The effects of initial public offerings on firm performance

A comparison of post-IPO firm performance pre-, mid- and post-financial crises

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Abstract

This paper investigates the effects of initial public offerings on firm performances for American firms between 2007 and 2014. It presents evidence that firms show a decrease in operating performance after going public, in comparison to the industry. This evidence was found for the short-, mid- and long-run periods. The results also show that firms that executed their IPO post-financial crisis perform worse in terms of ROA, than firm that executed their IPO pre- and mid-financial crisis. The decrease in operating performance is greater in the long-run compared to the short-run, thus these firms that go public show short-run and long-run underperformance in comparison to the industry.

Keywords: IPO, ROA, firm operating performance, financial crisis and underperformance.

Table of contents

1. Introduction

Initial public offerings (IPO's) are an important source of financing for privately held firms. The largest IPO in term of proceeds in the U.S. has raised 25 Billion in U.S. dollars and was executed by Alibaba in 2014. Even though the pecking order theory suggests that equity financing through executing an IPO, is the least preferable form of financing for firms (Myers, 1984). It is still a frequently used form of financing. In the U.S. alone 350 IPO's were executed in 2016. Initial public offerings are best described as the first sale of a company's shares to the public, leading to a stock market listing[1].

There have been numerous papers written on performance and IPO's in the past, but what is striking is that there are far less papers written on this topic in recent years. The most cited papers on this topic date from 2003 and earlier. The financial world has changed drastically due to technological improvements and there has been a financial crisis in 2008. For this reason, it is interesting and relevant to test whether the theories developed before the crisis are still applicable and valid to date. Most articles measure or test post-IPO firm performance through stock prices[2]. Far fewer articles measure the performances of firms that went public through key financial data such as earnings before interest, taxes, depreciation and amortization (EBITDA), return on assets (ROA) and profit margin. The article 'The Post-Issue Operating Performance of IPO Firms' by B. A. Jain and O. Kini has been a pioneer in this field. The theoretical framework includes a list of familiar research done for different countries. In conclusion, the contribution of this paper to the literature lies in measuring post-IPO firm performance with a distinctive and unique sample in the form of an up-to-date dataset (2007-2014).

The 2008 financial crisis has had a worldwide impact and it is possible that this crisis has also impacted the IPO market. In order to get a more accurate picture of the effect of an IPO on a firms' performance it is imperative to know whether, there is a difference in performance for firms that execute an IPO before, during and after a financial crisis. Besides focusing on the effect of IPO's on operating performance, this study also investigates whether the effect on operating performance differs between time periods. The time periods of interest are the year before the financial crisis (2007), the years during the financial crisis (2008-2010) and the years after the financial crisis (2011-2014). This method of investigating gives the possibility to see whether firms from a certain time period performed better in terms of operating performance (ROA) than firms from other time periods.

Previous research on IPO's and firm performance can be divided into two groups. Research that uses stock prices and research that uses the operating performance of firms. This paper uses the second method for measuring the effect of IPO's on firm performance and this paper can be subdivided into two main parts. The first part (intra-firm part) measures the operating performance of the firms in the

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[1] Definition of the financial times lexicon.
[2] See Ritter (1991) and Loughran and Ritter (1995) for evidence regarding post-IPO investment performance.

dataset using the change in ROA and the second part (inter-firm part) controls this performance for market effects. These two parts are complementary because both methods combined give a more accurate view of how the firm has actually performed over time. In the intra-firm part, the pre-IPO financial data (ROA) and post-IPO financial data (ROA) will be compared to see whether the performance before and after the IPO has significantly changed. This method shows whether the IPO created or destructed value, judging from the change in operating performance. The second part calculates the performance of the industry for the same time spans, so that together with the first part the performance of firms that execute IPO's can be assessed. The market effects are controlled for by subtracting the median change in ROA of the related industry from the change in ROA of the particular firm. This will be further explained in the methodology section. The intra-firm part and the inter-firm part are then combined and put in a time perspective to be able to calculate the effect of the financial crisis. This is the third and final part of this paper.

The main goal of this paper is to investigate whether the operating performance of firms that went public for the first time have improved or declined after the IPO. Summarizing the former into a main research question gives:

What is the effect of initial public offerings on the operating performance of firms before, during and after the financial crisis, in the United States of America?

This paper has the following structure. Section 2 covers the theoretical framework. Section 3 covers the data and methodology. Section 4 shows the results from the data and methodology section and section 5 consists of the conclusion. Section 6 presents the limitations and future research. Section 7 and 8 cover the reference list and the appendix.

2. Theoretical framework

This paper is based on and expands on earlier research that has been done in the field of Finance. Firm performance and IPO's were popular topics within Finance between 1990 and 2003. During this period, plenty of new theories were developed and tested. There has been a substantial amount of research done on IPO's and firm performances, due to its popularity in the past. The following topics will be discussed in this theoretical framework: Motives behind IPO's, waves in the IPO market and previous research on post-IPO firm performance.

Motives behind IPO's

Reasons for a firm to execute an IPO can be diverse. These reasons are important for this paper because they could contain valuable information about the effect of an IPO on firm performance. The most mentioned reason why firms execute an IPO is raising capital for investments. By executing an IPO, the firm acquires cash or other assets which they can use for multiple purposes. Issuance of primary shares is correlated with higher increases of investment, higher repayment of debt and increases in cash (Kim & Weisbach, Do Firms Go Public to Raise Capital?, 2005). Firms invest 18.8 cents in Research & Development and 7.3 cents in capital expenditures for an incremental dollar raised in an equity offer during the year following the offer (Kim & Weisbach, 2008). These findings are evidence for showing that the financing reason is a valid reason. However, firms also hold onto much of the cash they raised (Kim & Weisbach, 2008). In conclusion, companies use the newly raised cash for opportunities to invest but judging from the articles of Kim & Weisbach it is not always the main reason to go public. Other reasons for going public are discussed below.

