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Abstract

This study examines the impact of sustainability (ESG) on US listed firms' exit decision. Using a recent dataset of a large number of US firms over the period 2007- 2016, we perform a dynamic empirical analysis of the relation between ESG and firms' exiting mechanism by measuring environmental, social and governance issues. We provide evidence that corporate sustainability is a tool that can reduce risks and enable companies to boost surviving mechanisms and face less probability of failure. Finally, we perform several statistical tests for robustness purposes.

JEL classification: G1; G3; L2 ; M14 ; O1

Keywords: Sustainability; Longenvity, Corporate Sustainability Performance

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1. Introduction

In recent decades, the number of firms listed on US exchanges has been substantially decreased compared with the last 20 years. In 1996, there were 8.000 listed firms in the US markets while in 2016 only 3,627 firms. In addition, according to FRED[1], the number of listed firms per million for United States has been decreased from 27 to 13 during the period 1998 - 2016. These numbers highlight two things; first, the importance of this phenomenon and second, the growing need for studying the factors that may contribute to its reduction.

The extant empirical literature documents that there is a growing number of firms exiting US market either by failing or being acquired (Jenkinson and Ljungqvist, 2001; Ritter, 2003; Ciccotello, 2014; Grullon *et. al.,* 2015). This transition of companies from public to private ownership happens for many reasons such as higher investment in R&D, changes in ownership structure, new regulations and increased competition (Jain and Kini, 2000; Jain and Kini, 2008). Prior literature highlights the importance of firm level specific characteristics such as size, market share (Geroski, 1995) and drift in profitability and growth (Fama and French, 2013). However, little has been known about ESG determinants on firms' market longevity.

Firms delist due to their inability to follow the requirements set by the markets; by choice to go private, mainly in order to shield their strategies by public disclosing information or because they are acquired. Technological changes are an important factor that could lead to increase market concentration and firm size; reduce competition for big corporations enabling them to wield market power (Gao *et al*., 2013). However, because of the decreased number of listed firms, in order to mitigate the phenomenon, new laws are in force. Firms have to adapt more than ever and integrate new technologies and strategies that will help them to control risk factors and opportunity sets. This has attracted the attentions of many researchers (Ciccotello, 2014; Rosett and Smith, 2014a, b; Grullon *et al.,* 2015).

This paper provides several contributions to the literature. First of all, it contributes to the financial literature and shows that ESG has influence on corporate decisions and outcomes, hence

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plays an important role on firms' survival mechanism. The existing literature examines mainly the relation between ESG firms' financial performance (Margolis *et al*., 2009; Clark and Viehs, 2014) and firm value (Porter, 1991; Porter and van der Linde, 1995; Cho *et al*., 2010; Porter and Kramer, 2011; Malik, 2014; Fatemi *et al*., 2015). Those studies link ESG with better prospects in terms of value and performance. However, there are no empirical studies of the impact of ESG on firms' survivability. We find that firms' ESG issues can increase risks and this boosts companies exiting decisions. We provide evidence, that public trade firms with higher corporate sustainability (ESG) is more likely to stay listed and for longer periods of time. To the best of our knowledge, this is the first attempt in the literature that links direct firms' ESG issues with their survival mechanisms and characteristics.

The rest of this study proceeds as follows. Section 2 refers to the existing theory and presents a testable hypothesis for our empirical part. Section 3 discusses the sample selection and reports the descriptive statistics. Section 4 presents the analytical framework and discusses the main results. Section 5 presents the robustness analysis with several tests. Section 6 summarizes and provides conclusions remarks.

2. Theory and hypothesis Development

2.1 Literature Review

Some scholars examine the link between sustainability and corporate value (Heal, 2004, 2008; Landier and Nair, 2009; Carroll *et al*., 2012). The firms' portfolio with strong social (Edmans, 2011) and environmental responsibility (Derwall *et al*., 2005) generate risk-adjusted excess returns. According to Kempf and Osthoff (2007) and Statman and Glushkov (2009), portfolios that consist of firms with high sustainability policies perform better than those with low sustainability policies. Eccles *et al*. (2014) argue that there is a positive link between corporate sustainability and financial performance. Thus, firms with high sustainability are more long-term oriented and provide ESG reports as a transparency and accountability business strategy. Margolis and Walsh (2003) and Galbreath (2013) state that firms with ESG strategy are more likely to achieve capital at a lower cost as they build stronger reputation. Consumers, recognize the contribution to the society and support firms with strong environmental and social reputation (Godfrey, 2005).

However, there are some opposite research that evidence that portfolios that consist of SRI funds underperform (Renneboog *et al*., 2008; Hong and Kacperczyk, 2009), while Hamilton *et al*. (1993), Bauer *et al*. (2005) and Schroder (2007) conclude that there is no positive or negative impact.

Prior literature (Dowell *et al*., 2000; Derwall *et al*., 2005; Edmans, 2011; Servaes and Tamayo, 2013) documents that a firm can enhance shareholder wealth as it creates positive impact on the stakeholders. Firms that meet the needs of stakeholders create value for shareholders (Freeman 2010). Positive sustainability performance attract the attention of shareholders, as there is an impact on environmental issues (Konar and Cohen, 2001; Chava, 2011), social issues (Jarrell and Peltzman, 1985; Borenstein and Zimmerman 1988; Mitchell 1989; King and Soule 2007; Farber and Hallock 2009) and governance issues (Karpoff and Lott 1993; Chaney and Philipich 2002) on firms' market value, credit risk and cost of capital. Firms with ESG negative events experience a lower market value (Capelle-Blancard and Petit, 2017). Aouadi and Marsat (2016) believe that ESG controversies affect firms' market value, as they pose reputational risks. As a result, firms lose market share (Kang and Kim, 2013) and credibility (Yoon *et al.*, 2006; Godfrey *et al.,* 2009). Rennings *et al.* (2007) conclude that firms' reputational risks affect shareholder wealth. Thus, firms try to make amends with their stakeholders after negative external events. Controversary firms generate a more positive stock market reaction when they create positive events than those firms who have better sustainable performance (Kotchen and Moon, 2012). Therefore, ESG creates positive impact to stakeholders and add value to firms (Freeman 1984; Donaldson and Preston 1995; Godfrey *et al.,* 2009; Kacperczyk, 2009).

