UNIVERZITA KARLOVA V PRAZE

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Institut ekonomických studií

Diplomová práce

Signaling by IPO Under-Pricing:

Evidence from the Central Europe

2011 **Bc. Aleš Čornanič**

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Prague, July 29, 2011 Aleš Čornanič

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Abstract

This Master Thesis is focused on under-pricing of initial public offering. We examine the possibility of signaling by IPO under-pricing on Polish data over the period 2005 – 2010. Signaling by IPO under-pricing is analyzed using signaling model. Taking into consideration the uniqueness of Polish sample, we also analyze the signaling by IPO under-pricing used to the build up the government reputation as market-oriented. Our results suggest the statistical significant positive effect of IPO under-pricing on probability of seasoned equity issue as well as on size of seasoned issue. These findings together with negative relation between IPO under-pricing and lag between IPO and seasoned issue are consistent with predictions of signaling model. We do not find any statistical significant evidence that the Polish government tries to build up reputation for its privatization policy over time by under-pricing and selling a high fraction at the initial offer.

Keywords

IPO under-pricing, signaling hypothesis, Central Europe, asymmetric information, seasoned equity offering, privatization

Abstrakt

Tato diplomová práce je zaměřena na podhodnocování prvotní emise akcií. Možnou signalizaci pomocí podhodnocování prvotní emise zkoumáme na datech z polské burzy v období 2005 – 2010 s využitím signálního modelu. Vzhledem k výjimečnosti polských dat se též zabýváme signalizováním pomocí podhodnocování prvotní emise akcií v případě vlády, která může používat signalizování k budování reputace. Výsledky ukazují statisticky významné pozitivní efekty podhodnocování prvotní emise na pravděpodobnost opakování emise i na její velikost. Tyto výsledky jsou konzistentní s předpověďmi signálního modelu. V souladu se signálním modelem je i negativní vztah podhodnocování prvotní emise a dobou mezi primární emisí a opakovanou emisí. Nenalezli jsme žádné statisticky významné známky toho, že vláda se snaží využít podhodnocení prvotní emise a prodeje vysokého podílu v rámci primárních emisí jako signálu pro budování reputace privatizačních politik.

Klíčová slova

podhodnocení prvotní emise, signální hypotéza, střední Evropa, asymetrie informací, opakovaná emise, privatizace

Master Thesis Proposal

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Proposed Topic:

IPO under-pricing – evidence from Central Europe

Topic Characteristics:

The under pricing of initial public offerings (IPOs) in short run is one of the financial phenomena in the market for initial public offerings of common stock. The initial under-pricing of the IPO is the difference between the price obtained by the shares at the close of the first trading day and the price of the offer, adjusting for the market return in that same period (Adams, Thornton and Hall (2008)). This phenomenon is supported by large empirical and theoretical literature. First empirical evidence about IPO under pricing was for example Ibbotson (1975). Also the theories explaining the IPO under pricing were developed in time, for Winner's curse (Rock (1986)) or book-building theory (Benveniste and Spindt (1989)).

Many of these papers are about U.S. IPO market. On the other hand in my thesis I would like to examine the initial public offering from European perspective. The excellent work about EU IPO market is Gajewski, Gresse (2006). In my thesis I would like to focus on New member states of EU (10 countries enlarge the EU in 2004), mainly on the Central European countries. I would like to test whether the countries which were mostly post-communism under-price their IPO to attract investors from the "West". To test this I use signaling model.

Signaling models try to explain why initial public offerings of equity are on average under priced. The signaling models, for instance presented in Allen and Faulhaber (1989), Chemanur (1993) and Welch (1989) can be characterize as follows: (1) the issuers are more informed that the investors and (2) the issuers consider the possibility of future equity issues when they decide on IPO prices (Jegadeesh, Weinstein and Welch (1993)). Based on theory about signaling models there can be state the four simple testable hypotheses proposed in work Jegadeesh, Weinstein and Welch (1993) or Tse and Yu (2003).

For testing the signaling model I will need mainly the data for volume of IPO (SEO) and the historical prices. The data will be collected from several different sources: (i) the annual reports of individual companies; (ii) websites of stock exchanges (for instance Budapest Stock Exchange); (iii) another finance website such as yahoo finance website and (iv) the statistical databases such as Reuters (because of the University access).

Hypotheses:

(i) The existence of IPO under-pricing.

(ii) Signaling models hypotheses

H$_1$: *Firms with more under priced IPOs are more likely to issue seasoned equity than firms with less under priced IPOs.*

H$_2$: *Firms with more under price IPOs are likely to issue seasoned equity more promptly than firms with less under price IPOs.*

H$_3$: *Firms with higher IPO under pricing are likely to issue larger amounts of seasoned equity than firms with lower IPO returns.*

H$_4$: *The market will react less unfavorably to the announcements of seasoned equity issues by firms with higher under priced IPOs than by firms with lower IPO under pricing.*

Methodology:

Ad (i) For computation of IPO under-pricing I will use the "classical" initial return that is defined as logarithmic difference between the post-listing equilibrium price and the final offering price. As the post-listing equilibrium price I will choose as the closing price. The returns would be compute over one day and 5 days which is in line with existing literature. The second approach to measure IPO under-pricing is adjusted the "classical" initial return by market index.

Ad (ii) To verify the hypotheses about signaling models I formulate simple equations in line with existing literature. I estimate important coefficients by econometric methods such as Logit, Probit, Tobit or Ordinary Least Square. Closer description of hypotheses testing (individual equations) is provided for instance in paper Tse and Yu (2003) or Jegadeesh, Weinstein and Welch (1993).

Outline:

1. Introduction
2. Review of Existing Literature
3. IPO Under-pricing
   (a) Testing IPO Under-pricing
   (b) Development of IPO under-pricing over time
4. Signaling model
   (a) Methodology
   (b) Data description
   (c) Discussion of results
5. Conclusion

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1. Introduction

The decision of going public is one of the most important events for a company. Typically, firms go public to raise additional equity capital to finance their investment projects. In addition, there are several indirect benefits for firms that become public. Going public increases stock liquidity, which is likely to reduce the cost of capital and allow the firms to grow faster. Further, public firms attract more attention of financial analysts and fund managers. The broader publicity increases the company's chances to attract a broader range of investors or high caliber managers (Ljungqvist (2004)). The higher interest of potential investors is offset by new obligations connected with going public process. The companies have to meet the new criteria concerning disclosure and transparent requirements. The more stringent disclosure and transparent requirements need not be only burdening obligations but they can be also beneficial for company itself. If the information asymmetry exist then the fulfillment of more stringent disclosure and transparent requirements can be identify as signal company's "higher quality". Simultaneously with new obligations the companies are also forced to face new threat in form of accountability of relatively anonymous group of shareholders. New shareholders will prefer vote with their feet (selling of companies shares) instead of contribute to decision-making process in case of existence of potential problem.

Thus we will be focused on most common process of going public, i.e. initial public offering (IPO). The initial public offerings have drawn the attention of academic researchers and investors. One of the results of research of initial public offerings is the well-known financial puzzle, IPO under-pricing. The positive difference between the first day closing price and offering price usually called under-pricing of initial public offering was firstly appeared in work Ibbotson (1975). The research questions have been mostly related to examining the evidence of IPO under-pricing puzzle across different countries and seeking the possible explanations of this phenomenon (e.g. asymmetric information theories, institutional theories, behavioral theories and control ownership theory). The brief excursion into existing literature of IPO under-pricing is provided in section 2.

The best established theories of IPO under-pricing, supported by wide range of academic literature, are the asymmetric information theories (Ljungqvist (2004)). The main

assumption is existence of information asymmetry between issuers and investors. All asymmetric information theories of IPO under-pricing are based on the prediction that under-pricing is positively related to the degree of asymmetric information. Thus if the asymmetric information uncertainty approached zero in these models, IPO under-pricing would disappear entirely (Ritter and Welch (2002)).

In this thesis we re-examine one possible explanation of IPO under-pricing puzzle provided by asymmetric information theory, signaling hypothesis. Signaling hypothesis can be characteristic as afford to leave good taste in investors´ mouths´ by IPO under-pricing so that future issue from the same issuer could be sold at more attractive price. Thus the signaling hypothesis examine the relations between level of IPO under-pricing and second public offering (SPO). Following implications are predicted by signaling hypothesis, the IPOs that are more under-priced more likely: (i) issue a second public offering, (ii) issue a large portion of shares as SPO, (iii) issue SPO more quickly after IPO date and (iv) expect less unfavorable market reaction on SPO announcement.

The signaling theory is developed in works Welch (1989) or Allen and Faulhabre (1989) and in existing literature it is named as signaling model. The concept of signaling model is based on two simple assumptions: (i) existence of information asymmetry between issuer and investors (prospective shareholders) and (ii) the expectation that the second public offering will be realized in the future. The issuers use the IPO under-pricing as a signal of true quality of company in order to reduce the existing information asymmetry and believe that true quality will be recognized before second public offering. The cost of this strategy is representing by IPO under-pricing are compensated in form of higher offering price and interest of second public offering. Consistently with Francis et all (2008) we will follow the empirical verification of hypotheses of signaling model using the econometric models (e.g. Logit, Tobit, and Ordinary Least Square (OLS). The hypotheses of signaling model are presented in section 4.

