

Nijmegen School of Management
Department of Economics and Business Economics
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The effect of CSR disclosure on firm value with financial ratios as moderators: A specification curve analysis

By LOEK HEUTHORST (S1034913)

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Supervisor: Thomas Niederkofler

Abstract

This master thesis investigates the effect of corporate social responsibility (CSR) disclosure on firm value with financial ratios as moderators. Due to the new CSRD legislation of the European Union, the relevance of the effect of CSR disclosure on firm value is increasing. This study replicates three hypotheses of the Naseem et al. (2019) paper. The study uses a specification curve analysis (SCA) instead of the traditional regression analysis, which reduces researchers' degrees of freedom by including all theory-based analytical decisions and presenting the sum of all these results. The financial and CSR information data is derived from the original study and stems from the Chinese stock market from 2008 to 2012. The SCA comprises 2,816 different estimations of the models. Overall, the results are inconclusive and do not indicate a clear relationship between CSR disclosure and firm value. This is different from the conclusions from the Naseem et al. (2019) regression analysis, which identified a positive relationship. This paper contributes to the existing literature by adding new research to the perceived relationship between CSR disclosure and firm value, as well as comparing the specification curve analysis with the regression analysis.

Keywords: CSR disclosure, firm value, specification curve analysis, corporate social responsibility, researchers' degrees of freedom

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1 Introduction

Corporate Social Responsibility (CSR) is an important topic in current economic scientific literature (Stuart et al., 2022). Stakeholders request more non-financial information from companies in order to close the information asymmetry gap and to improve their ability to assess company performance for decision-making (Martínez-Ferrero et al., 2015). New European Union legislation obliges publicly traded companies in the EU to disclose CSR information in their annual report as of fiscal year 2024, as laid down in the Corporate Sustainability Reporting Directive (CSRD) (Primec & Belak, 2022). Other large companies are required to implement CSRD as of fiscal year 2025 when they reach two out of the following three criteria: a revenue higher than €50 million, a balance sheet total higher than €25 million or more than 250 employees. Due to the introduction of CSRD legislation, it is becoming increasingly important for stakeholders to understand the effect of corporate social responsibility performance and disclosure on firm value. Especially knowing whether the costly procedures of collecting all this non-financial information outweigh the financial benefits of the increased reputation of the company, as it could possibly be a waste of resources and potentially value-decreasing (Chung et al., 2018; Gamerschlag et al., 2010). The extended non-financial reporting required by CSRD, also further reduces the information asymmetry gap between management and stakeholders. Previous literature stated that reducing the information asymmetry gap between firms and stakeholders can affect financial and non-financial performance (Cui et al., 2016; Naseem, et al., 2019).

Traditional regression analysis focuses on investigating different significant correlations between dependent and independent variables from a researcher's chosen dataset and a created model with chosen control variables. Every step in collecting and cleaning the sample of data presents a researcher with a choice or degree of freedom in their research (Simonsohn et al., 2020). These choices lead to arbitrary decisions and could eventually shape the desirable narrative for a researcher's statistical results (Masur, 2021). Subjective analytical decisions could lead to interpretive biased results in statistical analysis. Therefore, to differentiate from other research, this study uses a relatively novel quantitative research method existing of a specification curve analysis (SCA). In this analysis, all different specifications of CSR independent variables and financial dependent ratios are investigated. The SCA is a new method, often used in physiological

research, that includes all theory-based analytical decisions and presents the sum of all these results (Orben & Przybylski, 2019). This type of analysis includes all sets of combinations between the variables and different model specifications, which reduces the researchers' degrees of freedom. By including all specifications, the specification curve analysis shows the joint distribution across the sum of all model specifications and provides an overview of the different estimations and significant values (Frey, et al., 2021). The inconsistencies in the results are tested in correlation with the null hypothesis that there is no effect, thus checking for significant relationships across different specifications. This paper uses the data and hypotheses of the Naseem et al. (2019) paper to replicate the study using the specification curve analysis instead of regression analysis. This replication is done to identify the differences in results between the two types of analyses. The ongoing discussions about the relationship between CSR disclosure and firm value and the added value of the specification curve analysis as a research method in the literature resulted in the following research question:

What is the effect of corporate social responsibility disclosure on firm value and what is the impact of the researchers' degrees of freedom on the results?

This research contributes to the existing literature and research in several ways. Firstly, it investigates the importance of CSR disclosure to all stakeholders of companies and not only shareholders, by showing the impact it could have on firm value. This also helps future policymakers in improving standards and regulations, such as the CSRD. Secondly, it makes management and business controllers of companies appreciate the importance of CSR disclosure and proper controls on these disclosures. Thirdly, the research demonstrates the usefulness of the specification curve analysis and the value it can add to traditional research. By using the specification curve analysis, this research restricts the researchers' degrees of freedom (Simonsohn et al., 2020), which make the results more generalizable and have an increased translational value. Finally, it creates recommendations for future research on the topic of CSR disclosure and firm value as well as the specification curve analysis as a research method.

This paper is structured in the following way: The next section includes the literature review regarding the CSR disclosure theory, the hypotheses that are tested and the explanation of the specification curve analysis. The third section starts with the data source and sample which is used. Furthermore, it explains the functional equation of the hypotheses and the specifications included in the analysis for three hypotheses of the Naseem et al. (2019) paper. The fourth section consists of the summary statistics of the data, the results and graphs of the specification curve analyses and a comparison with the results of the replicated regression analysis. The paper is finalized with a conclusion section including the limitations of this research and recommendations for future research.

2 Literature review

2.1 Increasing importance of CSR information and its impact on firm value

The definition of corporate social responsibility does vary across the literature. It could be defined as serving society further than the legal requirements of a company (Jo & Harjoto, 2011). Corporate social responsibility reporting is becoming increasingly important for multiple stakeholders of organizations (Cormier et al., 2011). Amel-Zadeh & Serafeim (2017) conducted a global survey of investors and portfolio managers, in which 82% of the participants value Environmental Social Governance (ESG) information when making investments. In addition, the research of Khan et al. (2016), noted an increase in the number of investors integrating CSR information into their investment choices. Stakeholders nowadays are more than only the shareholders of organizations and are defined in the stakeholder theory as all groups that can affect or are affected by an organization (Russo & Perrini, 2009). Every stakeholder has different interests that need to be constantly managed. Stakeholders can be divided into multiple different groups: the shareholders, employees, customers, suppliers, government and non-government organizations and the society as a whole (Cui et al., 2016; Naseem et al., 2019). The stakeholder theory is intended to broaden management's vision from only maximizing profits to improving stakeholder engagement (Russo & Perrini, 2009; Van Der Laan Smith et al., 2010). There is ample research investigating the perceived relationship between CSR reporting and firm value. Previous

regression analysis literature stated a positive relationship, with firm value increasing in the long run (Chung et al., 2018; Ding et al., 2016; Sampong et al., 2018). In contrast, there is research stating a mainly negative relationship between the variables (Friske et al., 2022). Others identified a negative short-term relationship as costs outweigh benefits at the start, but reversing in the long run (Chen & Lee, 2016). These different results indicate that there is still no consensus in academic literature.

Wherever there is a division between management and stakeholder interests, information asymmetry and the principal agent theory arises. Information is crucial for the decision-making process and stakeholders decide on publicly available information. Management often has more knowledge regarding a firm's prospects than stakeholders, resulting in information asymmetry. In the case of information asymmetry, there is usually a principal-agent relationship as described in the agency theory (Naseem et al., 2019). In line with this theory, stakeholders have a new desire for transparency of CSR information and additional future risk information, and management is obliged to provide this information. In an industry with comparative organizations, the competition is fierce and companies need to differentiate themselves to outperform other companies. Organizations with positive CSR reports experience favorable treatment from stakeholders and their reputation improves (Hickman, 2020). Reputational improvement can also partly mitigate information asymmetry. Organizations with positive CSR reports are correlated with a superior information-collecting and reporting environment. In addition, these costly CSR information systems confirm to stakeholders superior information quality, which makes the organization more attractive by reducing the information asymmetry (Cui et al., 2016). Literature analysis confirms the increasing importance of CSR disclosures for stakeholders.

