

Adrian Renner

Does carbon-conscious behavior drive firm performance?

An event study
on the Global 500 companies



RESEARCH

Adrian Renner

Does carbon-conscious behavior drive firm performance?

GABLER RESEARCH

Adrian Renner

Does carbon-conscious behavior drive firm performance?

An event study
on the Global 500 companies

With a foreword by Prof. Dr. Kai-Ingo Voigt



RESEARCH

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie;
detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

Dissertation University Erlangen-Nuremberg, 2011

1st Edition 2011

All rights reserved

© Gabler Verlag | Springer Fachmedien Wiesbaden GmbH 2011

Editorial Office: Ute Wrasmann | Jutta Hinrichsen

Gabler Verlag ist eine Marke von Springer Fachmedien.

Springer Fachmedien ist Teil der Fachverlagsgruppe Springer Science+Business Media.

www.gabler.de



No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright holder.

Registered and/or industrial names, trade names, trade descriptions etc. cited in this publication are part of the law for trade-mark protection and may not be used free in any form or by any means even if this is not specifically marked.

Cover design: KünkellOpka Medienentwicklung, Heidelberg

Printed on acid-free paper

Printed in Germany

ISBN 978-3-8349-2964-8

This is dedicated to my loving mother, Hannelore Renner, and girlfriend, Carolin Ulrich, whose constant support and words of encouragement have been a cornerstone for the success of this journey.

Foreword

Scientific research is still at the beginning to understand the relationship between disclosure of carbon information, carbon performance and stock price reaction. For almost any listed company the investors' pressure to disclose climate-relevant information has increased significantly over the last years. Additionally, businesses are ranked by independent parties (such as the Carbon Disclosure Project) in regards to their ability to cope with the challenges posed by climate change. Consequently corporate leaders need to decide whether their company shall take part in these kind of projects, possibly facing negative evaluations or rejecting the investors request, which might also have adverse implications. Knowing how equity holders, which ultimately determine the corporate leaders' fate, will react is crucial for their decision making.

To address these identified gaps in research and practice, Mr. Renner provides interesting insights into how investors react if businesses are moving towards a green future. The strength of this thesis is that research is grounded in appropriate and relevant theory and that sound and mature quantitative research method (event study approach) is pursued. Simultaneously, it addresses a highly relevant topic for practitioners, who are analyzing the capital markets response to carbon-conscious behavior depending on various factors e.g. region, sector, share of institutional investors, carbon intensity, etc.

Since this research project was trying to answer questions on a global scale, Mr. Renner used the Carbon Disclosure Project report on the Global 500 companies, which allowed him to synthesis results from 387 companies from 28 countries.

In conclusion, this book offers new and outstanding insights and can, thus, be highly recommended for researchers and practitioners who are engaged in this field of research.

Prof. Dr. Kai-Ingo Voigt

Acknowledgements

Although I understood from the beginning that writing a thesis would be a long and lonely journey full of pain and self-doubt, I was always able to count on a terrific group of people who helped me through even the darkest hours and helped to shape this dissertation. Indisputably, I would not have been able to master this challenge without them and will remain deeply indebted and grateful to each and every one of them.

First, I would like to thank my advisor, Prof. Dr. Kai-Ingo Voigt, for his support. His input during our discussions has been of significant importance and brought this document to an even higher level. Second, I would like to express my gratitude towards Prof. Dr. Peter Klaus for his questions, comments and advice, which greatly enhanced this thesis.

Third, I wish to thank my best friends, Dr. Gerhard Trautmann, Dr. Christian Funke, Fabian Frank, Holger Gürich, Thorsten Schrenk and Christopher Krauss, who gave up their weekends and came from all over Germany to criticize, comment on, but finally improve this document. Without you, I would have never been able to accomplish this project, and I will remain deeply indebted and grateful.

Fourth, I thank several McKinsey partners (Dr. Andreas Tschiesner, Dr. Andreas Cornet, Dr. Wolfgang Pointner and Dr. Nicolai Müller) for taking the time to give their highly valuable input on my work. Their ideas were outstanding and their support another reason why this company is so great.