Another reason for executing an IPO could be to profit from a change in leverage. Executing an IPO affects the debt-equity ratio of a firm. Reducing leverage could for example be used to work towards an optimal leverage level. Evidence for this has also been found; the new equity capital raised upon listing is not used to finance subsequent investment and growth, but to reduce leverage (Pagano, Panetta, & Zingales, 1998).

Further advantages for IPO's are overcoming borrowing constraints, greater bargaining power with banks, portfolio diversification, stock market discipline, liquidity, investor recognition, change of control and windows of opportunity. Going public allows companies to gain access to a source of finance, which is an alternative to bank finance. This helps firm overcome borrowing constraints. Banks can extract rents from their privileged information about the credit worthiness of their customers. By gaining access to the stock markets and disseminating information to the generality of investors, a company elicits outside competition to its lender and ensures a lower cost of credit, a larger supply of external finance, or both, as highlighted by (Rajan, 1992). This results in greater bargaining power with banks. The decision to go public affects the liquidity of a company's stock because the stock will be

traded on the stock exchange. After the listing, the former owners can invest their money in other assets which is an advantage in terms of diversification. With regards to monitoring, the stock markets also provide a managerial discipline device, both by creating the danger of hostile takeovers and by exposing the market's assessment of managerial decisions. Listing on a major exchange can be an advantage because the listing acts as an advertisement for the company. Going public can also function as an exit strategy for existing shareholders, indicating that change of control can be a reason. The last reason is windows of opportunity. If there are periods in which stocks are mispriced, as suggested by Ritter (1991), companies recognizing that other companies in their industry are overvalued have an incentive to go public. Managers can then exploit the overvaluation of their companies by investors.

The disadvantages of an IPO are adverse selection and moral hazard, administrative expenses and loss of confidentiality. The disadvantage of adverse selection is that investors are less informed than the issuers about the true value of the companies going public. The adverse selection problem that is discussed here, is another example of the problem that George Akerlof discussed in his paper 'The Market for Lemons: Quality Uncertainty and the Market Mechanism' in 1970. This informational asymmetry adversely affects the average quality of the companies seeking a new listing and thus the price at which their shares can be sold (Leland & Pyle, 1977). This determines the magnitude of the underpricing needed to sell them (Rock, 1986). The problem of moral hazard could arise after an IPO because investors carry the cost of the risk and firm management manages this risk. Besides the initial underpricing, the disadvantage of administrative expenses is bigger after going public. Going public implies considerable direct costs: underwriting fees, registration fees, etc. On top of the initial expenses, there are the yearly layouts on auditing, certification, and dissemination of accounting information, stock exchange fees, etc. The last disadvantage is loss of confidentiality. The disclosure rules of stock exchanges force companies to unveil information whose secrecy may be crucial for their competitive advantage, such as data about ongoing Research &Development projects or future marketing strategies[3].

Waves in the IPO market

This paper investigates the effect of an IPO on firm performance for firms that executed IPO's before, during and after the financial crisis of 2008. Research that can be linked to this, is the research done on waves in the IPO market. Similar to the Mergers & Acquisitions market, the IPO market also experiences waves. Fluctuations in IPO volumes have long been noticed and are discussed by for example Ibbotson & Jaffe in 1975. The latest influential article on IPO waves was written by Pàstor & Veronesi in 2005. They found 16 IPO waves between January 1960 and December 2002[4]. Their lengths range from 1 to 21 months, and their median length is 5 months (Pàstor & Veronesi, 2005). Pastor and Veronesi argue

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[3] The brief descriptions of the advantages and disadvantages originate from the article of Pagano, Panetta, & Zingales, 1998. For a more detailed and elaborate explanation of all the advantages and disadvantages see Pagano, Panetta, & Zingales, 1998.
[4] See appendix table 1 for full list of the 16 IPO waves.

that IPO waves are caused by variations in market conditions. They developed a model for optimal IPO timing. According to this model, IPO waves are caused by declines in expected market return, increases in expected aggregate profitability, and/or increases in prior uncertainty about the average future profitability of IPO's. It is therefore likely that the financial crisis has affected the IPO volume as a result of a change in expected market return and a change in expected aggregate profitability.

Previous research on post-IPO firm performance

All researchers that have done research on post-IPO firm operating performance have reported a long-run decline in operating performance after the IPO. Mikkelson, Partch and Shah (1997) and Jain and Kini (1994 and 1995) have concluded this for a U.S. sample, Pagaono, Panetta and Zingales (1998) concluded this for an Italian sample, Khurshed, Paleari and Vismara (2005) for a U.K. sample, Wang, Wang, and Lu (2003) for a Singaporean sample, Cai and Wei (1997) and Kutsuna, Okamura and Cowling (2002) for a Japanese sample and Wang (2005) for a Chinese sample. All the aforementioned studies find a decrease in operating return on assets post-IPO in comparison to pre-IPO operating return levels.