With regard to information asymmetry, agency theory and management's choice to disclose CSR information, researchers incorporate the signaling theory. Signaling theory states that there are two types of information asymmetries: 1. the behavioral intention of information and 2. the quality of information. Management's disclosure of CSR information can highlight that their organization is performing well on CSR topics and can showcase their commitment to sustainability to stakeholders (Connelly et al., 2010). In that case high CSR commitment goes hand in hand with high quality information. However, disclosing CSR information can equally be a

greenwashing activity. By overflowing the report with positive non-financial information, the actual poor performing CSR indicators can remain unreported. In that way, the signal intention is to leave out certain CSR performance elements and improve the perceived quality (Friske et al., 2022). Additionally, Conte et al. (2023) discovered that organizations in controversial sectors, for example, tobacco and energy sectors, disclose more of their CSR performance than non-controversial sectors. This overstatement of information can influence decision-making processes for stakeholders of companies. CSR disclosure is meant to improve the theories mentioned above and increase firm value. The following paragraph explains the hypotheses for the impact of CSR disclosure used in this research.

2.2 Hypotheses proposed by Naseem et al. (2019)

So far, many researchers have investigated the relationship between CSR disclosure and firm value, including Naseem et al. (2019), but still without consensus. In line with the stakeholder theory discussed before, Naseem identified several important stakeholders, including shareholders, suppliers and creditors, to analyze the impact of CSR disclosure on firm value.¹ The protection information of these stakeholders disclosed in the annual reports is used as the CSR disclosure variable. They use several financial ratios in the hypotheses to moderate the effect on the financial performance of the firm.

As shareholders are seen as important stakeholders of a company, the first hypothesis includes the correlation between shareholder protection disclosure and the financial performance using the dividends paid as moderator:

Hypothesis 1: Dividend per share moderates the link between shareholder protection disclosure and the financial performance of the firm.

CSR disclosure is used to provide different stakeholders, not only shareholders, with information regarding an organization's strategy and performance (Martínez-Ferrero et al., 2015). The supplier-buyer relationship is classified as a valued representation of CSR performance.

¹Note: the original study also included employees and customers as important stakeholders and as hypotheses in their paper, however, due to a lack of relevant information in the available datasets, this has not been included in this paper.

The CSR performance of suppliers can be derived from timely payments of purchases. Account payable turnover is an indication of the speed of payment of suppliers and therefore is used as a moderator in the following hypothesis:

Hypothesis 2: Accounts payable turnover moderates the link between supplier protection disclosure and the financial performance of the firm.

Creditors have legitimacy and power within companies as they can take control of the company in distressed situations. The CSR performance of creditors can be derived from timely payments of debts and lawful execution of contracts, as well as, disclosing solvency and profitability information to creditors. The interest cover ratio is used as an indication of the ability to meet the obligations towards creditors and is tested in the following hypothesis by Naseem et al. (2019):

Hypothesis 3: Interest coverage ratio moderates the link between creditor protection disclosure and the financial performance of the firm.

The three hypotheses derived from the Naseem et al. (2019) paper will be used in three different specification curve analyses, which will be discussed in more detail in the third paragraph.

2.3 Specification curve analysis literature

Data analysis and data cleaning itself are full of arbitrary decisions being made by the researcher, known as the researchers' degrees of freedom (Frey et al., 2021; Harder, 2020; Masur, 2021; Simonsohn et al., 2015). Researchers make theoretical assumptions in their model, choose the population and time phase of their sample, add variables and control variables. Each of these transformations of raw data provides researchers with multiple options to actively construct their own dataset. These decisions are often well-argued and based on theory or previous research. However, occasionally those decisions are only based on attainable information, workability of data, or time and monetary restrictions (Simonsohn et al., 2015). Each individual decision leads

to a different dataset and ultimately different statistical results (Masur, 2021). Together with running alternative specifications to create a false sense of robustness, researchers sometimes make arbitrary decisions. This ‘P-hacking’, maximizing the hypothesized effect through self-selection of models or analyses, is used to enable favored results (Semken & Rossell, 2022). In addition, it increases the likelihood that researchers report evidence that corroborates their own claims (Simonsohn et al., 2020). This framing of regression analysis research can give an incorrect conclusion of the correlation between variables.

The specification curve analysis does not aim to reveal the right statistical specifications to use but rather displays the joint distribution across all model specifications and the relationships (Harder, 2020; Orben & Przybylski, 2019). It allows researchers to investigate the complete set of specifications instead of the chosen sub-set with possibly arbitrary and theory-based decisions, which minimizes the risk of these decisions (Rauvola & Rudolph, 2023). Therefore, this research utilizes the specification curve analysis as the research method to analyze the hypotheses and regression analysis from the Naseem et al. (2019) paper.

The specification curve analysis contains three main steps. The first step is determining all valid specifications to be gathered in the dataset, which can be the sum of all different analytical decisions. Then, summarizing all alternative options a researcher could have chosen. Combining these two generates a total of researchers’ degrees of freedom. The second step is constructing a descriptive specification curve visualizing all specifications to display the overall distribution of estimates. The third step is running additional statistical tests for inference between specifications in combination with the null hypothesis (Simonsohn et al., 2015; Voracek et al. 2019). The methodology section will include more details regarding data treatment and specifications within the specification curve analysis.

3 Methodology

3.1 Data collection and sample

To analyze the hypotheses using specification curve analysis, this research uses the publicly available data from the Naseem et al. (2019) paper regarding the moderating role of financial

ratios in CSR disclosure and firm value. The sample has a total of 1,500 companies located in China including only non-financial industries. The data is collected from the CSMAR database and companies' annual reports. The dataset includes data points from all Chinese listed companies on the Shanghai Stock Exchange between 2008 and 2012. The period is interesting as China mandated disclosure of CSR activities in 2008 for publicly traded companies. This offers the opportunity for a bigger and more complete dataset for the analysis. Chen et al. (2018) examined the same period to find the impact of mandatory CSR disclosure on Chinese firms. They found that profitability and firm value decrease in the short run, only to have positive externalities, but increasing firm value and different firm behavior in the long run. For those reasons, this period is particularly interesting to investigate the effect of CSR disclosure on financial performance.

3.2 Model specifications

The functional equation of the model and the three hypotheses for the analysis are further explained below. Tobin's q is used as a proxy of the market value of a firm for each of the hypotheses as the dependent variable. This is the ratio of the market value and the replacement value of an asset. Therefore, Tobin's q measures whether a firm is overvalued or undervalued in the market, which makes it a good indicator of firm value and it has been widely used in prior research (Chen & Lee, 2016; Chung et al., 2018; Fatemi et al., 2018; Sampong et al., 2018). The independent variables used in the three investigated hypotheses are: dividends per share (DPS), accounts payable turnover (APT) and interest coverage (IC). The control variable in the equation is $\log TA$, which is the logarithm of a company's total assets. In addition, every hypothesis uses a dummy variable to indicate whether or not protection information is disclosed in the annual report of a company. The dummy variable will be valued as 1 when there is protection information disclosed and 0 when this is absent. There is also an interaction effect included between the independent variable and the dummy variable. An overview of all variables including abbreviations is provided in Table A1 in the appendix. The period indicated by the subscript of 't' is for the period 2008 to 2012. This results in the following overall equation model in which the independent and dummy variables above can be filled into.

EQUATION MODEL

Tobin's q_{it}

$$= \alpha_{it} + \beta_1 \log TA_{it} + \beta_2 \text{independent}_{it} + \beta_3 \text{dummy}_{it} + \beta_4 \text{independent}_{it} * \text{dummy}_{it} + \varepsilon_{it}$$

Hypothesis 1 contains the dividend per share (DPS) as the financial independent variable. The DPS is the ratio of the total dividends paid in a year divided by the total number of shares of a company. The dummy variable in this equation is shareholder protection (SP) which indicates whether or not shareholder protection information is disclosed. The following model is used to test the first hypothesis in the specification curve analysis:

EQUATION 1

$$Tobin's\ q_{it} = \alpha_{it} + \beta_1 \log TA_{it} + \beta_2 DPS_{it} + \beta_3 SP_{it} + \beta_4 DPS_{it} * SP_{it} + \varepsilon_{it}$$

Hypothesis 2 has the accounts payable turnover (APT) as the financial independent variable. The APT divides the annual purchases of a company by the average of the accounts payable position throughout the year. This is a good indicator of the short-term debt a company has and the rate at which this debt is paid to suppliers. The dummy variable in this equation is supplier protection (SPP) which indicates whether or not the company is disclosing supplier protection information. The following model is used to test the second hypothesis:

EQUATION 2

$$Tobin's\ q_{it} = \alpha_{it} + \beta_1 \log TA_{it} + \beta_2 APT_{it} + \beta_3 SPP_{it} + \beta_4 APT_{it} * SPP_{it} + \varepsilon_{it}$$

Hypothesis 3 contains the interest coverage ratio (IC) as the financial independent variable. The IC is the ratio between annual earnings before interest and tax (EBIT) and the total interest expense of a company. This ratio determines whether a company is capable of paying its interest on outstanding debt. When this ratio is below 1.5, it becomes questionable whether the company is able to meet its outstanding obligations (Ji, 2019). The dummy variable in this equation is

creditor protection (CP) which indicates whether or not the company is disclosing creditor protection information. The following model is used to test the third hypothesis:

EQUATION 3

$$\text{Tobin's } q_{it} = \alpha_{it} + \beta_1 \log TA_{it} + \beta_2 IC_{it} + \beta_3 CP_{it} + \beta_4 IC_{it} * CP_{it} + \varepsilon_{it}$$

These three models will be used in the specification curve analysis in order to test relationships between the variables. The following section includes more details regarding how the hypotheses are used in the SCA and the different specifications used in this study.

