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Innovation capability and company valuation: Evidence from global M&A market

Innovaatiokyvykkyyden ja yrityksen valuaation yhteys globaalilla yrityskauppamarkkinalla

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ABSTRACT

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Global M&A market has grown immensely and gained research attention from a variety of management disciplines. The research examining M&A has begun to focus on resource complementarity and innovation performance as the corporate transactions base on accessing new technology, knowledge, and capabilities. This study aims to determine how does the innovation capability of a target firm affect its value measured with the acquisition price. The innovation capability of a target firm is measured with its R&D intensity.

The research data was formed by merging financial statement data consisting of balance sheet, profit and loss, and cash flow statements of the target company with transaction reports of the deals made after 2010. To test the hypothesis of acquisition prices being higher for companies with greater innovation capability, a model for the linear regression analysis was constructed. The results indicated minor positive effect of innovation capability promoting higher transaction prices.

The results support the findings of the previous research and complement it by studying the subject from a novel perspective. The results also show that the innovation capability is valued in the M&A markets making it essential for both transaction sides to acknowledge for the sake of value and opportunities.

TIIVISTELMÄ

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Globaali yrityskauppamarkkina on kasvanut valtavasti ja kerännyt huomiota tutkimuksen suhteen usealta eri johtamisen tieteenalalta. Yritysjärjestelyihin syventyvä tutkimus on alkanut keskittyä resurssien täydentävyyteen ja innovatiivisuuteen yrityskauppojen lähtökohdan ollessa uusien teknologioiden, tiedon ja kyvykkyyksien hankkiminen. Tämän tutkimuksen tarkoituksena on selvittää, miten kohdeyrityksen innovaatiokyvykkyys vaikuttaa sen arvoon mitattuna sen ostohinnalla. Kohdeyrityksen innovaatiokykyä mitataan sen tutkimus- ja kehitysintensiteetillä.

Tutkimusdata on muodostettu kohdeyritysten taseesta, tuloslaskelmasta, kassavirtalaskelmasta ja toteutuneiden yrityskauppojen raporteista vuoden 2010 jälkeen. Tutkimuksen hypoteesia innovaatiokyvykkyyden kauppahintaa kasvattavasta vaikutuksesta testattiin lineaarisella regressioanalyysillä. Tutkimuksen tulokset osoittivat innovaatiokyvykkyydellä olevan vähäinen positiivinen vaikutus yrityksen kauppahintaan.

Tutkimuksen tulokset ovat linjassa aikaisempien tutkimusten tulosten kanssa ja samalla täydentävät aikaisempaa tutkimusta tutkimalla aihetta uudenlaisesta näkökulmasta. Tuloksien osoittaessa innovaatiokyvykkyyden arvostamisen yrityskauppamarkkinalla on transaktion vastapuolille tärkeää tunnistaa innovaatiokyvykkyyden olennaisuus niin yrityksen arvon, kuin yrityskaupan tuomien mahdollisuuksien suhteen.

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LIST OF ABBREVIATIONS

DCF	Discounted cash flow
EBITDA	Earnings before interests, taxes, depreciation, and amortization
EVA™	Economic value added model
FCFF	Free cash flow to firm
ISIN	International securities identification number
M&A	Mergers & acquisitions
NOPAT	Net operating profit after taxes
OLS	Ordinary least squares
R&D	Research & development
SME	Small and medium-sized enterprises
WACC	Weighted average cost of capital

1. Introduction

Mercer (2007) introduces the concept of the world of value stating that "The world of value is the real world". That world is formed by the valuation and investment decisions of individuals, companies, institutions, and governments in order, for example to seek debt and equity securities from public and private placement markets. (Mercer & Harms 2007, 33) Determining the value of an investment is a key object of economic analysis and the importance of reliable valuation is easily justified as it forms the basis of the prices to be paid for the investments, which can either create or destroy shareholder value (Katramo et al 2013, 71). Mergers and acquisitions (M&A) activity is more frequently being reviewed from perspective of competing investments and the research related to corporate transactions has begun to focus more on the trend where the motives of corporate transactions are highly based on enhancing the innovation performance through gaining access to technology, knowledge, and capabilities (Grimpe & Hussinger 2014, 1762). This thesis examines the relationship between acquired company's innovation capability proxied by the research and development (R&D) intensity and company value measured with the acquisition prices in corporate transactions.

1.1 Background

The number of corporate transactions and reorganizations have increased tremendously worldwide (Evans & Bishop 2002, 1). The annual M&A volumes have also grown in average with the 2019 reported volume exceeding 4 trillion dollars (J.P.Morgan 2020). The reasons behind the growth are not only strategic as companies and venture capitalists are trying to create new business and accelerate growth of an existing business through M&A but also structural due to the aging of the population and a great deal of companies being small and medium-sized enterprises (SME) which are too small to compete internationally (Katramo et al 2013, 19). M&A activity is also cyclical and according to survey conducted by PricewaterhouseCoopers (2020b) corporate transactions will play a key role in the companies' recovery strategy after the volatility in global economy caused by COVID-19.

Valuation of the target company is a key part of the M&A process and it is characterized by subjectivity (Knüpfer & Puttonen 2018, 243). It is also stated by Seppänen (2017) that valuation alone in the M&A process with its simplifications and suppositions requires significant amount of situation-specific qualitative analysis making it partly art whilst its basis is in the economic theory. This supports the perception of Larsson and Finkelstein (1999) who observed in their study M&A processes being very complex. This complexity is reflected in the M&A research as fragmentation of the theories used and as inconsistent application of research variables to find alternative causalities (King et al 2020, 1).

As a highly popular form of corporate development and a challenging and high-risk phenomenon, M&A has aroused substantial interest and research attention from a variety of management disciplines (Cartwright & Schoenberg 2006, 1). Valuation is an integrated part of the corporate transaction process as it affects the decisions of the investors (Kumar 2015, 210). Models and methods used in valuation have developed significantly over the years due to the amount of the research focused on the performance and biases of the techniques (Bhattacharya & Constantinides 2005, 1). Latter research has concentrated on factors that are more difficult to measure numerically and to include in the calculations, for example intellectual capital information or technological capabilities (Abhayawansa, Aleksanyan & Bahtsevanoglou 2015, 279). This thesis has its focus on the innovation capability which is somewhat equivocal as a concept and cannot be unambiguously defined as for example Mendoza-Silva (2020) and Krasadakis (2020) have disclosed the novelty of the concept. As the innovation capability of the target company is proxied by its R&D intensity due to the linkages between the concepts that are better introduced in the latter sections, the previous research is also reviewed focusing on the R&D intensity which could be also justified by lack of research examining innovations and M&A. The impact of R&D on M&A and valuation has attracted the interest of researchers and professionals as a research topic and the relevant results of the studies have been listed on the Table 1.

Table 1. Previous research

Topic of the research	Authors, year	Results of the research
R&D intensity and market value	Hall (2000)	R&D activities are valued by markets.
	Grupta, Banerjee and Onur (2017)	R&D intensity has stronger effect on market value in developed countries.
	Hall and Oriani (2006)	Differences occur between European countries in M&A investment market valuation.
	Chua, Eun and Lai (2007)	R&D intensity has positive effect on corporate market valuation worldwide.
R&D costs in accounting	Ciftci and Darrough (2015)	R&D should be capitalized to improve the value relevance of financial statements.
	Chan, Lakonishok and Sougiannis (2014)	Mispricing and distortions in valuation may arise from expensing rather than capitalizing R&D costs.
	Abrahams and Sidhu (1998)	R&D capitalization has a significant effect on company value.
R&D and valuation by analysts	Boer (2002)	The valuation of R&D has advanced substantially, and it continues developing.
	Palmon and Yezegel (2012)	R&D has a positive effect on valuation and revisions by analysts.
R&D intensity and M&A activity	Szücs (2014)	Merger targets are highly innovative firms indicated with R&D intensity.

Prior research has focused more on the relationship between R&D and market valuation while less attention has been paid to the linkages between company value measured with the acquisition prices and R&D intensity of the acquired companies. The efficiency of the valuation performed by public financial markets has been questioned in the literature concerning the relation between R&D expenditures and future stock returns as this premium is based on mispricing. (Chan et al 2015, 78) This is linked to the scientifically argued accounting bias related to the R&D reporting where these expenditures are decreasing the profit, possibly leading to company report losses, but simultaneously increasing the true value of the company (Ciftci & Darrough 2015, 138). One factor in the mispricing may also be the fact that the qualitative assessment of the company is undeniably at least as important as the quantitative assessment but may not be adequate if done by a nonprofessional (Mellen &

Evans 2010, 37). While the research has not tended to focus on the relation of R&D intensity to acquisition prices this perspective could also solve the problem of ineffective pricing done by the markets as the acquisition prices are based on evaluation of professionals (Palmon & Yezegel 2012).

1.2 Research objectives, questions, and structure

This thesis examines the relationship between innovation capability of the acquired firm measured with its R&D intensity, which has been calculated by dividing the company's annual R&D expenditures by the sales, and company value measured with the deal prices in corporate acquisitions. The data covers 169 completed deals from 23 different countries in every continent excluding Antarctica. The research question is:

"How does the innovation capability of a target firm affect its acquisition price?"

To answer this question, a model consisting of the acquisition price and target firm's innovation capability is constructed controlling with the effects of certain variables that have been formed based on theory whereby the justifications and reliability of all the research variables have been reviewed. The study also observes the strength of the relationships between the research variables focusing on the studied innovation capability. In addition, the factors and aspects that might affect reliability of the study or have not been noted in the study are considered taken the subjectivity related to the topic.

The research is highly based on the literature reflected and previous studies reviewed, however, broaching a different way of considering the value of a company in a research by examining the acquisition prices. The aim is to raise a different way of modelling and examining a topic that has been acknowledged by researchers and studied from the aspect of markets, and to bring forward the issues related to the reliability of this prior research.

1.3 Data and methodology

The research in this study is conducted with quantitative methods focusing on the linear regression analysis implemented using Stata SE 16.1 software. The data consists of the deal reports including the acquisitions prices and acquired company's balance sheet, profit and loss, and cash flow statements for two financial years reports prior the deal. The M&A deal data for the analysis is gathered from the Bureau Van Dijk's Zephyr database. The acquisitions used in the study were limited by the completion time, share of ownership, and deal type and these limitations are described more specifically in chapter 3.1. The financial statement reports are taken from Thomson Reuters' Datastream service. The preprocessing of the data including calculations and cleaning was done using Microsoft Office Excel and Visual Basic for Applications. All the theories and concepts introduced in the thesis and utilized in the methodology section are based on previous literature, statements, and research done by scholars in the field.