ESG reports present financial and non-financial information as a way to add value to firms and its shareholders and stakeholders (Eccles and Krzus, 2010). As a result, ESG reports that offer qualitative and quantitative information are firms' superior tool (Eccles and Serafeim, 2014; Higgins *et al*., 2014) to influence the stakeholders. Stakeholders (consumers, employees and investors) prefer transparent firms, as they disclose information. As a consequence, firms that integrate sustainability into their business strategies establish a strong brand name, reputation and credibility (Cornell and Shapiro 1987; Hammond and Slocum, 1996; Brown and Dacin 1997) that creates positive economic value (McWilliams and Siegel, 2001) and enhances the stakeholders' commitments (Godfrey 2005; Wang *et al*., 2008). Firms' sustainable performance can also enhance

its reputation as employer and attract the most qualified personnel (Turban and Greening, 1996; Greening and Turban, 2000) creating a positive outcome on corporate financial performance (Edmans, 2011). As a result, firms with positive employee relations have access on lower costs of debt financing and higher credit ratings (Bauer *et al.,* 2009).

Sustainability can be used as risk mitigation tool (Kim *et al*., 2014) as decreases systematic risk and increases firm value (Albuquerque *et al*., 2019). In particular, increases growth opportunities and minimize risk exposure. Thus, the higher the aggregated ESG performance is, the lower is the financial risk (Orlitzky and Benjamin, 2001). Sharpe (1964) state that firms' total risk reflects its stock volatility, as it is categorized into idiosyncratic risk and systematic risk (Luo and Bhattacharya, 2009; Jo and Na, 2012). McWilliams and Siegel (2001) and Oikonomou *et al.* (2012) state that sustainability enhances firm value on the basis of a risk-return balance (Derwall 2007) by lowering costs and idiosyncratic risks and that ESG concerns are affiliated with higher systematic risk. Also, higher ESG performance can reduce the negative outcomes of firms' scandals (Vanhamme and Grobben, 2009).

Furthermore, ESG is used as a deterrent tool for costly fines as high sustainability in business strategy entails lower possibilities of law suits and legal fines (McGuire *et al*.,1988). Bhat (1998) argue that fines can have a strong impact on firms' performance and profits. So, firms adopt sustainable business strategies to avoid fines and overcome regulations. In this way, firms create value to their stakeholders and create a sustainable society. Francis and Armstrong (2003) suggest that a good ethical image, through sustainable business strategies, can boost firms' reputation and help them to overcome regulations and reduce the possibility to be penalized. As a result, companies will have higher returns and access to capital and to other resources needed (Rindova and Fombrun, 1999; Cheng *et al.,* 2014), as the consumers preferred them instead of those who have not a responsible awareness. Firms that don't integrate ESG issues, experience bad performance as they don't have access to private equity and have a high cost of capital (Crifo and Forget, 2013).

Deng *et al.* (2013) conclude that corporate sustainable performance creates value for shareholders due acquisitions. Flammer (2015) reports that sustainability enhances shareholder value. Firms use sustainability to create strategies with superior characteristics that generate competitive advantage

and increase shareholders value (Dimson *et al*., 2015). Also, it improves financial returns to shareholders (Alexander and Buchholz, 1978; Porter and van der Linde, 1995; McWilliams *et al*., 2006; Porter and Kramer, 2006), resulting in higher market values. Investors react strongly to sustainability reports that contains economic and legal information, while react negatively to social and environmental information. Kruger (2015) believe that the stock prices decrease when an information is revealed and create negative impact to stakeholders as firms are not responsible. Capelle-Blancard and Petit (2017) state that ESG reports mitigate the risk of lower market value, when information is disclosed by the media and not by the firm. However, the loss is higher and have an impact on stock prices when they contain quantitative data from an economic or legal information.

Mervelskemper and Streit (2016) conclude that the stock market values a firm's ESG performance. Aouadi and Marsat (2016) believe that firms with ESG strategy will survive long term, as they perceived less risky. Waddock and Graves (1997) believe that the ESG strategy can be regarded as management quality, as it can face the long-term external factors, creating competitive advantage. So, firms' sustainability performance offers lower financial and stock market risks and consequently higher probability of longevity (Oikonomou *et al.,* 2012). Thus, firms integrate sustainability in their business strategies in order to gain competitive advantage, to claim more market share, to reduce asymmetry information and to mitigate risks (Du *et al*., 2011). Firms that disclose ESG information through transparency and accountable practices are more prone to have longevity (Chabowski *et al*., 2011).

2.2 Hypothesis Development

From all the above information, we end up that in terms of risk, is more important how companies make money rather than just how much they make. Investment in ESG provides a range of positive protentional impacts, reduce risk factors and help firms to overcome regulations and therefore comply with the rules before they are enforced. We expect that through ESG performance, firms reduce information asymmetry, capitalize valuation benefits and secure market position and consumer loyalty. In addition, the literature documents that ESG has strongly positive effect on the value of the firm. We hypothesize that ESG is a tool for companies to control reputational risks, increase competitiveness, reduce uncertainty and formulate strategies about non-financial

factors (such as environmental, social and governance) but with increasingly impact in financial that enables them to survive for longer periods of time in the market. From all the above we end up that firms with ESG exposure to reputation risks are more vulnerable, incorporate higher risk and face higher probability of delisting.

3. Sample and Data

3.1. Sample Construction

For our empirical analysis we construct our sample based on annual data for US publicly listed firms covered by Crisp and Compustat. We retrieve financial data and stock prices from Compustat and CRSP respectively. We gather sustainability information from Rep Risk database. The former data start from 2007 and so as and our sample. Our final dataset consists of 1,585 US public listed companies covering the period 2007- 2016.