3.3 Specification curve analysis methodology

Following the Gassen (2019) article regarding the researchers' degrees of freedom, there are four specification points used in the specification curve design. The specifications for this research and each of the three hypotheses are (1) omission of missing data (NA) in the dataset, (2) the control variables and the combination of these variables which specify the model, (3) outlier treatment of the data points and (4) estimating the model by fixed effects and clustering. The complete SCA design with every specification and decision point of the analysis is included in the appendix in Figure B1.

1) Omission of missing values

The first specification and decision point is at data import and the treatment of missing data in the dataset. There are two options for omitting missing data from the sample. The answer of 'yes' omits all the NA or missing values in the dataset for the continuation of the analysis, whereas for the 'no' answer these missing values remain inside the dataset. This results in two different paths for the analysis.

2) Model specifications

The second specification from the analysis and decision point is selecting which variables to use in the model. The first option is the model with only the independent variable and the dummy

variable, thus without the control variable and interaction effect. The second option is without the logarithm of total assets (logTA) as a control variable, which omits the control variable from the model. The third option is the model without the interaction effect between the independent variable and the dummy variable. The last option is capturing the complete model, thus not removing any variables. In this specification, it is not possible to exclude the independent variable as it is essential for the model. The same applies to the dummy variable for disclosure of protection information. All four options create four different paths.

3) Outlier treatments

The third specification point is the outlier treatment with the choice between winsorization or truncation, creating two different paths. Winsorizing data replaces extreme values in the sample with a maximum value from both ends of the sample. Truncation is completely removing extreme values from the sample. Winsorization and truncation can both be applied for the zero to tenth percentile outliers, which creates 11 different paths for each of them. Therefore, in total 22 different paths can be derived from this specification.

4) Fixed effects and clustering

The fourth and final specification point relates to the fixed effects and the clustering of standard errors. This includes four different option points for the fixed effects. These are the fixed effects in the model for 'year', 'company', 'companyyear' and 'none'. This measures the fixed effects for each year, each company, for company and year combined and no fixed effects at all. Following the determination of the fixed effects is the clustering of the standard errors. The clustering has the same four options as above namely 'year', 'company', 'companyyear' and 'none', which affect the significance levels of the output. This specification creates another four different paths for the analysis.

The different pathways of the four specifications used in this research indicate that there are $2*4*22*4*4=2,816$ models in total for the specification curve analysis. In the following section, the results of the hypotheses with these specifications as specification curve analyses will be included followed by a comparison with the regression results of the Naseem et al. (2019) paper.

4 Results

The results section includes the summary statistics of all variables, the density figures of the estimations from the three hypotheses followed by the specification curve analysis figures and additional explanations. This research focuses on patterns and effects of different decisions shown within the data and the model by the specification curve. The relationships between the dependent and independent variables are visible through inspection of the figures and analytics of the estimates, which is standard in the literature (Frey et al., 2021; Masur, 2021; Rauvola & Rudolph, 2023). Finally, the discussion section of the results includes a comparison between the specification curve results of this study and the results of the regression analysis of the Naseem et al. (2019) paper.

4.1 Summary statistics of data

Table C1 in the appendix depicts the summary statistics of the data used in the analysis. The summary statistics of the dependent variable Tobin's q (TQ) and the control variable, which is the logarithm of total assets (TA), are also shown. There are several missing values for the TQ variable, and a wide range between negative and high positive figures is noted. The logarithm of total assets seems to have a normal distribution in the dataset.

The blue highlighted rows indicate the dividends per share (DPS), the dummy variable for shareholder protection (SP) and the interaction effect between the variables (DPS*SP). The DPS has a mean figure of 0.1 with a small standard deviation and several negative and positive outliers. Furthermore, 20% of companies is disclosing their shareholder protection information, as the mean of the dummy variable SP is 0.2 out of 1. This also influences the interaction effect between the independent variable and the dummy variable.

The red highlighted rows in the summary statistics table are the summarized data of the second hypothesis. The accounts payable turnover ratio (APT) contains a few missing values as the number of observations is not equal to the other variables. The range of the APT variable also indicates a significant difference between the minimum and maximum figures ranging from 0 to 453.6 with a mean of 4.4, which reveals the presence of high outliers in the data. The supplier

protection disclosure of information (SPP) is rather low, with a mean of 0.1; only 10% of companies disclose supplier protection information. This also influences the interaction effect between the independent value and the dummy variable.

The green highlighted rows summarize the statistics of the third hypothesis including the interest coverage ratio (ICR), the dummy variable for creditor protection (CP) and the interaction effect between the variables (ICR*CP). The first figure that stands out is the lower number of ICR observations in comparison with other variables, which indicates that there are missing values. The other statistics show a high interest coverage ratio with a mean of almost 18 across the companies in the dataset. An ICR of 1.5 is considered the safety margin for a company to be able to pay its interest expense, whereas a higher ICR decreases the probability of a company default (Ji, 2019). In this sample, the mean for the creditor protection dummy is 0.1, which indicates only 10% disclosure of creditor protection information. This also influences the interaction effect between the independent value and the dummy variable.

4.2 Specification curve analysis dividends per share

The density of all estimates and the distribution of the degrees of freedom of the first hypothesis are shown in Figure 1 below. The figure indicates the estimates of the regressions between the independent variables and the dependent variable firm value. The specification curve analysis regarding the first hypothesis is firmly based around the zero mark, with three peaks of which two are negative and one positive. This indicates a very high density of estimations in all 2,816 models' variants. In addition, a few large outliers are noted, which stretch the model out to -2.0 and +1.5. According to the density outcomes of the model, there is no specific significant positive or negative relationship within the model.