2. Theoretical framework

The chapter reviews the key concepts of the study by starting from innovations and innovation capability. Following chapter focus on the M&A process and valuation ending to a chapter which binds together the subjects by concentrating on the M&A activity and innovations.

2.1 Innovations and innovation capability

The definition of an innovation depends on the context and point of view. However, most of the definitions have same characteristics inferring it being the entirety of inventing something new or significantly changed to fill a purpose or enhance something already existing including the implementation and adaption of the invention. (Krasadakis 2020, 6-11) Despite the diversity in the definitions and the instability of the concept, the classification of innovations is somewhat established to organizational, marketing, process, and product innovations (OECD 2020).

Organizational innovations target the organization itself referring to enhancement within its components (Krasadakis 2020, 12). According to Van der Aa and Elfring (2002) organizational innovations are connected to the administrative functions in developing the systems, procedures, and routines to improve coordination, cohesiveness, collaboration, and learning including the knowledge and information sharing. Rajapathirana and Hui (2017) state that organizational innovations may improve the performance of a company by reducing administrative and transaction costs. While the concept is rather strictly delimited inside an organization it still can be comprised to affect a larger whole as it is also defined to be new methods concerning organization's business practices and external relations (OECD 2020).

Marketing innovation refers to implementing new marketing methods that reshape the product's design, placement, promotion, and pricing (Gunday, Gunduz, Kemal & Lutfihak 2011, 663). As reported by Krasadakis (2020) marketing innovations relate to communication and persuasion of potential users in pursuing increase in engagement. The main objective of

the marketing innovation is to increase the company sales by penetrating a new market or changing the positioning on the current market (Rajapathirana & Hui 2017, 46).

Process innovation means an improvement in existing process or processes, or a totally new one which is implemented in one or more business functions (OECD 2018, 21). This kind of innovations affect the outputs positively by enhancing the handling of the inputs by impacting the design and production methods, the supply chain operations, the distribution and delivery of products, and the management of organizational resources (Krasadakis 2020, 12). Process innovations are targeted to operations in which the company itself can be recognized as the customer with goals of implementing new business strategies, reducing costs, improving the quality of the output, or working conditions or meeting regulatory requirements (OECD 2018, 72).

Product innovations, as Krasadakis (2020) stresses, are innovations resulting in new products or services, or improvements in existing ones with significant and novel enhancements. These kinds of innovations are required to be available to potential users but are not necessarily expected to generate sales as some product innovations fail to achieve established demand, need longer period of observation to realize or they are intended to be free for users creating revenue through advertising, commercializing user information or other methods (OECD 2018, 71).

Although the research examining innovation capability has been growing during last decades, no established consensus has emerged around the concept making it rather vague and controversial (Zawislak, Fracasso & Tello-Gamarra 2018). Existing definitions have similarities depicting the innovation capability as the company's ability to transform or use its different kinds of inputs in producing innovative outputs where both inputs and outputs have variability between definitions. Weber and Heidenreich (2018) define the innovation capability as the competence to attain and embrace novel knowledge and to utilize it in producing new products or services. Ngo and O'Cass (2013) stressed the innovation capability being the aptitude of generating innovations through the activities performed in the routines and processes of the company in which the knowledge and skills are embedded within. Innovation capability can be also linked to a wider outcome as Wang and Ahmed (2004)

defined it as the ability to introduce new products and services or opening new markets by harnessing combinations of innovative behaviour and strategic orientation.

The framework of dimensions from which innovation capability is constructed can be explicated more precisely and this conceptual framework has developed in recent studies with significant similarities. The number of dimensions varies but the themes and concepts are closely related if not repetitive. Recognizable dimensions of innovation capability are knowledge management, organizational learning and culture, leadership, collaboration, creativity, innovation strategy, and idea management. All these aspects comprise features that are important parts of a company's innovativeness. Knowledge management includes all the aspects from acquiring information to storing and exchanging it on the markets. Organizational culture and learning refer to an environment that is conducive to the emergence of innovations in many of its characteristics. Leadership challenges old habits of management with its attributes of certain openness and encouragement. Collaboration is not limited into an organization as it refers to the sharing of information with all stakeholders. Creativity refers to organizational habits that support the innovativeness such as achievable objectives, availability of resources, flexibility, and recognition of ideas. Innovation strategy is the development of a clear strategy for innovation including the allocation of the resources and initiatives for different kinds of innovations whereas idea management incorporates innovation guidelines to the strategy. (Saunila, Mäkimattila & Salminen 2014; Iddris 2016; Saunila 2014)

2.2 M&A and business valuation

Corporate transactions are always strategic measures for the buyer whether it was a company or a venture capitalist. While venture capitalists evaluate the company from a viewpoint of the total return on equity on the assumed investment period with the aim of value increase by the reorganization of operations, management, and resources, industrial buyers' motives and perspectives for the evaluation are more varied. The objectives of an industrial buyer are commonly related to the scope and growth of the business, the economies of scale achieved through the transaction, and greater market share and strength by enhancing the

controllability of resources and elimination of overlapping or duplicated activities of the companies. (Katramo et al. 2013, 19-20)

Many essential issues that affect the transaction in different ways are highlighted. Type of deals can be categorized into mergers and acquisitions and further by the strategic direction being horizontal, vertical, or conglomerate. Forms of payment may also differ between deals as cash, stock, or mixing these. The deal target may also be either private or publicly owned and locate in different country making the deal cross-border. The attitude of the acquirer may also be either friendly or hostile which significantly impacts on the management of different fragments of the transaction process. (Distler 2018, 13-17)

Corporate transaction processes can be divided into three fragments that must be managed successfully to harness all the potential of the formed organization: transaction, synergy, and integration management (Feix 2020). These areas are also identified in the study presented by Copeland, Koller & Murrin (1994) who researched the reasons of the high probability for corporate transactions to fail. According to Feix (2020), synergy management's objective is to capture the identified synergies, the additional value created by the transaction beyond the standalone values of the acquirer and the target. However, synergies are often overestimated causing failures in the capture and errors in the profitability analyses (Copeland, Koller & Murrin 1994, 420-421). While the integration management has been said to be successful when the forecasted synergies and the intended transition are achieved it has been also noted that poor implementation ruins even the best strategy (Feix 2020, 174; Copeland, Koller & Murrin, 422). While these two are mainly related to the post-transaction phase, the third identified fragment, transaction management consists of the valuation, analyses, due diligence investigations and finally the negotiations of the deal (Feix 2020, 110).

There are many important factors affecting the value of a company, which is why various analyses are also conducted as a part of the acquisition to support the estimation of the value and the assessment of the target's potential (Katramo et al. 2013). Figure 1 shows the simplified process of the determination of company value where these analyses have been divided into accounting based and business-based investigations.

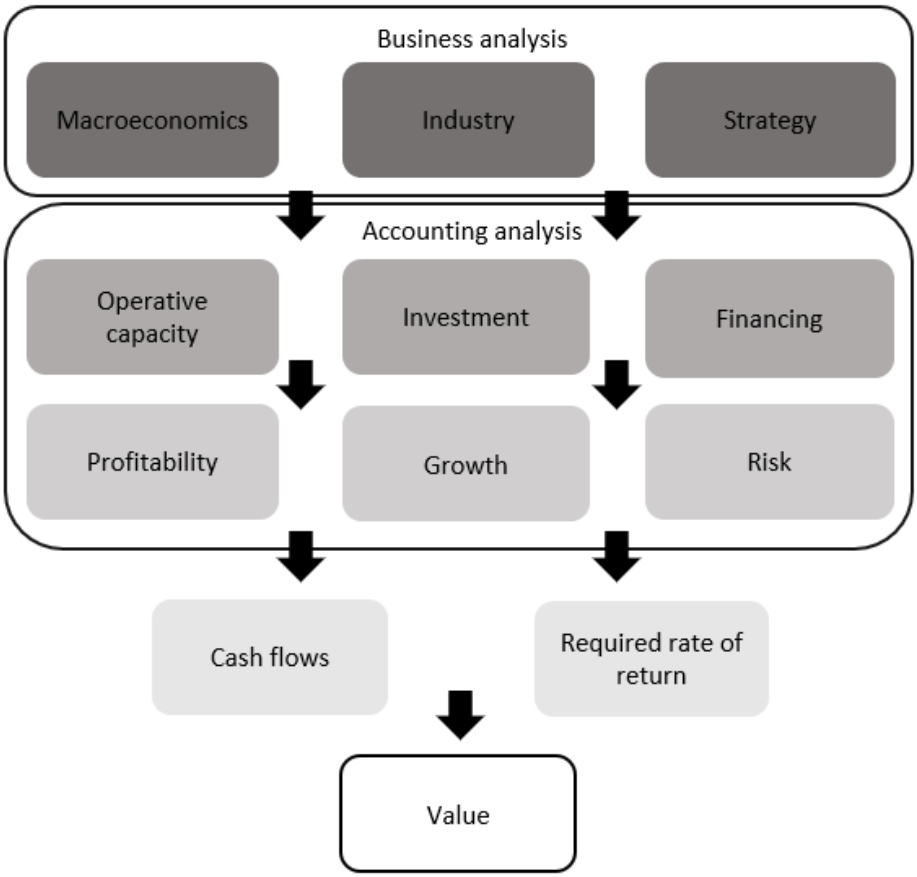

Figure 1. Drivers and factors behind company value (Seppänen 2017, 26).

First step of a company's business model analysis focuses on the strategic profile on internal and external front by qualitatively reviewing the company's internal structure and different players in its environment (De Luca 2018, 3). Strategy analysis views the choices of positioning and required matches between the value chain and activities, and core competencies and key success factors (Palepu, Healy & Bernard 2000, 21). Macroeconomic and industrial analyses overlap as they include the review of the overall cyclicality of the industry (Katramo et al. 2013, 83). Both analyses inspect the market behind different lenses combining perceptions of the possible future of the company's profitability (Seppänen 2017, 26). The importance of the industry analysis has been emphasized by Palepu, Healy & Bernard (2000) as it should focus on the competitors by reviewing the rivalry among existing firms, the threat of new entrants and substitute products, and the bargaining power of buyers and suppliers. The due diligence and business due diligence inspections are also in a key role in corporate transactions as they are to confirm the assumptions and to support the progression of the process in different areas by enhancing the informative position of the parties possibly shaping the opinions of

the financial and legal conditions, risks, and advantages gained from synergies and strategic benefits (Katramo et al. 2013, 50-56).