So far, two main explanations have been designed to explain the operating underperformance. The first one focusses on information asymmetries. For example, reduced management ownership post-IPO leads to increased agency costs according to Jensen and Meckling (1976) and a subsequent focus on non-value maximizing projects. The second explanation uses behavioral factors such as market timing to explain underperformance. Market timing for instance can be used by privately owned firms to take advantage of investors' sentiment. Managers of these firms plan IPO's knowing that the perceived investors' firm value will change in the near future. This is in line with the windows of opportunity theory of capital structure of Loughran and Ritter (1995) and the market timing theory of capital structure of Baker and Wurgler (2002). The underlying fact here is that there is a conflict of interest between insiders and outsiders of firms. Another article that relates to this is the article of Teoh, Welch and Wong (1998). They show that window-dressing of accounting numbers such as accruals lead to an overstatement of pre-IPO operating levels and understatement of post-IPO operating levels.

Even though this article does not use stock prices to examine firm performance, underpricing and overpricing in post-IPO stock prices is a topic that needs to be mentioned. The underpricing theory states that IPO's are underpriced in the short run and that they show high initial returns (Ibbotson & Ritter, 1995). The overpricing theory states that IPO's are overvalued (Ibbotson & Ritter, 1995) and that they perform worse than the market and their comparable firms in the long run. Research on these topics has been done based on stock prices and the efficient market hypothesis, whereby the author assumes that investors are rational. Investors expect high earnings growth after the IPO because they pay a relatively high price, but this is inconsistent with the decline in post-issue performance found by Jain, B and Kini,

O (1994). In this article there was no relation found between post-IPO operating performance and the level of initial underpricing.

3. Data and methodology

This section presents the research design used to find the effects of IPO's on firm performance. The process of data collection will be discussed first, followed by the methodologies used regarding approach one (intra-firm approach) and approach two (inter-firm approach). After this subsection, the methodology for the time period comparison of periods around the financial crisis will be discussed. This section is followed by the sample summary statistics.

Data

The original dataset consisted of 2072 firms that executed an IPO in the United States of America. This dataset was modified so that the dataset only consisted of companies that went public between 2007 and 2017. The companies that executed an IPO before 2007 were removed from the original dataset. This resulted in 1275 remaining companies. Not all firms had financial data for EBITDA and ROA for all years (2007-2014) so firms that had missing data were removed from the dataset as well. Only 4 companies with missing data were removed. This did not make a significant difference to the dataset. Companies were required to have financial data (EBITDA and total assets) for at least 1 year prior and 2 years after the IPO. This step resulted in the removal of all the firms that went public in the years 2015, 2016 and 2017. These years had a total of 966 IPO's. The firms that went public in 2007 are excluded from this last criterion. Orbis only provides data for 2007 and later, therefore financial data for the year 2006 was not retrievable. Also, it is of importance to mention that only completed IPO's were used. Rumored and planned IPO's were not included in the dataset. This dataset is retrieved from Orbis and contains small, medium and large sized companies. In the end 305 firms were used for the data analysis.

Methodology part 1: intra-firm approach

The research question has been researched using two approaches. The first approach used time series comparison of earnings before deducting interest, taxes, depreciation and amortization (EBITDA), divided by end-of-year assets of the firm (intra-firm approach)[5]. This ratio of EBITDA and assets can also be noted as return on assets (ROA) and this financial measure is used to assess operating performance. This division of operating income by assets converts operating income into an operating return on assets and allows for a comparison over time and across firms. For the intra-firm approach, the pre-IPO operating performance and post-IPO operating performance of the firm have been compared to see whether the IPO created or destroyed value, judging from the change in operating performance.

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[5] The measures of operating performance used in this paper have been widely used in the financial economics literature (see Kaplan, 1989; Smith, 1990; Jain and Kini, 1994 as examples).

Operating performance has been compared using change in median levels. The formula that was used to calculate operating return on firm level is:

$$1. \quad \{\Delta\, ROA = ROA(t) - ROA(t - n)\}$$

The letter 't' represents a pre- or post-IPO year. The years used in the equation depend on the time span used. Operating return is measured by the financial measure ROA so the change in return on assets stands for the change in operating return. Operating return and operating performance are used interchangeably in this paper.

The first step that was taken in this methodology section was to calculate the ROA's for all 305 firms for all available years (2007-2016). The second step was to calculate the change in median ROA per firm for different time spans. This change in median ROA stands for the change in operating performance. Then, these results were grouped. They were grouped on the basis of the year in which the firms went public. After this, the median value of ROA and also the median value of change in ROA were calculated for the different time spans. The median values were calculated per group (IPO year). Then, this median value was used to assess whether operating performance increased or decreased over time. This process has been repeated eight times for years 2008-2014 so that the effect of the IPO is visible for all individual years.

The formula that was used to calculate the change in performance for a group of companies is:

$$2. \quad \{\Delta\, Median\ ROA = Median\, \Delta\, ROA(t) - Median\, \Delta\, ROA(t - n)\}$$

The letter 't' represents a pre- or post-IPO year. The years used in the equation depend on the time span used.

The median value is used instead of the mean value because the median is less sensitive to outliers and will in this case be more suitable to compare change in operating performance. The change in operating performance was measured for multiple time spans, depending on the availability of data[6]. The time spans that were used are: [-1 to +1], [1 to 2], [1 to 3], [1 to 4], [1 to 5], [1 to 6], [1 to 7], [1 to 8] and [1 to 9][7]. The results section gives a detailed overview and explanation of the time spans used. This method shows whether the operating performance before and after the IPO has changed. The significance of the results that were obtained from the method above has been assessed by using the Wilcoxon signed rank test. The Wilcoxon signed rank test was used in the following way: the ROA's of a certain year (depending on the time span) were tested for a significant difference in comparison to ROA's of a

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[6] The amount and length of time spans used depends on a firms' year of going public. For instance, a firm that went public in 2014 will not have the firm performance of the fourth year after going public compared to the year after going public because the data for 2018 is not available yet.

