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Determinants of IPO underpricing in Europe

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ABSTRACT

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When a company goes public for the first time the shares that they offer tend to be underpriced meaning that the share price jumps substantially on the first days of trading. This phenomenon called IPO underpricing has received a lot of attention during past decades and prior literature has attempted to find reasons for initial IPO returns. This thesis studies the current situation of IPO underpricing and the determinants of underpricing in Europe. The time frame for this study is from 2009 to 2017. Underpricing of European IPOs is studied by examining initial IPO returns after the offering and multivariate linear regression models are used to study the determinants of underpricing. Underpricing and the determinants of underpricing are also studied in samples containing IPOs from European countries with similar institutional and legal systems. The variables in this study are focusing on information frictions explaining IPO underpricing. This thesis documented significant underpricing of European IPOs between 2009 and 2017 but the degree of underpricing has declined compared to earlier time periods. The cross-sectional analysis in this thesis found support for information-based explanations of IPO underpricing in Nordic markets and in European markets with English-, German- and Scandinavian legal origins. The explanations for IPO underpricing were dependent on the institutional and legal characteristics of the country where the IPO was issued. The results in this thesis suggest that in addition to information-based variables, some other such as behavioral-based variables should be used to explain underpricing of European IPOs.

TIIVISTELMÄ

Kun yritys listautuu pörssiin ensimmäistä kertaa, sen tarjoamat osakkeet on havaittu olevan alihinnoiteltuja. Alihinnoitelluissa osakeanneissa osakkeen hinta nousee ensimmäisen kaupankäyntipäivän aikana. Listautumisantien alihinnoittelu on saanut paljon huomiota viime vuosikymmenten aikana ja aikaisempi tutkimus on yrittänyt löytää syitä osakeannin jälkeisille tuotoille. Tämän tutkielman tarkoituksena on tutkia listautumisantien alihinnoittelun ja siihen vaikuttavien tekijöiden ajankohtaista tilannetta Euroopassa. Tämä tutkimus keskittyy eurooppalaisiin listautumisanteihin, jotka ovat tarjottu vuosien 2009 ja 2017 välissä. Ilmiötä tutkitaan tarkastelemalla osakkeiden tuottoja ensimmäisten kaupankäyntipäivien aikana. Alihinnoitteluun vaikuttavia muuttujia tutkitaan hyödyntämällä usean muuttujan lineaarista regressiota. Alihinnoittelua ja siihen vaikuttavia muuttujia tutkitaan myös otoksissa, jotka sisältävät listautumisia maista, joissa on samankaltaiset institutionaaliset ja lailliset järjestelmät. Tutkielmassa käytetyt selittävät muuttujat liittyvät epäsymmetriseen informaation. Tulosten perusteella eurooppalaiset listautumisannit olivat keskimäärin alihinnoiteltuja vuosien 2009 ja 2017 välillä, mutta alihinnoittelu on pienentynyt aikaisempiin ajanjaksoihin verrattuna. Regressioanalyysin perusteella epäsymmetriseen informaatioon liittyvät muuttujat selittävät listautumisantien alihinnoittelua pohjoismaissa sekä eurooppalaisissa maissa, joiden oikeusjärjestelmällinen alkuperä on englantilainen, saksalainen tai skandinaavinen. Epäsymmetriseen informaation liittyvien muuttujien lisäksi eurooppalaisten listautumisantien alihinnoittelua tulisi selittää myös muilla muuttujilla, kuten käyttäytymisperusteisilla muuttujilla.

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1 INTRODUCTION

When the company decides to go public for the first time the process is called initial public offering (IPO). The shares that companies offer for the public for the first time tend to be underpriced meaning that the share price jumps substantially on the first day of trading. This means that companies leave substantial amounts of money on the table by not pricing their IPOs efficiently. The phenomenon of IPO underpricing has been detected globally but the degree of underpricing varies during different time periods and between different countries. Loughran & Ritter (2004) reported underpricing of the U.S. IPOs between 1980 and 2000 and found out that in the 1980s the abnormal return on the first day of trading was on average 7%. Between 1990 and 1998 the average underpricing was 15% and in 1999 and 2000 average first day returns increased to 65%. Ljungqvist (2007) documented the initial IPO returns in European countries between 1990 and 2003 and the degree of underpricing varied between 5% and 60% depending on the country where the IPO was issued. Why do companies leave such an enormous amount of money on the table? This topic has attracted researchers' attention around the world and various theories for high initial returns have been constructed. Most of these theories have received a lot of empirical support but still there is no general explanation for underpricing. Earlier empirical literature focused on testing specific theories for example Beatty & Ritter (1986) tested Rock's (1986) theory of winner's curse. Nowadays entire models that use more sophisticated econometric techniques have been constructed to explain IPO underpricing (eg. Butler, Keefe & Kieschnick, 2014).

Topic of IPO underpricing has received a lot of attention during the last decades and the empirical literature about IPO underpricing is manifold. Prior literature has attempted to find reasons for underpricing and has presented numerous theories explaining underpricing. Even though empirical tests have found support for different theories, no general explanation for IPO underpricing exists. Each of these studies has their own assumptions and controls making the comparison between different studies hard. Loughran & Ritter (2004) argue that the relevant explanations for IPO underpricing vary depending on the time and environment. In the 1980s theories, such as the winner's curse and dynamic information acquisition were suggested to be the main reasons for underpricing (Loughran & Ritter, 2004). The situation changed during the Internet bubble in the 1990s when other explanations like behavioral explanations became more important (Ljungqvist, 2007). According to Ritter & Welch

(2002) no single theory can explain underpricing and the reason for high initial returns is dependent on the issuing company and timing of the issue. The financial environment is changing rapidly all the time and still high initial returns are experienced. Information-based explanations are maybe the most well recognized reasons behind IPO underpricing. However, in the current financial environment information acquisition has become easier and analyst reports are easily available for every investor. It is reasonable to assume that at least some of the effects of asymmetric information has decreased. Because explanations for IPO underpricing vary over time it is important to conduct a study about the current situation.

Most of the theories of IPO underpricing and empirical test focus on the U.S. markets. The results are also dependent on the assumptions specific to each research and the results are contradictory and difficult to generalize. The IPO markets in the U.S. are different from the European markets. Jenkinson, Morrison & Wilhelm (2006) state that unlike in the U.S. in Europe the information exchange between investors and issuers is allowed before setting up the indicative price range. Because of the limited information exchange the final offer prices are more frequently revised in the U.S. compared to the Europe (Jenkinson et al., 2006). Prior literature argues that offer prices adjust only partially to the private information (Benveniste & Spindt, 1989; Hanley, 1993). Because the information acquisition is different between the U.S. and European markets it is reasonable to assume that determinants of underpricing related to information acquisition are also different in the U.S. and Europe. Both European and U.S. companies consider growth opportunities as benefits of going public. However, U.S. companies consider monitoring and increasing transparency as costs of going public while European companies consider these issues as benefits (Bancel & Mittoo, 2009). In Europe the increasing regulation has improved the transparency related to the IPO and has decreased the ex-ante uncertainty (Akyol, Cooper, Meoli & Vismara, 2014). Thus, the determinants related to ex-ante uncertainty might not have that much explanatory power in Europe.

Because most of the reasons for IPO underpricing are based on the U.S. markets it is important to study the determinants of IPO underpricing in Europe. This thesis concentrates in explaining IPO underpricing with determinants relating to information frictions. No prior study has studied the determinants of underpricing in Europe wide entity as comprehensively as this study. The IPO sample in this study is also divided into sub-samples based on

institutional and legal systems of the country where the IPO is issued. This study also contributes to the existing literature by studying the determinants of underpricing in European countries with similar institutional characteristics and legal systems.

1.1 Objectives of the study

Majority of the IPO research has concentrated in the U.S. markets, but the phenomenon of IPO underpricing has also been observed in Europe. Ljungqvist (2007) documented initial IPO returns in 19 European countries between 1990 and 2003 and the first day returns showed great dispersion between countries. The initial IPO returns varied between 5% and 60% and in majority of European countries over 10% underpricing was observed (Ljungqvist, 2007). Akyol et al. (2014) studied how changes in regulatory environment have been affecting underpricing of European IPOs. They studied underpricing of European IPOs between 1998 and 2012 and found out that increasing regulation in the EU countries has increased the transparency related to the IPOs and thus the degree of underpricing has decreased. As stated previously the initial IPO returns have been fluctuating over time. The time frame for this study is from 2009 to 2017 and the objective of this thesis is to study the current situation of IPO underpricing in Europe.

The main objective of this thesis is to study the determinants of IPO underpricing in Europe. Underpricing is dependent on the institutional characteristics of the country where the IPO is issued and the characteristics of the issuing company. The institutional characteristics and legal systems in European countries are different from each other (eg. Röell, 1996; La Porta, Lopez de Silanez, Scleifer & Vishny, 1998). Engelen & van Essen (2010) argue that underpricing is significantly lower in countries where investor protection is better. In this study the dataset is divided based on institutional characteristics and legal systems of the country where the IPO is issued. In addition to the dataset containing IPOs from all the European countries in this study, the determinants of underpricing are studied in sub-samples containing IPOs from European countries with similar institutional and legal systems. This study contributes to the existing literature by studying the current situation of IPO underpricing and the determinants of underpricing in Europe.

1.2 Research questions

Based on the findings of prior studies, the research questions for this thesis are formed. As noted previously IPOs are widely recognized to be underpriced showing substantial price jumps straight after offering. The first research question concentrates on the pricing and initial returns of European IPO. Based on these arguments the first research question is formed:

Research question 1: Were European IPOs underpriced between 2009 and 2017?

The answer to the first research question should clarify if European IPOs are underpriced on average and if so, how much are the initial returns on average. The level of underpricing is also compared between different years, countries and industries. According to the efficient market hypothesis security prices fully reflect all available information (Fama, 1970). In line with the efficient market hypothesis, IPOs should be priced efficiently and there should not be underpricing. The first hypothesis is formed based on efficient market hypothesis.

H1: European IPOs are priced efficiently and are not underpriced.

Even though, theory suggests that IPO pricing should reflect all available information, empirical literature has found out that IPOs show substantial price jump on the first day of trading. IPO underpricing has been explained by various theories and the most notable theories are information-based explanations, institutional explanations and behavioral explanations. These theories have received support by several empirical studies, but contradictory opinions exist about reasons behind IPO underpricing. Prior literature argues that information-based explanations have the first order effect on IPO underpricing and this thesis also concentrates mainly on the information frictions explaining IPO underpricing. Based on prior literature and empirical findings the second research question is formed.

Research question 2: What are the determinants of IPO underpricing in Europe?

The second research question is related to the determinants of initial returns of IPOs. Using variables identified by previous empirical studies the most important determinants are identified. The objective is also to find out which of the theories of IPO underpricing are

supported in European IPO markets. Two hypotheses are formed in order to be able to answer to the second research question. Rest of the variables are added to the models as control variables. Empirical IPO literature has found out that IPO volumes are dependent on the market conditions. Favorable market conditions are followed by larger number of IPOs and the overall stock market rise before the offering is usually followed by higher underpricing (Loughran & Ritter, 2002). Based on this argument the second hypothesis is formed.

H2: Overall stock market growth before the IPO is followed by higher underpricing.

Beatty & Ritter (1986) argue that uncertainty related to the issue increases the degree of underpricing. IPOs of smaller companies can be considered to be riskier and more speculative and thus it is reasonable to assume that IPOs of smaller companies are also more underpriced. In this study the size of the issuing company is measured as total revenue of issuing company for the latest 12-month period before the offering and based on the arguments of prior literature the third hypothesis is formed.

H3: IPOs of smaller companies are more underpriced.

Based on the identified determinants of underpricing the objective is to find out why European IPOs are underpriced and if prior explanations for high initial returns are still valid or have the reasons for underpricing changed at the same time when financial environment has changed. The objective is to expand the reasoning from individual markets to Europe-wide entity. Thus, the objective is to find generalizable reasons for IPO underpricing in Europe. The institutional characteristics and legal systems in European countries are different from each other. Engelen & van Essen (2010) argue that underpricing is higher in countries where investor protection is weaker because of the greater ex-ante uncertainty relating to the value of the issuing company. Based on this argument the third research question is formed.

Research question 3: Are the determinants of IPO underpricing different in European countries with different legal and institutional characteristics?

When studying the determinants of underpricing, the IPO sample used in this study is divided into sub-samples based on institutional characteristics and legal systems of the countries where the IPOs are issued. The hypotheses presented above are tested for each IPO sample separately and the objective is to find if the determinants of underpricing vary in countries where the institutional and legal characteristics are different. Finding answers to the research questions presented above should clarify the current situation of IPO underpricing in Europe.

1.3   Limitations

The data for this study is collected from Thomson One database (Thomson One, 2018). IPO research requires a lot of financial data related to the issuing company and in most cases the financial data is from a time period when the issuing company is still privately owned. This study contains several different study variables and the data for all these variables should be available so that the IPO can be included in the sample. For some IPOs the data for different study variables was missing and these IPOs were excluded from the study. The data availability placed constraints for this study and the observations where data was missing were omitted from this study. The IPO sample used in this study contains 167 observations, which is only a narrow sample of the total dataset of IPOs that were issued between 2009 and 2017. In total 1830 common stock IPOs were issued in Europe during the study period so the sample used in this study contains only a small part of the total IPOs issued during the study period.

Prior literature has identified several different variables explaining IPO underpricing. Inclusion of all the variables identified by prior literature would not be possible in this study considering the scope of the master's thesis. The focus in this study is in information-based models and the study variables that were chosen for this study are related to information frictions explaining IPO underpricing. Variables are chosen based on prior literature. Identification and selection of the study variables are placing limitations for this study. Some important variables might have been omitted from this study and thus the results are limited.

1.4   Structure of the thesis

This thesis is structured as follows: The literature review is presented in the following chapter. Literature review is divided into three parts. Literature review starts by presenting

general information about IPOs. In the second part the theoretical background of IPO underpricing is presented and the theories of underpricing are discussed. Last part of the literature review concentrates in European IPO markets. After the literature review the data and methodologies for the empirical part of this study are presented in the third chapter. The results and analysis of the findings are presented in the fourth chapter. In the fourth chapter the results are also compared to the findings of previous literature and the economic implications are discussed. The conclusions are drawn in the final chapter.

2   LITERATURE REVIEW

The literature review for this thesis is presented in this section. The literature review starts by presenting general information about IPOs. In the second part, theoretical background of IPO underpricing is presented. Because literature around IPO underpricing is rather vast, this literature review will focus on the most notable and explanatory theories. Theories of IPO underpricing are divided into three sub-sections: theories of asymmetric information, institutional explanations and behavioral explanations. In the third part, the fluctuations in IPO volumes and underpricing are presented. Because the focus of this study is in the European markets, the last part of the literature review presents the characteristics of European IPO markets.

2.1   General information about IPOs

As stated in the previous chapter, when company goes public for the first time the process is called initial public offering (IPO). After IPO the issuing company becomes public. Maybe the most common reason for going public is the desire to raise equity capital for the company and create public market for the shares but there are also non-financial reasons for going public like increasing publicity (Ritter & Welch, 2002). Prior literature has presented several reasons for the decision to go public. Lucas & McDonald (1990) presented a market-timing theory explaining the decision going public. Theory is based on asymmetric information between managers of the company and investors. Managers time the equity issue based on their assumption of the current value of the company. If the company knows that it is currently undervalued the issue will be delayed and on the other hand if the company is overvalued, the issue is carried out immediately. Zingales (1995) presented a theory for the decision for going public when the issuer is eventually planning to sell the company. The decision of going public is driven by value-maximizing decision made by initial owners of the company. The findings suggest that the owners of the company utilize IPO to optimize the ownership structure of the company so that the value of eventual sale is maximized. According to Röell (1996) there are significant differences between European countries in the propensity of using publicly traded equity as a form of finance and the reasons for going public are also different in different European countries.

The initial public offering is most commonly the largest equity issue the company makes during its lifetime (Zingales, 1995). Different parts of the IPO process play important role so that the IPO is successful. According to Katti & Phani (2016) the IPO process follows six steps. The IPO process is presented in figure 1.

Figure 1. IPO process (Adapted from Katti & Phani, 2016)

According to Katti & Phani (2016) the issuing company normally appoints an underwriter and the underwriter carries out the IPO process. After deciding to go public the first step in the IPO process is research about the activities that are important for the IPO process. Underwriter conducts a process of due diligence and evaluates different macro-economic indicators and their impact on the success of the offering. In addition, this phase involves scanning the market and industry specific information.

Next step after research is underwriting. This phase involves the compilation of draft prospectus which has to be handed out to regulatory authorities (Katti & Phani, 2016). The offering must be approved by the exchange where the shares are listed and traded. According to Katti & Phani (2016) in this phase the issuer determines the syndicate of investment banks that are involved in the issue. The syndicate is formed based on the size and geographical requirements of the issue.

Underwriting is followed by marketing of an issue. According to Katti & Phani (2016) the members involved in the IPO process conduct a plan to raise the awareness of the issue and underwriters should use media and advertising to attract potential investors. The issue is also presented to various institutional investors. The objective of this step is to increase the publicity of the issue and attract investors.

According to Katti & Phani (2016) the next step in the IPO process is price determination. In this phase the investors from different classes show their interest in the IPO. The prices and quantities of demand are recorded and normally they are managed using electronic book.

The final offer price is determined based on the gathered information about the demand of investors. This is normally how the price of an IPO is determined if it follows book building process.

In the next phase the shares are allocated to the potential investors. According to Katti & Phani (2016) the determined price of the IPO is treated as a cut of price for allocation purposes. In many countries an issuer can allocate the shares according to its own interest. If the underwriter is not allowed to allocate the shares according to its own discretion, the ratio of oversubscription determines the share allocation to different classes of investors. According to Katti & Phani (2016) the final step in the IPO process is listing and trading of securities. This step also includes secondary market trading, market making and price stabilization activities.

2.2 Theoretical background of IPO underpricing

IPOs are recognized to be underpriced meaning that the share prices jump substantially straight after the offering. Companies leave enormous amounts of money on the table by not pricing their IPOs according to the real value of the company. IPO underpricing is identified globally, and the degree of underpricing fluctuates over time and is dependent on the country where the IPO is issued. Most commonly underpricing is measured as first trading day return after offering (Ljungqvist, 2007). Prior literature has identified several reasons for high initial returns. This part of the thesis concentrates on exploring the main theories explaining IPO underpricing. The literature review starts by going through the asymmetric information models. Next, the institutional theories explaining IPO underpricing are discussed. Finally, the behavioral explanations are presented.

2.2.1 Asymmetric information

Majority of the previous research has identified asymmetric information models to be critical in explaining IPO underpricing. Issuing company, underwriter and investors are the key parties in IPO transaction. The idea behind asymmetric information models is that one of these parties is better informed than others. Asymmetric information between different groups creates problems of adverse selection and moral hazard. The asymmetric information

models in this study are divided into four sub-sections: theory of winner's curse, information revelation theories, agency problems and signaling.

Winner's curse

One of the most famous asymmetric information model explaining IPO underpricing is Rock's (1986) theory of winner's curse. Rock (1986) studied the asymmetric information between various classes of investors, issuing company and underwriter. The model is an application of the so-called lemons problem where buyers and sellers in a transaction are not equally informed causing differing opinions about the true value of the transaction (Akerlof, 1970). Rock's (1986) model assumes that a group of investors has better information about the value of firm than issuing company, underwriter and other investors. These well-informed investors take part only in attractive offerings and withdraw from bad issues. According to Rock (1986) uninformed investors do not have information about the real value of the company, so they are investing randomly in both good and bad issues. This leads to a situation where uninformed investors earn profits below average underpricing and bad issues are left only for uninformed investors. Uninformed investors get only part of shares in attractive offerings because informed investors are also attending. The extreme case is when uninformed investors receive only overpriced IPOs and thus the average returns are negative. Rock (1986) argues that when the assumed average returns are negative the uninformed investors are not willing to bid for the IPOs and the IPO markets will consist only informed investors. However, the IPO market is dependent on the uninformed investors because the informed investors are incapable to take up all the shares on offer. Uninformed investors require compensation for the risk of trading against informed investors. The shares must be offered at a discount to ensure the participation of uninformed investors.

Rock's (1986) arguments are supported by Carter & Manaster (1990). Carter & Manaster (1990) extended Rock's (1986) model by suggesting that larger proportions of informed capital participating in the offering leads to a greater underpricing. Underpricing is also related to the uncertainty of company's market value. They argue that underpricing reduces the proceeds obtained by the issuer. Therefore, issuer has an incentive to reduce the underpricing. Issuers do this by hiring underwriters with prestigious reputation. Prestigious underwriters manage only IPOs of low risk firms in order to maintain their reputation. Hiring prestigious underwriter is a signal to the market about the low risk of the issuing company.

Underwriter reputation is negatively related to the variance and magnitude of the underpricing.

Habib & Ljungqvist (2001) suggested an alternative reason for IPO underpricing. Explanation is based on assumption that some owners care less about the degree of underpricing. Owners are concerned about the underpricing to the extent that they lose from it and owners are able to influence in the degree of underpricing by promoting the issue. They found that issuers spend more money on promoting the issue when more shares are offered. In addition, spending more on promotion leads to a lower degree of underpricing. Issuers promote their issue until the marginal costs of reducing underpricing equals marginal benefits. Habib & Ljungqvist (2001) also examined the choice of underwriter and its influence in underpricing. They assume that issuer chooses underwriters endogenously. Issuers choose the underwriter according to the expected underpricing and most speculative companies choose prestigious underwriters. According to Habib & Ljungqvist (2001) the IPOs of speculative companies are still more underpriced than average but less than they would have been without prestigious underwriter. Thus, issuers can influence in the level of underpricing by promoting the issue and choosing an underwriter according to their interest.