The subjectivity which characterizes the valuation ensues from the previously mentioned mainly qualitative analyses which support the valuation process (Knüpfer & Puttonen 2018, 242). Mathematical valuation models have developed notably during past decades, but the improvement of the efficiency and accuracy of the new methods is rather questionable, and the valuations should be anchored to the fundamentals (Penman 2002, 1). These fundamentals could be stated to be the valuation techniques utilizing discounted cash flow (DCF) and comparable methods which are also the most used models in real life applications where they are often used together (Kaplan & Ruback 1996, 45).

Mercer & Harms (2008) defined the equation of the basic DCF valuation model as follows:

$$V_0 = \left(\frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \ldots + \frac{CF_n}{(1+r)^n} \right) \tag{1}$$

where

V_0	value
CF_{1-n}	cash flows from period 1 to n
r	discount rate

As Allman (2010) emphasizes the importance of the projecting of growth which is universally acknowledged as a one dimension in valuation, Mercer and Harms (2008) presented the two-stage DCF model which utilizes the Gordon model in discounting the terminal value as follows:

$$V_0 = \left(\frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \ldots + \frac{CF_n}{(1+r)^n} \right) + \left(\frac{CF_{n+1}/(r-g)}{(1+r)^n} \right) \tag{2}$$

where

V_0	value
CF_{1-n}	cash flows from period 1 to n
r	discount rate
g	growth rate

There have been various models introduced during the previous decades which are all based on the principles of the DCF model but use different discountable components. Free cash Flow to firm (FCFF) and economic value added™ (EVA™) models are referred to be the most efficient and applied ones. (Mielcarz & Mlinarič 2014) EVA™ model is invented by Stern Stewart & Co in the late 1980's and it is also possible to define as a residual income model if distinguished to be a different category (Shrieves & Wachowicz 2001). FCFF and EVA™ as the CF_{1-n} in the models are calculated according to Vishwanath (2007) in the table 2:

Table 2. FCFF and EVA™ formulas (Vishwanath 2007).

Operating profit (EBIT)	Operating profit (EBIT)
- Taxes	- Taxes
= Net operating profit after taxes (NOPAT)	= Net operating profit after taxes (NOPAT)
+ Depreciation and amortization	- Weighted average cost of capital (WACC)
- Capital expenditures	* (equity + long term debt)
+/- Change in working capital	= Economic value added
= Free cash flow to firm	

Although these models are compared in literature, they have been proofed to be equivalent for valuation and decision-making (Shrieves & Wachowicz 2007, 47). What also unites the models is the utilization of WACC as the discount rate which is also universally used in the valuation models as the cost of capital and discount rate (Copeland, Koller & Murrin 1994, 239). According to Feldman (2005) the WACC can be calculated by weighing the cost of debt and equity by their market values' shares of the total market value of the company and subtracting the corporate tax rate from the cost of debt as it is tax-deductible. Allman (2010) notes about the WACC that the cost of equity can be calculated by using the capital asset pricing model and the cost of debt from the pre-tax debt interest rate.

Nevertheless, these models are dependent of multiple assumptions and simplifications which with the subjectivity of the valuation process itself lead to the fact that the value is not to be determined explicitly but rather as a range by implementing a sensitivity analysis on the models. As the methods assume growth rate and the discounting rate reflecting the cost of

capital or riskiness to be steady, these are tested with a sensitivity analysis providing a range of values to be a basis for the acquisition price. (Janiszewski 2011)

As mentioned before, companies are often valued using transaction or trading multiples. The method is based on measuring performance by calculating ratios and multiples of values to indicate a guideline or comparable firms. Value estimations are evaluated from multiplications of the ratios or multiples of the guideline companies and performance measures for the valued company. (Kaplan & Ruback 1996, 48) Three most relevant ratios used are enterprise value divided by earnings before interest, taxes, depreciation, and amortization (EBITDA) or book value of equity or sales where the enterprise value refers to the sum of the company's market capitalization and net debt. The usage of EBITDA has its advantages as it is negative only in anomalous situations, it has direct impact on the cash flows, and as it does not consider depreciation and amortization or leverage allowing the comparison of companies with different level of investments or capital structure. (De Luca 2018, 387)

However, this method is based on assumptions which affect its reliability. The utilization of the method necessitates that the comparable companies, which usually are publicly traded and usually selected by industry and company size, are priced fairly by the financial markets. The method also relies on the assumption of the phenomena affecting the guideline companies having corresponding effects to the company being appraised. (Hall 2003, 9)

2.3 M&A and innovations

Global M&A market has been characterized by high volatility and its long-term development has occurred in waves of which have been identified six hitherto. Today's global M&A market is amid the seventh wave driven by business model innovations within both high technology, and traditional industries. (Feix 2020, 1) The barriers to enter a market has been lowered by the advances in disruptive technologies and the increase in the digitalization of business models causing a dynamic in the markets which has forced companies to adopt inorganic

growth strategies to create innovative business through M&A and corporate venturing (Deloitte 2016, 1).

Cassiman and Veugelers (2006) noted that even the most innovation-active organizations cannot rely alone on internal sourcing, but they also need to acquire knowledge beyond their boundaries to evolve the innovation development. The competitive pressures have augmented the inbound knowledge flows in which a company acquires and absorbs external knowledge in its innovation activities for example by a transfer of rights to intellectual property or other knowledge-based capital through M&A (OECD 2018, 131-132). Corporate venturing is highly related to this as it can be defined as a set of corporate mechanisms to accelerate new business creation serving as a strategic instrument for capturing, creating, and delivering innovation (Gutmann 2018, 122-123). Furthermore, Gold (2017) emphasized the role of corporate venturing in the current ways of organizations to explore and exploit innovative ideas, knowledge spillovers and new technologies.

It has been stated that innovation activity increases the possibility to participate in M&A activity (Ozcan 2016; Feix 2020; Sevilir & Tian 2012). Fundamental reasons for the causality are however versatile. Shimizu, Hitt and Pisano (2004) noted that M&A enables possibilities in market entries and in transfers of technology and innovation to keep pace with the globalization of business. Cross-border M&A activity has been researched excessively due to the globalization in the last decades and its main motives has been identified being related to accessing new markets or acquiring new technology and know-how (Grimpe & Hussinger 2014). One strategic aspect in capturing innovation led growth has been identified to be a dedicated innovation M&A strategy for the acquisitions of capabilities and technologies to unlock new sources of growth (Deloitte 2016, 2). In his study of the technological cluster in Silicon Valley, Gold (2017) raised that the bureaucracy in large corporations may destroy the innovation capabilities leading to the emergence of innovative and technology intensive start-ups that threaten the market position of the established players forcing the larger corporations to execute M&A activities and corporate venturing. This perception is also supported by Bower's (2001) theory of M&A taking place as being a substitute for R&D and Ozcan's (2016) observation of companies filling gaps in their internal innovation activities with M&A. Feix (2020) emphasizes the synergistic value in the R&D functions supporting the

complements theory as the transition in the technology standards, best-practices, and R&D portfolios between the acquirer and the target increases the efficiency and enables the application of the acquired new technologies to the whole product portfolios.

Ahuja and Katila (2001) examined M&A activities and innovation performance from the perspective of resource-based view stating that the innovativeness of a company is an outcome of increase in its knowledge base and the motives for acquisitions are focusing on obtaining technological know-how and enhancing technological capabilities. Dezi et al. (2018) supported these views noting that growth of a firm through M&A can act as a strategic lever for improving the innovative capacity and sustaining a competitive advantage. Ferraris et al. (2017) also used the resource-based view as the framework reporting that acquisitions may enhance the development of innovations by fostering new organizational models, enabling access to the research and innovation capabilities, and growing the knowledge base of the formed organization.

Sevilir and Tian (2012) suggested M&A activity and innovation being positively correlated and R&D expenditures being a driver for innovation. Cefis and Marsili (2015) stressed that technologically motivated M&A processes benefit the post M&A innovation performance and both parties in regards of innovation activities. A model by Lawson and Samson (2001) also indicates the inputs, previously presented components of innovation capability, being the drivers of innovation capability and thereby strengthening the knowledge flows within an organization which simultaneously improves the development of innovations, innovation performance, and company performance. Based on the presented theories, relationships between concepts, and results of previous studies, a following hypothesis is proposed:

H_1 = "Acquisition price is higher for a target with a greater innovation capability."

3. Methods

This chapter begins with a subchapter which reviews the nature of the data and explains the constraints of it. The subsequent section focuses on the research variables and the final subchapter covers the research method and its theoretical background.

3.1 Data

The data used in the research consists of four separate reports taken from two separate databases. The acquisition deal information is queried from the Bureau Van Dijk's Zephyr database and the financial statement reports for acquired companies are gathered from the Thomson Reuters Datastream service. The acquisition deal report contains basic information of the M&A parties and the deal itself including the acquisition price. Financial statement reports used in this study are acquired company's balance sheet, profit and loss, and cash flow reports for a period of two years before the acquisition.

The search criteria used in the query of the acquisition deal information was constructed to acquire data as complete and comparable as possible. The query included only deals that had been completed after 2010 with a known and confirmed acquisition price to reduce the possibilities of erroneous data. The deals were also restricted to be acquisitions in which the share of ownership was increased from 0 to 100 percent since the deals would be incomparable with unequal sized stakes in transactions. The deals that included multiple parties were also left outside the query as it would have distorted the deal prices since the individual shares of the acquired companies in the purchase price were not available.

The search query in the Datastream service was based on the acquired companies' The International Securities Identification Number (ISIN) obtained from the deal information report. The balance sheet, profit and loss, and cash flow reports were acquired for two financial years before the completion date of the deal. To avoid the aggregation of the data, only companies which had full records to calculate the research variables were included in the study.

