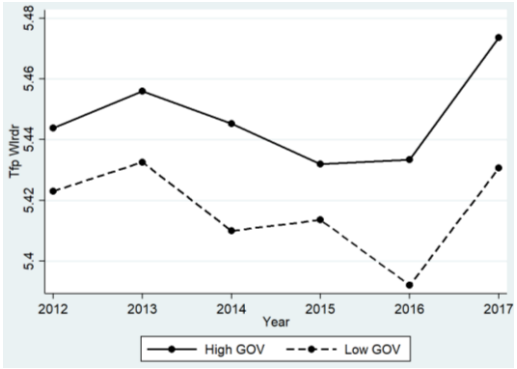


TFP L-P



Panel C: High GOV vs Low GOV

TFP WD



TFP L-P

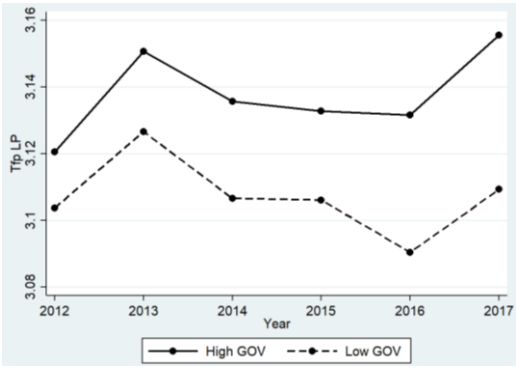


Table A.1 - Country distribution

This table presents a summary of our sample composition by country.

Country	*N. of Obs*	*%*
Austria	149	3.56
Belgium	154	3.68
Finland	211	5.04
France	215	5.13
Germany	576	13.75
Greece	56	1.34
Hungary	25	0.60
Ireland	163	3.89
Italy	226	5.40
Netherlands	292	6.97
Poland	96	2.29
Portugal	54	1.29
Spain	275	6.57
Sweden	330	7.88
United Kingdom	1360	32.62
Total	*4182*	*100*

Table A.2 - Correlation matrix

This table shows the correlation matrix of the variables used in the empirical analysis over the period 2002–2018.

	Variable	1	2	3	4	5	6	7	8	9	10
1	ESG	1									
2	ENV	0.831*	1								
3	SOC	0.858*	0.664*	1							
4	GOV	0.654*	0.266*	0.327*	1						
5	SIZE	0.526*	0.479*	0.491*	0.262*	1					
6	SALES	-0.108*	-0.108*	-0.080*	-0.064*	-0.152*	1				
7	LEV	0.041*	0.038*	0.067*	-0.015	0.183*	-0.006*	1			
8	HHI	0.046*	0.023	0.069*	0.019	0.062*	-0.011	0.079*	1		
9	KOF	0.052*	0.109*	0.038*	-0.030*	0.076*	-0.021	0.031*	-0.052*	1	
10	GDP_GRW	-0.032*	-0.069*	-0.018	0.015	0.021	0.127*	-0.056*	0.007	-0.036*	1

Table A.3 - Composition of ESG score

Pillar	Category	Category definition
Environmental (ENV)	*Resource Use score*	It reflects a company's performance and capacity to reduce the use of materials. energy or water. and to find more eco-efficient solutions by improving supply chain management.
	Emissions score	It measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.
	Innovation score	It reflects a company's capacity to reduce the environmental costs and burdens for its customers. and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.
Social (SOC)	*Workforce score*	It measures a company's effectiveness towards job satisfaction. healthy and safe workplace. maintaining diversity and equal opportunities. and development opportunities for its workforce.
	Human Rights score	It measures a company's effectiveness towards respecting the fundamental human rights conventions.
	Community score	It measures the company's commitment towards being a good citizen. protecting public health and respecting business ethics.
	Product Responsibility score	It reflects a company's capacity to produce quality goods and services integrating the customer's health and safety. integrity and data privacy.
Governance (GOV)	*Management score*	It measures a company's commitment and effectiveness towards following best practice corporate governance principles.
	Shareholders' score	It measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.
	CSR Strategy score	It reflects a company's practices to communicate that it integrates the economic (financial). social and environmental dimensions into its day-to-day decision-making processes.

Table A.4 - Variable definitions and data sources

Variable	Definition	Source
TFP WD	Total factor productivity derived from Wooldridge (2009) procedure	Author's own calculation
TFP L-P	Total factor productivity derived from Levinsohn and Petrin (2003) procedure	Author's own calculation
ESG	Total ESG score.	Thomson Reuters Refinitvì, Author's own calculation
ENV	Environmental performance score.	/
SOC	Social performance score.	/
GOV	Governance performance score.	/
SIZE	Natural Logarithm of firm's total asset.	/
SALES	Firms' Sales scaled to total asset.	/
LEV	Total debt to total asset.	/
HHI	The sum of the squared market share value (in term of total asset) of all firms in the country.	Author's own calculation
KOF	The KOF Globalisation Index measures the economic. social and political dimensions of globalisation.	ETH Zurich
GDP_GRWT	It measures the country GDP growth.	World Bank Database

Table A.5 - First Step Heckman model

This table shows the results of the first step estimation of the Heckman model (see Table 6 for the second step). This table estimates the decision equation using a multinomial probit model, whose parameters are used to calculate the Inverse Mills Ratio (IMR). In this setting the dependent variables is dummies (D_ESG) equal to 1 from the year in which a firm of our sample started to be involved in ESG practices; and 0 in the previous years (Jo and Harjoto, 2011).Variable definitions are provided in Table A.4 Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

Variables	D_ESG
SIZE (-1)	0.660***
	(0.047)
SALES (-1)	-0.471***
	(0.108)
LEV (-1)	-0.818***
	(0.253)
HHI (-1)	-0.877
	(1.487)
KOF (-1)	21.870***
	(6.302)
GDP_GRW	-0.004
	(0.012)
Time FE	Yes
Industry FE	Yes
Country FE	Yes
Cluster S.E.	Yes
N. of obs.	6386

Table A.6 - First stage IV TSLS

This table shows the results of the first stage estimation of IV TSLS and GMM model (see Table 7 for the second stage). We instrument our target variable (the ESG score) with the firms' industry peer ESG score (Peer ESG) (El Ghoul et al. 2011, Dumitrescu and Zakriya 2021), showing its correlations with reference to the original target variable being instrumented. Definitions are provided in Table A.4. Time, industry and country fixed-effect (FE) are included in all specifications. Firm clustered standard errors (SE) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%. 5%. and 10% levels, respectively, in two-tailed tests.

	ESG
Peer ESG (-1)	0.442***
	(0.052)
Controls (-1)	Yes
Time FE	Yes
Industry FE	Yes
Country FE	Yes
Cluster S.E.	Yes
N. of obs.	4918

Essay 3:
Hidden sustainability costs of "CSR deregulation" [24]

[24] This paper is under review to *Accounting Forum*.

Hidden sustainability costs of "CSR deregulation"

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University of Essex and University of Udine

Abstract

This paper investigates the consequences for UK firms' sustainability of the 2016 UK choice to leave the EU, few years after the issuing of the EU Directive on Non-Financial Reporting. By applying a Difference in Difference (DID) methodology on a sample of 1,370 firm-year observations from 2013 to 2018, we observe a decrease in UK firm's environmental and social performance compared to those headquartered in the EU. The results of this study show a positive effect of the 2014 EU Non-financial reporting directive on CSR engagement, but also provide suggestive evidence of a reduction in UK firms' ethical, diversity, and inclusion policies, in the post-Brexit. Additionally, our evidence stresses the importance of the Global Reporting Initiative (GRI) standards adoption in reducing the negative impact of Brexit on CSR performance, supporting the EU requirement for a standardized non-financial reporting framework. Overall, our results unbox the effects arising from an unintended "CSR deregulation", caused by exiting from the EU's strongly stakeholder-oriented regulatory approach, in terms of greater exposure of UK firms to future climate and social changes.

Keywords: Non-financial reporting directive; Environmental Social Governance (ESG) performance; Global Reporting Initiative (GRI); board diversity and inclusion; Brexit.

JEL Codes: G30; M14; F23.

1. Introduction

During recent years, institutional and stakeholders' pressure on business adoption of long term, sustainable and climate neutral behavior has increased. This behavioural change in stakeholders' preferences resonates in regulator call for companies to adopt socially responsible behaviour such as by designing environmentally friendly products or by increasing employee's well-being. To address this societal requirement, the European Union (EU) passed the Non-financial reporting directive (Directive 2014/95, hereafter Directive or EU NFRD), which mandates public entities operating in EU to disclose their environmental and social engagement during their annual reports. By adopting a "comply or explain" framework, the directive aims at enhancing the disclosure process of non-financial matters among EU business framework, thus increasing companies' stakeholder pressure on sustainability. According to recent literature contributes (see e.g Jackson et al. 2020 and Grewall et al. 2021) the effect of mandatory social responsibility behaviour led to a significant increase of firms' engagement. Similarly, a pilot study by Fiechter et al. (2020) provides detailed insight on the 2014 EU Non-financial directive (NFRD), concluding that EU firms anticipated their corporate social responsibility (CSR) activities increasing their engagement before the entry into force of the directive. Considering these positive effects of the Directive, it is interesting to investigate the impact of Brexit on the effect of the Directive for corporate sustainability in the UK, as Brexit has been perceived as a way to limit the influence of EU regulation to the UK.

According to Hirschman (1970), groups, nations and citizens can have two possible reactions to demonstrate against a decrease in quality or benefit in belonging to a coalition: exit, withdrawing from the group; or voice, attempting to repair the union proposing for changes and restoring the benefit. On the 23rd June 2016 the United Kingdom voted to exit from the European Union (EU) after almost half a century, letting the possibility of voicing down.

