



Research article

The role of ESG in acquirers' performance change after M&A deals

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Abstract: This research aims to study the impact of the target's ESG score on the acquirer's ROA and stock price changes after M&A deals by regressing the percentage change of acquirer's performance change against the target's ESG score and a set of control variables. This research contributes to the current literature by exploring whether this impact is influenced by the acquirer's pre-M&A ESG level through two methods—expressing the coefficient of the target's ESG as a linear function of the acquirer's ESG and dividing the deals into two groups according to the acquirer's ESG level. The result shows that the impact of the target's ESG score on the acquirer's ROA change is significant at 95% confidence level and varies for low-ESG and high-ESG acquirer groups. Although most acquirers suffer ROA declines one year after the deals, the ROA decline is aggravated for low-ESG acquirers but is relieved for high-ESG acquirers. This discrepancy can be attributed to the temporary integration costs that are higher for low-ESG acquirers than for high-ESG peers if the target's ESG level increases. Besides, this research concludes that the impact of the target's ESG score does not have a significant impact on the acquirer's stock price change before and after an M&A deal.

Keywords: CSR; ESG; green finance; mergers and acquisitions (M&A); sustainable finance

JEL Codes: C1, C3, C8, G3, Q5, M1

1. Introduction

In recent years, sustainability is becoming an increasingly important concern all over the world. The United Nations (UN) listed 17 sustainable development goals (SDG) to promote sustainable economic growth. In 2004, the UN first used the ESG term in a report about the impact of financial markets on sustainable development (United Nations, 2004). Such a trend makes it essential to investigate the impact of sustainability concerns on global business. In the investigation of Franklin

(2020), more than 50% of respondents said that the main reason that firms embrace ESG is that they want to do the right thing. But ESG practices are not just a purely voluntary initiative, and the ESG adoption depends on legal rules, institutional arrangements, and societal preferences (Liang and Renneboog, 2017). Therefore, it becomes attractive for academic researchers to explore the specific influence of sustainability concerns—such as environment, society, and governance (ESG)—on critical financial activities, for example, mergers and acquisitions (M&A).

Mergers and acquisitions (M&A) is a crucial way for firms to enlarge market share, improve competitiveness, and deepen diversification. Each year, M&A causes a massive amount of money flows in the global capital markets. The enormous capital flow, together with the potential tendency effect and conflict of interest of M&A deals, makes the study of M&A attractive for both academic and professional researchers (Arouri et al., 2019). Then the key question arises whether the ESG concerns in M&A deals can improve the financial performance of acquirers. The rationale lies in that a firm can improve its business image and reduce its corporate risk by taking over a target firm with a good ESG record. Indeed, firms with good sustainable practices usually have positive images and low legal risks (Gillan et al., 2021; Franklin, 2020), for instance, fines for excessive pollution. Moreover, by taking ESG into consideration during the early stage of an M&A deal, such as the Due Diligence process, the acquirer can evaluate the target firm's corporate governance and detect its firm-specific risks more thoroughly (Rydell and Leucht, 2020). These efforts can increase the information-transparency level of the target company and the post-M&A performance of the acquirer (Gillan et al., 2021; Rydell and Leucht, 2020). The study of Salvi et al. (2018) confirms that merging targets with good ESG practices can bring acquirers better financial outcomes than merging other firms.

The objective of this research is to investigate how the ESG scores of both targets and acquirers influence the post-M&A profitability change of acquirers. To achieve this objective, the main method is regressing the percentage change of acquirer's performance change against the target's ESG score and a set of control variables. Although several previous scholars have studied the impact of target firms' sustainability level on M&A deals, this research includes the most recent M&A cases from 2000 to 2020 and, for the first time, takes the influence of acquirers' pre-M&A ESG score into account by studying the impact of targets' ESG score on high-ESG acquirers and low-ESG acquirers separately. In this research, the percentage changes of acquirers' ROA and stock price are used as the dependent variables separately to reflect the change of acquirers' performance from different perspectives. ROA can reflect the acquirers' profitability from the perspective of accounting. Another commonly used profitability ratio—ROE—is not as stable as ROA because the existence of LBO deals can lead to an increase of debt and, therefore, decrease ROE. The stock price change before and after the deal is an indicator of performance change from the perspective of financial market value.

This research contributes to the current literature by solving one significant problem faced by previous studies. The problem lies in that previous studies do not consider that the coefficient of the target's ESG score (i.e., the influence of the target's ESG score on the acquirer's performance change) may vary among acquirers with different ESG scores. This research studies the impact of acquirers' pre-M&A ESG score through two regressions. The first regression introduces an interaction term—the product of the acquirer's ESG score and the target's ESG score—to incorporate the acquirer's ESG score into the overall coefficient of the target's ESG score. The mind behind this regression is to construct the coefficient of the target's ESG score as a linear function of the acquirer's ESG score. The overall coefficient/influence of the target's ESG score is presented as a constant plus the product of the acquirer's ESG score and the coefficient of the interaction term. The result shows that the target's ESG score does not have a significant influence on the

acquirer's performance change (both from the ROA and stock price change perspectives) and that the acquirer's ESG score does not have a significant influence on the coefficient of the target's ESG score. The second regression is devoted to studying further whether the overall coefficient of the target's ESG score is significantly different between high ESG (top 25%) acquirers and low ESG (lowest 25%) acquirers by running another interactive regression. The interaction term in the second regression model is constructed as the product of the target's ESG score and a new dummy variable that can classify acquirers into two groups—high ESG acquirers and low ESG acquirers. The result shows that, for the ROA change, the overall coefficient of the target's ESG score for low-ESG acquirers is lower (more negative) than that for high-ESG acquirers, i.e., low ESG acquirers suffer greater ROA decline than high ESG acquirers if the target's ESG score increases. However, the influence of the target's ESG score on the acquirer's stock price change is still not significant even though the acquirer's pre-M&A ESG level is considered.

The findings of this research have a set of practical implications for making M&A-related decisions. An acquirer should consider not only the target firm's ESG score but also the acquirer's own ESG status when making acquiring decisions. When selecting targets, an acquirer should pick firms whose ESG levels are in line with its strategic goals, rather than simply thinks that the higher the ESG score, the better. Moreover, an acquirer should evaluate the impact of the target's ESG level on its performance changes by considering various indexes such as ROA, stock price, etc.

This research develops in the following outline. It first briefly introduces the M&A activities under the ESG background and lists the research objectives and contributions. Following that, the literature review section presents the current research achievements about the impact of ESG consideration on M&A and other financial activities. In light of these previous studies, the paper then moves into the methodology section, which designs a set of regressions to test the impact of targets' ESG level on acquirers' post-M&A performances. The key findings are summarized and analyzed in the "numerical analysis" section. This section also proposes some business suggestions from a practical perspective. Then the following "robustness analysis" section presents some additional analysis to validate the key findings of this research. For example, consider the environmental score, social score, and governance score separately in the regression models and consider US deals only to exclude the country effect. This research also conducts a 2SLS regression to exclude the endogeneity problem. Finally, the conclusion section reviews the whole study and discusses the implication of the findings to real business practices and future researches in the area of ESG/green M&A.

2. Literature review

How to improve economic sustainability is one main business challenge today. There has been an increasing social concern on sustainability issues not only among environmental advocacy groups and policymakers but also among enterprises that have begun to consider ESG factors parallel to their economic performance (Abbasi and Nilsson, 2016; Rao et al., 2015).

2.1. Benefits of good ESG practices

Good ESG practices usually can reflect a firm's corporate social responsibility (CSR) and improve a firm's business image among stakeholders (Godfrey, 2005; Martínez-Ferrero et al., 2016; Franklin, 2019). Thanks to the positive business image, both the firm and its stakeholders are satisfied (Freeman, 1984). For example, customers will become more loyal to the firm, and business partners will trust the firm more if a

company has a positive image (Barney and Hansen, 1994; Fombrun et al., 2000). Besides, a good reputation can help the firm attract more capital investment (Cheng et al., 2014) and high-caliber talents (Fombrun et al., 2000; Branco and Rodrigues, 2006). Moreover, Ferrell et al. (2016) found that good ESG performances are helpful for increasing firm value and decrease the negative effect of managerial entrenchment. These impact of sustainability practices on stakeholders may, in turn, affect financial activities such as the M&A processes and the acquirers' post-M&A performance (Bettinazzi and Zollo, 2017). This relationship is just the underlying idea that guides this research, which is devoted to exploring whether and how good ESG practices determine post-M&A performances of bidders.