Our analysis is aimed to polish capital market that is a leader of Central European market. We decide to pick the Polish capital market as the representative of Central European capital markets for several reasons. First of all, the geographic reason is that Poland is the most populate country and also the largest one in the Central and Eastern European (CEE) region. The second one is that the Warsaw Stock Exchange (WSE) is the

most important stock exchanges in region[1]. The position of WSE as a leader of Central European region can be supported by following facts: (i) the largest number and capitalization of listed companies in comparison with other important Central European exchanges (Prague Stock Exchange, Budapest Stock Exchange)[2] (ii) the largest companies from the Central European region are single listed or dual listed at Warsaw Stock Exchange (for instance ČEZ, New World Resources, MOL) (iii) the Polish capital market as well as Hungarian capital market is characterized by listing so called privatized initial public offerings. A part of privatization process has been realized through the privatized initial public offering (PIPO). In more detail the Warsaw Stock exchange and its position in Europe is discussed in Chapter 3.

Hence we find out the Central European region represented by Warsaw Stock Exchange as suitable for the analysis of connection between the pricing of IPOs and second public offerings. Information asymmetries between issuers and prospective shareholders (investors) are likely to be larger due to more lax disclosure requirements and weaker enforcement. Furthermore, Central European companies lack long histories of operation of capital market. Herewith the post-communist past and resulting transformation of economics affected the whole economy. This experience of Central European capital market allows us examine the influence of past experience and make comparison with prior research of IPOs in Central European region as well as comparison with studies of IPO markets from developed countries.

In addition, Central European markets constitute a unique setting where the initial IPOs in 1990s were made by the state. Prior research suggests that opportunistic behavior of companies may be reduced in case the company considers making a second public offering after the IPO because the companies have incentives to build reputation at IPOs to attract more favorable condition in the subsequent SPO (Welch (1989)). Since IPOs of privatized companies were made by the same owner, i.e. state, we will examine if the government considers the reputation building motive. We will use market-oriented hypothesis for the analysis if government builds up reputation over their privatization program. Market-oriented hypothesis assume that market-oriented government uses

[1] Market capitalization at the end of 2009: Warsaw (105 157),Prague (31 265) , Budapest (20 887) and Bratislava (3 614) in millions of €. The Figure 4 presents the market capitalization across the Europe.
[2] The Figure 4 presents market capitalization across the Europe.

Privatized IPOs under-pricing as one of the signal of its credibility and that level of under-pricing declines over time as reputation of government increase. The hypotheses of market-oriented are formulated in section 4.

This thesis should contribute into under-pricing literature with examining the emerging capital market (Poland) in order to extend the empirical literature about asymmetric information theories by study of country with post-communism past. The understanding of relation between information asymmetry and initial public offering is necessary for countries from Central European region if they want to reduce the inherit information asymmetry from past at such level in than they will be able to finish the transformation from emerging to developed capital market. Prompt finishing of capital market transformation is important for growth of whole economy. We utilize the country's specifics as post communism past, privatization through IPOs into research of signaling by IPO under-pricing. First we provide standard research of signaling by IPO under-pricing as signal models when we use the higher expected information asymmetry associated with post-communism past and include the privatized IPOs variables into model as specific of Polish market. Second we analyze signaling by IPO under-pricing as tool for building up the government reputation.

The thesis is structured as follows. In second chapter we provide a review of existing literature related to under-pricing puzzle, theories of IPO under-pricing and empirical evidence. Chapter three introduce the Warsaw Stock Exchange and established its position among European Stock Exchanges. Chapter four presents the testable hypotheses of signaling model and market-oriented hypothesis. In the fifth chapter we describe the methodology of measurement of short and long-run performance and methodology of estimation the signaling model. The description of the examine data is provided in chapter six. Chapters seven is focused on presentation of empirical results of our analysis and in the chapter eight we make the conclusions.

2. Review of Existing Literature

Following sections provide the summary of IPO under-pricing literature. At the beginning we present the most common theoretical explanations of IPO under-pricing phenomena and describe one of them, signaling models, in more details. The second part of the chapter is oriented on empirical literature about IPO under-pricing puzzle. At the end we provide brief review of IPO under-pricing literature aimed to CEE region.

2.1. Theoretical Explanations of IPO Under-Pricing Puzzle

The effect of systematic increase of the offer price on the first day closing price was documented in early works for instance Logue (1973) or Reilly (1973) and Ibbotson (1975). Since these pioneer works many economists and academicals have become to pay attention to phenomena of IPO under-pricing. There have been developed several theories which try to explain under-pricing puzzle. Consistent with Ljungqvist (2004) we classify the theories of IPO under-pricing into four groups: asymmetric information theories, institutional theories, control theories and behavioral theories.

Asymmetric information theories are based on assumption that between individual parties of IPO transaction (issuer, underwriter and investor) exist the information asymmetry which provides the information advantage for one side of a deal. Rock (1986) provided the explanation of IPO under-pricing known as Winner's curse. The information asymmetry in Winner's curse is caused by the assumption that some investors are better informed about the true value of the shares in offering than are investors in general, the issuing firm, or its underwriter. The informed investors are interested only in attractive shares. On the other hand the uninformed investors bid for shares without exception. This leads to situation when uninformed investors gain the over-priced shares and only portion of attractive (under-priced) shares. Then the return of uniformed investors is conditional on allocation of attractive shares but the return is below the simple average of return from under-priced (attractive) shares. In extreme case when uniformed investors receive all over-priced shares and no one attractive shares they will not be willing to bid for IPO allocation

as the average return is negative. Rock assumes that the primary market is dependent on the continued participation of uninformed investors, because the demand of informed investors is not sufficient to bid for whole offer even in attractive offerings. Thus the requirement for the participation of the uninformed investors in IPO allocation is that the conditional expected returns of uninformed investors are non-negative. Otherwise all IPOs have to be under-priced in expectation.

Another theory based on asymmetric information also assumes that the investors (or some of them) are better informed than the other participant of the IPO issuing. The theory of book building was developed by Benviste and Spindt (1989). The book building is described as process when the under-writers trying to obtain favorable information from informed investors in order to set offer price of IPO more accurately. It is obvious that there is no incentive of informed investors to reveal their information to under-writers without any compensation. Thus under-writers have to design such mechanism when for informed investors the revealing of their information truthfully is in line with their best interest. After collecting investors' indications of interest, the under-writers reward the investors who bid aggressively and so reveal favorable information with disproportionately large allocations of shares (Ljungqvist (2004)). On the other hand the investors who bid conservatively are excluded from the IPO. Sherman and Titman (2000) sum up the whole book building process into following three steps: *"The investment bank first decides which investors will be invited to evaluate and perhaps buy the issue. Second, investors evaluate the issue and provide the investment bank with preliminary indications of their demand for the issue. Third, the investment bank prices the issue and allocates shares to investors, generally allocating more shares to investors who indicates higher levels of demand"*[3]. They show that in case when information is costless, the optimal number of participating investors is infinite and under-pricing is equal to zero. But in case of costly information, the level of under-pricing is determined by the desire for information.

The signaling models are one of asymmetric information models, where the information advantage is on issuer's side. Signaling models assume existence of two types of companies (high and low-quality) and two rounds of raising the company's equity (IPO issue and after some time SPO issue). The high and low quality companies seem to

[3] Citate from Sherman and Titan (2000) p. 1, NBER 7786 there is also the definition of book building process

investors as identical because of information asymmetry. The incentives of high and low quality companies are totally different. Ljungqvist (2004) describes the incentive of high-quality firms in following way: *in time of initial public offering high-quality company has incentive to signal credibly its higher quality in order to raise capital in time of SPO on more advantageous terms*. On the other hand the low quality firm's incentive is to imitate high-quality firms. The issue price of IPO serves as the signal of quality in the signaling models. Another important assumption of signaling model is that the issuers explicitly consider the possibility of future offering in deciding of IPO process (Jegadeesh, Weinstein and Welch (1993)). The threat of detect the "true" quality of firms before the IPO or SPO, which has positive probability, is sufficient to deter the low quality firms from imitation of behavior of high-quality ones. If this threat occurs then the low quality firms will not benefit from pretending the high quality ones which is costly. The high-quality firms "leave money on table" in first round of raising their capital because they believe that true quality of firm will be revealed before secondary public offering. Afterwards they will issue the SPO in higher price than what it could expect if it did not signal its quality through its IPO pricing decision (Jegadeesh, Weinstein and Welch (1993)). The expected benefit at the time of the SPO outweighs the signaling costs (i.e. IPO under-pricing). The signaling models were developed in Welch (1989), Allen and Faulhaber (1989) or Chemmanur (1993). The closer description of individual signaling models is provided later in this chapter.

Second group of explanations of IPO under-pricing can be denoted as "institutional" explanations of IPO under-pricing. We mentioned three of them: legal liability, price stabilization and tax arguments.

Based on strict disclosure rules in the U.S. the issuers and under-writers are exposed to risk of litigation by investors due to fact that some information were mis-stated or omitted from the IPO prospectus. Hughes and Thakor (1992) provide the explanation of IPO under-pricing as issuers under-price the IPO in order to reduce their legal liability. They also propose a trade-off between the expected litigation cost and revenue from IPO. The most important assumption is that the probability of litigation increases in the offer price, i.e. the more over-priced IPO the higher probability of future lawsuit. Ljunqvist (2004) notes that the legal liability as IPO under-pricing explanation is in some respect the U.S. specialty. To support this he quotes several studies which conclude that the risk of

being sued is not economically significant in other countries with under-pricing experience, for instance in case of Germany (Ljungqvist (1997)) or the U.K. (Jenkinson (1990)).