By increasing the level of political uncertainty, Brexit altered the economic and financial environment

of firms operating in the UK, favouring the spread of skepticism towards institutions and governments (Cao et al. 2019; Borg, 2020). However, as stated by Lehman and Kuruppu (2017), how environmental and social accounting practices changed after the Brexit political dilemma, remains an open question to be investigated.

To fill this gap, by exploiting a quasi-natural experiment built around the Brexit announcement, this paper investigates how a sudden exit from a stakeholder-oriented coalition, affected UK firms' CSR policies. The latter were proxied by Environmental, Social and Governance (ESG) data from Thomson Reuters Refinitiv database. Since Brexit also affected migration flows (Sobolewska and Ford, 2020), we additionally investigate if diversity (ethnicity and gender) in firms' boards changed. Although in the short-term pre-existing rights were preserved, changes may have occurred to the long-term decision of EU workers to remain in the UK (Portes and Forte, 2017). Finally, among the accepted international reporting standards, the Global Reporting Initiatives (GRI)[25] is one of the most widely used worldwide (Junior et al., 2014; KPMG, 2016), and we thus expect its usage affected the impact of the Brexit on firm's sustainability. Therefore, we investigate if firms compliant to the Global Reporting Initiative (GRI) standards were more prone to ESG adoption, despite the Brexit shock.

Baldock et al. (2016) highlighted the possibility for UK to cease EU policy involvement, potentially reducing their influence on climate change negotiations. These predictions are in line with the demand-side view arguments on a firm's sustainability practices, where stakeholder protection may affect their socially responsible engagement (Bènabou and Tirole 2006). Specifically, the demand for firms' socially responsible activities strictly depends on the political structure, on consumers' expectations and on political connections (Detomasi, 2008; Xu and Liu 2020).

[25] The Global Reporting Initiative (GRI) is an international independent standards organization that helps businesses, governments and other organizations to understand and communicate their impacts on sustainability issues such as climate change, human rights and corruption.

Therefore, the Brexit, by representing a "deregulation" process (Latorre et al. 2020) which implicitly reduced the EU pressure on CSR, might have affected UK firms' willingness to pursue ethical business purposes. This confirms the nexus between the political environment and Socially Responsible Investments - SRI (Detomasi, 2008), and may have been aggravated by the uncertainty and length of the following UK-EU negotiations. Besides nothing practically changed immediately after the 2016 referendum, it is possible that UK firms anticipated post-deal financial markets deregulation promises, especially on short-term costly issues such as environmental and social matters.

This paper makes several contributions to the CSR regulation and the Brexit literature.

Firstly, to the best of our knowledge, this is the first study employing ESG measures to investigate UK non-financial firms' sustainability consequences in the post-Brexit years. Beside recent contributes focus on the effect of mandatory requirement on CSR disclosure (see e.g Jackson et al 2020), no one has stressed the consequence of exit from a legal framework strongly oriented on sustainable development achievement such as EU. In 2014, the European Parliament announced the passage of the Directive 2014/95, which mandates "public interest entities" (i.e., firms with more than 500 employees and more than EUR 20 million of total assets or more than EUR 40 million of sales) to prepare non-financial (CSR) reports starting with the fiscal year 2017. As a consequence, the EU became a global leader in promoting environmental and social sustainability.

According to Latorre et al. (2020), UK citizens exaggerated the optimistic view of the Brexit deregulation process, interpreting international commitments that the UK may have implemented as a non-member of the EU as additional costs emanating from European regulation (Booth et al. 2015). As a consequence, it is possible that the expected positive output of UK deregulation policies finally turned on an increase in environmental and social costs. Therefore, by considering the EU a key actor in developing CSR practices in Europe, we investigate the hidden "CSR deregulation costs" of the Brexit process. Consistently, we focus on the environmental and social consequences of this decision

in the UK, stressing how a reduced institutional strain on sustainability can affect firms' decisions to engage in such practices, strengthening the link between political pressure and ESG practices.

Secondly, as argued by Mehmet Simsek (2016), Brexit can be considered as a pullback to labour movements and globalization, which are important factors in boosting the sustainable business transition (Detomasi et al., 2008). By interpreting the Brexit referendum as a pullback to nationalism, our paper provides empirical evidence on the link between an exogenous shock on globalization, international pressure and CSR investments in the light of the demand-side view.

As stressed by the literature (Cheung, 2016; Chiaramonte et al., 2020; Hasan et al., 2018, Baboukardos 2017), a reduction in CSR engagement in UK firms can pose several threats to its financial markets. A decrease in CSR warns on the possible detrimental consequences of lower sustainability in UK non-financial firms, suggesting that the UK government should take stronger actions to fill the gap created after the Brexit. At the same time, institutional investors may consider pricing the risk for UK firms' greater exposure to climate change and social issues in their funding decisions. As shown by Barret et. al (2021), the potential financial loss deriving from social unrest can reduce the financial market abnormal return of 1,4%, especially among poor governance firms. Therefore, managing environmental and social risk is crucial for firms and financial institutions.

Finally, we provide strong evidence on the importance of adopting an accounting framework such as that proposed by the GRI, especially after political shocks and pullback to nationalism and protectionism. Specifically, we rely on the need for an internationally shared environmental and social reporting framework, especially to increase its harmonization among countries and industries.

The remainder of this paper is organized as follows: Section 2 reviews the literature and identifies our hypotheses. Sections 3 describes the empirical methodology, the sample selection, and the variables used in the analysis. Section 4 discusses the main results and Section 5 provides a number of robustness checks. Finally, conclusions and policy implications are discussed in Section 6.

2. Literature review and hypotheses development

The Brexit implies that both UK and EU firms no longer enjoy the benefits of their former free market. The rules to withdraw from the EU are set in Article 50 of the Treaty of European Union. Although after 23 June 2016 nothing practically changed between the UK and EU, the complexity of reaching an agreement within the two years, rose concerns about negative repercussions on the UK economy. Therefore, UK firms may have anticipated a post-deal deregulation wave, by immediately cutting environmental and social compliance costs.

As widely recognized, the Brexit referendum outcome tightens foreign direct investments (FDI), reducing the incentive to invest in the UK and lowering capital inflows (Ellen and Waddle, 2017). Similarly, Baldock et al. (2016) warned about the risk of a reduced influence, stemming from the EU, on engagement towards climate and social changes, lowering the long-term benefits of sustainable practices.

Nevertheless, the ESG literature emphasizes two pivotal channels explaining the adoption of sustainability practices in firms: i) "doing good by doing well", in other words the relevance of enhancing ESG investments (Hong and Kubik; 2012); ii) "doing well by doing good", emphasizing how this enhances profitability (Dowell, Hart, and Yeung; 2000).

Neither of these two arguments can explain the cross-firm or cross-country variation in firms' social responsibility (Liang and Renneboog, 2017). The domestic political environment in which a firm operates can be a relevant explanatory variable in determining whether a company decides to pursue socially responsible behavior (Detomasi, 2008). Institutional pressure can positively shape environmental strategies, especially for firms highly exposed to their home country (Marano and Kostova, 2016).

From a demand-side perspective, stakeholders are pivotal actors in exerting effective pressure on firms' socially responsible behavior. At the same time, stakeholders benefit from stronger protection,

finally rewarding firms more engaged in ethical practices (Bouslah et al., 2018). Therefore, the level of sustainability in a firm may reflect the preferences of consumers and citizens (Benabou and Tirole, 2006). Based on the demand-side view, Liang and Renneboog (2017) investigate the relevance of country legal origins in promoting socially responsible practices. Consistent with the demand-side view, they conclude that firms' socially responsible behaviour might be considered an equilibrium outcome reflecting the demand for voluntary good practices (Liang and Renneboog, 2017).

In this framework, the European Union is a global leader for CSR. For example, in 2011 the Commission adopted (European Commission, 2011) a strategy for CSR that encouraged firms' socially responsible behaviour. In 2014, the EU commission passed the Directive 2014/95/EU, requiring disclosures from firms on their non-financial performance, such as environmental and social practices. The Directive 2014/95, mandates "public interest entities", including banks, insurance companies and listed firms, to disclose non-financial information in their annual reports, starting with the fiscal year 2017. Specifically, since 2017 all subjected companies must disclose information related to environmental, social, respect of human rights, anti-corruption, bribery and diversity on company boards matters. According to Jackson et al. (2020) the introduction of the Directive 2014/95 positively affected firms' CSR engagement, while Grewal (2021) provides more insights showing that such positive effects on CSR performance happened only for firms that were voluntary disclosers before the passage of the directive. Besides the effect of the Directive 2014/95 on firms' sustainable engagement is well reported, the consequences of exiting from such CSR oriented coalition are unknown so far.

In the aftermath of the Brexit referendum, concerns arose on a possible weakening of environmental standards in the UK, because of the reduction of institutional pressure on sustainability. Specifically, the main issues encompass both the loss of EU enforcement mechanisms, and the change in legal requirements to ensure compliance to environmental principles (Smith and Priestley, 2019). Therefore, it is reasonable to anticipate that the great level of political uncertainty created by the

Brexit referendum (Hill e al. 2019) led to an implicit reduction of EU pressure on the company's socially responsible behavior, finally affecting UK firms' ethical business engagement. At the same time, the pressure of EU on mandating CSR reporting, positively shaped the adoption of CSR practices among EU headquartered firms (Jackson et al. 2020, Grewal 2021). On the other side, when firms exit from a coalition strongly oriented to CSR, such as the EU, the operating mechanism should work in the oppositely: a reduction of CSR pressure and regulation may lead to a lower firms' engagement.