Beatty & Ritter (1986) found that there is a monotone relation between underpricing of the offering and investors' uncertainty about the value of issuing company. They argue that there is positive relation between ex ante uncertainty and expected initial return. Thus, an issuing firm has an incentive to reduce the uncertainty by disclosing information about the value of the company. They also argue that the degree of underpricing is determined by underwriter. Underwriter has an incentive to set the price correctly because it has its reputation on the table. If the underwriter sets the price too low or too high, it will lose potential investors or issuers in the future. Empirical findings presented by Beatty & Ritter (1986) showed that underwriters who do not set the price according to the underpricing equilibrium will lose market share in the future.

Information revelation

Benveniste & Spindt (1989) discussed the issue concerning information revelation and its influence in IPO pricing. They argue that information revelation during the book building process allows the underwriter to set the price to a level that maximizes the issuers proceeds

and one way to reveal the truthful information is to reward aggressive investors by providing underpriced shares for investors that reveal their information. Large amount of the shares is allocated for the investors who bid aggressively and so reveal positive information. The other way around inactive investors get only a few shares or no shares at all. The more investors are willing to pay for the shares the more the offer price rises. However, Benveniste & Spindt (1989) argue that the offering should also be underpriced so that investors are willing to reveal their information meaning that the offer price is only partially adjusted to private information. If the IPO is not underpriced the incentives for truthful information disappear. These findings have received support from subsequent studies. The findings are supported by Hanley (1993) who argues that share prices are only partially adjusted to new information. The offerings where positive revisions are done in the final offer price are more underpriced. This means that offerings that have positive price prospectus and good information are also more underpriced. Corwin & Schultz (2005) argue that offer price is more likely to be revised if the underwriting syndicate has more co-managers. They argue that larger syndicates are able to produce more reliable information and thus the probability of price revision increases when the underwriter syndicate is larger. According to Corwin & Schultz (2005) larger syndicates of co-managers reduce the underpricing. However, when price revision is controlled there is no additional relation between syndicate structure and underpricing.

Loughran & Ritter (2002) argue that final offer price adjusts only partially to public information. This leads to a situation where first-day returns can be predicted based on overall market returns preceding the issue. IPOs that are offered after the market rise tend to have higher expected first day returns. The other way around IPOs that came to market after market fall have lower first day returns. Partial adjustment of the offering price suggests that IPO pricing process is not efficient. The findings are supported by Bradley & Jordan (2002) who also studied the phenomenon of partial adjustment to public information and they also argue that underpricing can be partially predicted by public information. According to their findings underpricing of new issue is positively related to initial returns of previous IPOs. Lowry & Schwert (2004) also studied the pricing of IPOs and its adjustment to public information. They also found statistically significant relation between initial returns and market returns before offering but economic significance of this relation was quite low meaning that most of the public information is incorporated into the preliminary price range. Thus, they argue that IPO pricing process is almost efficient. According to Lowry, Officer

& Schwert (2010) the uncertainty in overall market conditions is also affecting the level of underpricing. When there is a high uncertainty in overall market conditions the valuation of issuing company becomes more difficult and during more volatile market conditions the IPOs tend to be more underpriced.

In more recent literature Bakke, Leite & Thorburn (2017) added public signal to the information-based framework presented by Benveniste & Spindt (1989). They found that the compensation required by investors to reveal their information decreases with public signals and private signals of investors are conditionally correlated with the public signal. According to Bakke et al. (2017) there are two ways in which public information is related to the IPO underpricing. First, positive public information increases the likelihood that the issue will be underpriced. Second argument relates to the investors' incentives to reveal information. Investors require higher compensation, in other words more underpricing, when the public signal is negative.

Agency problem
Underwriter's information acquisition and the possibility for share allocation increases the possibility for agency problems between investment bank and issuing company. Baron & Holmström (1980) studied this problem between underwriters and issuing companies. They argue that underwriters have the possibility to gather private information during preselling activities. This leads to a situation where underwriter is better informed than the issuing company. Underwriter is able to suggest a price that is not beneficial for the issuer. According to Baron & Holmström (1980) the reason behind the contradictory incentives is that underwriting banks try to limit their costs by pricing the offering lower. The issuing company should create incentives for the underwriter so that they use the information in advantage for the issuing company. Baron (1982) also studied the agency problem between the issuer and underwriter. If underwriter and issuer are equally informed the issuer would demand only distribution services from the underwriter. However, Baron (1982) assumes that underwriters are better informed than the issuer about the demand of the issue leading to a principal-agent problem. This causes the underwriter to supply the issue using less than the best possible effort and the distribution efforts are minimized by underpricing the issue.

Loughran & Ritter (2004) introduced a new agency explanation of IPO underpricing, which is the spinning hypotheses. Spinning hypotheses is based on differing interests between decision-makers and other pre-IPO shareholders. The decision-makers are the individuals who decide the managing underwriter of the issue. Pre-issue shareholders are limited partners of venture capital firms and other smaller shareholders. According to Loughran & Ritter (2004) the decision-makers of issuing company prefer to hire underwriters with a reputation for underpricing because of the side payments they will receive. These payments motivate the management to choose an underwriter that is likely to underprice the issue. Spinning theory explains why managers of issuing company and underwriters prefer leaving money on the table.

Arthurs, Hoskisson, Busenitz & Johnson (2008) studied further the issue of agency problem in IPO underpricing. They also examined the situations where underwriter's incentives differ from those of the offering company. They argue that underwriters tend to underprice the offerings to please institutional investors and to maintain their future business. They found out that monitoring decreases underpricing. They also found out that underpricing increases when venture capitalists have had previous cooperation with the underwriters.

Signaling

IPO underpricing is also explained using signaling theory. The idea is that insiders of the company have information that is not available in the markets. Companies reveal this information with their actions. Welch (1989) presented a signaling model in which firms underprice their IPOs in order to signal the quality of the company. High quality firms underprice their offering to obtain higher price from their future seasoned offerings. Underpricing is compensated with higher price at a seasoned offering. Model also assumes that low quality companies try to imitate high quality companies. According to Welch (1989) the marginal cost of underpricing is higher for low quality companies compared to quality companies. In addition to imitation costs occurring from signaling, the low-quality company must invest in activities similar to high quality company. Imitation is also risky because over time the market will discover the true value of the company. According to Welch (1989) these issues lead to a situation where only high-quality companies can afford to underprice their offerings.

Allen & Faulhaber (1989) were one of the first to study the signaling theory in IPO underpricing. Their model assumes that company itself knows its future performance best and companies that have favorable outlook on their performance are likely to signal it by underpricing their initial offerings. Investors expect that underpricing is a signal for future success because only well performing companies afford underpricing. The company benefits from the underpricing because they are able to price their future issues more attractively. Allen & Faulhauber (1989) argue that underpricing also reduces investors' expectations on future dividends. Bad companies cannot cope with the loss from the underpricing, so IPO underpricing can be seen as a signal of firm quality.

Grinblatt & Hwang (1989) ended up with similar conclusions. They also assumed that issuer has the best knowledge about their future cash flows. The issuer signals the true value of the company to the shareholders by underpricing its initial offering and retaining some of the shares. Grinblatt & Hwang (1989) found that intrinsic value of the company is positively related to the degree of underpricing. By underpricing company might try to avoid high costs related to the offering. Underpricing also enables the company to pay lower dividends and so the company avoids higher taxes.

Jegadeesh, Weinstein & Welch (1993) tested the implication of signaling theory in IPO underpricing and the assumption that companies underprice their offerings in order to get more favorable price from seasoned equity offerings. They found evidence consistent with signaling theory. According to Jegadeesh et al. (1993) companies that underprice their offerings are more likely to issue seasoned equity offerings and underpricing is positively related to the size of these offerings. However, the economic significance of these findings is rather weak. They also found out that market returns in two 20-day periods following the IPO are also significantly related to the likelihood and size of subsequent offerings. According to these findings, issuers do not have to underprice their IPOs to get favorable prices for seasoned offerings. The market returns explain better the size and likelihood of seasoned equity offerings than first day returns after initial offering. The findings presented by Jegadeesh et al. (1993) support signaling hypotheses but signaling should not be viewed as a main determinant of IPO underpricing.

Michaely & Shaw (1994) also tested the implication of signaling hypotheses in IPO underpricing. They found out that companies, which experience high underpricing issue subsequent offerings less frequently than companies with lower initial underpricing. The findings suggested that higher underpricing also results in lower size of seasonal equity offerings. Firms that underprice their issues have weaker earnings performance and pays less dividends in the future. Michaely & Shaw (1994) found out that the IPOs of companies with higher earnings after the offering are substantially less underpriced. These findings argue against signaling hypotheses in underpricing.

In more recent literature about signaling theory and IPO underpricing Park & Patel (2015) studied the influence of signaling ambiguity in underpricing. They found out that low ambiguity of the signaling result in lower underpricing. Low ambiguity can be related to the quality of the company and they found out that the underpricing is lower in case of quality companies.

Signaling hypotheses has been found out to be an important factor explaining IPO underpricing. Companies use underpricing to signal the quality of the company and please investors in order to receive more favorable price in the future equity issues (Welch 1989; Allen & Faulhaber, 1989; Grinblatt & Hwang, 1989). However, the empirical literature has also contradictory arguments. Jagedeesh et al. (1993) found support for signaling hypotheses but the economic significance was weak. Michaely & Shaw (1994) did not find support for signaling hypotheses in IPO underpricing. According to earlier literature signaling hypotheses should be considered to be one factor explaining underpricing, but it should be considered in addition to other variables.

Ritter & Welch (2002) argue that academic literature is overemphasizing information asymmetric theories in IPO underpricing and theories of asymmetric information are unlikely to be able to solely explain high initial returns. They argue that future research should concentrate more on agency problems, share allocation issues and behavioral explanations.

As stated above prior literature has identified asymmetric information to be a crucial factor explaining underpricing. Asymmetric information affecting IPO underpricing has been

widely studied and the issue has been approached from many different perspectives. Baron (1982) assumed that underwriter is better informed than the issuer leading to a principal-agent problem. Welch (1989) argue that issuer itself is better informed about its true value and uses underpricing to signal the quality for the markets. Rock (1986) assumes that some groups of investors are better informed than others resulting in participation discrimination. Finally, Benveniste & Spindt (1989) argue that companies underprice their IPOs to reward investors who truthfully reveal their information prior to the issue. It is hard to make a universal conclusion that combines all these assumptions. For example, Ritter & Welch (2002) argue that theories based on asymmetric information are not solely explaining high initial returns and future research should concentrate more on share allocation and behavioral explanations.

2.2.2 Institutional explanations

Institutional explanations of IPO underpricing contain models relating to the risk of legal actions, price stabilization activities and explanations relating to ownership and control. Academics have found out that firms underprice their IPOs to avoid potential legal activities of issuers and their agents (e.g. Tinic, 1988). The low threshold for legal activities in the U.S. has led to cautious pricing of IPOs. Although avoidance of legal activities is mainly issue in the U.S. it may have secondary effects also in other markets (Ljungqvist, 2007). Tinic (1988) studied underpricing as an insurance against potential legal activities. In 1933 the U.S. introduced a new legislation that protects investors and allows them to sue practically every person that is associated with the offering if the information about the issue is misleading. Tinic (1988) tested the legal liability hypothesis before and after the Securities Act of 1933. The empirical findings supported legal liability hypotheses. The initial excess returns after Securities Act were larger compared to the offerings issued before the new legislation. According to Tinic (1998) underpricing is an efficient form of insurance against potential legal activities.

Hughes & Thakor (1992) also examined IPO underpricing and the litigation risk. They argue that Tinic's (1988) model did not take time variations into account and thus the results are inconsistent. According to Hughes & Thakor (1992) litigation risk becomes irrelevant when time consistency problem is considered. They developed a richer litigation model explaining underpricing. According to their results the IPO pricing decision trades off between current

proceeds and future cost occurring from litigation and there is a link between litigation risk and underpricing. Underpricing has been recognized in countries where litigation risk is not a factor and thus litigation risk should not be considered as a sole factor of underpricing.

Drake & Vetsuypens (1993) argue that underpricing is not an efficient way to avoid potential legal activities. They studied 93 IPOs during 1969-1990 of companies that were sued based on Securities Act of 1933. According to Drake & Vetsuypens (1993) the companies are typically sued months or years after the offering and the legal activities are driven by large aftermarket drops long after IPO. IPOs of companies that were sued were on average as underpriced as IPOs of companies that were not sued. Drake & Vetsuypens (1993) also argue that Tinic (1988) did not justify his choice of post Securities Act period. Considering the period six years after Tinic's (1988) post act period the average underpricing was less than one percent. According to these results underpricing is not an efficient practice to avoid potential lawsuits.

In more recent literature Lowry & Shu (2002) found out that firms going public try to prevent potential lawsuits by underpricing their offerings. They argue that underpricing can be seen as a cost-effective form of insurance because it lowers the possibility of legal activities. The problem is approached by assuming that companies choose the level of underpricing based on the probability of future lawsuits. They found out that firms that have higher possibility to be sued are more likely to underprice their offerings. Other way around underpricing also reduces the risk of litigation.

Ruud (1993) questions the findings that higher initial returns of IPOs are caused by inefficient pricing of the offering. She argues that IPOs might be priced according to the true market value of the company and the higher initial returns are due to the price support of the underwriting company. Benveniste, Busaba & Wilhelm (1996) also studied the price support and underwriter's role as an intermediary in the IPO. Underwriters information acquisition causes information asymmetric and underwriters might use this information for their own interest. Price stabilization can be used to reduce different interests between issuer and underwriter. Price stabilization is highly costly for the underwriter if the offering price exceeds the true market value. Therefore, Benveniste et al. (1996) suggest that price stabilization is an effective method for the issuer to ensure underwriters interests.

Asquith, Jones & Kieschnick (1998) examined the issue of underpricing and price stabilization and they assumed that early IPO returns are better described using mixture of price-stabilized and underpriced distributions. They found out that price supported distribution has average mean return close to zero and the mean underpricing of unsupported firms is about 18 percent. These results suggest that underpricing is caused by factors other than price support. Asquith et al. (1998) argue that IPO returns are also better modeled for up to four weeks after offering indicating that price supporting activities last for up to four weeks. The findings that underpricing is better modeled using mixture of two or more distributions questions the results of earlier literature about IPO underpricing. Asquith et al. (1998) argue that earlier regression analyses should have account for the heterogeneity in the models. To illustrate this finding, they measured the effect of price uncertainty on IPO returns and found out that uncertainty increases underpricing, but the economic effect is much greater than previously argued.

Brennan & Franks (1997) examined how IPOs influence in separation of ownership and control of the issuing company. They studied how underpricing can be used to retain control of the company. Underpriced offerings are more interesting in the investor point of view and the issuing companies tend to underprice their initial offerings to ensure the oversubscription. Oversubscription allows the company to allocate the shares according to their interest and to prevent the situation where some investors own big part of shares. The discrimination is used to allocate the shares for small investors. According to Brennan & Franks (1997) the size of underpricing is negatively correlated with large blocks of shares and managers try to maximize their benefits by holding on to their control of the company.

In contrast with Brennan & Franks (1997), Stoughton & Zechner (1998) argue that the share allocation to large investors should be positively correlated with underpricing. Large investors are more capable in monitoring the management of the company. After all the owners of the company bear the costs associated with the agency problem. The issuers might allocate large proportions of shares for large investors in order to ensure well-functioning monitoring. According to Stoughton & Zechner (1998) this is why companies try to attract large investors that take part in monitoring activities by underpricing their offering. They

also argue that underpricing should be larger in case of companies that have high benefit-to-cost ratios of monitoring.

2.2.3   Behavioral explanations

According to Ritter & Welch (2002) it is unlikely that asymmetric information could explain average first day returns of 65% during the Internet bubble in the late 1990s. They argue that one reason for such high initial returns could be related to behavioral explanations. Behavioral approaches for IPO underpricing concentrate in explaining high initial returns by irrational behavior of investors or issuers.

Sequential sales of IPOs allow the investors to learn from the investment decisions of earlier investors. Welch (1992) introduced the theory of cascades in IPO underpricing. Basic assumption behind the theory is that investors make their investment decision based on purchasing decisions of earlier investors. According to Welch (1992) when IPOs are offered sequentially the investors are able to utilize earlier information about the pricing of the offering and when the investors are following others the demand for the offering is either very low or very high. Welch (1992) argues that investors tend to invest only when they assume that the issue is hot. This leads to situation where even risk-neutral issuers tend to underprice their offering to prevent failure. Theory suggests that underpricing is used to ensure high demand for the offering and thus ensure the success of the offering. To avoid the information flow between investors underwriter might expand the offering to more segmented market. Nationwide investors are less likely to share their information with others. Theory of cascades also criticizes the applicability of Rock's (1986) winner's curse. Welch (1992) argues that when IPOs are sold sequentially the issuer sets the price based on previous offerings. Amihud, Hauser & Kirsh (2003) tested the theory of information cascades in Tel Aviv Stock Exchange. Allocations to IPO subscribers exhibit convex pattern indicating that investors subscribe either overwhelmingly or the subscription is very low. These results presented by Amihud et al. (2003) support theory of information cascades.

Ljungqvist, Nanda & Singh (2006) studied the issuing company's reactions when sentiment investors are attending the markets. These irrational investors invest in intuition and they have optimistic beliefs about performance of issuing company. They argue that issuing company should try to take advantage of the presence of sentiment investors as much as

possible. This means maximizing the valuation of stocks. Ljungqvist et al. (2006) argue that high supply of the shares will depress the price so issuing company may hold part of the stocks to prevent the prices from falling. Regulations concerning price discrimination prevent the company from directly holding some of the shares. Therefore, Ljungqvist et al. (2006) suggest that the issuing company should delegate the task of holding the share for institutional or other rational investors and these investors will subsequently sell the shares for sentiment investors. According to Ljungqvist et al. (2006) keeping the stocks in the inventory is risky because sentiment investors might change their opinion about the company. To compensate this risk the shares should be underpriced. Offer price still exceeds the fundamental value and the issuer will benefit from these arrangements.

Loughran & Ritter (2002) presented prospect theory explaining IPO underpricing. They argue that issuers do not get upset about leaving money on the table. The model assumes that issuers care more about the change in their wealth than the level of wealth. According to Loughran & Ritter (2002) the wealth loss caused by underpricing will be compensated by price increase of retained shares in the aftermarket. Most of the IPOs that leave substantial amounts of money on the table are those where offer price and market prices are higher than had been assumed. When realizing the real value of the company, the issuer is left happy even though large amount of money is left on the table. Prospect theory is a complementary theory explaining underpricing and it should be considered in addition to other theoretical frameworks.

Ljungqvist & Wilhelm (2005) studied further behavioral approach in IPO underpricing. By utilizing the arguments presented by Loughran & Ritter (2002) they developed a behavioral proxy measuring issuers satisfaction with underwriter's performance. After this they examined how does the IPO performance affect the decision of underwriter in subsequent securities offering. Ljungqvist & Wilhelm (2005) argue that if company's decision makers are dissatisfied with the performance of IPO, they are more likely to switch underwriter in their seasoned equity offerings.

2.3   Fluctuations in IPO volumes and underpricing

The volume of initial public offerings has varied substantially over time. Ibbotson & Jaffe (1975) studied the concept of "hot issue markets" and focused on prediction of these markets.

Hot issues refer to stock issues that yield higher than average premia in the aftermarket. Ibbotson & Jaffe (1975) found out that relation between new issue performance and the performance of other new issues in previous calendar months exhibit strong serial dependency. These findings indicate that the hot issue markets can be predicted. Based on these findings the investors are able to predict profitable issues and concentrate their investments in months that returns are expected to be higher. Issuers are also able to benefit from the predictability of hot issue markets. Ibbotson & Jaffe (1975) suggest that issuers should time their issues to cold issue markets. Timing of an issue in cold markets allow the issuer to obtain higher offering price.

Lowry and Schwert (2002) studied the reasons behind IPO cycles. They argue that the underwriters do not fully incorporate all the information when they are setting the offer price. This is why there is a relation between initial returns and IPO volumes. According to Lowry & Schwert (2002) more companies go public after periods of high initial returns. The pricing of prior IPOs contain information about market valuation and positive information is positively related to the IPO volume in the future. During the registration process the value of the issuing company becomes available for other companies and this valuation influences future offering decisions and pricing decisions of other companies. In addition, they found that similar type of companies go public at the same time.

Lowry (2003) went deeper into the reasons behind fluctuation of IPO volume. He tested the effects of capital demand, adverse selection costs and the level of investor optimism in fluctuation of IPO volumes. The findings suggest that higher demand of capital and investor sentiment have positive impact on the volume of IPOs. Capital demand of the company and investor sentiment affect significantly the fluctuations of IPOs. According to Lowry (2003) adverse selection costs are also important factors in explaining IPO volumes. Lower adverse selection costs are associated with higher number of IPOs.

Pastor & Veronesi (2005) explored the effects of market conditions into IPO volume and according to their findings IPO volumes are highly dependent on the market conditions. Weakening market conditions are followed by lower number of IPOs. Pastor & Veronesi (2005) argue that during weak market conditions the stock prices drop, and the companies decide to wait for more favorable market conditions. High market returns are usually

followed by higher number of IPOs and the volume of IPOs decline when market returns decline. According to Pastor & Veronesi (2005) decrease in expected market return, increase in expected profitability and uncertainty about future profitability are the main drivers of fluctuations in IPO volumes.

2.4   European IPO markets

Because the focus of this study is in European IPO markets it is important to go through the characteristics of the IPO markets in Europe. Since most of the IPO studies are conducted in the U.S. it is also important to clarify the differences between IPO markets in Europe and the United States.