3.2. Data Description

The variable of our interest is firm's sustainability ESG issues based on Rep Risk Index RRI, where RRI is a risk metric that quantifies a company's exposure to environmental, social and governance matters. The RRI score is calculated based on several factors, including the credibility of the source of information, the frequency and timing of criticisms, and the novelty and severity of the criticism and express company's exposure to reputational risks related to ESG. The Rep Risk RRI score ranges from zero to hundred with higher value of the score correspond to greater risk exposure. We consider ESG issues as a dummy variable that takes value one when RRI score is greater than zero. We retrieve information for the firm' s sales (*Sales*), advertising (*Advertising*) and return on equity (*Return on Equity*) in millions of dollars from the Compustat database. In order to control for firm's innovation and market establishment, we use the natural logarithm of firm's patents (log (Patents +1)) and trademarks (log (TM +1)). Data for both former measures as well as for firm age (*Log (Firm Age)*) come from Orbis Intellectual Property, a global company database, produced by the Bureau Van Dijk (2005). Information about firms listing time to the market as well as delisting codes come from Center for Research in Security Prices (CRSP) database and for merger and acquisition announcement days from Securities Data Corporation's (SDC) database. We retrieve delisting codes from CRSP to indicate the status of issuing firm. Issue codes equal 100 indicate that firms at the end of our sample are still trading while those with

delisting codes from 200 to 299 acquired in mergers and above 300 are delisted for negative reasons (Alhadab *et al.,* 2014, Espenlaub *et al*., 2012). Last but not least, to control for financial crisis (*Crisis*), we use a dummy which takes the value of 1 for the US crisis time period of the year 2008 and zero otherwise.

Table 1 below provides summary statistics of our variables over the sample period, 2007-2016

Panel A: Descriptive statistics of firms 2007-2016

Variable	Obs	Mean	Std. Dev.	Min	Max
ESG Issues	11,337	.448	.497	0	1
RRI	11,337	7.40	10.83	0	71.50
Log (Sales)	11,337	7.35	1.88	.005	13.08
(Log (Sales))2	11,337	57.69	26.87	.000	171.31
Log (Sales growth)	11,337	.251	4.96	-.998	474.81
Log (Advertising)	11,337	1.61	2.19	0	9.182
Log (FirmAge)	11,337	3.29	.774	0	5.043
Log (Patents+1)	11,337	1.01	1.73	1.01	9.10
Log (TM+1)	11,337	.228	0.541	0	4.574
Return on Equity	11,337	.037	1.61	-58.54	99.50

Panel B: Failed survived statistics

	From 2007 to November 2016 failed total		From 2007 to November 2016 failed due negative reasons	
	N	*%*	*N*	*%*
Failed	540	34%	113	7.1%
Survived	1,045	66%	1,472	92.9%
Total	1,585	100.00	1,585	100%

Notes: Panel A, reports descriptive statistics for a sample of 1,585 US public listed companies. It documents the mean, standard deviation, minimum and maximum statistics for the sample as well as the total number of observations.The panels B, presents the distribution of the overall sample for both groups of firms, survived and failed. Survived firms are those that are still trading (CRSP delisting code of 100). Failed firms are those that are delisted due to acquisitions (delisting code from 200 to 299) and for negative reasons (delisting code greater than or equal 300). *N* denotes the number of observations.

Firms' Rep Risk Index RRI in our sample is on average quite low and about 7.40 (out of 100) and on average firms *Log (Sales growth)* is .25%. In addition, the average log of age is 3.29. Firms have on average 7.35% of log(sales) and their share of log(patents+1) is 1.01%, while their log (TM+1) share is .228. Last but not least, the share of return on equity and advertisement is 037% and 1.61%respectively. Panel B reports the number and shares of delisting firms in our sample. Survived firms on average are 66% while the delisting firms due to acquisitions (delisting code from 200 to 299) and for negative reasons (delisting code greater than or equal 300) RE 34%. If

we exclude delisting due successful merging then on the average, we have 92.9% surviving firms and 7.1% those who failed due negative reasons.

3.3. Graphical Representation of State average ESG issues and delisting activity for US firms

Figure 1 below provides a visualization of spatial distribution of ESG RRI issue index across states in the US and over the period 2007 - 2016. As we have the location of the firms and their sustainability performance, we were able to provide a spatial presentation of the firms in our sample. In addition, figure 2 presents firms market exiting distribution over the states, whereas highest number of delisting firms are presented with deep red and with light red orange and yellow are the ones that on average have lower concentration of sustainable firms. Comparing these figures, we see that states with on average higher ESG issues appear to have more intense delisting activity.

