CSR, Innovation and Financial Performance: On the Interaction between CSR and Innovation Strategies for Firm Performance

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Abstract

The relationship between Corporate Social Responsibility (CSR) and financial performance of firms has been studied quite extensively. The same is true for the impact of innovation on firm performance. Rather little attention has been paid to a likely interaction between CSR and innovation and the consequences of this interaction on financial performance. We attempt to close this gap by using data from the German Innovation Survey which has been extended by data of firms' CSR activities obtained from an additional telephone survey. We define CSR as firm activities in social and environmental areas that go beyond mere legal requirements and analyse their impact on firms' financial performance as well as likely complementarity effect between CSR and innovation. Our findings show no significant but positive impact of CSR or the combination of CSR and innovation on firm's financial performance. The results indicate a possible neutral effect of CSR as well as the combination of CSR and innovation on financial performance.

Keywords: Corporate Social Responsibility, Financial Performance, Innovation

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1 Introduction

The purpose of the study is to analyze the relationship of Corporate Social Responsibility (CSR) and innovation on the one hand and financial performance of firms on the other. While many studies found evidence for performance enhancing impacts of both CSR activities and innovation activities, little attention has been paid so far to likely interactive effects between CSR and innovation and corresponding performance impacts. In particular, we investigate whether firms that combine a high level of CSR activities with an innovation-oriented competitiveness strategy can outperform firms that primarily focus on CSR or innovation, respectively. CSR is a concept with very heterogeneous definitions: CSR as sacrificing profits going back to Friedman (1970) can still be found in literature (see e.g. Reinhardt et al. 2008). But most common in literature is to take a broad definition of CSR, where CSR are activities relate to social and environmental issues and go beyond legal requirements (see e.g. Lyon and Maxwell 2008; Portney 2008). This is also in line with the EU definition from the year 2006: "Corporate social responsibility (CSR) is a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis. It is about enterprises deciding to go beyond minimum legal requirements and obligations stemming from collective agreements in order to address societal needs" (EC 2006). We take this definition, because it leaves open if CSR is profit-maximizing, profit-neutral or profit-sacrificing, which is our aim to analyse how firms' financial performance is affected by CSR and innovation.

The relationship of CSR and financial performance (FP) has been examined in several empirical studies, which were recently reviewed by Orlitzky et al. (2003) and Margolis et al. (2007). The authors criticize that in most of the studies just unilateral relationships of how CSR influences the financial performance of a firm are taken into account (Margolis et al. 2007). But the mechanism and direction of causality are unclear. Theoretically three different concepts of the relation between CSR and FP can be summarized, namely stakeholder theory, slack resources theory and the virtuous circle concept. The stakeholder theory implies that the interests of a broad group of stakeholders are fulfilled by investing in wide range of CSR (Freeman 2010; Donaldson and Preston 1995; Preston and O'Bannon 1997). While the engagement in CSR activities depends on the financial resources of a firm in the slack resources theory (Preston and O'Bannon 1997; Orlitzky et al., 2003), the virtuous circle describes bi-directional impact of CSR and FP (MacGregor and Fontrodona 2008; Vilanova et al. 2009).

The connection of CSR and innovation has not been extensively examined yet. The management literature provides concepts how CSR and financial performance are related, but the link to innovation is either not made at all or only a small hint to innovation is given (e.g. Porter and Kramer 2006). Empirical studies, which specifically examine the relationship between CSR and innovation, are rare (McWilliams and Siegel 2000; Hull and Rothenberg 2008; Bocquet et al. 2011). Some case studies provide first insights into the link between CSR and innovation (e.g. Clausen and Loew 2009; (Halme and Laurila 2009). This article is meant to contribute to this research gap on the relationship between CSR, innovation and competitiveness. We concentrate on technological innovations (i.e. new products or new processes) and analyze whether CSR engagement and innovation affects financial performance of the firm. Using the profit margin (pre-tax profits over sales) as performance measure we are particularly interested whether firms that combine on strong CSR policy with technological innovations can outperform others.

Previous research on the link between CSR and innovation has stressed four different ways of these two strategic activities may be interlinked, namely lead-lag, complementary, substitutive, or connected through a virtuous circle. Starting from this research, we develop three hypotheses on the link between CSR and innovation and their impact on firms' financial performance (section 2). We test the hypotheses by using a unique firm-level data base that combines information on CSR, innovation and financial performance (section 3). Our estimation results (section 4) show that CSR and technological innovations tend to be mutually supporting. While we do not find significant effects of neither pure CSR activity nor combined with innovation, the impact seems to be positive in both cases. But the non-significant results indicate a possible neutral effect of CSR as well as the combination of CSR and innovation.

2 Hypotheses

The aim of this paper is to investigate the link between CSR and innovation and whether firms that combine CSR and innovation can achieve a better financial performance compared to firms that either innovate or engage in CSR or doing none of both.

Though both CSR and innovation are well-established concepts, there is still a large variety of approaches how to exactly conceptualize and measure them. In this paper, we use the following definitions:

(a) CSR activities used in this paper refer to social and environmental issues going beyond legal requirements, which is in line with the definition by the European commission from the year 2006 (EC 2006). Environmental concerns capture the impact of business on natural environment, which includes the usage of natural resources as well as different types of emissions and waste. In our data environmental concerns are captured by the increase of employee's environmental awareness in a way that goes beyond the legal requirements. This can be interpreted as the first step to further environmental protecting activities of a firm. The social aspect is usually related to quality of life on community, family and individual level. In our paper we refer to work around and quality of jobs conditions, which are safety at work, integrate disabled people, equality of men and women, avoid discrimination, and integrate foreign employees. Our data captures if the firms exceed the legal minimum standards, which is a main aspect of CSR activities. Former empirical research have examined a slight but positive impact of CSR on financial performance (Margolis et al. 2007). However, also a negative effect on financial performance is possible, because at first CSR activities come with costs.