Europe consists of several different capital markets. Different countries have their own characteristics and the IPO activity in these countries vary significantly. Röell (1996) documented that the propensity of the use of public financing in Europe shows great diversity. The ratio of total listed equity to GDP in Europe ranges between 17% and 125% depending on the country. Bancel & Mittoo (2009) studied the reasons why European companies decide to go public. They argue that European companies decide to go public for several different reasons and the reasons are dependent on the company characteristics, country where the IPO is issued and legal systems. The identified reasons why European companies go public were increasing publicity, seeking of growth, financial flexibility and external monitoring.

According to Gajewski & Greese (2006) listing requirements in European stock markets show a great diversity between different countries. Some exchanges have very strict size requirements for companies going public and vice versa some exchanges approve companies with lower market capitalization. When considering European exchanges an appropriate consensus threshold of market capitalization requirement varies from one to five million euros (Gajewski & Greese, 2006). In 2005 all the exchanges regulated by Euronext merged into a single list. This reformation reduced the diversity of exchanges and improved international integration. Especially the high size requirements existing in France and Belgium were removed.

When examining the IPO mechanisms in Europe almost always the issuer authorizes investment bank to control the pricing of the IPO and allocation of shares. Investment banks control the initial pricing and allocation of new issues. According to Gajewski & Greese (2006) Euronext Paris and Istanbul Stock Exchange are exceptions. They use exchange-run fixed-price and tender offer mechanisms. Book-building is the most common IPO mechanism in Europe (Gajewski & Greese, 2006).

Short-term and long-term performance of IPOs in Europe shows patterns, but the patterns also differ between countries. Gajewski & Greese (2006) documented that between 1995 and 2004 IPOs were underpriced in all countries but the level of underpricing varies. Underpricing was highest in Germany, Greece and Finland. Level of underpricing is also dependent on the market cycles. During hot market period of 1998-2000 underpricing increased substantially and then fell during the cold market period. Gajewski & Greese (2006) argue that the underpricing also varies between industries. Underpricing is highest in new technology industry. According to Gajewski & Greese (2006) IPO mechanism also affects the level of underpricing. Offerings that are issued using book-building mechanism tend to be more underpriced.

Akyol et al. (2014) argue that the changes in regulatory environment have an impact on the degree of IPO underpricing. The regulation improves the transparency and increases the amount of information related to the IPO. The regulation results in lower ex-ante uncertainty and information asymmetric. According to Akyol et al. (2014) the adoption of corporate governance codes in Europe has reduced the information asymmetric and reduced the level of IPO underpricing. The countries in Europe have different legal systems. La Porta et al. (1998) examined how different legal systems affect the corporate finance in different countries. The laws vary in different countries and the variation is mainly caused by the legal origin of the country. Laws can be divided into two broad categories which are common law and civil law. La Porta et al. (1998) divided the legal origins in four legal origins: English common-law origin, French civil-law origin, German civil-law origin and Scandinavian civil-law origin. They found out that investor protection is strongest in common-law countries. French civil-law countries have the weakest legal protection of investors. The investor protection in German- and Scandinavian civil-law countries is in the middle. According to La Porta et al. (1998) investor protection increases the concentration of

ownership because laws are unable to protect small shareholder. In French-civil law countries ownership is extremely concentrated because of the weak investor protection.

Because most of the IPO theories are formed and tested based on the U.S. IPO market it is reasonable to compare the IPO markets between the U.S. and Europe. Ritter (2003) examined the differences between European and the U.S. IPO markets. In the United States, issuing company is subject to a "quiet period". During this period the analysts that are affiliated with the underwriters are not allowed to release analyst reports or recommendations. This period starts at the day when the company decides to go public and it ends 40 days after the issue. In Europe this "quiet period" is not applied. According to Ritter (2003) another important difference between European and the U.S. IPO markets relates to the legal actions. In the U.S. the low threshold of legal activities exposes the issuing company for litigation risk while in Europe these legal activities are rare.

According to Jenkinson et al. (2006) the IPO process is also different between Europe and the U.S. Different characteristics of IPO process result in variations in information exchange between investors and issuers. The securities laws in Europe allow information exchange between investors and underwriters before the book-building process. Unlike in the U.S. the underwriters in Europe gather information from investors before setting up the indicative price range. Jenkinson et al. (2006) argue that the information acquisition before the book-building period should result in more accurate indicative price range and the price range is seldomly revised. In the U.S. the final offer prices are more frequently revised compared to Europe. According to Bancel & Mittoo (2009) there are also similarities and differences between European and the U.S. companies in the decision of going public. Both European and the U.S. companies consider growth and future merger and acquisition possibilities as benefits of going public. In Europe the monitoring and increase in transparency is considered as a benefit of going public but in the U.S. these issues are treated as costs of going public.

3 DATA AND METHODOLOGY

The empirical part of this thesis studies the current situation of IPO underpricing in Europe. The purpose is to find out if European IPOs are underpriced and what are the determinants of IPO underpricing. Based on the identified determinants the reasons for underpricing are discussed. As presented in the literature review the theoretical framework of IPO underpricing is manifold. Majority of the prior literature has explained underpricing with information-based models. The models concentrating in asymmetric information have received the most empirical support. The empirical research for this study is designed so that it concentrates mainly in the information frictions explaining IPO underpricing. First, the data used in this thesis is presented. In the second part the methodologies for this study are presented.

3.1 Data

The data and the data collection process for this research is presented in the following part. First, the general data collection process is described. Second, the proxies for underpricing are described in detail. In the last section of this part the construction of different variables that were used to study the determinants of underpricing are presented. The descriptive statistics of the whole dataset are presented in appendix 1 and the descriptive statistics of the sample used to study the determinants of underpricing are presented in table 3.

All the IPOs, after issue share price data and data for different determinants are collected from Thomson One database (Thomson One, 2018). Time frame for this study is from 2009 to 2017. This time period is chosen for two reasons. First, the objective of this thesis is to study underpricing and the reasons of underpricing as timely as possible. Second, the period of financial crisis is excluded from the study even though its effects might extend to the study period. The weak market conditions during the financial crisis would certainly distort the results and thus it is excluded from this study.

To start with, the full sample of European common stock IPOs between 2009 and 2017 is collected. Initial dataset contains 1830 European common stock IPOs between 2009 and 2017. After this the dataset is modified further using common data filters used in prior literature. In most of the prior studies IPOs with low offer prices are dropped off (eg. Butler

et al. 2014, Lowry & Schwert 2004, Michaely & Shaw 1994). Thus, all the IPOs with offer price less than 3 dollars are excluded leading to a dataset of 986 IPOs. Dollar denominated values are used because some of the data for different variables was available only in dollar values. Dollar values are also used in study variables. Studies concentrating in IPO underpricing require availability of after IPO share price data. Because of the limited availability of share price data after offering the dataset had to be modified further. All the IPOs where share price data on the first day after offering and share price one week after offering was not available were excluded leading to a dataset of 678 IPOs. The main focus of this thesis is to study the determinants and reasons of underpricing and thus the dataset had to be filtered based on the data availability of different variables used to study the determinants of underpricing. All the IPOs where data for different determinants was missing were excluded and the final data sample contains 167 IPOs from 18 different European countries and from 12 different industries. This sample is used to study the determinants of IPO underpricing in Europe and the main analysis is conducted based on this sample. The industry classification used in this study is Thomson Reuter´s macro-level industry classification (Thomson One, 2018) which comprises total of 14 industry classifications. The detailed construction of different variables used to study the determinants of IPO underpricing is described in chapter 3.1.2.

The IPO sample which is used to study the determinants of IPO underpricing is also divided into four sub-samples based on institutional characteristics and legal origin of the country where the IPO is issued. First, the dataset is divided into Nordic and Non-Nordic samples. Capital markets in the Nordics are similar and the legal systems in Nordic countries are very close to each other. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs from all the rest of the countries are in Non-Nordic sample. Second, the dataset is divided based on legal origin of countries. La Porta et al. (1998) identified four different legal families: English common-law origin, French civil-law origin, German civil-law origin and Scandinavian civil-law origin. Investor protection is weakest in French civil-law countries leading to a situation where corporate ownership is highly concentrated. Based on these arguments, the dataset in this study is divided into two samples based on legal origin of countries. First sample contains IPOs from French legal origin countries where investor protection is weakest. Second sample contains IPOs from English-, German-, and

Scandinavian legal origin countries. The countries in different samples are presented below in table 1 and in the next section the proxies of underpricing are presented.

Table 1. European countries in different IPO samples

Whole Sample	Nordic Sample	Non-Nordic Sample	French Legal Origin Sample	English-, German-, and Scandinavian Legal Origin Sample
Belgium	Finland	Belgium	Belgium	Denmark
Denmark	Sweden	France	France	Finland
Finland	Norway	Germany	Italy	Germany
France	Denmark	Gibraltar	Luxembourg	Gibraltar
Germany		Italy	Malta	Norway
Gibraltar		Luxembourg	Netherlands	Sweden
Italy		Malta	Poland	Switzerland
Luxembourg		Netherlands	Spain	United Kingdom
Malta		Poland	Turkey	
Netherlands		Spain	Ukraine	
Norway		Switzerland		
Poland		Turkey		
Spain		Ukraine		
Sweden		United Kingdom		
Switzerland				
Turkey				
Ukraine				
United Kingdom				

3.1.1 Measures of underpricing

Most commonly the underpricing is measured as a difference between offer price and the first trading day closing price. If the share price jumps substantially on the first day of trading the IPO is considered to be underpriced. In well-developed capital markets the share price adjusts to its real value fairly quick and the underpricing is evident by the end of the first trading day (Ljungqvist, 2007). Underpricing can be also measured as the amount of money left on the table. This measures how much the company loses money if the share price jumps straight after offering. The most common measure of underpricing used by prior literature is the first trading day return after offering which is also used in this study. The formula for initial return on the first trade day after offering is presented below.

$$IR_1 = \frac{p_t - p_{t-1}}{p_{t-1}} \qquad (1)$$

IR_1= first day return

p_t= share price at the close of first day of trading

p_{t-1}= offer price

European capital markets are different from each other. In less developed markets it might take some time until the underpricing is evident. For example, in Athens Stock Exchange daily volatility limits distort the measures of underpricing (Ljungqvist, 2007). In this case underpricing should be measured over longer time window. This research contains IPOs from different markets and some of the markets are less developed. Therefore, underpricing is also measured as first week return after offering. First week of trading contains five trading days. The formula for first week return is presented below.

$$IR_2 = \frac{p_t - p_{t-1}}{p_{t-1}} \tag{2}$$

IR_2= first week return

p_t= share closing price after the first week of trading

p_{t-1}= offer price

3.1.2 Identification of study variables

The independent variables for this study were chosen based on prior theories and empirical literature about reasons of IPO underpricing. Majority of the prior literature has explained underpricing with information-based models and these models have also received most empirical support. Thus, the variables used in this study are also related to information frictions explaining IPO underpricing. Determinants that were chosen for this study concentrate on information-based theories. In total 11 variables were constructed. The variables and detailed descriptions are presented below. The summary of independent variables and abbreviations that are used in the empirical section are presented in table 2 and the descriptive statistics of the variables are presented in table 3.

Table 2. Independent variables and abbreviations

Variables	Abbreviation
Average first day return of 10 prior IPOs on the same industry	AvgFirstDayPriorIPOs
Average first week return of 10 prior IPOs on the same industry	AvgFirstWeekPriorIPOs
Average daily return of the market index during 30-day period before the offering	AvgDailyMktInd
Standard deviation of daily market index returns during 30-day period before offering	SdDailyMktInd
Average weekly return of the market index during 30-day period before the offering	AvgWeeklyMktInd
Standard deviation of weekly market index returns during 30-day period before offering	SdWeeklyMktInd
Ln of firm sales	LnSales
Change in EBIT from 1 year prior to IPO to 1year after IPO	ChangeEBIT
Ln of uses of proceeds listed	LnUsesProceeds
Offer price revision dummy	OfferPR
Number of IPO shares per bookrunner	SharesPerBookrunner

Average first day return of 10 prior IPOs on the same industry:

Ibbotson & Jaffe (1975) found a strong serial dependency between new issue performance and performance of other issues in previous calendar month. This finding is also supported by Bradley & Jordan (2002) who found out that the underpricing of new issue is positively related to initial returns of other IPOs before the offering. Based on these findings the average first day return of 10 prior IPOs on the same industry is used in this study to explain IPO underpricing. The first day return is calculated as a difference between offer price and first trading day closing price and the returns are calculated for each IPO. Average returns are calculated arithmetically. Based on the first day returns average first day return of 10 prior IPOs on the same industry is calculated for each IPO. This variable is used in models where underpricing is measured as first day return after offering.

Average first week return of 10 prior IPOs on the same industry: As mentioned above, prior literature has found serial dependency between performance of new issues and performance of other issues before the IPO (Ibbotson & Jaffe, 1975; Bradley & Jordan, 2002). Since underpricing is also measured as first week return after offering, the performance of prior IPOs is also measured as average first week returns of 10 prior IPOs on the same industry. The first week return is calculated as a difference between offer price and first trading week closing price and the returns are calculated for each IPO and the

average returns are calculated arithmetically. This variable is used in models where underpricing is measured as first week return.

Average daily return of the market index during 30-day period before the offering: Market conditions have been found out to be affecting the level of underpricing. Prior literature argues that there is a significant relation between market index returns before offering and initial returns of the IPO. Level of underpricing increases during bull market conditions (Loughran & Ritter, 2002; Lowry & Schwert, 2004; Lowry & Murphy, 2007). Since this study focuses on European IPOs the market index data was collected for each market individually. Average 30-day returns are calculated arithmetically using daily price data and the returns are matched with the IPO according to the date and country of the issue. This variable is used in models where underpricing is measured as first day return after offering.

Standard deviation of daily market index returns during the 30-day period before the offering: The uncertainty in overall market conditions is affecting the level of underpricing. More volatile market conditions increase the uncertainty related to the valuation of issuing company and thus lead to higher degree of underpricing (Lowry et al. 2010). For calculations of standard deviation, daily market index price data was obtained for each country in the study. The calculated standard deviation during the 30-day period before the IPO is matched with the IPO according to the date and country of issue. This variable is used in models where underpricing is measured as first day return after offering.

Average weekly return of the market index during 30-day period before the offering: Since the underpricing is also measured as first week return after offering, the average market index returns are also calculated using weekly market index price data. Market indices are collected for each individual country separately and average returns are calculated arithmetically. This variable is used in models that measure underpricing as first week return after offering.

Standard deviation of weekly market index returns during the 30-day period before the offering: Since underpricing is also measured as first week return, the standard deviation

of market index returns is also calculated based on weekly market index prices. This variable is used in models where first week return after offering is used as a measure of underpricing.

Ln of firm sales: IPOs of smaller companies can be considered to be more uncertain. Uncertainty increases the degree of underpricing (eg. Beatty and Ritter, 1986). Issuing company´s sales is a variable related to the size of the company. Variable is natural logarithm of total revenue of issuing company for the latest 12-month period before the offering.

Change in EBIT from one year before IPO to one year after IPO: According to signaling theory in IPO underpricing companies that have favorable outlook on their performance are likely to signal it by underpricing their initial offerings (Welch, 1989; Allen & Faulhaber 1989). However, prior literature also argues against signaling theory in IPO underpricing. Michaely & Shaw (1994) found that the IPOs of companies with higher earnings after the offering are substantially less underpriced. In this thesis the earnings before interest and taxes (EBIT) is used to test the signaling hypothesis. EBIT for the 12-month period before the offering and EBIT for the 12-month period after offering are obtained from Thomson One (Thomson One, 2018) and based on these values the change in EBIT from one year before IPO to one year after IPO is calculated.

Ln of the uses of proceeds listed: The use of proceeds is a proxy for ex-ante uncertainty related to asymmetric information. Issues that have greater number of the uses of proceeds listed tend to have greater ex ante uncertainty (Beatty & Ritter, 1986). Uncertainty prior to the IPO increases the level of underpricing. Thomson One provides list of descriptions for the uses of IPO proceeds and the number of uses listed is calculated based on these descriptions. The number of uses listed is calculated for each IPO.

Offer price revision dummy: According to Benveniste & Spindt (1989) the information revelation by regular investors in pre-issue information gathering activities is rewarded by an increase in underpricing. Strong pre-market demand of the IPO results in a pricing at the higher end of the filing range. These IPOs normally show substantially higher first day returns. Positive revisions in the offer price results in higher underpricing (Hanley, 1993). The determinant of offer price revision is related to information revelation and its influence in underpricing. Offer price revision is the difference between final offer price and original

middle of filing price range. The variable gets value 1 if positive revisions are done in the final offer price and 0 otherwise. The final offer price was revised upwards in 41% of the IPOs used in this study and the final offer price was lower compared to the middle of filing price range in 59% of the IPOs. The sample used in this study contains no IPOs where final offer price is equal to the original middle of filing price range.

Number of IPO shares per bookrunner: Aggarwal et al. (2002) found negative relationship between number of IPO shares and first day returns meaning that first day returns are higher when the number of shares offered is lower. Smaller offerings are considered riskier and thus tend to be more underpriced than larger offerings. In addition, Corvin & Schultz (2005) argue that larger syndicates of underwriters are able to produce more reliable information. According to Corwin & Schultz (2005) larger syndicates of co-managers reduce the underpricing. Thomson One provides data for the number of bookrunners in the offering and it counts managers that have bookrunner responsibilities (Thomson One, 2018). The manager functions are shared between the number of bookrunners. This study combines these two variables and uses the ratio of number of IPO share per bookrunner as a proxy of information asymmetry. Since larger syndicates of bookrunners are able to produce more reliable information, it is reasonable to assume that underpricing decreases when number of IPO shares per bookrunner is smaller.

Table 3. Descriptive statistics of study variables

	Observations	Mean	Median	Standard deviation	Max	Min	Low Quartile	High Quartile
First day return	167	0.061	0.022	0.124	0.616	-0.244	-0.016	0.110
First week return	167	0.055	0.013	0.195	1.737	-0.317	-0.034	0.096
AvgFirstDayPriorIPOs	167	0.054	0.048	0.053	0.265	-0.073	0.023	0.076
AvgFirstWeekPriorIPOs	167	0.054	0.055	0.061	0.280	-0.096	0.017	0.083
AvgDailyMktInd	167	0.000	0.000	0.002	0.005	-0.006	0.000	0.001
SdDailyMktInd	167	0.010	0.009	0.005	0.032	0.004	0.007	0.011
AvgWeeklyMktInd	167	0.002	0.003	0.007	0.022	-0.018	-0.002	0.007
SdWeeklyMktInd	167	0.020	0.018	0.009	0.064	0.007	0.014	0.024
LnSales	167	4.301	4.398	2.339	10.404	-2.303	2.791	6.052
ChangeEBIT	167	-0.253	-0.036	1.502	5.330	-7.133	-0.248	0.174
LnUsesProceeds	167	0.660	0.693	0.497	1.792	0.000	0.000	1.099
OfferPR	167	0.413	0.000	0.494	1.000	0.000	0.000	1.000
SharesPerBookrunner	167	12191949	5300000	44565938	554000001	1000	1291250	11933333

3.2 Methodology

In this section the methodology for the empirical part is presented. Majority of prior literature studying the reasons for IPO underpricing have utilized regression models in their empirical tests (eg. Loughran & Ritter, 2004; Hanley, 1993; Michaely & Shaw, 1994). In the first part, the theory of multivariate regression is discussed and the regression models for this study are presented in the second part.

3.2.1 Multivariate linear regression

Regression analysis is used to capture the dependency between the dependent variable and explanatory variables. The objective is to estimate the mean or average value of the dependent variable using fixed values of explanatory variables. When an economic model has more than one dependent variable it is called multivariate regression model. The most commonly used estimation method for regression model is ordinary least squares (OLS). In OLS method the line is fitted to the data based on the sum of the squares of the vertical distance from each data point to the line (Hill, Griffiths & Lim, 2011, 49-53). The objective is to minimize the sum of the squares. The multivariate regression equation is in form:

$$Y = \alpha + \beta_1 x_1 + \cdots + B_n x_n + e \qquad (3)$$

where Y is the dependent variable, α is the intercept, B_n is the regression coefficient of variable x_n, x_n is the independent variable and e is the error term. The assumptions underlying the classical linear regression model according to Brooks (2008, 129-130) are presented in table 4.

Table 4. Linear regression assumptions (Adapted from Brooks, 2008, 129-130)

Assumption	Description
1) $E(u_t) = 0$	*The average value of the errors is zero.*
2) $\text{var}(u_t) = \sigma^2 < \infty$	*The variance of the errors is constant. This assumption is also known as assumption of homoskedasticity.*
3) $\text{cov}(u_i, u_j) = 0$	*Covariance between the error terms over time or cross-sectionally is zero.*
4) $\text{cov}(u_t, x_t) = 0$	*The disturbance u and explanatory variable x are not correlated.*
5) $u_t \sim N(0, \sigma^2))$	*The disturbances are normally distributed.*

If assumptions 1-4 hold the OLS estimator is consistent, unbiased and efficient. Under these four assumptions the estimators determined by OLS are said to be Best Linear Unbiased Estimators (Brooks, 2008, 44-45).

One of the assumptions in classical linear regression model is that there is no multicollinearity among regressors. In other words, the correlation among regressors should not be too high. According to Gujarati (2003, 359) if the correlation coefficient between regressors is higher than 0.8 the multicollinearity is a serious problem. In order to avoid the problem of multicollinearity the Pearson correlation table is formed for explanatory variables. Variables AvgFirstDayPriorIPOs, AvgDailyMktInd and SdDailyMktInd are used in different models with AvgFirstWeekPriorIPOs, AvgWeeklyMktInd and SdWeeklyMktInd so correlation between these variables is not a problem. Correlation table is presented in table 5.