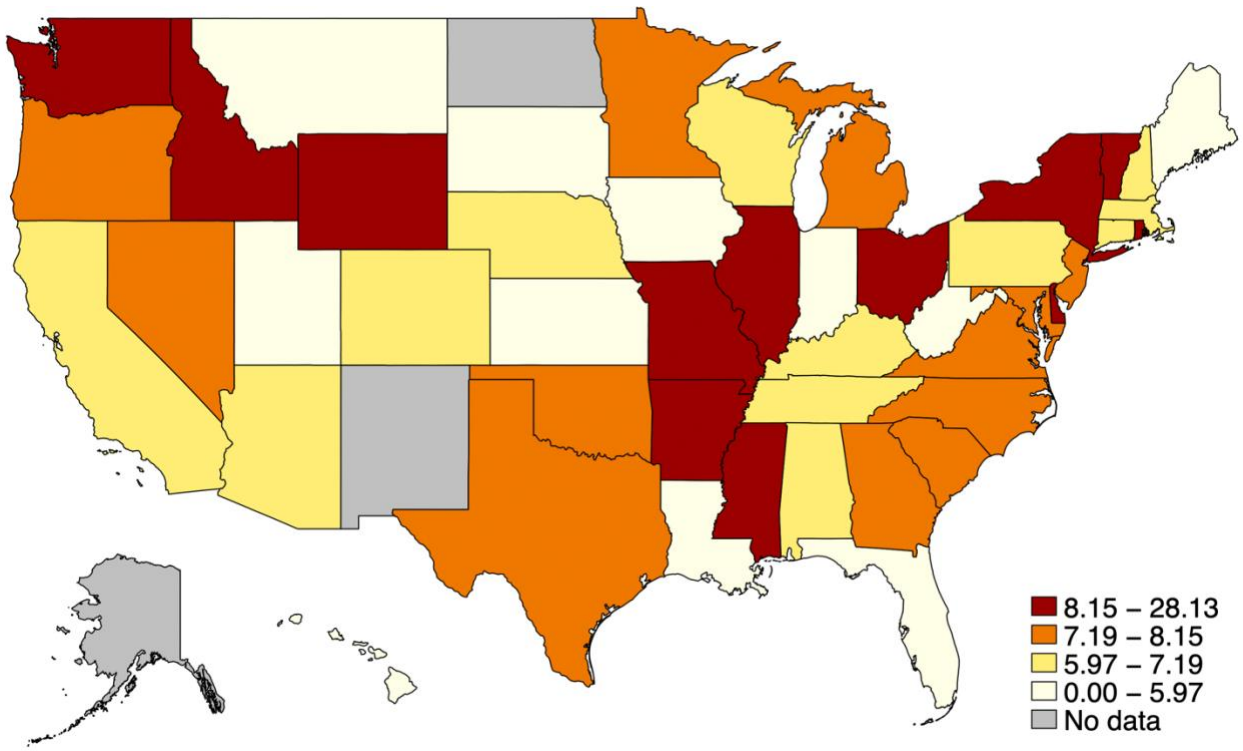


Figure 1: State average ESG issues for US firms over the period 2007 and 2016.

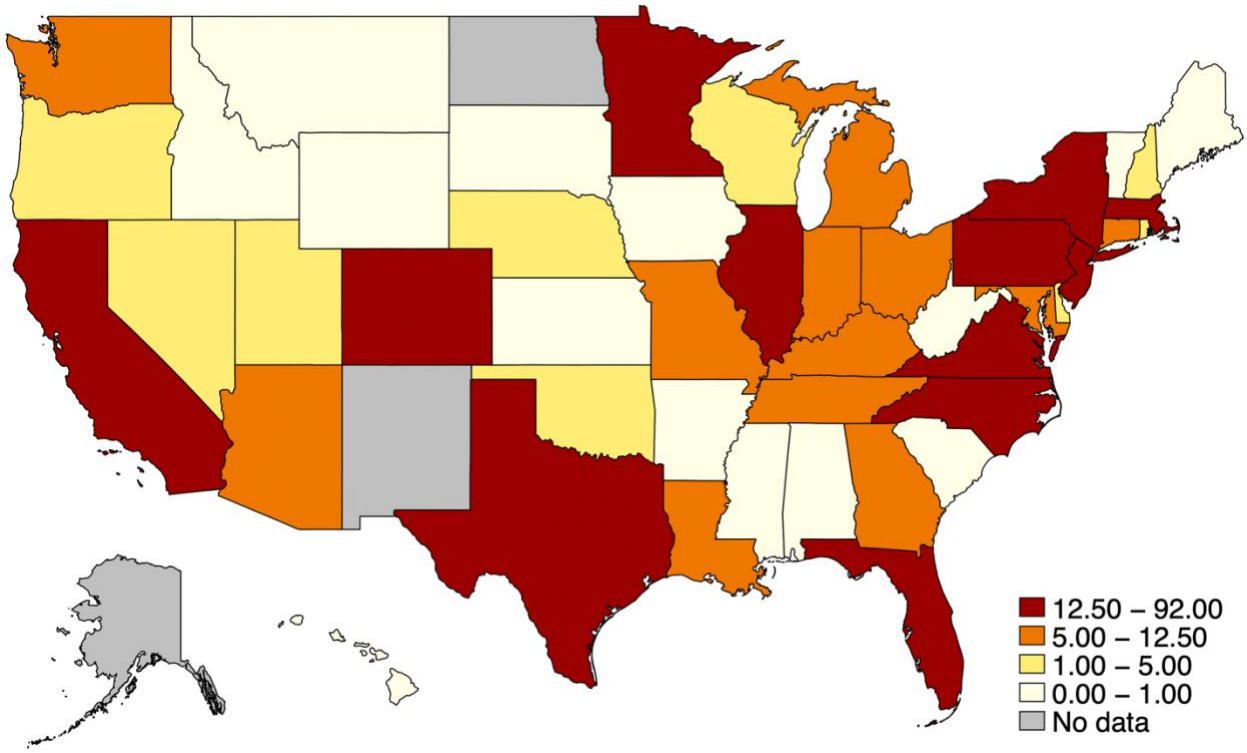


Figure 2: State average delisting activity for US firms over the period 2007 and 2016.

4. Empirical Analysis of the Impact of US listed firms ESG on Survival

4.1. Survival Analysis Methodology

Survival analysis is a branch of statistics for analyzing and determine the expected length of time until an event happens. There is an extensive literature that examines firms' market survivability by using this statistical tool (e.g. Hensler *et al*., 1997; Jain and Kini, 2000; Fama and French, 2004; Jain and Martin, 2005; Carpentier and Suret, 2011; Espenlaub *et al*., 2012; Gerakos *et al*., 2013; Alhadab *et al*., 2015). One reason for this, is its advantage over regression methods (such as Probit and Logit models) to account for both event occurrence and time to event. Moreover, this kind of technics works well with censored data and events with different time horizons (LeClere, 2000; Shumway, 2001). In our analysis, in order to study the association between ESG performance and firms' market survival, we apply nonparametric and semiparametric and parametric approaches. By using nonparametric estimates of hazard and survival functions, we compare the failure risks and survival rates between firms with ESG issues and those without, in order to determine if ESG has an impact in firms' survival mechanism. The hazard function expresses a conditional

probability of failure taking into account the time that the firm exists in the market. We use Nelson-Aalen estimator to compute the hazard functions for the two groups.

$$\widehat{H}(t) = \sum_{t_i \leq t} \frac{d_i}{n_i} \qquad (1)$$

We define d_i as the number of failed firms at time t_i, and n_i as the number of firms with possible risk at time t_i and we compute with survival function the probability of firms' survival at a particular time. We expect the survival function curve for firms with high ESG performance to be above of those with low. We use Kaplan-Meier methodology to estimate the survival functions.