Therefore, we propose the following hypothesis:

H1. The Brexit "deregulation" process negatively affected UK firms' CSR practices compared to EU firms.

The Brexit impacted not only migration and capital movements between the EU and the UK, but also the demand-side of environmental and social requirements. The migration system inevitably required reform and replaced the EU regulation (Sobolewska and Ford 2020). According to Plomien (2018), the recent European socially responsible policy developments, especially from a gender equality perspective, might represent one of the most important losses for the UK. Moreover, these losses can be amplified without a progressive post-Brexit agenda for UK (Plomien, 2018). Based on the demand-side view argument, the EU institutions promoted in 2016 the Gender Action Plan 2016-2020 (referred to as GAP II) increasing the attention of firms' practices on diversity and inclusion issues finally rooting gender equality principles in international law, aimed at preventing the abolition of such rights by governments unfavourable to gender inclusion and diversity policies (Fagan and Rubery, 2018). The gender diversity engagement is also materially required by the EU NFRD, which mandates from the 2017 fiscal year to "all public entities" to disclose how firms include diversity on their boards (e.g age, gender, educational and professional background).

Nevertheless, the uncertainty about long term preservation of EU and non-EU rights of skilled employees negatively affected the long-term decision of EU workers to remain in the UK (Portes and

Forte, 2017), and of UK entities to pursue inclusion policies, finally resulting in a reduction of the gender and ethnicity diversity composition of the UK firms' board.

Consistently, we propose this second hypothesis:

H2. The Brexit "deregulation" process reduced the firm's board and gender diversity policies compared to EU firms.

According to a report of KPMG (KPMG International, 2008) the publication of sustainability reports rapidly increased during recent years. For example, by the year 2013, 70% of the large mining firms started to produce non-financial reports providing stakeholders detailed information about their socially responsible programs (KPMG International, 2013). Besides the existence of many reporting frameworks such as the International Integrated Reporting Council (IIRC) framework, the UN (Global Compact), and Global Reporting Initiative (GRI) framework for non-financial reporting, no one provides a universal taxonomy of CSR accountability (Lokuwaduge and Heenetigala, 2016). Consistently, CSR measurement may also differs among economic sectors undermined investors' capability to understand specific firms' sustainable practices (Sjöström and Welford, 2009). The main objective of the GRI initiative is to improve the transparency and quality of environmental, social, and governance activities (Global Reporting Initiative, GRI, 2011). More precisely, the GRI initiative is a voluntary framework built to give the possibility to companies and organizations to comply with their guidelines, finally providing an international framework to harmonize the disclosure of CSR practices (Romolini et al., 2014). On the contrary, Parsa et al. (2018) rely on that firms' adopting GRI fails to report their workforce and employees' details, avoiding to provides material information, and industry comparability. Therefore, how, and when GRI adoption can be useful for firms' non-financial disclosure is an open question. The International Organization for Standardization (ISO) following the GRI, signed an agreement to enhance their cooperation and strengthen the universal validity of ESG measures. Therefore, the importance of GRI standards adoption spans from multiple aspects for non-financial firms. For example, the internal benefit for companies includes a better

understanding of risk and opportunities the connection between financial and non-financial performances as well as the enhancement and harmonization of corporate sustainability practices in an internationally recognized reporting methodology (Schadewitz and Niskala, 2010). The GRI definition of firms' stakeholders includes all "entities or individuals" that can be directly or indirectly affected by firms' business, whose actions can affect the ability of the company to successfully achieve its goals (GRI, 2013a, p. 92). Therefore, firms adopting GRI are expected to be more sensitive to stakeholders' engagement than others, thus resulting in a greater sustainability engagement also during a demand-side shock such as the Brexit. At the same time, the GRI helps market regulators to easily account for and compare corporate sustainability practices, optimizing the process of sustainability practices requirement. As shown in paragraph 8 of the EU NFRD reporting directive, firms are strongly encouraged to adopt the GRI framework, especially to enhance the disclosure of material aspects and indicators of CSR practices. Consistently, it is reasonable that the GRI adoption preserved the ability of UK firms to pursue and properly communicate ethical purposes despite the great level of implicit deregulation poses by Brexit, confirming the importance for firms and regulators of such adoption.

We, therefore, test the following last hypothesis:

H3. The negative social responsibility consequences of Brexit "deregulation" were mitigated by UK firms' GRI adoption.

3. Data and Methodology

3.1 Data sources

Our study focuses on the impact of the UK exiting process on firms' CSR performances, proxied by Environmental, Social and Governance (ESG) score. We collect data on firms' sustainability

performance measures from Thomson Reuters' Refinitiv[26]. We restrict our sample to the period 2013-2018 to empirically assess the change in firms' ESG engagement three years before (2013-2015) and after (2016-2018) the Brexit referendum.

Thomson Reuters ESG scores are gathered from public sources, such as company filings, its non-financial disclosures, and annual reports. Therefore, ESG scores are designed to transparently account for a firms' relative ESG performance and across the following themes: resource use, emissions, environmental product innovation, workforce management, community respect, human rights defence, and product responsibility creation among others.

Thomson Reuters' Refinitiv ESG scores range from 0 (worst) to 100 (best) and represent a widely used in the literature (Cheng et al., 2014; Liang and Renneboog 2017 among others), among several data providers. Unlike others, however, Thomson Reuters' database considers the material level of a firm's engagement, and not only the way they communicate it (as for example is the case of Bloomberg[27]). Additionally, Thomson Reuters' database provides detailed granular ESG data on its constituents, all with the same numerical range, allowing us to expand the tests to individual components of our dependent variables.

To empirically test our hypotheses, we exclude financial firms (Chen et al. 2018) from both UK as a treated sample and from EU countries as a matched sample. We employ the EU sample as a control group for the following reasons: i) the EU passed in 2014 the Non-financial reporting directive (NFRD), which mandates to "public interest entities" of all EU countries (included UK) to produce CSR reports within the 2017 fiscal year. Thus, it allows to stress the differences of CSR performance between UK and EU firms before and after the Brexit, by accounting for the EU NFRD effect and thus for its "institutional pressure"; ii) the EU firms is the "cleanest" control group at least for the

[26] Thomson Reuters' Refinitiv is an enhancement and replacement of Thomson Reuters ASSET 4. Notice that we use Thomson Reuters and Thomson Reuters' Refinitiv as interchangeable in the text.

[27] In the robustness tests section, we run our baseline model by employing Bloomberg ESG data, obtaining similar results.

pre-shock period (2013-2016), because of they were subjected to the similar regulatory framework (the EU legislation). This is valid also for the EU NFRD regulation, which passing during the pre-Brexit period, should have affected both UK and EU firms, thus strengthening the matching process. Therefore, by comparing UK firms (treated) with EU firms (control), we address the environmental and social consequences of ceasing from a CSR regulatory oriented coalition. We then apply a Propensity Score Matching (PSM) Caliper without replacement at 2% to prove the validity of the comparison between treatment (UK) and matched (EU) firms, based on widely used firm-level control variables (Chen et al. 2018). Finally, we test the robustness of the baseline model by applying different PSM strategies, by removing the PSM, and by running our tests under different restrictions and econometric settings.

3.2 Key variables

In order to test our hypotheses, we control for a battery of proxies of ESG engagement expected to be directly or indirectly affected by the Brexit. Following previous contributions (Liang and Renneboog 2017), we test which of the environmental (ENV) and social (SOC) components mostly changed as a consequence of the Brexit shock: Resource use score, Emission score, Environmental Innovation score (for ENV); and Workforce score, Human rights score, Community score, and Product responsibility score (for SOC).

Secondly, we are interested in testing if the Brexit affected firms' board and diversity disclosure practices, by considering the following measures: the board gender inclusion, the gender pay gap, and the board policy diversity and opportunity. Specifically, the board gender diversity measures the percentage of females on the firms' board, the gender pay gap measures the percentage of female remuneration to male, and the policy diversity and inclusion measure the level of company's policy to drive diversity and equal opportunities development. The board gender diversity and inclusion is a score taking value from 0 (no diversity and inclusion) to 100 (highest diversity and inclusion) and

measures the level of gender diversity within a board of a firm. Similarly, the gender pay gap score takes value from 0 (no gender pay-gap) to 100 (highest gender pay-gap) and measures the level of diversity of remuneration within a board of a firm. The policy diversity and opportunity is a dummy variable taking the value of 1 for firms with a consolidated policy of diversity within the board and 0 otherwise. Finally, to test the moderating effect of UK firms' GRI compliance on ESG scores after the Brexit, we use the GRI reporting score, a variable ranking from 100 (highest GRI reporting adoption), and 0 (no GRI adoption).

Motivated by previous studies on socially responsible engagement (Lys et al, 2015; Chen at al, 2018; Liang and Renneboog, 2017; Jackson et al, 2020; Chan et al 2013), we control for the following variables that may affect ESG practices: the SIZE, measured as the natural logarithm of total assets , the ROA, measured as the net income scaled by total asset, the QTOB as the ratio of the market to book value of assets, the ATO as the revenues/sales scaled by total asset, the CASH as the total cash divided by total assets, the leverage (LEV) as the total debt to total assets ratio. These control variables are designed to capture the widely recognized positive effects of firms' performance on the level of socially responsible engagement (Liang and Renneboog 2017).

Consistently to recent evidence finding a positive impact of firm's R&D expenditures on ESG engagement, we also include the research and development expenses (R&D) to sales ratio among regressors (Jackson et al. 2020) as well as the corporate governance quality (CG) because of its documented association with firms' sustainability engagement (Lys et al. 2015, Aggarwal and Dow, 2012, Johnson and Greening, 1999).