Table 5. Correlation table of independent variables

The abbreviations of study variables are described in section 3.1.2.

	AvgFirstDay PriorIPOs	AvgFirstWeek PriorIPOs	AvgDaily MktInd	SdDaily MktInd	AvgWeekly MktInd	SdWeeklyM ktInd	LnSales	ChangeE BIT	LnUsesProcee ds	OfferPR	SharesPerB ookrunner
AvgFirstDayPriorIPOs	1.000										
AvgFirstWeekPriorIPOs	0.877	1.000									
AvgDailyMktInd	0.063	0.015	1.000								
SdDailyMktInd	-0.171	-0.061	-0.210	1.000							
AvgWeeklyMktInd	0.058	0.001	0.931	-0.262	1.000						
SdWeeklyMktInd	-0.164	-0.094	-0.215	0.916	-0.227	1.000					
LnSales	0.102	0.055	-0.046	-0.027	-0.010	-0.020	1.000				
ChangeEBIT	-0.064	-0.046	-0.050	-0.081	-0.001	-0.097	0.143	1.000			
LnUsesProceeds	0.165	0.160	-0.059	-0.088	-0.090	-0.041	0.121	0.065	1.000		
OfferPR	-0.032	-0.010	0.034	0.084	0.009	0.126	0.015	-0.120	-0.124	1.000	
SharesPerBookrunner	0.300	0.245	-0.016	-0.068	-0.019	-0.058	0.214	0.053	0.132	0.080	1.000

Presence of heteroskedasticity in linear models lead to inefficient parameter estimates. As a result, incorrect conclusions are drawn when testing hypotheses (White, 1980). The solution for dealing with heteroskedasticity in multivariate linear regression models is to use heteroskedasticity-consistent standard errors suggested by White (1980). White's standard errors avoid incorrect estimates and values for test statistics in presence of heteroskedasticity (Hill et al. 2011, 309-310).

3.3 Regression models

Based on previously presented methodology the regression models for this study are formed. Regressions are estimated using heteroskedasticity-robust standard errors suggested by White (1980). The data sample contains IPOs from different European countries and the capital markets in these countries are different from each other. In well-developed countries the underpricing is evident shortly after the offering. In less developed countries it might take some time until the underpricing is evident and in these markets the underpricing should be measured over longer time window (Ljungqvist, 2007). Therefore, underpricing is measured both using first trading day return after offering and first week return. The determinants of IPO underpricing are studied in different sub-samples. First, the determinants are studied in the whole IPO sample. Second, the determinants of underpricing are studied in Nordic and Non-Nordic IPO samples. Third, the dataset is divided based on legal origin of the countries where the IPO is issued. The sample is divided into IPOs from

French legal origin countries and into sample containing IPOs from English, German- and Scandinavian legal origin countries. Detailed descriptions of the samples are presented in section 3.1. Regression models are estimated separately for each sample and the equations are presented below.

$$IR_1 = \alpha + \beta_1 AvgFirstDayPriorIPOs + \beta_2 AvgDailyMktInd$$
$$+ \beta_3 SdDailyMktInd + \beta_4 LnSales + \beta_5 ChangeEBIT$$
$$+ \beta_6 LnUsesProceeds + \beta_7 OfferPR$$
$$+ \beta_8 SharesPerBookrunners + e$$

(4)

Equation 4 models underpricing without time fixed effects. In the equation IR_1 is the first day return after offering and the explanatory variables are presented below in table 6.

$$IR_1 = \alpha + \beta_1 AvgFirstDayPriorIPOs + \beta_2 AvgDailyMktInd$$
$$+ \beta_3 SdDailyMktInd + \beta_4 LnSales + \beta_5 ChangeEBIT$$
$$+ \beta_6 LnUsesProceeds + \beta_7 OfferPR$$
$$+ \beta_8 SharesPerBookrunners + Year\ FE + e$$

(5)

Equation 5 models underpricing accounting for time fixed effects. In the equation IR_1 is the first day return after offering and the explanatory variables are presented in section below in table 6. Time dummies are added to the equation to account for the time fixed effects. One of the time dummies is omitted to avoid the perfect collinearity and dummy-variable-trap.

$$IR_2 = \alpha + \beta_1 AvgFirstWeekPriorIPOs + \beta_2 AvgWeeklyMktInd$$
$$+ \beta_3 SdWeeklyMktInd + \beta_4 LnSales$$
$$+ \beta_5 ChangeEBIT + \beta_6 LnUsesProceeds$$
$$+ \beta_7 OfferPR + \beta_8 SharesPerBookrunners + e$$

(6)

In equation 6, underpricing is measured as first week return after offering. Equation is estimated without time fixed effects. IR_2 is the first week return after offering and it contains five trading days. Explanatory variables are presented in table 6.

$$IR_2 = \alpha + \beta_1 AvgFirstWeekPriorIPOs + \beta_2 AvgWeeklyMktInd$$
$$+ \beta_3 SdWeeklyMktInd + \beta_4 LnSales$$
$$+ \beta_5 ChangeEBIT + \beta_6 LnUsesProceeds \qquad (7)$$
$$+ \beta_7 OfferPR + \beta_8 SharesPerBookrunners$$
$$+ Year\ FE + e$$

Equation 7 models underpricing accounting for time fixed effects. In the equation IR_2 is the first week return after offering and the time dummies are added to the equation to account for time fixed effects. Description of different determinants and expected signs are presented below in table 6. Variables AvgFirstDayPriorIPOs, AvgFirstWeekPriorIPOs AvgDailyMktInd, SdDailyMktInd, AvgWeeklyMktInd, SdWeeklyMktInd, OfferPR, LnUsesProceeds and SharesPerBookrunner are expected to have positive relation with initial returns meaning that increase of the value in these determinants would increase the level of underpricing. Variables LnSales and ChangeEBIT are expected to have negative impact on initial returns meaning that increase in the value of these determinants would result in lower level of underpricing.

Table 6. Explanatory variables and predicted relations to underpricing

Variables	Abbreviation	Used in equations	Expected sign	Source(s)
Average first day return of 10 prior IPOs on the same industry	AvgFirstDayPriorIPOs	4 and 5	(+)	Ibbotson & Jaffe, 1975 Bradley & Jordan, 2002
Average first week return of 10 prior IPOs on the same industry	AvgFirstWeekPriorIPOs	6 and 7	(+)	Ibbotson & Jaffe, 1975 Bradley & Jordan, 2002
Average daily return of the market index during 30-day period before the offering	AvgDailyMktInd	4 and 5	(+)	Loughran & Ritter, 2002 Lowry & Schwert, 2004 Lowry & Murphy, 2007
Standard deviation of daily market index returns during 30-day period before offering	SdDailyMktInd	4 and 5	(+)	Lowry et al. 2010
Average weekly return of the market index during 30-day period before the offering	AvgWeeklyMktInd	6 and 7	(+)	Loughran & Ritter, 2002 Lowry & Schwert, 2004 Lowry & Murphy, 2007
Standard deviation of weekly market index returns during 30-day period before offering	SdWeeklyMktInd	6 and 7	(+)	Lowry et al. 2010
Ln of firm sales	LnSales	4, 5, 6 and 7	(-)	Beatty & Ritter, 1986
Change in EBIT from 1 year before IPO to 1 year after IPO	ChangeEBIT	4, 5, 6 and 7	(-)	Michaely & Shaw, 1994
Ln of the uses of proceeds listed	LnUsesProceeds	4, 5, 6 and 7	(+)	Beatty & Ritter, 1986
Offer price revision dummy	OfferPR	4, 5, 6 and 7	(+)	Hanley, 1993
Number of IPO shares per bookrunner	SharesPerBookrunner	4, 5, 6 and 7	(+)	Aggarwall et al., 2002 Corwin & Schultz, 2005

4   RESULTS

The empirical findings of this thesis are presented in this chapter. In the first part, the IPO activity between 2009 and 2017 in the sample used in this study is presented. In the second part the underpricing results of European IPOs are presented. In the third part the results of multivariate regression models are presented, and determinants of IPO underpricing are identified. In the last section of this chapter the results are drawn together. The main analysis is conducted based on the sample of IPOs used to study the determinants of underpricing.

4.1   IPOs in Europe

Since the main objective of this thesis is to study the determinants of IPO underpricing the analysis is conducted using the data sample where data for all the variables used to study the determinants was available. To get better understanding of the IPO activity the wider data sample of IPOs is also presented, and the tables are presented in the appendices. This sample contains all the European IPOs with offer price greater than 3$ and the availability of after issue price data and the availability of different determinants is ignored. However, the main analysis is conducted using the sample with all the data available.

The number of IPOs and total proceeds raised by year of the sample with all the data available are presented in figure 2. This sample contains 167 European IPOs and these IPOs raised total proceeds of $37368m. The volume of IPOs varies between years measured both in terms of number of IPOs and total proceeds. Most IPOs were issued in 2015 when 42 IPOs raised total proceeds of $10049m. Lowest number of IPOs occurred in 2009 when 3 IPOs were issued, and they raised only $28m in proceeds. Between 2009 and 2015 there was a growing trend in the number of IPOs and total proceeds raised. Number of IPOs grew from 3 issues to 42 issues and the total proceeds grew from $28m to $10049m between 2009 and 2015. After 2015 the IPO activity started to decline and in 2017 total of 16 IPOs raised total proceeds of $1428m.
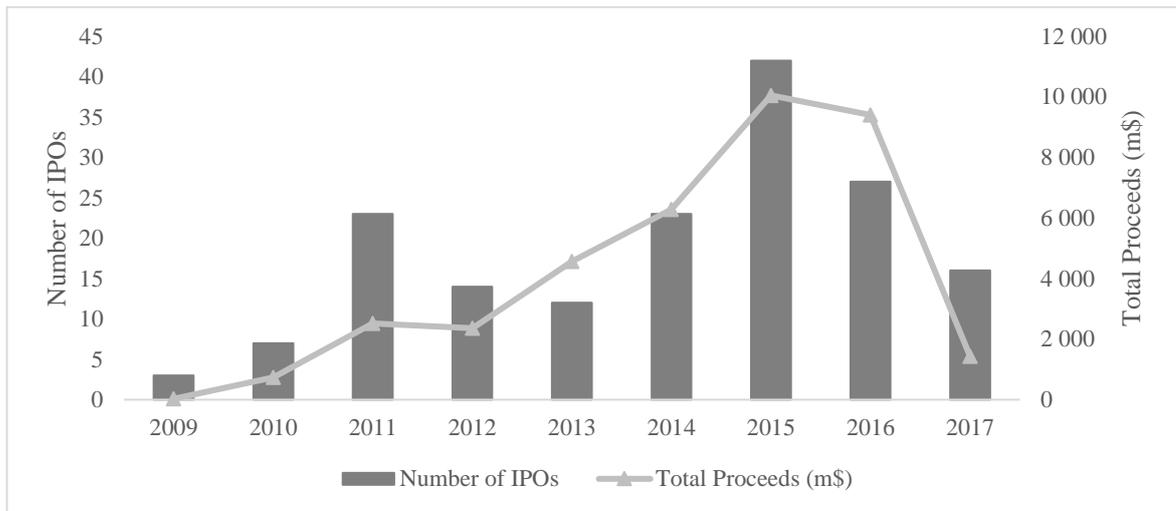
Figure 2. Number of IPOs and total proceeds by year

The volume of IPOs varies between 2009 and 2017 both in terms of number of IPOs and total proceeds. The results are in line with earlier literature of fluctuation of IPO volumes (eg. Ibbotson & Jaffe, 1975). The finding is also supported by the wider dataset presented in the appendix 2. Since the main objective is to study the determinants of IPO underpricing, more attention will be put to the narrower sample used to study the determinants. In 2009 the volume of IPOs is significantly lower compared to other years. After the period between 2009 and 2013 the volume started to increase reaching its peak in 2015. After 2015 the IPO activity started to decline. Earlier literature has found out that the market conditions are influencing to the volume of IPOs (Pastor & Veronesi, 2005). The lower volume at the beginning of the study period might be caused by the uncertainty of the market conditions after financial crisis. After the confidence to the market has revived, the volume of IPOs has increased.

This study focuses on the European IPOs. Different markets in Europe have their own characteristics. Thus, it is reasonable to compare the volume of IPOs between different countries. Total number of IPOs and total proceeds by country are presented in table 7. The volume of IPOs presented in table 7 contains the IPOs where data for all the determinants was available. This data sample comprises of 167 IPOs from 18 different countries and the sample is used to study the determinants of IPO underpricing. Again, the wider data sample of all the IPOs with offer price greater than 3$ is presented in the appendix 3 but the main focus is in the sample with all the data available.

As presented in table 7, the most IPOs in the sample were issued in Sweden in terms of number of IPOs. The number of IPOs in Sweden was 42 which is substantially higher compared to other countries. Even though the number of IPOs in Sweden was considerably higher compared to other countries the proceeds raised of Swedish IPOs were second highest being $6798m. The average proceeds per issue in Sweden were $162m which is below the average proceeds per issue in the whole sample. Measured in terms of total proceeds most IPOs were issued in the United Kingdom where 13 IPOs raised total proceeds of $7867m meaning that the issues in the United Kingdom were relatively large compared to other countries. Average proceeds per issue in the United Kingdom was $605m which is at the higher end in the whole sample. The sample contains also high number of IPOs from France. In France 32 IPOs were issued and these IPOs raised total proceeds of $2411m. Average proceeds per issue in France were $75m which is substantially lower compared to other countries indicating that the IPOs in France were relatively small. More than 10 IPOs were also issued in Germany and in Norway. In Germany 18 IPOs raised total proceeds of $3416m and in Norway 12 IPOs raised total proceeds of $2341m. In the rest of the markets the number of IPOs varies between 1 and 10 issues. Measured in average proceeds per issue Denmark differs from all the other markets. In Denmark 3 IPOs raised total proceeds of $3635m meaning that the average proceeds per issue were $1212m which is considerably higher compared to other markets.

Table 7. Number of IPOs and total proceeds by country

	Number of IPOs	Total Proceeds (m$)	Average proceeds per issue (m$)
Belgium	2	188	94
Denmark	3	3 635	1 212
Finland	10	1 304	130
France	32	2 411	75
Germany	18	3 416	190
Gibraltar	1	6	6
Italy	7	2 554	365
Luxembourg	1	314	314
Malta	1	101	101
Netherlands	5	3 078	616
Norway	12	2 341	195
Poland	9	1 142	127
Spain	1	107	107
Sweden	42	6 798	162
Switzerland	6	1 445	241
Turkey	3	611	204
Ukraine	1	50	50
United Kingdom	13	7 867	605
Total	**167**	**37 368**	**224**

In summary, the IPO activity varies between different countries. Measured in terms of number of issues most IPOs were issued in Sweden, France, Germany and United Kingdom. These markets were also active measured in total proceeds raised. In terms of total proceeds raised also Denmark can be considered in the group of high IPO volumes even though the number of issues in Denmark was only three. The findings are also supported by the data sample containing all the IPOs with offer price greater than 3$ presented in appendix 3. The most active IPO markets are similar in both data samples.

Number of IPOs and total proceeds by industry are presented in table 8. The industry classification used in this study is Thomson Reuter´s macro-level industry classification which comprises total of 14 industry classifications (Thomson One, 2018). The volume of IPOs presented in table 8 contains the IPOs where data for all the determinants was available. This data sample contains 167 IPOs from 12 different industries and the sample is used to study the determinants of IPO underpricing. Again, the wider data sample of all the IPOs

with offer price greater than 3$ is presented in the appendix 4 to get wider understanding of the IPO activity in different industries.

As presented in table 8 the sample used to study the determinants of IPO underpricing contains most IPOs from industrials industry where 28 IPOs raised $7577m in proceeds. Industrials industry was also most active measured in total proceeds. IPO activity in high technology, healthcare and consumer products and services industries was also relatively high compared to other industries. In high technology, healthcare and consumer products and services industries the number of IPOs was 22, 19 and 18, respectively. However, in healthcare industry the total proceeds were only $1469m resulting in average proceeds per issue of $77m which is clearly the lowest among different industries. Measured in terms of total proceeds raised the energy and power industry can be considered to be among the most active industries. In energy and power industry 12 IPOs raised total proceeds of $4722m and the average proceeds per issue was $394m which is highest among the industries. The IPO activity in the sample is lowest in telecommunications industry where four IPOs raised total proceeds of $837m. IPO activity was relatively low also in media and entertainment and materials industries.

Table 8. Number of IPOs and total proceeds by industry

	Number of IPOs	Total Proceeds (m$)	Average proceeds per issue (m$)
Consumer Products and Services	18	2 626	146
Consumer Staples	10	3 052	305
Energy and Power	12	4 722	394
Financials	15	4 046	270
Healthcare	19	1 469	77
High Technology	22	5 176	235
Industrials	28	7 577	271
Materials	7	1 257	180
Media and Entertainment	8	1 507	188
Real Estate	13	3 224	248
Retail	11	1 875	170
Telecommunications	4	837	209
Total	**167**	**37 368**	**224**

In summary, the most active industries in the sample of IPOs that were used to study the determinants of IPO underpricing were industrials, high technology, healthcare and consumer products and services industries. Measured in total proceeds raised also energy and power industry was active in IPOs. Overall, the IPOs are distributed quite evenly among different industries excluding telecommunications, materials and media and entertainment industries where the IPO activity was relatively low. The wider data sample of all the IPOs with offer price greater than 3$ is presented in appendix 4. The most active industries are very similar to the sample presented above. Biggest difference is concerning the financials industry which is the most active industry in the wider sample.

4.2   Underpricing of European IPOs

Underpricing is measured using both first trading day returns and first week returns. Since the objective of this thesis is to study the determinants of IPO underpricing, the main focus is in the IPO sample containing the IPOs where data for different determinants was available. This underpricing is explained with different variables in order to identify the determinants of IPO underpricing. The IPO sample containing IPOs that has all the data available is only a narrow sample of the total IPO dataset. In order to be able to answer for the question about the level of underpricing in Europe, the sample of IPOs that is missing data of different variables but has after issue price data available, is also studied in order to get wider understanding about the level of underpricing. The underpricing statistics of the wider data sample are presented in the appendices. The underpricing statistics of the IPO sample used to study the determinants of IPO underpricing are presented in table 9.

As presented in table 9, average first day return of 167 European IPOs was 6.07% and statistically significant at 1% level of significance. The null hypothesis of the t-test stating that average first day return is equal to zero is rejected at 1% level of significance. Average first day return is positive and statistically significantly different from zero. 67% of the sample IPOs were priced below the first trading day price and 33% of the IPOs yielded negative return on the first day of trading. These results indicate that European IPOs were underpriced between 2009 and 2017. Average first week return in the sample was 5.52% and statistically significant at 1% level of significance. 57% of the sample IPOs showed positive returns and the price of 43% of the IPOs declined during the first week of trading. Also measured in first week returns the IPOs in Europe were underpriced on average

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between 2009 and 2017. The average first day return was 0.55 percentage points higher compared to the average first week returns. The share of positive returns was also higher in first day returns compared to first week returns. Average first day returns and average first week returns of the wider IPO sample is supporting the findings. Statistically significant underpricing was also found in the wider IPO sample and the statistics are presented in the appendix 5. The level of underpricing is slightly lower in the wider IPO sample. The distributions of positive and negative returns are very similar in both samples.

Table 9. First day and first week returns of the European IPOs

The sample contains all the European IPOs that are used to study the determinants of underpricing. *** denotes significance at 1% level. The formulas for first day and first week returns are presented in section 3.1.1.

	Observations	Mean	Percent positive	Percent negative	Standard deviation	T Statistic
First day return	167	6.07 %	67 %	33 %	0.12	6.32***
First week return	167	5.52 %	57 %	43 %	0.19	3.66***

Average first day returns and average first week returns were positive and statistically significant in both IPO samples. The results indicate that European IPOs were underpriced on average between 2009 and 2017. Average first week return was lower compared to the average first week return. In addition, the distribution of positive and negative returns in first week returns was closer of being equal compared to the distribution of first day returns. This result is indicating that during the first week of trading the price adjusts closer to its real value. The comparison of underpricing between different years, countries and industries is presented in the next section.

4.2.1 Underpricing by year

Previously presented results indicate that the volume of IPOs fluctuate over time. But how does the underpricing change over time? Again, the main focus is in the sample of IPOs that is used to study the determinants of underpricing. The underpricing statistics by year of the sample of IPOs with missing data of different variables are presented in the appendices. Average first day returns and average first week returns by year of the sample used to study the determinants of IPO underpricing are presented in figure 3 and the analysis is conducted below.