Last but not least, I'm especially grateful to Carolin, whose patience was a never-ending source of encouragement. Her affection, loyalty and patience gave me the strength necessary to finish this dissertation.

Dipl.-Kfm. Adrian Renner

TABLE OF CONTENTS

LIST OF ABBREVIATIONS	XV
TABLE OF SYMBOLS.....	XIX
INDEX OF FIGURES.....	XXI
INDEX OF TABLES.....	XXIII
1 INTRODUCTION.....	1
1.1 PROBLEM DEFINITION	1
1.1.1 <i>Description of environmental challenges posed by climate change</i>	1
1.1.1.1 Relationship between human behavior and increased CO ₂	2
1.1.1.2 Relationship between CO ₂ increase and temperature rise	6
1.1.1.3 Relationship between increased temperature and global climate	9
1.1.1.4 Climate change and its consequences for mankind	15
1.1.2 <i>Reaction of consumers and policy makers to environmental challenges</i>	23
1.1.3 <i>Implications of climate change for corporate leaders and investors</i>	25
1.2 OUTLINE OF THE STUDY	27
2 LITERATURE REVIEW	30
2.1 RELATIONSHIP BETWEEN ENVIRONMENTAL DISCLOSURE AND ENVIRONMENTAL PERFORMANCE	30
2.1.1 <i>Theoretical perspective</i>	30
2.1.1.1 Socio-political theories	30
2.1.1.1.1 Stakeholder theory	31
2.1.1.1.2 Legitimacy theory	38
2.1.1.2 Disclosure theory	38
2.1.2 <i>Empirical perspective</i>	39
2.2 RELATION BETWEEN ENVIRONMENTAL AND ECONOMIC PERFORMANCE	41
2.2.1 <i>Theoretical perspective</i>	41
2.2.1.1 Traditionalist view	41
2.2.1.2 Revisionist view	42

2.2.1.3 Synthesis of traditionalist and revisionist views	45
2.2.2 <i>Empirical perspective</i>	46
2.3 SUMMARY AND NEW APPROACH TO THEORETICAL FRAMEWORK	51
3 DEFINITION OF TERMS	54
3.1 SUSTAINABILITY	54
3.2 CORPORATE SOCIAL RESPONSIBILITY	56
3.3 ENVIRONMENT.....	56
3.4 GREEN MANAGEMENT AND CARBON-CONSCIOUS BEHAVIOR.....	58
3.5 CORPORATE SUCCESS.....	61
3.6 EVENT STUDY	63
4 CARBON DISCLOSURE PROJECT AND ITS GLOBAL 500 REPORT	64
4.1 THE CARBON DISCLOSURE PROJECT AS AN ORGANIZATION.....	64
4.2 GLOBAL 500 REPORT	66
4.2.1 <i>Global 500, response rates and CO₂ emissions covered</i>	66
4.2.2 <i>Carbon disclosure score</i>	68
4.2.3 <i>Carbon performance score</i>	70
4.2.4 <i>Geographic and industry overview</i>	72
4.3 CRITIQUE OF THE CARBON DISCLOSURE PROJECT.....	75
5 RESEARCH QUESTIONS, MODEL SETUP AND HYPOTHESIS DEVELOPMENT	77
5.1 RESEARCH QUESTIONS ON CDP ACTIVITY	77
5.2 RESEARCH QUESTIONS ON SURVEY-SPECIFIC ITEMS	79
5.3 MODEL SETUP	79
5.4 PREDICTED RESEARCH OUTCOME BASED ON THEORIES AND HYPOTHESIS DEVELOPMENT ..	83
6 RESEARCH METHODOLOGY	87
6.1 RESEARCH APPROACH.....	87
6.1.1 <i>History of event studies and academic fields of application</i>	87
6.1.2 <i>Assumptions of event study</i>	89
6.1.3 <i>Event definition</i>	90