2.2. Impact of good ESG practices on M&A deals

It is reasonable to think that, after merging a target with good ESG performance, the acquirer's ESG level, reputation, and business image will be positively influenced. These positive influences will be finally reflected in the acquirer's market price and financial performances, which can be measured by various indexes such as ROA. Previous scholars have studied the interaction relationship between sustainable issues and M&A deals from various perspectives. Most researches focus on the influence of merging a good ESG firm on the acquirer's post-M&A performance. Tampakoudis and Anagnostopoulou (2020) studied 100 European M&A cases and concluded that acquires' post-M&A ESG level and market value increase after merging a target firm with high ESG performance. Deng et al. (2013) studied a sample of US M&A deals and found that deals taken by acquirers with high ESG scores are more likely to succeed, take less time to complete, and can improve the long-term post-M&A operating performance of these acquirers. Salvi et al. (2018) studied 171 firms in the US & EU 28 countries (including the UK) from 2001 to 2013. They conducted a simple OLS regression of acquirers' performance (ROA) on target firms' overall ESG score and a set of control variables. Their results rejected the null hypothesis that the target's ESG level did not significantly affect the acquirer's post-M&A performance and concluded that acquirers that choose "green" deals could gain better financial performances than acquirers that merge firms in other sectors. Most of these researches got a consistent result that merging a high-ESG target is good for the acquirer's post-M&A performance.

Some researchers studied the influence of ESG on acquires' risk rather than performance. For example, Arouri et al. (2019) mainly explored the relationship between the ESG and M&A uncertainty by focusing on 726 M&A deals worldwide from 2004 to 2016, and they found that the arbitrage spreads in M&A deals are decreased by 1.10 percentage points for each unit-increase of standard deviation in the acquirer's ESG score. Besides, they also concluded that 'Green' acquirers are more likely to avoid unsuccessful deals. Arouri et al. (2019) verified their results by conducting robustness tests.

Other relevant studies include Liang et al. (2017), who investigated the positive impact of acquirers' engagement in employee issues on the M&A deals. Rydell and Leucht (2020) qualitatively studied the role of ESG in M&A Due Diligence. They found that Investigating ESG in the Due Diligence process can help the acquirer to assess risk, identify sources of value, and support the achievement of long-term goals. Researches conducted by Manocha and Srani (2020), Manocha et al. (2016), and Feng (2021) tried to study the role of ESG, especially the environment factor, in M&A deals in the supply chain industry. Outside of the M&A topic, Ng and Rezaee (2015) explored the interaction relationship between sustainability and cost of equity. They discovered that good sustainability performance is helpful for reducing a firm's cost of equity.

To test whether acquiring a high ESG target can improve the acquirer's post-M&A performance, this research first "repeated" the simple OLS regression method frequently used in previous studies such as Salvi et al. (2018). The OLS regression in this research is based on 124 deals worldwide in the last two decades. Referring to the conclusion of previous studies that acquiring a high-ESG target can benefit an acquirer, the expectation on the relationship between the target's ESG score and the acquirer's performance change is formulated in hypothesis:

Hypothesis 1a: The increase of the target's ESG score will have a significant (confidence level no less than 95%) positive influence on the acquirer's ROA change (increase the acquirer's ROA).

2.3. Research gaps

Despite the various previous studies on the impact of sustainability on M&A deals, current literature has left unanswered two crucial questions about ESG activism. The first unanswered question is whether the impact of target firms' sustainability on acquirer's performance (the overall coefficient of target's ESG in regressions) differs between high-ESG and low-ESG bidders. This research, for the first time, studied the impact of acquirers before-M&A ESG level through two methods. The first method is to consider the overall coefficient of the target's ESG score as a linear function of the acquirer's pre-M&A ESG score by introducing an interaction term—the product of the acquirer's ESG score and the target's ESG score—into the regression. The findings of Franklin (2019) and Liang and Renneboog (2017) imply a negative relationship. They found that low ESG companies can significantly improve performance after merging high-ESG firms because the deals are helpful for them to build a positive business image, reduce cost, and mitigate legal risks. However, they argue that bidders that already have high-ESG performance may not improve their performance a lot. A high-ESG firm merges a firm with good ESG practices because it wants to continually keep a positive reputation, achieve economies of scale, or just select targets that are similar to themselves—reasons that do not directly lead to performance improvement. According to these findings, the expectation about the linear relationship is captured in the following hypothesis:

Hypothesis 2a: The increase of the acquirer's pre-M&A ESG score will significantly (at 95% confidence level) decrease the impact of the target's ESG score on the acquirer's ROA (change), i.e., a negative relationship between the acquirer's ESG score and the overall coefficient of the target's ESG score.

Besides, the hypothesis 1a is also tested in this method. Although this method has some merit, the linear relationship between the acquirer's ESG score and the overall coefficient of the target's ESG score may not hold in real practices. To release this strict assumption of linear relationship, the second method studies the influence of the acquirer's own ESG score by measuring the impact of target's ESG score on low-ESG and high-ESG acquirers separately. This method sorted selected acquirers into high-ESG group and low-ESG group based on acquirers' ESG levels before deals by constructing an interaction term, which is the product of the target's ESG score and a dummy variable that represents the two group of acquirers (1 if the acquirer is a high ESG acquirer and 0 if the acquirer is a low ESG acquirer based on pre-M&A ESG scores). It is necessary to distinguish the low-ESG and high-ESG bidders because the coefficient that reflects the impact of the target's ESG may significantly differ (but not in a linear relationship) between these two kinds of acquirers. Also referring to the findings of Franklin (2019) and Liang and Renneboog (2017), the expectation about the different impact of the target's ESG score between high-ESG acquirers and low-ESG ones is captured in the following hypotheses:

Hypothesis 3a: The increase of the target's ESG score will significantly increase the acquirer's ROA after the deal, but the ROA of high-ESG acquirers will increase significantly less (in percentage) than the ROA of low-ESG acquirers.

The second question is that what is a good proxy for the acquirer's performance change? And will the results converge if using different proxies? Salvi et al. (2018) only studied the impact of the target's ESG score on the acquirer's ROA change. And Deng et al. (2013) studied the impact of the targets' ESG levels on the acquirer's long-term operating performance. Both these two studies use the accounting performance as a proxy for performance without considering performance in the financial market, such as the stock price. Only Tampakoudis and Anagnostopoulou (2020) studied the influence on market value but only based on a European database. This research, for the first time, examines the impacts on both the accounting performance (ROA) and the stock price separately. This research studies the acquirer's stock price change by changing the dependent variable in regression models to the acquirer's stock price change. Therefore, the hypotheses about the impact of the target's ESG score on the acquirer's stock price change and the influence of the acquirer's own ESG score on this impact are defined as:

Hypothesis 1b: The increase of the target's ESG score will have a significant positive influence on the acquirer's stock price change (increase the acquirer's stock price).

Hypothesis 2b: The increase of the acquirer's pre-M&A ESG score will significantly (at 95% confidence level) decrease the impact of the target's ESG score on the acquirer's stock price (change), i.e., a negative relationship between the acquirer's ESG score and the overall coefficient of the target's ESG score.

Hypothesis 3b: The increase of the target's ESG score will significantly increase the acquirer's stock price after the deal, but the stock price of high-ESG acquirers will increase significantly less (in percentage) than the stock price of low-ESG acquirers.

In addition, this research also advances the current literature by focusing on the detailed impact of sustainability on the acquirer's performance change. Moreover, following the suggestion of Fransen (2013), this research exploits the effects of various ESG dimensions—environment, society, and governance—separately in the robustness analysis section.

A brief comparison between previous studies and this research is summarized in the following Table 1.

Table 1. A summarized comparison of previous literature.

	ESG				Research Entity		Dependent Variable			Impact from Acquirer's ESG
	Environment	Social	Governance	ESG overall	Target	Acquirer	ROA	Stock price	Other	
Salvi et al. (2018)				✓	✓		✓			
Arouri et al. (2019)	✓	✓	✓	✓	✓	✓				✓
Deng et al. (2013)				✓	✓	✓	✓			
Liang et al. (2017)			✓			✓	✓			
Tampakoudis & Anagnostopoulou (2020)				✓	✓	✓	✓	✓		
Rydell and Leucht (2020)	✓	✓	✓	✓		✓				✓
Ng and Rezaee (2015)	✓	✓	✓	✓						✓
Manocha and Srani (2020)	✓					✓				✓
This research	✓	✓	✓	✓	✓	✓	✓	✓		✓

3. Data and variable description

This section summarizes the overall observations and defines all the variables that are used in this research.

3.1. Sample selection

The data used in this research includes all important M&A cases that happened since 2000—from 1st Jan 2000 to 31st Dec 2020. We delete deals between 2007 and 2009 to exclude the influence of the abnormal merges trend caused by the financial crisis. Data about M&A transactions can be gained from the Zephyr database. Specifically, this research only selects M&A deals with the following prosperities: (1) the M&A deal is completed, (2) the deal value is at least 1 million USD, (3) the acquirer initially holds less than 50% of the target firm and acquires more than 50% finally, (4) the deal has standard terms and does not contain option-like contingent claims, and (5) both targets and acquirers' ESG scores can be gained from the Thomson Reuters ASSET4 ESG database. This research also excludes all financial (SIC code 6000–6999) and utilities (SIC code 4000–4949) companies from the study sample because M&A activities are highly regulated in these industries (Edmans et al., 2012). We delete all deals that have one or more unavailable values for variables defined in Table 3, Panel A. 124 deals satisfy all the above requirements and are used as inputs in this research. Table 2 briefly summaries these deals, and documents that included detailed information are available on https://github.com/XUAN-FENG9/ESG_Tar-and-performance_Acq.