Further possible explanation of IPO under-pricing is proposed by Ruud (1993). He focused on examining not only mean but also the distribution of initial returns of IPOs. Rudd figure out that "*instead of forming a symmetric curve centered over a positive mean, the distribution of one-day returns is found to peak steeply around zero and includes very few observations in negative tail"*. In the perspective of these new formulations of a mean and distribution of initial returns of IPOs, the IPO under-pricing is no longer taken as deliberate. Rather, the reason of IPOs under-pricing could be price support or stabilization. Price support (stabilization) is consistent from transactions that prevent or slow the decline in the market price of securities. Then price stabilization tends to suppress or eliminate negative (left) tail of the distribution of initial returns which implies the fiction of a positive average price growth. If we take into account the suppression of negative tail then the resulting mean of one day return is close to zero.

Last institutional explanation of IPO under-pricing is not very common. It is called Tax arguments and is focused on tax benefits. The under-pricing may be advantageous from a tax point of view in specific cases. Rygqvist (1997) refers to situation in Sweden before 1990 when the tax on employment income was much higher than tax on capital gains. This situation leads to paying to employees by allocation of appreciated assets (under-priced shares) instead of salaries. Rygqvist supported his hypothesis by evidence: (i) issuers announce in the prospectuses that employees are favored, (ii) as the response to situation two regulations were passed and finally (iii) after the regulatory changes there was significantly lower under-pricing. The tax benefits alone cannot explain the IPO under-pricing at all but with respect to Rygqvist work the some portion of IPO under-pricing could be motivated by tax benefits in specific case.

Another group of theories is so called control theory. The decision of company going public through IPO is closely connected with eventual separation of ownership and control. The possible change of ownership and control is linked with agency costs and benefits. Thus we mentioned here two models that try to explain the under-pricing puzzle in the framework of an agency cost approach.

First one is model proposed by Brennan and Franks (1997) that analyze the costs and benefits of the different contracting parties with respect to IPO under-pricing. They distinguish between directors and other (non-directors) pre-IPO shareholders. Directors of the IPO firm want to reduce the risk of hostile takeover that can happen during IPO process. The under-pricing results in oversubscription which allows issuer to ration to allocation of shares and to discriminate between applicants. The discrimination is usually against large applicants in order to reduce the individual size of new blockholding post-IPO or prevent the formation of large blocks (Brennan and Franks (1993)). This leads to greater dispersion which reduces incentives of the new shareholders to monitor the current management. In the existing literature this is called as reduced monitoring hypothesis.

In the contrary the model developed by Stoughton and Zechner (1998) suggests that under-pricing may be used to minimize agency costs by encouraging monitoring. Ownership structure affects the efficiency of corporate governance which is closely related to the intrinsic value of the firm. The important is assumption that only large institutional investors are capable to monitor the firm. Thus Stoughton and Zechner conclude that under-pricing and rationing in favor of large shareholders lead to a higher intrinsic value of the firm which compensates the cost of under-pricing.

Many researchers are doubtful whether information asymmetry or institutional explanation, or control considerations could clarify the IPO under-pricing puzzle. Hence some turn their attention to behavioral explanations of IPO under-pricing. Ljunqvist (2004) characterizes behavioral theories by two assumptions: (i) the presence of 'irrational' investors who bid up the price of IPO shares beyond true value, (ii) that issuers are subject to behavioral biases and therefore fail to put pressure on the underwriting banks to have under-pricing reduced. We will present the cascade effect and prospect theory as the examples of behavioral explanations.

Welch (1992) formulated the model of "informational cascades" which assumes that information advantage is on investor's side but not all investors are equally informed and that investors make their investment decision sequentially. The possibility of making decision sequentially implies that later investors can adjust their bids according to the bids of earlier investors, regardless of their own information. The subsequent investors interpret the successful initial sales as evidence of favorable information of earlier investor. Thus

later investors are encouraged to invest without respect to their own information. On the contrary disappointing of initial sales can deter later investors from investing disregarding their own private information. Thus the early investors can require more under-pricing in return with respect to the possibility of starting a positive cascade. Welch showed that "*cascades are not necessarily bad for an issuer"*. In case of later investors ignore their own private information and will follow act of previous investors then this action is not information valuable for the other investors. Hence the issuer's expected wealth can be larger, because an (uninformed) issuer faces to less of an informational disadvantage against early investors when setting his price.

The problem of leaving money on the table (companies are allows to make a profit for informed investors) is explored in paper by Loughran and Ritter (2002). They use a prospect theory to clarify why the issuers don't get upset about leaving money on the table. The main assumption of prospect theory is that issuers care about the change in their wealth rather than the level of wealth. In the framework of prospect theory the issuers will sum the wealth loss caused by IPO under-pricing with the large wealth gain on retain shares considering the positive jump in stock price. Thus the pre-IPO shareholder will generate net rising of his wealth. Loughram and Ritter also offer the possible explanation of IPO under-pricing puzzle. They view under-pricing as indirect cost of issuers. In other words the under-pricing can be explained as indirect form of underwriter's compensation.

2.2. Signaling Models – Theoretical Concepts

After the introduction of different theoretical explanation of IPO under-pricing we go back to signaling models and describe the individual models in more details. The original intuition of signaling models could be find in Ibbotson (1975) as one of the possible reason for under-pricing IPO. He writes that issuers under-price because they want to" *leave a good taste in investors´ mouths´ so that future underwritings from the same issuer could be sold at attractive prices"*. The Ibbotson intuition was elaborated into theoretical concept where model under-pricing as a signal sent from more informed issuers to less informed investors.

For instance Welch (1989) based on this intuition; he formulated a two period signaling model in which firms are rational participants with superior information in a perfectly competitive capital market. There are two types of risk-neutral individuals (high and low-quality firms) whose utilities are depending on the sum of the issuing proceeds from initial and second public offerings in the framework of Welch model. The investors cannot observe directly the true quality of the firm, but they know the portion of high-quality firm. Welch also assumed that *"low-quality firm owners must incur imitation costs to appear to be high-quality firms and that nature may nevertheless reveal the firm's true quality after the IPO but before a seasoned offering"*[4]. The high-quality firms have to signal their true quality to investors and they use the IPO under-pricing as the signal device. Then the positive probability of revealing the true quality firm before SPO and the additional expense in form of under-pricing costs can be sufficient to force low-quality firms to reveal their true quality voluntarily. The total costs (imitation and under-pricing) may be higher than expected gains. Thus Welch provides the explanation of IPO under-pricing through seasoned offering because the high-quality firms are compensated for intentionally low IPO price by a higher price at a seasoned offering, when the true quality of firms is revealed.

Allen and Faulhaber (1989) proposed another signaling model where the issuers use some form of signal in order to reduce information asymmetry and to illustrate the true quality of firms. Allen and Faulhaber suppose that earnings performance and dividend policy of firm after IPO help the market to make revision of firm's quality. They concluded that market evaluates more favorable such firms that under-priced IPO and paid higher dividends than firms which paid same dividends but did not under-priced IPO.

Chemmanur (1993) developed a model with the following assumption. There exist firm insiders with private information about their firm´ s prospects and outsiders which can produce information at a cost about firm's. The insiders sell equity on both markets (new issues and secondary market. Chemmanur argues that high-quality firms are encouraged to minimize the information asymmetry because of this it will be reflected in precise valuation in the secondary market.

[4] Cited from Welch I. (1989): Seasoned offerings, imitation costs and the underpricing of initial public offerings, page 422

2.3. Empirical Literature about IPO Under-Pricing Phenomena

After presentation of main theoretical concepts of explanation of IPO puzzle, we should compare theory with existing evidence. Firstly we mentioned empirical evidence from the U.S because most of existing empirical literature is aimed to the U.S market. The popularity of U.S. market is due to data availability and large number of IPOs each year.

Ritter and Welch (2002) provided the IPO survey on the U.S. market data. They found out that the average first day return for examined period 1980 – 2001 on the U.S. market is equal to 18.8 %. Approximately 70 % of IPOs generated the close price of first day trading higher than offering price. The interested period is from 1999 to 2000 when the averages first day return is 65 %. This period is sometimes called internet bubble. Ritter and Welch noted that: "*the large number of IPOs by young internet firms in 1999-2000, and their almost complete disappearance in 2001 raises the issue of what determines bubbles*". They argue that the asymmetric information theories are not capable to explain such great return as average first day return of 65 %.

Michaely and Shaw (1994) examined the IPOs on the U.S market from 1984 to 1988 and initial day return (first day return) was equal to 7.27 % for given period. They also tested the Winner's curse hypothesis and the Underwriter's reputation hypothesis to explain the IPOs under-pricing. Michealy and Shaw found out the empirical evidences that support the Winner's curse explanation, when the reason of IPO under-pricing is to make the less informed investors to go to IPO market. The examined U.S data also support the hypothesis that larger IPOs and those issued by more reputable underwriters are less under-priced. The IPOs U.S. market in period 1990 to 1998 was examined in Loughran and Ritter (2002). The mean first day return was computed as 14.07 %.