As presented in figure 3, the initial returns fluctuate substantially during the study period. Measured in terms of first day returns, the highest initial returns were experienced in 2009 when the average first day return of three IPOs was 9.51%. However, the share prices experienced substantial decline during the first week of trading and the average first week return turned out being -2.82% in 2009. The average share prices declined by 12.34 percentage points during the first week of trading in 2009. After 2009 the average first day returns declined and in 2010 the average first day return of 7 IPOs was -0.51% indicating that the IPOs in 2010 were overpriced on average. The share prices of these 7 IPOs also declined during the first week of trading and the average first week return was -2.23% in 2010. After 2010 there has been a growing trend both in average first day returns and average first week returns. From 2010 to 2017 the average first day return has increased by 9.67 percentage points and the average first week return has increased 10.89 percentage points. In addition, after 2010 the average first day and first week returns have been positive in each year. The average first day returns were higher than average first week returns in most of the years indicating that the share prices adjusted towards the real price during the first week of trading. The share prices increased during the first week of trading only in 2011 and 2015. In the wider IPO sample presented in appendix 6 the average first day and first week returns also fluctuate over time. After 2010 the level of underpricing has increased but the trend has been slightly more moderate compared to the sample used to study the determinants of underpricing. In addition, the difference between first day and first week returns are lower in wider IPO sample.
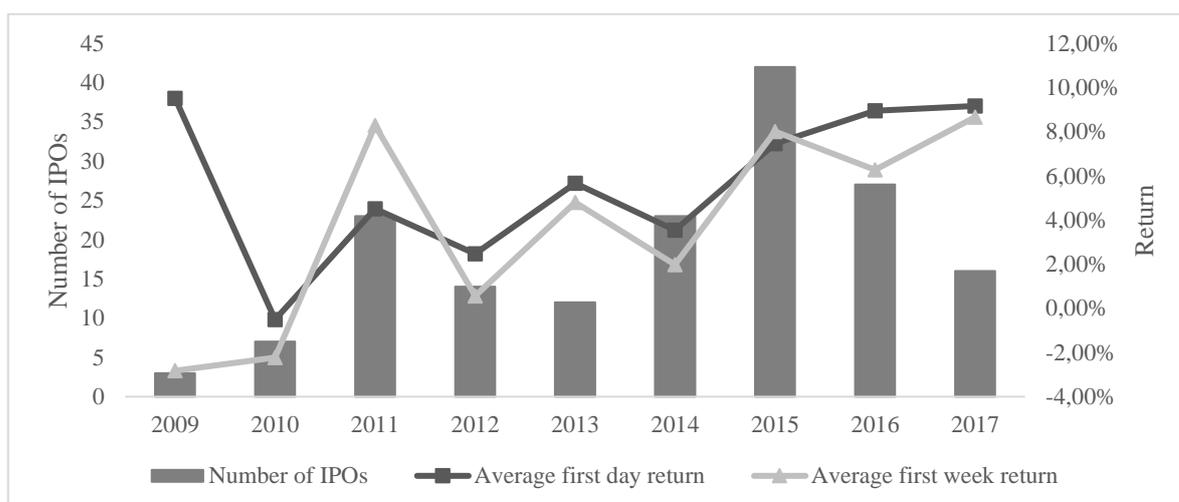
Figure 3. Average first day and first week returns by year

In summary, the underpricing fluctuates over time in the IPO sample used in this study. The average initial returns fluctuate between years both measured in first day returns and first week returns. The findings are in line with earlier literature arguing that the level of underpricing fluctuates over time (Ibbotson & Jaffe, 1975). The average first day returns of the sample used to study the determinants of underpricing were positive in each year excluding the year 2010 when IPOs were overpriced on average. Average first week returns were negative in years 2009 and 2010. In the wider IPO sample, the average first day and first week returns were positive in each year.

4.2.2 Underpricing by country

Prior literature has found out that the level of underpricing varies between different countries because of different institutional characteristics. The capital markets in some countries are less developed than others. Thus, it is important to compare the underpricing between different countries. The underpricing statistics of the data sample that is used to study the determinants of underpricing is presented and the main focus is in this sample. The underpricing statistics by country of the wider sample of IPOs that are missing data of different variables is presented in the appendices. This sample is also presented in order to get better understanding of the underpricing in different countries.

The average first day and first week returns by country of the data sample that is used to study the determinants of underpricing are presented in table 10. The sample comprises of

167 IPOs from 18 different countries. Average first day return was positive in 14 out of 18 countries and in four countries negative average first day returns were experienced meaning that the share prices declined on average during the first day of trading. These countries are Gibraltar, Norway, Turkey and Ukraine. However, the number of IPOs in Gibraltar, Turkey and Ukraine was low, so the results are difficult to generalize. In Norway the average first day return of 12 IPOs was -1.77% on average. The average first day return was highest in Malta where one IPO yielded 19.17% on the first day of trading but again the results cannot be generalized since the sample contains only one IPO from Malta. Over 10% average first day returns were also experienced in Italy, Luxembourg and Sweden where average first day returns were 16.24%, 14.55% and 12.77%, respectively. Measured in terms of first week returns the IPOs in 12 out of 18 countries were underpriced on average. In 6 countries the share price declined on average during the first week of trading. The countries where share prices declined during the first week of trading were Belgium, Germany, Gibraltar, Norway, Turkey and Ukraine. The average first week return was highest in Luxembourg where the share price of one IPO yielded 22.73% during the first week of trading. Over 10% average first week returns were also experienced in Italy, Malta and Sweden where average first week returns were 16.75%, 13.35% and 12.12%, respectively. In the wider IPO sample presented in appendix 7 the level of underpricing is slightly lower in different countries. The average first day return was positive in 84% of the countries and the average first week return was positive in 72% of the countries.

Table 10. Average first day and first week returns by country

	Number of IPOs	Average first day return	Average first week return
Belgium	2	0.34 %	-0.17 %
Denmark	3	8.04 %	8.80 %
Finland	10	4.06 %	3.38 %
France	32	3.32 %	6.27 %
Germany	18	1.22 %	-3.77 %
Gibraltar	1	-5.32 %	-23.22 %
Italy	7	16.24 %	16.75 %
Luxembourg	1	14.55 %	22.73 %
Malta	1	19.17 %	13.35 %
Netherlands	5	2.94 %	4.29 %
Norway	12	-1.77 %	-3.93 %
Poland	9	6.16 %	5.15 %
Spain	1	1.32 %	0.39 %
Sweden	42	12.77 %	12.12 %
Switzerland	6	5.80 %	3.78 %
Turkey	3	-1.13 %	-1.38 %
Ukraine	1	-2.07 %	-4.09 %
United Kingdom	13	4.77 %	4.20 %
Total	**167**	**6.07 %**	**5.52 %**

Positive initial IPO returns were experienced in majority of the countries and the average underpricing varies from country to country. The average first day return was positive in 78% of the countries and the average first week return was positive in 67% of the countries. The results indicate that underpricing is dependent on the country where the IPO is issued. The reason for this might be in the differences in institutional characteristics between different countries.

4.2.3 Underpricing by industry

Companies in different industries have their own characteristics. Thus, it is important to compare the initial IPO returns between different industries. The industry classification used in this study is Thomson Reuter´s macro-level industry classification which comprises total of 14 industry classifications (Thomson One, 2018). The underpricing statistics of the sample used to study the determinants of underpricing is presented and the main analysis is conducted based on this sample. To find support for these findings the underpricing statistics

by industry of the wider sample of IPOs that are missing data of different variables is also presented in the appendices.

The average first day and first week returns by industry are presented in table 11. The sample used to study the determinants of IPO underpricing contains 167 IPOs from 12 different industries. Average first day return was highest in high technology industry where the share price of 22 IPOs increased by 12.99% on average during the first day of trading. The average first day returns were higher than the average of the whole sample also in telecommunications, consumer staples, industrials and consumer products and services industries where average first day returns were 9.11%, 7.87%, 7.55% and 6.89%, respectively. Average first day return was lowest in materials industry where the share price of 7 IPOs declined on average by 0.32% during the first day of trading indicating that the IPOs in materials industry were overpriced on average. In rest of the industries the average first day returns were positive, and the average returns differ between 0.64% and 5.57%. Measured in terms of average first week returns the results are slightly different. Average first week returns were positive in 10 out of 12 industries. Average first week return was highest in telecommunications industry where the share price of 4 IPOs increased by 12.54% during the first week of trading. High average first week returns were also experienced in healthcare industry. In healthcare industry the average first week return was 12.26% which is 7.73 percentage points higher compared to the average first day return in corresponding industry. Average first week return was lowest in media and entertainment industry where the share price of 8 IPOs declined on average by 5.24% during the first week of trading. Measured in terms of first week returns the IPOs were also overpriced in materials industry. In the wider IPO sample presented in the appendix 8 the differences in the level of underpricing between different industries were more moderate. In the wider IPO sample, the average first day and first week returns were positive in every industry.

Table 11. Average first day and first week returns by industry

	Number of IPOs	Average first day return	Average first week return
Consumer Products and Services	18	6.89 %	6.21 %
Consumer Staples	10	7.87 %	7.05 %
Energy and Power	12	3.15 %	3.63 %
Financials	15	3.34 %	1.92 %
Healthcare	19	4.53 %	12.26 %
High Technology	22	12.99 %	9.07 %
Industrials	28	7.55 %	6.72 %
Materials	7	-0.32 %	-4.45 %
Media and Entertainment	8	0.64 %	-5.24 %
Real Estate	13	3.04 %	1.63 %
Retail	11	5.57 %	4.39 %
Telecommunications	4	9.11 %	12.54 %
Total	**167**	**6.07 %**	**5.52 %**

Positive initial returns were experienced in majority of the industries and the level of underpricing is dependent on the industry of the issuing company. The results are indicating underpricing is dependent on the company characteristics. In addition, the findings are in line with the earlier findings of high underpricing in high-tech industry. According to Ljungqvist & Wilhelm (2002) during the dot-com bubble in 1999-2000 extremely high underpricing was partially caused by company characteristics and during the period of 1999-2000 IPOs of high-tech companies accounted for approximately half of the whole sample. The IPOs in high technology industry might be more speculative and thus show higher initial returns.

4.2.4   Underpricing of Nordic and Non-Nordic IPOs

The countries in Europe have different institutional characteristics and legal systems. The IPO sample is divided into sub-samples when studying the determinants of IPO underpricing. First, the dataset is divided into Nordic and Non-Nordic IPOs. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark and all the rest of the IPOs are included into Non-Nordic sample. The underpricing statistics of Nordic and Non-Nordic samples are presented in table 12.

As presented in table 12, the average first day return of Nordic IPOs was 8.65% and statistically significant at 1% level of significance. The null hypothesis of the t-test stating

that average first day return is equal to zero is rejected at 1% level of significance. 67% of the Nordic IPOs were priced below the first day closing price and the share price of 33% of the IPOs declined on the first day of trading. Average first week return was 7.79% and also statistically significant at 1% level. The share of positive returns is slightly smaller compared to the first day returns. The share price of 63% of the Nordic IPOs increased during the first week of trading and 37% of the IPOs were priced below the closing price five trading days after offering. Based on these findings Nordic IPOs were underpriced on average.

The average first day return of 100 Non-Nordic IPOs was 4.34% and statistically significant at 1% level of significance. The null hypothesis of t-test stating that the average first day return is equal to zero is rejected. First day returns were positive in 68% of the Non-Nordic IPOs and the share price of 32% of the IPOs declined on the first day of trading. Average first week return of the Non-Nordic IPOs was 4.00%. However, the t-test is indicating weak statistical significance. Null hypothesis stating that average first week return is equal to zero is rejected at 10% level of significance. The distribution of positive and negative returns is closer of being equal. The share price of 53% of the Non-Nordic IPOs increased during first week of trading and the share price of 47% of the IPOs declined.

Table 12. First day and first week returns of Nordic and Non-Nordic IPOs

The sample is divided into Nordic and Non-Nordic countries. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs from rest of the countries are in Non-Nordic sample. Detailed descriptions of the samples are presented in section 3.1. *** denotes significance at 1% level and * denotes significance at 10% level. The formulas for first day and first week returns are presented in section 3.1.1.

	Observations	Mean	Percent positive	Percent negative	Standard deviation	T Statistic
Nordic:						
First day return	67	8.65 %	67 %	33 %	0.15	4.68***
First week return	67	7.79 %	63 %	37 %	0.18	3.61***
Non-Nordic:						
First day return	100	4.34 %	68 %	32 %	0.10	4.38***
First week return	100	4.00 %	53 %	47 %	0.21	1.94*

Number of IPOs and average first day returns by year of the Nordic and Non-Nordic IPO samples are presented in figure 4. The Nordic sample contains in total 67 IPOs during the study period. However, the Nordic sample contains no IPOs in years 2009 and 2010. Between 2011 and 2015 the number of Nordic IPOs increased from 3 to 23 IPOs. After 2015

the IPO activity in the Nordic sample experienced slight decline and 5 IPOs were issued in 2017. There was a growing trend in the average first day returns of the Nordic IPO sample between 2011 and 2017. From 2011 to 2017 average first day returns increased from -7.30% to 10.18%. Highest average first day returns were experienced in 2016 when the average first day return of 14 Nordic IPOs was 12.88%. The Non-Nordic sample contains 100 IPOs during the study period. The number of Non-Nordic IPOs was highest in 2011 when 20 IPOs were issued. Lowest number of Non-Nordic IPOs were issued in 2009. Highest first day returns in the Non-Nordic IPO sample were experienced in 2009 when average first day return was 9.51%. After 2009 the average first day return declined substantially and in 2010 the average first day return of 7 IPOs was -0.51%. The first day returns in the Non-Nordic sample were less volatile compared to the Nordic sample.
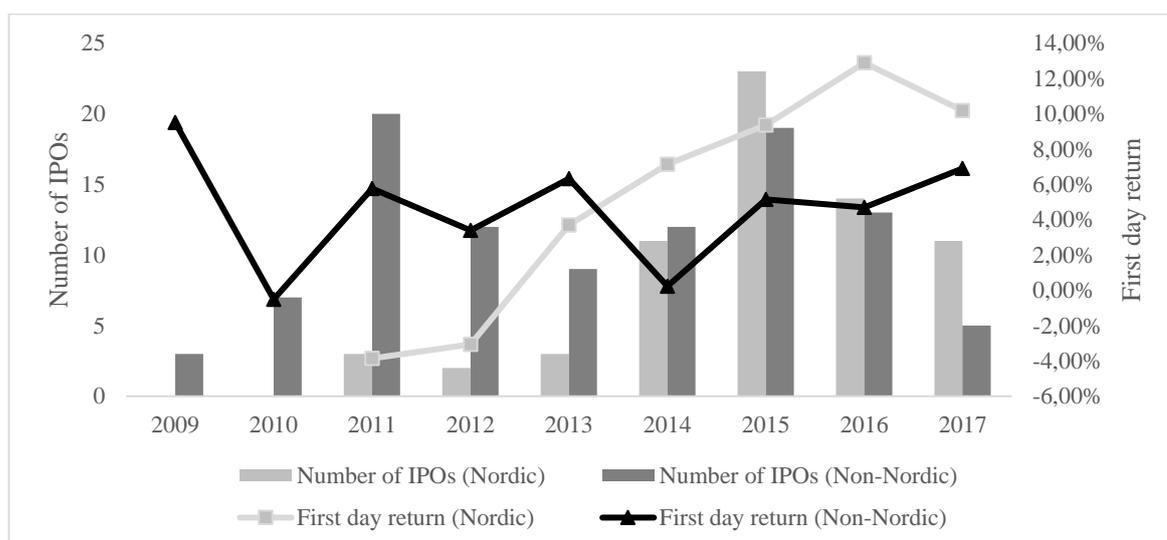
Figure 4. Number of IPOs and average first day returns by year of Nordic and Non-Nordic IPOs

The average first week returns by year of the Nordic and Non-Nordic IPO samples are presented in figure 5. The first day returns of Nordic IPO sample follow very similar trend compared to the first day returns. Lowest first week returns in the Nordic IPO sample were experienced in 2011 when average first week return was -7.23%. After 2011 the first week returns increased substantially. The first week returns were highest in 2017 when the average first week return of 5 Nordic IPOs was 10.11%. The first week returns of the IPOs in the Non-Nordic sample have been fluctuating substantially from year to year. The average first

week return was highest in 2011 when 3 IPOs yielded on average 10.61% during the first week of trading. Lowest first week returns were experienced in 2014.
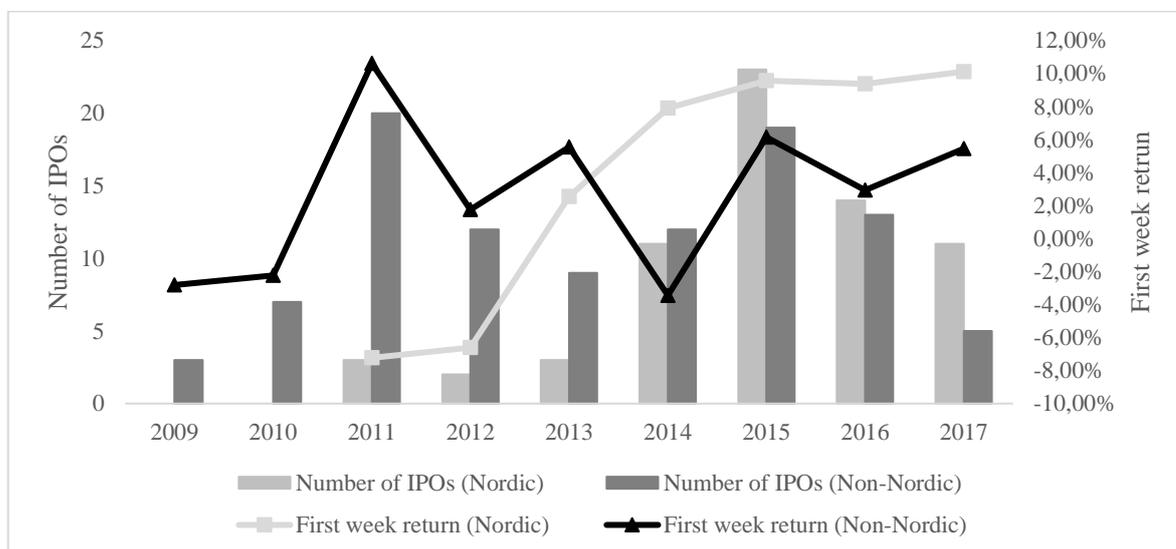
Figure 5. Number of IPOs and average first week returns by year of Nordic and Non-Nordic IPOs

The number of IPOs in both Nordic and Non-Nordic samples fluctuate during the study period. The average first day and first week IPO returns of both samples also show great dispersion during the study period. The Nordic IPOs were statistically significantly underpriced both measured in average first day and first week returns. Average first day and first week returns of the IPOs in Non-Nordic sample were lower compared to the Nordic sample. Average positive first day return of the Non-Nordic sample was showing strong statistical significance. However, average first week return was statistically significant only at 10% level of significance.

4.2.5 Underpricing in countries of different legal origins

The determinants of IPO underpricing are also studied in samples containing IPOs from countries of different legal origins. As stated by La Porta et al. (1998) the investor protection is weakest in French common-law countries. The dataset in this study is divided into two samples based on the legal origin of countries. First sample contains IPOs from French legal origin countries where investor protection is weakest. Second sample contains IPOs from

English-, German-, and Scandinavian legal origin countries. The average first day and first week returns of both samples are presented in table 13.

The average first day return of the IPOs from French legal origin countries was 5.17% and statistically significant. The null hypothesis of the t-test stating that the average first day return is equal to zero is rejected at 1% level of significance. 66% of the IPOs from French legal origin countries yielded positive returns on the first day of trading. The share price of 34% of the IPOs declined during the first day of trading. The average first week return of 62 IPOs from French legal origin countries was 6.67% and the null hypothesis of t-test is rejected at 5% level of significance. Surprisingly, the average first week return is higher compared to the average first day return indicating that the share prices continued to increase on average after the first day of trading. The investor protection is weakest in French legal origin countries. In these countries it might take more time for the investors to re-adjust their beliefs about the true value of IPO. 58% of the IPOs in the French legal origin sample were priced below the first trading day closing price and the share price of 42% of the IPOs declined during the first day of trading.

The average first day return of the sample containing IPOs from English-, German- and Scandinavian legal origin countries was 6.60%. The null hypothesis of the t-test stating that the average first day return is equal to zero is rejected at 1% level of significance. The first day returns were positive in 69% of the IPOs and 31% of the IPOs yielded negative returns on the first day of trading. The average first week return of the IPOs in English-, German- and Scandinavian legal origin sample was 4.84% indicating that the share prices started declining on average after the first day of trading. The null hypothesis of the t-test is again rejected with 1% level of significance. The distribution of positive and negative returns is closer of being equal compared to the first day returns. 56% of the first week returns were positive and the share price of 44% of the IPOs declined during the first week of trading.

Table 13. First day and first week returns of samples divided by legal origin of countries

The sample is divided into French legal origin countries and English-, German-, and Scandinavian legal origin countries. Detailed descriptions of the samples are presented in section 3.1. *** denotes significance at 1% level and ** denotes significance at 5% level. The formulas for first day and first week returns are presented in section 3.1.1.