[7] These numbers refer to the year of the IPO, whereby year -1 stands for the year prior to the IPO. The year 1 stands for the year after the IPO, the year 3 stands for the third year after the year of the IPO, and so on.

different year. These ROA's are the ROA's of the same firms. The only thing that changes in this significance test is the year for which the test is carried out. Again, this process was repeated eight times for years 2008-2014, so that the significance of the change is visible for all individual years. This process was also repeated several times for the different time spans. Significance was tested using the Wilcoxon sign rank test because the normal distribution assumption cannot be assumed. This assumption cannot be made because of small sample sizes for years with a relative small amount of firms that executed an IPO. The hypothesis that is tested using the Wilcoxon signed rank test is[8]:

$$Ho: ROA\,(t) = ROA\,(t + n)$$

This means that there is no significant difference in the ROA between two years.

$$H1: ROA\,(t) \neq ROA\,(t + n)$$

This means that there is a significant difference in the ROA between two years.

Methodology part 2: inter-firm approach

The second approach calculated the operating performance of all the 305 firms in relation to the industry (inter-firm approach). The first step of this part was again calculating the ROA's for all 305 firms for all available years (2007-2016). The second step is however different in this part. All 305 firms have been matched to an industry based on the two digit U.S. SIC codes[9]. The median ROA's of all the industries of all years were then obtained from *Orbis financial database*. The next step was to subtract the median ROA's of the industries from the ROA's of all the individual firms for all years. After this, the median value of change in ROA was calculated for the different time spans. What has happened is that the change in ROA of the industry has been subtracted from the change in ROA of the firm that went public. Once again, this was done in groups based on IPO year. This was done so that the performance of firms from different IPO years was visible.

From the above it should be clear that this part of the paper uses nearly the same methodology as the first part. The main difference is that the data that is used is now adjusted for market effects. This part used formula 1 and formula 2 as well, to calculate firm performance.

The inter-firm approach compared the performance of the newly public firm using four time spans; a short time span (years 1-3), a medium time span (years 1-5), a long time span (years 1-7). The fourth and last time span is used to show the difference in operating performance of one year prior to the IPO and one year after the IPO (years -1 to +1). This second method shows the difference in performance for firms that executed an IPO adjusted for how the overall industry has performed. This method is used to control for industry effects. If this second method is not used, wrong conclusions could be drawn

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[8] The hypotheses are tested using a 95% confidence interval.
[9] For an overview of the two digit codes used to link firms to an industry see appendix table 6.

from the results. For example, if the operating performance decreases for the whole industry then it is incorrect to blame the decrease in operating performance on the IPO. Again, the significance of the difference in ROA was measured by the Wilcoxon signed rank test. The choice of this test is made on the basis of the same reason named in part 1. The significance was tested in nearly the same way as in part one; the ROA's of a certain year (depending on the time span) were tested for a significant difference in comparison to ROA's of a different year. The difference is that the change in ROA is adjusted for the industry change in ROA. This results in the same hypothesis[10]:

$$Ho: ROA\,(t) = ROA\,(t + n)$$

This means that there is no significant difference in the ROA between two years.

$$H1: ROA\,(t) \neq ROA\,(t + n)$$

This means that there is a significant difference in the ROA between two years.

This process has again been repeated for the different IPO years and also for the different time spans.

Methodology part 3: effect of the financial crisis

The effect of the financial crisis was calculated using the results from part 1 and 2 and dividing these results into three different groups. These groups contain data per firm and were formed using the year of executing the IPO. This means that there are three groups namely 'pre-financial crises', 'mid-financial crisis', and 'post-financial crisis'. The pre-financial crisis group consists of firms that executed their IPO in 2007. The mid-financial crisis group consists of firms that executed their IPO in 2008, 2009 and 2010. Lastly, the post-financial crisis group consists of firms that executed their IPO in 2011, 2012, 2013 and 2014. The methodology is again very similar to the methodology of part 1 and 2. For this part, the industry-adjusted data for firms was used. The first step included calculating the change in ROA for different time spans for the different groups (formula 1). Then, the significance of these changes in comparison to other time periods was tested by using the Wilcoxon signed rank test. The significance was tested by comparing the ROA's of a certain time period to the ROA's of a different time period. This process was repeated for the different time spans and different groups (time periods). This results in the same hypothesis as previously mentioned[11]:

$$Ho: ROA\,(t) = ROA\,(t + n)$$

This means that there is no significant difference in the ROA between two years.

$$H1: ROA\,(t) \neq ROA\,(t + n)$$

This means that there is a significant difference in the ROA between two years.

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[10] The hypotheses are tested using a 95% confidence interval.
[11] The hypotheses are tested using a 95% confidence interval.

In order to answer the question, whether firms that went public during a certain time period performed significantly different from firms that went public in a different time period, a different test is needed. In this case the Anova (F-test) is used because three different groups (pre-financial crises, mid-financial crisis, and post-financial crisis) are being compared. The data that is now used includes larger group sizes[12]. The normal distribution assumption can therefore be presumed. This means that a parametric test can be used. The hypothesis that is tested using the Anova (F-test) is[13]:

H0: There is no difference between the changes in ROA for the time periods pre-financial crises, mid-financial crisis, and post-financial crisis.

H1: There is a difference between the changes in ROA for the time periods pre-financial crises, mid-financial crisis, and post-financial crisis.