3.3 Empirical model

Our identification strategy strongly suggests that a difference-in-difference (DID) methodology, with a Propensity Score Matching (PSM), is appropriate to test the changes in sustainable practices in UK

firms, compared to the EU, in the post-referendum period (2016-2018), compared to the pre-Brexit period (2013-2015).

We match UK with EU firms over the 2013-2018 period to "difference out" possible confounding factors and isolate the effect of the Brexit. We apply a 1-to-1 PSM without replacement (Meng et al. 2020) Caliper 2% on all firm covariates, obtaining 251 UK firms (treated) and 251 EU firms (controls). Alternatively, the robustness of the baseline model is checked by changing the matching algorithm (nearest neighbour) and through alternative controls.

We are confident that this process allows us to minimise all potential biases arising from cross-industry and cross-country confounding factors. Finally, the DID approach furtherly allows us to check parallel trends, supporting the validity of the model.

The DID regression model is as follows:

$$1)\ ESG_{i,t}=c+\beta_1 UKfirms*PostBrexit_{i,t}+\beta_2 PostBrexit_{i,t}+\beta_3 UKfirms_{i,t}+\beta_4 X_{i,t-1}+\upsilon_t+\delta_i+\alpha_t+\varepsilon_{i,t.}$$

where our dependent variable is the firm's engagement in socially responsible practices measured by employing the following score: the ESG score, the ENV score, and the SOC score. *PostBrexit* is a dummy variable taking a value of 1 for the years 2016-2018 and 0 otherwise; *UKfirms* is a dummy equal to 1 for firms headquartered in UK; *X* is a set of firm controls on characteristics correlated to ESG score, and υ_t, δ_i, α_t, ε_i, represent, respectively, industry, time, country fixed effects and the error term. The main target variables, therefore, are *UKfirms*PostBrexit* and *PostBrexit*.

Secondly, we are interested in assessing the moderating role of GRI initiative compliance on UK firms ESG score (Eq. 2). We explore if any difference exists between firms' non adopting GRI and firms compliant with it in the aftermath of the Brexit referendum. Therefore, to empirically address the moderating role of GRI standard on UK firms' sustainability performance after the Brexit referendum we run the following triple DID model:

2) $ESG_{i,t}=c+\beta_1 UKfirms*PostBrexit*GRIscore_{i,t}+\beta_2 UKfirms*PostBrexit_{i,t}+\beta_3 PostBrexit*GRIscore_{i,t}+\beta_4 PostBrexit_{i,t}+\beta_5 UKfirms*GRIscore_{i,t}+\beta_6 UKfirms_{i,t}+\beta_7 GRIscore_{i,t}+\beta_8 X_{i,t-1}+v_t+\delta_i+\alpha_t+\varepsilon_{i,}$

Where the key variables of interest are *UKfirms*PostBrexit*GRIscore* and *UKfirms*PostBrexit* in Eq.2 and represent UK firms' compliant to GRI and sustainability performance reaction to the Brexit. Again, X is a set of firm controls on characteristics correlated to ESG score, and v_t, δ_i, α_t, $\varepsilon_{i,}$ represent, respectively, industry, time, country fixed effects and the error term.

4. Empirical Analysis

4.1 Sample description analysis

Table 1 describes our sample composition.

[insert Table 1 about here]

Looking at our target variables, we observe values consistent with the previous literature (Liang and Renneboog 2017). Specifically, the average value of ESG, ENV and SOC score, is 0.59, 0.63 and 0.62, respectively. This intuitively means that there is room to further exploit ESG scores for European and United Kingdom firms. This is valid also for other variables included in our analysis such as the CO2 emission, ESG controversies (*ESG contr*), Board gender diversity and inclusion, and gender pay gap. Similarly, firms' policy of environmental climate change (Policy env change), the policy of diversity and inclusion (Policy diversity and inclusion) and GRI score take respectively 0.11, 0.27 and 0.26 values, being therefore below to the average value of their rank (from 0 to 1). Similarly, figure 1 describes the ESG score trend among UK firms from 2011 to 2018, showing the

increase of ESG performance after the announcement of the EU NFRD in 2014-2015 years and a decreasing trend during the post-brexit period (2016-2018). Moreover, figure 1 contributes to initially stress our hypothesis, confirming the implicit CSR "deregulation" caused by the UK departures from the EU. To sum up, besides nothing should have changed until the end of the Brexit process, figure 1 seems to unveil the importance of the EU NFRD in enhancing CSR practices adoption among UK firms, which lost its "effectiveness" during the post-referendum years (2016-2018), thus supporting the reduced EU pressure on socially responsible practices adoption hypothesis.

[insert figure 1 about here]

Similarly, in Table 2 we run a t-test between UK and EU firms ESG, ENV and SOC engagement before the announcement of the NFRD directive (2011-2013), after the passage of the NFRD directive (2014-2015) and after the Brexit (2016-2018). Specifically, it shows that the change between treated (UK) and control (EU) firms during pre-Brexit and post-Brexit is statistically significant, confirming the results of figure 1: the political shock harmed UK ESG practices. More precisely, if we look at the difference between UK and EU firms, we observe no statistically significant differences of ESG, ENV and SOC scores before the Brexit referendum output (2013-2015). However, this difference becomes statistically significant after 2016: the size of divergence in ESG, ENV and SOC scores of UK firms, compared to EU ones, lies in the 3%-4% range. Most importantly, the divergence seems to be more on the EU side, which shows an increase in CSR performance during post Brexit years, thus corroborating the scope of the 2014 EU NFRD in enhancing CSR practices adoption. At the same time, UK firms show a flat ESG trend in the post-Brexit period, supporting the decreased demand for CSR engagement during the 2016-2018 years and thus an implicit "CSR deregulation" process.

[insert Table 2 about here]

4.2 Brexit and UK firms' ESG scores.

After an initial univariate analysis, we test whether the exit choice affected socially responsible practices for UK non-financial firms in a quasi-natural experiment framework. Using Equation 1, we perform a difference-in-difference (DID) regression of ESG, ENV, and SOC scores on the following dummies: *PostBrexit* (2016-2018) and its interaction with treated firms (*UKfirms*), controlling for firms' level financial data and industry, time, and country fixed effects. Our OLS regression follows a PSM procedure for each of the models tested.

Panel A of Table 3 shows the results of the PSM (Rosenbaum and Rubin, 1983). Its purpose is to reduce the potential bias arising from heterogeneity between treated (T) and control (C) groups, employing all non-binary firm-level controls. Panel B of Table 3 provides the univariate statistics on the effectiveness of the PSM procedure. Finally, panel C of Table 3 shows our baseline analysis.

[Insert table 3 about here]

Therefore, if UK firms reacted to the Brexit reducing their socially responsible practices, we should obtain a negative and significant coefficient for the interaction terms.

Table 3 shows that both the coefficient of the interaction *UKfirms*PostBrexit and PostBrexit* are statistically significant and correlated with the level of the ESG, the ENV, and the SOC scores. The coefficients of interest empirically confirm the negative effect of the Brexit for UK firms, stressing its negative impact on sustainability. At the same time, EU firms increased their ESG scores, supporting the argument of an increasing stakeholder demand of socially responsible investments (Ioannides, 2017). Looking at the *UKfirms*PostBrexit* coefficients, we account that the change is

significant with ESG score decreasing by 5,7%, ENV score by 5% and SOC score by 6,9 % during the post-Brexit referendum period.[28]

Finally, Figure 2 shows that before the 2016 shock, the direction for firms' ESG, ENV and SOC scores were similar for both the treatment (UK) and the control (EU) groups. Hence, it supports the parallel trends' assumption.

In Table 4 we furtherly broke down ENV and SOC scores in constituents, to measure which ones changed the most because of the Brexit. We find that these are the resource use score, the emission score, the workforce score and the community score. Taken together, the documented decline of the resource use score and the emission score are warning signal of an increasing exposition of UK firms to climate change risk as well as to future international environmental regulation. Similarly, the workforce score and community score reduction after the Brexit reflect a detachment to stakeholders' needs, rising the UK firms' price of future social unrest (Barrett et al 2021). While the former is well known to the academic literature, the latter has been investigating only recently. According to Barret et al. (2021), the price of social unrest can also reduce firms' abnormal return of 1.4%, especially for firms with poor corporate governance mechanisms.

[Insert table 4 about here]

The second step in this analysis comprises measuring how UK firms' diversity and inclusion policies changed after the Brexit announcement. We add the following variables to our Equation 1: the board gender diversity score, the gender pay gap score, and the policy diversity and opportunity score. Table 5 summarises the results of this analysis.

[28] 5,7% = 0.034/0.60; 0.034 is the β of ESG in Table 3 and 0.60 the mean value of ESG of treated sample after the Brexit (Table 2); 5 % = 0.034/0.65; 0.034 is the β of ENV in Table 3 and 0.65 the mean value of ENV of treated sample after the Brexit (Table 2); 6,9% = 0.043/0.62; 0.043 is the β of SOC in Table 3 and 0.62 the mean value of ENV of treated sample after the Brexit (Table 2)

[Insert table 5 about here]

We find that all these diversity and inclusion variables shows a reduction in UK firms. Again, this result confirms the risk of diversity and inclusion losses highlighted by Plomien (2018), finally reflecting the hidden CSR deregulation consequences of the Brexit.

All these results are in line with the demand-side arguments, as well as with previous finding on the effectiveness of EU requirements of CSR engagement (see e.g Jakson et al. 2020, Grewal 2021). Since firms are required to disclose responsible activities, it is reasonable that they compare their disclosed activities with peer firms, finally increasing the scope of CSR activities across more issues (Chen et al. 2018). At the same time, confirms what happens when firms "cease" from a coalition strongly oriented to CSR, such as the EU. In this framework, the operating mechanism works in the opposite way: e sudden reduction of CSR pressure lead to an implicit deregulation process which finally resulted in a lower engagement.