(b) Innovation is used in this paper to refer to the introduction of new products or new processes, following the concepts developed by OECD and Eurostat (2005). New products are goods and services that differ from the goods and services that a firm has offered so far. The novelty may refer to new technical features, new components or new intended uses. New processes comprise new methods to produce or deliver goods and services. Introducing each type of innovation typically implies some changes in the technology a firm uses. These innovations may therefore be called technological innovations, as opposed to organizational or marketing innovations that represent new ways of organizing internal operations or external relations, or the marketing of products. Successfully introduced technological innovations can contribute to better financial performance of firms. Product innovations may enable firms to differentiate from competitor's products and achieve higher product prices. In case new products imitate prior innovations of competitors, they may

reduce the competitor's competitive advantage and raise a firm's market share, which can also transfer into better financial performance. As to process innovations, these may reduce unit costs of production or improve the quality of goods and services, which both should have positive impacts on profitability. However, developing and introducing technological innovations is costly and risky, why it is that innovations do not automatically result in better performance but can also deteriorate a firm's financial situation if high costs for introducing them are followed by lacking market success.

The relationship between CSR and innovation can mainly take four different forms: lead-lag, complementary, substitutive or a virtuous circle. The lead-lag relationship implies a sequent character of CSR and innovation, which includes two directions. CSR creates opportunities for innovations or innovation supports CSR engagement. The complementary connection of CSR and innovation means that CSR activity is implemented in the innovation strategy. If CSR and innovation take a substitutive connection, companies have two ways to differentiate themselves from their competitors, namely innovation or doing CSR. However, CSR and innovation are no pure substitutes in the sense that the firm can decide on a case to case basis whether to innovate or to engage in CSR. The substitutive character should be taken to a more strategic perspective, in which companies choose their strategic orientation to base more on CSR or innovation. The bi-directional or virtuous circle relation of CSR and innovation means that CSR and innovation promote each other, but which of them is the initial trigger is unclear. All four approaches have in common that they suppose a positive link between CSR activities and innovations

H1: CSR active companies are also more engaged in innovations than non-CSR companies

This hypothesis is related to the lead-lag connection and implies that CSR creates opportunities for innovation. This is also taken by Porter and Kramer (2006), who develop a strategic approach on corporate involvement of companies in society to provide an overarching concept addressing the link between competitive advantage and CSR. In their framework the link of CSR and innovation is not explicitly described, but they mention at the beginning of their paper that CSR can be a source of innovation. Furthermore Husted and Allen (2007b, 2007a) tested in both studies if CSR is a source of innovation and competitiveness. They concluded that CSR can generate opportunities for innovation but not necessarily resulting in competitive advantage. The results have to be taken with care, because a clear distinction of value creation, competitive advantage and innovation was not made in both of the studies. The empirical study by Bocquet et al. (2011) explicitly address the link of CSR and innovation. They take the distinction into strategic and responsive CSR developed by Porter and Kramer (2006) and found that companies engaged in strategic CSR tend to innovate in respect to products and responsive CSR is not likely to promote innovations, especially organizational innovations. Also Wagner (2010) tests the positive link of CSR on socially benefiting innovations, which he could verify with his data. Based on a literature review on both concepts, CSR and innovation, Midttun (2006, 2007) differs between the static and dynamic perspective. He claims that static stakeholder concepts of CSR bind capacities and therefore hamper innovation, whereas a dynamic concept of CSR stakeholder theory may support innovation.

H2: Innovation creates capabilities for CSR.

Midttun (2006, 2007) also looks at how innovation supports CSR engagement. This approach was also used by Pavelin and Porter (2008), who estimate the impact of innovation on corporate social

performance for U.K. companies. Their results show that the probability that innovation leads to CSP is higher for industries related to social and environmental issues and larger companies.

If both H1 and H2 hold this would indicate that a virtuous circle or bi-directional link of CSR and innovation is the case. This means that CSR creates innovation and vice versa. Furthermore CSR as well as innovation create competitiveness with in turn builds the basis for further CSR and/or innovation activity. The virtuous circle connection is described in Vilanova et al. (2009) as well as MacGregor and Fontrodona (2008).

H3: Combining CSR and innovations creates a competitive advantage which results in higher performance.

The complementary link means that CSR activity is implemented in the innovation strategy and creates competitive advantage. Based on estimations which reveal positive effects of CSR on financial performance, McWilliams and Siegel (2000) claim that models without controlling for R&D are not entirely correct. Under the assumption that innovation has a positive impact on financial performance, and that R&D and CSR are highly correlated, the positive effect of CSR and financial performance might be smaller or even disappear if R&D is taken into account in the estimations. They could confirm both assumptions and show a neutral effect of CSR on financial performance. Also Halme and Laurila (2009) analyzed the complementary link. Based on a literature review on theoretical literature, empirical studies, and case studies Halme and Laurila (2009) explain theoretically the financial and societal outcomes of different corporate responsibility (CR) types. They come to the conclusion that CR integration and CR innovation are likely to create financial performance rather than philanthropy.

The hypothesis H1, H2, and H3 describe a complementary character of CSR and innovation. The different approach of a substitutive link between CSR and innovation is based on the assumption that companies have two possibilities of product differentiation for competitive advantage, namely CSR or innovation. Hull and Rothenberg (2008) examined positive effects of CSR on financial performance when companies differentiate either by innovation or doing CSR. They conclude that highly innovative companies do not need further differentiation via CSR activity. This CSR-Innovation connection cannot be taken into account in this paper, because specific data on products' innovation characteristics and CSR characteristics would be needed.

We concentrate on the complementary relationship of CSR and innovation and how they affect companies' performance. Therefore we test the hypothesis H1, H2 and H3 in this paper. Our estimations provide insight into the connection of CSR, innovation and competitiveness, which have not yet been tested extensively. We concentrate on technological innovators and examine how CSR and innovation together and separately affect the Return on Sales as a competitiveness indicator.