After the presentation empirical evidence from U.S. market as the probably the most active IPO market in the world, by number of companies going public and by the aggregate amount of capital raised, we turn our attention on other IPOs markets like Western European and Asia. The overall survey of European IPOs market is proposed in work by Gajewski and Gresse (2006). The survey is based on data from European IPOs markets from 1995 to 2004 and compares the IPO under-pricing across the European countries. The

mean first day return for all sample is equal to 22.06 %. The under-pricing varied during the examined period. In period 1995 – 1997 the mean first day return was 15.86 %, during 1998 – 2001 the mean first day return increased up to 27.18 %. The mean of first day return in last period (2002 – 2004) declined back and it was equal to 12.19 %. The higher under-pricing around 1998 – 2001 is constant with findings of Ritter and Welch (2002), when the under-pricing on U.S market from 1999 – 2010 was abnormal higher and equal to 65 %.

If we look at the under-pricing of individual countries, then the mean first day return for large European economics is as follows: Germany (38.93 %), the U.K. (21.27 %), France (5.36 %) and Italy (10.26 %). If we analyze the cross-section of national first day return we have to take into account the macroeconomic factors, business cycle and the introduction mechanism of IPOs. Now if we focus, for instance, on the economics of Poland, Portugal and Austria, we figure out that the mean first day return in Poland is equal to 19.55 % and for Portugal it is 21.15 % which is closed to average first day return of full sample. On the other hand the under-pricing in Austria is only 6.96 %. The European Initial public offering market is also discussed by Ritter (2003) where are noticed the differences between European and U.S markets.

Reber and Fong (2006) examine the Singapore IPOs for a period of 1998 – 2000. The mean of under-pricing of IPOs was 17.98 % for a given period. Reber and Fong test several possible explanations of IPO under-pricing as Winner´s curse, under-pricing as the signal of firm value or under-pricing as the result of principal agent conflict and underwriter certification. The evidences from the examined data are as follows: the under-pricing cannot be explain as the signaling of firm value, they found out significant difference between mean of the over-subscribed and under-subscribed IPOs which implies support for Winner´s curse explanation as need to attract less informed investors to participated in market. They also conclude that underwriter's reputation is positive but not significantly related to IPO under-pricing.

Another research focus on Asian country is provided by Vong and Trigueiros (2010) which analyze the Hong Kong IPOs over 1995 – 2004. They estimate the important determinants of IPO under-pricing. The positive relationship between subscription rate and under-pricing support the Winner´ s curse explanation developed by Rock (1986). Based on negative influence of proxy for reputation of underwriters and situation where there is more

than one underwrite on IPO under-pricing Vong and Trigueiros conclude that IPO under-pricing declines with higher reputation and with additional underwriter.

2.4. Signaling Models – Empirical Evidence

Now we focus only on empirical evidence of signaling models. Firstly we mentioned works based on the U.S. data. Later we aimed to researches considering also the non U.S. data. Jegadeesh, Weinstein and Welch (1993) test the signaling model at the U.S data in the period from 1980 to 1986. They find out the positive relationship between degree of under-pricing and the probability of issuing and size of seasoned equity offerings. Although their findings prove statistically significant relations, they are relatively weak from the economic perspective. In contrast of basis of signaling models Jegadeesh, Weinstein and Welch find evidence that "*issuers do not have to rely on the costly under-pricing mechanism to signal to the market information relevant for future equity issues*"[5]. They find that an alternative hypothesis, which they term the "market-feedback hypothesis", has a stronger explanatory power for firms' subsequent equity issuing activities. Thus the support for the signaling hypothesis as the major determinant of IPO under-pricing is weak. Michaely and Shaw (1994) that test the signaling hypothesis formulated in works Welch (1989), Allen and Faulhauber (1989) and Grinblatt and Hwang (1989) on U.S. data between years 1984 and 1988. Contrary to the signaling models predictions they find out that the firms with higher earnings and paying higher dividends are less under-priced and that more under-priced firms go to the reissue market less often and for lesser amount than less under-priced firms. Hence Michaely and Shaw (1994) reject signaling hypotheses fully. Francis et al. (2008) tried to revisit the signaling hypothesis on U.S. data. Using the fact proposed by Welch (1989), i.e. it is not necessary that all issuers be willing to apply the signaling strategy, they noticed that high quality firms in signaling models are subject to following important condition: "*there is an ongoing need for these firms to raise funds, thus making it more likely that they will raise external capital (issue equity) in future*"[6]. Hence if firms want to

[5] Cited from Jegadeesh N., Weinstein M., Welch I. (1993): An empirical investigation of IPO returns and subsequent equity offerings, page 174

[6] Cited from Francis B., B., Hasan I., Lothian J., R., Sun X. (2008): The signaling hypothesis revisited: Evidence from foreign IPOs, page 4

maximize the benefit flows from signaling models, they have to issue equity multiple times. Francis et al. (2008) suppose that very weak empirical support is caused by inability of researchers to select proper firms. The researchers should select such firms that use under-pricing as a signaling device and are willing to apply this time-intensive strategy. The authors test the signaling hypothesis on sample of foreign IPOs from 1985 to 2000. Francis et al. (2008) found strong support for the signaling hypotheses for IPOs of firms from financially segmented markets.

The analysis of under-pricing of Chinese IPOs in period 1995 – 1998 provided by Yu and Tse (2003) also suggests that signaling hypothesis does not stand for Chinese IPO market. On the other hand Su and Fleisher (1999) examine the Chinese IPOs over period 1987 – 1995 and conclude that signaling hypothesis explain the under-pricing puzzle for Chinese IPO market well, but the alternative market feedback hypothesis cannot be completely rejected.

2.5. Empirical literature of IPO under-pricing in CEE region

There is a few papers and researches work focused on either simple description or empirical testing of theories of under-pricing in Central and Eastern European (CEE) countries. The main reasons of this situation can be the low availability of data from this region and size of financial markets. Despite all of these facts we can find out the existing literature aimed to CEE countries, mainly Poland and Hungary, either as a part of international evidence as for instance IPO European survey by Gajewski and Gresse (2006), examination of privatization IPO in Huang and Levich (1999) or as the evidence focus on particular countries like for instance Lyn and Zychowicz (2003) or Jelic and Briston (1999).

Lyn and Zychowicz (2003) provide an analysis of IPO in Hungary and Poland during period 1991 - 1998. The analysis suggests that the first day under-pricing was 15,12 % in Hungary and 54,45 % in Poland. Based on the regression analyses of the determinants of initial under-pricing they conclude that there is no significant relationship between the degree of under-pricing and origins of public offering (privatization or public IPOs). The percentage change in the local market index 1 month prior to the offering day (MOM) is

positive and significant for both Hungary and Poland. The rest of variables as size of IPO, return of equity or variables measure the percentage of shares retained by government (STATE) are insignificant. The mixed results are obtained for the percentage of share owned by managers and employees (INSD). For Poland the coefficient is positive and significant at 5 % level considering the model of all public offerings, on contrary for Hungary the variables is insignificant for all specification.

The privatization initial public offerings (PIPO) were part of privatization program in Poland and Hungary. Thus several studies are focused on privatization and under-pricing or comparing the performance of PIPOs and private sector IPOs in CEE region. Aussenegg (2000) proposes evidence that the Polish government was market-oriented in 90´s. Under-pricing, selling a higher fraction at the initial offer and under-pricing more when selling to domestic retail investors was the attempt of the Polish Government in order to build up reputation for its privatization policy over time. The privatization IPOs were under-priced with a mean of 60% which is about 40 percentage points above under-pricing of private IPOs, but these results are not statistically significant at 5 % level. Aussenegg also used a multivariate cross-sectional analysis to examine determinants of initial market adjusted returns in polish capital market in 90´s. Based on results of multivariate cross-sectional analysis he reject the hypothesis about pure signaling. Aussenegg found out the positive relation between fraction of the share capital sold and IPO under-pricing for public IPOs as well as PIPOs.

Schindele and Perotti (2002) examined the Hungarian market in period 1990 – 1998 and found out that degree of under-pricing was approximately 22 % in this period. Schindele and Perotti found out the significant evidence that privatization IPOs are under-priced more than private sales. They also showed that asymmetric information theories do not explain the situation in IPOs market in Hungary in period 1990 - 1998. The under-pricing phenomenon in this period is strongly related to the transition state of economy and the low maturity of the capital market (Schindele and Perotti (2002)). The compensation was identified as the most important factor of under-pricing.

Jelic and Briston (2003) investigate the polish PIPO over period 1991 – 1999 and provide following findings. They found no significant differences in market adjusted first day returns between PIPOs and other IPOs. The mean of market adjusted initial return for

all polish IPOs is equal to 27,37 %, in case of PIPOs the mean is 24,57 % and if we consider only the public IPOs the mean of market adjusted initial returns is 28.83 %. The evidence also suggests that Polish government tended to manage the timing of PIPOs.

The study provided by Jelic and Briston (1999) is focused on the Hungarian PIPOs. They compare the mean of market adjusted initial returns for private IPOs (40 %) and PIPOs (44 %) and conclude that there is no significant difference between initial returns for Hungarian PIPOs and IPOs. Another important finding of Jelic and Briston is that the returns for PIPOs are predominantly positive and statistically significant and they outperform private IPOs in all periods after listing.