$$\hat{S}(t) = \prod_{t_i \leq t} \frac{n_i - d_i}{n_i} \qquad (2)$$

Finally, we use the log-rank test to examine the difference in survival curves between firms with high ESG intensity and those with low. We use semi parametric approach to fit via maximum likelihood proportional hazards on a panel with multiple records using Cox proportional hazards model (Cox, 1972) for panel which extends our analysis taking into account the simultaneously impact of several risk factors on survival time. One of the advantages of Cox pro- portional hazards model is that works with no pre-specified baseline hazard function so it can take any functional form (Allison, 2000). We estimate the following model using Cox proportional hazard model on panel data

$$h_{\text{Exit}}(t, ESG_i, Controls_i) = h_0(t) \exp\left(\beta_0 + \beta_1 ESG_i + \beta_2 Controls_i\right) \qquad (3)$$

We define h(t) as the baseline hazard function with t to be time to exit from the market (failure). The dependent variable captures the risk of exiting the market. The independent variables hazard ratio measures the increase in failure risk for a unit increase. For continuous variables the hazard rate for one-unit increase is 100*(hazard ratio – 1) (Allison, 2000). Our variable of interest is firms' sustainability performance (ESG). Following, the literature (Hensler *et al.,* 1997); Wagner, 2010). we control for firms' characteristics such as Sales, Sales Growth, Advertising, Firm Age, Patents, trademarks Return on Equity and firm financial crisis. All regressions include year and industry fixed effects.

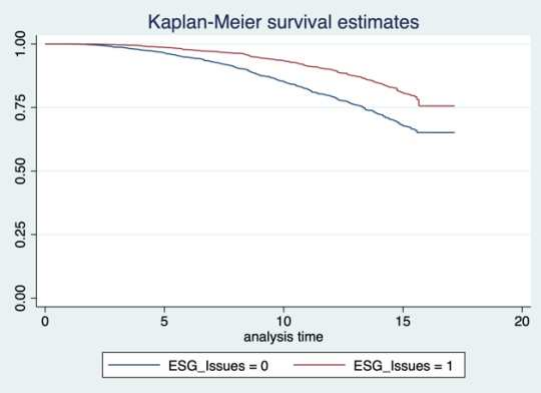
Finaly, we make an assumption that our data follow Weibull distribution and fit a parametric survival model with panel data. We cluster panel surviving data (Gutierrez *et al*., 2001) and fit a mix effect[2] survival model containing both fixed and random effects. With the implementation of random effects, we take into account protentional bias that could arise from intracluster correlation. The definitions of all variables are provided in Appendix A.

4.2. Empirical Results

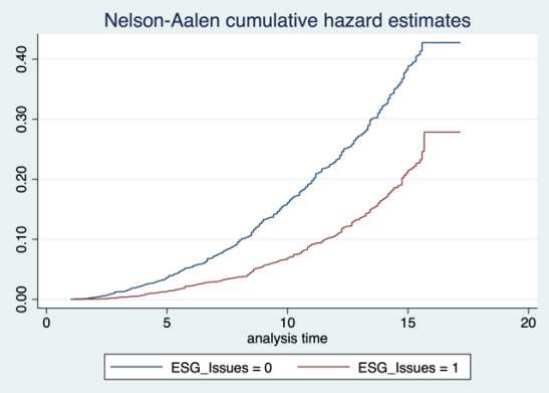
4.2.1. Analysis of the Hazard and Survival Curves (non-parametric approach)

We provide graphic representation of hazard and survival functions for firms with ESG issues and those do not. Figures 1 and 2 provide Kaplan Meier survival and Nelson Aalen cumulative hazard estimates. Hazards functions for firms with no ESG Issues (Figure 1) are below those of firms with ESG issues and the gap widens in the length of time. Contrariwise, as we can see from Figure 2, the survival function of firms with ESG issues is bellow that of firms with no ESG issues. Graphical analysis indicates that the probability of delisting in greater for firms with ESG issues through the entire time span of our study. In addition, the long run test shows the survival distributions of the two samples are different at the 1% significant and provide evidence that there is efficiency in the comparison. In a nutshell, hazard and survival functions document that firms with ESG issues are more likely to exit the market compared with those with no ESG issues. The results suggest that sustainability is a risk mitigation tool and sustainable companies tend to be less risky with better survival profiles.

2 Mixed-effects survival models contain both fixed effects and random effects. In longitudinal dataand panel data, random effects are useful for modeling intracluster correlation; that is, observationsin the same cluster are correlated because they share common cluster-level random effects.



Figs. 1 Survival Estimates firms with and without ESG issues.



Figs. 2 Survival function firms with and without ESG issues.

4.2.2. Estimation using semi-parametric and parametric approach

In order to test our hypothesis, we use two model specifications. Table 2 documents the results Cox proportional hazards model, specification 1, which uses a semi parametric approach (columns 1,3). In order to secure further robustness for results, specification 2, we report estimates of a mixed-effects parametric survival-time model with the assumption that the conditional distribution of the response is Weibull (columns 2,4). In both specifications the results are consistent and in line with our previous findings of the non-parametric analysis. In columns 1 and 2 we consider that a firm is failing when exiting the market while in 3 and 4 we expand our analysis taking into account firms that have an exit from the market for negative reasons. We control for the presence of no linear effects by using the quadratic term of sales (*lnSales*$_2$) and is expected to find a negative association with firms' probability exiting the market. We control for Growth in sales (*Sales growth*) (Hirsch, 1990) and innovation activity proxy by patents and trademarks. We find a negative association between patents and market delisting which is expected as firms through patent investing put barriers to the market, reduce risks and acquire competitive advantage. Last but not least, we control for firms' advertising expenses to capture adjustments on consumers preferences and hence public support to companies. The results indicate that for both specifications we use to define the exit from the market and both semi- parametric and parametric models' firms with ESG issues face higher probability of delisting from 8% to 17,8% compared with those no ESG issues. Our estimates, provide evidence to support our hypothesis that ESG issues weakness companies, increase uncertain and decrease their competitiveness. In a nutshell, through ESG, firms formulate strategies about non-financial factors (such as environmental, social and

governance) however with great impact on financial, that will enable them to survive for longer periods of time in the market.