	Observations	Mean	Percent positive	Percent negative	Standard deviation	T Statistic
French Legal Origin:						
First day return	62	5.17 %	66 %	34 %	0.11	3.75***
First week return	62	6.67 %	58 %	42 %	0.25	2.14**
English-, German- and Scandinavian Legal Origin:						
First day return	105	6.60 %	69 %	31 %	0.13	5.10***
First week return	105	4.84 %	56 %	44 %	0.16	3.13***

Number of IPOs and average first day returns by year of the IPO samples divided based on the legal origin of countries are presented in figure 6. The French legal origin sample contains 62 IPOs during the study period. Most IPOs in the sample were issued in 2011 when number of IPOs was 15. The least IPOs from French legal origin countries were issued in 2009. Relatively low number of IPOs were also experienced in 2014 and 2017. The average first day returns of the IPOs in the French legal origin sample fluctuated substantially from year to year. Highest first day returns were experienced in 2009 but the average first day return declined substantially from 2009 to 2010. The average first day return of the IPOs in French legal origin sample was lowest in 2010. The English-, German- and Scandinavian legal origin sample contains 105 IPOs and highest number of IPOs in this sample were issued in 2015. Between 2009 and 2013 the number of IPOs stayed relatively low but after 2013 the number of IPOs started increasing and has stayed relatively high. The average first day return of the IPOs from English-, German- and Scandinavian legal origin countries was 8.95% in 2009 but declined to -1.55% in 2011. After 2011 the average first day returns started increasing and highest returns were experienced in 2016.
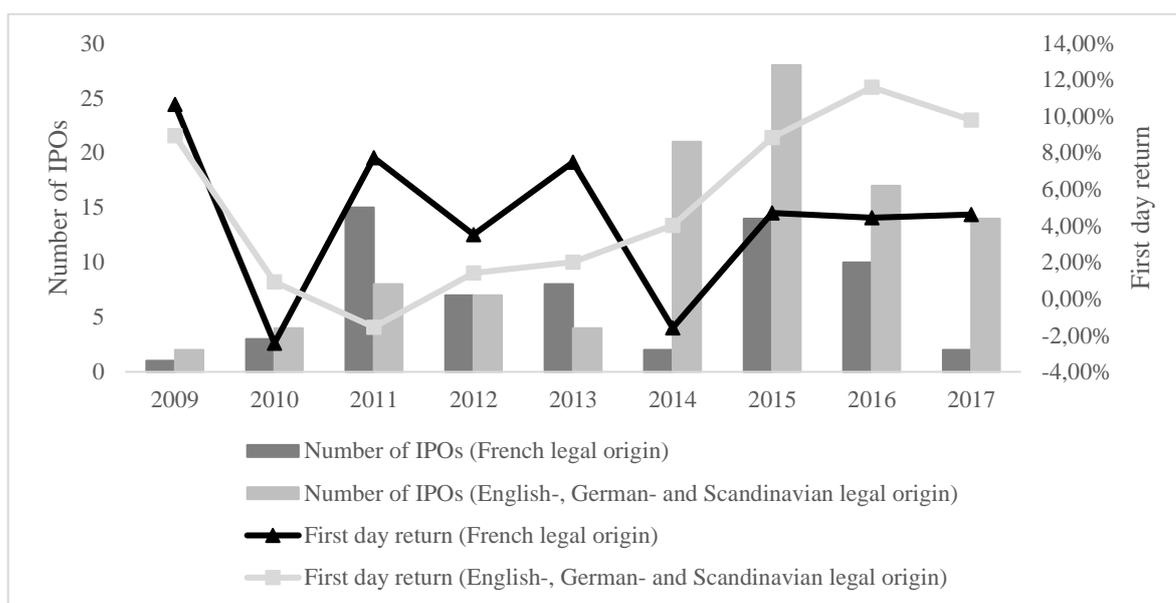
Figure 6. Number of IPOs and average first day returns by year of IPOs divided by legal origin

The first week returns by year of the IPO samples divided based on the legal origin of countries is presented in figure 7. The first week returns of the IPOs in French legal origin sample have fluctuated substantially from year to year. The first week returns were lowest in 2010. The highest first week returns were experienced in 2011 and after 2011 there has been a declining trend in first week returns of IPOs in French legal origin sample. The first week returns of IPOs in English-, German- and Scandinavian legal origin sample have increased during the study period. First week returns were lowest in 2009 and highest first week returns were experienced in 2017.
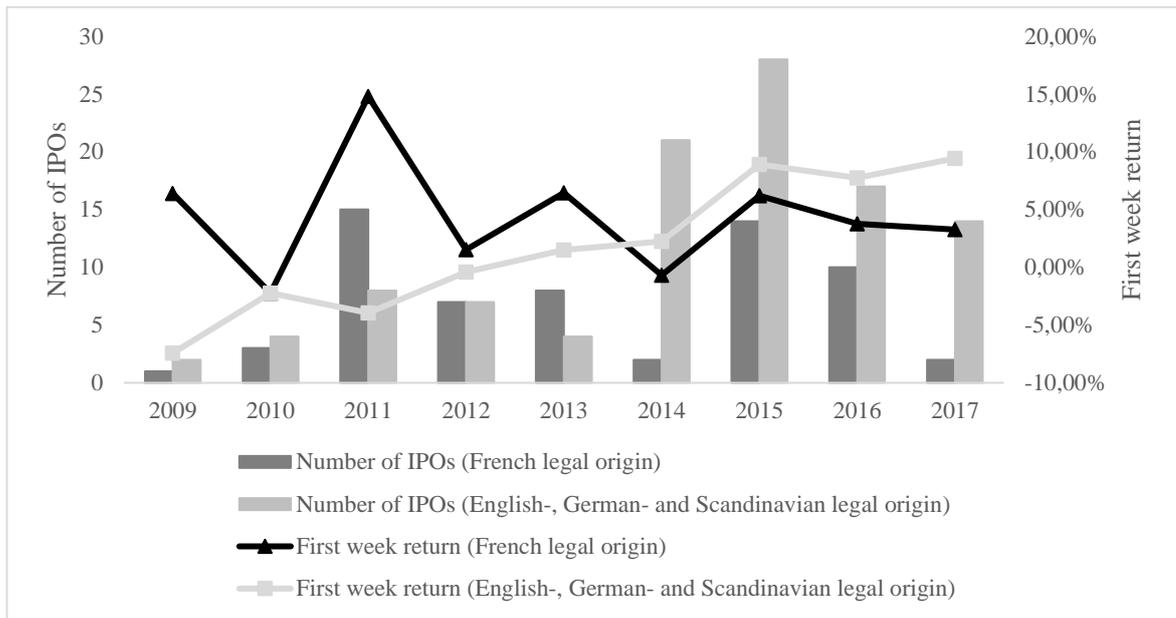
Figure 7. Number of IPOs and average first week returns by year of IPOs divided by legal origin

Positive average first day and first week returns were identified in both French legal origin sample and English-, German- and Scandinavian legal origin sample. The number of IPOs fluctuated substantially between different years. The average first day and first week returns were positive and showed strong statistical significance in the English-, German- and Scandinavian legal origin sample. The average first day return was also statistically significant at 1% level of significance in the French legal origin sample. The average first week return of the IPOs in the French legal origin sample was statistically significant at 5% level of significance.

4.3   Determinants of IPO underpricing

The determinants of IPO underpricing are presented in this section. Previously presented first day returns and first week returns of the sample of 167 IPOs are explained with the variables presented in section 3.1.2. In addition, the IPO sample is divided into four sub-samples based on institutional characteristics and legal origin of country where the IPO is issued, and the determinants of IPO underpricing are studied in these samples. First, the dataset is divided into Nordic and Non-Nordic samples. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs from all the rest of the countries are in Non-Nordic sample. Second, the dataset is divided based on the legal origin of the countries. First

sample contains IPOs from French legal origin countries. Second sample contains IPOs from English-, German-, and Scandinavian legal origin countries. In total twenty regression models are estimated. First ten regression equations are estimated using first day return as dependent variable. Second ten equations use first week returns as dependent variables. To check the robustness of each variable the models are estimated both with and without time fixed effects. The equations are presented above in section 3.3. The equations are estimated using White's heteroskedasticity consistent standard errors. In the first part of this section the determinants of first day returns are presented. In the second part the determinants of first week returns are presented.

4.3.1 Determinants of first day returns

The results of multivariate OLS regressions using first day return as dependent variable of the whole IPO sample are presented in table 14. The first model is estimated without time fixed effects. In second model the time fixed effects are taken into account. The models provide weak explanatory power. The values of r-squared in models 1 and 2 are 0.068 and 0.104 respectively indicating that the models are able to explain only a fraction of the changes in first day returns. Durbin-Watson statistics are close to two in both models indicating that there is no problem of autocorrelation.

Model 1 is not accounting for time fixed effects and the r-squared is 0.068 meaning that the model explains 6.8% of the variations in first day returns. Three of the independent variables in model 1 are statistically significant. The coefficient of AvgDailyMktInd is positive and significant at 10% level of significance indicating that increase in the average market index return before the offering increases the level of underpricing. The coefficient of 10.709 is meaning that one percentage point increase in the average return of the market index during 30-day period before the offering increases the first day return by 10.709%. The coefficient of OfferPR is also positive and statistically significant at 5% level of significance. Positive coefficient of OfferPR is indicating that the first day returns are higher in IPOs where positive revisions are done in the final offer price. The coefficient of SharesPerBookrunner is negative and statistically significant at 5% level. Negative coefficient is meaning that increase in the total IPO shares per bookrunner decreases the first day return. The rest of the variables in model 1 are statistically insignificant. To check the robustness of the variables, the model is also estimated with time fixed effects. Model 2 accounts for time fixed effects.

The r-squared of 0.104 is indicating that the model explains 10.4% of the variations in first day returns. Same variables as in model 1 also appeared to be statistically significant in model 2. The coefficient of AvgDailyMktInd is positive and statistically significant at 10% level of significance also in model 2 supporting the finding that increase in the average market index return before the offering increases the level of underpricing. The coefficient of OfferPr is positive and statistically significant at 10% level of significance. Model 2 provides weaker statistical support compared to the model 1 for the argument that positive revisions in the final offer price increases the first day returns. The coefficient of SharesPerBookrunner is negative and statistically significant at 5% level of significance supporting the finding in model 1.

Table 14. Multivariate regression results for first day returns of the whole IPO sample

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The sample contains all the European IPOs that are used to study the determinants of underpricing.

	Expected Sign	(1) Whole Sample	(2) Whole Sample
Dependent variable		First day return	First day return
Constant		0.007 (0.214)	0.008 (0.122)
AvgFirstDayPriorIPOs	(+)	0.267 (1.551)	0.196 (1.140)
AvgDailyMktInd	(+)	10.709 (1.659)*	12.313 (1.738)*
SdDailyMktInd	(+)	1.810 (1.010)	1.746 (0.814)
LnSales	(-)	-0.001 (-0.319)	-0.001 (-0.277)
ChangeEBIT	(-)	0.007 (1.000)	0.006 (0.831)
LnUsesProceeds	(+)	0.018 (0.895)	0.009 (0.434)
OfferPr	(+)	0.042 (2.141)**	0.038 (1.884)*
SharesPerBookrunners	(+)	-0.000 (-2.300)**	-0.000 (-1.979)**
Year dummies		No	Yes
Observations		167	167
Durbin-Watson		1.866	1.950
R-squared		0.068	0.104

The determinants of IPO underpricing were also studied in Nordic and Non-Nordic samples. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs from all the rest of the European countries are in Non-Nordic sample. The results of multivariate regression models for Nordic and Non-Nordic IPOs are presented in table 15. The dependent variable in models 3-6 is first day return. The equations were estimated with and without time fixed effects for both samples. The models explaining first day returns in Nordic sample provided better fit compared to the models of Non-Nordic sample. Durbin-Watson statistics are close to two in all models indicating that there is no problem of autocorrelation.

Model 3 is explaining first day returns of the Nordic IPOs without time fixed effects. The r-squared is 0.251 meaning that the model explains 25.1% of the variations in first day returns. The coefficient of AvgDailyMktInd is positive and statistically significant at 5% level of significance indicating that there is a positive relationship between market index returns before the offering and first day returns. The coefficient of 22.213 is meaning that one percentage point increase in the average return of the market index during 30-day period before the offering increases the first day return by 22.213%. The coefficient of LnUsesProceeds is positive and statistically significant at 5% level of significance indicating that the first day returns are higher for companies that have announced more uses for the IPO proceeds. Statistical significance was also found for the coefficient of OfferPR. Positive and statistically significant coefficient at 10% level of significance is meaning that first day returns are higher in IPOs where positive revisions are done in the final offer price. The rest of the variables in model 3 did not provide statistically significant explanatory power. The first day returns of Nordic IPOs were also explained with model accounting for time fixed effects. As presented in table 15 the r-squared of model 4 is 0.296 and the model explains 29.6% of the variations in first day returns. The statistically significant variables in model 4 appeared to be the same as in model 3 and the signs of the coefficients are also as expected. According to these findings, variables AvgDailyMktInd, LnUsesProceeds and OfferPr are able to explain variations in first day returns of Nordic IPOs.

Models 5 and 6 are explaining first day returns of IPOs from Non-Nordic countries. Model 5 is estimated without time fixed effects and model 6 accounts for time fixed effects. The models provided weak explanatory power. Values of r-squared are indicating that the models explain only a fraction of the variations in first day returns. In model 5 the coefficient of AvgFirstDayPriorIPOs is positive and statistically significant at 10% level placing some support for the argument that underpricing is higher when the average first day return of 10 prior IPOs on the same industry also increases. However, the coefficient of AvgFirstDayPriorIPOs is insignificant in model 6 so the variable is not robust. All the independent variables in model 6 are statistically insignificant. Based on these findings the variables used in this study are not able to explain first day returns of IPOs from Non-Nordic European countries. The findings are suggesting that information-based variables explain

variations in first day returns better in the Nordic markets compared to the Non-Nordic markets.

Table 15. Multivariate regression results for first day returns of Nordic and Non-Nordic IPO samples

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The sample is divided into Nordic and Non-Nordic countries. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs of all the rest of the countries are in Non-Nordic sample.

	Expected Sign	(3) Nordic	(4) Nordic	(5) Non-Nordic	(6) Non-Nordic
Dependent variable		First day return	First day return	First day return	First day return
Constant		-0.027 (-0.393)	-0.040 (-0.548)	0.011 (0.410)	0.064 (1.094)
AvgFirstDayPriorIPOs	(+)	0.182 (0.393)	0.001 (0.002)	0.252 (1.756)*	0.270 (1.569)
AvgDailyMktInd	(+)	22.213 (2.169)**	24.044 (2.188)**	-0.566 (-0.080)	-0.839 (-0.100)
SdDailyMktInd	(+)	5.568 (1.113)	2.604 (0.419)	2.540 (1.538)	1.477 (0.721)
LnSales	(-)	-0.013 (-1.242)	-0.016 (-1.420)	0.002 (0.465)	0.003 (0.697)
ChangeEBIT	(-)	-0.012 (-0.538)	-0.004 (-0.173)	0.005 (0.666)	0.003 (0.441)
LnUsesProceeds	(+)	0.128 (2.637)**	0.116 (2.089)**	-0.017 (-0.894)	-0.025 (-1.070)
OfferPr	(+)	0.073 (1.974)*	0.087 (1.890)*	0.007 (0.312)	0.016 (0.634)
SharesPerBookrunner	(+)	-0.000 (-0.487)	-0.000 (-0.284)	-0.000 (-1.563)	-0.000 (-1.237)
Year dummies		No	Yes	No	Yes
Observations		67	67	100	100
Durbin-Watson		1.929	2.071	2.154	2.203
R-squared		0.251	0.296	0.048	0.103

The determinants of IPO underpricing were also studied in samples divided based on the legal origin of the country. The dataset in this study is divided into two samples based on the legal origin of countries. First sample contains IPOs from French legal origin countries where investor protection is weakest. Second sample contains IPOs from English-, German-

, and Scandinavian legal origin countries. The models are again estimated with and without time fixed effects for both samples and the results of multivariate regression models are presented in table 16. Durbin-Watson statistics are close to two in both models indicating that there is no problem of autocorrelation.

As presented in table 16 the models explaining first day returns of the IPOs from French legal origin countries provided weak explanatory power. The r-squared in model 7 is 0.040 meaning that the model explains only a fraction of the variations in first day returns. In addition, none of the variables in model 7 are statistically significant. Model 8 is estimated with time fixed effects and the results are in line with model 7. Low value of r-squared is again supporting the finding that the model is not able to explain first day returns and all the independent variables are statistically insignificant. The results of models 7 and 8 are indicating that the variables related to information frictions used in this study are not able to explain first day returns of the IPOs from French legal origin countries.

Models 9 and 10 explain first day returns of IPOs from English-, German-, and Scandinavian legal origin countries. The models provided better fit compared to the models for French legal origin IPOs. Model 9 is estimated without time fixed effects. Based on the value of r-squared, model 9 explains 15.6% of the variations in first day returns of IPOs from English, German-, and Scandinavian legal origin countries. The coefficient of AvgDailyMktInd is positive and statistically significant at 1% level of significance. One percentage point increase in the average return of the market index during 30-day period before the offering increases the first day return by 21.797%. The coefficient of LnUsesProceeds is positive and statistically significant at 10% level of significance. Little statistically significant support is found for the argument that the first day returns are higher for companies that have announced more uses for the IPO proceeds. The coefficient of OfferPr is positive and statistically significant at 5% level indicating that the first day returns are higher in IPOs where offer price is adjusted upwards. The coefficient of SharesPerBookrunner is negative and statistically significant at 1% level of significance. This result is meaning that underpricing decreases when total IPO shares per bookrunner are higher. The rest of the independent variables in model 9 are statistically significant. To check the robustness of the significant variables the model is also estimated with time fixed effects. Model 10 explains 22.7% of the variations in first day returns. Statistical significance of the coefficients in

model 10 are slightly different compared to model 9. The coefficient of LnUsesProceeds is not statistically significant in model 10 and the statistical significance of variables OfferPr and SharesPerBookrunner decreased. According to the findings first day returns of IPOs from English-, German-, and Scandinavian legal origin countries can be explained with variables AvgDailyMktInd, OfferPr and SharesPerBookrunner.

Table 16. Multivariate regression results for first day returns of IPO samples divided by legal origin of countries

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The dataset is divided into sample containing IPOs from French legal origin countries and in sample containing IPOs from English-, German-, and Scandinavian legal origin countries.

	Expected Sign	(7) French Legal Origin	(8) French Legal Origin	(9) English-, German- and Scandinavian Legal Origin	(10) English-, German- and Scandinavian Legal Origin
Dependent variable		First day return	First day return	First day return	First day return
Constant		0.033 (0.829)	0.062 (0.369)	-0.038 (-0.760)	-0.039 (-0.408)
AvgFirstDayPriorIPOs	(+)	0.216 (0.635)	0.138 (0.362)	0.317 (1.519)	0.192 (0.883)
AvgDailyMktInd	(+)	-3.221 (-0.340)	-3.909 (-0.302)	21.797 (2.716)***	24.051 (2.821)***
SdDailyMktInd	(+)	0.556 (0.242)	1.059 (0.296)	5.376 (1.604)	4.872 (1.269)
LnSales	(-)	-0.000 (-0.028)	0.001 (0.085)	-0.006 (-0.780)	-0.007 (-0.820)
ChangeEBIT	(-)	0.002 (0.201)	-0.003 (-0.270)	0.014 (1.656)	0.013 (1.626)
LnUsesProceeds	(+)	-0.015 (-0.565)	-0.013 (-0.371)	0.058 (1.751)*	0.043 (1.140)
OfferPr	(+)	0.020 (0.578)	0.021 (0.505)	0.057 (2.186)**	0.051 (1.820)*
SharesPerBookrunner	(+)	0.000 (0.876)	0.000 (0.749)	-0.000 (-2.942)***	-0.000 (-2.152)**
Year dummies		No	Yes	No	Yes
Observations		62	62	105	105
Durbin-Watson		2.384	2.387	1.977	2.165
R-squared		0.040	0.113	0.156	0.227

4.3.2 Determinants of first week returns

European capital markets are different from each other and some of the markets are less developed. In this case underpricing should be measured over longer time window. In well-developed capital markets the underpricing is evident shortly after the offering. Because this study contains IPOs from several different countries the underpricing is also measured as first week return after the offering. The first week returns are explained in 5 different IPO samples. First, the regression equations are estimated for the whole IPO sample. Second, the sample is divided into Nordic and Non-Nordic sample. Third, the dataset is divided into two samples based on the legal origin of the countries.

The results of multivariate linear regressions of the sample containing all the European IPOs used in this study are presented in table 17. Model 11 is estimated without time fixed effects and model 12 accounts for time fixed effects. The explanatory power of both models is weak. Value of r-squared are 0.047 and 0.080 indicating that the models explain only a fraction of the variations in first week returns. However, the coefficient of OfferPr shows statistical significance in both models. In model 11 the coefficient of OfferPr is positive and statistically significant at 5% level of significance. Inclusion of time dummies decreased the statistical significance of OfferPr and in model 12 the coefficient is statistically significant at 10% level of significance. These results indicate that some support can be placed for the argument that the first week returns are higher in IPOs where positive revisions in the final offer price are done, even though the statistical significance is weak.

Table 17. Multivariate regression results for first week returns of the whole IPO sample

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The sample contains all the European IPOs that are used to study the determinants of underpricing.

	Expected Sign	(11) Whole Sample	(12) Whole Sample
Dependent variable		First week return	First week return
Constant		0.068 (0.893)	-0.007 (-0.084)
AvgFirstWeekPriorIPOs	(+)	-0.216 (-0.761)	-0.208 (-0.822)
AvgWeeklyMktInd	(+)	0.176 (0.067)	0.598 (0.235)
SdWeeklyMktInd	(+)	-0.171 (-0.136)	-0.275 (-0.183)
LnSales	(-)	-0.005 (-0.659)	-0.004 (-0.586)
ChangeEBIT	(-)	-0.014 (-0.824)	-0.017 (-0.852)
LnUsesProceeds	(+)	-0.004 (-0.137)	-0.009 (-0.326)
OfferPr	(+)	0.058 (1.992)**	0.057 (1.729)*
SharesPerBookrunner	(+)	0.000 (0.303)	0.000 (0.452)
Year dummies		No	Yes
Observations		167	167
Durbin-Watson		2.102	2.171
R-squared		0.047	0.080

The multivariate regression result for first week returns of the Nordic and Non-Nordic IPO samples are presented in table 18. The equations were estimated with and without time fixed effects for both samples. The models explaining first day returns in Nordic sample provided considerably better fit compared to the models of Non-Nordic sample. Durbin-Watson statistics are close to two in all models indicating that there is no problem of autocorrelation.