Table 2. Summary of deals.

Panel A: Sample composition by cross-border			
	Cross-border deals	Domestic deals	Total deals
Number of deals	23 (19%)	101 (81%)	124 (100%)
Panel B: Sample composition by cross-industry			
	Cross-industry deals	Intra-industry deals	Total deals
Number of deals	78 (63%)	46 (37%)	124 (100%)
Panel C: Sample composition by payment method			
	Cash deals	Non-cash deals	Total deals
Number of deals	66 (53%)	58 (47%)	124 (100%)
Panel D: Sample composition by year			
Year	Number of deals	Year	Number of deals
2001	0	2011	7
2002	0	2012	8
2003	1	2013	4
2004	0	2014	5
2005	0	2015	12
2006	0	2016	12
2007	0	2017	18
2008	0	2018	27
2009	0	2019	26
2010	1	2020	3
Total deals			124 (100%)

3.2. Variable description

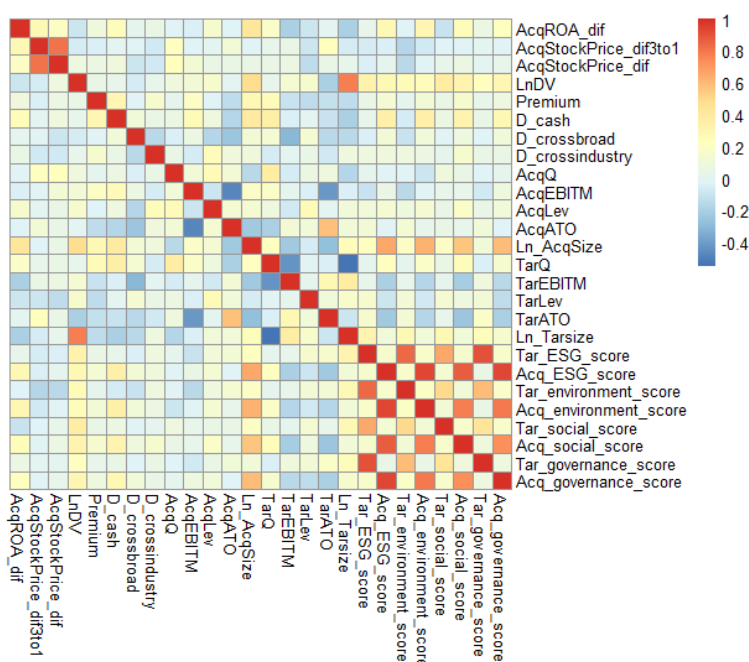


Figure 1. Correlation-coefficient map among variables.

Table 3, Panel A details all the variables used in this research. Their statistics are summarized in Panel B.

Table 3. Summary of variables.

Panel A: Variable definitions	
Dependent variable	
$\Delta ROAAcq$	Acquirer's ROA percentage change the year before and after the deal. The percentage change is calculated as $(\Delta ROAAcq_t / \Delta ROAAcq_{t-1}) - 1$
$\Delta StockPrice_{-3to1}$	Acquirer's stock price percentage change from 3 months before announcement to 1 month after completion
$\Delta StockPrice$	Acquirer's stock price percentage change the day before announcement and the day after completion
Independent variable	
ESGTar	The ESG score of the target company
ESGAcq	The ESG score of the acquirer
Control variables reflecting characteristics of M&A deals (X)	
LnDV	Nature logarithm of deal value
Premium	Bid premium at the announce date (1 plus percentage premium)
D_Cash	A dummy variable that equals 1 for pure cash-deals, and 0 for others
D_Crossbrd	A dummy variable that equals 1 if the acquirer and target are not in the same country, and 0 otherwise
D_Crossind	A dummy variable that equals 1 if the acquirer and target are not in the same industry (based on the SIC code), and 0 otherwise
Control variables reflecting characteristics of acquirers (A)	
AcqQ	Tobin's Q of the acquirer
AcqEBITM	Acquirer's operating margin—EBIT/sales revenue
AcqLev	Acquirer's leverage ratio—debt/asset
AcqATO	Acquirer's asset turnover—sales/asset
Ln_AcqSize	Nature logarithm of acquirer's total asset (in million)
Control variables reflecting characteristics of targets (T)	
TarQ	Tobin's Q of the target firm
TarEBITM	Target's operating margin—EBIT/sales revenue
TarLev	Target's leverage ratio—debt/asset
TarATO	Target's asset turnover—sales/asset
Ln_TarSize	Nature logarithm of target's total asset (in million)
Interaction term reflecting acquirer's ESG level	
D_ESGAcq	1 if the acquirer is a high ESG acquirer (top 25%) and 0 if the acquirer is a low ESG acquirer (lowest 25%).
Instrumental variables affecting ESG of target firms	
AESGcty	Average total ESG score of a country
AESGInd	Average total ESG score of a three-digit SIC industry

Continued on next page

Panel B: Summary statistics						
Variable	mean	sd	median	min	max	range
Δ ROAAcq	-0.37	0.44	-0.38	-1.17	0.58	1.74
Δ StockPrice_-3to1	0.06	0.27	0.03	-0.65	1.19	1.84
Δ StockPrice	0.01	0.18	0.03	-0.57	0.48	1.05
LnDV	8.47	1.07	8.52	6.11	11.21	5.1
Premium	1.22	0.2	1.19	0.81	2.01	1.2
D_cash	0.53	0.5	1	0	1	1
D_crossbrd	0.19	0.39	0	0	1	1
D_crossind	0.63	0.49	1	0	1	1
AcqQ	2.13	0.95	1.88	0.62	5.64	5.02
AcqEBITM	0.17	0.11	0.16	0.01	0.41	0.4
AcqLev	0.58	0.18	0.57	0.12	1.15	1.03
AcqATO	0.72	0.49	0.62	0.05	2.82	2.77
Ln_AcqSize	9.48	1.47	9.41	5.77	12.71	6.94
TarQ	3.14	2.17	2.28	0.99	9.07	8.08
TarEBITM	-0.06	0.55	0.09	-2.08	0.34	2.42
TarLev	0.57	0.29	0.55	0.05	2.09	2.04
TarATO	0.74	0.52	0.67	0	2.73	2.73
Ln_Tarsize	7.65	1.32	7.72	4.28	10.61	6.33
Tar_ESG_score	40.91	13.82	40.14	9.91	77.35	67.44
Acq_ESG_score	55.17	17.51	55.01	18.41	89.2	70.79
Tar_environment_score	38.17	16.33	35.79	11.01	87.9	76.89
Acq_environment_score	54.26	20	55.55	11.21	93.12	81.91
Tar_social_score	44.27	14.79	43.59	10.92	93.7	82.78
Acq_social_score	58.4	18.02	59.04	15.98	91.58	75.6
Tar_governance_score	42.14	15.13	41.98	9.7	75.91	66.2
Acq_governance_score	54.18	18.06	54.4	15.33	87.49	72.16

This research uses two different proxies as the dependent variables to reflect the acquirers' performance change from different perspectives. The first one is an accounting proxy—the acquirers' Performance change from 1 year before the deal completion to 1 year later after the deal completion. The ROA is defined as EBIT divided by total asset in this research. Instead of the net income, the EBIT is used as the nominator of ROA because it is a more stable proxy for the return as the EBIT excludes the influence of deal characteristics on the acquirer's performance. For example, deals that are conducted by high-leverage LBO or deals in countries that charge high tax on income will lead to smaller net income for acquirers after the deal. But EBIT is not affected by these factors, and, therefore, ROA with EBIT as the nominator is a more suitable proxy to reflect acquirers' profitability. The second proxy—the stock price change from 3 months before the announcement to 1 month after the completion (Δ StockPrice_-3to1)—is from a perspective of financial markets. The stock price change Δ StockPrice_-3to1 is highly positively related to the stock price change from the day before the announcement to the day after the completion (Δ StockPrice). For the independent variables, a company's ESG score is chosen as the arithmetic mean of its available ESG scores from 2000 to the year before the announcement year. The ESG scores (DS Datatype: TRESGS) is directly available at

the Thomson Reuters' Asset 4 database, in which a company's ESG score is defined as the overall company score based on the self-reported information in the environmental, social, and corporate governance pillars. We choose the average score before the announcement year, rather than the completion year, to exclude the abnormal ESG changes led by expected M&A activities. Another reason for using the historical average ESG score is that the ESG scores before the announcement year are not available for many companies, even though they have ESG scores years before the announcement year. Control variables that reflect characteristics of a deal include the deal size, the deal premium, the deal payment methods (cash or others), geographic information (cross-border deal or domestic deal), and industry information (cross-industry deal or inter-industry deal). For control variables reflecting firm characteristics (A for acquirers and T for targets), this research uses financial data one year before the deal announcement. These control variables reflect the firm from five different perspectives. Tobin's Q value can reflect whether the firm is overvalued or undervalued in the market. The Debt-to-Asset ratio is a proxy for the firm's financial leverage. The asset-turnover ratio is an indicator of a firm's efficiency to generate revenue from its asset. And the EBIT margin measures a firm's efficiency of operation and its capability to transfer sales revenue to profit. This research also includes the natural log value of the total asset to represent the firm size. There are no significant correlations among all independent and control variables, as shown in **Figure 1**. For further regression models, all continuous inputs are winsorized at 5% and 95% levels.