Sample summary statistics

The 305 firms that are included in the sample of this paper went public over the years 2007 to 2014. The year 2007 is the year with the most IPO's namely 79 and 2014 is year with the least IPO's namely 10. The pre-financial crises period contains the least IPO's with 79 IPO's. The mid-financial crisis period is runner up with 104 IPO's and the post-financial crisis period contains the most IPO's, namely 122. Table 1 gives an overview of the number of IPO's per year. The financial data variables EBITDA and total assets were used for the measurement of performance in the first and second part of this paper. Table 2 gives an overview of the aggregates of EBITDA and total assets for the years 2007 to 2016. Overall, the total assets and EBITDA increase over time and increase substantially. For EBITDA and assets both the mean and median are given in table 2. The mean and median values for EBITDA for 2016 are respectively 553 and 82 million U.S. dollars. The mean and median value for EBITDA for 2007 are 389 and 33 million U.S. dollars. The values of the assets also show a strong increase over time. The mean and median values for total assets for 2016 are respectively 5.253 and 928 million U.S. dollars. The mean and median values for total assets for 2007 are 3.906 and 536 million U.S. dollars.

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[12] See numbers below subheadings 'Post', 'Mid' and 'Pre' on table 1 on page 15 for exact group size numbers.

[13] The hypotheses are tested using a 95% confidence interval.

Table 1: Number of IPO's per year for the years 2007-2014.				
Year	Number of issues	Post	Mid	Pre
2014	10	10		
2013	18	18		
2012	54	54		
2011	40	40		
2010	56		56	
2009	24		24	
2008	24		24	
2007	79			79
Total	305	122	104	79

'Pre' stands for the number of issues in pre-financial crisis period. 'Mid' stands for the number of issues mid-financial crisis period and 'post' stands for the number of issues post-financial crisis period.

The data in this table originates from *Orbis financial database* and calculations are done by the author.

Table 2: Mean and median values for EBITDA and total assets for years 2007-2016.				
	Total EBITDA		Total assets	
	Mean	Median	Mean	Median
2016	533.123	82.180	5.252.928	927.659
2015	500.033	82.300	5.125.009	908.384
2014	555.591	81.674	5.124.804	868.867
2013	536.447	80.531	4.699.486	727.286
2012	494.811	74.878	4.443.823	677.211
2011	498.288	63.326	4.010.356	587.919
2010	443.267	53.027	3.764.249	491.188
2009	346.037	36.835	3.590.895	450.998
2008	412.608	37.512	3.714.742	511.638
2007	389.299	32.851	3.905.526	535.596

All values for mean and median EBITDA and assets are in U.S. dollars and in thousands.

The data in this table originates from *Orbis financial database* and calculations are done by the author.

4. Results

In this section the main results regarding effects of IPO's on firm performance will be discussed per approach. First the results of the intra-firm approach and the inter-firm approach will be presented, followed by the results of the time period comparison of periods around the financial crisis.

Results for part 1: intra-firm approach

The first part of the results section is based on and elaborates on the data shown in table 3. Results from the first part of the data analysis show that for the unadjusted data (unadjusted for industry effects) the changes in performance are substantially different for different years and for different time spans. These changes stand for the difference in median ROA (EBITDA divided by total assets) between certain years. The time span [-1 to +1[14]] consists of 3 negative changes and 4 positive changes (see table 3 panel B). It can be seen in the table that for the firms that executed their IPO in 2008, 2012 and 2014 the overall ROA has decreased (for that time span), meaning that operating performance has decreased. The positive changes in the time span [-1 to +1] are substantial compared to other positive changes in different time spans. This relatively large positive change can be explained by inflated assets due to the increase in assets in the year of the IPO. For the time span [1 to 2] the amount of negative changes increases to 4, the amount of positive changes decreases to 3 and there is 1 neutral observation[15]. Then, the time span [1 to 3] contains 5 negative changes, one positive change and one neutral observation. Do notice that for this time span there is one less observation because the IPO year 2014 is excluded. There is no financial data for 2017 yet, therefore the requirements for time span [1 to 3] cannot be met for the sample of IPO from 2014. The time span [1 to 4] up to time span [1 up to 9] all have negative changes meaning that the EBITDA assets ratio has decreased over time. Majority of these results are not significant which means that there is no significant change in operating performance. Only the year 2009 includes multiple significant values. The firms that executed their IPO in 2009 show to have a worse EBITDA to assets ratio three and more years after the IPO in comparison to the year after the IPO.

Results for part 2: inter-firm approach

The industry-adjusted changes for ROA are shown in panel C in table 3. The time span [-1 to +1] now contains 4 negative changes and 3 positive changes. There is one more negative change and one less positive change compared to the results from panel B. For the time span [1 to 3] the amount of negative changes is 6 and the amount of positive changes is 1. The time spans [1 to 5] and [1 to 7] all have negative changes. The changes in ROA for the different time spans are more negative for the market-adjusted results, in comparison to the changes in ROA for the results that are not adjusted for industry

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[14] These numbers refer to the year of the IPO, whereby year -1 stand for the year prior to the IPO. The year 1 stands for the year after the IPO, the year 3 stands for the third year after the year of the IPO, and so on.

[15] A neutral change means that there is no difference in ROA between the compared years.

effects. This means that the EBITDA assets ratio has changed even more when corrected for industry effects. The change becomes more negative which means that the operating performance decreases more. The changes in median ROA for the market-adjusted results have nineteen significant observations out of twenty-two observations. It is therefore fair to conclude that firms that execute an IPO show a significant decrease in operating performance, in comparison to the industry.