Lastly, we test if any difference exists between the ESG practices of UK firms adopting GRI initiative accounting framework and not adopting it in the aftermath of the Brexit shock (Table 6). Therefore, we test the Eq.2, proceeding as follows. After running a PSM, we interacted the *UKfirms*PostBrexit* dummy whit the GRI score, creating the *UKfirms*PostBrexit*GRIscore*. Then we test if any difference exists in ESG, ENV, and SOC score after the Brexit shock. Looking at table 6, the coefficient for *UKfirms*PostBrexit*GRIscore* is statistically and positively correlated with the UK socially responsible activity, stressing the moderating effect of GRI standard adoption on the negative impact of Brexit. Therefore, UK firms adopting GRI standards were lower affected by the negative impact of Brexit shock, showing the importance of GRI standards in strengthening socially responsible practices engagement.

[Insert table 6 about here]

This result confirms the scope of the GRI framework, that is of aligning environmental and social disclosure to the stakeholder expectations and needs (Calabrese et al. 2015). At the same time, it supports the EU NFRD efforts to require the GRI standard adoption in annual CSR reports. Therefore, although the political shock, UK firms' voluntary adopting the GRI framework were more prone to be CSR engaged and thus stakeholder oriented.

5. Robustness checks

To strength the validity of our findings we run once more our baseline model under alternative settings.

Firstly, we use an alternative source for ESG scores. Bloomberg ESG variables (BESG, BENV and BSOC) are not only produced by a different provider but are also aggregated through a different methodology: the focus is on the level of disclosure of sustainability practices in non-financial reporting of firms. Consistently, the use of Bloomberg database allows us to reduce two possible gaps: i) the sample selection bias; ii) testing the impact of the Brexit on UK firms' ENV and SOC disclosure, and not only their material engagement. As shown in Table 7, the negative impact of the Brexit on UK firms' sustainability is confirmed, stressing consistency between ESG engagement and ESG disclosure reduction.

[Insert table 7 about here]

In order to test the consistency of our findings on UK firms' environmental and social policies, we exploit the depth of Thomson Reuters' Refinitiv database by running our baseline model on the following additional measure of socially responsible practices: the CO2 emission (scaled by total

sales), the policy on environmental climate change score, the policy business ethics score and the ESG controversies score. Results are provided in Table 8.

[Insert table 8 about here]

We observe a statistically significant increase in UK firms' CO2 emissions and controversies directly or indirectly related to ESG scores. Again, UK firms decreased their engagement in business ethics and on climate change, confirming our baseline findings. Interesting, the negative change of UK firms' CSR engagement, is captured also by the increase of ESG controversies score (Table 8), again confirming the detrimental effect of a sudden shock to socially responsible engagement such as that caused by the Brexit.

As a final check, we perform two placebo tests. In the first placebo test we run our baseline DID for non-UK non-financial firms, therefore those not affected by the Brexit. More precisely, we select US non-financial firms and match them with the EU sample, to strengthen the validity of the causality link between the Brexit and the reduction of UK firms' ESG practices. The rationale behind the selection of the US placebo sample is simply to check if the differences of ESG scores after the Brexit can be attributed by the EU demand-side shock or not. At the same time, the placebo test allows us to properly infer the causality link between the Brexit and the engagement in environmental and social policies by UK firms, stressing if results are limited to the UK-EU relationship or not. Therefore, we let the PSM (Caliper 2% without replacement) match US firms based on their control variables to obtain control (EU firms) and treatment (US firms) firms that are qualitatively comparable. Results are disclosed in Table 9.

[Insert table 9 about here]

If the change in firms' ESG scores is not statistically significant after the Brexit shock (*USfirms*PostBrexit*) for the placebo sample, we can conclude that the Brexit referendum, by leading to an implicit "CSR deregulation", affected UK non-financial firms' socially responsible practices.

In the second placebo test, we run once more our baseline model by changing the timing of the Brexit shock from 2016 to 2015. Specifically, we create a dummy variable *Post2014* equal to 1 for the period 2015-2017 and 0 otherwise. Then we interact this variable with the UK firms' group (*UKfirms*), testing its statistical significance. Again, the rationale of this additional placebo is simply to check if rumours about future Brexit referendum or political uncertainty before 2016 affected firms' ESG practices before the referendum took place, and therefore bias our inference. Moreover, by considering as placebo years 2015-2017 period, we account also for the 2014 EU NFRD announcement, reducing possible bias coming from a different adoption of the 2014 directive between UK and EU firms. Results are presented in Table 10.

[Insert table 10 about here]

Looking at Tables 9 and 10, we observe that the coefficients of interest (*USfirms*PostBrexit* and *UKfirms*Post2014*) are not statistically significant. This confirms that the divergence between UK and EU sustainability practices occurred due to the EU demand shock caused by the Brexit.

Finally, we run the following set of additional tests which strengthen the validity of our baseline results: i) we redo our model including firms' country legal origins and institutional factors to assure that results were not lead by additional confounding factors (Liang and Renneboog 2017); ii) we rerun our model by applying alternative PSM methodology, as well as without PSM[29] (Buchanan et al.

[29] All these results are available in the appendix.

2018); iii) we matched treated and controls firms on their SIZE and industry[30] (Buchanan et al. 2018). Again, all these tests confirm our baseline results. In summary, after controlling for alternative measures and rigorous robustness tests, our findings support the demand-side prediction that the Brexit political shock, by decreasing the EU institutional stakeholders' pressure, finally turned in a reduction of UK firms' ESG investments.

6. Conclusions

In this paper, we show that after the positive effect of the 2014 EU NFRD on sustainability, the Brexit choice led to an implicit CSR "deregulation" process, finally turning on a reduction in the socially responsible activities of UK firms. These decreases also involved board diversity and inclusion policies, gender pay gap, and firms' business ethics engagement. Moreover, by disentangling the environmental and social pillars, we illustrate which components were mostly affected by the Brexit deregulation process. By running several econometric tests, we measure the magnitude of this negative impact on UK firms' ESG scores between 5% and 6,9%, compared to EU firms.

Therefore, our study contributes to the ongoing attention on the economic and social consequences of CSR regulation, confirming the importance of the demand-side as a channel through which non-financial firms develop ESG practices. We also shed light on the way firms' socially responsible engagement reacts to a political shock that radically changed the institutional pressure for ESG investments. At the same time, the comparison with EU firms, allows us to confirm the effect of EU institutional pressure on firms' responsibility remained in the "coalition". Finally, we rely on the

[30] Results are available upon request.

importance of an international taxonomy and sustainable reporting guidelines such as the GRI standards, in enhancing firms' ESG engagement also after exogenous economic and political shock. This evidence is of pivotal importance to shape CSR adoption worldwide, considering the growing challenges the business industry will face in the next post-COVID-19 era.

Our contribution is threefold. After empirically showing the importance of the EU NFRD in enhancing firms' CSR, we investigate the hidden sustainability costs of the unintended CSR "deregulation" process caused by Brexit. Secondly, we prove how a reduction of the EU demand for firms' ethical engagement and UK political stability can influence firms' board diversity and inclusion, raising concerns on how these unintended consequences may impact the future performance of non-financial firms. More precisely, ceasing from a coalition strongly oriented to CSR, such as the EU, UK firms experienced a reduction of CSR pressure, finally resulting in a lower engagement.

Thirdly, we prove how adopting the GRI framework act as a shield against political shock on firms' socially responsible engagement, corroborating the EU NFRD suggestion about its adoption.

Our paper provides also relevant policy implications both for UK public institutions and investors. From a regulatory perspective, our results warn about the detrimental consequences of business sustainability in UK non-financial firms. This also suggests the need for UK institutions to take stronger actions to fill the gap emerging after Brexit. At the same time, it warns about the need to strengthen the adoption of a global reporting framework, such as the GRI, to successful social development goal achievement. From a financial market perspective, this gap may suggest to institutional investors that a potential future financial weakness due to exposure to climate change and social issues emerged after Brexit for UK firms. Finally, we support the role played by EU institutions in shaping firms' socially responsible behavior through active policies and political pressure.

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Figure 1. UK firms ESG trend

These figures show the trend of the evolution of ESG scores for UK firms since 2011 to 2018.