3 Data

A main purpose of the study is to test whether technological innovators engaged in CSR activity are more competitive than their non-CSR counterparts. We use firm-level survey data that provide measures for CSR, innovation and financial performance. Innovation and financial performance data are taken from the Mannheim Innovation Panel (MIP) which is the German contribution to the Community Innovation Surveys (CIS). In contrast to standard CIS, the MIP is an annual survey, covering a wider set of sectors, size classes and containing additional questions. The MIP provides

general firm data (financial data etc.) as well as detailed information on innovation activities. The basic population for the innovation survey are all legal independent companies with a minimum of 5 employees located in Germany. MIP is a panel which source is a basic random sample drawn in 1992. This sample is yearly resolved and refreshed every second year to compensate for panel mortality.

We use the 2009 survey of the MIP which refers to innovation activities in the years 2006-2008 and is equal to the CIS 2008. The 2009 survey was responded by 7,061 firms. In order to collect information on CSR activities, we drew a sub-sample from these firms and conducted a follow-up survey by telephone. While the main purpose of this follow-up survey was to obtain additional information on environmental innovation activities and their impacts, we also included a question on CSR activities. The follow-up survey was addressed to 3,776 firms which have in common that they reported some type of environmental innovation activity. The sub-sample of the follow-up survey includes both firms with technological innovations (63.3%) and without technological innovation (36.7%). Out from the 3,776 firms in the sub-sample, a total of 2,984 were willing to participate in the telephone survey and provided information on CSR activities, giving a response rate of the follow-up survey of 79%. The share of technological innovators in the net sample is exactly the same as in the gross sample (63.3%). Since not all surveyed firms provided full information on all our model variables, we could only use a reduced sample of 2,202 firms for estimation. The reduced sample does not differ significantly from the full sample of the innovation survey in terms of sector coverage and firm size. However, it does differ significantly with respect to the share of technological innovators, which is 63.7%, compared to 50.9% in the full sample (50.9%) which raises the issue of selection bias.

We account for this bias by estimating a sample selection equation and using the inverse of the Mills ratio as an additional regressor in our models (Kennedy 1998). Firstly, we run two probit models with CSR and innovation, respectively, as dependent variables and including the inverse Mills ratio to reduce the sample selection bias. These models test H1 and H2. Secondly, we test H3 with an interval regression on financial performance and included CSR and innovation as single and interaction variables, and again, the inverse Mills ratio is added for sample selection correction.

Many empirical studies on CSR examine the effects of CSR on financial performance (see meta-analyses by Orlitzky et al. 2003 and Margolis et al. 2007). According to Margolis et al. (2007) two substantial types of financial performance measurement can be distinguished: accounting-based and market-based measurement. For the market-based method, the stock market performance is taken into consideration. Whereas accounting-based measuring includes firm internal financial data like Return on Equity (see Margolis et al. 2007). Also Orlitzky et al. (2003) differentiate market-based as external market responses and accounting-based as internal efficiency financial performance measurement.[1] The dataset includes accounting related types of financial performance measurement like turnover, exports, Return on Sales (ROS), market share, and productivity. These indicators are among others also identified as competitiveness indicators or specifically as economic or financial performance or profitability of a firm in the literature (see e.g. Rexhäuser and Rammer 2011). As the term competitiveness is elusive because it is a concept and not measurable in itself and as a common definition is missing, a variety of measurement types exist (see e.g. for overviews (Siggel 2006; McFetridge 1995).

[1] Orlitzky et al. (2003) differentiate a third type the perceptual measurement, which are subjective estimates of survey respondents. For further explanation see Orlitzky et al. (2003).

McWilliams and Siegel (2000) provide one of the few empirical studies controlling for R&D as an innovation indicator in their model to estimate the effect of CSR on financial performance. They base their study on work by Waddock and Graves (1997). Hull and Rothenberg (2008) base their analysis on both studies and extend these approaches. All of these studies use Return on assets (ROA) as a dependent performance indicator. The MIP database does not include the ROA, therefore we need to use another indicator, which limits the comparability of the studies.

We will run our estimation on financial performance with the dependent variable Return on Sales (ROS). This is mainly driven by two reasons. Firstly, the empirical research on profitability and the driving factors is well established (see e.g. Ravenscraft 1983; Schmalensee 1988; Allen and Hagin 1989). A recently published paper by Czarnitzki and Kraft (2010) deals with the topic of profitability and innovation. Another research by Rexhäuser and Rammer (2011) addresses the Porter Hypothesis on environmental quality and firms' profitability. In both studies ROS is used as a dependent variable for profitability. Secondly, the indicator ROS is integrated in the original MIP survey and therefore also available for the companies that participated in the telephone survey on CSR activities. The variable is constructed as an interval with known threshold, which enables us to estimate the relationship of CSR, innovation and profitability with an interval regression model.

The independent variables (all taken from MIP survey 2009) are separated into explanatory variables and control variables. The explanatory variables in the ROS estimation include a dummy for competitive environment, Herfindahl index, a dummy for market share, capital intensity, and patent stock. In addition to the traditional variables that explain the financial performance of a firm, CSR and technological innovation activity are included. In the estimations we control for size (by employees), industry, and age of the firm, and a dummy for East German companies is included. Furthermore the inverse of the Mills ratio is included to reduce the sample selection bias. The detailed explanation of the specific variables and their descriptive analyses are provided in the next section and the appendix.

4 Descriptive Results

The used sample contains 2,202 companies. It is a reduced sample of the 2,984 companies included in the telephone survey, because not all the asked companies gave an answer to the entire variables in the model. The telephone survey and the subsample do not differ significantly in sector coverage. Concerning firm size (measured by number of employees) in both samples the small and medium sized companies are dominating (SME). The mean number of employees in the telephone survey is 950 (median 45.5), whereas the reduced subsample has a mean of 636 (median 46.25). Table 9 in the appendix shows the summary statistics of the independent variables included in in models as well as the dependent variable ROS. A detailed overview of the dependent variable ROS provides Table 10 in the appendix with the thresholds of the seven categories, the frequencies and the percentage. The correlation matrix for the dependent variable ROS and the independent variables is also provided in the appendix in Table 11.