It is notifiable as well that not only the sign of the ROA changes but also the size of the ROA change. The size of the change decreases negatively over time for all years. This is also shown in table 3 panel C. The effect becomes larger for longer time spans.

Results for part 3: effect of the financial crisis

The firm median changes in ROA are combined into three groups (pre-financial crisis period, mid-financial crisis period, and post-financial crisis period) for this part of the results section. The results of these groups are shown in table 4. Table 4 Panel A presents the change in median ROA for the three different groups, for the different time spans. The post-crisis group has a significant negative change of -0.028, -0.078 and -0.235 for respectively, time spans [-1 to +1], [1 to 3] and [1 to 5]. The mid-crisis group has a significant change of 0.003, -0.018, -0.072 and -0.198 for respectively, time spans [-1 to +1], [1 to 3], [1 to 5] and [1 to 7]. The last group, the pre-crisis group has a change of 0.005, -0.005 and -0.064 for respectively, time spans [1 to 3], [1 to 5] and [1 to 7]. Within the pre-crisis group, only the last time span showed a significant change.

The results from the comparison between time periods show that the operating performance of firms that executed their IPO in the post-crisis period (2011-2014) perform worse in terms of operating performance than firms that executed their IPO in the pre- and mid-crisis period (2007, 2008-2010). Evidence for this claim is presented in table 4 panel B. The results show that firms that went public in the post-crisis period have a larger ROA decline in comparison to the firms that went public in the pre- and mid-crisis period. The negative difference amounts to -0,049 for the time span [-1 to +1], -0,080 for the time span [1 to 3] and -0,623 for the time span [1 to 5]. The [-1 to +1] time span and the [1 to 3] time span did not include a significant difference. Post-crisis IPO's also perform worse in terms of ROA than the pre-crisis period IPO's. There is a negative difference in the change of ROA of -0,105 for the time span [1 to 3] which is not significant and -0,771 for the time span [1 to 5] which is highly significant. These results also show that for both comparisons, the longer the time span the larger the decrease in ROA.

The comparison of the pre-crisis period and the mid-crisis period also shows a significant difference in the mean of the change of ROA for firms that executed their IPO's before and during the financial crisis. The firms that went public mid-crisis period perform worse in terms of ROA than firms that went public before the financial crisis. The mean difference in the change of ROA was -0,185 for time span [1 to 3], -0,148 for time span [1 to 5] and -0.532 for time span [1 to 7]. The results from the first and second time

span were not significant. The third time span however did show a highly significant result. The larger time span shows a larger decrease in change of ROA again.

Table 3: Performance measures for the companies that executed an IPO for the years 2007-2014.										

Panel A: Median ROA (EBITDA divided by total assets)

IPO year	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
2014	0,024	0,037	0,055	0,102						
2013	0,099	0,136	0,089	0,069	0,105					
2012	0,088	0,095	0,084	0,097	0,093	0,115				
2011	0,070	0,061	0,058	0,071	0,063	0,036	0,056			
2010	0,072	0,066	0,058	0,085	0,076	0,091	0,082	0,086		
2009	0,058	0,063	0,067	0,071	0,099	0,103	0,112	0,088	0,100	
2008	0,088	0,086	0,095	0,089	0,079	0,106	0,090	0,098	0,112	0,108
2007	0,065	0,070	0,078	0,074	0,078	0,088	0,078	0,071	0,081	0,070

Panel B: Changes in the median ROA (EBITDA divided by total assets)

IPO year	Time span	-1 to +1	1 to 2	1 to 3	1 to 4	1 to 5	1 to 6	1 to 7	1 to 8
2014		-0,025	0,012						
2013		0,013	0,005	0,007					
2012		-0,002	-0,014*	-0,005	-0,015***				
2011		0,020**	0,000	0,000	-0,009	-0,014			
2010		0,015	-0,018***	-0,005	-0,003	-0,004	-0,010		
2009		0,012	0,001	-0,003*	-0,046***	-0,032***	-0,061***	-0,078***	
2008		-0,015	-0,001	-0,003	-0,011	-0,017	-0,016	-0,013	-0,016

IPO year	Time span	0 to +1	1 to 2	1 to 3	1 to 4	1 to 5	1 to 6	1 to 7	1 to 8	1 to 9
2007		0,000	-0,007	-0,001	-0,003	-0,005	-0,018	-0,018	-0,024*	-0,045**

	Time span	-1 to +1	1 to 3	1 to 5	1 to 7
Panel C: Changes of the median ROA (EBITDA divided by total assets) adjusted for market effects					
IPO year					
2014		-0,131***			
2013		-0,047***	-0,146***		
2012		-0,024***	-0,075***		
2011		-0,010***	-0,024***	-0,235***	
2010		0,001***	-0,018***	-0,064***	
2009		0,015	-0,038**	-0,160***	-0,411***
2008		0,003***	-0,013***	-0,057***	-0,116***
2007			0,005	-0,005	-0,064***

The first column (y-axis) in panel A, B and C stands for the year in which the IPO's have been executed. The numbers displayed in panel A stand for the median ROA of firms that went public in a certain year (first column). For instance, the median ROA for 2016 of firms that went public in 2014 is 0,024. The first horizontal row in panel B and C presents the different time spans. The information in the table should be interpreted as follows; -0,131 in panel C means that the median ROA has decreased by -0,131 from the year prior to the IPO to the year after the IPO (-1 to +1) for the sample of firms that executed their IPO in 2014. The blanc spaces in the table are combinations of years and time spans for which the data is irrelevant or for which there is no financial data available.