As we can see from review of existing literature the evidence about validity of signaling hypothesis is mixed. The examining of Polish capital market could bring new findings because of the expected higher information asymmetry than in U.S. or Western Europe. With respect to Post-communism past and still continuing transformation of economy, we assume higher information asymmetry for Polish capital market as emerging market in compare to developed markets (U.S., Western Europe). We plan to supplement existing literature about IPO under-pricing literature in Central European region by empirical study of IPO under-pricing using asymmetric information theory. The papers and research works focused on CEE region attract their attention mostly to individual determinants of under-pricing or only comparing the PIPOs and IPOs performance. There is no existing literature aimed to CEE region about testing individual asymmetric information theory separately only as a part of cross-analysis (for instance Aussenegg (2000)).

3. Characteristics of Polish capital market

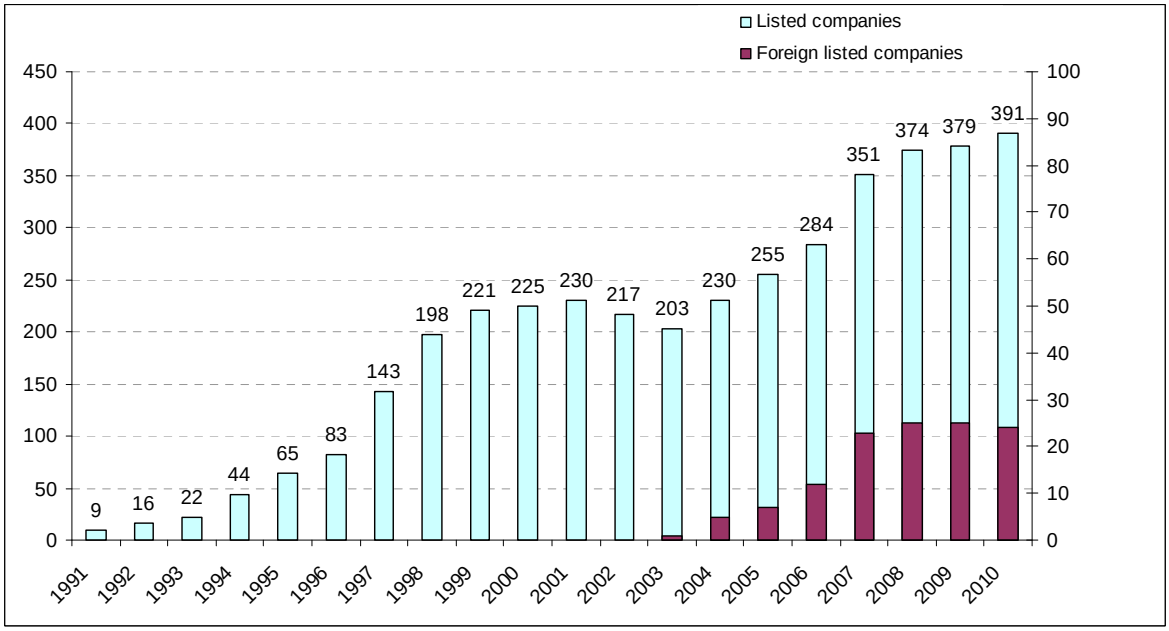
This part is dedicated to introduction of Polish capital market. We describe the past development of capital market and settled the position of Warsaw stock exchange as a leader of the CEE region. We also present the comparison of Polish IPO market with others IPO markets.

3.1. Warsaw Stock Exchange and Polish IPO market

The Warsaw Stock Exchange (WSE) was established as joint company in 12 April 1991. The WSE continue to the Polish capital market traditions of Warsaw Mercantile Exchange which was founded in 1817. The trading on WSE has started in 16 April 1991 when the first five companies were listed WSE. In comparison with this modest start nowadays there are more than 400 companies listed on main market of WSE and about 178 companies listed on NewConnect. NewConnect is a market organized and maintained by the WSE as an alternative trading system. It was designed for startups and developing companies, especially from the sector of new technologies. NewConnect was launched on 30 August 2007.

The Figure 1 shows us the dynamic development of number of listed companies on main market over the period of modern history of Polish capital market. We can see that since 2003 there have been also listed foreign companies in main market of Warsaw Stock Exchanges. The first foreign company listed in WSE was Bank Austria Creditanstalt, which became the largest company listed on the Exchange (in term of 2003). At the end of 2010 there are listed 25 foreign companies is listed in WSE at the end of 2010. Nearly a half of the foreign companies are dual listed companies (12) and the rest (13) are the single listed ones.

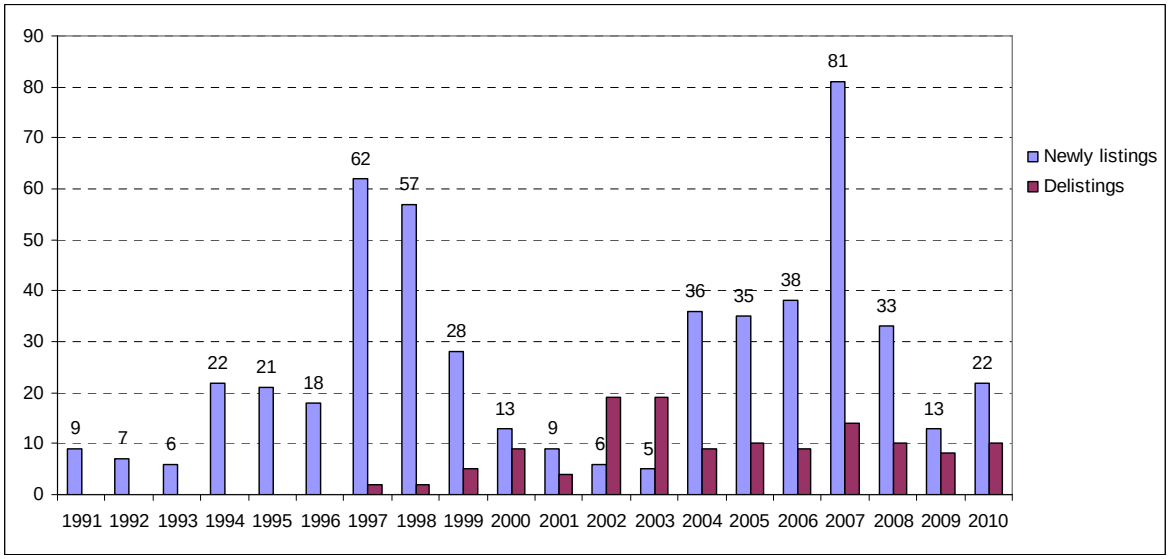
Figure 1: Listed companies in Warsaw stock exchange



Source: WSE

The Figure 2 describes the number of newly listed and delisted companies in main market from 1991 to 2010. The debuts activity in individual years can indicate the "hot and cold" period. The "hot" period is identical with peaks in Figure 2. We can identify two "hot periods" in number of newly listed companies in WSE. First significant increase of listed companies is in 1997 and 1998 when more then 110 companies were introduced to trading. Second important increase is dated to year 2007 when 81 companies debut at WSE. The period between 2001 and 2003 can be noted as "cold period" in Polish IPO market. We can see that for years 2002 and 2003 in "cold period" the differences between number of newly listed and delisted companies are even negative.

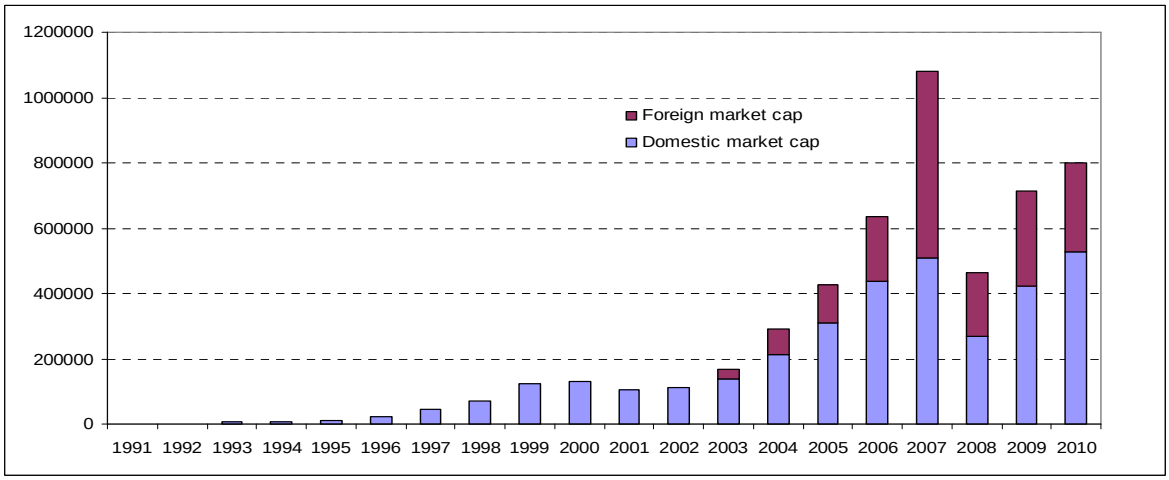
Figure 2: Number of newly listed and delisted companies over 1991 – 2010 on WSE



Source: WSE

After the presentation of development of number of newly listed companies in WSE we focus on other important characteristic, i.e. the market capitalization. The raising of market capitalization and the development of share of domestic and foreign companies on total capitalization is presented in Figure 3**.** Based on the Figure 3 we are able to also identify the important periods in "modern life" of Warsaw Stock Exchange. The slightly decrease of market capitalization in the beginning of 2000s as well as the significant impact of introduction of trading foreign companies. The share of foreign companies increases over time up to 50 % of total market capitalization in 2007. In this year the market capitalization reached the highest value in modern history of WSE. After this record the market capitalization dramatically fell down due to financial crisis that occurs at the end of 2007. The share of foreign companies on total market capitalization also significantly drop that can be explain partly by financial crisis but the government introduce to trading large privatized IPOs in years 2008 – 2010 (e.g. energy companies ENEA, PGE, Tauron or insurance company PZU).