FIGURE 1. DENSITY OF ESTIMATES HYPOTHESIS 1

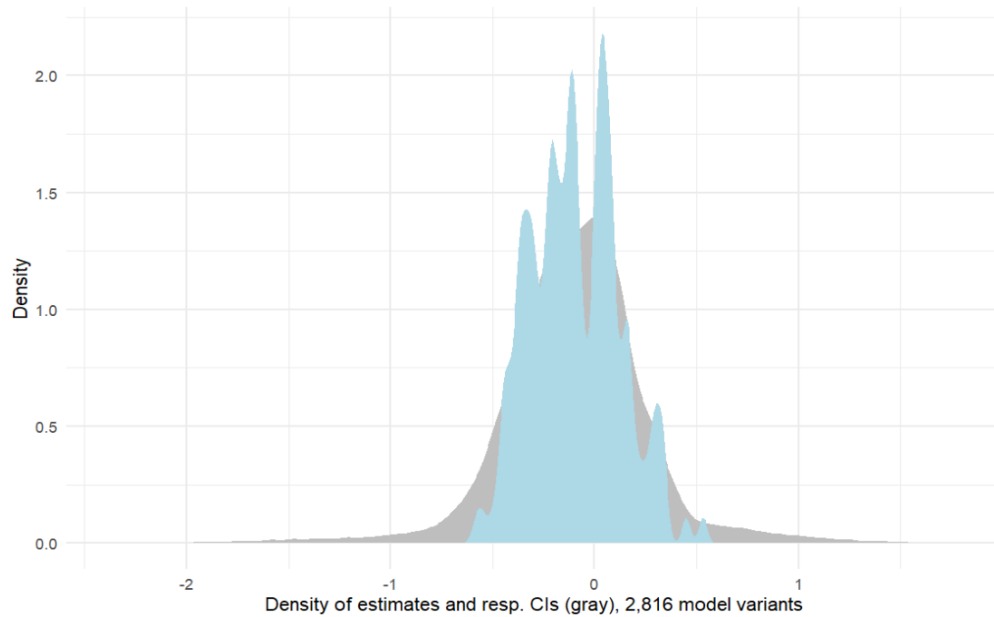
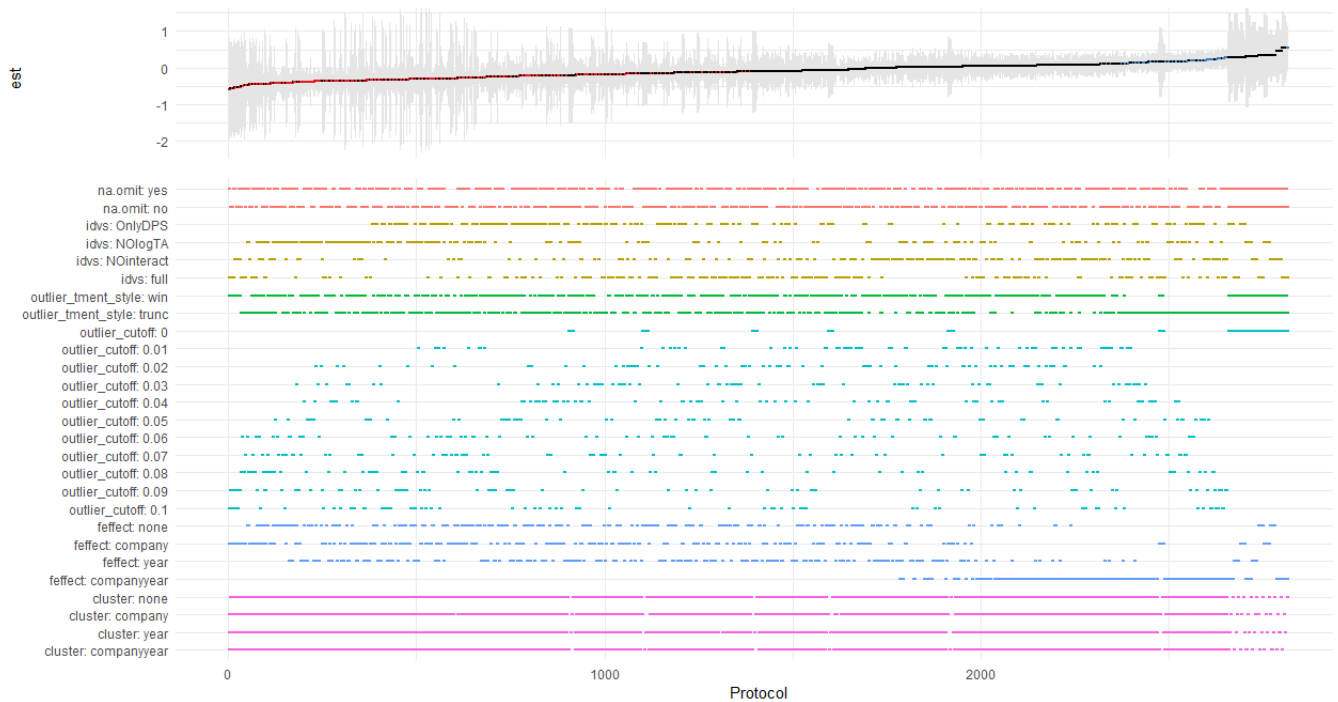


Figure 1 indicates all estimates for the 2,816 model variants. The grey area indicates the 95% confidence interval of the results and the blue areas indicate the number of models in that area.

FIGURE 2. SPECIFICATION CURVE HYPOTHESIS 1



The specification curve above shows the summary effect and specification curve of dividends per share, shareholder protection and Tobin's q. The red dots in the specification line are the significant negative values and the blue dots are the significant positive values. The black dots indicate values that are not significant for either negative or positive values. The grey areas indicate the 95% confidence interval for the value, thus making the 5% statistical significance. The colored lines in the panel below the curve indicate the different analytical specifications and the effect on the coefficient.

The specification curve in Figure 2 above shows a predominant effect of around 0, as the specification curve varies between -0.5 and 0.5. The red dots within the specification curve imply a negative relationship and the blue dots imply a positive relationship. Analytics indicate that out of 2,816 total estimates, 167 estimates (5.93%) have a significantly positive relationship and 748 estimates (26.56%) have a significantly negative relationship. The remaining estimates of the model (67.51%) are insignificant. The grey areas within the figure show the confidence intervals of 95%, which indicates the range between the upper and lower outcomes of the model per estimate. As visible in the figure, the higher positive and negative outcomes have a larger grey area than the rest of the estimations, which means that for those models the outcomes are more spread out.

The dotted lines in the panel below the specification curve are the different specifications applied and the dots indicate in which model the specification is used. The choice of omitting missing values reveals no clear difference from each other, indicated by the two lines with red dots in the figure. The estimations of the different model specifications highlight a difference between the omission of different variables. However, adding all variables to the model, indicated by the 'idvs: full' line in the panel shows that the full model does not represent the whole specification curve and more variables should be added to the model before being complete. The fixed effect specification is not present at all times in the model. Figure D1 in the appendix shows the structure of the fixed effects estimates. It indicates that the 'companyyear' fixed effect is only present in positive estimates. The cluster of standard errors indicated by the pink line in the panel of Figure 2 is almost constant for the different clusters, which indicates that it is present in most of the estimates.

Concluding from all estimations and the specification curve, there is no definite answer to the relationship between firm value and disclosure of shareholder protection information with dividends per share as moderator. The SCA indicates significant negative and positive estimations in the model, although most of the estimates (67.51%) are insignificant. Therefore, the SCA shows that it depends on the choices within the model chosen by the researcher whether the results of the model are positive or negative.

4.3 Specification curve analysis accounts payable turnover

Figure 3 below shows the distribution of the estimates for the degrees of freedom, within model 2, with the independent variables accounts payable turnover and disclosing creditor protection information. The estimations are clustered between -0.05 and 0, with some outliers ranging to -0.20. The peak of the estimations is just below 0 and contains several small peaks between -0.05 and -0.10. This indicates a dense clustering of the 2,816 model variants, with also some large negative outliers. As the density figure does not indicate whether the estimates are significant, the significant estimates will be further examined in Figure 4.

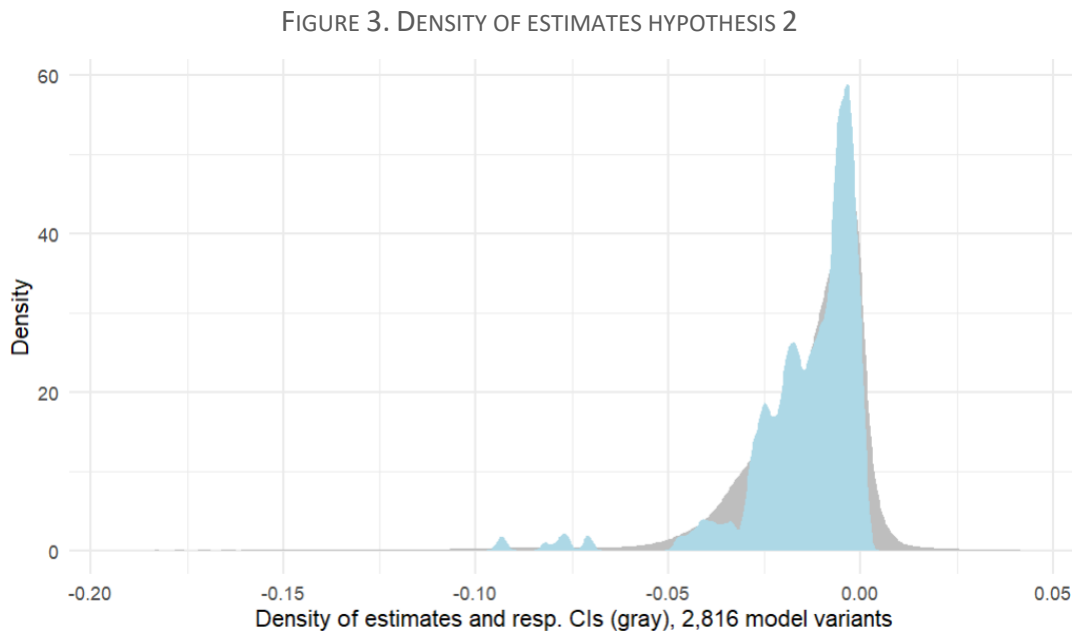
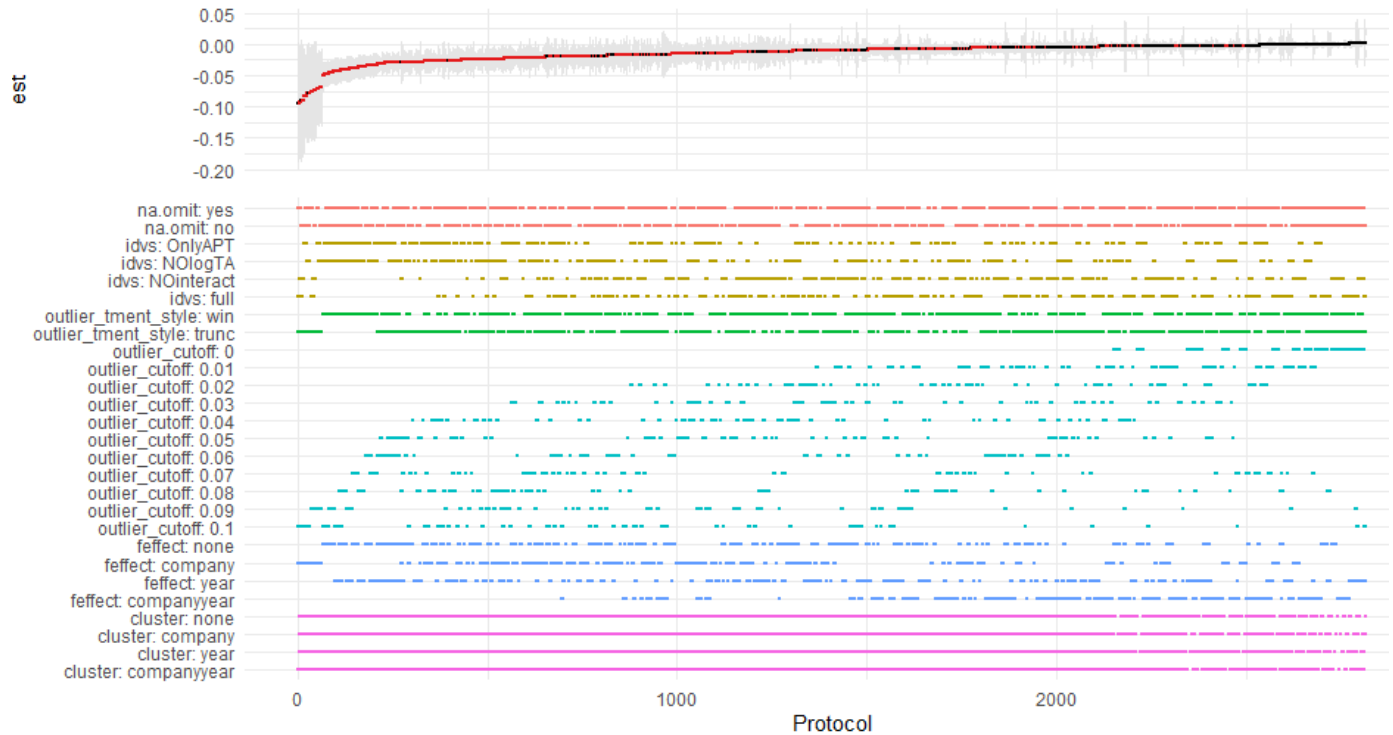