The final sample consisted of 169 acquisitions where the deal value ranged from 80 million to 35 billion euros. The sample included different sized companies measured with the total assets ranging from 25 million to 5 billion euros with an average of 46 million euros. The R&D intensity was relatively variable as the minimum was 0.5 percent and the maximum was 96 percent with moderately low average of 14 percent. Sample also included both lucrative and unprofitable companies as the minimum of the NOPAT was 8 million euros negative and the maximum was 260 million euros positive. Capital structure of the sample firms also included deviation as the debt to assets ratio ranged from 0 to 96 percent with the average of 19 percent.

3.2 Measures

This chapter will present the research variables focusing on the theoretical support and justifications of including them in the regression model. The dependent variable is introduced first followed by the independent variable of the study with the last subchapter focusing on the control variables used in the model.

3.2.1 Dependent variable

Previous research has used the Tobin's Q as a proxy for company value when studying the relationship between R&D intensity and market valuation (Gupta, Banerjee & Onur 2017). However, the usage of Tobin's Q in regressions as a dependent variable has been criticized and suggested to be viewed with suspicion. Direct estimates of firm value should be used instead of Tobin's Q due to the biased estimates that it might cause. (Bartlett & Partnoy 2018, 1) As an alternative approach, the acquisition price is the dependent variable in this study. It reflects the value of company differently since the valuation of the company, which constructs the basis of the price in the acquisition process, is carried out as an assignment to an external specialist. Grimpe and Hussinger (2014) also note in their study that this price is the reflection of the acquirer's expectations of the resource complementarity and as this is heterogenous across the potential bidders, the one with the highest expected resource complementarity may outbid the other competitors.

3.2.2 Independent variable

Innovation capability is the independent variable of the study and it is proxied by R&D intensity that is calculated by dividing R&D expenditures by sales. R&D expenditures and different intensity ratios have been linked to innovation over the time. Savrul & Incekara (2015) state R&D being the main driver of innovation while the R&D intensity is a key indicator in monitoring resources devoted in generating new knowledge. Several studies have concluded R&D intensity having significant positive effects on company's innovation performance (Zhang et. Al 2009; Desyllas & Hughes 2010; Thornhill 2006; Bhattacharya & Bloch 2004). Due to this and while numerous studies use and state R&D intensity being a commonly used indicator and a proxy for innovation input and innovation intensity, it can be concluded having rather established nature as a proxy for innovations (Hughes 1988; Baumann & Kritikos 2016; Ketchen, Ireland & Baker 2013; Symeonidis 1996; Jensen & Webster 2009; Sher & Yang 2005; Katz 2006).

3.2.3 Control variables

According to financial theory, the value of a company can be determined either by starting from the company's assets or, alternatively, by determining the value of its liabilities and equity - the financial instruments or instruments used to finance the assets. This liquidation price of a company represents the amount of money it would take to build the enterprise from nothing. (Seppänen 2017, 37) Despite the highly theoretical basis of the liquidation price it has been said that the book value of assets has its role in the valuation and due diligence (King 2008, 84). Therefore, the total assets book value has been included in the model as a control variable.

Since the FCFF valuation model is the most used model in corporate transaction advisory as indicated, and to avoid multicollinearity, the components of the FCFF are included into the model forming the only discountable component of DCF models used. It is also demonstrated by Shrieves and Wachowicz (2001) that the DCF models are theoretically equivalent which indicates that adding another discountable component would not add new information to the model. All the components of the FCFF are included as control variables to the model. The

components are NOPAT, depreciation and amortization, capital expenditures and change in working capital as indicated in the formula presented in the theory section.

Risk is one of the main factors to be considered in the valuation of a company (Katramo et al 2013, 72). It is reflecting to the valuation model through the cost of capital in the DCF models (Copeland, Koller & Murrin 1994, 239). It is also indicated by Katramo et al. (2013) and Seppänen (2017) that the risk in the valuation model is partly a scenario-based factor which is one reason for the sensitivity analysis conducted in the latter part of the valuation process. Riskiness is also highly related to the indebtedness of a company and changes in the capital structure (Katramo et al. 2013, 118). A debt ratio calculated by dividing the total debt by the total assets of company is used as a proxy for the risk factor in the valuation and included in the model as a control variable.

3.3. Multiple regression analysis

Regression analysis typically seeks to elucidate causal relationships between variables and the linear regression model is one of the most practical and used model in econometrics. Multiple regression analysis is a method which utilizes a model where the dependent variable is related to more than one explanatory variable. (Hill, Griffiths & Lim 2018, 47-49) In line with Hill, Griffiths and Lim (2018) the general form of the equation can be written as:

$$y_i = \beta_1 + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_n x_{in} + \varepsilon_i \tag{3}$$

where

y_i	dependent variable
β_1	intercept
$\beta_{2\text{-}k}$	independent variables
$x_{i2\text{-}in}$	constant terms
ε_i	error term

According to Hill, Griffiths and Lim (2018) the linear regression has six assumptions concerning the components in the equation in completing the specification of the model:

1. Observations form the dependent variable's values with population relationship of $y_i = \beta_1 + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_n x_{in} + \varepsilon_i$
2. The random error term ε_i is conditionally expected to equal zero with all observations.
3. The variance of the error is a constant, $var(\varepsilon_i) = \sigma^2$
4. The covariance of any different error terms equals zero, $cov(\varepsilon_i, \varepsilon_j) = 0$
5. No exact linear relationship exist between the independent variables.
6. Residuals of the model are normally distributed. (conditional)

Gauss-Markov theorem states that under the assumptions 1-5 the ordinary least squares (OLS) estimator has the smallest variance within all linear and unbiased estimators being the best linear unbiased estimators. The OLS method used in this study fits a line to the data by minimizing the sum of the squares of every point's vertical distance to the line. The squaring of the values prevents the large positive distances from being cancelled by large negative distances. Although the rule is arbitrary it is a highly effective method in drawing a line in the middle of the data where the vertical distances from each point to the fitted line form the least square residuals. (Hill, Griffiths & Lim 2018, 61, 72)

4. Results

This chapter begins with a review of descriptive statistics of the variables. The subsequent section focuses on the regression analysis and its results and the final subchapter evaluates the reliability of the model and the research and assesses the limitations of the study.

4.1 Descriptive statistics

In regression analysis, the residuals should be normally distributed. Strongly skewed variable distributions might hinder this but can be converted to normal distributions by various transformations. The downside of the variable transformations is the fact that they make it more difficult to interpret the regression results as well as the weight of the extreme values. (Hill, Griffiths & Lim 2012, 71-73) Basic information of the variables used in the study is presented in the Table 3. All the standard deviations are greater than the mean of the variable which suggests that the variables would not be evenly distributed.

Table 3. Basic information of the research variables.

Variable	**Mean**	**Standard deviation**	**Min**	**Max**	**N**
DEALVALUE	44500000	294000000	8128000	3520000000	169
TOTALASSETS	45900000	391000000	24610000	4990000000	169
INNOVATION	0.137469	0.378164	0.005067	0.957716	169
NOPAT	1998891	19900000	-7935693	257000000	169
DEBTTOASSETS	0.189369	0.207681	0	0.970923	169
CAPEX	2955272	26300000	0	332000000	169
CHANGEINWC	488197	7522864	-47500000	71000000	169
DA	2301135	19600000	20	248000000	169

Appendix 1 shows the distribution of the variables as histograms. It can be observed that the variables are strongly skewed positively which is why the logarithmic transformations are done to each variable. Appendix 2 shows the histograms of the transformed variables where

they are significantly better normally distributed and consequently used in the study although some skewness is still observable.

A correlation matrix of the variables used in the regression model is shown in the Table 4. All the variables have a positive correlation with the dependent variable deal value (DEALVALUE) except the change in working capital (CHANGEINWC). Deal value has the strongest correlation (0.8805) with the total assets (TOTALASSETS) and the lowest (0.0414) with the innovation capability (INNOVATION). High correlations between control variables exist as the total assets and the debt ratio (DEBTRATIO) and the depreciation and amortization (DA) have correlations around 0.9 with each other. However, this does not violate the assumption of no perfect multicollinearity but the high correlation between variables may yield imprecise estimates for these variables. All the variables are justifiably left in the model since it does not affect the objectives of the study as the multicollinearity could be problematic only in the control variables. (Baltagi 2011, 74-76)

Table 4. Correlation matrix of the variables.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. DEALVALUE	1.000							
2. TOTALASSETS	0.8805	1.000						
3. INNOVATION	0.0414	-0.1723	1.000					
4. NOPAT	0.5983	0.6078	-0.0227	1.000				
5. CAPEX	0.1803	0.2257	-0.151	0.0441	1.000			
6. DA	0.7276	0.8893	-0.2987	0.5772	0.1811	1.000		
7. CHANGEINWC	-0.2387	-0.2414	0.0096	-0.7695	-0.0315	-0.2298	1.000	
8. DEBTRATIO	0.8002	0.9103	-0.2395	0.5951	0.2437	0.9061	-0.2393	1.000

4.2 OLS regression

The results of the linear regression can be found on the Table 5. Significance level of 5% is used in the study. The results indicate that the model is statistically significant with p-value under 0.01 and that it explains 81% of the variation in the deal values if considering the adjusted R-squared value. The adjusted R-squared value is preferable since it considers the

number of the predictor variables in the model (Das 2019, 79). The innovation capability is statistically significant with p-value under 0.01 whereas all the control variables are not statistically significant. The change in working capital, capital expenditures (CAPEX) and the debt ratio had high p-values and the total assets, NOPAT (NOPAT), and depreciation and amortization were statistically significant with p-values under 0.05. As the variables are logarithmic, it can be stated by observing the coefficients that if the innovation capability grows by one percent, it will increase the company value by 0.175 percent.

Table 5. Regression results.

Prob > F	R-Squared	Adjusted R-Squared
0.0000	0.8221	0.8153

Variable	Coefficient	Standard error	P-value
TOTALASSETS	1.024035	.0990369	0.000
INNOVATION	.1745455	.0359383	0.000
CHANGEINWC	.4670428	.2952386	0.116
NOPAT	1.019586	.4128020	0.015
CAPEX	-.335532	.0666192	0.321
DA	-.2320243	.0992626	0.021
DEBTRATIO	-.0045049	.0476284	0.662

The review of the needed statistical assumptions of the model in least squares estimation was initiated by testing the specification and linearity of the model. This was tested with Ramsey's RESET test which results can be found from Appendix 4. The null hypothesis of the test was failed to be rejected with p-value of 0.4850 which indicates that there is no misspecification in the model. The linearity of the model is illustrated with component plus residual plots which are shown in the Appendix 5. The plots convey that the variables are mainly linear although some non-linearity is observable in few variables. However, the non-linearity is not alarmingly strong and the Ramsey's RESET test indicated the model being well specified.