Figure 3: Market capitalization of listed companies in WSE (mln. of PLN)



Note: Market Capitalization is for main market of WSE.

Source: WSE

In the next section we look at the position of Warsaw stock exchange in CEE/SEE region as well as comparison of Warsaw Stock Exchange with other European Stock Exchanges on European IPO market.

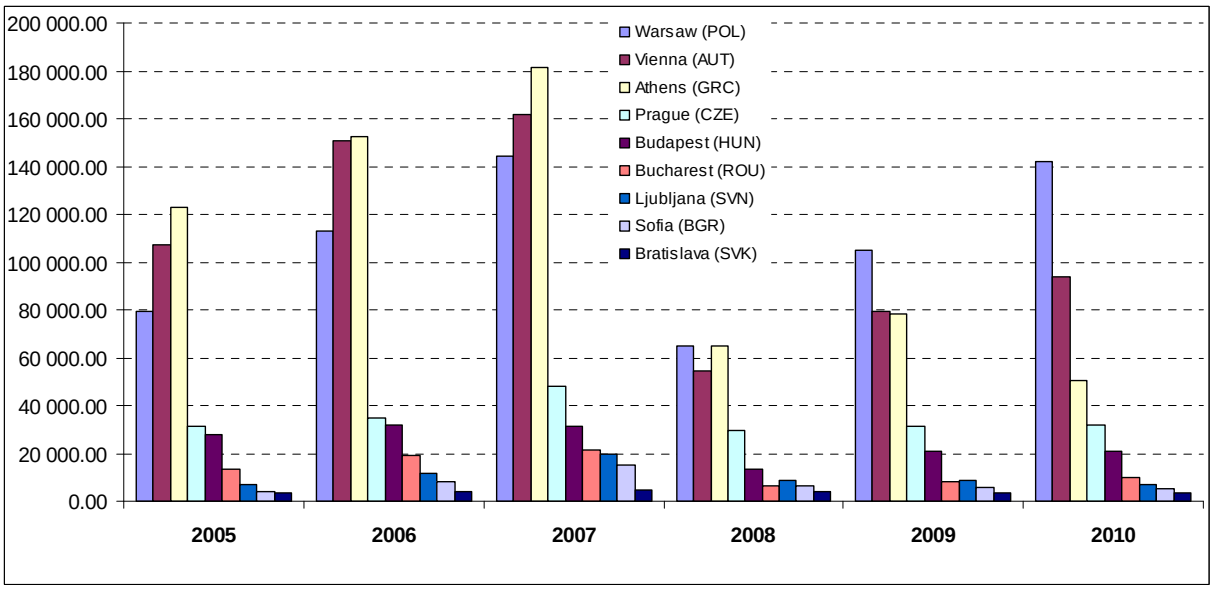
3.2. Polish stock exchange versus other European stock exchanges

After we presented development of Polish stock and IPO markets in modern history of WSE, we focus on establishing the position of WSE among the other European Stock Exchanges. For comparison we include other CEE stock exchanges (i.e. Prague, Budapest, Bratislava), SEE stock exchanges (for instance Bucharest, Ljubljana) as well as Vienna and Athens Stock Exchanges.

The Figure 4 shows the market capitalization of CEE and SEE stock exchanges over last five years. From the figure we can conclude that Warsaw stock exchange has had the largest market capitalization from the post-communism countries. The sum of market capitalization of two other important stock exchanges (e.g. Prague and Budapest Stock exchange) is still significantly smaller than the market capitalization of WSE. This supports the view of WSE as the leading and the most important stock exchange in Central Europe. If we take in also the Vienna Stock exchange and exchanges from South Eastern Europe

(SEE) than we can see that for pre-crisis period (2005 – 2007) the highest market capitalization had the Vienna and the Athens stock exchange was second one. On the other hand in crisis period (2008 – 2010) the Warsaw Stock exchange had the highest market capitalization. The main reason is significantly better position in IPOs market in comparison with other CEE and SEE stock exchanges as well as the issuing of large IPOs in crisis period (privatized IPOs).

Figure 4: Market Capitalization in CEE/SEE region over period 2005 – 2010 (in mil. €)



Note: The market capitalization is computed for all market (main and alternative). The market capitalization includes shares of domestic companies and shares of foreign companies which are exclusively listed on an exchange (i.e. the foreign company is not listed on any other exchange).

Source: FESE

3.3. Polish IPO market in comparison with Europe IPO market

Now we look at European IPO market and compare the issue activity and offering values across the most important European Stock Exchanges. The development of number of newly listed companies as well as the offering values of individual European Stock Exchanges is in Table 1. Based on Table 1 we can indentify the leaders in IPO market in pre-crisis period (2005 – 2007) and in crisis period (2008 – 2010). In case of pre-crisis period the leading stock exchanges in sense of offering value are as follows: London Stock

Exchanges, Euronex and Deutsche Börse. The largest offering value in pre-crisis period (27 683 mln €) was issued in London Stock Exchanges in 2006. The London Stock Exchange also holds the record of number of newly introduced companies to trading in one year. Nearly 100 companies were newly listed on London Stock Exchange in 2007. For WSE this year was also the best one in sense of number of newly listed companies (80).

Now we look closer on crisis period. As we noted above the Warsaw Stock Exchange relatively improved its position in European IPO market during the crisis period. Over the crisis period WSE be ranked among three stock exchanges with highest offering value and largest number of newly listed companies. Warsaw stock exchange gradually introduced to trading 68 companies with offering value more than 7 800 millions €. The primary reason of such large offering values in crisis years is privatization of several polish companies in crisis period. For instance: ENEA in 2008 with offering value 546 millions €, PGE Polska Grupa Energetyczna with 1 407 million of € in 2009 or Tauron Polska Energia and PZU in 2010 with offering value 1 026 respectively 1 990 million of €. All these polish companies was ranked among ten largest IPOs of corresponding year[7].

[7] We use the figures from IPO Watch Europe published by PricewaterhouseCoopers LLP

Table 1: Comparison of IPO Market across Europe (in mil. €)

Stock Exchange	2005		2006		2007		2008		2009		2010	
	No. of IPOs	Offering value	No. of IPOs	Offering value	No. of IPOs	Offering value	No. of IPOs	Offering value	No. of IPOs	Offering value	No. of IPOs	Offering value
London	41	12 521	97	27 683	99	27641	38	7137	9	620	52	9034
Euronext	25	16 168	49	20 805	40	7563	16	2466	6	1907	11	344
Deutsche Börse	19	3 515	38	6 278	28	6734	2	324	1	48	10	2297
Borsa Italiana	15	2 400	21	4 330	29	3 943	6	129	1	105	2	2099
Swiss Stock Exchange	10	2 137	9	1 022	10	1975	6	169	4	-	4	163
Luxemburg	18	1 459	-	-	-	-	4	18	-	-	-	-
Warsaw Stock Exchange	35	1 740	38	1 045	80	1 980	30	2455	12	1584	26	3770
Oslo Børs	30	1 391	14	1 293	18	1 264	4	2	-	-	9	2362
Wiener Burse	7	1 162	7	1 715	6	1 427	-	-	-	-	-	-
BME (Spanish Exchanges)	1	157	10	2 969	12	10 084	1	292			2	1541
Athens Stock Exchange	2	29	2	612	3	479	-	-	1	10	-	-

Note: IPO by market are shown gross of dual listing and it is the values obtain from main market of individual stock exchanges

Source: PWC IPO WATCH

4. Hypotheses

Following sections provides the motivation and formulation of individual testable hypotheses. First one we present the testable hypotheses of signaling model, further there is a discussion of testable hypotheses about Privatized IPOs.

4.1. The hypotheses of signaling model

In this part we present the testable hypotheses of the signaling models. As we mentioned in review of literature according to theory of signaling model the high-quality firms are motivated to under-price their IPOs, because they expect that the market find out their quality before SPO. Then they will be compensated by higher price of seasoned equity. The testable hypotheses of signaling model follow the work of Jegadeesh, Weinstein and Welch (1993)[8].

H_1: *Firms with more under-priced IPOs are more likely to issue seasoned equity than firms with less under-priced IPOs.*

Another implication from signaling model that we expect is that firms with more under-priced IPOs come back to capital market as soon as the opportunity are available. The reason for this is simple. It is a more costly to postpone investment in new project for firms with more under-priced IPOs. Thus we can conclude such hypothesis.

H_2: *Firms with more under-priced IPOs are likely to issue seasoned equity more promptly than firms with less under-price IPOs.*

Jegadeesh, Weinstein and Welch (1993) announced that "*under the singling hypothesis the cost of raising funds at the IPOs are higher for firms that under price more, so these firms*

[8] This work is basic for empirical testing of signaling hypothesis, for instance Tse and Yu (2003), Francis et al. (2008). They use hypothesis and econometrical models formulated in Jegadeesh, Weinstein and Welch (1993).

are more likely to raise a larger proportion of their capital requirements through seasoned offerings.„ Thus we can imply another testable hypothesis in following way.