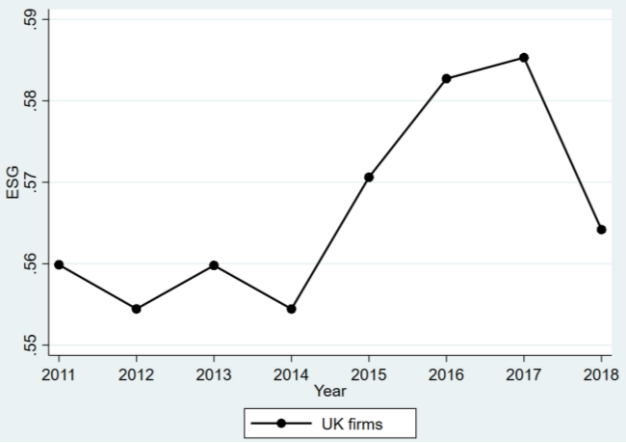
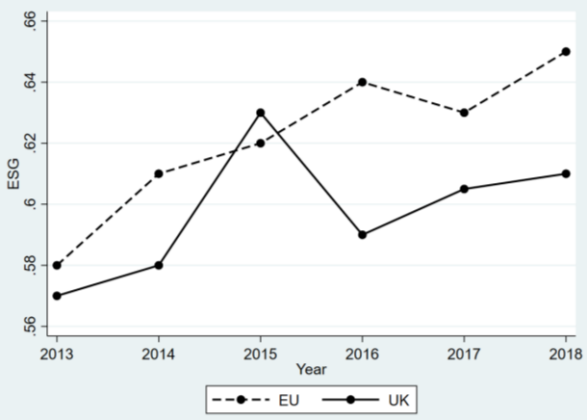


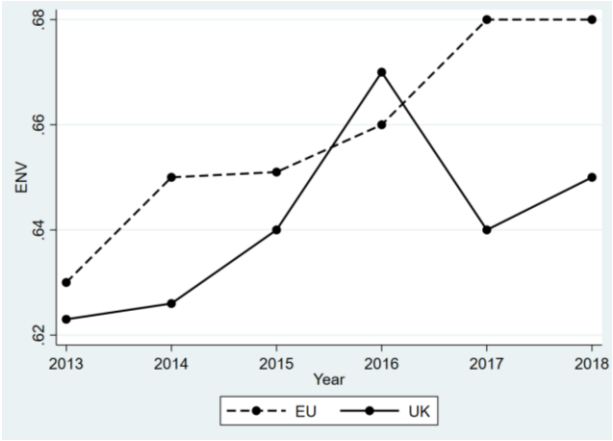
Figure 2. Parallel trends

These figures show parallel trends after the PSM procedure of the evolution of ESG (Panel A), ENV (Panel B) and SOC (Panel C) scores for UK firms (treated) and EU firms (control).

Panel A: ESG trend



Panel B: ENV trend



Panel C: SOC trend

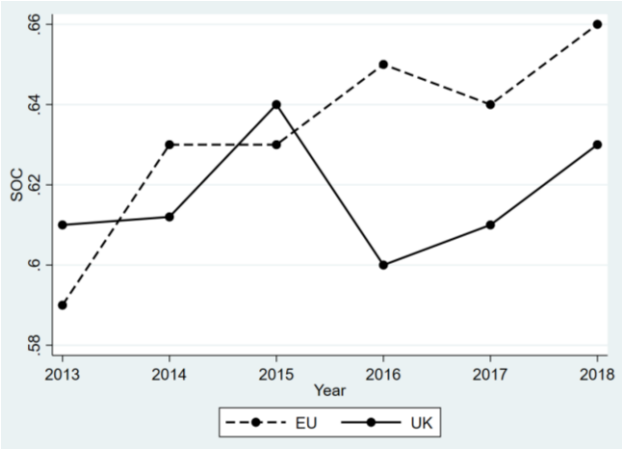


Table 1. Summary statistics

This table summarizes the main statistics for all our variables and for the period 2013-2018.

Variable	Mean	Std. Dev.	Min	Max
ESG	.5956	.1634	.0998	.9595
ENV	.6392	.1975	.0493	.9950
SOC	.6263	.1926	.0319	.9905
Resource Use	.6741	.2362	.0019	.9985
Emissions score	.6512	.2503	.0013	.9986
Environmental Innovation	.5913	.2592	.0018	.9973
Workforce	.6743	.2297	.0013	.9985
Human Rights	.7116	.2407	.0531	.9978
Community score	.5075	.3120	.0018	.9986
Product responsibility	.5970	.2891	.0014	.9982
CO2emission	.2980	.0530	.0335	.5523
ESG contr	.4830	.2052	.0163	.7436
Board gender diversity and inclusion	.6277	.2185	.0947	.9662
Gender pay gap	.5625	.1345	.0454	.7441
Policy diversity and opportunity	.2736	.1325	.0000	.7143
Policy env change	.1170	.0295	.0000	.1167
Policy business ethics	.5893	.0426	.0500	.7628
GRI	.2631	.0248	.0000	.8314
QTOB	.6554	1.0660	-.9948	5.4321
SIZE (log. of millions)	147706	1.9148	1.9451	223225
ROA	.0369	.1293	-.7668	.3383
LEV	.2522	.1791	.0010	.8142
ATO	.8763	.6212	.0041	3.3131
CASH	.0556	.1240	.0010	.4918
R&D	.0594	.1561	.0010	.6131
CG	.5096	.0228	.0556	.9814

Table 2. Univariate analysis of target variables: UK versus EU, pre- and post-Brexit

This table report the univariate analysis of target variables from pre- directive (2011-2013), Post-directive (2014-2015) to post-Brexit (2016-2018) period for EU (control) and UK (treated) firms of the following dependent variables: ESG, ENV, SOC score. *,**, and *** indicate significance at 10, 5, and 1% levels, respectively.

	Pre directive (2011-2013)		Differences	Post directive period (2014-2015)		Differences	Post Brexit (2016-2018)		Differences
Variables	EU (1)	UK (2)	(2-1)	EU (1)	UK (2)	(2-1)	EU (1)	UK (2)	(2-1)
ESG	0.58	0.58	0	0.60	0.60	0.00	0.64	0.60	-0.04***
ENV	0.63	0.61	-0.02	0.64	0.64	0.00	0.68	0.65	-0.03**
SOC	0.58	0.60	0.02	0.61	0.62	0.01	0.66	0.62	-0.04***

Table 3. Changes in ESG, ENV and SOC scores

This table reports results from the difference-in-difference regression of ESG, ENV and SOC scores after the Brexit referendum. Firstly (Panel A) we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983) to reduce the potential bias arising from heterogeneity of treated (T) and control (C) groups, employing all non-binary firm-level controls. Panel B provides the univariate statistics on the effectiveness of the PSM procedure. Finally, Panel C shows the results of the DID estimation. The dependent variables are: ESG score, ENV score and SOC score. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Panel A – Logit Model: identifying propensity score

Variables	UKFirms (I)
SIZE	-0.794***
	(0.0367)

ROA	-0.486
	(0.334)
QTOB	0.0372
	(0.0478)
LEV	0.0310
	(0.256)
ATO	-0.168**
	(0.0720)
CASH	-0.355
	(0.394)
CG	0.0296***
	(0.00208)
R&D	-0.653**
	(0.289)
Observations	3618
Pseudo r-squared	0.188

Panel B – Univariate Statistics: effectiveness of matching

	Matched Sample			
	Treated	Controls	Difference in means	p-Value
Variables	(I)	(II)	(I)-(II)	
SIZE	14890	14892	-2	0.975
ROA	0.0399	0.0413	-0.0014	0.796
QTOB	0.6461	0.6496	-0.0034	0.475
LEV	0.2429	0.2447	-0.0018	0.781
ATO	0.8259	0.8175	0.0083	0.825
CASH	0.0465	0.0468	-0.0003	0.923
R&D	0.0521	0.0558	-0.0037	0.323
CG	0.5216	0.5318	-0.0102	0.717

Panel C – Difference in Difference (DID) estimation

Variables	ESG (I)	ENV (II)	SOC (III)
UKFirms*PostBrexit	-0.0340***	-0.0341**	-0.0439***
	(0.0110)	(0.0157)	(0.0168)
PostBrexit	0.0622***	0.0621***	0.0596***
	(0.0102)	(0.0146)	(0.0157)
UKFirms	0.00238	-0.00268	0.0367
	(0.0214)	(0.0354)	(0.0344)
SIZE (-1)	0.0498***	0.0680***	0.0646***
	(0.00425)	(0.00633)	(0.00585)
ROA (-1)	0.0314	0.0676	0.0349
	(0.0328)	(0.0481)	(0.0499)
QTOB (-1)	-0.00198	-0.00843	-0.000760
	(0.00718)	(0.0103)	(0.00977)
LEV (-1)	-0.104***	-0.135***	-0.117**
	(0.0318)	(0.0479)	(0.0469)
ATO (-1)	-0.00487	0.0176	-0.0114
	(0.00936)	(0.0139)	(0.0132)
CASH (-1)	0.0437	0.0316	0.0674
	(0.0455)	(0.0702)	(0.0631)
R&D (-1)	-0.0473	-0.0545	-0.0683
	(0.0292)	(0.0426)	(0.0464)
CG (-1)	0.00285***	0.000799**	0.00123***
	(0.000219)	(0.000341)	(0.000333)
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,370	1,370	1,370
R-squared	0.564	0.388	0.373

Table 4. Change in ENV and SOC constituents

This table reports results from the difference-in-difference regression of ENV and SOC scores on the Brexit referendum from 2013 to 2018, after applying a PSM. The dependent variables are: the Resource Use score, the Emission score, the Environmental Innovation score the Workforce score, the Human Rights score the Community score and the Product responsibility score, representing firm's engagement in single ENV and SOC components. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	Resource Use (I)	Emissions score (II)	Environmental Innovation (III)	Workforce (IV)	Human Rights (V)	Community score (VI)	Product responsibility (VII)
UKFirms*PostBrexit	-0.0466**	-0.0355*	-0.0202	-0.0499**	-0.0113	-0.0532*	-0.0404
	(0.0206)	(0.0214)	(0.0244)	(0.0230)	(0.0255)	(0.0275)	(0.0266)
PostBrexit	0.0731***	0.0517**	0.0624***	0.0482**	0.132***	0.0581**	0.0407
	(0.0190)	(0.0212)	(0.0228)	(0.0223)	(0.0234)	(0.0256)	(0.0248)
UKFirms	0.105*	0.0802	-0.201***	-0.00593	0.140***	0.0457	0.0573
	(0.011)	(0.0107)	(0.0112)	(0.012)	(0.011)	(0.0117)	(0.0111)
Controls (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,370	1,370	1,370	1,370	1,370	1,370	1,370
R-squared	0.323	0.301	0.225	0.228	0.298	0.297	0.246

Table 5. Change in board diversity and inclusion policies

This table reports results from three difference-in-difference regressions of alternative measures directly or indirectly linked with ESG scores around the Brexit referendum (2013-2018), after a PSM. The dependent variables are: the Board gender diversity and inclusion score, the Gender pay gap score, and the Policy diversity and opportunity score. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	Board gender diversity and inclusion (I)	Gender pay gap (II)	Policy diversity and opportunity (III)
UkFirms*PostBrexit	-0.0222**	0.317***	-0.0555**
	(0.0107)	(0.0227)	(0.0230)
PostBrexit	0.117***	0.185***	0.0695***
	(0.0101)	(0.0208)	(0.0254)
UkFirms	0.000207	0.0359*	-0.0139
	(0.0248)	(0.0204)	(0.0251)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,370	1,370	1,370
R-squared	0.403	0.435	0.155

Table 6. Change in firm ESG, ENV and SOC score, and the mediating role of GRI standard.