Table 2: Semi- parametric and parametric estimates of firms' ESG impact on the probability exiting the market

VARIABLES	(1)	(2)	(3)	(4)
	All firms Exiting the market		**Exits with for negative reasons**	
ESG Issues	0.080*	0.077*	0.178**	0.178**
	(0.041)	(0.041)	(0.070)	(0.070)
Log (Sales)	0.090**	0.086**	-0.004	-0.004
	(0.038)	(0.037)	(0.039)	(0.039)
(Log (Sales))2	-0.028***	-0.027***	-0.022***	-0.022***
	(0.003)	(0.003)	(0.004)	(0.004)
Log (Sales growth)	0.003***	0.003***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Log (FirmAge)	-0.205***	-0.195***	-0.193***	-0.192***
	(0.024)	(0.024)	(0.038)	(0.038)
Log (Patents+1)	-0.076***	-0.077***	-0.113***	-0.112***
	(0.014)	(0.014)	(0.030)	(0.030)
Log (TM+1)	-0.026	-0.029	-0.166***	-0.169***
	(0.032)	(0.032)	(0.062)	(0.062)
Log (Advertising)	-0.002	-0.002	0.017	0.017
	(0.011)	(0.010)	(0.019)	(0.019)
Crisis		0.988***	0.958***	0.960***
		(0.152)	(0.276)	(0.275)
Return on Equity	-0.035***	-0.033**	-0.055***	-0.056***
	(0.014)	(0.014)	(0.010)	(0.010)
Observations	11,337	11,337	11,337	11,337
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES

This table provides the estimations of Cox proportional hazards and mix- effect survival model of probability of failure and time-to failure. In all regressions we include industry and year fixed effects. All variables are defined in Appendix A. The standard errors are shown in parentheses below of the estimated coefficient. Robust standard errors in parentheses. One two and three asterisks indicate statistical significance at the 10%, 5% and 1% level respectively. *** p<0.01, ** p<0.05, * p<0.1

5. Robustness Checks

In this section, we use semi - parametric and parametric approaches to estimate the impact of three major (*ESG) issues* components namely environmental (*EP)* issues, social (*SP*) issues and

governance (*GP*) issues on the probability exiting the market. As Table 3 shows, columns (1), (3), (5) and (7) and columns (2), (4), (6) and (8) present semi- parametric and parametric estimates respectively. Concerning delisting scenarios, we define as failed all firms exiting the market for negative reasons. In this way we categorize firms due to their inability to control risk and unveil their weaknesses to comply with the prerequisite market criteria. Following the literature, we control for sales *(lnSales)* and we capture the presence of no linear effects by using the quadratic term of sales ($lnSales^2$) which is expected to find a negative association with firms' probability exiting the market. In addition, we control for Growth in sales (*Sales growth*) (Hirsch, 1990) and innovation activity proxy by patents and trademarks. We find a negative association between innovation expressed by patents and trademarks and market delisting which is expected as firms through innovation put barriers to the market, reduce risks and acquire competitive advantage. Last but not least, we control for firms' advertising expenses to capture adjustments on consumers preferences and hence public support to companies. Our results indicate that firms' ESG exposure to reputational risks increase significant the probability of delisting and reduce the period of time that firms remain listed. Our finding is extended for issues on the mainly components of ESG such as social (*SP*) and governance (*GP*) but not in environmental. Concerning this outcome, our analysis shows that firms with social and governance issues face larger extent of information asymmetry around control transparency and social reputation so they are more likely to face exit mechanism.

Table 3: Semi- parametric and parametric estimates of three major sustainability (*ESG*) components namely environmental (*EP*), social (*SP*) and governance (*GP*) impact on the probability exiting the market

VARIABLES	(1) ESG Issues	(2) ESG Issues	(3) EP Issues	(4) EP Issues	(5) GP Issues	(6) GP Issues	(7) SP Issues	(8) SP Issues
ESG Issues	0.178**	0.178**						
	(0.070)	(0.070)						
Environmental Issues			0.136	0.137				
			(0.087)	(0.087)				
Governance Issues					0.258***	0.255***		
					(0.081)	(0.081)		

Social Issues							0.165**	0.166**
Log (Sales)	-0.004	-0.004	-0.005	-0.006	-0.001	-0.002	-0.004	-0.005
	(0.039)	(0.039)	(0.039)	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)
(Log (Sales))2	-0.022***	-0.022***	-0.021***	-0.021***	-0.022***	-0.022***	-0.022***	-0.022***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Log (Sales growth)	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log (FirmAge)	-0.193***	-0.192***	-0.194***	-0.194***	-0.192***	-0.191***	-0.194***	-0.193***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	(0.039)	(0.038)	(0.038)
Log (Patents+1)	-0.113***	-0.112***	-0.113***	-0.112***	-0.119***	-0.117***	-0.113***	-0.111***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.029)	(0.030)	(0.029)	(0.030)
Log (TM+1)	-0.166***	-0.169***	-0.163***	-0.166***	-0.162***	-0.165***	-0.165***	-0.168***
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
Log (Advertising)	0.017	0.017	0.019	0.019	0.015	0.015	0.018	0.018
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Crisis	0.958***	0.960***	0.869***	0.871***	0.940***	0.941***	0.913***	0.915***
	(0.276)	(0.275)	(0.273)	(0.273)	(0.274)	(0.273)	(0.275)	(0.274)
Return on Equity	-0.055***	-0.056***	-0.055***	-0.056***	-0.055***	-0.055***	-0.055***	-0.055***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	11,337	11,337	11,337	11,337	11,337	11,337	11,337	11,337
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES

This table provides the estimations of Cox proportional hazards and mix- effect survival model of probability of failure and time-to failure for the three major sustainability (*ESG*) components namely environmental (*EP*), social (*SP*) and governance (*GP*). In all regressions we include industry and year fixed effects. All variables are defined in Appendix A. The standard errors are shown in parentheses below of the estimated coefficient. Robust standard errors in parentheses. One two and three asterisks indicate statistical significance at the 10%, 5% and 1% level respectively. *** p<0.01, ** p<0.05, * p<0.1