6.1.4	<i>Selection of companies</i>	90
6.1.5	<i>Event and estimation window</i>	91
6.1.6	<i>Correction for confounding events</i>	92
6.1.7	<i>Estimation of abnormal returns</i>	93
6.1.8	<i>Estimation of normal returns</i>	95
6.1.8.1	Statistical models	95
6.1.8.1.1	Constant mean model	95
6.1.8.1.2	Index model	96
6.1.8.1.3	Market model	97
6.1.8.1.4	Other statistical models	99
6.1.8.2	Economic models	100
6.1.9	<i>Benchmarks</i>	101
6.1.10	<i>Statistical testing methods</i>	102
6.1.10.1	T-test for significance of abnormal returns	103
6.1.10.2	T-test for equality of abnormal returns	107
6.1.10.3	Non-parametric tests	108
6.2	DATA COLLECTION	110
6.3	CRITIQUE OF EVENT STUDIES	111
6.4	SUMMARY	112
7	DESCRIPTION OF DATA SET	113
7.1	REGIONAL AND INDUSTRIAL SEGMENTATION OF GLOBAL 500	113
7.2	BREAKDOWN OF GLOBAL 500 DATA SET INTO RELEVANT SAMPLE	114
7.3	REGIONAL AND INDUSTRIAL SEGMENTATION OF RELEVANT SAMPLE	115
7.4	FURTHER CHARACTERISTICS OF THE SAMPLE	115
8	EMPIRICAL RESULTS AND INTERPRETATION	120
8.1	IMPACT OF CDP PARTICIPATION ON FINANCIAL PERFORMANCE	120
8.2	IMPACT OF MEMBERSHIP IN CARBON DISCLOSURE LEADERSHIP INDEX ON FINANCIAL PERFORMANCE	124
8.3	IMPACT OF CARBON PERFORMANCE AWARD ON FINANCIAL PERFORMANCE	128
8.4	IMPACT OF SETTING CO ₂ REDUCTION TARGETS ON FINANCIAL PERFORMANCE	129

8.5	IMPACT ON FINANCIAL PERFORMANCE OF HAVING A BOARD-LEVEL MEMBER RESPONSIBLE FOR CLIMATE CHANGE	131
8.6	IMPACT ON FINANCIAL PERFORMANCE OF HAVING AN INCENTIVE SYSTEM TO SUPPORT CLIMATE-FRIENDLY BEHAVIOR	134
9	SUMMARY AND CONCLUSION	137
9.1	MAJOR FINDINGS	137
9.2	MANAGERIAL IMPLICATIONS	139
9.3	LIMITATIONS OF THE STUDY	140
9.4	SUGGESTIONS FOR FURTHER RESEARCH	141
	APPENDIX.....	142
	REFERENCE LIST	151

List of abbreviations

APT	Arbitrage Pricing Theory
AR	Abnormal return
B2B	Business-to-Business
B2C	Business-to-Consumer
BAU	Business as usual
BRIC	Brazil, Russia, India and China
CAC 40	Cotation Assistée en Continu 40
CAPM	Capital Asset Pricing Model
CDP	Carbon Disclosure Project
CDLI	Carbon Disclosure Leadership Index
CEO	Chief Executive Officer
CEP	Center on Economic Priorities
CO ₂	Carbon dioxide
COGS	Cost of goods sold
CH ₄	Methane
CSR	Corporate Social Responsibility
DAX	Deutscher Aktien Index
EBIT	Earnings before interest and taxes

XVI

EMS	Environmental Management System
EPA	Environmental Protection Agency
ET	Eastern Time
ETF	Exchange Traded Fund
EU	European Union
EUR	Euro
FRDG	Franklin Research and Development Group
GAAP	Generally Accepted Accounting Principles
GDP	Gross Domestic Product
GHGs	Greenhouse gases
GICS	Global Industry Classification Standard
GM	General Motors
GSCM	Green Supply Chain Management
IFRS	International Financial Reporting Standards
IPCC	Intergovernmental Panel on Climate Change
IRRC	Investor Responsibility Research Center
ISO	International Standardization Organization
IT	Information Technology
JV	Joint Venture
M&A	Mergers and Acquisitions
MBA	Master of Business Administration
MSCI	Morgan Stanley Capital International