The data in this table originates from *Orbis financial database* and calculations are done by the author.

The significance of the results in panel B and C was tested using the Wilcoxon signed rank test. The asterix in panel B and C stand for a significant difference in median value. For example, the change in median ROA for firms that went public in 2014 is -0,131 (panel C, time span -1 to +1). This means that the median of this group is significantly smaller (-0,131) for the year after the IPO in comparison to the year before the IPO. The significant changes in median ROA provide evidence for the alternative hypothesis (H1) noted in the methodology section.

* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.

Table 4: Effect of IPO on firm performance compared between pre-, mid- and post-financial crisis periods.						
Panel A: median change of firm ROA adjusted for market effects						
	Time span	-1 to +1	1 to 3	1 to 5	1 to 7	
Post-crisis (2011-2014)		-0,028***	-0,078***	-0,235***		
Mid-crisis (2008-2010)		0,003**	-0,018***	-0,072***	-0,198***	
Pre-crisis (2007)			0,005	-0,005	-0,064***	
Panel B: difference in the mean of change in firm ROA adjusted for market effects, for the pre-, mid- and post-crisis period						
	Time span	-1 to +1	1 to 3	1 to 5	1 to 7	
	In comparison to:					
Post-crisis (2011-2014)	Mid-crisis	-0,049	-0,080	-0,623***		
	Pre-crisis		-0,105	-0,771***		
Mid-crisis (2008-2010)	Pre-crisis		-0,185	-0,148	-0,532***	
	Post-crisis	0,049	0,060	0,623***		
Pre-crisis (2007)	Post-crisis		0,105	0,771***		
	Mid-crisis		0,185	0,148	0,532***	

The first horizontal row in panel A and B presents the different time spans. The information in the table should be interpreted as follows; -0,028 in panel A means that the median ROA has decreased by -0,028 from the year prior to the IPO to the year after the IPO (-1 to +1) for the sample of firms that executed their IPO in the post-crisis period (2010-2014). The blanc spaces in the table are combinations of time periods and time spans for which there is no financial data available. Panel B presents results two-fold for completeness reasons.

The data in this table originates from *Orbis financial database* and calculations are done by the author.

The significance of the results in panel A was tested using the Wilcoxon signed rank test. The asterix in panel A stands for a significant difference in median value. For example, the change in median ROA for firms that went public in the post-crisis period is -0,028 (panel A, time span -1 to +1). This means that the median of this group is significantly smaller (-0,028) the year after the IPO in comparison to the year before the IPO. The significant changes in median ROA provide evidence for the alternative hypothesis (H1) noted in the methodology section.

The significance of the results in panel B was tested using the Anova (F-test). The asterix in panel B stands for a significant difference in mean value. For example, the difference in mean of -0,623 means that the post-crisis period firms perform worse than the mid-crisis period firms. The post-crisis period group has a ROA that decrease more than the ROA of the mid-crisis period group for the time span of one year after the IPO to five years after the IPO. The significant difference in mean provide evidence for the alternative hypothesis (H1) noted in the methodology section.

* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.

5. Conclusion

This paper aimed to answer the main research question of whether going public affects operating performance and if there is significant differences in operating performance for firms that went public before, during and after the financial crisis of 2008. Three different approaches were used to investigate the effect of IPO's on firm operating performance. The first approach found a few significant changes in median ROA, which meant that the operating performance changed significantly after the IPO. The evidence however is not quite convincing. Therefore, the conclusion from this part of this paper is that IPO's have no significant effect on firm performance. The second approach on the other hand presents more convincing evidence. This part of the paper showed that when operating performance is adjusted for industry operating performance, operating performance decreases after the IPO for firms that execute these IPO's. This decrease in operating performance is highly significant (significant at 1 percent) for nearly all years (2007-2014) and all time spans ([-1 to +1], [1 to 3], [1 to 5] and [1 to 7]). The decrease in firm operating performance is greater for longer time spans which means that firms that execute an IPO perform worse in the long-run than in the short-run. All in all, the findings of this part of this paper are in line with earlier research done on IPO's and firm operating performance[16].

The calculations of different effects of IPO's on operating performance for the pre-, mid- and post-crisis period has also led to significant results. The findings show that firms that executed their IPO post-financial crisis perform worse in terms of change in ROA than firm that executed their IPO before and during the financial crisis for the time span of [1 to 5]. Firms that executed their IPO during the crisis also perform worse than firms that executed their IPO before the financial crisis for the time span of [1 to 7]). The effect is larger for longer time spans which means that the firm performance is worse in the long-run. Do note that in this case the effect is calculated in comparison to a different time period, so that the long-run operating performance is worse in comparison to the other time period.

The negative effect of the IPO on firm performance is different for different firms and for different years. There is no clear coefficient which captures the effect of the IPO on firm performance which applies to all IPO's. The reason why no clear coefficient emerged is most likely due to the fact that different firms with different characteristics such as industry, firm size and management equity stakes were used in this sample. The literature has shown that these factors influence the performance of firms. Therefore, to make a realistic expectation of the magnitude of the IPO effect on firm operating performance, it is important to look at the characteristics for each IPO separately.