4. Methodology

Firstly, based on the study of Arouri et al. (2019), this research builds a benchmark model in **section 4.1** by regressing the change of acquirers' performance against the target companies' ESG scores, the acquirers' ESG scores, and a set of control variables that reflect the characteristics of the deal, target firm, and acquirers. Different from the research of Arouri et al. (2019) that explores the impact on M&A uncertainty, this research mainly focuses on investigating the potential impacts of target companies' sustainability level on acquirers' post-M&A performances.

Furthermore, this research builds two interaction regression models to study the impact of acquirers' own ESG level on the causal effect from targets' ESG to acquirers' performance change. As presented in **section 4.2**, the first model considers the impact of targets' ESG score to acquirers' performance change as a linear function of acquirers' ESG score. As presented in **section 4.3**, the second model is devoted to exploring whether the causal effect's extent significantly differs between high-ESG acquirers and low-ESG acquirers. The acquirers can be sorted into two groups by introducing a dummy variable that equals 1 for high-ESG acquirers and 0 for low-ESG acquirers.

4.1. Model 1—The benchmark model

This research begins with a benchmark model without considering the impact of acquirers' ESG scores. The benchmark model can be written as:

$$\Delta Performance_i = \alpha + \beta_1 ESGTar_i + \beta_2 ESGAcq_i + \beta_4 T_i + \beta_5 A_i + \beta_6 X_i \quad (1)$$

$$+ f_T + f_C + f_I + \varepsilon_i$$

where the subscript i represents the identity of deals. $\Delta Performance$ is the change of acquirers' performance defined in **Table 3**. This research runs the regressions separately based on two proxies of

performance change—ROA change (one year before to one year after the announcement) and the stock price change (3 months before the announcement to one month after the completion). α – the intercept of this model—is meaningless because, in reality, all control variables cannot be zero at the same time. $ESGTar_i$ and $ESGAcq_i$ are the initial observed ESG score of targets and acquirers, separately. As defined in **section 4**, A_i is a set of control variables that reflect the acquirer’s characteristics, X_i is a set of control variables that represent characteristics relative to the deal, and T_i represents control variables that represent the characteristics of the target company. f_T , f_C , and f_I are fixed effects of time, country and industry, separately.

4.2. Model 2—Considering the coefficient β_1 as a linear function of acquirer’s ESG

Then this research considers the impact of targets’ ESG on acquirers’ performance change as a simple linear function of the acquirers’ ESG score. In the first step, this research builds an interaction term—the product of $ESGAcq_i$ and $ESGTar_i$. This interaction term in **Equation (2)** is meaningful by considering that merging a target company can have different impacts on post-M&A performance among acquirers with different ESG levels. This interaction regression is presented as:

$$\Delta Performance_i = \alpha + \beta_1 ESGTar_i + \beta_2 ESGAcq_i + \beta_3 ESGAcq_i \times ESGTar_i + \beta_4 T_i + \beta_5 A_i + \beta_6 X_i + f_T + f_C + f_I + \varepsilon_i \quad (2)$$

The **Equation (2)** can also be written as **Equation (3)**:

$$\Delta Performance_i = \alpha + (\beta_1 + \beta_3 ESGAcq_i) \times ESGTar_i + \beta_2 ESGAcq_i + \beta_4 T_i + \beta_5 A_i + \beta_6 X_i + f_T + f_C + f_I + \varepsilon_i \quad (3)$$

where the overall coefficient of target’s ESG score ($ESGTar_i$) is comprised of two parts—a constant (β_1) and another term that is determined by acquirer’s ESG score ($\beta_3 \times ESGAcq_i$). β_1 is the effect of targets’ ESG on acquirers’ performance change when the acquirers’ ESG score is zero. β_3 measures the impact of acquirer’s ESG score on the overall coefficient of target’s ESG score, i.e., the incremental impact of targets’ ESG on acquirers’ performance change when the acquirers’ ESG score increases by 1. So, the overall impact of target’s ESG score on the acquirer’s performance change is presented as $\beta_1 + \beta_3 ESGAcq_i$. As defined in **section 3**, A_i is a set of control variables that reflect the acquirer’s characteristics, X_i is a set of control variables that represent characteristics relative to the deal, and T_i represents control variables that represent the characteristics of the target company. f_T , f_C , and f_I are fixed effects of time, country and industry, separately.

4.3. Model 3—Sorting acquirers into high-ESG and low-ESG groups

The ESG level of acquirers can have an influence on the impact of targets’ ESG level on acquirers’ performance change after deals. The coefficient β_3 in **Equations (2)–(3)** is devoted to reflecting this impact, but the **Equations (2)–(3)** in the last step are based on all deals and do not directly distinguish the different effect of targets’ ESG level on acquirers’ performance change between high and low ESG acquirers. The overall coefficient ($\beta_1 + \beta_3 ESGAcq_i$) in **Equations (2)–(3)** implies a linear relationship between the acquirer’s ESG score and the overall coefficient/impact of the target’s ESG level. However, this linear increase relationship may not hold true in practice. To study the influence of the acquirer’s own

ESG score but release the strict assumption of linear relationship, this model explores the different impact of the target's ESG on two opposite acquirer groups (high-ESG acquirers and low-ESG ones). These two groups should have an obvious difference in their ESG scores. Therefore, this model only selects deals in which the acquires' total ESG scores are ranked in the top 25% and the lowest 25% among all acquirers. Acquirers that ranked in the top 25% are defined as high ESG acquirers, and those ranked in the lowest 25% are called low ESG acquirers. A dummy variable— D_ESGAcq_i is created to distinguish the acquirers based on their overall ESG levels. D_ESGAcq_i equals 1 if the acquirer is a high ESG acquirer and equals 0 if the acquirer is a low ESG acquirer. The product of this dummy variable and the target's ESG score is used as an interaction term to distinguish the impact of the target's ESG score on performance change between high-ESG and low-ESG acquirers. This model can be presented as:

$$\Delta Performance_i = \alpha + \beta_1 ESGTar_i + \beta_2 D_ESGAcq_i + \beta_3 ESGTar_i \times D_ESGAcq_i + \beta_4 T_i + \beta_5 A_i + \beta_6 X_i + f_T + f_C + f_I + \varepsilon_i \quad (4)$$

The **Equation (4)** can also be written as **Equation (5)**:

$$\begin{aligned} \Delta Performance_i &= \alpha + (\beta_1 + \beta_3 D_ESGAcq_i) \times ESGTar_i + \beta_2 D_ESGAcq_i \\ &+ \beta_4 T_i + \beta_5 A_i + \beta_6 X_i + f_T + f_C + f_I + \varepsilon_i \end{aligned} \quad (5)$$

where in **Equations (4)–(5)**, the D_ESGAcq_i replaces the $ESGAcq_i$ in **Equations (2)–(3)** to reflect the acquirers' difference in terms of their ESG level. For low-ESG acquirers, D_ESGAcq_i equals 0, and the coefficient β_1 reflects the the impact of targets' ESG level on the acquirers' performance change. For high-ESG acquirers, the impact of targets' ESG on acquirers' performance change is reflected by the sum $\beta_1 + \beta_3$, because the D_ESGAcq_i equals 1. As defined in **section 3**, T_i , A_i , X_i represents control variables that represent the characteristics of the target company, acquirer, and the deal separately. f_T , f_C , and f_I are fixed effects of time, country and industry, separately.

5. Numerical analysis

This section discusses the main results gained from **Equations (1)–(5)**. The output of the fundamental OLS regression is first presented in **Table 4**. Then **Table 5** records the result of the regression that considers the coefficient of the target's ESG score as a linear function of the acquirer's ESG score. **Table 6** presents the result of the regression that introduces an interaction term to sort the acquirers into two groups (high-ESG and low-ESG acquirers).

All the regression models in this research are run on the R Studio environment. An Intel Core i5-8250U CPU (1.60 GHz) laptop with 8 GB RAM is applied for carrying out all the computations.

5.1. The benchmark model

Table 4 presents the result of **Equation (1)**—the fundamental OLS regression model. The result shows that targets' ESG scores do not have a significant influence on acquirers' post-M&A ROA or stock price change at 95% confidence level, a result that denies the *hypotheses 1a and 1b*. This result is also contradictory to the conclusion of most previous scholars such as Salvi et al. (2018), who found that acquirers could increase their ROA after deals by merging “green” targets. This discrepancy can be attributed to three possible reasons. The first reason is that merging a high-ESG target has opposite

influences on low and high ESG-level acquirers. The opposite influences are offset in the OLS regression based on all deals, so the coefficient of the target's ESG score is not significant. Whether the opposite influences exist are explored in the third model that runs the regression on low-ESG and high-ESG acquirer groups separately. The second reason may be the data limitation. This research only collects 124 deals, and the study of Salvi et al. (2018) is based on 171 deals. Such small databases can not support a stable and reliable conclusion. So, the discrepancy between this research and previous studies may be attributed to random errors. The third reason is that different ESG proxies may lead to conflicting ESG scores for a company. In this research, firms' ESG score is calculated as the average ESG scores before deals, and the ESG scores are gained from the Thomson Reuters ASSET4 ESG database. Salvi et al. (2018) define a firm's ESG level according to its industry attributes (green industry or sin industry). There are also other ESG databases such as the MSCI (Formerly KLD). As Gibson et al. (2021) studied, seven different data providers have considerable disagreements on ESG ratings. Therefore, the discrepancy of the result of this research and previous studies may be attributed to the variance of methods used to measure firms' ESG level.

Table 4. Target's ESG and acquirer's performance change (fundamental OLS regression).

	Dependent variable	
	Acquirer ROA % change (-1 year to +1 year)	Acquirer stock-price % change (-3 month to +1 month)
Constant	-1.979 (-1.601)	-0.518 (-0.710)
Target ESG score	0.010 (1.539)	-0.004 (-1.047)
Acquiror ESG score	-0.008 (-1.361)	-0.004 (-1.032)
Ln_DV	-0.262 (1.279)	-0.012 (-0.099)
Premium	-0.399 (-0.927)	-0.163 (0.644)
D_cash	-0.146 (-0.967)	-0.037 (-0.411)
D_Crossbrd	0.824** (2.211)	0.492** (2.238)
D_Crossind	-0.179 (-1.192)	0.169* (1.903)
AcqQ	0.002 (0.024)	-0.015 (-0.365)
AcqEBITM	-0.276 (-0.392)	-0.006 (-0.015)
AcqLev	-0.759 (-1.397)	-0.029 (-0.090)

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	Dependent variable	
	Acquirer ROA % change (-1 year to +1 year)	Acquirer stock-price % change (-3 month to +1 month)
AcqATO	0.148 (0.771)	-0.004 (-0.032)
Ln_AcqSize	0.143* (1.837)	-0.065 (-1.424)
TarQ	0.129* (1.763)	-0.003 (-0.065)
TarEBITM	0.052 (0.316)	0.057 (0.589)
TarLev	-0.042 (-0.172)	-0.049 (-0.344)
TarATO	-0.425 (-1.114)	0.113 (0.504)
Ln_TarSize	0.127 (0.662)	0.068 (0.599)
Year fixed-effects	Yes	Yes
Country fixed-effects	Yes	Yes
Industry fixed-effects	Yes	Yes
Observations	124	124
Adjusted R ²	0.368	0.426
p-value of NCV test	0.161	0.618

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we cannot reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

5.2. Considering the coefficient β_1 as a linear function of acquirer's ESG

Table 5 presents the result of the regression that consider the overall impact of the target's ESG score on the acquirer's performance change as a linear function of the acquirer's ESG score. The coefficient of the interaction term (β_3) is not significant at the 95% confidence level. So, the *hypotheses 2a and 2b* cannot be held, i.e., there is not a significant linear relationship between the overall impact of the target's ESG score and the acquirer's ESG score. From this result, we cannot clearly recognize the influence of the acquirer's own ESG level. Besides, the coefficient of the target's ESG score in **Table 5** is also insignificant. This result is consistent with the conclusion gained from **Table 4**—the targets' ESG scores do not have a significant influence on acquirers' post-M&A ROA or stock price change. Similar to the coefficient of the target's ESG score in the first OLS regression model, these insignificant coefficients in this regression can also be classified into the three potential reasons: random errors due to data limitation, ESG-proxy selection bias, and the non-linear relationship.

Table 5. Target's ESG and acquirer's performance change (Model 2—Considering the coefficient β_1 as a linear function of acquirer' ESG).

	Dependent variable	
	Acquirer ROA % change (-1 year to +1 year)	Acquirer stock-price % change (-3 month to +1 month)
Constant	-0.945 (-0.663)	-0.222 (-0.257)
Target ESG score	-0.018 (-0.839)	-0.012 (-0.945)
Acquiror ESG score	-0.031* (-1.769)	-0.010 (-0.955)
TarESG×AcqESG	0.000 (1.392)	0.000 (0.656)
Ln_DV	-0.333 (-1.603)	-0.032 (-0.256)
Premium	-0.573 (-1.299)	0.114 (0.425)
D_cash	-0.122 (-0.817)	-0.030 (-0.328)
D_Crossbrd	0.894** (2.416)	0.512** (2.283)
D_Crossind	-0.182 (-1.234)	0.168* (1.873)
AcqQ	-0.003 (-0.045)	-0.017 (-0.394)
AcqEBITM	-0.353 (-0.508)	-0.028 (-0.067)
AcqLev	-0.761 (-1.424)	-0.029 (-0.091)
AcqATO	0.130 (0.687)	-0.009 (-0.076)
Ln_AcqSize	0.173** (2.183)	-0.056 (-1.170)
TarQ	0.155** (2.078)	0.004 (0.097)
TarEBITM	0.015 (0.093)	0.047 (0.470)
TarLev	-0.189 (-0.726)	-0.091 (-0.578)
TarATO	-0.288 (-0.742)	0.153 (0.649)

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	Dependent variable	
	Acquirer ROA % change (−1 year to +1 year)	Acquirer stock-price % change (−3 month to +1 month)
Ln_TarSize	0.213 (1.075)	0.092 (0.768)
Year fixed-effects	Yes	Yes
Country fixed-effects	Yes	Yes
Industry fixed-effects	Yes	Yes
Observations	124	124
Adjusted R ²	0.389	0.414
p-value of NCV test	0.107	0.423

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we cannot reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

5.3. Sorting acquirers into high-ESG and low-ESG groups

However, the result is different if we release the linear relationship assumption and consider the influence of acquirers' ESG scores by running regressions for low-ESG acquirers and high-ESG acquirers separately. As defined in **Equations (4)–(5)**, acquirers are separated into high-ESG and low-ESG groups before M&A deals by introducing an interaction term—the product of targets' ESG scores and the acquirers' property according to their pre-M&A ESG level (a dummy variable separating acquirers into high-ESG and low-ESG groups). As presented in **Table 6**, the result shows that the targets' ESG score has a significant impact (at 90% confidence level) on acquirers' post-M&A ROA change, but not on their post-M&A stock price change. The direction of this impact varies between high-ESG acquirers and low-ESG acquirers. For low-ESG acquirers, the coefficient that measures the extent of this impact is β_1 , which equals 0.01 (1%). This value shows that, for low-ESG acquirers, if the target's ESG score increases 1 unit, the acquirer's ROA change will decrease 1%. The decrease of acquirers' ROA change also means the decrease of acquirers' ROA. In this research, most acquirers' ROA changes are negative (as shown in **Table 3**, the mean value of the ROA change is −37%), so the decrease of ROA change implies that the ROA change becomes more 'negative', i.e., the acquirer's ROA decreases. But the increase of targets' ESG score has a positive impact on high-ESG acquirers. This impact is measured by $\beta_1 + \beta_3$, which equals 1.3% (−0.01+0.023), as presented in **Table 6**. This value shows that if the target's ESG score increases 1 unit, the ROA change of a high-ESG acquirer will increase 1.3% (absolute value) after the M&A deal. The increase of acquirers' ROA change also means the increase of acquirers' ROA.

The result—the target's ESG score has a positive impact on high-ESG acquirers' ROA but a negative impact on low-ESG acquirers' ROA—is just opposite to *hypothesis 3a* and previous studies such as Salvi et al. (2018). Previous researchers found that a high-ESG target can increase the ROA of both high and low ESG acquirers, but this research concludes that the increase of the target's ESG score has the opposite impacts on these two kinds of acquirers. This discrepancy can be potentially explained by the short-term cost of integration that is not considered in previous studies. In this research, the acquirer's ROA change is measured from a short-term period perspective—the difference

of ROA one year before the announcement and one year after the completion. In the short term, high-ESG acquirers can integrate with high-ESG targets more efficiently than low-ESG peers because they have similar ESG-oriented corporate cultures, strategic goals, and governance organizations. As implied by the negative ROA change (ROA decrease) for all deals in this research database, the cost of integration cost cannot be avoided after M&A deals, and this integration cost can lead to the short-term decrease of acquirers' ROA. However, in the short term, high-ESG acquirers will cost less and decrease less in their ROA after acquiring a similar high-ESG target than low-ESG acquirers do. This difference is especially significant in the short term because there will be no more integration costs after completing the integration. For low-ESG acquirers, the benefit of acquiring a high-ESG target that may lead to ROA increase can only be observed in the long term when the integration is completed. The long-term ROA increase is found by previous scholars, such as Salvi et al. (2018), who studied the acquirer's ROA change several years after the completion of M&A deals.

Even though this method sorts acquirers into high-ESG and low-ESG groups, the impact of the target's ESG score on the acquirer's stock-price change is not significant, and the *hypothesis 3b* cannot be verified. One main possible reason is that the considerable stock-price volatility brings lots of noise into the regression models. The stock price has greater volatility (daily change) than accounting indexes such as ROA, which is measured annually. So, in order to study the impact on acquirers' stock-price change, future researches should monitor each day's stock price during a broader period, rather than just select the stock prices at two points—the day 3 months before the deal and the day 1 month after the deal, as this research does.

The result in **Table 6** can also explain why the fundamental model (**Equation 1**, result shown in **Table 4**) and linear relationship model (**Equations 2–3**, result shown in **Table 5**) do not show a significant impact of targets' ESG score on acquirers' post-M&A ROA change. The targets' ESG score has opposite impacts on high-ESG and low-ESG acquirers, but both these two models do not distinguish acquirers according to their pre-M&A ESG level. If pooling all acquirers together in the regression, the overall coefficient/impact of targets' ESG score is not significant because the negative impact on low-ESG acquirers offsets the positive impact on high-ESG acquirers.

Table 6. Target's ESG and acquirer's performance change (Model 3—Sorting acquirers into high-ESG and low-ESG groups).

	Dependent variable	
	Acquirer ROA % change (-1 year to +1 year)	Acquirer stock-price % change (-3 month to +1 month)
Constant	-1.91*** (-2.889)	-0.736 (-1,259)
Target ESG score	-0.01* (-1.792)	-0.004 (-0.688)
D_ESGAcq	-1.15*** (-2.906)	-0.517 (-1.468)
TarESG×D_ESGAcq	0.023** (2.723)	0.007 (0.952)

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	Dependent variable	
	Acquirer ROA % change	Acquirer stock-price % change
	(-1 year to +1 year)	(-3 month to +1 month)
Ln_DV	0.055 (0.250)	0.144 (0.739)
Premium	-0.122 (-0.457)	-0.311 (-0.263)
D_cash	0.123 (0.922)	-0.031 (-0.263)
D_Crossbrd	0.180 (1.419)	-0.005 (-0.040)
D_Crossind	-0.066 (-0.685)	-0.002 (-0.022)
AcqQ	0.100 (1.134)	0.157* (2.007)
AcqEBITM	-0.506 (-0.858)	0.455 (0.872)
AcqLev	0.397 (1.254)	0.225 (0.803)
AcqATO	0.117 (0.700)	-0.017 (-0.114)
Ln_AcqSize	0.247*** (3.983)	0.060 (1.098)
TarQ	-0.046 (-0.727)	-0.043 (-0.763)
TarEBITM	-0.061 (-0.524)	-0.032 (-0.305)
TarLev	-0.271 (-1.469)	-0.324* (-1.981)
TarATO	0.236 (1.636)	0.233* (1.820)
Ln_TarSize	0.147 (-0.772)	-0.127 (-0.747)
Year fixed-effects	Yes	Yes
Observations	63	63
Adjusted R ²	0.541	0.114
p-value of NCV test	0.668	0.139

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we cannot reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

6. Robustness analysis

6.1. Separate ESG scores

To explore whether the target's individual ESG scores have different impacts on the acquirer's performance change, this research also separately uses the environment score, the social score, and the governance score to replace the total ESG score in the fundamental OLS regression model. The Thomson Reuters' Asset 4 database records three indexes relative to environment (Resource Use Score, Emissions Score, and Environmental Innovation Score), four indexes relative to governance (Management Score, Shareholders Score, CSR Strategy Score, and Workforce Score), and three indexes relative to society (Human Rights Score, Community Score, and Product Responsibility Score). In this research, the environment score in each year is defined as the arithmetic mean of the three indexes relative to the environment topic in that year. The society score and the governance score in each year are defined in the same way. Like the total score, a company's environmental, social, or governance score is calculated as the average value of each score before the announcement year. The whole Thomson Reuters' Asset 4 ESG database is available at https://github.com/XUAN-FENG9/ESG_Tar-and-performance_Acq/blob/main/Original%20ESG%20database.xlsx.

As presented in **Table 7**, the result shows that each of the three separate scores of a target does not have a significant impact, as the target's total ESG score does. This result is in line with the coefficient matrix in **Figure 1**, which shows that the three separate scores are highly positive related to the total score. There is no need to explore the impacts of these individual scores in other models.

Table 7. Target's ESG and acquirer's ROA and stock price change.

Panel A: Dependent variable: Acquirer's ROA percentage change one year before and after the deal				
	(1)	(2)	(3)	(4)
	ESG	Environment	Society	Governance
Constant	-1.979 (-1.601)	-2.039 (-1.614)	-2.240 (-1.716)	-2.14 (-1.675)
Target ESG score	0.010 (1.539)			
Target Environment score		0.007 (1.348)		
Target Social score			0.007 (1.038)	
Target Governance score				0.006 (0.978)
Acquiror ESG score	-0.008 (-1.361)			
Acquirer Environment score		-0.005 (-0.937)		
Acquirer Social score			-0.004 (-0.670)	

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Panel A: Dependent variable: Acquirer's ROA percentage change one year before and after the deal				
	(1)	(2)	(3)	(4)
	ESG	Environment	Society	Governance
Ln_DV	-0.262 (1.279)	-0.233 (-1.113)	-0.268 (-1.252)	-0.233 (-1.103)
Premium	-0.399 (-0.927)	-0.286 (-0.670)	-0.304 (-0.699)	-0.317 (-0.716)
D_cash	-0.146 (-0.967)	-0.142 (-0.923)	-0.157 (-1.015)	-0.167 (-1.074)
D_Crossbrd	0.824** (2.211)	0.829** (2.124)	0.835** (2.120)	0.747* (1.977)
D_Crossind	-0.179 (-1.192)	-0.099 (-0.627)	-0.144 (-0.936)	-0.161 (-1.026)
AcqQ	0.002 (0.024)	0.007 (0.089)	0.033 (0.474)	0.030 (0.407)
AcqEBITM	-0.276 (-0.392)	-0.214 (-0.298)	0.044 (0.060)	-0.206 (-0.280)
AcqLev	-0.759 (-1.397)	-0.739 (-1.335)	-0.301 (-0.478)	-0.717 (-1.288)
AcqATO	0.148 (0.771)	0.089 (0.441)	0.045 (0.203)	0.159 (0.790)
Ln_AcqSize	0.143* (1.837)	0.115 (1.367)	0.125 (1.530)	0.154* (1.978)
TarQ	0.129* (1.763)	0.119 (1.579)	0.112 (1.507)	0.111 (1.478)
TarEBITM	0.052 (0.316)	-0.003 (-0.020)	0.022 (0.134)	0.042 (0.244)
TarLev	-0.042 (-0.172)	-0.043 (-0.174)	-0.075 (-0.309)	-0.101 (-0.407)
TarATO	-0.425 (-1.114)	-0.297 (-0.776)	-0.396 (-1.012)	-0.361 (-0.910)
Ln_TarSize	0.127 (0.662)	0.117 (0.600)	0.120 (0.612)	0.107 (0.544)
Year fixed-effects	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes	Yes
Observations	124	124	124	124
Adjusted R ²	0.368	0.343	0.332	0.322
p-value of NCV test	0.161	0.461	0.639	0.469

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Panel B: Dependent variable: Acquirer's stock-price percentage change from -3 month to +1 month				
	(1)	(2)	(3)	(4)
	ESG	Environment	Society	Governance
Constant	-0.518 (-0.710)	-0.574 (-0.789)	-0.527 (-0.678)	-0.445 (-0.615)
Target ESG score	-0.004 (-1.047)			
Target Environment score		-0.004 (-1.327)		
Target Social score			0.002 (0.664)	
Target Governance score				-0.002 (-0.616)
Acquiror ESG score	-0.004 (-1.032)			
Acquirer Environment score		-0.003 (-0.926)		
Acquirer Social score			-0.001 (-0.295)	
Acquirer Governance score				-0.004 (-1.492)
Ln_DV	-0.012 (-0.099)	-0.024 (-0.204)	-0.017 (-0.135)	-0.014 (0.120)
Premium	-0.163 (0.644)	0.175 (0.710)	0.086 (0.333)	0.113 (0.450)
D_cash	-0.037 (-0.411)	-0.051 (-0.579)	-0.036 (-0.388)	-0.037 (-0.426)
D_Crossbrd	0.492** (2.238)	0.437* (1.945)	0.609** (2.602)	0.536** (2.507)
D_Crossind	0.169* (1.903)	0.119 (1.317)	0.156* (1.708)	0.174* (1.956)
AcqQ	-0.015 (-0.365)	-0.025 (-0.586)	-0.033 (-0.788)	-0.011 (-0.265)
AcqEBITM	-0.006 (-0.015)	-0.024 (-0.059)	0.015 (0.033)	0.015 (0.037)
AcqLev	-0.029 (-0.090)	0.008 (0.025)	0.210 (0.561)	-0.034 (-0.108)
AcqATO	-0.004 (-0.032)	0.036 (0.308)	-0.045 (-0.338)	-0.010 (-0.090)
Ln_AcqSize	-0.065 (-1.424)	-0.053 (-1.103)	-0.103** (-2.119)	-0.070 (-1.584)
TarQ	-0.003 (-0.065)	0.005 (0.104)	0.002 (0.036)	-0.002 (-0.057)

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Panel B: Dependent variable: Acquirer's stock-price percentage change from -3 month to +1 month				
	(1)	(2)	(3)	(4)
	ESG	Environment	Society	Governance
TarEBITM	0.057 (0.589)	0.080 (0.845)	0.089 (0.900)	0.074 (0.764)
TarLev	-0.049 (-0.344)	-0.046 (-0.328)	0.006 (0.044)	-0.042 (-0.303)
TarATO	0.113 (0.504)	0.039 (0.176)	0.040 (0.172)	0.126 (0.564)
Ln_TarSize	0.068 (0.599)	0.067 (0.602)	0.054 (0.459)	0.067 (0.601)
Year fixed-effects	Yes	Yes	Yes	Yes
Country fixed-effects	Yes	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes	Yes
Observations	124	124	124	124
Adjusted R ²	0.426	0.432	0.384	0.434
p-value of NCV test	0.618	0.649	0.349	0.491

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we cannot reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

6.2. Only US deals

Despite considering the country effect, the regression models used in this research can be biased because the main analysis used only 124 deals as inputs—some countries' acquirers only joined one deal. Among the 124 deals, there are 95 (over two-thirds) all-US deals in which both the acquirer and the target are US firms. Therefore, we only consider these all-US deals in this step to further control the country effect. As presented in **Table 8**, the results are in line with the result of the main analysis based on all deal data. For US firms, the coefficient of the target's ESG score is not significant at the 95% confidence level under the OLS model, and this coefficient does not have a significant linear relationship with the acquirer's ESG level under model 2. However, the result of model 3 is more meaningful. Although both the low-ESG and high-ESG acquirers will suffer a short-term ROA decline after the M&A deal, a low-ESG acquirer will decrease 1.3% more in its ROA while a high-ESG US acquirer will decrease 1.5% ($-0.013+0.028$) less in its ROA if the target's ESG score increase by 1 unit. These results verify the findings in the main analysis of this research.

Table 8. Target's ESG and acquirer's ROA and stock price change for US deals.

Panel A: Dependent variable: Acquirer's ROA percentage change one year before and after the deal			
	(1)	(2)	(3)
	Model 1 (OLS)	Model 2	Model 3
Constant	-1.237 (-1.233)	-0.148 (-0.109)	-2.287*** (-4.354)
Target ESG score	0.006 (0.785)	-0.014 (-0.747)	-0.013** (-2.415)
Acquiror ESG score	-0.003 (-0.480)	-0.023 (-1.266)	
TarESG×AcqESG		0.000 (1.176)	
D_ESGAcq			-1.511*** (-4.175)
TarESG×D_ESGAcq			0.028*** (3.439)
Ln_DV	-0.230 (-1.330)	-0.305 (-1.670)	0.032 (0.192)
Premium	-0.070 (-0.166)	-0.338 (-0.716)	_0.007 (-0.033)
D_cash	-0.150 (-0.970)	-0.082 (-0.503)	0.311** (2.430)
D_Crossind	-0.174 (-1.247)	-0.193 (-1.389)	-0.167* (-1.848)
AcqQ	0.001 (0.018)	-0.015 (-0.214)	0.044 (0.616)
AcqEBITM	-0.030 (-0.049)	-0.210 (-0.337)	-0.827 (-1.353)
AcqLev	0.025 (0.045)	-0.124 (-0.217)	0.469* (1.729)
AcqATO	-0.087 (-0.413)	-0.098 (-0.471)	0.152 (1.044)
Ln_AcqSize	0.127 (1.552)	0.135 (1.659)	0.257*** (4.539)
TarQ	0.085 (1.222)	0.125 (-0.217)	-0.028 (-0.542)
TarEBITM	-0.036 (-0.199)	-0.005 (-0.027)	-0.409** (-2.814)
TarLev	-0.083 (-0.388)	-0.181 (-0.793)	-0.285 (-1.601)
TarATO	-0.238 (-0.580)	-0.237 (-0.583)	0.267** (2.308)

Continued on next page

Panel A: Dependent variable: Acquirer's ROA percentage change one year before and after the deal			
	(1)	(2)	(3)
	Model 1 (OLS)	Model 2	Model 3
Year fixed-effects	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes
Observations	95	95	48
Adjusted R ²	0.546	0.556	0.764
p-value of NCV test	0.391	0.286	0.146
Panel B: Dependent variable: Acquirer's stock-price percentage change from -3 month to +1 month			
	(1)	(2)	(3)
	Model 1 (OLS)	Model 2	Model 3
Constant	-0.452 (-0.741)	-0.137 (-0.161)	-1.070* (-1.729)
Target ESG score	-0.004 (-0.935)	-0.010 (-0.869)	-0.018** (-2.738)
Acquiror ESG score	-0.002 (-0.538)	-0.008 (-0.669)	
TarESG×AcqESG		0.000 (0.541)	
D_ESGAcq			-1.071** (-2.512)
TarESG×D_ESGAcq			0.018* (1.845)
Ln_DV	-0.068 (-0.649)	-0.090 (-0.784)	-0.054 (-0.279)
Premium	0.049 (0.192)	-0.029 (-0.097)	-0.192 (-0.757)
D_cash	-0.063 (-0.668)	-0.043 (-0.421)	-0.057 (-0.378)
D_Crossind	0.171* (2.014)	0.165* (1.895)	-0.196* (-1.848)
AcqQ	-0.019 (-0.439)	-0.024 (-0.528)	0.186** (2.189)
AcqEBITM	0.013 (0.034)	-0.039 (-0.101)	0.394 (0.547)
AcqLev	0.139 (0.407)	0.096 (0.268)	-0.194 (-0.606)
AcqATO	-0.067 (-0.528)	-0.071 (-0.542)	0.102 (0.595)
Ln_AcqSize	-0.039 (-0.782)	-0.037 (-0.720)	0.170** (2.547)
TarQ	0.015 (0.346)	0.026 (0.543)	0.006 (0.097)

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Panel B: Dependent variable: Acquirer's stock-price percentage change from -3 month to +1 month			
	(1)	(2)	(3)
	Model 1 (OLS)	Model 2	Model 3
TarLev	-0.007 (-0.050)	-0.035 (-0.243)	-0.283 (-1.351)
TarATO	0.158 (0.634)	0.159 (0.623)	0.257* (1.885)
Ln_TarSize	0.123 (1.229)	0.149 (1.318)	0.111 (0.606)
Year fixed-effects	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes
Observations	95	95	48
Adjusted R ²	0.562	0.024	0.259
p-value of NCV test	0.845	0.797	0.054

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we cannot reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

6.3. Endogeneity problem

In previous researches, the causal effect from targets' ESG score to acquirers' performance change may suffer endogeneity problems. The study of Salvi et al. (2018) is under skeptical because they only simply regressed the acquirer's performance change on the target's ESG, without considering the endogeneity problems that may be caused by (1) the reversal effect from the acquirer's expected performance change to the selected target's ESG score; (2) the omitted variables that may influence both the dependent and independent variable; (3) measurement errors (Edmans et al., 2012). The first endogeneity problem is the most remarkable because an acquirer may acquire a certain ESG-level target because it knows that this action will improve its performance (ROA or stock price) after the deal. Therefore, the commonly expected performance change of acquirers may determine the acquirers' desirable ESG scores of targets, and, in practice, acquirers choose to merge targets with ESG levels similar to what they want. This reversal influence weakens the explanation power of the causal relationship between targets' ESG score and acquirer's post-M&A performance change.

To enhance the result that it is the targets' ESG level that leads to the change of acquirers' performance change, this research constructs a two-stage least squares (2SLS) model by introducing two instrumental variables—the average ESG scores of the targets' industry ($AESGInd_i$) and the average ESG scores of the targets' country ($AESG Cty_i$), respectively. The use of these two instrumental variables is referred from Arouri et al. (2019). The two instrumental variables only determine the target company's ESG level but do not directly influence the performance change of acquirers (Arouri and Pijourlet, 2017; Gomes and Marsat, 2018).

For the first step, the target companies' ESG scores are regressed against the target's country average ESG scores, its industry average ESG score, and T_i —a set of control variables that reflect target firms' characteristics, as defined in **Section 3**. The regression model is presented in **Equation (6)**. And the regression result is recorded in column (1) in **Table 9**.

$$ESGTar_i^0 = \varphi + \gamma_1 AESGCty_i + \gamma_2 AESGCIInd_i + \gamma_3 T_i + \xi_i \quad (6)$$

where the $ESGTar_i^0$ represents the target-firms' observed ESG score. The residual term ξ_i can have non-zero correlation with the dependent variable or the residual term ε_i in **Equation (6)** if the endogeneity problems exist. Therefore, in the following second step, we use the fitted value \widehat{ESGTar}_i in **Equation (7)** as the independent variable to represent the ESG level of the target company.

$$\widehat{ESGTar}_i = \varphi + \gamma_1 AESGCty_i + \gamma_2 AESGCIInd_i + \gamma_3 T_i \quad (7)$$

Then in the second step, instead of the real ESG score of target companies, the fitted targets' ESG score – \widehat{ESGTar}_i – is used as the independent variable in the model 3 (**Equations (4)–(5)**) to mitigate the biases caused by endogeneity problems. The second-stage regression results are presented in column (2) in **Table 9**.

The result in **Table 9** is consistent with the main conclusion from the model 3. Although both the low-ESG and high-ESG acquirers will suffer a short-term ROA decline after the M&A deal, a low-ESG acquirer will decrease 1.5% more in its ROA while a high-ESG US acquirer will decrease 0.4% ($-0.015+0.019$) less in its ROA if the target's ESG score increase by 1 unit. The impact on ROA change is significant at 90% confidence level, but the impact on stock-price change is not significant. These results verify the findings in the main analysis of this research.

Table 9. Target's ESG and acquirer's ROA and stock price change (2SLS regression).

	(1)	(2)	
		ROA change	Stock price change
Constant	-90.664*** (-4.103)	-2.061** (-2.676)	-0.643 (-1.006)
Target ESG score (fitted)		-0.015* (-1.772)	0.008 (1.214)
AESGCty	0.964*** (2.850)		
AESGInd	1.070*** (5.003)		
D_ESGAcq	-1.611 (-0.389)	-1.083 (-1.583)	-0.083 (-0.147)
TarESG×D_ESGAcq	6.994 (1.317)	0.019* 1.755	-0.001 (-0.104)
Ln_DV	-4.489 (-0.725)	0.024 (0.095)	0.235 (1.144)
Premium	1.320 (0.172)	-0.016 (-0.055)	-0.303 (-1.267)
D_cash	-2.007 (-0.517)	0.086 (0.606)	-0.061 (-0.517)

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	(1)	(2)	
		ROA change	Stock price change
D_Crossbrd	0.486 (0.132)	0.141 (0.988)	-0.019 (-0.164)
D_Crossind	0.612 (0.215)	-0.046 (-0.440)	0.013 (0.156)
AcqQ	1.171 (0.459)	0.101 (1.069)	0.117 (1.497)
AcqEBITM	10.162 (0.593)	-0.450 (-0.689)	0.480 (0.887)
AcqLev	-13.940 (-1.531)	0.321 (0.905)	0.324 (1.101)
AcqATO	-1.027 (-0.210)	0.105 (0.566)	-0.017 (-0.109)
Ln_AcqSize	2.147 (1.243)	0.247 (3.693)	0.025 (0.452)
TarQ	2.389 (1.334)	-0.035 (-0.491)	-0.074 (-1.252)
TarEBITM	0.769 (0.220)	-0.086 (-0.664)	-0.004 (-0.040)
TarLev	-1.364 (-0.241)	-0.145 (-0.722)	-0.374** (-2.254)
TarATO	1.713 (0.412)	0.207 (1.362)	0.191 (1.513)
Ln_TarSize	6.994 (1.317)	-0.111 (-0.509)	-0.237 (-1.317)
Year fixed-effects	Yes	Yes	Yes
Observations	63	63	63
Adjusted R ²	0.523	0.482	0.123
p-value of NCV test	0.678	0.318	0.235

Note: All continuous variables are winsorized at the 5% and 95% level. T-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The NCV (non-constant-variance) test is used to test whether heteroscedasticity exists. If the p-value of NCV test is greater than 0.05, we can not reject the null hypothesis that the variance of the residual constantly equals to zero, i.e., the heteroscedasticity does not significantly exist.

7. Conclusions

The topic of this research is to explore the impact of the target's ESG score on the acquirer's post-M&A ROA change and stock price change. This impact is studied through a set of regression models (regress the acquirer's performance change against the target's ESG score and a set of control variables). As most previous researches did, this study firstly runs a simple OLS regression model, and the result shows that there is no significant impact of the target's ESG score on the acquirer's performance (ROA and stock price) change. Then this research contributes to the current literature by, for the first time, studying how the acquirer's pre-M&A ESG level can influence the impact of the target's ESG score on

the acquirer's performance change. This influence is studied through two methods. The first method is to consider the coefficient/impact of the target's ESG score on the acquirer's performance changes (ROA change and stock price change) as a linear function of the acquirer's pre-M&A ESG score. The result of this method shows that there is not a significant linear relationship between these two variables. The second method is to measure the impact of the target's ESG score on the acquirer's performance change for high-ESG acquirers and low-ESG acquirers separately. The result of this method shows that the increase of the target's ESG score will deteriorate the ROA of low-ESG acquirers but benefit the ROA of high-ESG acquirers at 95% confidence level and that the influence on acquirers' stock price change is not significant. This result is opposite to the conclusion of previous scholars such as Franklin (2019) and Liang and Renneboog (2017), who found that the performance of high-ESG acquirers increased less than the performance of low-ESG acquirers. In this research, the input database for all regression models is comprised of 124 international M&A deals that happened during the last two decades. All acquirers and targets in these deals are list companies whose financial information is collected from the Zephyr database and ESG scores from the Thomson Reuters ASSET4 ESG database.

The findings of this study provide some valuable implications to real business practices. Bidders should consider their own ESG levels before making M&A decisions. Although it is reasonable to think that acquiring a target with good ESG performance is conducive to improve the acquirer's public image and mitigate its compliance risk, the stereotype 'the higher target's ESG, the better' is inaccessible and even harmful to acquirers. When acquiring a high-ESG target, a bidder should evaluate and balance both the benefit of the target's good ESG performance and the potential cost of integration due to the differences in corporate system and strategic goals. Low-ESG firms and high-ESG peers usually have different corporate policies, strategic goals, cultures, and organizational structures. A bidder should carefully consider these differences caused by ESG variation when evaluating a potential target firm.

This research is subject to a set of limitations in need of further investigation. Firstly, this research studies the impact of the target's ESG score on the acquirer's short-term performance change without considering the long-term influences. Although this study finds that acquiring a high-ESG target can deteriorate a low-ESG acquirer's short-term ROA (in one year), it is reasonable to think that such a situation may reverse in the long-term when the acquirer makes enough adjustments to finish the strategic and cultural integration. It is interesting to verify this long-term impact in future researches. Secondly, this research only uses acquirers' short-term ROA and stock price changes as proxies for their performance change. But only considering these two indexes is far from sufficient for an acquirer to make M&A decisions. Therefore, it is attractive for future scholars to study the impact of targets' ESG level on acquirers from other perspectives such as risk, bid premium, and credit rating. It is also interesting to study whether a potential target company can have a higher valuation by improving its ESG score before M&A. Thirdly, in this research, all firms' ESG scores are gained from the Thomson Reuters ASSET4 ESG database. But the proxy used to represent the ESG level/score varies across different rating agencies. This variation may lead to estimation biases, and, therefore, further scholars are encouraged to find a method that can better reflect the real ESG level of a firm. Last but most important, the database available for this research is small. This research only gathered 124 deals in which both the acquirer and the target are listed companies and have available ESG score before M&A. Results based on such a small database may be biased and do not have sound persuasion. In order to verify the results of this study, further researches are recommended to repeat the method in this research but based on a larger deals database if available. Besides, because the available data volume is limited,

this research does not explore the different impacts on acquirers across different regions/economic entities. Most of the deals used in this research come from the US market. In further researches, it is worthwhile to study M&A deals in various economic entities separately. The separate impacts are worth exploring because the impact of ESG practices on M&A deals may vary because the economic properties – such as legal systems, social preferences, and institutional arrangements – differ among US, European, and emerging markets (Liang and Renneboog, 2017). Moreover, it is also interesting to investigate the impact on acquirers that are not public firms. The result may vary because private companies usually face less regulation and stakeholder engagement than public firms. But it is very challenging to obtain data of non-public firms.

8. Ethical considerations

Research ethics is highly essential in research. Although primary researches are supposed to follow more ethics, secondary researches are subject to rigorous ethics as well. The research process of the project obeys all the ethical rules and principles that secondary researches must follow. This research is based on secondary data mainly collected from the Zephyr and Thomson Reuters ASSET4 ESG databases. These sources are all public and freely accessible through the online Erasmus University library. The data in this research only hold information about the data, are correctly cited with references, and do not expose any personal details. This research does not contain any confidential data, and the “Data Protection Act of 1998” is maintained in the data collection process. This research conducts the data analysis mainly through programming tools such as R and Python. Advanced models are established according to statistical theories described in this research. The output of this research will be in a dissertation style, and the APA citation style will be maintained in the whole paper. Overall, this research has followed all the business research rules and gives a clear view to readers.

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Conflicts of interest

The author declares no conflict of interest.

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