One of the explanatory variables concerning the main question in our paper if CSR makes any difference for environmental innovators is based on questions in the telephone survey. The telephone survey included six questions on possible CSR activities: one question on environmental issues and five concerning quality of job topics. The term CSR was not explicitly mentioned during the survey. The survey was designed that, first a question on a specific activity was asked and then

whether this activity exceeded the legal limits. The following table gives an overview on the questions and the engagement of the companies.

Table 1: Dimensions of CSR activity

CSR activity	Engagement in CSR activity (absolute numbers and % of subsample)		Beyond legal requirements (absolute numbers and % of subsample)	
	Yes	No	Yes	No
Increase of employee's environmental awareness	1,332 60.49%	870 39.51%	820 37.24%	1,382 62.76%
Increase of safety at work	1,880 85.38%	322 14.62%	1,049 47.64%	1,153 52.36%
Integrate disabled people	919 41.73%	1,283 58.27%	382 17.35%	1,820 82.65%
Equality of men and women	1,174 53.32%	1,028 46.68%	447 20.30%	1,755 79.70%
Avoid discrimination	1,118 50.77%	1,084 49.23%	491 22.30%	1,711 77.70%
Integrate foreign employees	915 41.55%	1,287 58.45%	489 22.21%	1,713 77.79%

Source: Telephone survey and MIP own calculations

The overview shows that more companies are engaged in "increase of employee's environmental awareness" and "increase of safety at work" than in all the other CSR activities. Looking on how many of the companies going beyond legal requirements also "increase of safety at work" and "increase of employee's environmental awareness" show the highest engagement. The most companies answered not going beyond legal limits especially in the four last questions on equality issues.

Another option to look at the answers concerning CSR is to sum how often the companies explain to fulfill more than the legal limits. The results on this CSR intensity are provided in Table 2. The value "none" means no CSR activity, "extremely high" means that the firm is engaged in all asked activities and goes beyond the law. The table shows that 30.47% of the companies in the subsample had no CSR activity at all and 41.37% had only a low involvement in CSR activities. In the medium range are 13.44% and 14.71% had a high involvement in CSR activities.

Table 2: Summary CSR intensity

CSR intensity	Frequency	Percent
None	671	30.47
Very low	500	22.71
Low	411	18.66
Medium	296	13.44
High	185	8.40
Very high	106	4.81
Extremely high	33	1.50
Total	2,202	100.00

Source: Telephone survey and MIP own calculations

For the estimation of our model we use an aggregated CSR indicator. The variable is a dummy for CSR engagement. It is based on the six questions in the survey and takes the value one if at least in one of the questions the firm answered to go beyond legal requirements. The dummy variable takes the value zero if companies not going beyond the legal limits in all the six questions.

Table 3: Summary CSR activity

CSR activity	Frequency	Percent
yes	671	30.47
no	1,531	69.53
Total	2,202	100.00

Source: Telephone survey and MIP own calculations

5 Empirical Methodology

Our main research question is to analyze whether firms engaged in CSR activities doing better concerning competitiveness issues than their non-CSR active counterparts. This research question was taken several times in different specific areas like environment or social concern in the past as the huge meta-analysis by Orlitzky et al. (2003) or Margolis et al. (2007) show. The same is true for the impact of innovation on firm performance. Rather little attention has been paid to a likely interaction between CSR and innovation and the consequences of this interaction on financial performance. McWilliams and Siegel (2000) point out that most of the studies on CSR and financial performance miss to control for innovation. In their approach R&D investments were taken to control for product and process innovations. This methodology is classified as complementary connection of CSR and innovation, explained above. It leads to our hypotheses H1, H2, and H3.

Before testing the hypotheses, we have to take into account a sample selection bias present in our data. Information on CSR activities has been obtained only from a subsample of firms, and this subsample is not a random sample of the full sample, but only included firms that reported some type of environmental innovations. Though environmental innovations, as defined in the CIS 2008 go far beyond mere technological innovation, the share of firms with environmental innovation activities that are at the same time technological innovators is significantly higher than the respective share in the full (random) sample. We control for this sample selection bias by estimating a sample selection correction model and use the inverse Mills ratio generated from this model to adjust for the biased sample in all our main model estimations (Kennedy 1998). The sample selection model is

$$EI_i = \gamma' W_i + \tau M_i + e_i$$

with EI_i is a yes/no variable indicating if the firm reported some type of environmental innovation activity and was thus part of the subsample for which CSR information has been obtained. The control variables include size, age, sector and location of firm *i* and are put together in vector W_i. M_i represents material and energy intensity and is our instrument variable. Firms with high material and energy costs per unit of sales are more likely to engage in environmental innovation activities since on the one hand these activities can lower their cost exposure, while on the other marginal returns of investment in reducing environmental impacts will be higher. At the same time, we find no significant impact of material intensity on firms' propensity to introduce technological innovations or engage in CSR activities.

The inverse Mills ratio (IMR) is calculated using the results of the sample selection model[2] and used in our probit models for testing H1 and H2 as well as in the interval regression on ROS. Firstly, we

[2] $Inverse\ Mills\ Ratio = \frac{Probability\ Density\ Function\ (predicted\ EI)}{Cumulated\ distribution\ Function\ (predicted\ EI)}$

estimate two probit models with technological innovation and CSR, respectively, as dependent variables.

In order to test hypotheses H1 and H2 we include innovation (*I*) and *CSR* in each of the other model:

$$I_i = \alpha CSR_i + \gamma' S_i + \varphi IMR_i + u_i$$

$$CSR_i = \alpha I_i + \gamma' S_i + \varphi IMR_i + v_i$$

Since both innovation and CSR are dummy variables we run probit estimations. In both models the control variables are put together in S_i. These are firm size (logarithm), firm age, dummies for industry and East Germany and a dummy for the competitive environment of the firm, the percentage of graduated employees, and a dummy for organizational innovations (for specific explanation see descriptive analysis). Furthermore the inverse Mills ratio IMR_i estimated before for sample selection correction is included in both probit models.