The homoscedasticity of the model was tested with Breusch-Pagan test which results can be found from Appendix 6. The null hypothesis of homoscedasticity was rejected due to the p-

value being under 0.05. Robust standard errors technique was used to obtain the unbiased standard errors of the coefficients due to the presence of heteroscedasticity. The results of the model with the robust standard errors are shown in the Appendix 7. The results indicate that the heteroscedasticity was not disturbingly strong since the standard errors and p-values had no significant difference between the models excluding the p-value of the change in working capital which made the variable statistically significant with p-value under 0.01.

Multicollinearity of the variables was observed by calculating the score of the variance inflation factor with VIF test which results can be found from the Appendix 8. 81.97% of the variance of innovation capability cannot be explained by control variables which is rather satisfactory in comparison with the corresponding values of the total assets or the depreciation and amortization being less than 10%. However, these problematic values indicating multicollinearity occur only in control variables which is why they can be safely ignored.

Residual analysis was conducted by interpreting the residual-versus-predictor plots and leverage-versus-squared-residual plot, and by observing the distribution of the model's residuals with a histogram. It can be observed from the residual-versus-predictor plots in the Appendix 9 that the residuals have no certain pattern and are distributed around the x-axis. The leverage-versus-squared-residual plot shows that there are no problematic outliers although some values have higher leverage and few values higher residual. The histogram of the residuals can be found from the Appendix 10 which shows the residuals being quite well normally distributed with minor negative skewness which should not affect the reliability of the results.

In addition to the analysis and because the variables contain highly different sized values due to some variables being ratios and some consisting of actual values the standardized beta coefficients and effect sizes were gathered. The variables which are composed of greater values may receive lower coefficients than the variables which consist of smaller values which may lead to ambiguities in the result interpretation with the unstandardized regression coefficients since (van Ginkel 2020). The beta coefficients and effect sizes are shown in the Appendix 11 from where it is possible to observe the comparable coefficients and the

individual proportions of the dependent variable's variance explained. The standardized beta coefficient and effect size values have similar results which imply the total assets having the major impact on the deal value and explaining the most of its variance whereas the innovation capability has greater coefficient and effect than the other control variables.

4.3 Limitations of the study

Several research limitations need to be acknowledged. The sample itself is rather small due to limited access to the data and constrictions between two databases which are also reflected in the data in several other ways. First, the control variables lack the acquirer's R&D intensity which would have been essential in the model considering the effect of R&D synergies on the acquisition as well as no other control variables regarding the acquirer were included in the model. Another limitation concerning the control variables was the lack of the geographic effect which would have distinguished the domestic and cross-border M&A. Second, innovation capability as a concept is characterized by ambiguity and multiple different metrics have been used to measure it, however, using only one in this study. These limitations are all due to the sparsity of the data either caused by the previously described R&D reporting standards related issues or the impracticalities caused by the usage of two separate databases in sampling the data. The ISIN number-based queries were the most limiting factor as both databases comprised only some data with some ISIN numbers causing a formation of recurring limitations. Third, an analysis between industries would have been an integral part of the study, but the sample collected would have formed an excessive number of sub-samples or the sectoral breakdown would have been questionable.

5. Conclusions and recommendations for future research

As the relevance and importance of the concepts of innovation, M&A, and valuation are growing as their own fields of research, these fields are converging to form complementary relationships, causal sequences, and entirely new subjects to study. This thesis researched the relationship between innovation capability and company value. The effect was studied with regression analysis by which the relation between the variables selected based on the theory was examined. The study covered 169 acquisitions executed in 23 countries during a period of 10 years.

In the theory section the concepts were presented individually forming the base for defining the variables in the model and finally the connections between the topics were introduced integrating the main subjects of the research and enabling the forming of a hypothesis. While the company value was measured with the acquisition price of a company, the control variables were generated based on the valuation theory. Based on previous research examining the innovation and innovation capability, and their measurement, R&D intensity was calculated by dividing company's annual R&D expenditures by annual sales and chosen to proxy the innovation capability.

The results of the study showed that innovation capability and company value have a positive relationship, although reasonably small, by which giving an answer to the research question *What is the relationship between innovation capability and the company value?* The positive relationship between deal value and innovation capability can be acknowledged from the figure 2 and considering the regression model it can be noted that as the innovation capability, in this case the R&D intensity, grows by one percent, the value of a company increases by 0.175 percent.

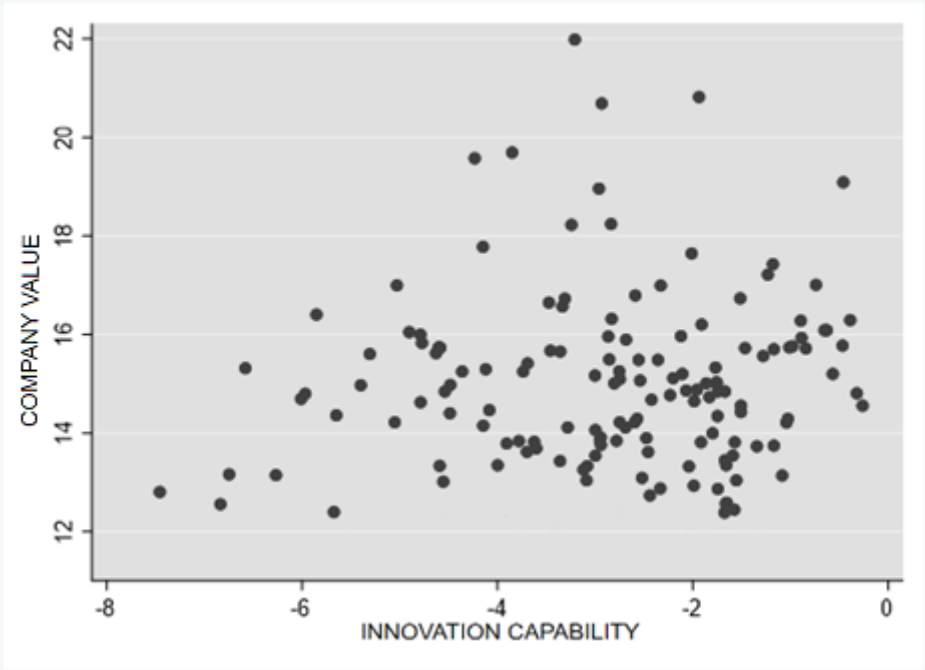

Figure 2. Deal value versus innovation capability plot.

Prior research has noted the accounting biases related to the innovation activities, especially R&D expenditures, which might affect the decision-making of a company. The findings of the study suggest that the innovation capability is valued in the M&A markets and increases the value of a company due to which companies need to understand the value that lies in the innovation activities and emerges from the resource complementarity and capability of producing innovations. It is equally important from the acquirer's side to understand the value of innovation capability. Significant opportunities of capturing value through innovation capabilities might be missed if the innovation capability of a target is not valued duly for the bid or offer.

The results of the study support the findings of previous research that has focused more on the effect of innovation capability on company performance and value creation. The findings complement prior research by examining a generalizable and diverse sample of companies from a slightly different perspective. The perspective also contributes to the innovation theory by exploring relatively understudied area of M&A and innovations. The results of the positive relationship between the transaction price and innovation capability motivate research within this area as the study has not applied all the possible measurements of

innovation activities that some are also yet to be discovered. While this study focuses on the innovation capability and company value, innovation theory in the field of M&A has also several other relevant relationships associated with M&A activity and post M&A performance.

The limitations of the study also offer opportunities for additional work and future research. To enhance the generalizability of the results a larger sample size is essential. Also, the used model may have included omitted variable bias as there have not been controlled for the acquirer's R&D intensity, size, or industry nor the domestic and cross-border transaction have not been distinguished that would have presumably improved the reliability of the model. The validity of the measurement of innovation capability could also be improved by including other measures in the model like the number of patents in the company's patent portfolio before the acquisition or manpower focused on R&D functions.

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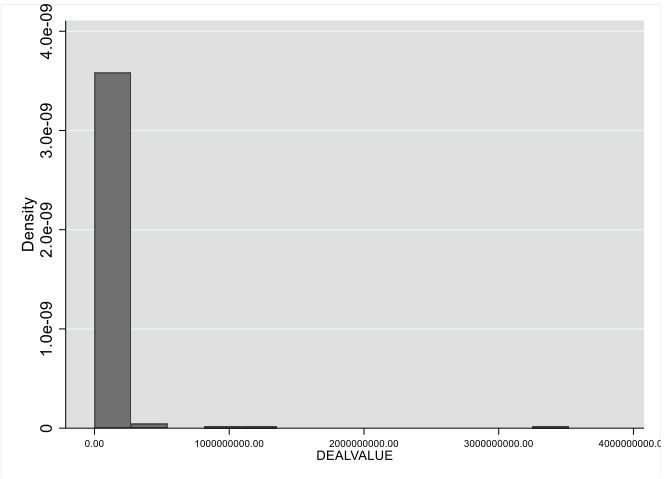
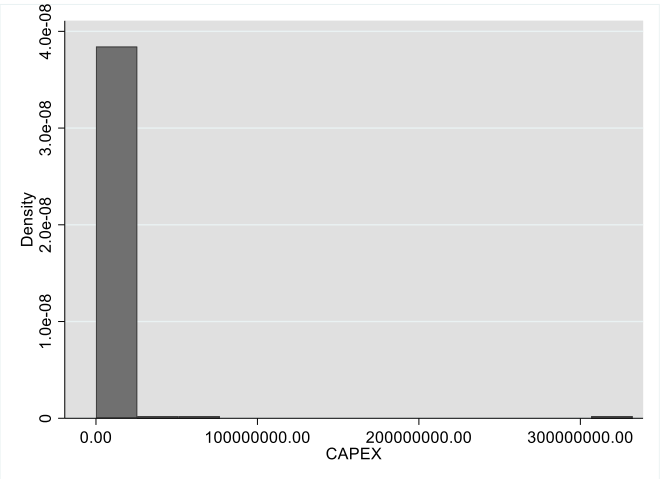
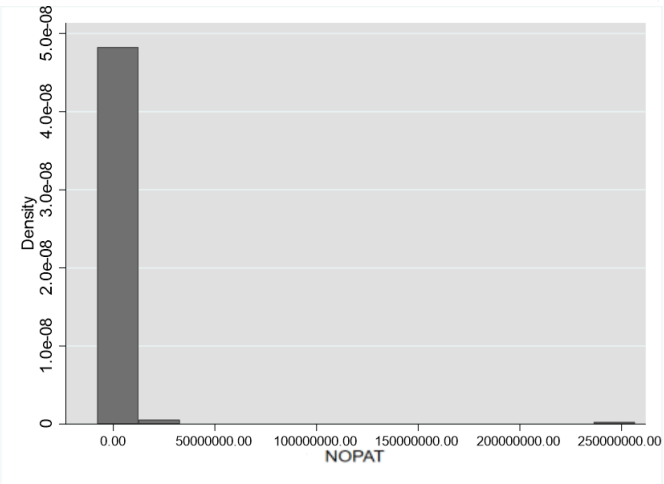
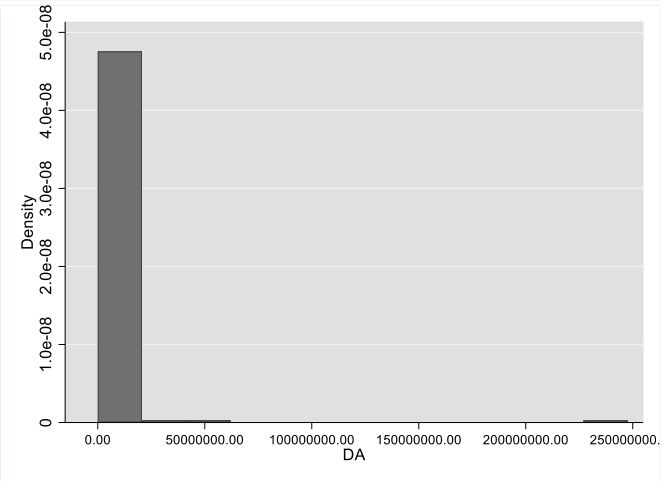
Appendices