Model 13 is explaining first week returns of the Nordic IPOs without time fixed effects. The model provided relatively good explanatory power and the model explains 28.1% of the variations in first week returns. The coefficient of AvgWeeklyMktInd is statistically

significant at 1% level of significance. Positive coefficient is indicating that increase in the average market index return before the offering increases the first week IPO returns. The coefficient of 6.392 is meaning that one percentage point increase in the average return of the market index during 30-day period before the offering increases the first day return by 6.392%. The coefficient of LnUsesProceeds is also positive and statistically significant at 1% level of significance indicating that the first week returns are higher for issuers that have announced more uses for the IPO proceeds. The coefficient of OfferPr is positive and statistically significant at 5% level of significance. The first week returns are higher when positive revisions are done in the final offer price. To check the robustness of the identified variables the model is also estimated with time fixed effects. The same variables appeared to be statistically significant also in model 14. The model explains 32.4% of the variations in first day returns. The statistical significance of LnUssProceed decreased to 10% level but statistical significance of AvgWeeklyMktInd and OfferPr remained at the same level. The results in models 13 and 14 are indicating that variables AvgWeeklyMktInd, LnUsesProceeds and OfferPr are explaining first week IPO returns of Nordic IPOs. The signs of statistically significant variables were as expected.

Models 15 and 16 are explaining first day returns of Non-Nordic European IPOs. Both models provided weak explanatory power. The r-squared in model 15 is 0.099 indicating that the variables explain only a fraction in variations of first week returns. None of the variables in model 15 are statistically significant. Model 16 was estimated with time fixed effects. The coefficient of LnUsesProceeds is statistically significant at 10% level of significance. Surprisingly the sign of the coefficient is negative indicating that the first week returns are higher for issuers who have announced less uses for the IPO proceeds. However, the statistical significance is weak so no support can be placed for this argument. The results of models 15 and 16 are indicating that the variables used in this study are not able to explain first week returns of Non-Nordic European IPOs. Explanatory power of regression models explaining first week returns of Nordic IPOs was considerably better suggesting that information-based variables explain variations in first week returns better in the Nordic markets compared to the Non-Nordic markets.

Table 18. Multivariate regression results for first day returns of Nordic and Non-Nordic IPO samples

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The sample is divided into Nordic and Non-Nordic countries. Nordic sample contains IPOs from Finland, Sweden, Norway and Denmark. IPOs of all the rest of the countries are in Non-Nordic sample.

	Expected Sign	(13) Nordic	(14) Nordic	(15) Non-Nordic	(16) Non-Nordic
Dependent variable		First week return	First week return	First week return	First week return
Constant		-0.012	-0.043	0.093	0.084
		(-0.129)	(-0.537)	(1.084)	(0.771)
AvgFirstWeekPriorIPOs	(+)	-0.162	-0.275	-0.349	-0.236
		(-0.364)	(-0.533)	(-0.988)	(-0.780)
AvgWeeklyMktInd	(+)	6.392	7.081	-5.393	-5.184
		(2.839)***	(2.708)***	(-1.386)	(-1.330)
SdWeeklyMktInd	(+)	1.302	0.374	0.124	-0.736
		(0.570)	(0.129)	(0.082)	(-0.384)
LnSales	(-)	-0.012	-0.016	-0.001	0.001
		(-0.823)	(-1.024)	(-0.102)	(0.126)
ChangeEBIT	(-)	-0.035	-0.035	-0.015	-0.021
		(-1.303)	(-1.155)	(-0.912)	(-0.921)
LnUsesProceeds	(+)	0.153	0.148	-0.059	-0.063
		(2.696)***	(2.325)**	(-1.633)	(-1.664)*
OfferPr	(+)	0.085	0.104	0.019	0.033
		(2.205)**	(2.308)**	(0.425)	(0.689)
SharesPerBookrunner	(+)	-0.000	-0.000	0.000	0.000
		(-1.081)	(-1.085)	(1.105)	(1.331)
Year dummies		No	Yes	No	Yes
Observations		67	67	100	100
Durbin-Watson		2.105	2.204	2.086	2.184
R-squared		0.281	0.324	0.099	0.156

The regression results of the IPO samples divided based on the legal origin of the country are presented in table 19. First sample contains IPOs from French legal origin countries where investor protection is weakest. Second sample contains IPOs from English-, German, and Scandinavian legal origin countries. The equations were estimated with and without time fixed effects for both samples. Models 17 and 18 are explaining first week returns of IPOs

form French legal origin countries and models 19 and 20 explain first week returns of IPOs from English-, German, and Scandinavian legal origin countries.

As presented in table 19 the models explaining first week returns of IPOs from French legal origin countries provided weak explanatory power. Model 17 was estimated without time fixed effects and none of the independent variables in model 17 are statistically significant. Model 18 was estimated with time fixed effects. Inclusion of time dummies did not improve the model and all the independent variables remain insignificant. The results in models 17 and 18 are indicating that the variables in this study are not able to explain first week returns of IPOs from French legal origin countries.

Models 19 and 20 are explaining first week returns of IPOs from English-, German-, and Scandinavian legal origin countries. As presented in table 19 the r-squared in model 19 is 0.120 and the model explains 12.0% of the variations in first week returns. The coefficient of AvgWeeklyMktInd is positive and statistically significant at 1% level of significance. Coefficient of 5.938 is indicating that one percentage point increase in average return of the market index during 30-day period before the offering increases the first week return by 5.938%. In addition, the coefficient of OfferPr is positive and statistically significant at 5% level of significance. Based on this finding the first week returns are higher in IPOs where final offer price is adjusted upwards. Model 20 was estimated with time fixed effects and the inclusion of time dummies improved the model. The r-squared in model 20 is 0.203. Same coefficients as in model 19 were statistically significant and the signs were as expected. However, the statistical significance of OfferPr decreased and the coefficient is statistically significant at 10% level of significance. The findings in models 19 and 20 are indicating that variables AvgWeeklyMktInd and OfferPr are able to explain first week returns of IPOs from English-, German-, and Scandinavian legal origin countries.

Table 19. Multivariate regression results for first day returns of IPO samples divided by legal origin of countries

Equations are estimated with White's heteroskedasticity-consistent standard errors. Coefficients are presented on the first line. T-statistics are presented below the coefficient in parenthesis. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. The abbreviations of independent variables are described in section 3.1.2. The dataset is divided into sample containing IPOs from French legal origin countries and in sample containing IPOs from English-, German-, and Scandinavian legal origin countries.

	Expected Sign	(17) French Legal Origin	(18) French Legal Origin	(19) English-, German- and Scandinavian Legal Origin	(20) English-, German- and Scandinavian Legal Origin
Dependent variable		First week return	First week return	First week return	First week return
Constant		0.199 (1.474)	0.315 (1.675)	-0.028 (-0.431)	-0.140 (-1.616)
AvgFirstWeekPriorIPOs	(+)	-0.981 (-1.213)	-0.938 (-1.397)	0.017 (0.069)	-0.137 (-0.534)
AvgWeeklyMktInd	(+)	-9.625 (-1.627)	-10.617 (-1.616)	5.938 (3.034)***	6.607 (3.107)***
SdWeeklyMktInd	(+)	-2.540 (-0.933)	-2.278 (-0.854)	0.711 (0.408)	0.527 (0.254)
LnSales	(-)	-0.010 (-0.951)	-0.009 (-0.884)	-0.003 (-0.271)	-0.005 (-0.501)
ChangeEBIT	(-)	-0.018 (-0.846)	-0.035 (-1.005)	0.003 (0.386)	0.000 (0.305)
LnUsesProceeds	(+)	-0.037 (-0.831)	-0.012 (-0.196)	0.045 (1.116)	0.041 (0.907)
OfferPr	(+)	0.047 (0.636)	0.044 (0.560)	0.067 (2.302)**	0.058 (1.773)*
SharesPerBookrunner	(+)	0.000 (1.422)	0.000 (1.291)	-0.000 (-0.670)	-0.000 (-0.051)
Year dummies		No	Yes	No	Yes
Observations		62	62	105	105
Durbin-Watson		2.115	2.235	2.037	2.251
R-squared		0.176	0.254	0.120	0.203

4.4 Summary of results

The objective of this thesis was to examine the current situation of IPO underpricing in Europe. The purpose of the empirical section in this thesis was to find answers for the research questions presented in section 1.2. The main analysis is conducted based on data sample of 167 IPOs from 18 different countries. Prior literature has found out that European

IPOs are underpriced meaning that the price of the shares jump right after the offering and the underpricing fluctuates over time (Ljungqvist, 2007; Akyol et al., 2014). The first research question in this thesis was:

Research question 1: Were European IPOs underpriced between 2009 and 2017?

Significant positive initial returns were found in the IPO sample between 2009 and 2017. The average first day return of 167 European IPOs was 6.07% and statistically significant at 1% level of significance. The average first week return was 5.52% and also statistically significant at 1% level. Underpricing was also studied in four sub-samples and significant underpricing was also found in these samples. First, the dataset was divided into Nordic and Non-Nordic IPO samples. The average first day return of 67 Nordic IPOs was 8.65% and the average first week return was 7.79%. Underpricing of Non-Nordic IPOs was substantially lower compared to Nordic IPOs. The average first day returns of Non-Nordic European IPOs was 4.34% and average first week return was 4.00%. Second, the IPO sample was divided based on the legal origin of the country. The average first day return of the IPOs from French legal origin countries was 5.17% and the average first week return was 6.67%. Surprisingly, in this sample the average first day return was lower compared to the first week return. The average first day returns of the IPOs from English, German-, and Scandinavian legal origin countries was 6.60% and the average first week trading was 4.48%.

Based on these findings the first hypothesis stating that European IPOs are priced efficiently and are not underpriced is rejected. The results are in line with earlier empirical literature arguing that European IPOs are underpriced on average (Ljungqvist, 2007; Akyol et al., 2014). However, the level of underpricing is lower compared to the findings of prior literature concentrating in earlier time periods (Ljungqvist, 2007) indicating that the level of underpricing has declined. The empirical results in this thesis show that the level of underpricing has declined substantially compared to earlier time periods. The level of underpricing is also dependent on the timing of the issue. First day and first week returns fluctuate from year to year. According to the empirical results in this thesis the level of underpricing is also dependent on the country where the IPO is issued and the industry of the issuing company.

The objective of the second research question was to identify the determinants of IPO underpricing in Europe. The first day returns and first week returns of the sample of 167 IPOs were explained with different variables presented in section 3.1.2 in order to identify the reasons behind IPO underpricing in Europe. The hypotheses were tested separately for each sample. The second research question was:

Research question 2: What are the determinants of IPO underpricing in Europe?

The statistically significant variables varied in different samples. In the whole IPO sample positive and statistically significant relationship was found between first day returns and average daily return of the market index during 30-day period before the offering indicating that first day returns increase when average total market index returns before the offering increase. In addition, the coefficient of offer price revision dummy was positive and statistically significant meaning that first day returns are higher when positive revisions are done in the final offer price. Negative and significant relationship was found between first day returns and total number of IPO shares per bookrunner indicating that underpricing is lower when total number of IPO shares per bookrunner increases. Only significant determinant explaining first week returns of the whole IPO sample was offer price revision dummy. Based on the results first week returns are higher if final offer price is revised upwards. The signs of identified determinants of underpricing were as expected and in line with prior literature. Average market index returns before the offering were explaining first day returns statistically significantly but no significant relationship was found when explaining first week returns. Based on these findings the second hypothesis stating that overall stock market growth before the IPO is followed by higher underpricing is rejected for the whole European IPO sample. In addition, no statistically significant relationship was found between underpricing and the total revenue of issuing company for the latest 12-month period before the offering leading to a rejection of the third hypothesis stating that IPOs of smaller companies are more underpriced.

The objective of the third research question was to compare the determinants of IPO underpricing in countries with different institutional and legal characteristics. The determinants of IPO underpricing were studied in four sub-samples. First, the dataset was divided into Nordic and Non-Nordic IPO samples. Second, the determinants of underpricing

were studied in French legal origin countries and in English, German-, and Scandinavian legal origin countries. The hypotheses were tested separately for each sample and the third research question was:

Research question 3: Are the determinants of IPO underpricing different in European countries with different legal and institutional characteristics?

In the Nordic IPO sample positive and statistically significant relationship was found between average first day returns and average daily return of the market index during 30-day period before the offering again supporting the argument that first day returns are higher during bull market conditions. Positive relationship was also found between first day returns and number of uses of proceeds. This finding is meaning that Nordic IPOs are more underpriced when issuing company has announced more uses for the IPO proceeds. In addition, the coefficient of offer price revision dummy was positive and statistically significant indicating that Nordic IPOs are more underpriced when positive revisions are done in the final offer price. Same variables showed statistical significance when the determinants of first week returns of Nordic IPOs were studied. The signs of the coefficients were also the same indicating similar relationships. Total market index returns were explaining statistically significantly both first day and first week returns of Nordic IPOs leading to acceptance of the second hypothesis stating that overall stock market growth before the IPO is followed by higher underpricing. The third hypothesis stating that IPOs of smaller companies are more underpriced is rejected. In the Non-Nordic IPO sample, no statistically significant determinants of underpricing were identified indicating that the variables in this study were not able to explain first day and first week returns of Non-Nordic IPOs. For Non-Nordic IPO sample both second and third hypotheses are rejected. Regression models explaining underpricing of Nordic IPOs provided considerably better explanatory power compared to the Non-Nordic models. The results suggest that information-based variables explain cross-sectional variations in underpricing better in Nordic countries compared to the Non-Nordic countries.

The models explaining fist day and first week returns of IPOs from French legal origin countries provided weak explanatory power. The variables in this study were not able to explain IPO underpricing in French legal origin countries leading to a rejection of second

and third hypotheses. In the sample containing IPOs from English, German-, and Scandinavian legal origin countries positive and statistically significant relationship was found between first day returns and average daily return of the market index during 30-day period before the offering. This finding is meaning that in English, German-, and Scandinavian legal origin countries IPOs are more underpriced when average market index returns before the offering increase. In addition, positive relationship was found between first day returns and offer price revision dummy indicating that IPOs are more underpriced when final offer price is revised upwards. Negative and statistically significant relationship was found between first day returns and total IPO shares per bookrunner meaning that in English, German-, and Scandinavian legal origin countries underpricing is lower when total IPO shares per bookrunner increase. Statistically significant determinants explaining first week returns of IPOs from English, German-, and Scandinavian legal origin countries were average weekly return of the market index during 30-day period before the offering and offer price revision dummy. The signs were as expected and similar to the ones explaining first day returns. Because average market index returns before the offering was explaining significantly both first day and first week returns the first hypothesis stating that overall stock market growth before the IPO is followed by higher underpricing is accepted for IPOs from English, German-, and Scandinavian legal origin countries. No statistically significant relationship between underpricing and the total revenue of issuing company for the latest 12-month period before the offering was found. Thus, the third hypothesis stating that IPOs of smaller companies are more underpriced is rejected. The results suggest that the variables used in this study explain cross-sectional variations in underpricing better in English, German-, and Scandinavian legal origin countries compared to the French legal origin countries.

4.5   Economic implications

The results presented above have several economic implications for prior literature about IPO underpricing. The results in this study show that European IPOs were underpriced between 2009 and 2017. The average first day return of 167 IPOs was 6.07% and the average first week return was 5.52%. The findings are in line with earlier literature arguing that IPOs are underpriced. However, the level of underpricing is lower compared to the findings of earlier literature indicating that the level of underpricing has decreased. Ljungqvist (2007) reported the average initial IPO returns in 19 European countries between 1990 and 2003

and the level of underpricing varied between ca. 5% to 60% depending on the country where the IPO was issued. The empirical findings in this thesis show that the level of underpricing has declined substantially compared to earlier time periods. Akyol et al. (2014) argue that regulation improves the transparency and increases the amount of information related to the IPO resulting in lower IPO underpricing. In Europe the adoption of corporate governance codes has reduced the level of underpricing (Akyol et al., 2014). The findings in this thesis also found substantial decline in the degree of underpricing in Europe. According to the findings in this thesis the share prices also adjust towards the real price during the first week of trading. This argument is supported by the finding that average first day returns are higher compared to the average first week returns. The distribution of positive and negative returns also gets closer of being equal during the first week of trading. The level of underpricing is also dependent on the timing of the issue. The results in this thesis showed that first day and first week returns fluctuate from year to year during the study period. The finding is in line with Ibbotson & Jaffe (1975) who found out that the volume of IPOs fluctuate over time and the average initial returns are dependent on the timing of the IPO. They found cyclical patterns of IPOs, where during some periods IPOs show higher than average underpricing.

Being in line with the findings of Ljungqvist (2007), the results in this thesis showed that the level of underpricing is also dependent on the country where the IPO is issued. Positive initial returns were documented in majority of the countries in this study, but the initial IPO returns fluctuate substantially between different countries. La Porta et al. (1998) found out that the legal origin of the country has an impact in country's capital markets and corporate finance. The findings in this thesis are indicating that the IPO underpricing is dependent on the institutional characteristics of the country where the IPO is issued. The degree of underpricing also varied in different sub-samples used in this study. Highest first day and first week returns were experienced in the Nordic IPO sample and the underpricing of Non-Nordic European IPOs was substantially lower. Underpricing was close of being equal in the IPO samples that were divided based on legal origin of the countries.

The findings in this thesis indicate that the level of underpricing is dependent on the industry of the issuing company. Majority of the industries experienced positive average initial returns during the study period and the returns were highest in high technology, telecommunications and healthcare industries. Ljungqvist & Wilhelm (2002) documented

extremely high underpricing during the dot-com bubble in 1999-2000. They argue that the level of underpricing is partially dependent on the characteristics of the issuing company. The findings in this thesis are in line with the arguments of Ljungqvist & Wilhelm (2002). Companies in high technology, telecommunication and healthcare industries might be more speculative and thus show higher initial IPO returns.

The determinants of IPO underpricing were studied in order to be able to understand the reasons for underpricing in Europe. In addition to the whole IPO sample, the determinants of IPO underpricing were studied in four sub-samples. First, the dataset was divided into Nordic and Non-Nordic European IPOs. Second, the IPOs were divided into two samples based on the legal origin of the countries. The statistical significance in different models showed great dispersion and the determinants of IPO underpricing varied in different samples.

As presented by Bradley & Jordan (2002) the IPO underpricing can be predicted based on the performance of other IPO before the offering. According to the arguments of Bradley & Jordan (2002) the underpricing of new issue is positively related to the initial returns of other IPOs before the offering meaning that higher underpricing of previous IPOs results in higher degree of underpricing of new issue. The findings of this thesis indicate that the initial IPO returns cannot be explained with underpricing of prior IPOs on the same industry. Average first day return of 10 prior IPOs on the same industry showed statistical significance in Non-Nordic IPO sample but the variable was not robust when the model was estimated with time fixed effects. Average first week return of 10 prior IPOs on the same industry was insignificant in every model supporting the finding that IPO performance cannot be predicted based on initial returns of prior IPOs on the same industry.

Prior literature argues that IPO underpricing is dependent on the market conditions before the offering. Based on these arguments there should be significant relation between total market index returns before the offering and IPO underpricing. The degree of underpricing increases during bull market conditions (Lowry & Schwert, 2004; Lowry & Murphy, 2007). The empirical findings of this thesis found some support for this argument. Average daily return of the market index during 30-day period before the offering was statistically significant in models that were explaining first day returns of the whole IPO sample, IPOs

from Nordic countries and IPOs from English-, German-, and Scandinavian legal origin countries. Positive coefficients are supporting the finding that increase in average total market index returns before the offering increases the level of underpricing. Relatively high coefficients are indicating that relatively small increase in average market index returns before the IPO results in considerably higher first day returns. Average daily return of the market index during 30-day period before the offering was not statistically significant in models that were explaining first day returns of IPOs from Non-Nordic European countries and from French legal origin countries. Average weekly return of the market index during 30-day period before the offering explained statistically significantly first week returns of Nordic IPOs and English-, German-, and Scandinavian legal origin IPOs. Coefficients were positive indicating positive relationship between average market index returns and first week IPO returns in these IPO samples. In rest of the models the average weekly return of the market index during 30-day period before the offering did not provide statistically significant explanatory power. These findings are indicating that average total market index returns explain IPO underpricing in Nordics and in English-, German-, and Scandinavian legal origin countries. As stated by La Porta et al. (1998) the investor protection in English common law countries and in German- and Scandinavian civil-law countries is stronger compared to French civil law countries. In Nordic countries and in English-, German-, and Scandinavian legal origin countries investors might trust more on the information provided by total market index returns.

According to the findings presented by Lowry et al. (2010) the uncertainty in overall market conditions is affecting the degree of underpricing. More volatile market conditions increase the uncertainty related to the valuation of issuing company and thus lead to higher degree of underpricing (Lowry et al. 2010). The findings in this study do not support this argument. No statistically significant dependency was found between market index volatility and first day IPO returns. The standard deviation of weekly market index returns during 30-day period before the offering was also insignificant in models explaining first week IPO returns indicating that neither first week IPO returns can be predicted based on market volatility before the IPO.

Prior literature has found out that uncertainty related to the issuing company has an impact on the degree of underpricing (eg. Beatty & Ritter, 1986). IPOs of smaller companies can be

considered more uncertain. The size of the issuing company in this study was measured as total revenue of issuing company for the latest 12-month period before the offering but no statistically significant relationship was found between total revenue of issuing company before the offering and IPO underpricing. This finding is meaning that issuing company's size before the IPO is not explaining first day or first week returns. The finding is rather surprising since the valuation of smaller companies should be more uncertain compared to larger issues and companies. The size of the offering has also been found out to be affecting the IPO underpricing. Aggarwal et al. (2002) found negative relationship between underpricing and total IPO shares in the offering. In addition, Corwin & Schultz (2005) argue that larger syndicates of underwriters in the IPO can produce more reliable information and thus reduce the degree of underpricing. In this study these two variables were combined, and the information asymmetry was measured as total IPO shares per bookrunner. Since prior literature suggests that larger underwriter syndicates reduce underpricing it was expected in this study that underpricing is lower when shares per bookrunner decrease. However, the results in this study suggest opposite relationship. Total number of IPO shares per bookrunner was negative and statistically significant in models that were explaining first day returns of the whole European IPO sample and English-, German-, and Scandinavian legal origin IPOs. These findings are indicating that underpricing is lower when number of IPO shares per bookrunner increase. This finding might suggest that underpricing is more driven by the size of the offering than number of bookrunners. Total number of IPO shares per bookrunner was insignificant in rest of the models and the variable was not explaining first week IPO returns.