For testing H3 we use the following model:

$$ROS_i = \beta' X_i + \alpha CSR_i + \mu I_i + \omega CSR_i * I_i + \gamma' Z_i + \varphi IMR_i + \varepsilon_i$$

The dependent variable ROS_i represents financial performance of firm i and is measured as pre-tax return on sales on a categorical level using seven categories with known thresholds (see Table 10). This type of variable allows us to use the interval regression method for estimating our model (Wooldrige 2006; Cameron and Trivedi 2010). In our case the first and the last category are censored. This means that in the first category we can only observe that the data is less than zero per cent. Additionally the last category contains values of fifteen per cent or higher. Therefore our sample is left and right censored (Wooldrige 2006; Stewart 1983). The assumptions for an interval regression model are normal distribution of the error terms and homoscedasticity (Wooldrige 2006). The results of such an interval regression model can be interpreted like results of a linear regression (Wooldrige 2006).

The measurement of impact on competitiveness and in our case on ROS would actually require data from previous years to estimate the current performance situation of a firm, because the performance is likely to depend on decisions in the past. We do not use a lagged approach, which can be justified by our data base. The MIP survey 2009 asks for data in the period between 2006 and 2008, which contributes to the necessity that past data and therefore firm action in the past is required. Furthermore the dependent variable is measured and used for the specific year 2008, which is a specific point in time for performance. We use innovation activity as innovation output instead of innovation input in form of R&D investments, which can only show the potential of innovation but not the real outcome of the investment. Innovation input variables would need a lagged structure of the model. By including innovation itself a lagged approach is not necessary, because current innovation influent the current performance of a firm. The variable for innovation includes process and product innovations taken in the period 2006-2008. It is a dummy variable, which takes the value one if the firm introduced new products or implemented cost reducing process innovations. The implemented CSR variable is based on the telephone survey conducted in 2009. Therefore the observations include the specific situation in that point in time. Nevertheless, as the questions on CSR are contributed to CSR activities with a strategic perspective, we assume that the CSR activities have been implemented in the past and not just in the same year of the survey.

Strategic CSR measurements should be included in the whole management strategy of a firm (Porter and Kramer 2006), whereas CSR activities like donations are often based on the slack resources theory (see explanations above; e.g. Preston and O'Bannon 1997) and decisions on that are taken in the current financial year of the firm. Due to the observation procedure of our survey, the non-lagged model approach can be justified.

The independent variables include traditional variables explaining competitiveness called X_i. Czarnitzki and Kraft (2010) use in their research on companies' profitability measured as ROS the market structure as one of the key factors (see also Rexhäuser and Rammer 2011). Indicators for market structure are the market concentration, with the standard measurement as Herfindahl index, and the market share (Shepherd 1972; Czarnitzki and Kraft 2010; Rexhäuser and Rammer 2011). Both indicators reflect the price setting opportunities of a firm. The Herfindahl index is not included in the survey. Therefore it is constructed with external data from the German Monopoly Commission from reporting year 2007, which is the latest available data (see also Rexhäuser and Rammer 2011). The percentage of market share is prompted in the survey as the total market share in percent for the firm's main product group in terms of turnover. A further indicator connected to the market structure is the competitive environment. We included a dummy variable taking the value one if the firm faces at least one of the six asked threats to competitive position. The capital intensity is calculated as assets per employee. Therefore we use stated assets from the survey and correct first for outliers and then correct missing values with the average value of industry and size of firm (imputation of data) to overcome potential selection bias. Furthermore we included the patent stock over the period 1989 to 2006 with 15% depreciation rate of knowledge (Griliches and Mairesse 1984) to capture the high level of technology, which might affect ROS (see Rexhäuser and Rammer 2011). The CSR variable is CSR_i and the innovation variable is called I_i. The innovation variable is a dummy for product or process innovations in the period 2006-2008. CSR and innovation are included as single dummy variables and also as interaction term. The control variables are put together in Z_i and include logarithm of the firm size, age of firm, and dummies for industry, and a dummy for East Germany (for specific explanation see descriptive analysis). Concerning the size variable attributes to two assumptions in literature. Firstly, the engagement in innovation depends on the size of companies and larger companies are more involved in innovation activities (Rennings and Rexhäuser 2011). Secondly larger companies tend to involve more often in CSR measures (Stanwick and Stanwick 1998). Again the inverse Mills ratio is included to reduce the sample selection bias.

6 Results

We run two probit regressions to test H1 and H2. In probit regressions the p-value directly displays the significance of a parameter. The results in Table 4 and Table 6 show, that CSR activity is highly significant for innovation and vice versa. Maximum Likelihood estimators measure the influence of an explanatory variable on the probability that the dependent variable takes the value one. Furthermore for the probit regression on innovation the variable "graduated employees" is highly significant at the 1% level. For the probit regression on CSR the variable "organizational innovation" is highly significant at the 1% level. At the same time these variables are not significant (even at a 10% level) for ROS. Therefore these two variables will not be included into the interval regression on ROS. Goodness of fit test on the percentage of correctly classified observations (Cameron and Trivedi 2010) show for the probit regression on innovation that 73.75% are correctly classified and for the csr probit regression that 70.16% are correctly classified. But the displayed coefficients give only a

hint on the direction of influence but not on the quantity. Therefore the marginal effects have to be estimated. The probit regression on Process and Product Innovations 2006-2008 (Table 5) shows that if the dummy for CSR engagement changes from zero to one, the probability that the firm innovates rises by 7.52%. Therefore H1 that CSR companies are also more engaged in innovations than non-CSR companies is proven. Concerning H2 the results of the probit regression on CSR (Table 7) show that if the dummy for innovation changes from zero to one, the probability that the firm is engaged in CSR activities rises by 8.20%. This result indicates that innovation can create capabilities for CSR. The both probit regressions show that CSR and technological innovations are linked and influence each other. Therefore a statement on the causal relationship whether CSR influence innovation or rather the other way around cannot be made. Both directions (H1 and H2) are possible according to our estimations.