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[16] The findings are in line with Mikkelson, Partch and Shah (1997), Jain and Kini (1994 and 1995), Pagaono, Panetta and Zingales (1998), Khurshed, Paleari and Vismara (2005, Wang, Wang, and Lu (2003), Cai and Wei (1997) and Kutsuna, Okamura and Cowling (2002) and Wang (2005)

6. Limitations and future research

Due to unavailable data for recent years, the long term-effect of an IPO on firm performance has not been measured for firms that went public in recent years. This means that for the long-run no conclusion can be drawn on whether firms that executed their IPO before and during the financial crisis perform better or worse than firms that executed their IPO after the financial crisis. Another limitation is the lack of multiple performance measures. Initial public offerings typically increase assets substantially, which potentially imparts a downward bias to measures of operating income scaled by assets. This paper uses ROA (EBITDA divided by total assets) but other performance measures such as operating income divided by sales could be used. The effect of the IPO on firm performance may then differ and be more or less significant. Both limitations are also potential new topics or drivers for future research. Another limitation is the lack of data from before 2007. The pre-crisis data only consists of data from the year 2007 and may thus give a biased result if the year 2007 is not representative for other years prior to the financial crisis.

This paper has shown that the financial crisis affected the operating performance of firms and that there is a difference in operating performance post-IPO for firms that went public before, during and after the financial crisis. Future research could focus on more specified effects or reasons for this difference in operating performance. Would for example firms from the technological industry react differently to a financial crisis than firms from the transport industry? Are different effects seen? Future research could also investigate whether the reasons for going public were different during these different time periods[17].

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[17] See reasons for going public listed in the theoretical framework (page 7 and 8).

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8. Appendix

	Beginning of Wave	End of Wave	Number of IPOs	Avg. Prewave Market Return		Beginning of Wave	End of Wave	Number of IPOs	Avg. Prewave Market Return
1	196108	196205	480	10.56	9	198601	198709	1,517	27.69
2	196810	197002	1,061	0.07	10	199111	199112	93	25.04
3	197110	197207	488	13.47	11	199202	199205	206	23.86
4	197209	197209	32	−2.70	12	199304	199406	828	6.85
5	197211	197211	40	19.02	13	199507	199507	50	31.20
6	198103	198107	245	16.16	14	199510	199612	1,068	22.15
7	198302	198407	1,223	22.72	15	199710	199711	145	33.76
8	198507	198511	249	12.78	16	199906	199907	122	19.60

Table 5: IPO waves from the article of Pàstor & Veronesi, 2005.

The table reports 16 IPO waves observed in a dataset from January 1960 through December 2002. 'Avg prewave market return' stands for the average monthly total market return during the respective prewave.

Table 6: U.S. two digit SIC codes

A. Agriculture, Forestry, & Fishing
01 Agricultural Production - Crops
02 Agricultural Production - Livestock
07 Agricultural Services
08 Forestry
09 Fishing, Hunting, & Trapping
B. Mining
10 Metal, Mining
12 Coal Mining
13 Oil & Gas Extraction
14 Nonmetallic Minerals, Except Fuels
C. Construction
15 General Building Contractors
16 Heavy Construction, Except Building
17 Special Trade Contractors
D. Manufacturing
20 Food & Kindred Products
21 Tobacco Products
22 Textile Mill Products
23 Apparel & Other Textile Products
24 Lumber & Wood Products
25 Furniture & Fixtures
26 Paper & Allied Products
27 Printing & Publishing
28 Chemical & Allied Products
29 Petroleum & Coal Products
30 Rubber & Miscellaneous Plastics Products
31 Leather & Leather Products
32 Stone, Clay, & Glass Products
33 Primary Metal Industries
34 Fabricated Metal Products
35 Industrial Machinery & Equipment
36 Electronic & Other Electric Equipment
37 Transportation Equipment
38 Instruments & Related Products
39 Miscellaneous Manufacturing Industries
E. Transportation & Public Utilities
40 Railroad Transportation
41 Local & Interurban Passenger Transit
42 Trucking & Warehousing
43 U.S. Postal Service
44 Water Transportation
45 Transportation by Air
46 Pipelines, Except Natural Gas
47 Transportation Services
48 Communications
49 Electric, Gas, & Sanitary Services
F. Wholesale Trade
50 Wholesale Trade - Durable Goods
51 Wholesale Trade - Nondurable Goods

G. Retail Trade
52 Building Materials & Gardening Supplies
53 General Merchandise Stores
54 Food Stores
55 Automotive Dealers & Service Stations
56 Apparel & Accessory Stores
57 Furniture & Home furnishings Stores
58 Eating & Drinking Places
59 Miscellaneous Retail
H. Finance, Insurance, & Real Estate
60 Depository Institutions
61 No depository Institutions
62 Security & Commodity Brokers
63 Insurance Carriers
64 Insurance Agents, Brokers, & Service
65 Real Estate
67 Holding & Other Investment Offices
I. Services
70 Hotels & Other Lodging Places
72 Personal Services
73 Business Services
75 Auto Repair, Services, & Parking
76 Miscellaneous Repair Services
78 Motion Pictures
79 Amusement & Recreation Services
80 Health Services
81 Legal Services
82 Educational Services
83 Social Services
84 Museums, Botanical, Zoological Gardens
86 Membership Organizations
87 Engineering & Management Services
88 Private Households
89 Services, Not Elsewhere Classified
J. Public Administration
91 Executive, Legislative, & General
92 Justice, Public Order, & Safety
93 Finance, Taxation, & Monetary Policy
94 Administration of Human Resources
95 Environmental Quality & Housing
96 Administration of Economic Programs
97 National Security & International Affairs
98 Zoological Gardens
K. No classifiable Establishments
99 Non-Classifiable Establishments

This table contains all of the U.S. two digit SIC codes used in this paper to match certain firms to certain industries. Letters A to K classify certain groups. Numbers 01 to 99 are the U.S. two digit SIC codes.

The source of this table is SICCODE business list. (www.SICCODE.com)