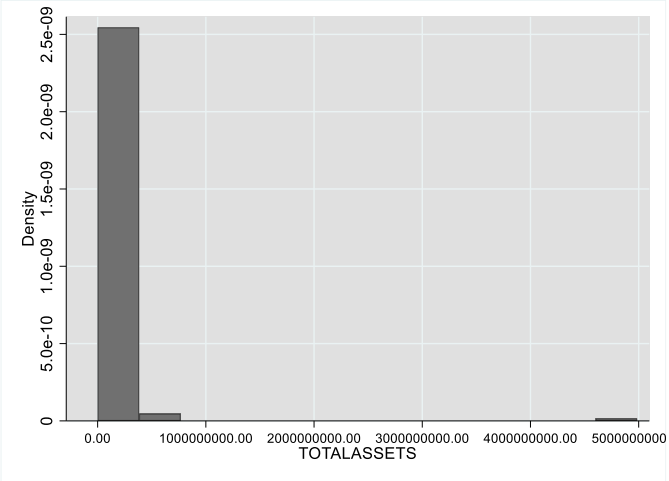
Appendix 1. Histograms of the original variables

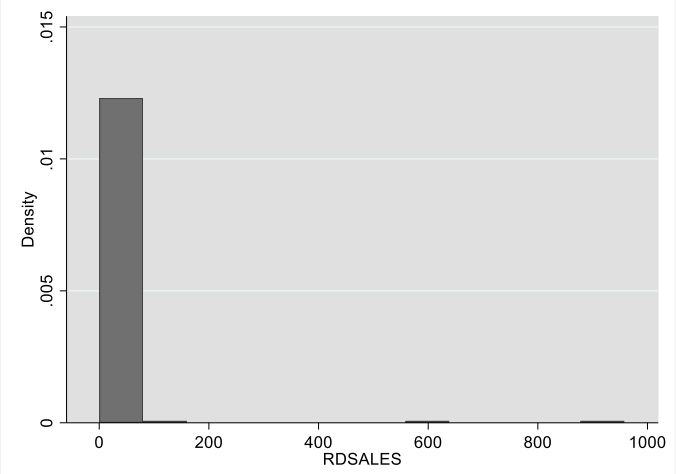


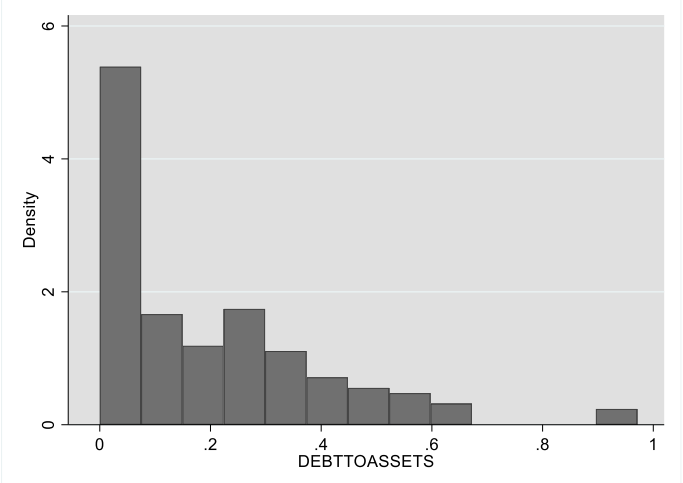


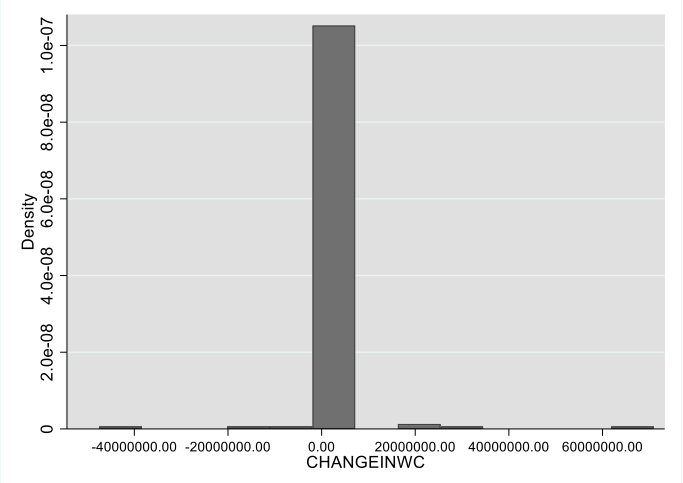




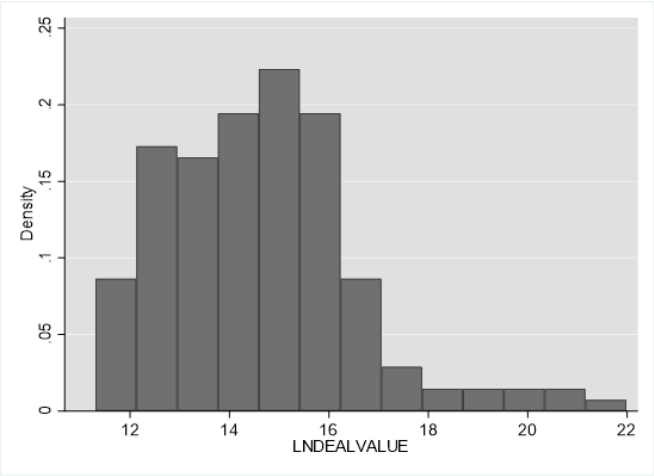


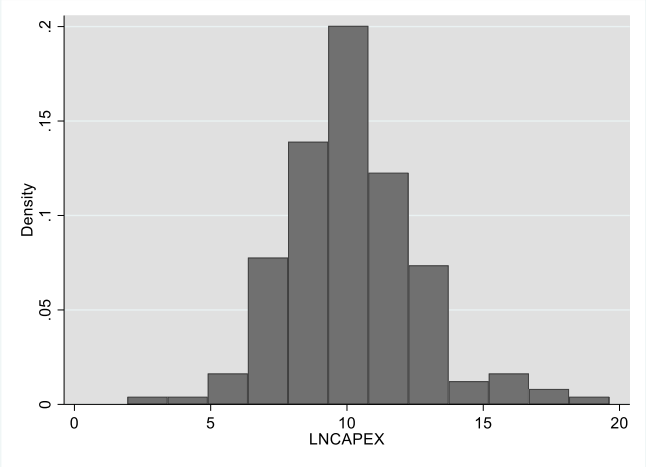


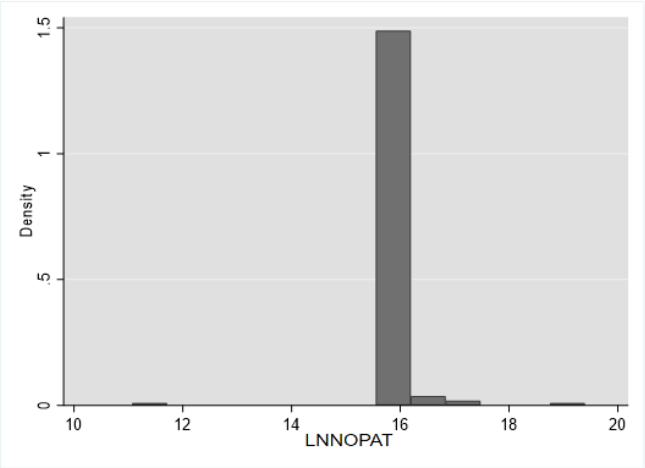


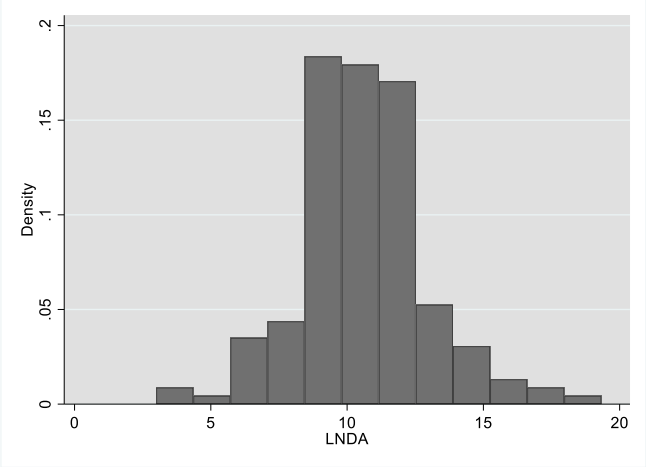


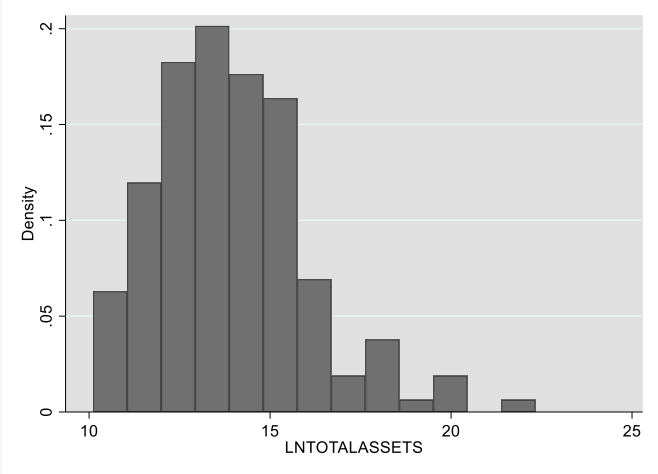
Appendix 2. Histograms of the log-transformed variables