Table 4: Estimation Results Probit regression on Product and Process Innovations

Dependent variable: Product and Process Innovations 2006-2008		
	Coef.	Std. Errors
COMP	0.402**	(0.168)
ln_SIZE	0.368***	(0.130)
AGE	-0.000659	(0.000873)
EAST	-0.166**	(0.0731)
CSR	0.249***	(0.0655)
GRAD	0.00859***	(0.00168)
OI	0.550***	(0.0620)
InvMillsRatio	2.665*	(1.570)
Constant	-4.436***	(1.697)
Observations	2202	
Standard errors in parentheses		
* p<0.10; ** p<0.05; *** p<0.01		
The model includes 21 sector dummies based on aggregated NACE 2-digit levels.		

Table 5: Marginal effects Probit regression on Product and Process Innovation

Dependent variable: Product and Process Innovations 2006-2008						
	dy/dx	Std. Err.	z	P>z	[95% Conf.	Intervall]
COMP	0.1215149	0.0506442	2.40	0.016	0.022254	0.2207757
ln_SIZE	0.111318	0.0392699	2.83	0.005	0.0343504	0.1882856
AGE	-0.0001993	0.0002639	-0.76	0.450	-0.0007164	0.0003179
EAST	-0.0502652	0.0220279	-2.28	0.022	-0.093439	-0.0070913
CSR	0.0752199	0.0196138	3.84	0.000	0.0367775	0.1136623
GRAD	0.0025968	0.0005	5.19	0.000	0.0016167	0.0035769
OI	0.166219	0.0177652	9.36	0.000	0.1313998	0.2010382
InvMillsRatio	0.80563	0.4737267	1.70	0.089	-0.1228572	1.734117

Table 6: Estimation Results Probit regression on CSR

Dependent variable: CSR activity		
	Coef.	Std. Errors
COMP	-0.0746	(0.168)
ln_SIZE	0.281**	(0.117)
AGE	-0.00144*	(0.000858)
EAST	-0.260***	(0.0699)
PDC	0.253***	(0.0660)
GRAD	0.00136	(0.00157)
OI	0.295***	(0.0614)
InvMillsRatio	1.766	(1.411)
Constant	-2.122	(1.525)
Observations	2202	
Standard errors in parentheses		
* p<0.10; ** p<0.05; *** p<0.01		
The model includes 21 sector dummies based on aggregated NACE 2-digit levels.		

Table 7: Marginal effects Probit regression on CSR

Dependent variable: CSR activity						
	dy/dx	Std. Err.	z	P>z	[95% Conf. Intervall]	
COMP	-0.0241458	0.0542856	-0.44	0.656	-0.1305435	0.082252
ln_SIZE	0.0907969	0.0376707	2.41	0.016	0.0169636	0.1646302
AGE	-0.0004668	0.0002773	-1.68	0.092	-0.0010103	0.0000766
EAST	-0.0840881	0.0224497	-3.75	0.000	-0.1280888	-0.0400875
PDC	0.0819648	0.0211614	3.87	0.000	0.0404892	0.1234403
GRAD	0.0004386	0.0005087	0.86	0.389	-0.0005584	0.0014357
OI	0.0956015	0.0195562	4.89	0.000	0.0572721	0.133931
InvMillsRatio	0.571326	0.4563902	1.25	0.211	-0.3231824	1.465834

Table 8 reports the results of the interval regressions on ROS. We run two models: The first one includes only the innovation variable and the CSR as single variables. The second model includes both variables and the interaction term of innovation and CSR. The included terms are implemented that innovation (*PDC*) reflects that the firm only innovates but is not engaged in CSR. The same for the variable CSR, which means the firm is only engaged in CSR activity but does not innovate. The interaction term (*INTpdccsr*) takes into account if the firm at the same time has process or product innovations and is engaged in CSR activities. The inverse Mills ratio is included for selection bias correction. The provided effects can be interpreted as in standard OLS models (Wooldrige 2006). In our case the dependent variable is measured in %, so the marginal effects represent also percentage results.

Table 8: Estimation Results

Dependent Variable: Return on Sales in Percent		
	Estimated Models	
	(1)	(2)
COMP	-1.085	-1.085
	(0.730)	(0.730)
HHI	0.000329*	0.000330*
	(0.000175)	(0.000175)
MASH	0.0142***	0.0142***
	(0.00511)	(0.00511)
CAPI	-0.375***	-0.374***
	(0.138)	(0.138)
PATSTOCK	0.00189	0.00189
	(0.00234)	(0.00235)
PDC	0.481*	0.548
	(0.287)	(0.468)
CSR	0.0822	0.141
	(0.283)	(0.428)
INTpdccsr		0.587
		(0.401)
ln_SIZE	1.168***	1.170***
	(0.415)	(0.415)
AGE	-0.00852**	-0.00852**
	(0.00366)	(0.00366)
EAST	-0.663**	-0.663**
	(0.301)	(0.301)
InvMillsRatio	18.51***	18.54***
	(5.228)	(5.230)
Constant	-11.86**	-11.92**
	(5.587)	(5.599)
lnsigma	1.741***	1.741***
	(0.0182)	(0.0182)
Observation summary:		
244	left-censored observations	
0	uncensored observations	
211	right-censored observations	
1741	interval observations	

Standard errors in parentheses

* p<0.10; ** p<0.05; *** p<0.01

The model includes a significant dummy for inputation of variable MASH.
The model includes 21 sector dummies based on aggregated NACE 2-digit levels.