5.1. Controlling for Service - Manufacturing Industries and crisis periods

Service and manufacturing industries may contain firms with different characteristics such as growth, innovation and risk exposure. In this subsection, we study the impact of ESG issues on firms' probability of exiting the market with respect on these industries. We also include in our study the three major components of ESG issues namely environmental (EP) issues, social (SP) issues and governance (GP) issues. Our analysis considers failed firms, all those exiting the market but excluding firms that have a successful exit from the market through a merger and acquisition (M&A). We define as successful exit, the one at which the share price of the company increases

after the merger and acquisition announcement. We perform a semi parametric approach by using Cox proportional hazards model. We control for the presence of no linear effects by using the quadratic term of sales (*lnSales2*) and is expected to find a negative association with firms' probability exiting the market. We control for Growth in sales (*Sales growth*) (Hirsch, 1990) and innovation activity proxy by patents and trademarks. We find a negative association between patents, trademarks and market delisting (Table 4). This is expected as firms' patent and trademark investing put barriers to the market increases market establishment and consumer loyalty, reduce risks and acquire competitive advantage. We control for firms' advertising expenses to capture adjustments on consumers preferences and hence public support to companies. By using semi-parametric estimates, we extend our initial findings to industry level. We find that firms in manufacturing sector are vulnerable to ESG reputation risks while those belonging to services are not. When we focus on ESG components the results are inline finding higher probability of delisting from 20% to 38,6% in manufacturing sector for governance and social ESG reputation exposure. This is consistent with the view that firms in the product market when are in a weaker position face greater risk of delisting (Chemmanur *et al*., 2019). Overall, our initial results are robust and we support the hypothesis that ESG issues play important role in firm delisting mechanism.

Table 4: Semi- parametric estimates of ESG impact on firm exiting the market Controlling for Service - Manufacturing Industries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	_t	_t	_t	_t	_t	_t	_t	_t	_t	_t	_t	_t
	Total Sectors	service	Manufacturing	Total Sectors	service	Manufacturing	Total Sectors	service	Manufacturing	Total Sectors	service	Manufactu ring
	ESG Issues	ESG Issues	ESG Issues	EP Issues	EP Issues	EP Issues	GP Issues	GP Issues	GP Issues	SP Issues	SP Issues	SP Issues
ESG Issues	0.178**	0.124	0.200**									
	(0.070)	(0.108)	(0.092)									
Environmental Issues				0.136	0.112	0.137						
				(0.087)	(0.153)	(0.106)						
Governance Issues							0.258***	0.039	0.386***			
							(0.081)	(0.127)	(0.106)			
Social Issues										0.165**	-0.088	0.274***
										(0.078)	(0.132)	(0.100)
Log (Sales)	-0.004	-0.059	0.005	-0.005	-0.056	0.003	-0.001	-0.063	0.012	-0.004	-0.072	0.009
	(0.039)	(0.091)	(0.046)	(0.039)	(0.091)	(0.045)	(0.040)	(0.090)	(0.046)	(0.040)	(0.091)	(0.046)

(Log (Sales))2	-0.022***	-0.020***	-0.020***	-0.021***	-0.020***	-0.020***	-0.022***	-0.019***	-0.021***	-0.022***	-0.017**	-0.021***
	(0.004)	(0.007)	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)	(0.007)	(0.005)
Log (Sales growth)	0.006***	0.078***	0.006***	0.006***	0.078***	0.006***	0.006***	0.078***	0.006***	0.006***	0.078***	0.006***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.001)	(0.001)	(0.007)	(0.001)
Log (FirmAge)	-0.193***	-0.149**	-0.213***	-0.194***	-0.150**	-0.215***	-0.192***	-0.148**	-0.212***	-0.194***	-0.147**	-0.214***
	(0.038)	(0.066)	(0.048)	(0.038)	(0.066)	(0.048)	(0.039)	(0.066)	(0.049)	(0.038)	(0.066)	(0.048)
Log (Patents+1)	-0.113***	-0.137**	-0.119***	-0.113***	-0.138**	-0.119***	-0.119***	-0.136**	-0.126***	-0.113***	-0.134**	-0.118***
	(0.030)	(0.066)	(0.034)	(0.030)	(0.066)	(0.034)	(0.029)	(0.067)	(0.034)	(0.029)	(0.067)	(0.034)
Log (TM+1)	-0.166***	-0.277***	-0.062	-0.163***	-0.274***	-0.061	-0.162***	-0.274***	-0.057	-0.165***	-0.274***	-0.065
	(0.062)	(0.102)	(0.081)	(0.062)	(0.102)	(0.080)	(0.062)	(0.102)	(0.081)	(0.062)	(0.102)	(0.081)
Log (Advertising)	0.017	0.043*	-0.006	0.019	0.044*	-0.004	0.015	0.045*	-0.012	0.018	0.047*	-0.005
	(0.019)	(0.026)	(0.028)	(0.019)	(0.026)	(0.027)	(0.019)	(0.026)	(0.028)	(0.019)	(0.026)	(0.027)
Crisis	0.958***	0.679*	1.211***	0.869***	0.613*	1.117***	0.940***	0.617*	1.229***	0.913***	0.567	1.178***
	(0.276)	(0.364)	(0.422)	(0.273)	(0.358)	(0.420)	(0.274)	(0.360)	(0.417)	(0.275)	(0.361)	(0.421)
Return on Equity	-0.055***	-0.033***	-0.111***	-0.055***	-0.032***	-0.113***	-0.055***	-0.032***	-0.110***	-0.055***	-0.032***	-0.109***
	(0.010)	(0.008)	(0.015)	(0.010)	(0.008)	(0.015)	(0.010)	(0.008)	(0.015)	(0.010)	(0.009)	(0.015)
Observations	11,337	4,526	6,811	11,337	4,526	6,811	11,337	4,526	6,811	11,337	4,526	6,811
Year 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

In table 5, we document the results of Cox proportional model (specification 1) for Crisis periods. We split our sample in subsamples for crisis and no crisis periods. Considering the basic analysis results we report that having sustainability ESG issues increase the probability of delisting and reduce the surviving time in both cold and hot market periods. The results suggest that during crisis periods the impact of ESG issues on firms' probability of delisting is almost double. This implies that in crisis periods firms should pay even more attention to their ESG policies. Overall, our results support our main analysis and extent the importance of our findings by incorporate the extra systemic risk of crisis periods.