This table reports results from the triple difference-in-difference regression of ESG, ENV and SOC score after PSM methodology in the aftermath of Brexit referendum. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. GRI is a score ranking from 0 to 1, indicating the strength of firms' adherence to GRI reporting guidelines. The detailed variable definitions are provided in Appendix A.1. The model includes industry, time and country fixed effects. All continuous variables are winsorized at the 0.1% level. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

	ESG	ENV	SOC
Variables	(I)	(II)	(III)
UKFirms*PostBrexit*GRI	0.0009*	0.0016**	0.0017**
	(0.0005)	(0.0007)	(0.0007)
UKFirms*PostBrexit	-0.0466***	-0.0675***	-0.0665**
	(0.0179)	(0.0252)	(0.0269)
PostBrexit*GRI	0.0003	-0.0009	-0.0006
	(0.0004)	(0.0005)	(0.0006)
PostBrexit	0.0610***	0.0838***	0.0681***
	(0.0155)	(0.0225)	(0.0230)
UKFirms*GRI	-0.0007	-0.0018***	-0.0015**
	(0.0004)	(0.0007)	(0.0007)
UKFirms	0.0722***	0.1380***	0.1370***
	(0.0246)	(0.0432)	(0.0398)
GRI	0.0015***	0.0029***	0.0025***
	(0.0003)	(0.0005)	(0.0005)
F-Test for differences	0.000***	0.000***	0.000***
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,370	1,370	1,370
R-squared	0.403	0.435	0.155

Table 7. Alternative ESG measure: Bloomberg

This table reports results from the difference-in-difference regression of ESG, ENV and SOC scores in the aftermath of the Brexit, after a PSM employing an alternative measure of ESG scores provided by Bloomberg (BESG, BENV and BSOC). UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

	BESG	BENV	BSOC
Variables	(I)	(II)	(III)
UKFirms*PostBrexit	-0.0264***	-0.0235*	-0.0316**
	(0.0094)	(0.0128)	(0.0126)
PostBrexit	0.0412***	0.0372***	0.0534***
	(0.0102)	(0.0132)	(0.0131)
UKFirms	0.0408	0.0132	0.0109
	(0.0286)	(0.0340)	(0.0209)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,370	1,370	1,370
R-squared	0.537	0.482	0.410

Table 8. Alternative measure of firm's socially responsible engagement.

This table reports results from the difference-in-difference regression of CO2 emissions, Policy business ethics, Policy environmental management (Policy env change) and ESG controversies (ESG contr) scores, after a PSM in the aftermath of the Brexit. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	CO2 emission (I)	Policy business ethics (II)	Policy env change (III)	ESG contr (IV)
UKFirms*PostBrexit	0.0130*	-0.0370*	-0.0597**	0.0354*
	(0.0068)	(0.0195)	(0.0242)	(0.0202)
PostBrexit	-0.0062	0.0305	0.0376*	-0.0553***
	(0.0049)	(0.0192)	(0.0228)	(0.0213)
UKFirms	-0.0118	0.0349	0.0812	-0.0743*
	(0.0099)	(0.0572)	(0.0730)	(0.0423)
Controls (-1)	Yes	Yes	Yes	Yes
Year fe	Yes	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes	Yes
Country fe	Yes	Yes	Yes	Yes
Observations	1,350	1,370	1,370	1,370
R-squared	0.226	0.255	0.206	0.227

Table 9. Placebo test: EU vs US after the Brexit.

This table reports results from the placebo test for the difference-in-difference regression of ESG, ENV and SOC score in the aftermath of Brexit referendum. Firstly (Panel A) we employ a propensity score matching (PSM) procedure (Rosenbaum and Rubin, 1983) to reduce the potential bias arising from heterogeneity of treated (T) and control (C) groups, employing all non-binary firm-level controls. Panel B provides the univariate statistics on the effectiveness of the PSM procedure. Finally, Panel C shows the results of the DID estimation. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. USFirms is equal to 1 for firms headquartered in US and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	USFirms (I)
SIZE	-0.2051***
	(0.0391)
ROA	-0.7320**
	(0.2930)
QTOB	0.0117
	(0.0504)
LEV	2.8180***
	(0.2760)
ATO	0.3500***
	(0.0877)
CASH	-0.7170
	(0.4940)
CG	0.3130
	(0.3110)
R&D	-0.0009
	(0.0021)
Year fe	Yes
Industry fe	Yes
Country fe	Yes
Observations	10,162
R-squared	0.486

Panel B – Univariate Statistics: effectiveness of matching

	Matched Sample			
	Treated	Controls	Difference in means	p-Value
Variables	(I)	(II)	(I)-(II)	
SIZE	15357	15312	45	0.310
ROA	0.0380	0.0360	.0020	0.548
QTOB	0.5884	0.6093	-.0208	0.398
LEV	0.2536	0.2556	-.0020	0.643
ATO	0.8416	0.8321	.0095	0.573
CASH	0.0411	0.0401	.0010	0.682
R&D	0.0611	0.0588	.0023	0.562
CG	0.5139	0.5079	.0060	0.323

Panel C – Difference in Difference (DID) estimation

Variables	ESG (I)	ENV (II)	SOC (III)
USFirms*PostBrexit	0.0003	-0.0029	-0.0063
	(0.0059)	(0.0091)	(0.0086)
PostBrexit	0.0355***	0.0354***	0.0324***
	(0.0053)	(0.0080)	(0.0078)
USFirms	-0.0182	-0.0746*	-0.0046
	(0.0191)	(0.0384)	(0.0382)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	5,012	5,012	5,012
R-squared	0.549	0.325	0.315

Table 10. Placebo test: EU vs UK, ENV and SOC scores one year before the Brexit

This table reports results from the placebo test for the difference-in-difference regression of ESG, ENV and SOC score on year before the Brexit. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; Post2014 is equal to 1 for 2015-2017 years and 0 otherwise. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	ESG (I)	ENV (II)	SOC (III)
UKFirms*Post2014	-0.018	-0.025	-0.032
	(0.013)	(0.020)	(0.020)
Post2014	0.039***	0.057***	0.043**
	(0.0108)	(0.017)	(0.017)
UKFirms	0.012	0.032	0.064
	(0.024)	(0.044)	(0.047)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,053	1,053	1,053
R-squared	0.56	0.37	0.39

Appendix

A.1 Variable description and data source.

Variable	Definition	Source
ESG	Environmental Social Governance (ESG) score is an overall company score based on the self-reported information in the Environmental (ENV), Social (SOC), and corporate Governance (GOV) pillars	Thomson Reuters Refinitiv, Author's own calculation
ENV	Environmental performance score.	
SOC	Social performance score.	
Resource use	Resource use score.	
Emissions	Emission score.	
Environmental Innovation	Environmental innovation score.	
Workforce	Workforce score.	
Human rights	Human rights score.	
Product responsibility	Product responsibility score.	
ESG contr	It measures firm's controversies linked to ESG activities	
Policy diversity opportunity	Does the company have a policy of diversity and opportunity? 0 No; 1 Yes.	Thomson Reuters database
Policy business ethics	Does the company have a policy of business ethics? 0 No; 1 Yes	
Policy env change	Does the company have a policy to fight climate change? 0 No; 1 Yes	
Board gender diversity	Board gender diversity score.	
Gender pay gap	Gender pay gap percentage score.	
CO2 emission	It measures firm's Co2 emission (in tonnes) scaled by total sales.	
GRI	It measures the degree of firms' GRI reporting adoption to disclose CSR practices	
ROA	Net income available to common shareholder deflated by total asset.	
QTOB	Log of market value scaled by total assets.	
SIZE	Natural logarithm of total assets.	
LEV	Total long-term debt to total assets.	Thomson Reuters Refinitiv, Author's own calculation
ATO	total revenues to total assets.	
CASH	total cash to total assets.	
R&D	research and development expenses divided by total revenues.	
CG	Corporate governance quality score.	