In our sample of German innovators all the traditional explanatory variables X_i for ROS have the expected positive or negative effect. Competitive environment (*COMP*) shows a negative but non-significant impact on ROS. The both market concentration determinants market share (*MASH*) and the Herfindahl index (*HHI*) are significant on the 1% level or 10% level. The market share in % of the product group with the highest sales has a positive effect on profitability with 0.0142 percentage

points increase in Return on Sales. The coefficient of the Herfindahl index show 0.000330 percentage points increase in ROS. The significance of the Herfindahl index is in line with results by Czarnitzki and Kraft (2010). The patent stock (*PATSTOCK*) with depreciation of knowledge of 15% per year has a positive but not significant impact on ROS. Although the positive effect of the patent stock is in line with results by Czarnitzki and Kraft (2010), their findings show an highly significant and strong impact of patent stock on ROS. The significant determinant capital intensity (*CAPI*) as assets per employee effect ROS negatively. This variable partially controls for our specific measure of financial performance which is returns excluding depreciation. Since firms with high capital intensity will have higher depreciation (everything else being the same), their return on sales will be lower even if cash flow may be higher than for firms with lower capital intensity. Hart and Ahuja (1994) explain the negative capital intensity in their study on impact of emission reduction on firm performance by the recession in the specific year of the estimation. The estimation results by Czarnitzki and Kraft (2010) are in the opposite direction: They found a positive and significant effect of capital intensity, which they interpret as market entry barrier, but they did not control directly for the firm's market share. Furthermore we found a significant positive effect of firm size (*ln_SIZE*) measured in log of employees on ROS. This implies positive effects of scale. The age (*AGE*) of a firm has a significant negative effect. Also the dummy for East German companies (*EAST*) has an expected significant negative effect on ROS. These results count for both estimated models.

Model 1 includes innovation (*PDC*) and CSR activity (*CSR*) as dummy variables. Technological innovations introduced between year 2006 and 2008 (*PDC*) show a positive effect on ROS significant at the 10% level. This shows that technological innovations can contribute to better financial performance of firms. For product innovations this might be reasoned by achieving higher product prices with new products or raising firm's market share when imitating products from competitors. Concerning process innovations reduced unit costs could have positive impacts on profitability. In the first model CSR activities do not significantly affect financial performance.

Model 2 includes in contrast to model one the pure effects of technological innovation (*PDC*) and CSR activities (*CSR*) as well as the interaction of innovation and CSR (*INTpdccsr*). In this model the variable for innovation (*PDC*) is constructed in a way that it represents only innovating but no CSR activity. The same counts for CSR activity (*CSR*): Here only the engagement of CSR and no innovation activity is measured. The interaction term (*INTpdccsr*) represents the case when the firm is engaged in CSR *and* innovation activity. For interpretation the reference group of the firms with no technological innovation and no CSR activity has to be taken into account. All three variables are not significant, but have a positive impact on financial performance. The technological innovations (*PDC*) have a positive impact on financial performance compared to the control group of firms with no innovation and no engagement in CSR activities. However, in our model 2 the impact is not significant. The positive impact of CSR on financial performance compared to the control group with no CSR and no innovation would be in line with other empirical results with a slight positive impact of CSR on financial performance (see as an overview Margolis et al. 2007). McWilliams and Siegel (2000) show in their estimations that models without any innovation variable might be misleading in a biased CSR. They found a neutral effect of CSR on financial performance when taking R&D into account. They attribute this bias to a high correlation of their CSR variable with R&D expenditures. Also Margolis et al. (2007) advice beside other control variables also to take innovation into account. Our data also indicates a high correlation of CSR and innovation in the correlation results (see Table 11). Furthermore the probit estimations on innovation with CSR as explanatory variable and vice versa,

show both a highly significant impact on each other. This indicates a high correlation although the causal direction is not clear. If the firm is engaged in CSR and at the same time introduced innovations (*INTpdccsr*) the impact of CSR on ROS is positive with 0.587 percentage points compared to the control group of non-innovating and non-CSR firms.

This result shows that the engagement in technological innovation or CSR or both at the same time have a positive impact on financial performance compared to the control group neither innovating nor doing CSR. If CSR is implemented at the same time with innovations the interaction term shows a higher positive impact on financial performance. Therefore concerning our data it seems that if CSR is combined with innovation this could create competitive advantage which results in higher financial performance. But as the results are not significant this might indicate a possible neutral effect of CSR as well as the combination of CSR and innovation on financial performance, which is in line with findings by McWilliams and Siegel (2000). Due to limits of our data this conclusion cannot be drawn for firms in general. Especially the innovation activity of German firms may be different to other European countries. Furthermore the effects are not significant.

The contribution of our study to the existing empirical research on CSR and firm performance is the inclusion of innovation aspects in form of general process and product innovations. The need for implementing innovation into models explaining CSR and performance relation was mentioned and conducted by McWilliams and Siegel (2000). Also in the overall advice by Margolis et al. (2007) for future research they make clear that in the past controlling for size and industry was not common let alone including R&D or other innovation indicators. McWilliams and Siegel (2000) based their model on the assumption that CSR and R&D are highly correlated and found that by including R&D expenditures CSR has a neutral effect on profitability. Also Hull and Rothenberg (2008) included innovation in their estimations but with an completely different assumption, namely that product differentiation is either made by innovation or CSR. Although our data cannot contribute to the specific model of Hull and Rothenberg (2008), the general advice by them to include innovation in the model can be supported by our study.

7 Conclusion

Corporate Social Responsibility is a topic with a long research history going back to Friedman (1970). Margolis et al. (2007) critically point out that further research might not find new results and research should better concentrate on other tasks. This critique particularly refers to empirical literature on CSR and financial performance. This may be true if only the amount of empirical research is taken into account. But by looking at the different research approaches and data bases further research is justifiably. Especially the connection of CSR and innovation has not been extensively examined yet. Our study contributes to this specific research gap.

Our results show neither a significant effect of CSR nor the combination of CSR and innovation on ROS, but the impacts are positive. It seems that the combination of CSR and innovation could create competitive advantage which results in higher financial performance. The non-significance of the single CSR engagement and the combination of CSR and technological innovation rather imply a eutral effect on firm's financial performance. The correlation and the probit estimations for testing H1 and H2 show a strong correlation of CSR and innovation. The causal effect remains unclear, which might imply a virtuous circle conncetion.