H_3: *Firms with higher IPO under-pricing are likely to issue larger amounts of seasoned equity than firms with lower IPO returns.*

Last hypothesis follows from the statement above that the firms with higher under-pricing are more likely to return with seasoned equity issue. It implies that market and investors are not surprised by or more expect their SPOs.

H_4: *The market will react less unfavorably to the announcements of seasoned equity issues by firms with higher under-priced IPOs than by firms with lower IPO under-pricing.*

Thus we have these four hypotheses that are consistent with both market-feedback and pooling hypotheses (Jegadeesh, Weinstein and Welch (1993)).

4.2. Hypotheses about Privatized initial public offerings

Consistently with Perotti (1995) we assume the existence of informational asymmetry between the privatization government and the investors. Perotti distinguishes between two types of governments: (i) market-oriented and (ii) populist government. The aim of a market-oriented government is to provide privatization of state owned companies seriously and irreversible. *"This does not apply to populist governments. Privatization can only restrain but not eliminate public interference, for example to transfer value from shareholders to other groups by policy changes through regulation or taxation*[9]*."* Hence the market-oriented government is able to resist redistribution. On the other hand a populist government cannot resist to public interference. Therefore we consider market-oriented government to be the parallel of the signaling model for public IPOs. The market-oriented government also tries to build up to reputation for its privatization policy. The market-oriented government uses the PIPOs under-pricing and fraction of shares as the signal

[9] Cited from Aussenegg (2000), p. 72

because the market doesn't know whether the government is a market-oriented or populist. To test whether the government behave market-oriented or populist and examine the privatize IPOs we formulate the hypotheses in line with existing literature, for instance (Aussenegg (2000) or Jelic and Briston (2003)).

First hypothesis considers the fact of existence of asymmetric information between the issuers (government) and investors. Following the asymmetry information theories we assume that the uncertainty about the value of small, not established company is higher than for relatively large well-known company. The value of well-known company should be better predictable thus it implies that the initial return would be lower in comparison with initial return of small, not established company. If we apply the same logic on the public and privatized IPOs then we can formulate following hypotheses

H_5: *The initial return of PIPOs is a lower than for a private IPOs*

The value of initial public offering of privatized company tends to be higher than for public sector. The privatized companies are better known to investors due to higher publicity as the companies control by state than the public companies. These facts can lead to lower information asymmetry than would imply the lower initial return in comparison with public sector.

The following part of description of testable hypotheses about PIPOs is related to behavior of government as a market-oriented. With respect to political uncertainty at the beginning of a privatization program, the government can be pressure to sell the higher fraction at the initial offer if it can be viewed as a market-oriented. By selling the higher fraction at the initial offering the government expresses the willingness of transfer of ownership from state to public. Another instrument how the government can build up the reputation is PIPOs under-pricing. The under-pricing will be used as discount for market in order to the market can absorb a large fraction of PIPOs sold at the beginning of privatization. We expect that if the government behaves as market-oriented the uncertainty will be decrease as the government builds up its reputation.

H_6: *The under-pricing of PIPOs is expected to be highest at the beginning and gradually decreases (as well as fraction sold) as the reputation builds up.*

The government needs to preserve the reputation as a market-oriented for whole time duration of privatization program for this purpose, the long-run performance of Privatized IPOs are also important. Thus the following hypothesis about non-negative long-run abnormal performance for PIPOs can indicate the government as the market-oriented.

H_7: *The long-run market-adjusted return of PIPOs is non-negative.*

The long-run aftermarket performance is not important only from perspective of building of government's reputation but also as the tool how to attract potential investors. If there is a competition between public IPOs and Privatized IPOs on IPO market then good long-run performance of PIPOs can attract the investors for future government issue. Therefore the market-oriented government is also interested in better long-run performance in comparison with public IPOs. We will test the hypothesis that the long-run performance of PIPOs is significantly better than long-run performance of public IPOs:

H_8: *The PIPOs will outperform the private sector in a long-run.*

5. Methodology

Following part of thesis is dedicated to outline the basic methodology. We start with definition of measurement of short and long-run performance. Last section of this chapter is focused on introduction the signaling model construction as well as definition of main variables.

5.1. Measures of IPO under-pricing

We can consider several measures of under-pricing according which price is set as the post IPO equilibrium price and which return is chose as benchmark. For the purpose of this thesis we will use two types of measure of under-pricing. One is raw initial return[10] and another is initial return adjusted for market index.

5.1.1. Raw Initial return

The raw initial return (U) is measured by the difference between the closing price on first day trading (CP) and the issue price (IP) divided by the issue price (IP). The definition of initial return is expressed by equation (1):

$$U = \frac{CP - IP}{IP} = \frac{CP}{IP} - 1 \qquad (1)$$

The initial return U can be considered a measure of under-pricing, assuming that the normal return under efficiency would be 0 and that the equity risk is equivalent to the market risk Gajewski and Gresse (2006). The second one measure of under-pricing relaxes these assumptions and adjusts returns.

[10] We follow the division proposed by Gajewski and Gresse (2006).

5.1.2. Adjusted initial returns by a market index return

Consistently with existing literature the initial return adjusted for a market index return is described as

$$U_m = \frac{CP - IP}{IP} - \frac{MI_1 - MI_0}{MI_0} = \frac{CP}{IP} - \frac{MI_1}{MI_0} \tag{2}$$

,where MI_1 denotes the market index closing price on the first trading day and MI_0, the index closing value the day before. We will use the polish stock market index (WIG) as the proxy of market. Considering that the market movements are too small to affect the initial returns significantly, most studies measure IPO under-pricing with raw returns and select the closing price at the end of the first day of quotation as the equilibrium price.

5.2. Long-run Aftermarket performance

Beside the IPO under-pricing (the short-run aftermarket performance) described in previous section, the long-run aftermarket performance is also useful to analyses the IPO process. The study of long-run aftermarket performance is useful at least from two reasons. First, we can examine the performance of the IPO in a long-run and test the hypothesis about IPO under-performance in long-run. For instance, Ritter (1991) suggests that in a long-run the IPOs returns are negative. Second, the long-run aftermarket performance of privatized IPOs can help the government to appear as market-oriented. Because the long-run aftermarket performance has to be non negative whether the government tries to build up the reputation thereby support its privatization policy (Aussnegg (2000)).

5.2.1. Raw long-run aftermarket returns

The long-run aftermarket performance is measured by buy-and-hold returns. The buy-and-hold return (BHR) is computed as follows:

$$BHR_{i,T} = \prod_{t=2}^{T} (1 + R_{i,t}) - 1 \tag{3}$$

where $R_{i,t}$ is the return of IPO_i in period t and t = 2 means the second trading in the aftermarket[11].

Consistently with Aussnegg (2000) the buy-and-hold returns (BHR) are calculated for the following time periods: T = 1 week, 2 weeks, 1 year, 2 years, 3 years. In the next section we define buy-and-hold abnormal return (BHAR).

5.2.2. Adjusted long-run aftermarket returns using a market index

If we are interested in measure of abnormal returns than the crucial part is choose proper benchmark. The selection of appropriate benchmark is important because it can significantly affect the aftermarket performance measure. We select the market index as a benchmark. In our case we will use the WIG index. Consistently with raw long-run aftermarket return, the buy-and hold return of the market index is defined as follows:

$$BHR_{WIG,i,T} = \prod_{t=2}^{T}(1+R_{WIG,i,t})-1 \tag{4}$$

where $R_{market,i,t}$ is the return of the market index in period t and t = 2 represents the second trading in the aftermarket. Finally we can calculate the buy-and-hold abnormal returns (BHARs) as the measurement of market adjusted performance. The BHARs are computed as difference between BHRs of the IPO and BHRs of the market index. The definition of BHARs is as follows:

$$BHAR_{i,T} = BHR_{i,T} - BHR_{WIG,i,T} \tag{5}$$

Another measure pf the market-adjusted performance is wealth relatives (WRs) are used. In accordance with Ritter (1991) the WR of IPO $_i$ ($WR_{i,T}$) is defined as:

$$WR_{i,T} = \frac{1+BHR_{i,T}}{1+BHR_{WIG,i,T}} \tag{6}$$

[11] The beginning of measuring of the aftermarket performance is the closing price of the first trading day

5.3. Signaling Models

We present in this subsection the methodology that we use for testing the hypothesis of signaling model. The methodology of signaling model follows Jegadeesh, Weinstein and Welch (1993) and Francis et al (2008). The most important independent variable that we use to test signaling model is IPO under-pricing (UNDP) defined as a difference between the first closing price and issue price divided by issue price. In order to control the market-feedback hypothesis as alternative to signaling model proposed by Jegadeesh, Weinstein and Welch (1993), we also include the abnormal returns over two 20 days period after IPO date as independent variables. Following Jegadeesh, Weinstein and Welch, we define the variable AbRet1 as the abnormal returns over period from trading day 1 to trading day 20 after the IPO date. The abnormal returns are estimated as the difference between raw return (actual return) and beta times market return (expected return). We use the WIG index as the market proxy and estimate beta by a market model regression fitted over trading day 41 to 140 following the IPO date. The variable AbRet2 is define in same way as AbRet2 expect that it covers the period from trading day 21 to trading day 40 after the IPO date. In line with existing empirical literature, we include the natural logarithm of volume of IPO (LogIPO) as the control variable. In contrast to Jegadeesh, Weinstein and Welch (1993) and Francis et al (2008) we add additional three independent variables with respect to specifics of Polish capital market (existence of Privatized and Public IPOs). We include a dummy variable PIPO that is equal to 1 if company´s origin is State Treasure and 0 otherwise for potential differences in SEO activities between private and privatized IPOs[12].