Beatty & Ritter (1986) used the number of uses of proceeds as a proxy for uncertainty and they argue that IPOs with more uses of proceeds listed are more uncertain and thus are also more underpriced. Statistically significant relationship between IPO underpricing and number of uses of proceeds listed was found in Nordic IPO sample. Positive relationship is indicating that the first day and first week returns are higher in Nordic IPOs that have announced more uses for the IPO proceeds. Some support for positive relationship between underpricing and uses of proceeds listed was also found in English-, German-, and Scandinavian legal origin IPO sample but the variable was not robust. Surprisingly, negative relationship between uses of proceeds listed and first week returns was found in Non-Nordic

European IPO sample. However, the statistical significance was weak, and the coefficient was not robust in both models.

As suggested by Benveniste & Spindt (1989) the offer price adjusts only partially to private information that investors reveal during book building process. According to their arguments investors that reveal their information are rewarded with more underpriced shares. This finding is supported by Hanley (1993) who found that the IPOs where positive revisions are done in the final offer price tend to be more underpriced. The empirical findings in this study found some support for these arguments. Positive and statistically significant relationship between offer price revision and initial IPO returns was found in the whole IPO sample, Nordic IPO sample and English-, German-, and Scandinavian legal origin IPO sample. In these samples the IPOs were more underpriced if positive revisions were done in the final offer price. As stated by Jenkinson et al. (2006) final offer prices are more frequently revised in the U.S. compared to Europe. If offer prices are seldomly revised in Europe, it is reasonable to assume that offer price revisions in Europe contain also more information and thus affect underpricing. No statistically significant relationship between offer price revision and underpricing was found in Non-Nordic IPO samples and in sample containing IPOs from French legal origin countries.

Prior literature argues that companies use underpricing to signal their quality (Welch, 1989; Allen & Faulhauber, 1989). However, empirical literature also argues against signaling theory in IPO underpricing. Jegedeesh et al (1993) found support for signaling hypotheses but they argue that the economic significance is weak. In addition, Michaelly & Shaw (1994) argue the IPOs of companies with higher earnings after the offering are substantially less underpriced. The findings of this study did not found support for signaling hypothesis in IPO underpricing. No significant relationship was found between underpricing and change in company's earnings. One of the reasons for the IPO is that the issuing company is seeking for growth. Therefore, issuing company's earnings might increase because of the growth resulting from receiving public equity. Company's growth after IPO might also result in increasing need of capital in the future. In this sense the argument of earlier literature that companies, which underprice their IPO are more likely to issue seasoned equity offering, is not justified. The findings in this thesis support these arguments.

The dataset used in this study contains IPOs from several different European countries and from several different industries. The financial markets in these countries are different from each other and thus it makes sense that robust determinants common for all these markets are difficult to identify. The models concentrating in Nordic IPOs and in IPOs from English, German-, and Scandinavian legal origin countries provided best explanatory power and in these samples some support was found that the information frictions are explaining IPO underpricing. No generalizable determinants of underpricing were found in Non-Nordic IPO sample and in sample containing IPOs from French legal origin countries. The variables that were chosen for this study concentrated in information-based explanations in IPO underpricing. The results indicate that information frictions do not solely explain high initial IPO returns of European IPOs. The findings are in line with Ritter & Welch (2002) who argue that academic literature is overemphasizing the explanatory power of information asymmetric models in IPO underpricing. However, the reliability of the results has to be assessed because the IPO sample used in this study is limited.

5 CONCLUSIONS

IPO underpricing is widely recognized phenomenon and the topic has received a lot of attention during past decades. Prior literature has identified several determinants affecting the degree of underpricing and initial IPO returns have been explained with several different theories. Majority of prior literature has focused on information-based models and based on prior arguments information frictions have first order effect on IPO underpricing. However, the arguments of prior literature differ and no generalizable reason for IPO underpricing exists. Majority of the theories of IPO underpricing are created based on the U.S. markets. In addition, prior literature argues that the volume of IPOs and the degree of underpricing fluctuates over time (eg. Ibbotson & Jaffe, 1975; Ljungqvist, 2007; Akyol et. al 2014). These issues have motivated this study and based on these issues it was important to conduct a current study of IPO underpricing in Europe.

The purpose of this thesis was to study the current situation of IPO underpricing in Europe. The time frame for this study was from 2009 to 2017. The sample used to study the determinants of IPO underpricing contained 167 IPOs from 18 different countries. The capital markets and legal systems in European countries are different from each other (La Porta et al., 1998). Thus, the determinants of underpricing were also studied in four sub-samples. First, the dataset was divided into Nordic and Non-Nordic IPO samples. Second, the dataset was divided based on the legal origin of the countries into sample containing IPOs from French legal origin countries and into sample containing IPOs from English, German-, and Scandinavian legal origin countries. The most common measure of underpricing is first day return after offering. The characteristics of different capital markets in Europe are different and some of the markets are less developed. In less developed markets it might take some time until the underpricing is evident. Thus, underpricing was also measured as first week return after offering. The level of underpricing in Europe was analyzed based on first day and first week IPO returns. The volume of IPOs and the degree of underpricing was compared between different years, countries and industries. The focus of this thesis was to study the determinants of IPO underpricing and based on these determinants the reasons of IPO underpricing were analyzed. Since prior literature has stressed out the importance of information friction the focus in this study was in variables related to information-based models. The study variables for this study were identified based on the findings of prior literature and these variables were used to explain first day and first

week IPO returns. In total 11 variables were used to study the determinants of underpricing. Multivariate OLS regression was used to identify the determinants of underpricing. To check the robustness of each variables two regression equations were estimated for each IPO sample. First equations were estimated without time fixed effects and second equations accounted for time fixed effects.

This study documented significant underpricing of European IPOs between 2009 and 2017. Average first day return of European IPOs was 6.07% and the average first week return was 5.52%. Based on the empirical findings of this thesis the degree of underpricing in Europe has declined substantially compared to earlier time periods. The reason for the decline in underpricing might be in the changes of information availability. Uncertainty related to the value of the issuing company increases the level of underpricing. As stated by Akyol et al. (2014) the increase in regulation in Europe has resulted in lower degree of underpricing. Information availability has improved compared to earlier periods and thus the valuation of issuing company has become easier. When IPOs are valued based on more certain information the degree of underpricing declines. The results in this study showed that the degree of underpricing is also dependent on the timing of the issue. Average underpricing is different during each year in the study period. Overall market conditions during the study period have fluctuated so the argument is justified

Cross-sectional regression analysis in this study found some support for information-based variables explaining IPO underpricing. Most support for information-based reasons for IPO underpricing were found in sample containing IPOs from Nordic countries and in sample containing IPOs from English, German-, and Scandinavian legal origin countries. The models explaining underpricing in Non-Nordic countries and in French legal origin countries provided weak explanatory power and the results suggest that in these countries information-based variables are not solely able to explain IPO underpricing.

The significant determinants explaining first day returns in the whole IPO sample used in this study were average daily return of the market index during 30-day period before the offering, offer price revision dummy and number of IPO shares per bookrunner. When examining the determinants of first week returns in the sample containing all the European IPOs in this study, the only significant variable was offer price revision dummy. The

significant variables explaining underpricing of Nordic IPOs were average return of the market index during 30-day period before the offering, ln of the uses of proceeds listed and offer price revision dummy. Same variables were significant in models explaining first day returns and in models explaining first week returns suggesting that these variables explain underpricing of Nordic IPOs. The variables used in this study were not able to explain underpricing of IPOs from Non-Nordic European countries. The findings are indicating that some other variables should be used when explaining underpricing of IPOs from Non-Nordic countries. The institutional characteristics and legal systems in Nordic countries are very similar so it is reasonable that determinants of underpricing are easier to identify compared to the Non-Nordic countries. The significant determinants that were explaining first day returns of IPOs from English, German-, and Scandinavian legal origin countries were average market index return during 30-day period before the offering, offer price revision dummy and number of IPO shares per bookrunner. However, the number of IPO shares per bookrunner did not provide explanatory power when explaining first week returns. The models explaining underpricing of IPOs from French legal origin countries provided poor explanatory power. None of the variables were significant suggesting that the underpricing should be explained with some other variables.

Based on the results in this thesis the determinants of underpricing are dependent on the institutional characteristics and legal systems of the country where the IPO is issued. The models explaining underpricing of Nordic IPOs and IPOs from English, German-, and Scandinavian legal origin countries provided best explanatory power and some support for information-based variables were found in these models. However, some other variables that were omitted from this study should also be considered. In Non-Nordic countries and in French legal origin countries the variables in this study were not able to explain IPO underpricing. Either variables related to information asymmetric are not able to explain underpricing in Non-Nordic and French legal origin countries or some important variables related to information frictions were omitted from this study.

There were several limitations that need to be taken into account when reviewing the results of this thesis. First, the focus in this study was in information-based models and the study variables were related to information frictions explaining underpricing. Identification and selection of the study variables are placing limitations for this study. Some important

variables might have been omitted from this study and thus the results are limited. Second, the IPO sample used in this study contained only 167 observation which is only a narrow sample of the total dataset of IPOs that were issued during the study period. The data availability placed constraints for this study and the observations where data was missing were omitted from this study. Exclusion of some IPOs is weakening the reliability of the results and it should be considered as a limitation of this study. Third, the data sample contains IPOs from different European countries and the number of IPOs in the sample varies substantially between different countries. Therefore, the analysis of the reasons for IPO underpricing focuses more on countries with higher number of IPOs and this issue should be considered when assessing the generalizability of the results.

The results in this thesis found some support for information-based explanations of IPO underpricing in Nordic markets and in European markets with English-, German- and Scandinavian legal origins. The results in this thesis are suggesting that information-based variables used in this study are not able to explain IPO underpricing in Non-Nordic markets and in markets with French legal origin. The determinants of underpricing in Europe are dependent on the institutional and legal characteristics and in addition to the variables used in this study some other determinants should also be considered. The results are in line with Ritter & Welch (2002) who argue that academic literature is overemphasizing the explanatory power of information asymmetric models in IPO underpricing. Financial markets are changing rapidly, and information acquisition has become increasingly easier. Based on the results of this study the future research should not explain IPO underpricing solely with information-based variables. Because the investors are more and more aware of the information on the market the future research should concentrate on behavioral explanations of IPO underpricing. The sample used in this study contains IPOs from different European countries. The financial markets and legal systems of these countries are different from each other and thus it makes sense that robust determinants common for all these markets are difficult to identify. The results in this thesis found that the determinants of underpricing vary in countries with different legal systems and institutional characteristics. Based on these arguments future research should concentrate on individual markets when studying the reasons of IPO underpricing. The company characteristics in different industries are also diverse and the reason for IPO underpricing might be different

between different companies suggesting that future research should find reasons for underpricing in different industries.

Even though the literature of IPO underpricing is manifold the puzzle has not yet been solved. The degree of underpricing is fluctuating over time and the reasons for IPO underpricing also seem to change with time. IPO underpricing requires continuous research as the financial environment is changing and more advanced econometric techniques are required in the future research.

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APPENDICES

Appendix 1. Descriptive statistics of the whole dataset

	Observations	Mean	Median	Standard deviation	Max	Min	Low Quartile	High Quartile
First day return	682	0.049	0.017	0.159	1.725	-0.861	-0.016	0.091
First week return	784	0.048	0.017	0.199	2.228	-0.866	-0.028	0.098
AvgFirstDayPriorIPOs	682	0.049	0.040	0.052	0.265	-0.077	0.018	0.074
AvgFirstWeekPriorIPOs	682	0.049	0.045	0.058	0.280	-0.098	0.013	0.078
AvgDailyMktInd	966	0.000	0.000	0.002	0.011	-0.007	-0.001	0.001
SdDailyMktInd	966	0.010	0.009	0.005	0.059	0.002	0.007	0.012
AvgWeeklyMktInd	964	0.002	0.002	0.009	0.056	-0.038	-0.002	0.007
SdWeeklyMktInd	964	0.021	0.019	0.011	0.157	0.004	0.013	0.026
LnSales	685	4.586	4.760	2.462	11.290	-2.303	2.950	6.404
ChangeEBIT	523	-0.327	-0.038	2.407	10.205	-27.000	-0.369	0.171
LnUsesProceeds	986	0.648	0.693	0.543	2.197	0.000	0.000	1.099
OfferPR	463	0.425	0.000	0.495	1.000	0.000	0.000	1.000
SharesPerBookrunner	985	11271326	3916667	27364408	554000001	10	1364770	10718703

Appendix 2. Total number of IPOs and total proceeds by year
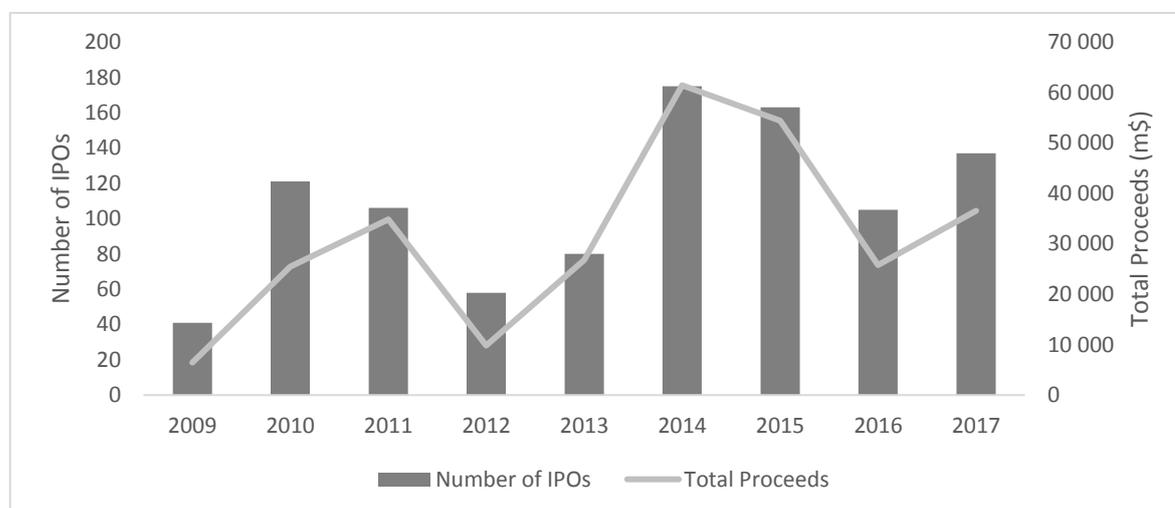
Appendix 3. Total number of IPOs and total proceeds by country

|	Number of IPOs	Total Proceeds (m$)	Average proceeds per issue (m$)
Austria	5	2 863	573
Belgium	22	3 286	149
Bulgaria	1	5	5
Croatia	1	4	4
Cyprus	4	2 104	526
Czech Republic	2	48	24
Denmark	18	11 565	642
Estonia	2	57	29
Faroe Islands	1	111	111
Finland	33	3 659	111
France	157	17 475	111
Georgia	1	239	239
Germany	90	29 965	333
Gibraltar	1	6	6
Greece	9	929	103
Guernsey	5	893	179
Hungary	5	146	29
Ireland-Rep	10	1 989	199
Isle of Man	2	181	91
Italy	81	21 382	264
Jersey	3	2 100	700
Latvia	1	4	4
Lithuania	3	62	21
Luxembourg	20	8 064	403
Malta	2	140	70
Monaco	4	789	197
Netherlands	37	21 311	576
Norway	34	8 479	249
Poland	85	12 027	141
Portugal	2	894	447
Romania	5	1 357	271
Russian Fed	27	12 344	457
Spain	42	26 575	633
Sweden	97	14 004	144
Switzerland	29	21 822	752
Turkey	29	2 912	100
Ukraine	7	418	60
United Kingdom	109	51 424	472
Total	**986**	**281 634**	286

Appendix 4. Total number of IPOs and total proceeds by industry

	Number of IPOs	Total Proceeds (m$)	Average proceeds per issue (m$)
Consumer Products and Services	85	16 197	191
Consumer Staples	60	11 475	191
Energy and Power	60	21 732	362
Financials	152	66 734	439
Government and Agencies	1	3 391	3391
Healthcare	139	13 475	97
High Technology	117	26 288	225
Industrials	131	39 333	300
Materials	55	26 367	479
Media and Entertainment	38	12 704	334
Real Estate	64	15 424	241
Retail	59	17 281	293
Telecommunications	25	11 233	449
Total	**986**	**281 634**	286

Appendix 5. First day and first week returns of the IPO sample containing all the IPOs with offer price greater than 3$ and after issue price data available

	Observations	Mean	Percent positive	Percent negative	Standard deviation	T Statistic
First day return	678	4.88 %	64 %	36 %	0.16	7.95***
First week return	678	4.67 %	58 %	42 %	0.19	6.47***

Appendix 6. Underpricing by year of the IPO sample containing all the IPOs with offer price greater than 3$ and after issue price data available
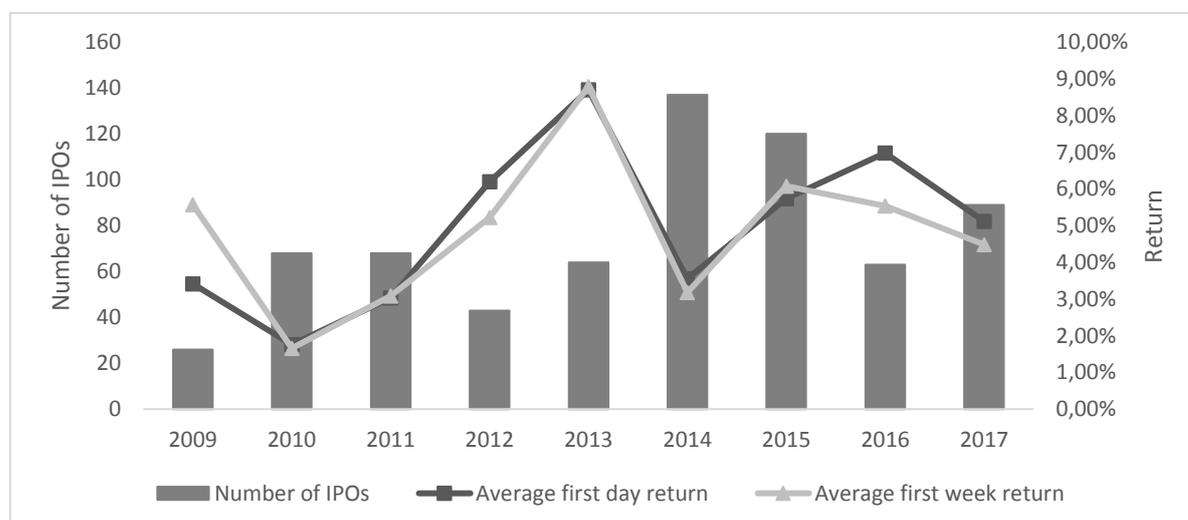
Appendix 7. Underpricing by country of the IPO sample containing all the IPOs with offer price greater than 3$ and after issue price data available

	Number of IPOs	Average first day return	Average first week return
Austria	3	7.02 %	-6.03 %
Belgium	18	3.60 %	6.33 %
Cyprus	1	0.00 %	-0.53 %
Czech Republic	2	2.13 %	-0.60 %
Denmark	13	7.07 %	5.22 %
Faroe Islands	1	15.49 %	16.93 %
Finland	20	5.48 %	5.27 %
France	136	2.60 %	4.22 %
Germany	67	4.86 %	2.18 %
Gibraltar	1	-5.32 %	-23.22 %
Greece	6	1.68 %	-0.09 %
Guernsey	4	6.87 %	9.27 %
Hungary	2	-11.18 %	-13.62 %
Ireland-Rep	8	2.44 %	3.58 %
Isle of Man	1	8.71 %	10.16 %
Italy	51	9.00 %	8.77 %
Jersey	3	1.98 %	4.19 %
Lithuania	2	7.54 %	6.68 %
Luxembourg	16	3.27 %	1.68 %
Malta	1	19.17 %	13.35 %
Monaco	4	1.63 %	-1.29 %
Netherlands	29	2.10 %	2.79 %
Norway	26	-0.15 %	-1.39 %
Poland	29	3.03 %	2.29 %
Portugal	2	-0.43 %	3.58 %
Russian Fed	7	5.26 %	5.43 %
Spain	16	2.64 %	1.76 %
Sweden	70	9.35 %	8.78 %
Switzerland	27	6.10 %	5.77 %
Turkey	13	2.27 %	3.68 %
Ukraine	3	-6.10 %	-9.99 %
United Kingdom	96	6.99 %	6.85 %
Total	**678**	**4.88 %**	**4.67 %**

Appendix 8. Underpricing by industry of the IPO sample containing all the IPOs with offer price greater than 3$ and after issue price data available

	Number of IPOs	Average first day return	Average first week return
Consumer Products and Services	62	4.66 %	3.89 %
Consumer Staples	41	5.33 %	5.11 %
Energy and Power	43	1.59 %	2.65 %
Financials	104	5.03 %	5.07 %
Healthcare	97	3.72 %	5.58 %
High Technology	92	6.85 %	5.35 %
Industrials	89	8.05 %	7.68 %
Materials	36	3.02 %	1.48 %
Media and Entertainment	23	3.87 %	2.41 %
Real Estate	35	1.60 %	0.97 %
Retail	38	5.35 %	4.59 %
Telecommunications	18	2.47 %	2.33 %
Total	**678**	**4.88 %**	**4.67 %**