A.2 Correlation Matrix

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	ESG	1												
2	ENV	0.7951	1											
3	SOC	0.8343	0.6160	1										
4	Resource Use	0.6987	0.8022	0.6083	1									
5	Emissions score	0.6471	0.7968	0.5217	0.5883	1								
6	Environmental Innovation	0.5165	0.7275	0.3272	0.3420	0.2826	1							
7	Workforce	0.6304	0.4741	0.7994	0.4802	0.4577	0.1900	1						
8	Human Rights	0.5674	0.4751	0.6262	0.4937	0.3946	0.2395	0.3665	1					
9	Community score	0.6026	0.4036	0.6901	0.3975	0.2850	0.2679	0.2624	0.4121	1				
10	Product responsibility	0.5702	0.4246	0.6747	0.3862	0.3327	0.2772	0.3237	0.3492	0.3599	1			
11	GRI	0.4249	0.3876	0.4153	0.3472	0.3120	0.2496	0.2463	0.3672	0.3650	0.2786	1		
12	CO2emission	0.0489	0.0806	0.0238	0.1055	0.0273	0.0598	0.0366	0.0469	-0.0232	0.0148	-0.0572	1	
13	ESG contr	0.3809	0.2316	0.4322	0.2481	0.1471	0.1528	0.1367	0.2974	0.6321	0.2454	0.2946	-0.0247	1
14	Board gender diversity and inclusion	0.4933	0.5407	0.4321	0.6522	0.3974	0.2474	0.3080	0.4000	0.3170	0.2641	0.2307	0.0632	0.2161
15	Gender pay gap	0.3063	0.2570	0.3848	0.2642	0.2098	0.1354	0.3939	0.2673	0.1959	0.1766	0.1010	0.0368	0.1465
16	Policy diversity and opportunity	0.2727	0.2352	0.1842	0.2023	0.2019	0.1467	0.1065	0.2168	0.1433	0.1210	0.1392	0.0559	0.1368
17	Policy env change	-0.0196	-0.0509	-0.0286	-0.0212	-0.0436	-0.0500	0.0014	0.0158	-0.0666	-0.0245	-0.1604	0.0370	-0.0831
18	Policy business ethics	0.0617	0.0658	0.0824	0.1042	0.0484	0.0093	0.0616	0.0683	0.1090	-0.0081	0.0973	0.0441	0.7332
19	QTOB	0.4919	0.4591	0.4710	0.4043	0.3570	0.3129	0.2656	0.3968	0.4474	0.3107	0.4790	-0.1315	0.3199
20	SIZE	-0.0222	-0.0415	-0.0203	-0.0344	-0.0273	-0.0346	0.0074	-0.0434	0.0030	-0.0588	-0.0068	-0.0117	-0.0333
21	ROA	-0.2523	-0.2392	-0.2413	-0.1803	-0.1671	-0.2052	-0.1306	-0.1736	-0.2409	-0.1711	-0.2529	0.0636	-0.1879
22	LEV	0.0309	0.0226	0.0456	0.0170	-0.0020	0.0359	-0.0165	-0.0188	0.0905	0.0793	0.0777	-0.0561	0.0796
23	ATO	-0.0697	-0.0571	-0.0900	-0.0416	-0.0612	-0.0303	-0.0816	-0.0053	-0.0822	-0.0476	-0.1014	0.1612	-0.0444
24	CASH	-0.1337	-0.1338	-0.1228	-0.1194	-0.1108	-0.0837	-0.0554	-0.1204	-0.1273	-0.0833	-0.1666	0.0628	-0.0919
25	R&D	0.0411	0.0040	0.0287	0.0072	-0.0050	0.0073	-0.0084	0.0086	0.0574	0.0347	-0.0099	0.0549	-0.0013
26	CG	0.4336	0.2400	0.3154	0.2118	0.2041	0.1470	0.1879	0.2087	0.3076	0.2122	0.2444	-0.0236	0.2144

		14	15	16	17	18	19	20	21	22	23	24	25	26
15	Gender pay gap	0.2153	1											
16	Policy diversity and opportunity	0.1672	0.0802	1										
17	Policy env change	-0.0295	0.0060	0.0784	1									
18	Policy business ethics	0.0431	0.1803	-0.0685	-0.1179	1								
19	QTOB	0.2795	0.1191	0.1729	-0.1343	0.0955	1							
20	SIZE	-0.0253	-0.0218	0.0002	0.0170	0.0248	-0.0550	1						
21	ROA	-0.1395	-0.0790	-0.0657	0.0873	-0.0510	-0.4668	0.0403	1					
22	LEV	0.0254	0.0521	0.0014	-0.0066	0.0749	0.1648	-0.0312	-0.0553	1				
23	ATO	-0.0016	-0.0172	0.0278	0.0438	0.0520	-0.2120	0.0542	0.1390	-0.3680	1			
24	CASH	-0.0816	-0.1018	-0.0536	0.0460	0.0310	-0.3004	0.0198	0.2513	-0.0337	0.0259	1		
25	R&D	0.0355	-0.0292	-0.0066	-0.0091	-0.0776	0.0256	0.0437	-0.0874	-0.0448	-0.0032	0.0650	1	
26	CG	0.1585	0.0565	0.1625	0.0356	-0.0132	0.2999	0.0079	-0.1388	0.0152	0.0452	-0.0817	0.0746	1

A.4 Country and Industry classification

This table shows the Country and industry classification of our total sample before the PSM procedure. Specifically, Panel A report the country of headquarter of non-financial firms included in our sample. Panel B reports the industry classification according to the Global Industry Classification Standards (GICS).

Panel A

Country	N. of Obs.	Freq.
Austria	53	1,77%
Belgium	99	3,31%
Cyprus	6	0,20%
Czech Republic	12	0,40%
Denmark	103	3,44%
Finland	94	3,14%
France	393	13,13%
Germany	356	11,89%
Hungary	17	0,57%
Italy	110	3,67%
Luxembourg	32	1,07%
Netherlands	115	3,84%
Poland	77	2,57%
Portugal	41	1,37%
Slovenia	73	2,44%
Spain	140	4,68%
Sweden	222	7,41%
United Kingdom	1051	35,10%
Total	2994	100,00%

Panel B

Global Industry Classification Standard (GICS)	N. of Obs.	Freq.
Communication Services	297	9,92%
Consumer Discretionary	485	16,20%
Consumer Staples	210	7,01%
Energy	131	4,38%
Health Care	212	7,08%
Industrials	761	25,42%
Information Technology	176	5,88%
Materials	357	11,92%
Real Estate	199	6,65%
Utilities	166	5,54%
Total	2994	100,00%

A.5. Alternative PSM matching strategy.

This table reports results from the difference-in-difference regression of ESG, ENV and SOC score in the aftermath of Brexit referendum, by applying an alternative matching estimator (PSM): the nearest neighbour methodology. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The detailed variable definitions are provided in Appendix A.1. The model includes industry, time and country fixed effects. All continuous variables are winsorized at the 0.1% level. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

	ESG	ENV	SOC
Variables	(I)	(II)	(III)
UKFirms*PostBrexit	-0.0330***	-0.0302**	-0.0330**
	(0.0088)	(0.0128)	(0.0129)
PostBrexit	0.0640***	0.0437***	0.0546***
	(0.0087)	(0.0130)	(0.0129)
UKFirms	0.0271	0.0196	0.0706**
	(0.0202)	(0.0393)	(0.0318)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	2,209	2,209	2,209
R-squared	0.539	0.386	0.362

A.6. Baseline results without PSM.

This table reports results from the difference-in-difference regression of ESG, ENV and SOC score in the aftermath of Brexit referendum, without PSM matching. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The detailed variable definitions are provided in Appendix A.1. The model includes industry, time and country fixed effects. All continuous variables are winsorized at the 0.1% level. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

	ESG	ENV	SOC
Variables	(I)	(II)	(III)
UKFirms*PostBrexit	-0.0262***	-0.0170*	-0.0211**
	(0.0073)	(0.0101)	(0.0105)
PostBrexit	0.0563***	0.0294***	0.0435***
	(0.0060)	(0.0086)	(0.0088)
UKFirms	0.0096	0.0047	0.0230
	(0.0176)	(0.0312)	(0.0353)
Controls (-1)	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	2994	2994	2994
R-squared	0.553	0.398	0.384

A.7. Controlling for legal origins and institutional factors.

This table reports results from the difference-in-difference regression of ESG, ENV and SOC score in the aftermath of Brexit referendum, after PSM methodology controlling for additional legal and institutional factors. The dependent variables are: ESG score, ENV score and SOC score representing firm's engagement in CSR practices. UKFirms is equal to 1 for firms headquartered in UK and 0 otherwise; PostBrexit is equal to 1 for 2016-2018 years and 0 otherwise. The detailed variable definitions are provided in Appendix A.1. The model includes industry, time and country fixed effects. All continuous variables are winsorized at the 0.1% level. The t-values in parenthesis are computed using firm level clustered standard errors. *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

Variables	ESG (I)	ENV (II)	SOC (III)
UKFirms*PostBrexit	-0.0394**	-0.0546**	-0.0385*
	(0.0155)	(0.0236)	(0.0231)
PostBrexit	0.0473***	0.0481**	0.0377*
	(0.0140)	(0.0193)	(0.0203)
UKFirms	0.0573**	0.0305	0.1070**
	(0.0224)	(0.0441)	(0.0489)
German	0.1380***	0.2381***	0.1240*
	(0.0425)	(0.0671)	(0.0649)
French	0.1381***	0.2351***	0.1482**
	(0.0418)	(0.0566)	(0.0606)
EnglishCommon	0.0129	0.0446*	0.0059
	(0.0154)	(0.0257)	(0.0264)
Scandinavian	0.2381***	0.3430***	0.2960***
	(0.0564)	(0.0954)	(0.0814)
REG_QUALITY (-1)	0.1040*	0.1381*	0.1401*
	(0.0573)	(0.0838)	(0.0791)
GOV_EFF (-1)	-0.0749**	-0.0748	-0.148***
	(0.0359)	(0.0524)	(0.0536)
CONTROL_CORR (-1)	0.0525	0.123	0.0517
	(0.0470)	(0.0756)	(0.0733)
ECO_FREE (-1)	0.0149	0.0287	-0.0563
	(0.0566)	(0.0838)	(0.0883)
Controls (-1)	Yes	Yes	0Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
Country fe	Yes	Yes	Yes
Observations	1,370	1,370	1,370
R-squared	0.565	0.391	0.375