Figure 3 indicates all estimates for the 2,816 model variants. The grey area indicates the 95% confidence interval of the results and the blue areas indicate the number of models in that area.

FIGURE 4. SPECIFICATION CURVE HYPOTHESIS 2



The specification curve above shows the summary effect and specification curve of accounts payable turnover, supplier protection and Tobin's q. The red dots in the specification line are the significant negative values and the blue dots are the significant positive values. The black dots indicate values that are not significant for either negative or positive values. The grey areas indicate the 95% confidence interval for the value, thus making the 5% statistical significance. The colored lines in the table below the curve indicate the different analytical specifications and the effect on the coefficient.

Figure 4 shows the specification curve analysis for the second hypothesis. Most of the specification curve is below the zero-effect line, revealing it has a negative value for most estimations. Many of the negative points are red in color, indicating significant negative estimates. A few positive points are noted, although none of them are significant given the absence of blue dots. The summary statistics of the results indicate that there are 1,649 estimates (58.56%) significantly negative and none are significantly positive of the total of 2,816 estimates.

A more detailed review of the SCA reveals no difference between omitting the missing data or leaving it in. This can be seen through the almost straight red lines in Figure 4 when looking at omitting of NA's. The selection of different variables in the model also does not significantly differ from each other. In the panel of the variable selection, there is much overlap in the different specifications. However, adding all variables to the model, indicated by the 'idvs: full' line in the panel, shows that the full model does not represent the whole specification curve. The fixed

effects specification lines in the panel are similar to the first hypothesis, as the 'companyyear' fixed effect is only present in higher estimates close to zero. In Figure D2 in the appendix, the detailed view also shows that the fixed effect 'company' has some negative outliers compared to the rest of the fixed effects. The cluster of the standard errors is also similar to the first hypothesis, as the pink lines in Figure 4 are almost constant indicating the presence of clustering in the estimates.

For the second hypothesis, it can be concluded that there is a predominant negative relationship. The detailed view of the specifications also indicates the dominance of a significant negative relationship. The relationship between supplier protection disclosure and firm value with accounts payable turnover as moderator is in 59% of the estimates significantly negative. Therefore, the choices of a researcher only influence the significance of the relationship between the variables.

4.4 Specification curve analysis interest coverage ratio

In Figure 5 below, the density of all 2,816 model estimates distributions across the researcher degrees of freedom are visible. The peak of the figure is slightly above zero, predominantly around positive figures and most of the estimations are between 0 and 0.01. This indicates that the main part of the model specifications is positive. The range of the estimations is between -0.005 and 0.4, which indicates the presence of high positive outliers in the estimations. As the density figure does not indicate whether the estimates are significant, the significance will be further examined in Figure 6.

FIGURE 5. DENSITY OF ESTIMATES HYPOTHESIS 3

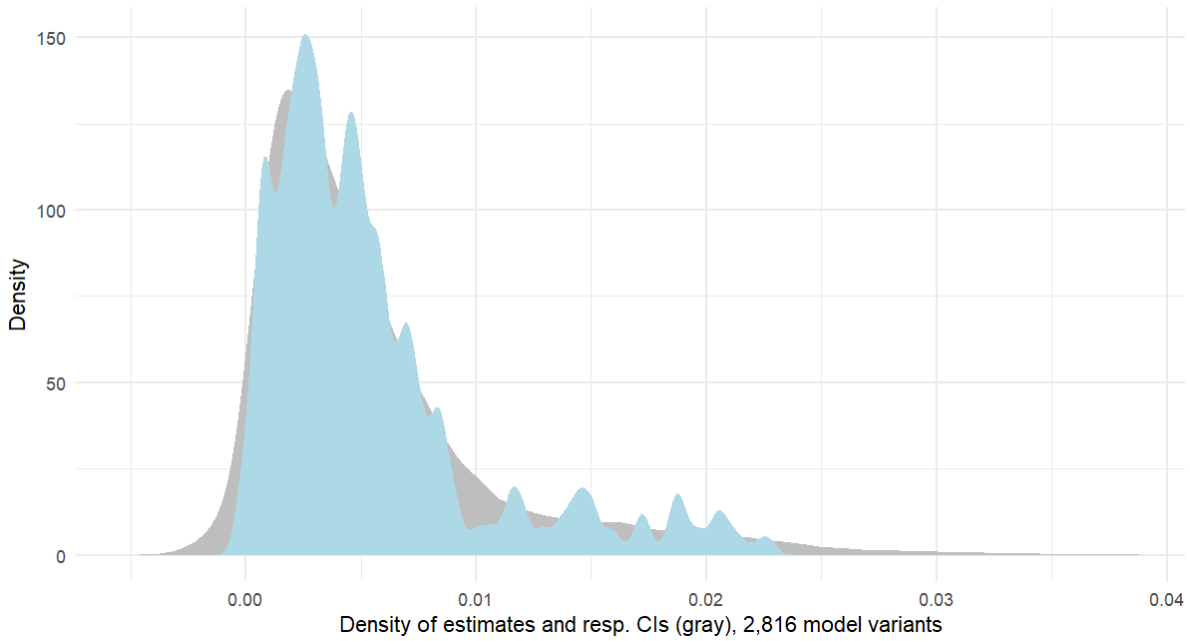
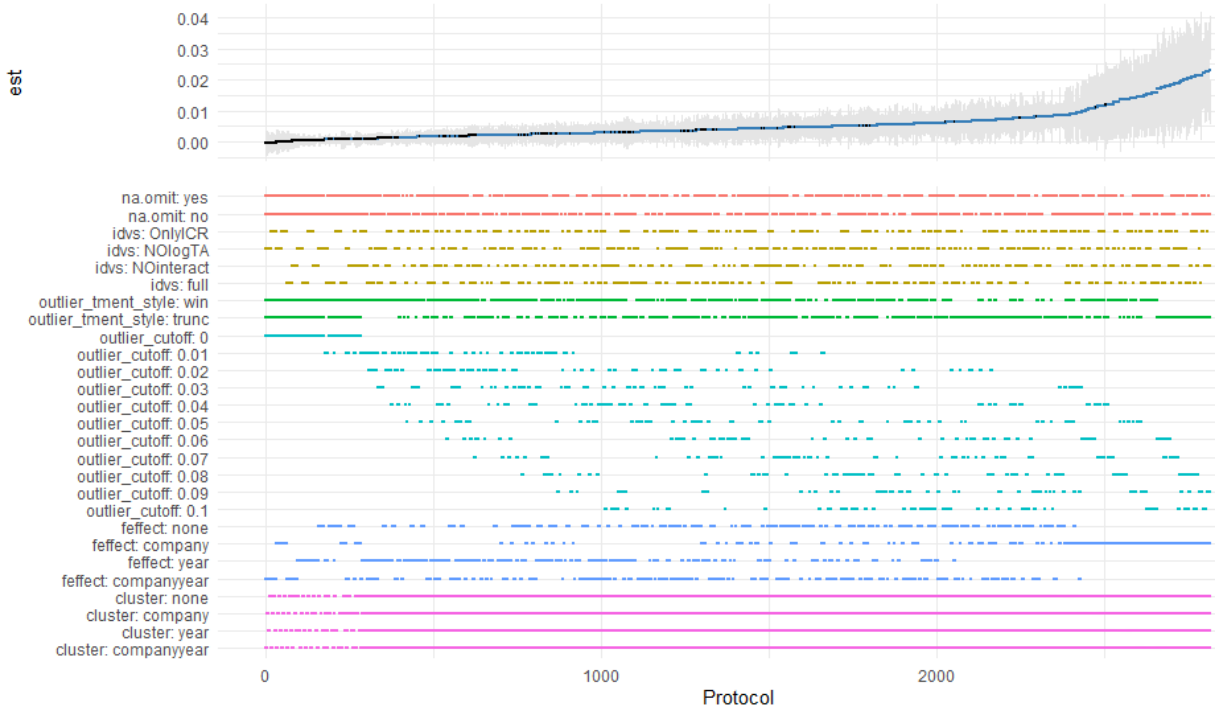