NO ₂	Nitrous dioxide
NGO	Non-governmental organizations
OEM	Original Equipment Manufacturer
OLS	Ordinary Least Squares
PPM	Parts per million
PR	Public relations
PWC	PriceWaterhouseCoopers
RoA	Return on Assets
RoI	Return on Investment
RoS	Return on Sales
S&P 500	Standard and Poor's 500
SRES	Special Report on Emission Scenarios
SUV	Sport Utility Vehicle
TCTF	Total Company Target Fulfillment
UK	United Kingdom
US	United States
USD	United States Dollars
UV	Ultraviolet
W	Watt

Table of symbols

Σ

Summation

Index of figures

Figure 1: Development of carbon dioxide concentration over the last 250 years	2
Figure 2: Development of carbon dioxide concentration over the last 50 years	3
Figure 3: Composition of greenhouse gases by type (e.g., CO ₂ , CH ₄).....	5
Figure 4: Greenhouse gas emissions by sector in 2004	5
Figure 5: Greenhouse effect.....	6
Figure 6: Development of global temperatures since 1880	8
Figure 7: Development of global disasters	10
Figure 8: Development of sea level since 1880	11
Figure 9: Effects of global average temperature change	21
Figure 10: Future issues for consumers and executives	25
Figure 11: Life-cycle model of environmental issues	35
Figure 12: Traditional view of environmental and economic performance	42
Figure 13: Revisionist view of environmental and economic performance	44
Figure 14: Synthesis view of environmental and economic performance.....	45
Figure 15: Classical theoretical framework	52
Figure 16: New approach to theory	53
Figure 17: Level of carbon consciousness	61
Figure 18: Number of CDP respondents by year (adapted from CDP website).....	65
Figure 19: Total reported emissions (Scopes 1, 2 and 3) in billions of tons of CO ₂ (Source: CDP Global 500 Report)	67
Figure 20: Proportion of Global 500 at each disclosure level - year-on-year (Source: CDP Global 500 report)	68
Figure 21: Carbon High Performance Group (Source: CDP Global 500 Report).....	72
Figure 22: Key facts by geography (Source: CDP Global 500 Report)	73
Figure 23: Splitting up of title question into three key research questions.....	78
Figure 24: Simple model setup	81

Figure 25: Model with pathways	83
Figure 26: Overview of predicted outcomes based on theory	85
Figure 27: Summary t-test of abnormal returns	105
Figure 28: Summary t-test of equality	108
Figure 29: Comparison of tests based on normal distribution with nonparametric tests for similar settings	109
Figure 30: Regional and industrial segmentation of Global 500	113
Figure 31: Breakdown of basic population to relevant sample	114
Figure 32: Regional and industrial segmentation of relevant sample	115
Figure 33: Average sales by industry	116
Figure 34: Average EBIT margin by industry	116
Figure 35: Leverage by industry	117
Figure 36: Share of institutional investors by industry	118
Figure 37: Carbon intensity by industry	118
Figure 38: Segmentation by business model	119
Figure 39: First part of empirical results on research question 1	121
Figure 40: Second part of empirical results on research question 1	122
Figure 41: Empirical results for research question 1A	123
Figure 42: First part of empirical results on research question 2	125
Figure 43: Second part of empirical results on research question 2	126
Figure 44: Regression analysis on disclosure score and abnormal return	127
Figure 45: Empirical results for research question 3	128
Figure 46: First part of empirical results on research question 4	130
Figure 47: Second part of empirical results on research question 4	131
Figure 48: First part of empirical results on research question 5	132
Figure 49: Second part of empirical results on research question 5	133
Figure 50: First part of empirical results on research question 6	134
Figure 51: Second part of empirical results on research question 6	135

Index of tables

Table 1: Overview stakeholders (adapted from Meffert/Kirchgeorg 1998)	32
Table 2: Largest non-respondents in 2009 (Source: CDP Global 500 Report)	67
Table 3: Carbon Disclosure Leadership Index 2009 (Source: CDP Global 500 report)	70
Table 4: Change in level of disclosure by sector (Source: CDP Global 500 Report).....	74