But as Margolis et al. (2007) already mention the results strongly depend on the measurement methods, also our data has some restrictions. The limits of our study are three-folded: Firstly, the data only includes German companies which have at least an innovation with low positive environmental effects in the asked fields. We correct for this sample bias by the inverse Mills ratio. Nevertheless, the results might be different if more companies would be included in the sample. Furthermore for companies in other European countries the results might also vary (see e.g. Bocquet et al. 2011).

Secondly, only a few aspects of CSR activities were included in the questionnaire. Therefore the results only contribute to these specific aspects. But to portray and include all the variety of CSR into a questionnaire and use them in empirical studies is almost not possible. The papers by Halme and Laurila (2009) and Margolis et al. (2007) provide concepts to classify different CSR activities. The need for a classification demonstrates the huge variety of CSR.

Thirdly, the measurement of profitability might limit the conclusion on other types of profitability. As in the introduction mentioned profitability of a firm can be measured in different ways. The two types differentiated by Margolis et al. (2007) are accounting-based and market base measurements. According to Margolis et al. (2007) results might be misleading if the measurement of profitability does not fit to the CSR measurement. Our estimation are limited to the companies perspective, but they fulfill the requirements Margolis et al. (2007) came up with. The dependent variable ROS is an accounting-based performance measurement and the included CSR activities also concern the firm itself and not via a stock market reaction. With all these restriction we have to admit that if we could include all German companies and further issues on CSR the picture might be different.

Research on CSR, innovation and financial performance with a more extensive data on CSR would provide further insights on the dynamic of CSR and innovation. Furthermore with panel data on CSR and innovation long term effects could be revealed. Particularly the recently growing interest of consumers on sustainable products and CSR activities in the supply chain, may lead to a growing activity in strategic CSR by companies. Companies might implement their CSR measures within their management strategy and combine innovation and CSR on the long run. As both are costly and risky further research on which kind of CSR with which type of innovation generates better financial performance is needed. On the other side a higher Willingness-to-pay (WTP) for sustainable products might lead to product differentiation by CSR instead of innovation. Which strategy is taken by which type of firm or sector and also by what factors the WTP of consumers is driven are further research aspects in the research area of CSR.

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9 Appendix

Table 9: Summary descriptive statistics of the variables (2202 observations)

Variable	Description	Mean	STD. DEV	Min	Max
Dependent variable					
ROS	Pre-Tax Return on Sales. Measured as categorical variable with seven categories and known thresholds.	3.779	1.825	1	7
Explanatory variables					
COMP	Dummy for competitive environment. The dummy takes all six questions on competitiveness in the MIP into account. It takes the value one if at least one indicator for the competitive environment was assigned as rather applicable.	0.966	0.180	0	1
HHI	Herfindahl index as market concentration variable. Data is taken from the German Monopoly Commission reporting year 2007.	482.192	836.117	2.107	6684.311
CAPI	Capital intensity as assets per employee.	0.311	1.073	0.0000162	20.635
PATSTOCK	Patent stock with a depreciation of knowledge of 15% per year.	8.034	260.711	0	12163.200
MASH	Market share 2008 in % of the product group with the highest sales	15.331	25.211	0	100
GRAD[a]	Percentage of graduated employees	18.074	22.052	0	100
OI[a]	Dummy variable for organizational innovations. It takes value 1 if firm introduced a new organizational method between 2006 and 2008 which has not been previously used by the enterprise.	0.589	0.492	0	1
PDC	Dummy variable for product and process innovation 2006-2008.	0.637	0.481	0	1
CSR	Dummy variable for CSR activity of a firm, taking value one if the firm is engaged in at least one of the seven prompted CSR activity.	0.695	0.460	0	1
Control Variable					
ln_SIZE	Size of the firm measured in logarithm number of full-time employees.	3.904	1.734	0	12.9337
AGE	age of the firm in year 2008	33.491	37.513	0.5	347.5
EAST	Dummy for East German companies. It takes the value 1 for companies located in East Germany.	0.312	0.464	0	1
SECTOR_1-21	21 sector dummies generated on the two-digit NACE code.				

[a] Variables are only included into the probit estimations on innovation or CSR. Both are not significant for ROS.
Source: Telephone survey and MIP own calculations

Table 10: Summary dependent variable ROS

Pre-Tax ROS	Frequency	Percent
smaller than 0%	244	11.08
0% until < 2%	410	18.62
2% until < 4%	377	17.12
4% until < 7%	410	18.62
7% until <1 0%	291	13.22
10% until < 15%	259	11.76
15% and more	211	9.58
Total	2,202	100.00

Source: MIP own calculations

Table 11: Correlation matrix

	ROS	COMP	HHI	CAPI	PATSTOCK	MASH	GRAD	OI	PDC	CSR	ln_SIZE	AGE	EAST
ROS	1												
COMP	-0.0088	1											
HHI	0.0381	-0.0059	1										
CAPI	-0.0463	-0.1262	-0.0053	1									
PATSTOCK	0.0402	0.0056	0.0093	-0.0086	1								
MASH	0.0494	-0.1233	0.0364	0.0103	0.0030	1							
GRAD	0.0624	0.0437	0.0397	-0.0040	0.0011	0.0077	1						
OI	0.0104	0.0592	0.0564	-0.0691	0.0222	0.0135	0.0593	1					
PDC	0.0647	0.1054	0.0558	-0.1038	0.0221	0.0303	0.1326	0.2607	1				
CSR	0.0079	0.0025	0.0214	-0.0343	0.0186	0.0052	-0.0051	0.1602	0.1584	1			
ln_SIZE	-0.0417	0.0449	0.1234	-0.2803	0.1041	0.0997	-0.1532	0.2204	0.2321	0.2007	1		
AGE	-0.0646	-0.0211	-0.0224	-0.0125	0.0664	0.0425	-0.1586	-0.0305	0.0075	0.0149	0.2400	1	
EAST	-0.0026	0.0007	-0.0127	0.0133	-0.0193	-0.0213	0.1596	0.0081	-0.0592	-0.0944	-0.1706	-0.2658	1

Source: Telephone survey and MIP own calculations