Figure 5 indicates all estimates for the 2,816 model variants. The grey area indicates the 95% confidence interval of the results and the blue areas indicate the number of models in that area.

FIGURE 6. SPECIFICATION CURVE HYPOTHESIS 3



The specification curve above shows the summary effect and specification curve of interest coverage ratio, creditor protection and Tobin's q. The red dots in the specification line are the significant negative values and the blue dots are the significant positive values. The black dots indicate values that are not significant for either negative or positive values. The grey areas indicate the 95% confidence interval for the value, thus making the 5% statistical significance. The colored lines in the table below the curve indicate the different analytical specifications and the effect on the coefficient.

The specification curve in Figure 6 above indicates that there are only a limited number of estimations below zero, which are not significant as there are no red dots in the curve. Most of the estimations are significantly positive indicated by the blue dots in most of the curve. The analytical analysis shows that there are 2,133 significant positive estimates (75.75%) out of the 2,816, whereas there are zero significant negative estimates. This is an indication of a predominantly significant positive relationship between all specifications. The increasing grey area at higher estimations highlights an increase in the 95% confidence interval, which indicates the range between the upper and lower outcomes of the model, indicating a high degree of uncertainty in the estimates.

In a more detailed view of the specifications, the full red line in the panel shows the omission of missing values indicating almost no difference between omitting missing values or leaving them in the data. The estimations for the variable selection show much overlap in the different models, indicating a high explanatory power of the model. However, adding all variables to the model, indicated by the 'idvs: full' line in the panel shows that the full model does not represent the whole specification curve. The fixed effect specification, indicated in more detail in Figure D3 of the appendix, shows three dense estimates. The 'company' fixed effect is again stretched out due to outliers in the model. The cluster of standard errors again is the same as the last two SCA's, the cluster is present in all of the different models indicated by the almost full pink line in the panel.

An overall conclusion of the specification curve of the third hypothesis is that the model relationship is mostly significantly positive (75.75%). The detailed view of the specifications indicates a positive relationship between the variables, only a few negative outliers are included. Therefore, the effect of creditor protection disclosure on firm value with interest coverage as a moderator is positive.

4.5 Discussion

The purpose of this paper is to further investigate the relationship between CSR disclosure and firm value, as well as the accuracy of regression analysis. This research uses the specification curve analysis to counter so-called 'P-hacking' in regression analysis and discuss the relationship

between the variables. By using the data and hypotheses of the Naseem et al. (2019) paper, the relevance and generalizability of the SCA is conveyed. Table E1 in the appendix includes the original regression analysis of the Naseem et al. (2019) paper for the three hypotheses investigated in this research. The shareholders and creditors models of the regression indicate a positive relationship between the independent variables and the dependent variable firm value. For suppliers, the model indicates a small negative relationship between firm value and the accounts payable turnover as well as for the intercept. The interaction effect is positive, only the significance level is 10%. The relationship between firm value and the dummy variable is positive in all models. Therefore, the overall conclusion of the original paper was a positive relationship between CSR disclosure and firm value with financial ratios as moderators. The Naseem et al. (2019) conclusions differ from the outcomes of the specification curve analysis in this paper.

The shareholder model with dividends per share as the moderator variable is positive in the regression analysis, which is not the case for the specification curve analysis. The SCA results are more widely spread with some negative significant values. Therefore, the model decisions by Naseem et al. (2019) have resulted in a positive result. The SCA shows that if the researchers had chosen other options within their outlier treatment, deleting missing variables and fixed effects the results could also have been negative.

The supplier model with accounts payable turnover as the moderator variable shows a positive regression result, although the regression relationship of the interaction effect has a 10% significance level. The SCA uses a significance level of 5% in the analysis and the result indicates a predominant negative value. Most of these negative SCA estimates are significant as well, which are not in line with the supplier analysis regression results. The researchers' choice to use a 10% significance level influence the regression to be significantly positive.

The creditor model with interest coverage ratio as the moderator variable shows a significant positive regression result for all variables. The SCA results also show that most of the curve is significantly positive. Therefore, this is the only regression result that is in line with the SCA results.

The overall conclusion of the comparison between the regression results and the SCA is that two regression results are not in line with the predominant effect of the specification curve

results. In one specification curve, its dominant effect is the same as the found regression result by the Naseem et al. (2019) paper. The contradicting results in the first two models can indicate, that there is no corroborating effect between the regressions and the specification curve analysis. The revealed differences between the regression analysis and SCA are related to the researcher's degrees of freedom applied in the regression analysis, in which the decisions made by the researcher influence the results. The data decisions made by the Naseem et al. (2019) paper, such as Winsorizing the 1st and 99th percentages and treating missing values as 0 could have a significant impact on the overall results. They also performed the Hausman and Wald statistical test to choose between fixed effects, random effects, or pooled regression models. The model ultimately uses fixed effects regression due to the rejection of the other models by test results. As confirmed by the SCA results, the use of fixed effects for 'companyyear' results in mostly positive results, which can explain the positive regression result by the Naseem et al. (2019) paper. This indicates the biased relationship results that can occur due to the researchers' degree of freedom and choices being made.

The purpose of the specification curve analysis by Simonsohn et al. (2015), was to demonstrate that the decisions made in the regression analyses influence the results and potentially result in biased relationships. This is confirmed by the comparison between the SCA results and the Naseem et al. (2019) paper in this paragraph.

5 Conclusion & limitations

The purpose of this research is to add value to extensive, but not conclusive literature regarding CSR disclosure and its effect on firm value. It also intends to improve the understanding of the specification curve analysis in academic literature. By restricting the researchers' degree of freedom, the SCA creates a more generalizable overview. The data and hypotheses from the Naseem et al. (2019) paper are used to present the joint distribution of all specifications and degrees of freedom from the model (Gassen, 2019). The model includes 2,816 estimations, which are used to answer the research question:

What is the effect of corporate social responsibility disclosure on firm value and what is the impact of the researchers' degrees of freedom on the results?

The specification curve analysis does not confirm a positive relationship between the variables, whereas a positive relationship was concluded from the regression analysis of the original paper. The results of the specification curve analysis provide no definite conclusion to the research question, as there is no positive significant relationship between all variables and all models. Only one of the three SCA models shows a dominant positive relationship in the results. Therefore, the conclusion is not able to corroborate this positive relationship between CSR disclosure and firm value when diminishing the researcher's degree of freedom.