Table 5: Estimates of ESG impact on firm exiting the market Controlling for crisis periods

	(1)	(2)	(3)
VARIABLES	_t	_t	_t
ESG Issues	0.253***	0.436*	0.241***

	(0.066)	(0.262)	(0.068)
Log (Sales)	-0.033	0.001	-0.026
	(0.038)	(0.099)	(0.041)
(Log (Sales))2	-0.019***	-0.021**	-0.020***
	(0.004)	(0.010)	(0.004)
Log (Sales growth)	0.006***	-0.042	0.006***
	(0.001)	(0.036)	(0.001)
Log (FirmAge)	-0.218***	-0.120	-0.237***
	(0.038)	(0.107)	(0.041)
Log (Patents)	-0.210***	-0.178**	-0.218***
	(0.029)	(0.074)	(0.031)
Log (TM)	-0.211***	-0.356**	-0.187***
	(0.062)	(0.172)	(0.066)
Log (Advertising)	-0.021	-0.013	-0.022
	(0.018)	(0.048)	(0.020)
Crisis	1.139***		1.106***
	(0.278)		(0.277)
Return on Equity	-0.064***	-0.040***	-0.097***
	(0.009)	(0.005)	(0.014)
Observations	11,337	1,252	10,085
Crisis	Overall Sample	Sub-sample crisis periods	Sub-sample not in crisis periods
Year FE	YES	YES	YES
Industry FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2. Other robustness checks

For further robustness purposes, we examine the relation between ESG issues and firms' exiting due negative acquisitions. We categorize as negative those with decreased share price after the acquisition announcement. Our results document that ESG issues weaken firms' market position and increase the probability to be acquired while firms without ESG issues incorporate lower risk and are more likely to remain listed and for longer periods of time. Our findings indicate that firms with ESG exposure who are very close to fail considering the situation choose acquisitions in order to avoid their fate. This result is stronger when we focus to corporate governance issues.

6. Conclusion

In this paper, we use a dataset of US listed firms and perform a dynamic empiric analysis where ESG performance is associated with public firms' market exiting profile. We consider different types of firms' failure including exiting in the case of M&A and based on financial criteria apply a financial analysis to distinguish firms with successful exits from those who do not meet the requirements to remain in the markets. We apply nonparametric, semiparametric and parametric approaches of survival analysis in order to study the association between corporate sustainability and firms' market survival. We also consider the impact on exiting mechanism of the three major sustainability (ESG) components namely environmental (EP), social (SP) and governance (GP) and study this relation in Service and Manufacturing Industries. Last but not least, we also examine if our findings remain unaltered during crisis periods.

The findings indicate that firms with ESG issues face higher probability of exiting the market across all determinants of delisting. The results remain unaltered even when we consider subsamples with respect to Service and Manufacturing Industries and crisis periods.

In addition, our research provides evidence to support that firms with ESG issues have higher probability to be acquired compared with those without ESG issues, especially when we focus to corporate governance issues.

Overall, the empirical results of this research show how listed firms may be able to incorporate the benefits arising from ESG sustainable policies considering firms' delisting mechanism and suggest how such incorporations may contribute to the reduction of the number of firms exiting US market. Particularly, it contributes to the literature by bring to light firms' corporate sustainability performance as a no financial characteristic that leads to substantial benefits for firms market survival.

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APPENDIX

Table A.1. Variable names and definitions.

Variables	Definition
ESG Variables	
RRI	Rep Risk RRI index that quantifies a company's exposure to environmental, social and governance matters
EP issues	An index that quantifies a company's exposure to environmental matters
SP issues	An index that quantifies a company's exposure to social matters
GP issues	An index that quantifies a company's exposure to governance matters
ESG issues	Dummy variable set to 1 if there is firms exposure to environmental, social and governance matters
Control Variables:	
Log (Sales)	Natural log of firms' sales
(Log (Sales))2	Natural log of sales quadratic term that indicates
Log (Sales growth)	Log of firm's sales growth
Log (Firm Age)	Log of the number of years from the firm's initial incorporation date.
Log (Advertising)	The natural log of Firms advertising expenses
Log (TM)	The natural log of firm's trademarks
Log (Patents)	The natural log of firm's patents
Return on Equity	Firms return on equity
Crisis	Dummy variable that takes the value of 1 for financial crisis period, else 0.

Table A1: Estimates of firms M&A probability with respect to ESG issues and its three major components namely environmental (EP) issues, social (SP)issues and governance (GP) issues on firms M&A probability.

	(1)	(2)	(3)	(4)
VARIABLES	Successful merger	Successful merger	Successful merger	Successful merger
ESG issues	0.013***			
	(0.003)			
Governance (GP) issues		0.294***		
		(0.061)		
Environmental (EP) issues			0.051	
			(0.062)	
Social (SP) issues				0.031
				(0.059)
Log (Sales)	0.280***	0.252***	0.216**	0.213**
	(0.100)	(0.089)	(0.085)	(0.084)
(Log (Sales))2	-0.023***	-0.020***	-0.017***	-0.016***
	(0.007)	(0.006)	(0.006)	(0.006)
Log (Sales growth)	-0.007	-0.007	-0.008	-0.008
	(0.013)	(0.012)	(0.013)	(0.013)

Log (FirmAge)	0.029	0.039	0.037	0.039
	(0.030)	(0.031)	(0.030)	(0.030)
Log (Patents)	-0.019	-0.021	-0.014	-0.014
	(0.016)	(0.016)	(0.015)	(0.015)
Log (TM)	-0.119***	-0.119***	-0.122***	-0.123***
	(0.044)	(0.044)	(0.044)	(0.044)
Log (Advertising)	-0.011	-0.011	-0.007	-0.007
	(0.011)	(0.011)	(0.011)	(0.011)
Crisis	0.870***	0.879***	0.753***	0.759***
	(0.223)	(0.223)	(0.224)	(0.224)
Return on Equity	-0.012	-0.011	-0.011	-0.011
	(0.016)	(0.015)	(0.015)	(0.015)
Observations	11,337	11,337	11,337	11,337
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES