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**ESG SCORES AND FIRMS FINANCIAL
PERFORMANCE**

Tatsi Eleni (AM 2253)

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**ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ
ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ, ΕΠΙΧΕΙΡΗΜΑΤΙΚΩΝ & ΔΙΕΘΝΩΝ ΣΠΟΥΔΩΝ
ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ**

**ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ
«ΒΙΟΟΙΚΟΝΟΜΙΑ, ΚΥΚΛΙΚΗ ΟΙΚΟΝΟΜΙΑ & ΒΙΩΣΙΜΗ
ΑΝΑΠΤΥΞΗ»**

**ESG SCORES ΚΑΙ ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗ
ΑΠΟΔΟΤΙΚΟΤΗΤΑ ΕΠΙΧΕΙΡΗΣΕΩΝ**

Τάτση Ελένη (ΑΜ 2253)

Πειραιάς, Ελλάδα, Νοέμβριος 2024



ΤΜΗΜΑ
ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

ΒΕΒΑΙΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

«Δηλώνω υπεύθυνα ότι το έργο που εκπονήθηκε και παρουσιάζεται στην υποβαλλόμενη διπλωματική εργασία, για τη λήψη του μεταπτυχιακού τίτλου σπουδών, στη «*Βιοοικονομία, Κυκλική Οικονομία και Βιώσιμη Ανάπτυξη*» με τίτλο:

“ESG SCORES ΚΑΙ ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗ ΑΠΟΔΟΤΙΚΟΤΗΤΑ ΕΠΙΧΕΙΡΗΣΕΩΝ”

έχει γραφτεί από εμένα αποκλειστικά στο σύνολό της. Δεν έχει υποβληθεί ούτε εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού προγράμματος ή προπτυχιακού τίτλου σπουδών στην Ελλάδα ή στο εξωτερικό, ούτε είναι εργασία ή τμήμα εργασίας ακαδημαϊκού ή επαγγελματικού χαρακτήρα.

Δηλώνω επίσης υπεύθυνα ότι οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης εργασίας αναφέρονται στο σύνολό τους, κάνοντάς πλήρη αναφορά στους συγγραφείς, τον εκδοτικό οίκο ή το περιοδικό, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο. Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου.»

Υπογραφή Μεταπτυχιακού Φοιτητή

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Ονοματεπώνυμο

ΤΑΤΣΗ ΕΛΕΝΗ

Ευχαριστίες

Με την παρούσα Διπλωματική εργασία ολοκληρώνονται οι Σπουδές μου στο Τμήμα Βιοοικονομίας, Κυκλικής Οικονομίας και Βιώσιμης Ανάπτυξης του τμήματος Οικονομικής Επιστήμης Πανεπιστημίου Πειραιώς.

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ESG Scores and Firms Financial Performance

Keywords: Non-financial performance, Financial performance, ESG Scores, Accounting Performance Measures, Market Performance Measures

Abstract

In the context of this dissertation the effect of non-financial performance, as measured by well-known ESG scores, on financial performance, measured by several accounting and market measures, were examined. For this purpose, a panel data initial sample of 466 firms from Germany and 372 firms from Italy for the period 2010-2022 was used, came from almost all economic industries and sectors, excluding the financial industry. Employing appropriate econometric methodology, results were as follows:

For German firms, non-financial performance effect on financial performance was mainly found non-linear U scheme. Therefore, German firms with very low or very high non-financial performance (very low or very high ESG and related scores) tend to enjoy a high level of financial performance. On the contrary, German firms with a medium level of non-financial performance tend to have a low level of financial performance. Based on turning points, for ESG and related scores ranged from 41-66 the level of financial performance measures is minimized, implying that non-financial performance effect on financial performance is negative and above these scores turn into positive, confirming research hypothesis H5 which accounts for a long-term beneficial effect of non-financial performance. For Italian firms, non-financial performance effect was mainly found insignificant, confirming research hypothesis H3 which accounts for irrelevance theory.

ESG Scores και Χρηματοοικονομική Αποδοτικότητα Επιχειρήσεων

Σημαντικοί Όροι: Μη-χρηματοοικονομική Αποδοτικότητα, Χρηματοοικονομική Αποδοτικότητα, ESG Scores, Λογιστικά Μέτρα Αποδοτικότητας, Αγοραία Μέτρα Αποδοτικότητας

Περίληψη

Στο πλαίσιο της παρούσας διπλωματικής εργασίας εξετάζεται η επίδραση της μη-χρηματοοικονομικής αποδοτικότητας, όπως μετράται με τα γνωστά ESG scores, πάνω στη χρηματοοικονομική αποδοτικότητα η οποία μετράται από διάφορα λογιστικά και αγοραία μέτρα. Για αυτό το σκοπό συγκεντρώθηκε ένα δείγμα δεδομένων πάνελ από 466 Γερμανικές επιχειρήσεις και 372 Ιταλικές για την περίοδο 2010-2022, από όλους τους κλάδους με εξαίρεση τον χρηματοοικονομικό τομέα. Εφαρμόζοντας μια κατάλληλη οικονομετρική μεθοδολογία, τα αποτελέσματα είχαν ως εξής:

Για τις Γερμανικές επιχειρήσεις, η επίδραση της μη-χρηματοοικονομικής αποδοτικότητας στην χρηματοοικονομική αποδοτικότητα, βρέθηκε, κατά κύριο λόγο, μη γραμμική σχήματος U. Επομένως, οι Γερμανικές επιχειρήσεις με πολύ χαμηλή ή πολύ υψηλή μη-χρηματοοικονομική αποδοτικότητα (πολύ υψηλά ή πολύ χαμηλά ESG scores) τείνουν να έχουν ένα υψηλό επίπεδο χρηματοοικονομικής αποδοτικότητας. Αντίθετα, οι Γερμανικές επιχειρήσεις με ένα μεσαίο επίπεδο μη-χρηματοοικονομικής αποδοτικότητας τείνουν να έχουν ένα χαμηλό επίπεδο χρηματοοικονομικής αποδοτικότητας. Με βάση τα σημεία καμπής, για ESG scores στο διάστημα 41-66 το επίπεδο της χρηματοοικονομικής αποδοτικότητας ελαχιστοποιείται, υπονοώντας ότι η επίδραση της μη-χρηματοοικονομικής αποδοτικότητας στη χρηματοοικονομική αποδοτικότητα είναι αρνητική και μετά από αυτά τα σκορ μετατρέπεται σε θετική, επιβεβαιώνοντας την ερευνητική υπόθεση H5 που αναφέρεται στη μακροχρόνια ευεργετική επίδραση της μη χρηματοοικονομικής αποδοτικότητας. Για τις Ιταλικές επιχειρήσεις, η επίδραση της μη-χρηματοοικονομικής αποδοτικότητας στη χρηματοοικονομική αποδοτικότητα βρέθηκε ασήμαντη, κατά κύριο λόγο, επιβεβαιώνοντας

την ερευνητική υπόθεση H3 που αναφέρεται στη θεωρία μη σχετικότητας (irrelevance theory).

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CHAPTER 1: Introductory Notes

1.1 Introduction

In this introductory chapter, an as detailed and thorough as possible introduction in this dissertation is presented. More particularly, dissertation's topic is fully described. Then, dissertation's aim and objectives are mentioned. Finally, dissertation's structure is presented, mentioning a short description of all other chapters' content.

1.2 Dissertation Topic Description

The topic of this dissertation is 'ESG Scores and Firms Financial Performance'. More particularly, it will be investigated whether non-financial performance, measured officially and as reliably as possible by well-known ESG Scores, affects firms' financial performance. This relationship is investigated both theoretically, mentioning several recently developed theories and past related research empirical results, as well as practically, using a particular firm's sample come from some European Union (EU) countries.

Several theories concerning the relationship between ESG Scores and firms' financial performance have been developed. These theories contradict each other, as they support different views.

Under one related theory, firms categorized with high ESG Scores, meaning they have achieved a high level of non-financial performance, tend to enjoy high corporate reputation among customers, partners and investors managing to arrange fruitful and profitable agreements which contribute to cut several expenditures as well as to a lower cost of capital and, thus, to higher financial returns and higher overall financial performance. Under another opposite theory, firms which manage to have high ESG Scores have invested too much effort and, possibly money in order to achieve such high non-financial returns targeting to hide some poor financial returns, implying a speculative use of ESG Scores and non-financial performance. Finally, under a third, different, theory it is argued that ESG Scores are non-

relevant for financial performance. The rationale of this theory is that all firms try to invest in non-financial performance and due to intensive competition in this field, non-financial performance doesn't affect financial performance at all, meaning that there is not any effect of ESG Scores on financial performance.

A more recent theory has combined the theories argued for the positive and negative effect of non-financial performance on financial performance implying a non-linear effect with inverted U scheme. The rationale under this theory is that firms with very poor or very strong non-financial performance, meaning with very low or very high ESG Scores, tend to have low financial performance implying that firms with moderate non-financial performance, thus firms with a moderate level of ESG Scores tend to achieve the highest financial performance implying the existence of an optimal ESG score level. Under this theory it is argued that firms with low level of non-financial performance, investing in order to improve this performance, manage to improve financial performance as well, exploiting related benefits, mainly come from improved corporate reputation, as mentioned in the context of the non-financial performance positive effect theory. However, investing too much despite the fact that ESG Scores may keep rising, comes to a result that related benefits don't overcome related costs and positive effect starts disappearing, turning into a negative effect.

Finally, it is worth mentioning another theory under which it is argued that a bi-directional relationship between non-financial and financial performance truly exists. The rationale under this theory is that firms with strong financial performance tend to possess necessary resources and competencies in order to properly invest and achieve high non-financial performance and, thus, high ESG Scores. Therefore, it is implied that financial performance affects non-financial performance as well and not only the reversed, under the non-financial performance positive effect theory.

All these contradictive theories concerning positive, negative, non-significant, non-linear and bi-directional relationship between ESG Scores and financial performance have led to several mixed results concerning related empirical research in this field. Using firms' sample from particular EU countries all these theories will be empirically tested.

1.3 Dissertation Aim and Objectives

This very dissertation's basic aim is to completely understand the notion and the importance of ESG Scores as well as to completely understand the link between ESG Scores and financial performance in the context of contemporary firms. It should be stressed that dissertation's basic aim has to do with the correct assessment of ESG Scores importance, avoiding any exaggerations either positive or negative. The point is to make a correct assessment of non-financial performance effect on financial performance and the true importance of ESG Scores.

Dissertation objectives include ESG Scores full description and understanding, concerning the content of their measures, as well as the justification of so many theories concerning non-financial (ESG Scores) and financial performance relationship.

1.4 Dissertation Structure

The rest of this dissertation is structured in four (4) other chapters. In chapter two the literature review is presented. More particularly, several elements concerning ESG scores notion and importance presented first. Then, several elements concerning theories about non-financial and financial performance relationship are presented, establishing the possible effect of ESG Scores on firms' financial performance. After that, empirical findings of several past research in this field are presented. Finally, the development of research hypotheses which are tested in the empirical research of this dissertation is presented.

In chapter three, the empirical research methodology is fully presented. More particularly, in the context of econometrical methodology, the detailed specification of econometric model(s) is presented. Variables description and justification are presented along with econometric estimation methodology and related coefficients statistical tests in order to provide empirical evidence concerning research hypotheses. Finally, several elements concerning research sample of this dissertation's empirical research, as well as with statistical and other related software which is employed in order to store, process and analyze empirical data.

In chapter four, empirical findings of this dissertation are fully presented. More particularly, first some basic descriptive statistics are presented concerning firms' characteristics as well as concerning econometrical equations variables. Then, econometrical results are presented which provide empirical evidence concerning research hypotheses about ESG scores effect on financial performance.

Finally, in chapter five, final conclusions of this dissertation are presented. These conclusions are based on empirical evidence results in comparison with past research results. More particularly, a short results review is presented highlighting which research hypotheses are confirmed or rejected. Then, a discussion of empirical results is presented, in which current results are compared to other related past research results as well as several justifications and interpretations of current empirical findings are provided. After that, managerial implications based on current empirical results are provided, servicing an important objective of this dissertation, and finally propositions for future research are suggested.

1.5 Summary

In this introductory chapter, an introduction as detailed and thorough as possible in this dissertation was presented. More particularly, dissertation's topic was fully described providing the rational of several contradictive theories. Then, dissertation's aim and objectives were mentioned. Finally, dissertation's structure was presented, mentioning a short description of all other chapters' content in order to understand what this dissertation will contain.

CHAPTER 2: Literature Review

2.1 Introduction

In this chapter the literature review is presented. More particularly, several elements concerning ESG scores notion and importance are presented first. Then, several elements concerning theories about non-financial and financial performance relationship are presented establishing the possible effect of ESG Scores on firms' financial performance. After that, empirical findings of several past research in this field are presented. Finally, the development of research hypotheses which are tested in the empirical research of this dissertation is presented.

2.2 ESG-Scores: Notion and Importance

ESG scores can be considered as measures which quantitatively reflect the level of responsible and prudent practices and policies that firms engage, meaning the actions of corporate social responsibility (CSR) and the quality of corporate governance (GC), as Alareeni & Hamdan (2020), Egorova et al (2022) and Heinzer & Mezzanzanica (2022) have mentioned. This level of all these actions is summarized with the term 'non-financial performance'. ESG scores take arithmetic values in a 0-100 scale. More particularly, scores close to '0' indicate a firm with the lowest possible level of non-financial performance a certain year, while scores close to '100' indicate a firm with the highest possible level, as Alareeni & Hamdan (2020) and Heinzer & Mezzanzanica (2022) have stated.

ESG scores are official and established measure which are recorded and publicly disclosed for each firm which has an ESG certification, as Heinzer & Mezzanzanica (2022) have mentioned. Such recordings and disclosure take place once a time each economic year. ESG score measurements come from specific standardized procedures and research which take place only from international certified houses which have undertaken this special duty. On a worldwide basis, 140 official houses operate. The most well-known houses are Sustainalytics, MSCI ESG Research and ESGI.

Importance of ESG scores is high enough and it grows for the time passes, as Alareeni & Hamdan (2020), Egorova et al (2022) and Heinzer & Mezzanica (2022) have argued. Its importance has to do with the opportunity given to firms which are certified to provide ESG scores in a reliable and official way their non-financial performance in several critical stakeholders which would care so much to be aware of them, so that firms can exploit several economic benefits. ESG score gives the opportunity to several critical stakeholders to monitor and check non-financial performance of firms and press, officially or unofficially, firms to maintain a high level of such performance which is not only of firms' interest, but also of the broad society and physical environment interest.

Typically, ESG Scores constitute from three (3) related sub-scores, as Alareeni & Hamdan (2020), Egorova et al (2022) and Heinzer & Mezzanica (2022) have stated: (1) Environmental score, (2) Social score and (3) Governance score. A short description of each sub-score is presented in the next sub-sections.

2.2.1 Environmental Score

Environmental score (E-score) quantitatively reflects the level of responsible actions which have to do with environmental responsibility. E-scores take arithmetic values on a 0-100 scale. More particularly, scores close to '0' indicate a firm with the lowest possible level of responsible actions concerning the environment a certain year, while scores close to '100' indicate a firm with the highest possible level.

2.2.2 Social Score

Social score (S-score) quantitatively reflects the level of responsible actions which have to do with social responsibility. S-scores take arithmetic values on a 0-100 scale. More particularly, scores close to '0' indicate a firm with the lowest possible level of responsible actions concerning society for a certain year, while scores close to '100' indicate a firm with the highest possible level.

It is worth mentioning that combining E-score and S-score by averaging them, the result quantitatively reflects the level of corporate social responsibility for a certain year.

2.2.3 Governance Score

Governance score (G-score) quantitatively reflects the level of transparent actions, rational management practices and management quality or, in other words, the level of corporate governance. G-scores take arithmetic values on a 0-100 scale. More particularly, scores close to '0' indicate a firm with the lowest possible level of transparent and rational actions concerning the corporate governance a certain year, while scores close to '100' indicate a firm with the highest possible level.

2.3 Non-financial and Financial Performance Relationship

The non-financial and financial performance relationship is presented both on a theoretical basis, where several related theories are mentioned, and on an empirical basis, where empirical findings of several past researched are mentioned in order to confirm (or not) the related theories.

2.3.1 Theory

According to Aggarwal (2013), the basic theoretical approaches of CSR actions and policies which have to do with beneficial effects, implying a positive relationship between non-financial and financial performance, include legitimacy theory (LT) and stakeholders' theory (ST).

According to LT, firms should operate under certain social norms in order to enjoy long-term economic performance. Therefore, according to this theory, firms with high level of CSR actions and high level of CG typically have substantially lower chances to face low issues or to develop a bad reputation and, thus, bad relationship with several critical stakeholders. On the contrary, such firms have substantially higher chance to smoothly continue their business operation. Under this theory, CRS and CG actions are a pre-request necessity for sustainable business operation.

According to ST, firms with high level of CSR and CG actions have substantially higher chance to build and develop strong relationship with critical stakeholders, while they also

have higher chance for building a strong corporate image and corporate reputation. Under this theory, CRS and CG actions are a required condition for sustainable business operation.

According to Aggarwal (2013), there are also theories which support a negative effect of CSR actions and policies, implying that they are far from beneficial, the well-known theory is the opportunistic theory (OT).

According to OT, firms with too many actions of CSR, they engage in that in order to enhance their corporate reputation so that they can hide economic, managerial and operational issues. Moreover, it is common for firms to be pressed, officially or unofficially, to undertake so many CSR and CG actions that typically cost a lot and it is questionable whether they pay off. As these actions are considered as constraints with substantial economic cost and cause missing opportunities for core productive activities, there is high chance to cause some significant negative effect on financial performance, as Aggarwal (2013) has pointed out.

Finally, according to Aggarwal (2013), there are also theories which support a zero effect of CSR and CG actions and policies, implying that financial performance may come from other factors and not from non-financial performance. The most well-known theory is the irrelevance theory (IT).

According to IT, almost all firms, nowadays, plan and implement many CSR and CG actions either because they are pressed or even obliged to do so, or because they perform it in the context and integrated marketing strategy plan, as Kotler & Lee (2004) have pointed out. This practically results in a tense competition, no differentiation of cost / benefit ration and not any sustainable competitive advantage with respect to non-financial performance level. Therefore, non-financial performance doesn't incur additional costs or offer additional benefits and, thus, there is any effect on firms' financial performance.

2.3.2 Empirical Findings

It is obvious that related theories of non-financial performance effect on financial performance support quite different views, including positive effect, negative effect or even no effect at all. This is the major cause that empirical findings of several past research are mixed, as Aggarwal (2013) και Friede et al (2015) have pointed out.

In most empirical research, a positive effect of non-financial performance, as CSR and / or CG, on financial performance has been found, confirming related theories of LT and ST, according to Aggarwal (2013), Friede et al (2015) and Whelan et al (2021). Such empirical research include, among others, studies of Chen et al (2018), Wu et al (2020), Alareeni & Hamdan (2020), Dimitropoulos & Koronios (2021), Yahya & Vaihekoski (2021), Aydogmus et al (2022), Egorova et al (2022), Hamdi et al (2022), Heinzer & Mezzanzanica (2022), Gao et al (2022), D'Amato et al (2023) and Fu & Li (2023).

In less empirical research, a negative effect of non-financial performance on financial performance has been found, confirming the OT, according to Aggarwal (2013), Friede et al (2015) and Han et al (2016). Such empirical research include, among others, studies of Xu et al (2019), Alareeni & Hamdan (2020), Liu et al (2020), Yahya & Vaihekoski (2021) and Setiani (2023).

In a few research, a zero effect of non-financial performance on financial performance has been found, confirming the IT, according to Aggarwal (2013) and Han et al (2016). Such empirical research include, among others, the studies of Moraleja & Whittaker (2019) and Junius et al (2020).

In some more recent empirical research, a non-linear inverted U scheme effect of non-financial performance on financial performance has been found, confirming simultaneously theories favoring positive and theories favoring negative effect, as Aggarwal (2013) has pointed out. Such empirical research include, among others, the study of Guo et al (2020).

In some other recent research, a non-linear U scheme effect of non-financial performance on financial performance has been found, confirming, again, simultaneously theories favoring negative and theories favoring positive effect. This effect implies that non-financial performance effect on financial performance is long-term, as Whelan et al (2021) have pointed out. Such empirical research include, among others, the study of Cai et al (2023).

2.4 Research Hypotheses Development

As in most empirical research, a positive effect of non-financial performance on financial performance has been found, which confirms LT and ST under the rationale that the higher the non-financial performance, measured by ESG scores, the higher the financial performance, due to beneficial effects come from higher firms reputation and stronger relationships with critical stakeholders. Therefore, the first research hypothesis is stated as follows:

H1: ESG scores (and related sub-scores) effect on firms' financial performance is positive

There are also some empirical research which have found a negative effect of non-financial performance on financial performance, which confirms OT, meaning that the higher the non-financial performance, measured by ESG scores, the lower the financial performance, under the rational that higher ESG scores mean higher related investment expenditures which don't pay off at all and / or that higher ESG scores are pursued in order to hide lack of managerial, operational and economic capabilities which lead to low financial performance. Therefore, the second research hypothesis is stated as follows:

H2: ESG scores (and related sub-scores) effect on firms' financial performance is negative

There are also some empirical research which have found a non-significant effect of non-financial performance on financial performance, which confirms IT, meaning that irrespectively of a lower of higher level of non-financial performance, measured by ESG scores, the financial performance is not systematically lower of higher respectively. The rational of this theory is that intense competition among firms and high pressure of stakeholders to firms to engage in a more responsible and prudent business behavior make non-financial performance not to provide any substantial differentiation or any competitive advantage, thus any additional value which may offer the higher financial performance. Therefore, the third research hypothesis is stated as follows:

H3: ESG scores (and related sub-scores) effect on firms' financial performance is non-significant

There are also some more recent empirical research which have found a non-linear inverted U scheme effect of non-financial performance on financial performance which combines theories favoring both positive and negative effect. The rational is that there is, indeed, a positive effect of non-financial performance on financial performance which stops above some level of non-financial performance, meaning above some level of ESG scores. Then, the effect turns negative, implying the inverted U scheme effect at all. Such a non-linear effect may explain mixed empirical findings, while combines both contradicted theories. Under this non-linear effect, when level of non-financial performance is low, related investments that increase this level, meaning increasing ESG scores, are beneficial and pay off, while as non-financial performance gets higher and higher, meaning from a higher ESG score level and above related expenditures are extremely high and related investments don't continue to pay off. Therefore, the fourth research hypothesis is stated as follows:

***H4:** ESG scores (and related sub-scores) effect on firms' financial performance is non-linear inverted U scheme*

Finally, there are also some more recent empirical research which have found a non-linear U scheme effect of non-financial performance on financial performance which combines theories favoring both negative and positive effect. The rational is that there is a negative effect of non-financial performance on financial performance which stops above some level of non-financial performance, meaning above some level of ESG scores. Then, the effect turns into positive, implying the U scheme effect at all. Such a non-linear effect may also explain mixed empirical findings, while combine both contradicted theories. Under this non-linear effect, when level of non-financial performance is low, related investments that increase this level, meaning increasing ESG scores, incur substantial costs and don't pay off, while as non-financial performance gets higher and higher, meaning from a higher ESG score level and above related expenditures start generate higher benefits and related investments start to pay off. Therefore, the fifth research hypothesis is stated as follows:

***H5:** ESG scores (and related sub-scores) effect on firms' financial performance is non-linear U scheme*

2.5 Summary

In this chapter the literature review is presented. More particularly, several elements concerning ESG scores notion and importance, are presented first. Then, several elements concerning theories about non-financial and financial performance relationship are presented establishing the possible effect of ESG Scores on firms' financial performance. After that, empirical findings of several past research in this field are presented. Finally, the development of research hypotheses which are to be tested in the empirical research of this dissertation is presented.

CHAPTER 3: Empirical Research Methodology

3.1 Introduction

In this chapter, the empirical research methodology is fully presented. More particularly, in the context of econometrical methodology, the detailed specification of econometric model(s) is presented. Variables description and justification are presented along with econometric estimation methodology and related coefficients statistical tests in order to provide empirical evidence concerning research hypotheses. Finally, several elements concerning research sample of this dissertation's empirical research, as well as with statistical and other related software which is employed in order to store, process and analyze empirical data are presented.

3.2 Econometric Equations Specification

Based on related literature and past research of Aggarwal (2013), Alareeni & Hamdan (2020), Guo et al (2020), Wu et al (2020), Aydogmus et al (2022), Egorova et al (2022), Heinzer & Mezzanzanica (2022) and Setiani (2023), the following econometric equations specifications are proposed, in order to obtain empirical evidence concerning the stated research hypotheses. More particularly, as these hypotheses referred to ESG Scores effect on financial performance of firms, the appropriate specifications should include dependent variables which measure financial performance and basic independent variables which measure the non-financial performance, measured by ESG scores. Moreover, some appropriate additional independent should be also included as control variables.

$$ROA_{it} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 ESG_{i,t-1}^2 + \gamma_1 SIZE_{it} + \gamma_2 LEV_{it} + \gamma_3 LEV_{it}^2 + \gamma_4 CI_{it} + \gamma_5 AT_{it} + \gamma_6 NM_{it} + \gamma_7 SG_{it} + \gamma_8 Q_{it-1} + industry\ effects + time\ effects + u_{it} \quad (3.1)$$

$$ROE_{it} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 ESG_{i,t-1}^2 + \gamma_1 SIZE_{it} + \gamma_2 LEV_{it} + \gamma_3 LEV_{it}^2 + \gamma_4 CI_{it} + \gamma_5 AT_{it} + \gamma_6 NM_{it} + \gamma_7 SG_{it} + \gamma_8 Q_{it-1} + industry\ effects + time\ effects + u_{it} \quad (3.2)$$

$$Q_{it} = \beta_0 + \beta_1 G_{i,t-1} + \beta_2 G_{i,t-1}^2 + \gamma_1 SIZE_{it} + \gamma_2 LEV_{it} + \gamma_3 LEV_{it}^2 + \gamma_4 CI_{it} + \gamma_5 AT_{it} + \gamma_6 NM_{it} + \gamma_7 SG_{it} + \gamma_8 ROA_{i,t-1} + \text{industry effects} + \text{time effects} + u_{it} \quad (3.17)$$

$$EV/EBITDA_{it} = \beta_0 + \beta_1 G_{i,t-1} + \beta_2 G_{i,t-1}^2 + \gamma_1 SIZE_{it} + \gamma_2 LEV_{it} + \gamma_3 LEV_{it}^2 + \gamma_4 CI_{it} + \gamma_5 AT_{it} + \gamma_6 NM_{it} + \gamma_7 SG_{it} + \gamma_8 ROA_{i,t-1} + \text{industry effects} + \text{time effects} + u_{it} \quad (3.18)$$

Where,

ROA_{it} = Return on Assets of i -th firm at year t

ROE_{it} = Return on Equity of i -th firm at year t

$ROIC_{it}$ = Return on Invested Capital of i -th firm at year t

M/B_{it} = Market-to-Book ratio of i -th firm at year t

Q_{it} = Tobins' Q Ratio of i -th firm at year t

$EV/EBITDA_{it}$ = Enterprise / EBITDA ratio of i -th firm at year t

$ESG_{i,t}$ = ESG Score of i -th firm at year t

$CSR_{i,t}$ = Corporate Social Responsibility Score of i -th firm at year t

$G\text{-SCORE}_{i,t}$ = Corporate Governance Score of i -th firm at year t

$SIZE_{it}$ = Firms' Size of i -th firm at year t

LEV_{it} = Leverage of i -th firm at year t

CI_{it} = Capital Intensity of i -th firm at year t

AT_{it} = Assets Turnover of i -th firm at year t

NM_{it} = Net Profit Margin of i -th firm at year t

SG_{it} = Sales Growth of i -th firm at year t

The rationale of the above econometric equations specifications is the following. In order to investigate whether ESG Scores effect on financial performance is linear or non-linear inverted U scheme, as Aggarwal (2013) and Guo et al (2020) have argued, or non-linear U scheme, as Whelan et al (2021) have argued, the basic independent variable (ESG score and related measures) is included both with first and second order.

Concerning again the basic independent variable, as related theories and empirical past research argue for bidirectional relationship between ESG Scores and financial performance of firms, the endogeneity of the basic independent variable is very possible (Aggarwal, 2013). In order to avoid this econometrical problem which would lead to biased and inconsistent estimates and non-reliable statistical testing, the basic independent variable is included with one year lag. Indeed, using this lag, only allows the effect of ESG Scores on financial performance and not the vice versa.

Concerning control variables, an appropriate set of additional independent variables should be also included in order to avoid biased and inconsistent estimates of ESG scores effect. More particularly, based on several past empirical research on the field of ESG scores effect on financial performance of firms of Aggarwal (2013), Alareeni & Hamdan (2020), Guo et al (2020), Wu et al, 2020, Aydogmus et al (2022), Egorova et al (2022) and Setiani (2023), these control variable should include several firm-specific characteristics like their size, leverage, capital intensity, assets turnover, profit margin and sales growth which are assumed to affect their financial performance.

More particularly, it has been empirically shown that larger firms tend to enjoy a higher level of financial performance in the context of a linear effect. This is why only the first order is included as variable control. In the same context, theories and practices have shown that leverage has a non-linear inverted U scheme effect on financial performance, according to Vasiliou & Iriotis (2018). This is why both first and second orders are included as control variables. Capital intensity has also been found to affect firms' financial performance. Based on DuPont analysis on a theoretical context, as Vasiliou & Iriotis (2018) and Palepou et al (2013) have mentioned, and on several empirical research, it is argued that firms with higher level of assets turnover and / or higher level of profit margin tend to enjoy a higher level of financial performance in a context of a linear effect. Sales growth has also been found to positively affect firms' financial performance.

Finally, it is possible that a bidirectional relationship exists between accounting and market measures of financial performance in order to avoid both omitted variables problem and endogeneity problem, the related control variable is included with one year lag. More particularly, when accounting measures are used as dependent variable, the market measure Tobins Q is used as control variable, while when market measures are used as dependent

variable, the accounting measure ROA is used as control variable. The rationale is that these two measures are more representative as market and accounting measures of financial performance respectively, according to Vasiliou & Iriotis (2018) and Palepou et al (2013).

As sample data structure are panel, in a sense that they are characterized from both cross-sectional mode (each firm represents one cross-section) and time-series mode (for each firm a sample of consecutive year is taken), then industry effects and time-series effects should be included as additional independent variables, as control variables, in a context of fixed effect estimation. The rationale of this inclusion is that these variables may account for any possible omitted factors which vary either across industries or across time, avoiding, then, omitted variables problem and inconsistent estimates of ESG scores effect and non-reliable statistical testing.

3.3 Involved Variables Description

In this section, involved variables descriptions along with related formulas are presented. More particularly, several financial performance measures, which are dependent variables, ESG Scores and related non-financial performance indices, which are basic independent variables, as well as control variables are fully presented and described.

3.3.1 Dependent Variables: Financial Performance Measurement

Firms' financial performance, which is the dependent variable as it has already been mentioned, can be measured both by several accounting measures and by several market measures, according to Vasiliou & Iriotis (2018) and Palepou et al (2013).

Accounting Measures

More particularly, concerning accounting measures, can be calculated from financial statements data, as Vasiliou & Iriotis (2018) and Palepou et al (2013) have stated. In the related literature, several accounting measures have been proposed as financial performance measures. In the context of the current empirical research, the following accounting measures will be employed.

Return on Assets:

$$ROA = \frac{\text{Net Profit After Taxes}}{\text{Total Assets}} \quad (3.19)$$

Return on Equity:

$$ROE = \frac{\text{Net Profit After Taxes}}{\text{Total Shareholder Equity}} \quad (3.20)$$

Return on Invested Capital:

$$ROIC = \frac{\text{Earnings Before Interest and Taxes}}{\text{Total Shareholders Equity} + \text{Total Debt}} \quad (3.21)$$

Return on Assets (*ROA*) measures the ability of firms to obtain profitability on total assets which firms' investors invest. It shows, thus, how effectively total assets are exploited, according to Vasiliou & Iriotis (2018) and Palepou et al (2013).

Return on Equity (*ROE*) measures the ability of firms to obtain profitability on total shareholders' equity which shareholders invest. It shows, thus, how effectively total shareholders' equity funds are exploited, according to Vasiliou & Iriotis (2018) and Palepou et al (2013). It should be noted that ROE is not that meaningful in case of negative total shareholders' equity. This is why observations with negative total shareholders' equity will be excluded from current empirical research's sample.

Return on Invested Capital (*ROIC*) measures the ability of firms to obtain operating profitability on total invested capital which firms' major investors invest. It shows, thus, how effectively total invested capital funds are exploited, irrespectively the capital structure of firms, according to Vasiliou & Iriotis (2018) and Palepou et al (2013).

Based on calculations and interpretations of the above accounting measures of financial performance, it is obvious that these measures depend on static accounting results of each year, representing a realized performance. Therefore, accounting measures of financial performance show firms' performance on a short-term horizon. This is why they are mentioned as short-term measures of financial performance.

Market Measures

Concerning market measures, they can be calculated both from financial statements data and from market data, as Vasiliou & Iriotis (2018) and Palepou et al (2013) have stated. It is more than obvious that market measures of financial performance can be calculated only for listed firms. In the related literature, several market measures have been proposed as financial performance measures. In the context of the current empirical research, the following market measures will be employed.

Market-to-Book ratio:

$$M/B = \frac{\text{Market Value}}{\text{Total Shareholders Equity}} \quad (3.22)$$

Tobins' Q Ratio:

$$Q = \frac{\text{Market Value of Equity} + \text{Market Value of Liabilities}}{\text{Total Assets}} \quad (3.23)$$

Enterprise Value to EBITDA

$$EV/EBITDA = \frac{\text{Enterprise Value}}{EBITDA} \quad (3.24)$$

Market to Book ratio (M/B) measures the ability of firms to maintain a market value of their equity higher than their book value, according to Vasiliou & Iriotis (2018) and Palepou et al (2013). In case that M/B is higher than unity, it is meant that the market price of firms' equity is higher than their book value assessing positive prospects and several hidden positive values which are not shown in public financial statements. On a similar notion, in case that M/B is lower than unity, it is meant that the market price of firms' equity is lower than their book value assessing negative prospects and several hidden negative values. It should be noted that M/B is not that meaningful in case of negative total shareholders' equity. This is why observations with negative total shareholders' equity will be excluded from current empirical research's sample.

Tobins Q Ratio (Q) measures the ability of firms to maintain a market value of their total assets higher than their book value, according to Vasiliou & Iriotis (2018) and Palepou et al (2013). In case that Tobins Q is higher than unity, it is meant that the market price of firms' assets is higher than their their book value assessing positive future prospects and several

hidden positive values which are not shown in public financial statements. On a similar notion, in case that Tobins Q is lower than unity, it is meant that the market price of firms' assets is lower than their book value assessing negative future prospects and several hidden negative values. Therefore, the higher the value is this measure is, the higher the financial performance is on market terms and vice versa. It should be noted that the nominator of Tobins Q measures market value of total assets in a sense that includes the market value of total liabilities. In this point, it should be mentioned that market value of liabilities can be measured by their book value, in a sense that book value of liabilities converge their market values in the context of International Financial Report Standard (IFRS), as Gikas & Papadaki (2012), Gikas et al (2016) and Balas & Hevas (2016) have stated.

Enterprise value to EBITDA ratio (EV/EBITDA) measures how much higher is total firms' market value over their profitability measured by EBITDA, according to Palepou et al (2013). A higher value of this ratio means that the market price of firms' total value is highly priced, assessing positive future prospects and several hidden positive values which are not shown in public financial statements. On a similar notion, a lower value means that the market price of firms' total value is low enough assessing negative future prospects and several hidden negative values. It should be noted that EV/EBITDA is not that meaningful in case of negative EBITDA. Therefore, observations with negative EBITDA will be excluded from current empirical research's sample.

Based on calculations and interpretations of the above market measures of financial performance, it is obvious that these measures depend on future possible results, representing a long-term performance. Therefore, market measures of financial performance show firms' performance on a long-term horizon. This is why they are mentioned as long-term measures of financial performance.

3.3.2 Basic Independent Variables

According to this current dissertation topic and related research hypotheses, the basic independent variables, for which their effect on financial performance will be investigated, are the well-known ESG Scores (Environmental Scores, Social Scores, Governance Scores) and the related indices which separately measure each component of non-financial performance (E-Score, S-Score, G-Score).

As it has been already mentioned (Chapter 2), according to Alareeni & Hamdan (2020), Egorova et al (2022) and Heinzer & Mezzanzanica (2022), ESG scores are assessed and publicly disclosed on an annual basis on a 0-100 scale. More particularly, scores close to zero indicate a very poor non-financial performance, while scores close to 100 indicate a very strong non-financial performance. ESG scores jointly measure the overall non-financial performance, while E-Scores separately measure environmentally friendly practices in the context of environmental responsibility; S-Scores separately measure socially friendly practices in the context of social responsibility; and G-Scores separately measure the level of Corporate Governance practices. It should be mentioned that the average of E-Score and S-Score measures the level of corporate social responsibility (CSR) practices, in the context of corporate social responsibility - CSR.

All these related scores are annually produced through specialized research which are conducted from worldwide well-known certified houses. More particularly, there are around 140 such houses like Sustainalytics (the most popular), MSCI ESG Research and ESGI.

3.3.3 Control Variables

The control variables that are included in econometric equations specifications are calculated as follows:

Firms' Size:

$$SIZE_{it} = \log(Assets) \quad (3.25)$$

Leverage:

$$LEV_{it} = \frac{Total Liabilities}{Total Assets} \times 100 \quad (3.26)$$

Capital Intensity:

$$CI_{it} = \frac{Plant Property \& Equipment}{Total Assets} \times 100 \quad (3.27)$$

Assets Turnover:

$$AT_{it} = \frac{\text{Total Revenues}}{\text{Total Assets}} \quad (3.28)$$

Net Profit Margin:

$$NM_{it} = \frac{\text{Net Profit After Taxes}}{\text{Total Revenues}} \quad (3.29)$$

Sales Growth:

$$SG_{it} = \frac{\text{Sales}_{it} - \text{Sales}_{i,t-1}}{\text{Sales}_{i,t-1}} \times 100 \quad (3.30)$$

3.4 Econometric Estimation Methodology

For all econometric equations the similar econometric estimation methodology is followed. First, pooled ordinary least squares (POLS) estimation method is employed. Including industry and time effects, this method is similar to fixed effects method, according to Wooldridge (2013). Then, several appropriate diagnostic tests should be conducted, mainly in equations residuals, in order to check whether the regression's assumptions are held, required for reliable estimates and related statistical testing, or some violations may exist, as Wooldridge (2013) has argued.

More particularly, according to Wooldridge (2013), for possible multicollinearity detection, the Variance Inflation Factor (VIF) is calculated. If for at least one independent variable, the VIF index has value higher than value '10', which is the related cut-off point, it is meant that there is the violation of partial multicollinearity exists. In that case, the exclusion of these independent variables should be considered.

For possible heteroskedasticity detection, Breusch-Pagan criterion is employed, as Wooldridge (2013) has argued. If heteroskedasticity violation exists, the White heteroskedasticity robust standard errors should be employed in order to conduct reliable statistical testing.

For possible serial autocorrelation, according to Wooldridge (2013), the appropriate for panel data Wooldridge criterion is employed. If serial autocorrelation violation exists, the

inclusion of one year lag of dependent variable as additional independent variable should be considered.

3.5 Statistical Testing for Research Hypotheses Empirical Investigation

To obtain empirical evidence for the research hypotheses, statistical significance testing should be conducted for β_1 and β_2 coefficients in each econometric equation employing t-statistic using a one-tail comparison, as research hypotheses refer to signs of these coefficients.

More particularly, in case that β_1 is inferred statistically significant and positive and β_2 is inferred statistically non-significant, there is evidence for a linear positive effect, confirming the first research hypothesis for positive ESG Scores effect on financial performance (legitimacy theory and theory of social stakeholders)

In case that β_1 is inferred statistically significant and negative and β_2 is inferred statistically non-significant, there is evidence for a linear negative effect, confirming the second research hypothesis for negative ESG Scores effect on financial performance (opportunistic theory).

In case that both β_1 and β_2 are inferred statistically non-significant, there is evidence for a non-significant effect, confirming the third research hypothesis for non-significant ESG Scores effect on financial performance (irrelevance theory).

In case that β_1 is inferred statistically significant and positive and β_2 is inferred statistically significant and negative, there is evidence for a non-linear inverted U scheme effect, confirming the fourth research hypothesis for non-linear ESG Scores effect on financial performance (combination of legitimacy theory & theory of social stakeholders and opportunistic theory).

Finally, in case that β_1 is inferred statistically significant and negative and β_2 is inferred statistically significant and positive, there is evidence for a non-linear U scheme effect, confirming the fifth research hypothesis for non-linear ESG Scores effect on financial

performance (combination of legitimacy theory & theory of social stakeholders and opportunistic theory).

3.6 Empirical Research Sample

The current empirical research sample comes from two Eurozone countries: Germany, which represents the economically strong north and Italy, which represents the economically weak south of Europe.

More particularly, the sample consists 466 firms from Germany and 372 firms from Italy for the period 2010-2022. Therefore, the total sample contains 10.894 firm-year observations representing a panel data set, as it has been already mentioned. As there are several missing values, the final sample consists of some fewer observations.

Firms in both countries come from almost all economic industries and sectors, excluding the financial industry. Firms from financial industry are not part of the sample for two main reasons. One reason is that these firms are characterized in an extremely high leverage due to the nature of their business. The second reason is that these firms are subjected in a very strict supervisory regime, much different compared to all other non-financial firms. Due to these two reasons financial firms tend to have much different firm-specific economic characteristics compared to non-financial firms and, thus, the inclusion of former will cause several biases in results.

All related sample data for all involved variables were obtained using DATASTREAM data based and especially Worldscope and Thomson Refinitiv ESG data data-bases.

3.7 Summary

In this chapter, the empirical research methodology was fully presented. More particularly, in the context of econometrical methodology, the detailed specification of econometric model(s) was presented. Variables description and justification were presented along with econometric estimation methodology and related coefficients statistical tests in order to provide empirical

evidence concerning research hypotheses. Finally, several elements concerning research sample of this dissertation's empirical research, as well as with statistical and other related software which is employed in order to store, process and analyze empirical data were presented.

CHAPTER 4: Empirical Findings

4.1 Introduction

In chapter four, empirical findings of this dissertation are fully presented. More particularly, first some basic descriptive statistics are presented concerning firms' characteristics as well as concerning econometrical equations variables. Then, econometrical results are presented, which provide empirical evidence concerning research hypotheses about ESG-Scores effect on financial performance.

4.2 Basic Descriptive Statistics

On table 4.1, some basic descriptive statistics are presented concerning all involved variables for both countries. For German firms, mean ROA is equal to 3,91%, with a high standard deviation (SD=6,79%) and high range, implying a very high volatility. As mean ROA is slightly higher than median ROA (p50=3,85%), a slightly positive skewness of distribution is implied. Mean ROE is equal to 7,81%, with a high standard deviation (SD=31,99%) and high range, implying a very high volatility. As mean ROE is quite lower than median ROE (p50=11,31%), a negative skewness of distribution is implied. Mean ROIC is equal to 17,75%, with a high standard deviation (SD=12,62%) and high range, implying a high volatility. As mean ROIC is slightly higher than median ROIC (p50=17,11%), a slightly positive skewness of distribution is implied.

Mean MB is equal to 2,99x, with a high standard deviation (SD=3,16x) and high range, implying a high volatility. As mean MB is higher than median MB (p50=2,11x), a positive skewness of distribution is implied. Mean Q is equal to 1,80x, with a relatively high standard deviation (SD=1,35x) and high range, implying a high volatility. As mean Q is higher than median Q (p50=1,34x), a positive skewness of distribution is implied. Mean EV/EBITDA is equal to 6,95x, with a very high standard deviation (SD=107,17x) and very high range, implying a very high volatility. As mean EV/EBITDA is much higher than median

Table 4.1 Descriptive statistics of involved variables

<i>Panel A: Germany</i>							
<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>min</i>	<i>p25</i>	<i>p50</i>	<i>p75</i>	<i>max</i>
ROA	3.91	6.79	-27.76	1.29	3.85	6.74	67.93
ROE	7.81	31.99	-499.26	4.89	11.31	16.05	164.97
ROIC	17.75	12.62	-90.26	12.28	17.11	23.29	101.14
MB	2.99	3.16	0.14	1.30	2.13	3.48	36.61
Q	1.80	1.35	0.51	1.07	1.34	1.93	13.45
EV/EBITDA	6.95	107.17	-3698.75	5.94	8.64	13.35	243.36
ESG	60.00	20.08	7.52	45.04	62.38	76.48	94.94
CSR	58.73	23.05	1.95	40.71	60.73	79.06	94.91
G-Score	59.77	21.56	4.07	44.73	61.78	77.22	97.77
TA	33,300	102,000	25	1,193	4,150	16,700	1,080,000
LEV	61.06	18.05	9.25	49.79	61.92	73.68	97.71
CI	24.77	16.36	0.15	12.35	22.34	33.46	94.66
AT	0.91	0.51	0.04	0.58	0.81	1.17	3.87
NM	5.24	25.35	-286.43	1.73	4.94	8.51	669.00
SG	8.03	23.89	-82.20	-0.83	5.62	13.96	372.22
<i>Panel B: Italy</i>							
<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>min</i>	<i>p25</i>	<i>p50</i>	<i>p75</i>	<i>max</i>
ROA	2.74	5.77	-27.49	0.48	2.54	5.01	38.57
ROE	2.83	58.38	-756.75	2.43	9.90	15.99	68.16
ROIC	15.05	10.74	-41.53	10.12	14.00	19.52	62.96
MB	2.74	4.01	0.12	0.96	1.63	2.75	47.67
Q	1.59	1.21	0.71	0.99	1.15	1.56	10.77
EV/EBITDA	20.51	145.91	-46.63	6.02	8.58	12.37	3177.77
ESG	64.51	17.09	7.81	53.04	65.28	76.94	94.91
CSR	65.57	19.36	3.77	52.79	68.45	80.56	97.47
G-Score	58.99	20.24	9.84	43.57	60.82	76.46	97.26
TA	30,700	77,900	9	1,301	5,755	17,100	574,000
LEV	67.77	16.21	17.76	56.26	70.33	78.72	97.09
CI	25.59	18.09	0.70	11.05	22.50	37.08	78.14
AT	0.67	0.48	0.07	0.39	0.58	0.83	3.73
NM	6.32	20.38	-63.17	0.91	4.32	8.93	394.85
SG	9.49	23.91	-78.52	-3.92	5.21	17.88	158.80

M = means score, SD = standard deviation, min = minimum value, p25 = 1st quartile, p50 = median, p75= 3rd quartile, max = maximum value, ROA, ROE, ROIC, LEV, CI, NM, SG are measured in %, MB, Q, EV/EBITDA, AT are measured in x-times, ESG, CSR, G-Score are measured in 0-100 scale, TA = total assets in ml. €

EV-EBITDA (p50=8,64x), a very high positive skewness of distribution is implied.

Mean ESG-Score is equal to 60,00, with a medium standard deviation (SD=20,08) and high range, implying medium volatility. As mean ESG-Scores is slightly lower than median

ESG-Score (p50=62,38), a slightly negative skewness of distribution is implied. Mean CSR Score is equal to 58,73, with a medium standard deviation (SD=23,05) and high range, implying a medium volatility. As mean CSR Score is slightly lower than median CSR Score (p50=60,73), a slightly negative skewness of distribution is implied. Mean G-Score is equal to 59,77, with a medium standard deviation (SD=21,56) and high range, implying a medium volatility. As mean G-Score is slightly lower than median G-Score (p50=61,78), a slightly negative skewness of distribution is implied.

Mean assets are equal to bn.33,3€ with a high standard deviation (SD=bn.102,0€) and high range, implying a high volatility. As mean assets are much higher than median assets (p50=bn.4,15€), a very high positive skewness of distribution is implied. Mean leverage is equal to 61,06%, with a small standard deviation (SD=18,05%) and high range, implying a small volatility. As mean leverage is slightly lower than median leverage (p50=61,92%), a slightly negative skewness of distribution is implied. Mean capital intensity is equal to 24,77%, with a relatively high standard deviation (SD=16,36%) and high range, implying a high volatility. As mean capital intensity is slightly higher than median capital intensity (p50=22,34%), a slightly positive skewness of distribution is implied. Mean assets turnover is equal to 0,91x, with a high standard deviation (SD=0,51x) and high range, implying a high volatility. As mean assets turnover is slightly higher than median assets turnover (p50=0,81%), a slightly positive skewness of distribution is implied. Mean net profit margin is equal to 5,24%, with a high standard deviation (SD=25,35%) and high range, implying a high volatility. As mean net profit margin is slightly higher than median net margin profit (p50=4,94%), a slightly positive skewness of distribution is implied. Mean sales growth is equal to 8,03%, with a high standard deviation (SD=23,89%) and high range, implying a high volatility. As mean sales growth is much higher than median sales growth (p50=5,62%), a very high positive skewness of distribution is implied.

For Italian firms, mean ROA is equal to 2,74%, with a high standard deviation (SD=5,77%) and high range, implying a very high volatility. As mean ROA is slightly higher than median ROA (p50=2,54%), a slightly positive skew of distribution is implied. Mean ROE is equal to 2,83%, with a high standard deviation (SD=53,38%) and high range, implying a very high volatility. As mean ROE is quite lower than median ROE (p50=9,90%), a negative skewness of distribution is implied. Mean ROIC is equal to 15,05%, with a

relatively high standard deviation (SD=10,74%) and high range, implying a high volatility. As mean ROIC is slightly higher than median ROIC (p50=14,00%), a slightly positive skewness of distribution is implied.

Mean MB is equal to 2,74x, with a high standard deviation (SD=4,01x) and high range, implying a high volatility. As mean MB is much higher than median MB (p50=1,63x), a very high positive skewness of distribution is implied. Mean Q is equal to 1,59x, with a relatively high standard deviation (SD=1,21x) and high range, implying a high volatility. As mean Q is higher than median Q (p50=1,15x), a positive skewness of distribution is implied. Mean EV/EBITDA is equal to 20,51x, with a very high standard deviation (SD=145,91x) and very high range, implying a very high volatility. As mean EV/EBITDA is much higher than median EV-EBITDA (p50=8,58x), a very high positive skewness of distribution is implied.

Mean ESG-Score is equal to 64,51, with a medium standard deviation (SD=17,09) and high range, implying medium volatility. As mean ESG-Scores are slightly lower than median ESG-Score (p50=65,28), a slightly negative skewness of distribution is implied. Mean CSR Score is equal to 65,57, with a medium standard deviation (SD=19,36) and high range, implying medium volatility. As mean CSR Score is slightly lower than median CSR Score (p50=68,45), a slightly negative skewness of distribution is implied. Mean G-Score is equal to 58,99, with a medium standard deviation (SD=20,24) and high range, implying a medium volatility. As mean G-Score is slightly lower than median G-Score (p50=60,82), a slightly negative skewness of distribution is implied.

Mean assets are equal to bn.30,7€ with a high standard deviation (SD=bn.77,9€) and high range, implying a high volatility. As mean assets are much higher than median assets (p50=bn.5,75€), a very high positive skewness of distribution is implied. Mean leverage is equal to 67,77%, with a small standard deviation (SD=16,21%) and high range, implying a small volatility. As mean leverage is slightly lower than median leverage (p50=70,33%), a slightly negative skewness of distribution is implied. Mean capital intensity is equal to 25,59%, with a relatively high standard deviation (SD=18,09%) and high range, implying a high volatility. As mean capital intensity is slightly higher than median capital intensity (p50=22,50%), a slightly positive skewness of distribution is implied. Mean assets turnover is equal to 0,67x, with a high standard deviation (SD=0,48x) and high range, implying a high volatility. As mean assets turnover is higher than median assets turnover (p50=0,58%), a

positive skewness of distribution is implied. Mean net profit margin is equal to 6,32%, with a high standard deviation (SD=20,38%) and high range, implying a high volatility. As mean net profit margin is higher than median net margin profit (p50=4,32%), a positive skewness of distribution is implied. Mean sales growth is equal to 9,49%, with a high standard deviation (SD=23,91%) and high range, implying a high volatility. As mean sales growth is much higher than median sales growth (p50=5,21%), a very high positive skewness of distribution is implied.

Descriptive statistics show that there is high volatility in all financial performance ratios and in all other financial ratios, implying that there are, in both countries, firms with differentiated characteristics. Only in ESG-Scores volatility is not so high, in both countries. Comparing German and Italian firms, they have similar size, comparing their assets, while German firms have higher financial performance, based on relevant financial ratios, lower leverage, similar capital intensity, higher assets turnover, but slightly lower net profit margin and sales growth.

4.3 Econometrical Results

In this section, econometrical results are presented which provide empirical evidence concerning research hypotheses about ESG-Scores effect on financial performance.

4.3.1 Germany

Results concerning ESG-Score effect on several financial performance measures, are presented in table 4.2.

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity (VIF=6,53 < 10). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level (F=0,83, p=0,364). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=645,76$, p<0,001). According to $R^2=0,520$, financial performance, measured by ROA, volatility is explained by 52,0% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically significant negative in 1% level ($b_1=-0,1205$, $t=-4,03$, p<0,001), while second

Table 4.2 ESG-Score effect on financial performance – German firms

Variables	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
ESG	-0,120*** (0,0299)	-0,425** (0,184)	-0,293*** (0,0780)	-0,0310** (0,0145)	-0,00689 (0,00538)	0,110* (0,0767)
ESG ²	0,000914*** (0,000288)	0,00389** (0,00182)	0,00273*** (0,000728)	0,000361*** (0,000124)	7,40e-05* (4,66e-05)	-0,000433 (0,000660)
SIZE	0,491*** (0,147)	0,564 (1,031)	-0,510 (0,339)	-0,272*** (0,0526)	-0,0400** (0,0180)	-1,456*** (0,317)
LEV	0,0655 (0,0638)	1,532*** (0,533)	0,320** (0,150)	-0,0591*** (0,0180)	-0,0254*** (0,00864)	-0,622** (0,294)
LEV ²	-0,00128** (0,000543)	-0,0147*** (0,00521)	-0,00219 (0,00138)	0,000631*** (0,000174)	0,000181*** (6,68e-05)	0,00419* (0,00225)
CI	0,00623 (0,0105)	-0,0711 (0,0631)	0,0963*** (0,0232)	-0,0113*** (0,00302)	-0,00234** (0,00118)	-0,119*** (0,0197)
AT	1,704*** (0,412)	3,885 (3,191)	5,373*** (1,058)	-0,0420 (0,145)	0,0285 (0,0550)	-3,238*** (1,232)
NM	0,147*** (0,0336)	0,384** (0,154)	0,144 (0,0920)	-0,00257 (0,00238)	-0,000804 (0,00114)	-0,0496 (0,0310)
SG	0,00540 (0,0107)	0,0398 (0,0664)	0,00498 (0,0319)	0,00981* (0,00516)	0,000261 (0,00261)	0,0502* (0,0261)
Q	1,326*** (0,129)	2,323*** (0,439)	2,837*** (0,306)			
ROA				0,0392*** (0,0133)	0,00380 (0,00383)	-0,171 (0,133)
AR(1)		0,116** (0,0527)		0,593*** (0,0625)	0,774*** (0,0584)	
Mean VIF	6,53	6,36	6,53	6,32	6,37	6,53
Wooldridge test	0,83 [0,364]	3,02* [0,084]	2,24 [0,137]	18,96*** [0,000]	4,73** [0,031]	2,55 [0,112]
Breusch-Pagan test	645,76*** [0,000]	2.493,41*** [0,000]	305,90*** [0,000]	3.802,68*** [0,000]	4.123,84*** [0,000]	1.245,86*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Turning point	65,65	54,43	53,66	42,94	-	-
N	1.248	1.248	1.242	1.248	1.248	1.184
R-squared	0,520	0,237	0,285	0,669	0,764	0,134

All equations have been estimated employing Pooled Ordinary Least Squares (POLs). Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking. The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking. Statistically significant autocorrelation was treated with AR(1) term inclusion. Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses). In brackets, p-value of autocorrelation and heteroskedasticity tests are presented. In all equations, industry fixed effects time fixed effects are included. Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant.

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

order coefficient is statistically significant positive in 1% level ($b_2=0,00091$, $t=3,17$, $p=0,001$). These results imply a non-linear U scheme effect of ESG-Score on ROA, as (accounting) financial performance measure. Turning point, estimated as 65,65, implies that until ESG-Score equal to 65,65 ESG effect is negative and then, turns out to a positive effect.

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,36 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 10% level ($F=3,02$, $p=0,084$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.493,41$, $p<0,001$). According to $R^2=0,237$, financial performance, measured by ROE, volatility is explained by 23,7% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically significant negative in 5% level ($b_1=-0,4247$, $t=-2,30$, $p=0,011$), while second order coefficient is statistically significant positive in 5% level ($b_2=0,0039$, $t=2,14$, $p=0,017$). These results imply a non-linear U scheme effect of ESG-Score on ROE, as (accounting) financial performance measure. Turning point, estimated as 54,43, implies that until ESG-Score equal to 54,43 ESG effect is negative and, then, turns out to a positive effect.

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,53 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level ($F=2,24$, $p=0,137$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=305,90$, $p<0,001$). According to $R^2=0,285$, financial performance, measured by ROIC, volatility is explained by 28,5% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically significant negative in 1% level ($b_1=-0,2929$, $t=-3,76$, $p<0,001$), while second order coefficient is statistically significant positive in 1% level ($b_2=0,0027$, $t=3,75$, $p<0,001$). These results imply a non-linear U scheme effect of ESG-Score on ROIC, as (accounting) financial performance measure. Turning point, estimated as 53,66, implies that until ESG-Score equal to 54,66 ESG effect is negative and, then, turns out to a positive effect.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,32 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=18,96$, $p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=3.802,68$, $p<0,001$). According to $R^2=0,669$, financial performance, measured by MB, volatility is explained by 66,9% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is

statistically significant negative in 5% level ($b_1=-0,031$, $t=-2,14$, $p=0,017$), while second order coefficient is statistically significant positive in 1% level ($b_2=0,00036$, $t=2,92$, $p=0,002$). These results imply a non-linear U scheme effect of ESG-Score on MB, as (market) financial performance measure. Turning point, estimated as 42,94, implies that until ESG-Score equal to 42,94 ESG effect is negative and, then, turns out to a positive effect.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,37 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 5% level ($F=4,73$, $p=0,031$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=4.123,84$, $p<0,001$). According to $R^2=0,764$, financial performance, measured by Q, volatility is explained by 76,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically non-significant even in 10% level ($b_1=-0,0069$, $t=-1,28$, $p=0,101$), while second order coefficient is statistically significant positive in 10% level ($b_2=0,000074$, $t=1,59$, $p=0,056$). These results imply a non-linear positive effect of ESG-Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,53 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in in 10% level ($F=2,55$, $p=0,112$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=1.245,86$, $p<0,001$). According to $R^2=0,134$, financial performance, measured by EV/EBITDA, volatility is explained by 13,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically significant positive in 10% level ($b_1=0,1069$, $t=1,39$, $p=0,083$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,00039$, $t=-0,59$, $p=0,278$). These results imply a linear positive effect of ESG-Score on EV/EBITDA, as (market) financial performance measure.

Results concerning CSR Score effect on several financial performance measures, are presented in table 4.3.

Table 4.3 CSR score effect on financial performance – German firms

Variables	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
CSR	-0,0963*** (0,0255)	-0,338*** (0,138)	-0,253*** (0,0607)	-0,0221** (0,0120)	-0,00489 (0,00400)	0,0530 (0,0566)
CSR ²	0,000738*** (0,000245)	0,00307** (0,00142)	0,00251*** (0,000584)	0,000271*** (0,000102)	5,56e-05* (3,51e-05)	-2,63e-05 (0,000475)
SIZE	0,497*** (0,141)	0,758 (1,004)	-0,583* (0,334)	-0,258*** (0,0480)	-0,0383** (0,0174)	-1,411*** (0,313)
LEV	0,0662 (0,0653)	1,542*** (0,535)	0,317** (0,152)	-0,0578*** (0,0179)	-0,0251*** (0,00860)	-0,634** (0,303)
LEV ²	-0,00130** (0,000555)	-0,0148*** (0,00523)	-0,00218 (0,00140)	0,000617*** (0,000173)	0,000178*** (6,66e-05)	0,00433* (0,00234)
CI	0,00948 (0,0102)	-0,0645 (0,0631)	0,0992*** (0,0226)	-0,0117*** (0,00306)	-0,00238** (0,00119)	-0,122*** (0,0195)
AT	1,742*** (0,417)	3,923 (3,233)	5,301*** (1,064)	-0,0565 (0,147)	0,0261 (0,0551)	-3,340*** (1,255)
NM	0,147*** (0,0342)	0,386** (0,156)	0,145 (0,0927)	-0,00249 (0,00242)	-0,000780 (0,00115)	-0,0491 (0,0313)
SG	0,00519 (0,0108)	0,0389 (0,0657)	0,00638 (0,0320)	0,00989* (0,00519)	0,000278 (0,00263)	0,0582** (0,0281)
Q	1,313*** (0,130)	2,323*** (0,440)	2,820*** (0,304)			
ROA				0,0395*** (0,0134)	0,00387 (0,00388)	-0,172 (0,136)
AR(1)		0,115** (0,0529)		0,594*** (0,0626)	0,774*** (0,0584)	
Mean VIF	6,19	6,03	6,19	5,98	6,04	6,19
Wooldridge test	0,85 [0,358]	3,05* [0,083]	2,22 [0,138]	19,89*** [0,000]	5,12** [0,025]	2,56 [0,112]
Breusch-Pagan test	715,94*** [0,000]	2,450,63*** [0,000]	317,78*** [0,000]	3.736,19*** [0,000]	4.122,38*** [0,000]	1.259,65*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Σημείο καμπής	65,24	55,05	50,40	40,77	-	-
N	1.248	1.248	1.242	1.248	1.248	1.182
R-squared	0.519	0.237	0.287	0.668	0.764	0.134

All equations have been estimated employing Pooled Ordinary Least Squares (POLLS). Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking. The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking. Statistically significant autocorrelation was treated with AR(1) term inclusion. Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses). In brackets, p-value of autocorrelation and heteroskedasticity tests are presented. In all equations, industry fixed effects time fixed effects are included. Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant.

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 6,19 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level ($F = 0,85$, $p = 0,358$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2 = 715,94$, $p < 0,001$).

According to $R^2=0,519$, financial performance, measured by ROA, volatility is explained by 51,9% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically significant negative in 1% level ($b_1=-0,0963$, $t=-3,78$, $p<0,001$), while second order coefficient is statistically significant positive in 1% level ($b_2=0,00074$, $t=3,02$, $p=0,002$). These results imply a non-linear U scheme effect of CSR Score on ROA, as (accounting) financial performance measure. Turning point, estimated as 65,24, implies that until CSR score equal to 65,24 CSR effect is negative and then, turns out to a positive effect.

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,03 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 10% level ($F=3,05$, $p=0,083$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.450,63$, $p<0,001$). According to $R^2=0,237$, financial performance, measured by ROE, volatility is explained by 23,7% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically significant negative in 1% level ($b_1=-0,3381$, $t=-2,46$, $p=0,007$), while second order coefficient is statistically significant positive in 5% level ($b_2=0,0031$, $t=2,16$, $p=0,016$). These results imply a non-linear U scheme effect of CSR Score on ROE, as (accounting) financial performance measure. Turning point, estimated as 55,05, implies that until CSR score equal to 55,05 CSR effect is negative and, then, turns out to a positive effect.

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,19 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level ($F=2,22$, $p=0,138$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=317,78$, $p<0,001$). According to $R^2=0,287$, financial performance, measured by ROIC, volatility is explained by 28,7% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically significant negative in 1% level ($b_1=-0,2527$, $t=-4,16$, $p<0,001$), while second order coefficient is statistically significant positive in 1% level ($b_2=0,0025$, $t=4,30$, $p<0,001$). These results imply a non-linear U scheme effect of CSR Score on ROIC, as (accounting)

financial performance measure. Turning point, estimated as 50,40, implies that until CSR score equal to 50,40 CSR effect is negative and, then, turns out to a positive effect.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=5,98 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=19,89$, $p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=3.736,19$, $p<0,001$). According to $R^2=0,668$, financial performance, measured by MB, volatility is explained by 66,8% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically significant negative in 5% level ($b_1=-0,0221$, $t=-1,85$, $p=0,033$), while second order coefficient is statistically significant positive in 1% level ($b_2=0,00027$, $t=2,65$, $p=0,004$). These results imply a non-linear U scheme effect of CSR Score on MB, as (market) financial performance measure. Turning point, estimated as 40,77, implies that until CSR score equal to 40,77 CSR effect is negative and, then, turns out to a positive effect.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,04 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 5% level ($F=5,12$, $p=0,025$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=4.122,38$, $p<0,001$). According to $R^2=0,764$, financial performance, measured by Q, volatility is explained by 76,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically non-significant even in 10% level ($b_1=-0,0049$, $t=-1,22$, $p=0,111$), while second order coefficient is statistically significant positive in 10% level ($b_2=0,000056$, $t=1,58$, $p=0,057$). These results imply a non-linear positive effect of CSR Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,19 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in in 10% level ($F=2,56$, $p=0,112$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=1.259,65$, $p<0,001$). According to $R^2=0,134$, financial performance, measured by EV/EBITDA, volatility is explained by 13,4% from this model. Accounting for any violation,

statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR Score is statistically non-significant even in 10% level ($b_1=0,053$, $t=0,94$, $p=0,175$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,000026$, $t=-0,06$, $p=0,478$). These results imply a non-significant effect of CSR Score on EV/EBITDA, as (market) financial performance measure.

Results concerning G-Score effect on several financial performance measures, are presented in table 4.4.

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,05 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level ($F=0,86$, $p=0,354$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=682,24$, $p<0,001$). According to $R^2=0,516$, financial performance, measured by ROA, volatility is explained by 51,6% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically significant negative in 5% level ($b_1=-0,0644$, $t=-2,05$, $p=0,020$), while second order coefficient is statistically significant positive in 5% level ($b_2=0,00048$, $t=1,71$, $p=0,044$). These results imply a non-linear U scheme effect of G-Score on ROA, as (accounting) financial performance measure. Turning point, estimated as 67,51, implies that until G-Score equal to 67,51 G effect is negative and, then, turns out to a positive effect.

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=5,89 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 10% level ($F=3,08$, $p=0,081$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.469,54$, $p<0,001$). According to $R^2=0,235$, financial performance, measured by ROE, volatility is explained by 23,5% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=-0,1901$, $t=-1,01$, $p=0,157$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,0017$, $t=1,03$, $p=0,152$). These results imply a non-significant effect of G-Score on ROE, as (accounting) financial performance measure.

Table 4.4 G-Score effect on financial performance – German firms

Μεταβλητές	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
G-Score	-0,0644** (0,0314)	-0,190 (0,189)	-0,0917* (0,0653)	-0,00937 (0,0118)	-0,00243 (0,00488)	0,0923 (0,0775)
G-Score ²	0,000477** (0,000280)	0,00175 (0,00170)	0,000721 (0,000580)	8,95e-05 (0,000100)	1,94e-05 (4,18e-05)	-0,000586 (0,000642)
SIZE	0,412*** (0,119)	0,683 (0,860)	-0,258 (0,296)	-0,181*** (0,0442)	-0,0233 (0,0151)	-1,074*** (0,294)
LEV	0,0738 (0,0642)	1,566*** (0,535)	0,346** (0,153)	-0,0558*** (0,0179)	-0,0246*** (0,00855)	-0,659** (0,299)
LEV ²	-0,00136** (0,000550)	-0,0150*** (0,00522)	-0,00246* (0,00142)	0,000592*** (0,000173)	0,000172*** (6,59e-05)	0,00450* (0,00229)
CI	0,00141 (0,0103)	-0,0807 (0,0629)	0,0877*** (0,0228)	-0,0119*** (0,00306)	-0,00255** (0,00113)	-0,111*** (0,0206)
AT	1,725*** (0,410)	4,047 (3,182)	5,466*** (1,072)	-0,0222 (0,144)	0,0319 (0,0547)	-3,242*** (1,243)
NM	0,147*** (0,0336)	0,385** (0,156)	0,144 (0,0930)	-0,00250 (0,00252)	-0,000793 (0,00117)	-0,0502 (0,0307)
SG	0,00583 (0,0106)	0,0379 (0,0674)	0,00284 (0,0320)	0,00918* (0,00511)	0,000148 (0,00260)	0,0556** (0,0280)
Q	1,315*** (0,131)	2,328*** (0,458)	2,868*** (0,315)			
ROA				0,0394*** (0,0136)	0,00385 (0,00386)	-0,177 (0,134)
AR(1)		0,117** (0,0526)		0,596*** (0,0630)	0,776*** (0,0581)	
Mean VIF	6,05	5,89	6,05	5,85	5,90	6,05
Wooldridge test	0,86 [0,354]	3,08* [0,081]	2,42 [0,122]	18,77*** [0,000]	4,69** [0,032]	2,62 [0,108]
Breusch-Pagan test	682,24*** [0,000]	2,469,54*** [0,000]	367,55*** [0,000]	3,777,66*** [0,000]	4,106,34*** [0,000]	1,255,49*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Σημείο καμπής	67,51	-	-	-	-	-
N	1.248	1.248	1.242	1.248	1.248	1.182
R-squared	0,516	0,235	0,277	0,666	0,763	0,133

All equations have been estimated employing Pooled Ordinary Least Squares (POLLS). Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking. The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking. Statistically significant autocorrelation was treated with AR(1) term inclusion. Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses). In brackets, p-value of autocorrelation and heteroskedasticity tests are presented. In all equations, industry fixed effects time fixed effects are included. Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant.

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 6,16 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in 10% level ($F = 2,42$, $p = 0,122$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2 = 367,55$, $p < 0,001$).

According to $R^2=0,277$, financial performance, measured by ROIC, volatility is explained by 27,7% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically significant negative in 10% level ($b_1=-0,0917$, $t=-1,40$, $p=0,082$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,00072$, $t=1,24$, $p=0,107$). These results imply a linear negative effect of G-Score on ROIC, as (accounting) financial performance measure.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=5,85 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=18,77$, $p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=3.777,66$, $p<0,001$). According to $R^2=0,666$, financial performance, measured by MB, volatility is explained by 66,6% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=-0,0094$, $t=-0,80$, $p=0,213$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,000089$, $t=0,89$, $p=0,187$). These results imply a non-significant effect of G-Score on MB, as (market) financial performance measure.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=5,90 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 5% level ($F=4,69$, $p=0,032$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=4.106,34$, $p<0,001$). According to $R^2=0,763$, financial performance, measured by Q, volatility is explained by 76,3% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=-0,0024$, $t=-0,50$, $p=0,310$), while second order coefficient is statistically significant positive in 10% level ($b_2=0,000019$, $t=0,46$, $p=0,322$). These results imply a non-significant effect of G-Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=6,05 < 10$). Wooldridge test for

autocorrelation provides no evidence of this violation, even in in 10% level ($F=2,62$, $p=0,108$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=1.255,49$, $p<0,001$). According to $R^2=0,133$, financial performance, measured by EV/EBITDA, volatility is explained by 13,3% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=0,0923$, $t=1,19$, $p=0,117$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,00059$, $t=-0,91$, $p=0,182$). These results imply a non-significant effect of G-Score on EV/EBITDA, as (market) financial performance measure.

4.3.2 Italy

Results concerning ESG-Score effect on several financial performance measures are presented in table 4.5.

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,41 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=13,21$, $p=0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=40,32$, $p<0,001$). According to $R^2=0,743$, financial performance, measured by ROA, volatility is explained by 74,3% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically non-significant even in 10% level ($b_1=0,0064$, $t=0,15$, $p=0,442$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,000053$, $t=-0,14$, $p=0,443$). These results imply a non-significant effect of ESG-Score on ROA, as (accounting) financial performance measure.

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,62 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F=0,88$, $p=0,352$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=4.010,43$, $p<0,001$). According to $R^2=0,268$, financial performance, measured by ROE, volatility is explained by 26,8% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient

Table 4.5 ESG-Score effect on financial performance – Italian firms

Variables	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
ESG	0,00639 (0,0436)	0,709* (0,486)	-0,0397 (0,132)	0,00975 (0,0411)	0,000993 (0,00536)	0,839 (0,930)
ESG ²	-5,33e-05 (0,000372)	-0,00661* (0,00512)	0,000486 (0,00111)	-9,33e-05 (0,000320)	-2,66e-06 (4,62e-05)	-0,00983 (0,0114)
SIZE	0,154 (0,146)	2,610** (1,201)	-0,0934 (0,404)	-0,647*** (0,140)	-0,0310 (0,0247)	-5,207* (2,801)
LEV	0,0453 (0,0782)	7,044** (2,949)	0,274 (0,199)	-0,174 (0,134)	-0,0342** (0,0146)	-12,96 (9,494)
LEV ²	-0,000978 (0,000654)	-0,0630** (0,0262)	-0,00264 (0,00171)	0,00220* (0,00123)	0,000270** (0,000109)	0,116 (0,0846)
CI	-0,00836 (0,0103)	-0,255* (0,155)	0,00858 (0,0220)	0,0118 (0,00828)	0,00120 (0,00124)	0,401 (0,379)
AT	1,562*** (0,463)	7,267* (3,829)	3,916** (1,639)	-0,946*** (0,294)	0,0639* (0,0368)	-17,74 (13,65)
NM	0,144*** (0,0365)	0,829* (0,457)	0,0689 (0,0530)	0,00310 (0,00860)	-0,000360 (0,000975)	-0,998 (1,021)
SG	0,0402*** (0,0110)	0,475*** (0,180)	0,0934*** (0,0245)	0,00469 (0,00599)	0,000981 (0,00107)	-0,625 (0,408)
Q	1,118*** (0,228)	3,480** (1,661)	1,118** (0,433)			
ROA				0,239*** (0,0426)	0,00710 (0,00504)	-0,688 (0,961)
AR(1)	0,235*** (0,0650)		0,510*** (0,0732)		0,853*** (0,0684)	
Mean VIF	8,41	8,62	8,37	8,62	8,41	8,62
Wooldridge test	13,21*** [0,001]	0,88 [0,352]	26,57*** [0,000]	0,42 [0,519]	59,60*** [0,000]	0,62 [0,435]
Breusch-Pagan test	40,32*** [0,000]	4.010,43*** [0,000]	79,10*** [0,000]	829,64*** [0,000]	2.257,67*** [0,000]	6.737,89*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Turning point	-	53,63	-	-	-	-
N	562	562	561	564	561	545
R-squared	0,743	0,268	0,558	0,254	0,845	0,093

All equations have been estimated employing Pooled Ordinary Least Squares (POLS), Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking, The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking, Statistically significant autocorrelation was treated with AR(1) term inclusion, Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses), In brackets, p-value of autocorrelation and heteroskedasticity tests are presented, In all equations, industry fixed effects time fixed effects are included, Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant,

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

of ESG-Score is statistically significant positive in 10% level ($b_1=0,7089$, $t=1,46$, $p=0,073$), while second order coefficient is statistically significant negative in 10% level ($b_2=-0,0066$, $t=-1,29$, $p=0,099$). These results imply a non-linear inverted U scheme effect of ESG-Score on ROE, as (accounting) financial performance measure. Turning point, estimated as 53,63,

implies that until ESG-Score equal to 53,63 ESG effect is positive and, then, turns out to a negative effect.

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,37 < 10$). Wooldridge test for autocorrelation provides evidence of this violation, in 1% level ($F=26,57, p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=79,10, p<0,001$). According to $R^2=0,558$, financial performance, measured by ROIC, volatility is explained by 55,8% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically non-significant even in 10% level ($b_1=-0,0397, t=-0,30, p=0,382$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,00049, t=0,44, p=0,332$). These results imply a non-significant effect of ESG-Score on ROIC, as (accounting) financial performance measure.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,62 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F=0,42, p=0,519$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=829,64, p<0,001$). According to $R^2=0,254$, financial performance, measured by MB, volatility is explained by 25,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically non-significant even in 5% level ($b_1=0,0098, t=0,24, p=0,406$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,000093, t=-0,29, p=0,386$). These results imply a non-significant effect of ESG-Score on MB, as (market) financial performance measure.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,41 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=59,60, p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.257,67, p<0,001$). According to $R^2=0,845$, financial performance, measured by Q, volatility is explained by 84,5% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is

statistically non-significant even in 10% level ($b_1=0,0010$, $t=0,19$, $p=0,427$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,0000027$, $t=-0,06$, $p=0,477$). These results imply a non-significant effect of ESG-Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,62 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in in 10% level ($F=0,62$, $p=0,435$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=6.737,89$, $p<0,001$). According to $R^2=0,093$, financial performance, measured by EV/EBITDA, volatility is explained by 9,3% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of ESG-Score is statistically non-significant even in 10% level ($b_1=0,8389$, $t=0,90$, $p=0,184$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,0098$, $t=-0,86$, $p=0,196$). These results imply a non-significant effect of ESG-Score on EV/EBITDA, as (market) financial performance measure.

Results concerning CSR Score effect on several financial performance measures are presented in table 4.6.

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,11 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=13,06$, $p=0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=43,09$, $p<0,001$). According to $R^2=0,744$, financial performance, measured by ROA, volatility is explained by 74,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically significant negative in 10% level ($b_1=-0,0424$, $t=-1,35$, $p=0,089$), while second order coefficient is statistically significant positive in 10% level ($b_2=0,00035$, $t=1,29$, $p=0,099$). These results imply a non-linear U scheme effect of CSR-Score on ROA, as (accounting) financial performance measure. Turning point, estimated as 59,89, implies that until CSR-Score equal to 59,89 CSR effect is negative and, then, turns out to a positive effect.

Table 4.6 CSR score effect on financial performance – Italian firms

Variables	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
CSR	-0,0424* (0,0314)	0,200 (0,356)	-0,115 (0,0915)	0,0177 (0,0322)	-0,00156 (0,00448)	1,039 (0,861)
CSR ²	0,000354* (0,000275)	-0,00153 (0,00398)	0,000894 (0,000784)	-0,000318 (0,000281)	7,75e-06 (4,03e-05)	-0,0124 (0,0118)
SIZE	0,151 (0,137)	1,875* (1,001)	0,112 (0,387)	-0,481*** (0,142)	-0,0199 (0,0256)	-4,005* (2,109)
LEV	0,0577 (0,0797)	7,094** (2,956)	0,297 (0,202)	-0,184 (0,135)	-0,0339** (0,0146)	-13,24 (9,722)
LEV ²	-0,00107 (0,000667)	-0,0634** (0,0262)	-0,00280 (0,00173)	0,00230* (0,00125)	0,000269** (0,000109)	0,118 (0,0868)
CI	-0,00771 (0,0105)	-0,268* (0,161)	0,0138 (0,0221)	0,0153* (0,00900)	0,00144 (0,00129)	0,432 (0,422)
AT	1,604*** (0,456)	7,410* (3,859)	4,044** (1,617)	-0,944*** (0,303)	0,0680* (0,0369)	-18,43 (14,34)
NM	0,144*** (0,0366)	0,834* (0,461)	0,0679 (0,0530)	0,00294 (0,00852)	-0,000392 (0,000987)	-0,993 (1,014)
SG	0,0392*** (0,0108)	0,472*** (0,181)	0,0903*** (0,0243)	0,00431 (0,00601)	0,000868 (0,00105)	-0,615 (0,396)
Q	1,124*** (0,224)	3,514** (1,672)	1,172*** (0,432)			
ROA				0,236*** (0,0423)	0,00686 (0,00496)	-0,707 (0,981)
AR(1)	0,237*** (0,0638)		0,507*** (0,0739)		0,855*** (0,0678)	
Mean VIF	8,11	8,33	8,08	8,33	8,12	8,33
Wooldridge test	13,06*** [0,001]	0,90 [0,345]	26,44*** [0,000]	0,43 [0,516]	60,24*** [0,000]	0,63 [0,431]
Breusch-Pagan test	43,09*** [0,000]	3,983,09*** [0,000]	72,41*** [0,000]	895,02*** [0,000]	2,263,59*** [0,000]	6,882,36*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Σημείο καμπής	59,89	-	-	-	-	-
N	562	562	561	564	561	545
R-squared	0,744	0,266	0,560	0,258	0,845	0,094

All equations have been estimated employing Pooled Ordinary Least Squares (POLLS), Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking, The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking, Statistically significant autocorrelation was treated with AR(1) term inclusion, Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses), In brackets, p-value of autocorrelation and heteroskedasticity tests are presented, In all equations, industry fixed effects time fixed effects are included, Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant,

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 8,33 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F = 0,90$, $p = 0,345$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2 = 3.983,09$,

$p < 0,001$). According to $R^2 = 0,266$, financial performance, measured by ROE, volatility is explained by 26,6% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically non-significant even in 10% level ($b_1 = 0,2002$, $t = 0,56$, $p = 0,287$), while second order coefficient is statistically non-significant even in 10% level ($b_2 = -0,0015$, $t = -0,38$, $p = 0,351$). These results imply a non-significant effect of CSR-Score on ROE, as (accounting) financial performance measure.

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 8,08 < 10$). Wooldridge test for autocorrelation provides evidence of this violation, in 1% level ($F = 26,44$, $p < 0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2 = 72,41$, $p < 0,001$). According to $R^2 = 0,560$, financial performance, measured by ROIC, volatility is explained by 56,0% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically non-significant even in 10% level ($b_1 = -0,1146$, $t = -1,25$, $p = 0,106$), while second order coefficient is statistically non-significant even in 10% level ($b_2 = 0,00089$, $t = 1,14$, $p = 0,128$). These results imply a non-significant effect of CSR-Score on ROIC, as (accounting) financial performance measure.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 8,33 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F = 0,43$, $p = 0,516$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2 = 895,02$, $p < 0,001$). According to $R^2 = 0,258$, financial performance, measured by MB, volatility is explained by 25,8% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically non-significant even in 5% level ($b_1 = 0,0177$, $t = 0,55$, $p = 0,292$), while second order coefficient is statistically non-significant even in 10% level ($b_2 = -0,00032$, $t = -1,14$, $p = 0,128$). These results imply a non-significant effect of CSR-Score on MB, as (market) financial performance measure.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF = 8,12 < 10$). Wooldridge test for autocorrelation provides

evidence of this violation in 1% level ($F=60,24$, $p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.264,59$, $p<0,001$). According to $R^2=0,845$, financial performance, measured by Q, volatility is explained by 84,5% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically non-significant even in 10% level ($b_1=-0,0016$, $t=-0,35$, $p=0,364$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,0000078$, $t=0,19$, $p=0,424$). These results imply a non-significant effect of CSR-Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,33 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in in 10% level ($F=0,63$, $p=0,431$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=6.882,36$, $p<0,001$). According to $R^2=0,094$, financial performance, measured by EV/EBITDA, volatility is explained by 9,4% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of CSR-Score is statistically non-significant even in 10% level ($b_1=1,039$, $t=1,21$, $p=0,114$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,0124$, $t=-1,05$, $p=0,147$). These results imply a non-significant effect of CSR-Score on EV/EBITDA, as (market) financial performance measure.

Results concerning G-Score effect on several financial performance measures are presented in table 4.7.

When ROA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,23 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=13,34$, $p=0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=28,76$, $p<0,001$). According to $R^2=0,745$, financial performance, measured by ROA, volatility is explained by 74,5% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically significant positive in 10% level ($b_1=0,0503$, $t=1,42$, $p=0,078$), while second order coefficient is statistically non-significant even in 1% level ($b_2=-0,00039$, $t=-1,25$,

Table 4.7 G-Score effect on financial performance – Italian firms

Variables	(1) ROA	(2) ROE	(3) ROIC	(4) MB	(5) Q	(6) EV/EBITDA
G-Score	0,0503* (0,0354)	0,195 (0,342)	0,0129 (0,0942)	0,0455* (0,0292)	0,00495 (0,00462)	1,089 (1,185)
G-Score ²	-0,000392 (0,000312)	-0,00246 (0,00318)	0,000125 (0,000846)	-0,000157 (0,000268)	-1,96e-05 (4,12e-05)	-0,00926 (0,0104)
SIZE	0,0820 (0,125)	2,565* (1,477)	-0,163 (0,329)	-0,889*** (0,164)	-0,0493** (0,0193)	-8,668 (6,899)
LEV	0,0482 (0,0773)	7,179** (2,996)	0,263 (0,196)	-0,175 (0,132)	-0,0344** (0,0146)	-12,74 (9,305)
LEV ²	-0,00101 (0,000648)	-0,0641** (0,0265)	-0,00253 (0,00170)	0,00221* (0,00121)	0,000273** (0,000110)	0,114 (0,0828)
CI	-0,00929 (0,00996)	-0,258 (0,157)	0,00880 (0,0213)	0,00922 (0,00751)	0,00105 (0,00119)	0,348 (0,314)
AT	1,525*** (0,468)	7,925** (3,962)	3,811** (1,625)	-1,066*** (0,316)	0,0522 (0,0354)	-18,36 (14,58)
NM	0,144*** (0,0361)	0,828* (0,460)	0,0692 (0,0524)	0,00375 (0,00837)	-0,000299 (0,000919)	-0,998 (1,027)
SG	0,0412*** (0,0108)	0,461*** (0,176)	0,0957*** (0,0242)	0,00758 (0,00622)	0,00124 (0,00105)	-0,608 (0,385)
Q	1,091*** (0,223)	3,649** (1,582)	1,080** (0,436)			
ROA	0,232*** (0,0653)			0,230*** (0,0419)	0,00682 (0,00488)	-0,723 (0,979)
AR(1)	0,232*** (0,0653)		0,507*** (0,0741)		0,846*** (0,0677)	
Mean VIF	8,23	8,44	8,19	8,44	8,23	8,44
Wooldridge test	13,34 [0,001]	0,86 [0,358]	26,72*** [0,000]	0,43 [0,514]	57,44** [0,000]	0,63 [0,430]
Breusch-Pagan test	28,76*** [0,000]	3,985,08*** [0,000]	86,95*** [0,000]	855,02*** [0,000]	2,196,90*** [0,000]	6,668,21*** [0,000]
Industry effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Turning point	-	-	-	-	-	-
N	562	562	561	564	561	545
R-squared	0,745	0,266	0,559	0,267	0,846	0,093

All equations have been estimated employing Pooled Ordinary Least Squares (POLs), Multicollinearity was detected using VIF criterion (if $VIF < 10$ there is no evidence of this violation). The test under the criterion Wooldridge was conducted for autocorrelation checking, The test under the criterion Breusch-Pagan was conducted for heteroskedasticity checking, Statistically significant autocorrelation was treated with AR(1) term inclusion, Statistically significant heteroskedasticity was treated with robust standard errors use (presented in parentheses), In brackets, p-value of autocorrelation and heteroskedasticity tests are presented, In all equations, industry fixed effects time fixed effects are included, Turning point was estimated as $-b_1/2b_2$ only when both coefficients have been found statistically significant,

*** $p < 0,01$, ** $p < 0,05$, * $p < 0,10$

$p = 0,105$). These results imply a linear positive effect of G-Score on ROA, as (accounting) financial performance measure.

When ROE is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,44 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F=0,86, p=0,358$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=3.985,08, p<0,001$). According to $R^2=0,266$, financial performance, measured by ROE, volatility is explained by 26,6% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=0,1946, t=0,57, p=0,285$), while second order coefficient is statistically significant negative in 10% level ($b_2=-0,0025, t=-0,77, p=0,220$). These results imply a non-significant effect of G-Score on ROE, as (accounting) financial performance measure.

When ROIC is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,19 < 10$). Wooldridge test for autocorrelation provides evidence of this violation, in 1% level ($F=26,72, p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=86,95, p<0,001$). According to $R^2=0,559$, financial performance, measured by ROIC, volatility is explained by 55,9% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=0,0129, t=0,14, p=0,446$), while second order coefficient is statistically non-significant even in 10% level ($b_2=0,00013, t=0,15, p=0,441$). These results imply a non-significant effect of G-Score on ROIC, as (accounting) financial performance measure.

When MB is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,44 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation even in 10% level ($F=0,43, p=0,514$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=855,02, p<0,001$). According to $R^2=0,267$, financial performance, measured by MB, volatility is explained by 26,7% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically significant positive in 10% level ($b_1=0,0455, t=1,56, p=0,060$), while second order coefficient is statistically non-significant even in 1% level ($b_2=-0,00016, t=-0,59,$

$p=0,279$). These results imply a linear positive effect of G-Score on MB, as (market) financial performance measure.

When Q is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,23 < 10$). Wooldridge test for autocorrelation provides evidence of this violation in 1% level ($F=57,44$, $p<0,001$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=2.196,90$, $p<0,001$). According to $R^2=0,846$, financial performance, measured by Q, volatility is explained by 84,6% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=0,0049$, $t=1,07$, $p=0,143$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,000020$, $t=-0,48$, $p=0,319$). These results imply a non-significant effect of G-Score on Q, as (market) financial performance measure.

When EV/EBITDA is used as dependent variable, mean VIF implies that there is not any evidence of serious multicollinearity ($VIF=8,44 < 10$). Wooldridge test for autocorrelation provides no evidence of this violation, even in in 10% level ($F=0,63$, $p=0,430$). Breusch-Pagan test for heteroskedasticity provides evidence this violation in 1% level ($X^2=6.668,21$, $p<0,001$). According to $R^2=0,093$, financial performance, measured by EV/EBITDA, volatility is explained by 9,3% from this model. Accounting for any violation, statistical significance tests of relative coefficients is reliably conducted. Results showed that first order coefficient of G-Score is statistically non-significant even in 10% level ($b_1=1,089$, $t=0,92$, $p=0,179$), while second order coefficient is statistically non-significant even in 10% level ($b_2=-0,0093$, $t=-0,89$, $p=0,187$). These results imply a non-significant effect of G-Score on EV/EBITDA, as (market) financial performance measure.

4.4 Summary

In chapter four, empirical findings of this dissertation were fully presented. More particularly, first some basic descriptive statistics were presented concerning firms' characteristics as well as concerning econometrical equations variables. Then, econometrical results were presented which provided empirical evidence concerning research hypotheses about ESG-Scores effect

on financial performance. More particularly, results were different across countries and in most cases research hypotheses were not confirmed, providing evidence for some new theories.

CHAPTER 5: Final Conclusions

5.1 Introduction

In chapter five, final conclusions of this dissertation are presented. These conclusions are based on empirical evidence results in comparison with past research results. More particularly, a short results review is, first presented, highlighting which research hypotheses are confirmed or rejected. Then, a discussion of empirical results is presented, in which current results are compared to other related past research results, as well as several justifications and interpretations of current empirical findings are provided. After that, managerial implications, based on current empirical results, are provided, servicing an important objective of this dissertation, as well as final propositions for future research are suggested.

5.2 Empirical results review

In the context of this dissertation the effect of non-financial performance, as measured by well-known ESG scores, on financial performance, measured by several accounting and market measures, was examined. For this purpose, a panel data initial sample of 466 firms from Germany and 372 firms from Italy for the period 2010-2022 was used. The initial sample of 10.894 firm-year observations resulted in a much smaller sample due to missing values. Firms in both countries came from almost all economic industries and sectors, excluding the financial industry.

Appropriate econometric equations were specified which were supposed to link the several measures of financial performance and ESG scores, as the basic explanatory variable. These equations were estimated employing POLS. Including industry and time effects, this method was, rather, similar to fixed effects estimation method. Moreover, several appropriate diagnostic tests were conducted in order to check whether the regression's assumptions were

held. More particularly, for possible multicollinearity detection, the Variance Inflation Factor (VIF) was calculated. For possible heteroskedasticity detection, Breusch-Pagan criterion was employed and for possible serial autocorrelation, the appropriate for panel data Wooldridge criterion was employed. Making any necessary adjustment, where needed, to accounting for any assumptions violation, reliable coefficients' estimation and statistical testing (one-tail) took place.

For German firms results were as follows: for all accounting financial performance measures (ROA, ROE, ROIC), as well as for the market measure MB, non-financial performance, such ESG or CSR score, effect was found non-linear U scheme. Therefore, German firms with very low or very high non-financial performance, thus very low or very high ESG or CSR score tend to enjoy a high level of financial performance, thus high level of ROA, ROE, ROIC, MB. On the contrary, German firms with a medium level of ESG or CSR score tend to have a low level of financial performance, thus low level of these financial performance measures. Based on turning points, for ESG scores equal to 65,65, 64,84, 53,66 and 42,94, for CSR scores equal to 65,24, 55,05, 50,40 and 40,66, the level of ROA, ROE, ROIC, MB respectively is minimized, implying that ESG and CSR scores effect on financial performance is negative and above these scores turns into positive. For the rest of the market financial performance measure (Q, EV/EBITDA), non-financial performance, thus ESG score effect was found to be insignificant and positive linear respectively. Therefore, German firms with low (high) non-financial performance, thus low (high) ESG score, tend to have a low (high) level of financial performance, thus low (high) level of EV/EBIDTA measure, while there is not any relevant trend for the MB level. For Q, EV/EBITDA measures, CSR score effect was found non-linear positive and insignificant respectively. Therefore, German firms with low (high) CSR score, tend to have a low (high) level of financial performance, thus low (high) level of MB measure, while there is not any relevant trend for the EV/EBIDTA level.

Concerning G-score effect, it was found non-linear U scheme only on ROA measure. Therefore, German firms with very low or very high non-financial performance, thus very low or very high G-score tend to enjoy a high level of financial performance, thus high level of ROA. On the contrary, German firms with a medium level of G-score tend to have a low level of financial performance, thus low level of this financial performance measure. Based on turning point, for G-score equal to 67,51 the level of ROA is minimized, implying that G-

score effect on ROA is negative and above these scores turn into positive. For the rest of the accounting financial performance measure (ROE, ROIC), non-financial performance, thus G-score, effect was found insignificant and negative linear respectively. Therefore, German firms with low (high) non-financial performance, thus low (high) G-score, tend to have a high (low) level of financial performance, thus high (low) level of ROIC measure, while there is not any relevant trend for the ROE level. For all market financial performance, non-financial performance, thus G-score, effect was found to be insignificant.

For Italian firms results were as follows: for accounting financial performance measure ROE, non-financial performance, such ESG score, effect was found non-linear inverted U scheme. Therefore, Italian firms with very low or very high non-financial performance, thus very low or very high ESG score tend to have a high level of financial performance, thus high level of ROE. On the contrary, Italian firms with a medium level of ESG score tend to have a high level of financial performance, thus high level of this financial performance measure. Based on turning points, For ESG scores equal to 53,63, the level of ROE is maximized, implying that ESG scores effect on financial performance is positive and above this score turns into negative. For accounting financial performance measure ROA, non-financial performance, such CSR score, effect was found non-linear U scheme. Therefore, Italian firms with very low or very high non-financial performance, thus very low or very high CSR score tend to have a low level of financial performance, thus low level of ROA. On the contrary, Italian firms with a medium level of CSR score tend to have a low level of financial performance, thus low level of this financial performance measure. Based on turning points, for CSR scores equal to 59,89, the level of ROA is minimized, implying that CSR scores effect on financial performance is negative and above this score turns into positive. For the rest of the accounting financial performance measures and for all market financial performance measures, the effect of ESG or CSR scores was found to be insignificant.

Concerning G-score effect, it was found linear positive only on ROA and on MB measures. Therefore, Italian firms with very low (high) non-financial performance, thus very low (high) G-score, tend to have a low (high) level of financial performance, thus low (high) level of ROA or MB. For the rest of the accounting and market financial performance measures, non-financial performance, thus G-score, effect was found to be insignificant.

5.3 Empirical results discussion

For German firms, in most cases H5 research hypothesis is confirmed, as non-linear U scheme effect in such cases was found. However, there are some few cases, especially for G-score effect, that there was found an insignificant effect, confirming the IT. For Italian firms in most cases there is no any significant effect, confirming the IT, while only for some cases, especially for G-score effect, there is a positive effect confirming LT and ST. In the next lines several justifications and interpretations of current empirical findings are provided.

It seems that German firms with low non-financial performance level, do not invest a lot in several practices referring to the environment or society, thus they save relevant costs and / or they invest relevant funds in more core productive activities achieving high profit margin, high profitability and, thus, high accounting performance, even in a short-term horizon, which it seems to provide a good sign in market so that to lead to a high market valuation as well. It also seems that German firm with medium non-financial performance level, investing some funds in related practices like environment or society, they incur relevant costs and / or they engage related funds not investing so much in more core productive activities, resulting in a lower profit margin and profitability and, thus, to some lower accounting performance in a short-term, and a low market performance as well, explaining the negative effect of ESG or CSR score for low to medium scores levels. Finally, German firms with high non-financial performance level, investing a lot in related practices including environment or society, although they incur high relevant costs and / or they engage more related funds, they have already managed to enjoy higher operating cost savings and / or revenue receiving, exploiting their good reputation in the several critical stakeholders including investors, banks, state, suppliers, customers and the whole market, resulting in higher profit margin and profitability and, thus, to some higher accounting performance and market performance as well, explaining the positive effect of ESG or CSR score for medium to high scores levels. Concerning G-score effect, its insignificant effect, in most of financial performance measures, just confirms irrelevance theory for German firms. Only for ROA accounting performance measure, the non-linear U scheme effect can be explained as it was described in few lines above.

It seems that Italian firms have not the required infrastructures in order to exploit all benefits of ESG practices which related to high related scores. It is implied that Italian firms

achieving high ESG scores have incur too high expenditures paying too much attention in this, against their core productive operation which offer economic returns both in an accounting framework and for their stockholders. In other words, it seems that Italian firms which try to enjoy a high non-financial performance, they do it in a wrong way, on average, so that some of them enjoy a high financial performance as well, but some others don't, implying that financial performance depends on other factors irrelevant of their non-financial performance. Another explanation of non-relevance of ESG score may be that Italian firms with not so good financial performance and related prospects, they try to have good non-financial performance, through high ESG scores, in order to make a good reputation or to make stakeholders to pay more attention in these scores, believing that in the future they would achieve financial performance as well. It seems that some of these firms can achieve that and some of them not, implying again that financial performance is not actually achieved through high ESG scores, but from other factors or just from coincidence. Summarizing, it can be concluded that Italian firms find it difficult to harmonize financial and non-financial performance.

Results in both countries show that in economies with high development, as Germany, investments in non-financial performance don't pay off immediately, but they do on the long-run. On the contrary, in economies with less high development, as Italy, investments in non-financial performance may pay off or may not, in a sense that there are not the appropriate infrastructures in order to fully exploit non-financial investments benefits as well as firms are not so wise enough in order to harmonize their non-financial and financial performance.

5.4 Managerial implications

Although investments in non-financial performance, thus on ESG and other related scores, don't have an immediate pay-off in strong economies, like German economy, the finding of a positive effect on financial performance, especially on accounting performance, after a medium level of ESG or CSR score, implies that firms should invest in related practices and policies of ethical and prudent behaviors, enhancing their non-financial performance and, in turn, their financial performance even in a long-term horizon.

Even in less strong economies, like Italy, where ESG or CSR scores don't have such beneficial effect, especially on market financial performance, the importance of non-financial performance should not be underestimated. As low economic level may not allow non-financial performance, it is very possible that non-financial performance may drive financial performance in a long-term horizon, meaning that even in less strong economic ESG and related scores is not meaningless.

In a similar context, investors should consider ESG and other related scores as a positive sign concerning firms' prospects in strong economies like Germany. Indeed, irrespectively of any short-term high or even low accounting performance, it is of high importance for firms their ESG score, as a relatively high level is linked with a high market valuation level, implying that market assesses positively firms with high ESG or other related scores. Therefore, it is recommended investors seek non-financial performance information on firms they want to deposit their investments. In less strong economies, like Italy, investors are recommended to pay special attention to G-score, as firms with high G-scores were found to be highly market valued.

5.5 Propositions for further research

A proposition for further research is to extend this research to several countries and economies in order to draw relevant conclusions by addressing differences and similarities based on economic growth level and geographical region.

Another interesting proposition is to examine the effect of non-financial performance, measured by EGS scores and other relevant scores, on firms ethical or unethical behavior, as it can be assessed by engaging on earning management or financial fraud in general.

5.6 Summary

In chapter five, final conclusions of this dissertation were presented. These conclusions were based on empirical evidence results in comparison with past research results. More particularly, a short results review was, first, presented highlighting which research

hypotheses were confirmed or rejected. Then, a discussion of empirical results was presented, in which current results were compared to other related past research results as well as several justifications and interpretations of current empirical findings were provided as well. After that, managerial implications, based on current empirical results, were provided, serving an important objective of this dissertation, as well as finally propositions for future research were suggested.

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