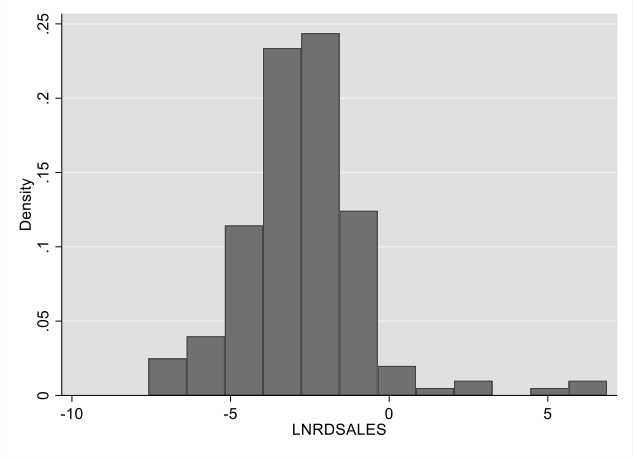


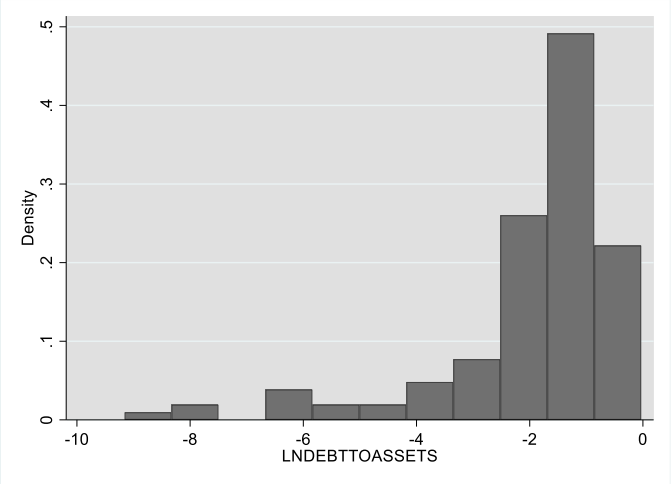


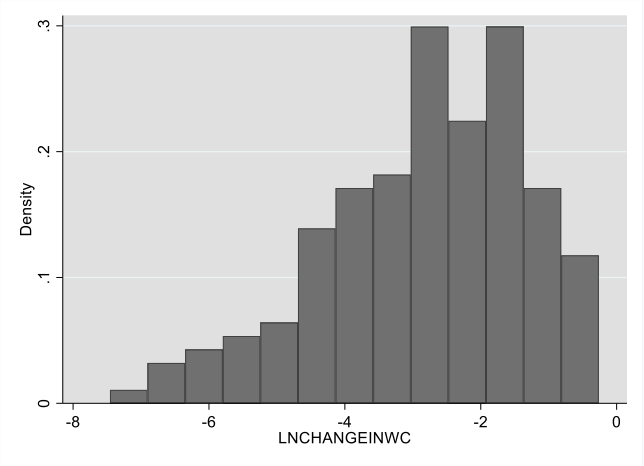








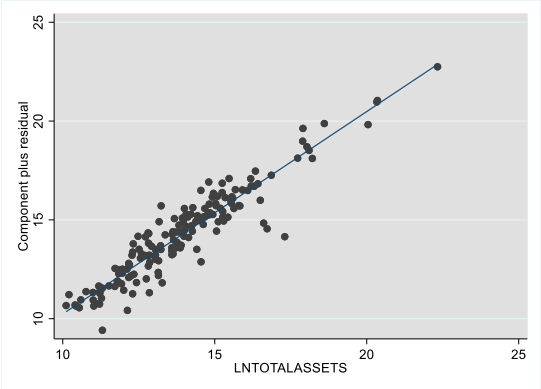


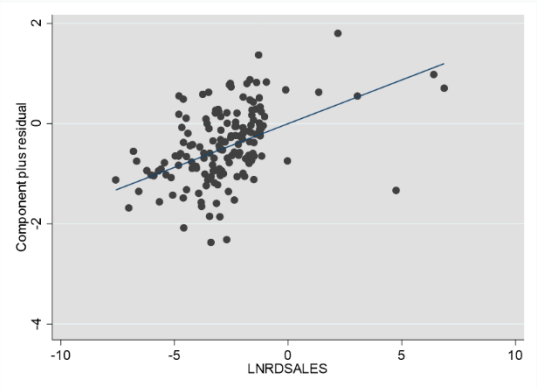


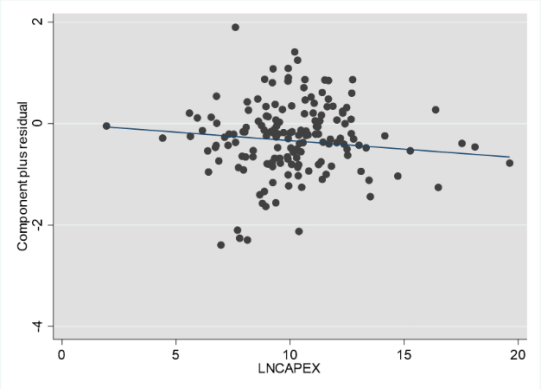
Appendix 3. Ramsey's RESET test results

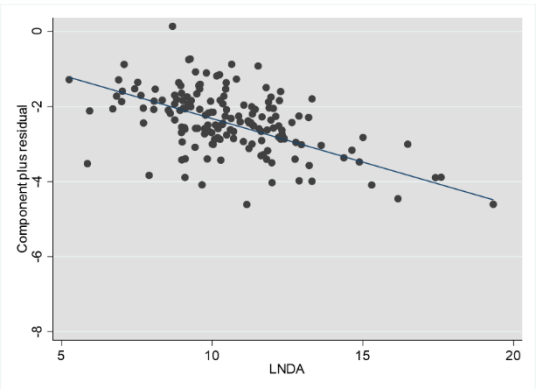
Test	P-value
Ramsey RESET test	0.4850

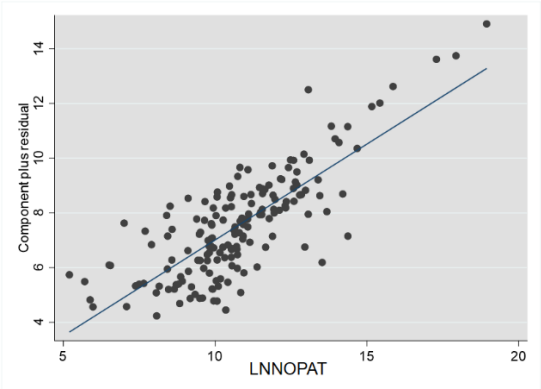
Appendix 4. Component plus residual plots

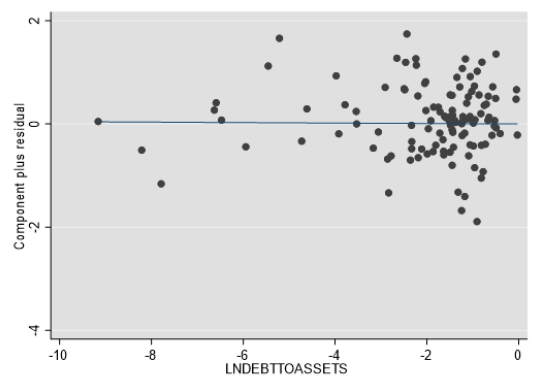


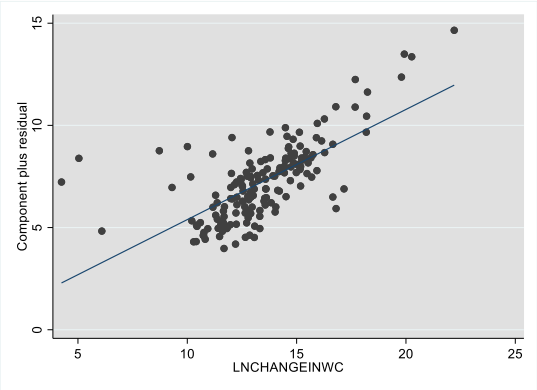












Appendix 5. Breusch-Pagan test results

Breusch-Pagan test for heteroskedasticity	
chi2	32.63
Prob > chi2	0.0314

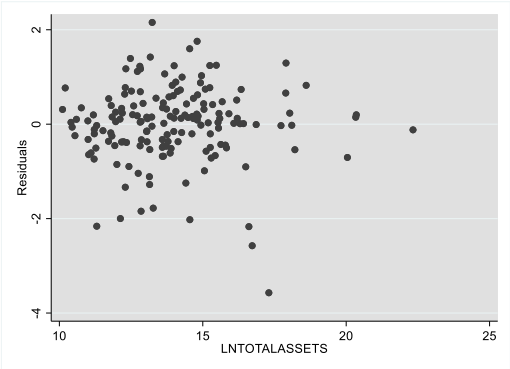
Appendix 6. Regression results with robust standard errors