This study contains a number of limitations. Only four specifications are tested for the different hypotheses and for example, the specification of the model type by Gassen (2019) is left out due to the high number of negative values, which makes it hard to compute level-level, log-level, level-log and log-log estimations. Voracek et al. (2019) used different models in their specification curve analysis, such as the random-effects model (REM) and the unweighted meta-analytic model (UWM). Orben & Przybylski (2019) used a specification where co-variables were included in the analysis. This reveals that more specifications could have been tested which could influence overall results and the generalizability of the specification curve analysis. Another limitation is that the study only tests three out of the five hypotheses from the Naseem et al. (2019) paper. The online dataset from the PLOS ONE journal provided only data for three hypotheses. The financial variables for advertisement intensity and salary expense were not available in the dataset provided. This can influence the conclusion and overall result of this research compared to the original study. The final limitation of this research is the choice of financial ratios and the use of only the logarithm of total assets as a control variable in the model. Other choices could have revealed other outcomes of the model and the relationship between CSR disclosure and firm value.

Future research on this topic and especially the research method is recommended. Within academic literature, there is still no consensus about the relationship between CSR disclosure and firm value. Especially with new (CSRD) legislation to be implemented shortly, a better understanding of this relationship is desirable for a wide variety of stakeholders. The novel

specification curve analysis introduces a new data analysis type, different from the traditional regression analysis, but is still in its early adoption phase. Further research should be done to underpin the added value of specification curve analysis in identifying relationships between variables.

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7 Appendix

7.1 Appendix A

TABLE A1: VARIABLE DESCRIPTIONS

Name	Abbreviation	Definition
Tobin's q	Tobin's q	The ratio between an asset's market value and its replacement value
Total assets	TA	All assets of an organization on the balance sheet as a control variable
Accounts payable turnover	APT	The proportion of all purchases to the average of the accounts payable
Interest coverage	IC	Proportion of earnings before interest and tax to total interest expense
Dividends per share	DPS	The total dividends paid in a year divided by the number of shares
Shareholder protection	SP	The dummy variable is whether a company discloses shareholder protection information
Supplier protection	SPP	The dummy variable is whether a company discloses supplier protection information
Creditor protection	CP	The dummy variable is whether a company discloses creditor protection information
Time period	t	The time period of the sample which is between 2008 and 2012

Table A1 indicates the abbreviations and descriptions of the variables used in the analysis.

7.2 Appendix B

FIGURE B1: SPECIFICATION CURVE ANALYSIS DESIGN

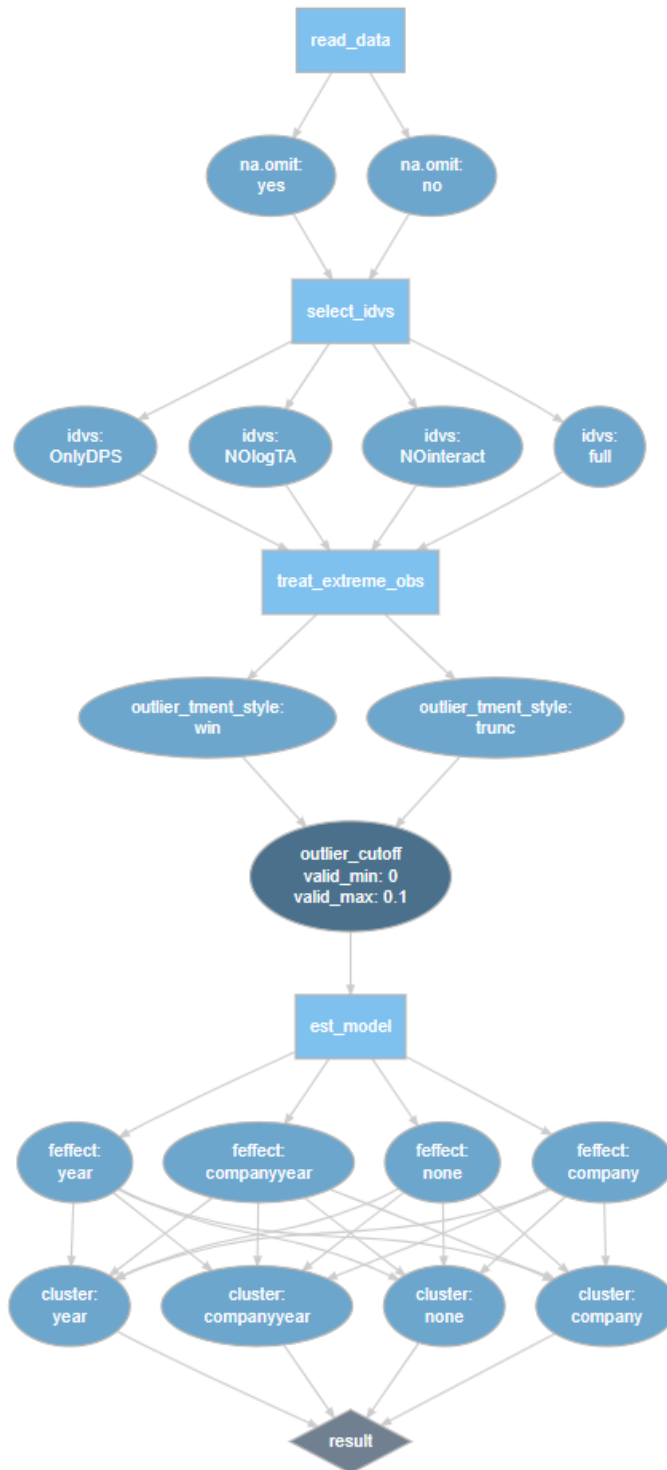


Figure B1 shows the specification curve design for this research, with the four different specifications: omission of NA's, variable selection, outlier treatment and the fixed effect or cluster estimations.

7.3 Appendix C

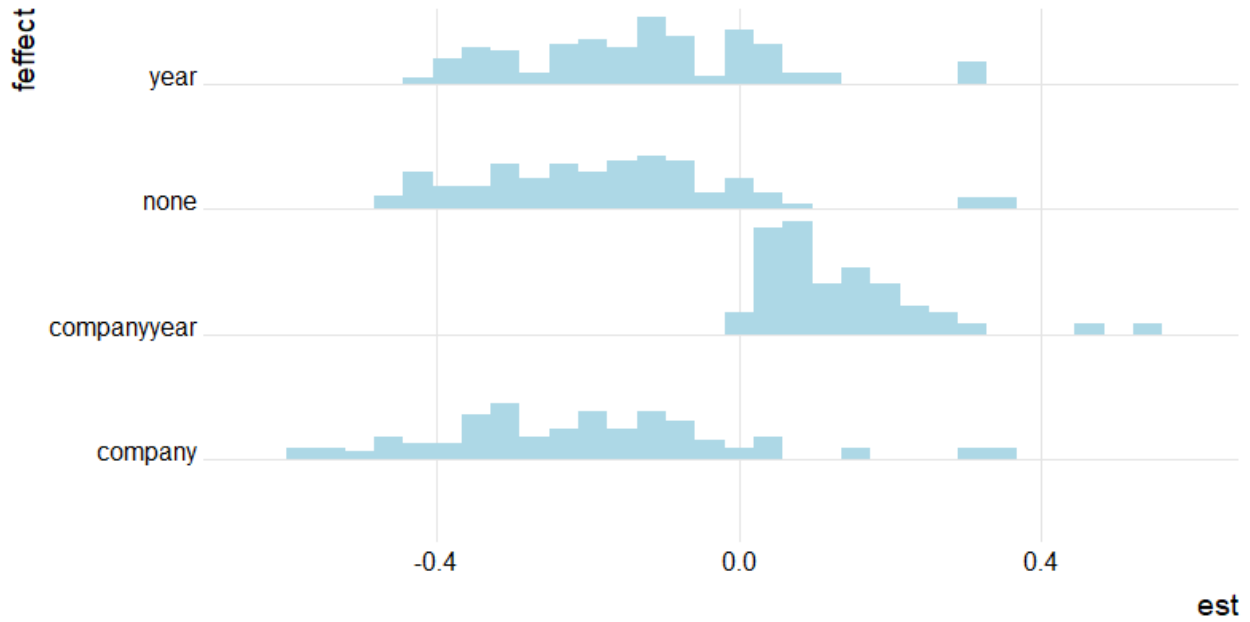
TABLE C1. SUMMARY STATISTICS DATA

SUMMARY STATISTICS					
STATISTIC	N	Mean	St. Dev.	Min	Max
TA	9,899	9.4	0.6	6.1	12.1
TQ	9,643	2.1	7.0	-7.7	389.2
DPS	9,899	0.1	0.3	-3.4	4.1
SP	9,899	0.2	0.4	0	1
DPS* SP	9,899	0.02	0.1	-2.2	4.1
APT	9,870	4.4	20.6	0.0	453.6
SPP	9,899	0.1	0.3	0	1
APT* SPP	9,899	0.7	9.9	0.0	453.6
ICR	7,420	17.7	72.0	-146.4	1,741.4
CP	9,899	0.1	0.3	0	1
ICR* CP	9,899	1.7	24.9	-52.0	1,373.3

Table C1 shows the summary statistics of all data used in the analysis. The white highlighted rows are the control variable 'TA' and the dependent variable 'TQ'. The blue highlighted rows are for model 1, the red highlighted rows for model 2 and the green highlighted rows for model 3.

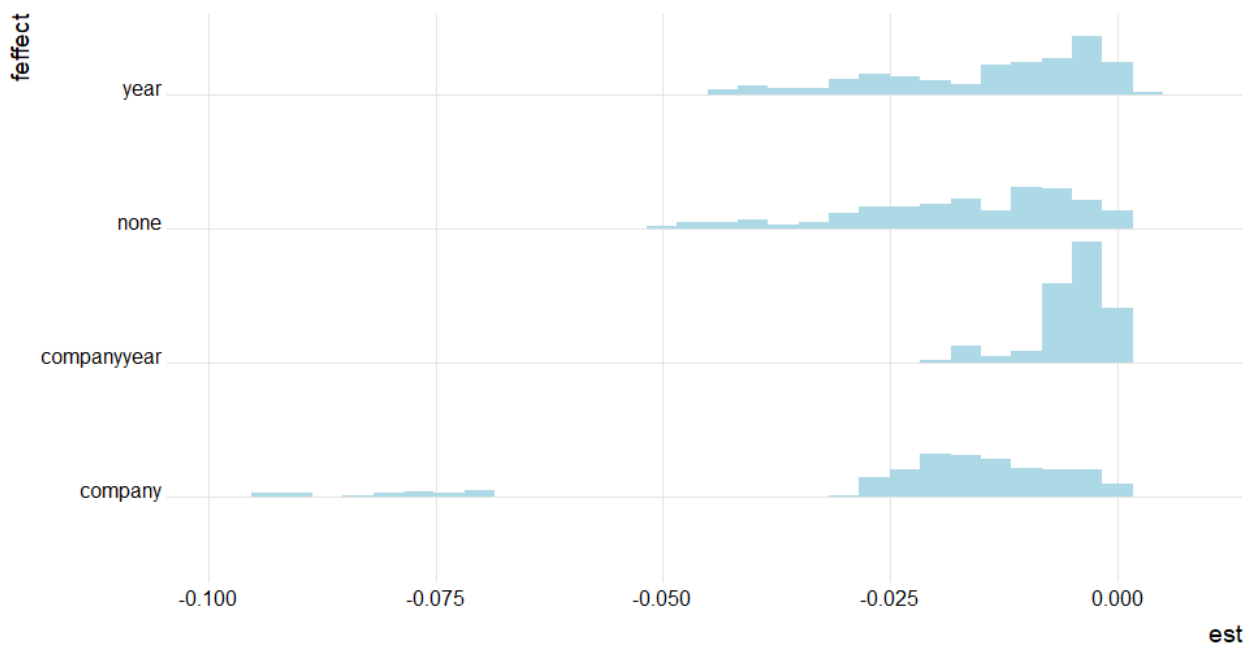
7.4 Appendix D

FIGURE D1 ESTIMATES OF FIXED EFFECTS SPECIFICATION HYPOTHESIS 1



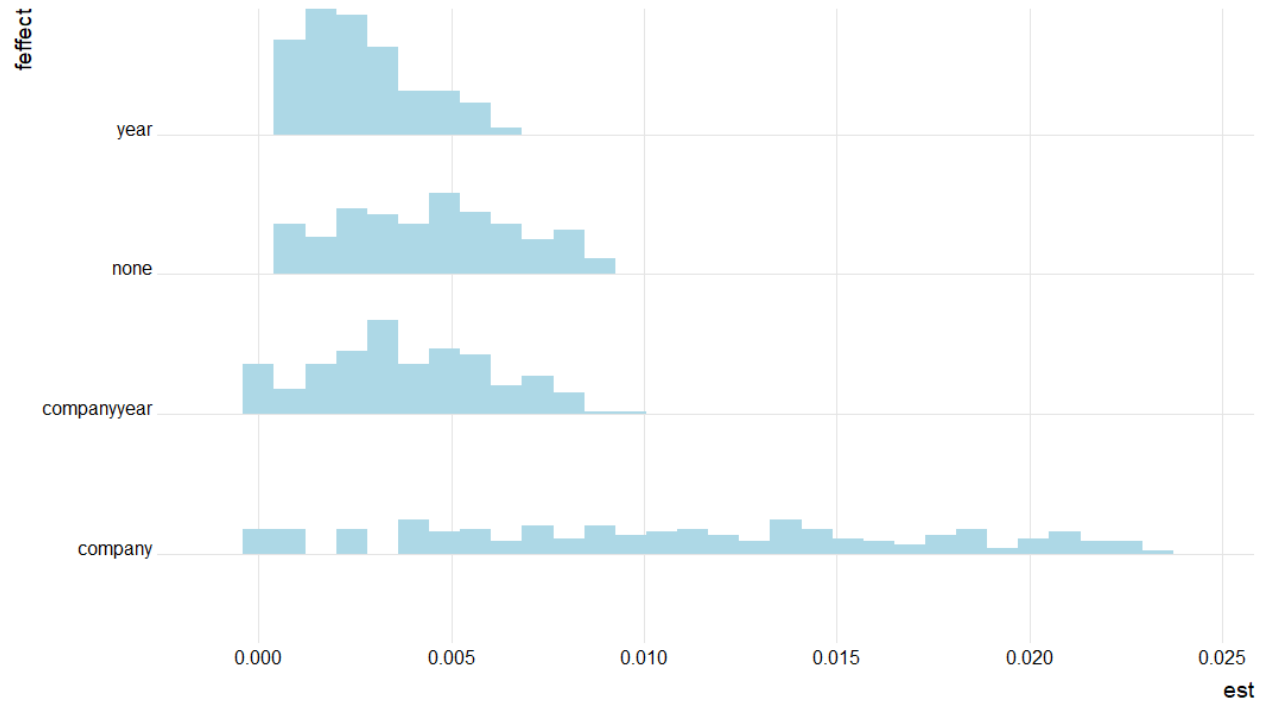
In figure D1, the different estimations are shown for the specifications of the variable selection in a histogram. The blue blocks indicate the frequency of the specification option in the estimates.

FIGURE D2 ESTIMATES OF FIXED EFFECTS SPECIFICATION HYPOTHESIS 2



In figure D2, the different estimations are shown for the specifications of the variable selection in a histogram. The blue blocks indicate the frequency of the specification option in the estimates.

FIGURE D3 ESTIMATES OF FIXED EFFECTS SPECIFICATION HYPOTHESIS 3



In figure D3, the different estimations are shown for the specifications of the variable selection in a histogram. The blue blocks indicate the frequency of the specification option in the estimates.

7.5 Appendix E

TABLE E1. PANEL REGRESSION NASEEM ET AL. (2019)

ITEMS	MODEL-1	MODEL-2	MODEL-3
	Shareholders	Suppliers	Creditors
INTERCEPT	0.34 (0.00)***	-1.32(0.00) ***	0.35(0.00)***
LOG TOTAL ASSETS	0.04(0.00) ***	0.03(0.00) ***	0.07(0.00) ***
DPS	0.24(0.00) ***		
ICR			0.24(0.00) ***
APT		-0.13(0.00) ***	
SP(SHAREHOLDER PROTECTION)	0.39(0.00) ***		
CP(CREDITOR PROTECTION)			0.07(0.08)*
SPP(SUPPLIER PROTECTION)		0.15(0.00) ***	
DPS * SP	0.23(0.00) ***		
ICR * CP			0.04(0.00) ***
APT * SPP		0.03(0.06)*	
ADJUSTED R ²	0.47	0.49	0.44
HAUSMAN TEST /CHI-SQUARE	69.90(0.00) ***	17.52(0.01) ***	79.13(0.00) ***
WALD TEST /CHI-SQUARE	115.46(0.00) ***	59.51(0.00) ***	134.53(0.00) ***

NOTE: *, ** AND *INDICATE SIGNIFICANCE AT THE 10%, 5%, AND 1% LEVELS, RESPECTIVELY**

Table E1 shows the panel regression analysis for the three different models by Naseem et al. (2019). The significance levels are indicated by the number of '*' after the coefficient.