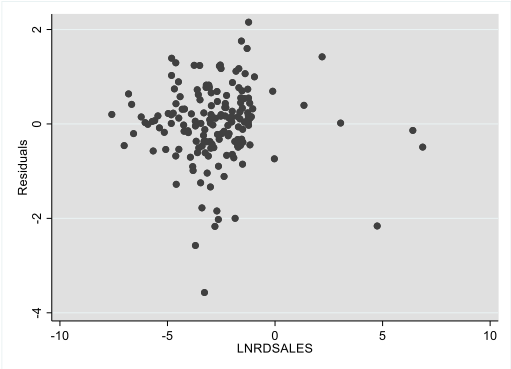
Prob > F		R-Squared	
0.0000		0.7428	
Variable	Coefficient	Standard error	P-value
LNTOTALASSETS	1.024035	.0857900	0.000
LNRDTOSALES	.1745455	.0382082	0.000
LNCHANGEINWC	.4670428	.1692571	0.006
LNNOPAT	1.019586	.3358889	0.003
LNCAPEX	-.0335532	.0666192	0.307
LNDA	-.2320243	.1075469	0.032
LNDEBTTOASSETS	-.0045049	.0449444	0.618

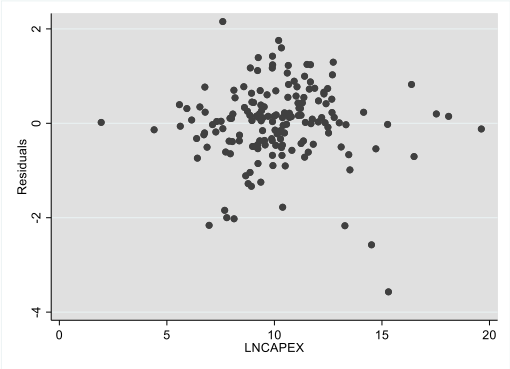
Appendix 7. Variance inflation factors

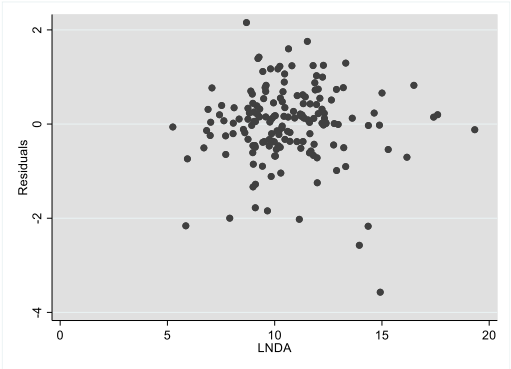
Variable	VIF	1/VIF
LNTOTALASSETS	11.51	0.086917
LNRDSALES	1.22	0.819747
LNCHANGEINWC	3.19	0.313799
LNNOPAT	4.98	0.200674
LNCAPEX	6.43	0.155611
LNDA	12.89	0.077598
LNDEBTTOASSETS	1.11	0.899978

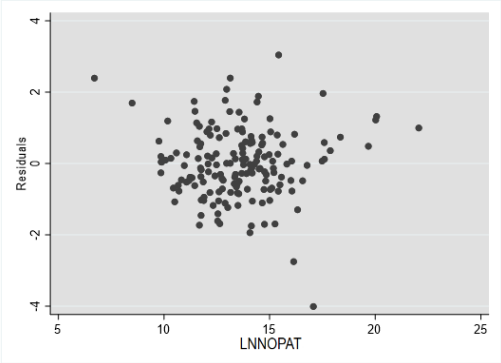
Appendix 8. Residual plots of the variables

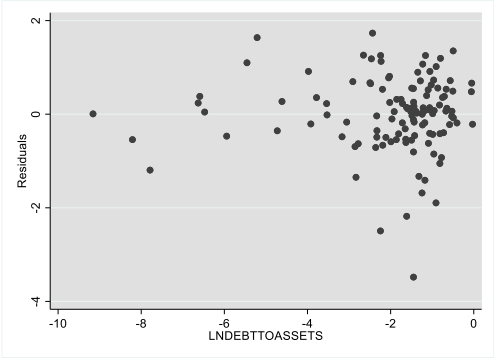


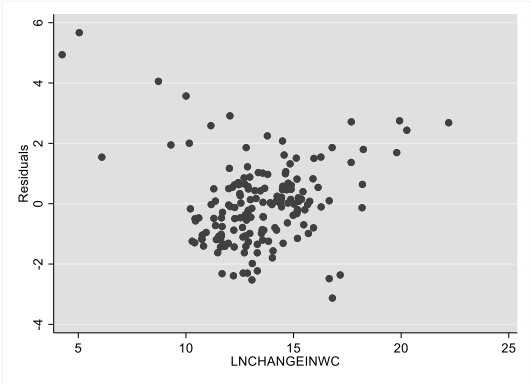




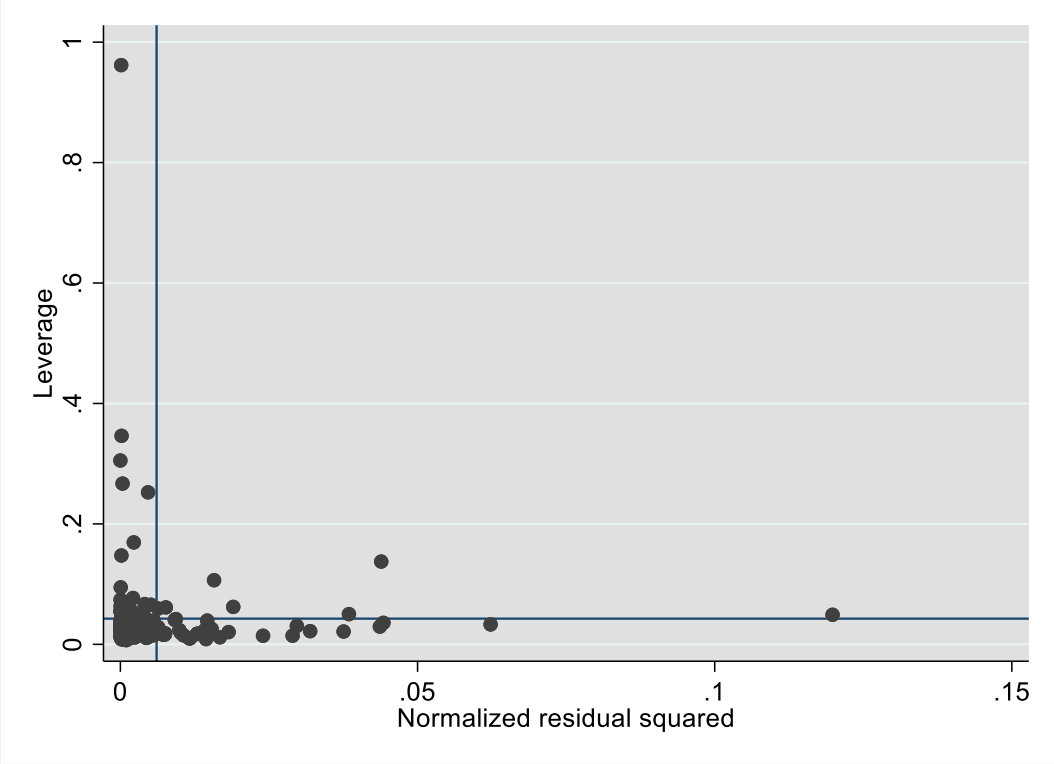




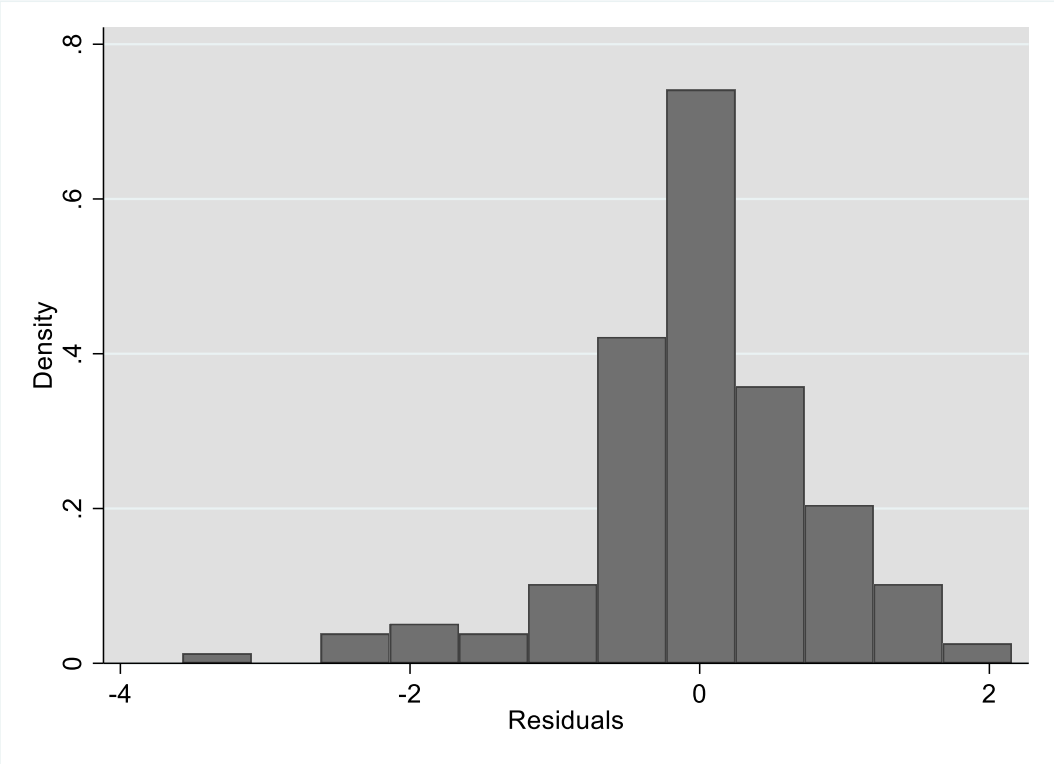




Appendix 9. Leverage versus squared residual plot



Appendix 10. Histogram of the residuals



Appendix 11. Effect sizes and standardized coefficients

	Beta coefficient	Effect size
LNTOTALASSETS	1.132833	.4051099
LNRDSALES	.1828286	.1306204
LNCHANGEINWC	.0903419	.0156892
LNNOPAT	.1705484	.0374032
LNCAPEX	-.0435609	.0016131
LNDA	-.2725225	.0336309
LNDEBTTOASSETS	-.0038903	.0188454