To control the different magnitude of volumes of public IPOs and privatized IPOs, we decide to add a dummy on variable LogIPO (LogPIPO) which is equal to actual value of LogIPO when it is privatized IPOs and zero otherwise. Finally we also include a dummy variable PDA that is equal to 1 if company´s new shares are traded as right to shares for some time after IPO issue instead of immediately traded in main market its shares after IPO date and zero otherwise[13].

[12] We used the WSE Factbook 2010 and list of company origin to construct PIPO dummy variables.
[13] The PDA dummy is based on statistics about IPOs published in WSE FactBooks.

After description of definition of main independent variables used to test signaling model, we focus on construction of individual models. Hence we use logit model to test hypothesis **H_1** that more under price IPO has higher probability of issuing seasoned equity. The model has this structure

$$P_i = e^{\alpha + x_i^T \beta + u_i} / \left(1 + e^{\alpha + x_i^T \beta + u_i}\right) \tag{7}$$

, where P_i is the probability that the *i*th firm issues seasoned equity and x_i is the column vector of independent variables. The IPO under pricing (UNDP) and the unexpected aftermarket returns in two 20 days periods after IPO (AbRet 1 and Abret2) are the independent variables of primary interest. We also include into our model other independent variables as LogIPO, PIPO, LogPIPO, PDA and year dummy variables to test potential differences in SPO across years. If hypothesis **H_1** is true then we expect a positive β coefficient of variable UNDP. If market feedback hypothesis is true then we also expect positive β coefficients of variables AbRet.

Now we examine the relation between returns around the time of the IPO and the time before a firm returns to the market with a seasoned equity offering (testing hypothesis **H_2**). For the purpose of testing hypothesis **H_2** we select only SPOs within 3 years of the IPO date. Thus we follow the regression in Francis et al. (2008) where they apply Tobit model. The dependant variable is the log of the time between the IPO and the SPO (LogDays). If there is no SPO within three years following the IPO, the dependent variable is equal to the natural logarithm of the maximum value of 1095 days (three years). The independent variables are still same as in previous case, there are IPO under-pricing, abnormal aftermarket returns (Abret1, AbRet2), natural logarithm of IPO volume, a dummy PIPO, a dummy on variable LogIPO, a dummy PDA and dummy variables for industry or years. Hence the model for testing of hypothesis **H_2** is presented below:

$$(LogDays)_i = \begin{Bmatrix} \alpha + x_i\beta + u_i & if\ LHS < Ln(1095) \\ Ln(1095) & otherwise \end{Bmatrix} \tag{8}$$

If the β coefficient of IPO under-pricing is negative then it implies that there is a negative relation between LogDays and under-pricing. It means that firms with more under-priced IPO return to market as soon as opportunity comes and that the hypothesis **H_2** is true. Market feedback hypothesis is true in case of the β coefficients of variables AbRet is also negative (Tse and Yu (2003))

The hypothesis **H_3** that firms with more under-priced IPO issue large portion as a SPO testing by Tobit model. The dependent variable is defined like the size of the seasoned equity offering, measured as a fraction of the IPO size (SPO/IPO) (Jegadeesh, Weinstein and Welch (1993)). If there is no SPO issue the after IPO date, the dependent variable is equal to 0. The explanatory variables vector is same as in previous cases. Thus the relation between the size of SPO and the IPO under-pricing, the abnormal aftermarket returns and other explanatory variables, is modeled as follows:

$$(SPO/IPO)_i = \begin{cases} \alpha + x^{\mathrm{T}}\beta + u_i & \text{if RHS} \succ 0, \\ 0 & \text{otherwise,} \end{cases} \qquad (9)$$

For the Tobit regression, we use again the same independent variables as previous. If hypothesis **H_3** is true then the β coefficient of variable UNDP must be again positive. And β coefficient of variable AFTRET is a positive if the market feedback hypothesis holds (Tse and Yu (2003)).

Finally, we test the hypothesis **H_2** The market will react less unfavorably to the announcements of seasoned equity issues by firms with higher under-priced IPOs than by firms with lower IPO under pricing. Now we use the simple regression method, the Ordinary Least Square, for examine the relation between the stock-price response to the announcement of seasoned equity offerings and under-pricing and aftermarket response. As we say in section dedicated to hypothesis, we expect that the market to be less surprised by SPO announcements by firms that had a more under-priced IPO. To test the hypothesis **H_2**, we regress the announcement data stock return (ANNREACT), define in Francis et al. (2008) as the abnormal SPO three-day announcement reaction, against the independent variables. The abnormal SPO three-day return (-1,1) is calculated as standard abnormal

return (raw return minus beta times market return) . As the market proxy we use WIG index and the beta is estimated over the (-266, - 11) interval[14].

The independent variables include the same variables as in previous cases plus we add following additional variables: logarithm of the number of calendar days between IPO and the SPO announcement data (LogDays), the log of the size of the SPO (LogSPO), the size of the SPO in the relation to the size of the IPO plus SPO (SEOSIZE) and dummy on variable IPO under-pricing. We include these variables into independent variables because we assume that announcement reaction can be affected by variables around time of IPO as level of IPO under-pricing, size of IPO volume or aftermarket return as well as by variables considering time between IPO and SPO issue, size of SPO volume or by size of the SPO divided by total size of IPO and SPO. We add a dummy on variable IPO under-pricing to control potential differences in relation between IPO under-pricing and market reaction across years. With respect to examine period (2005 – 2009) we expect that financial crisis could influence this relation between IPO under-pricing and market reaction o announcement of SPO. Jegadeesh, Weinstein and Welch (1993) reason including these additional independent variables in a similar way as a control for possible differences in the extent to which the market is surprised by the SPO announcements that are unrelated to the stock returns around the time of their IPOs. The equations (10) present the model used for testing the hypothesis.

$$ANNREACT = \alpha + x^{T}\beta + \gamma_1 LogDays + \gamma_2 LogSPO + \gamma_3 (SEOSIZE) + u_i \qquad (10)$$

If we think about validity of hypothesis H_4 that market will react less unfavorably to the announcements of seasoned equity issues by firms with higher under-priced IPOs then the hypothesis is true if β coefficient of IPO under-pricing variable (UNDP) is positive. The market feedback hypothesis is true if the β coefficients of variables AbRet is positive.

[14] We exclude companies that have not at least 100 days´ stock return for the estimation period.

6. Data description and summary statistics

In this chapter we describe the dataset collection and present the descriptive statistics of our dataset.

6.1. Data and descriptive statistics

Our sample is obtained from two main sources: (i) Warsaw stock exchange websites[15] and publications and (ii) the Reuters database Thomson One. Combination of both sources give us the possibility to construct dataset of Polish IPOs that includes not only public IPOs but also 12 companies privatized through IPOs. The database is consist from companies issued their IPO over period 2005 - 2009. During this examine period 200 IPOs were issued at the main market in Warsaw Stock Exchange. We excluded 13 companies dually-listed on WSE (List of companies is enclosed in Appendix as Table 11) due to possible absence or different level of information asymmetry in comparison with rest of the sample. Finally we have to take out 17 companies due to data unavailability[16]. Finally our data set consists of 170 IPOs and 45 SPOs. The data set includes 158 public IPOs and 12 privatized IPOs.

The descriptive statistics for our sample are presented in Table 2. We split our dataset into panels according to owners (Private IPOs vs. Privatized IPOs) and SPO issue within 3 years [17](SPO issue vs. No SPO issue).

[15] There are used the original website www.gpw.pl as well as information website www.gpwinfostrefa.pl.
[16] We decide to exclude all companies that have incomplete debutant information available at WSE webpage. A part of excluded companies was transferred from alternative market as NewConnect or CETO to main market.
[17] It ´s common to proposed these restriction

Table 2: Descriptive statistics of full sample

Variables	Description	N	Mean	Stand. Dev.	Median	Min	Max
Panel A :	*The Private IPOs*						
Up	IPO under-pricing	158	0.174	0.462	0.066	-0.741	4.813
LogIPO	Logarithm of IPO volume	158	17.373	1.359	17.309	11.814	20.781
AbRet1	First 20 day abnormal return	158	0.001	0.205	-0.020	-0.355	1.792
AbRet1	Second 20 day abnormal return	158	0.012	0.150	-0.007	-0.624	0.521
PDA	Dummy for Rights to share	158	0.620	0.487	1	0	1
SPO	Dummy for SPO issue	158	0.253	0.436	0	0	1
Panel B :	*The privatized IPOs*						
Up	IPO under-pricing	12	0.093	0.151	0.084	-0.180	0.326
LogIPO	Logarithm of IPO volume	12	20.132	1.185	19.526	18.856	22.510
AbRet1	First 20 day abnormal return	12	-0.009	0.128	-0.058	-0.107	0.345
AbRet1	Second 20 day abnormal return	12	-0.025	0.053	-0.026	-0.111	0.094
PDA	Dummy for Rights to share	12	0.417	0.515	0	0	1
SPO	Dummy for SPO issue	12	0.417	0.515	0	0	1
Panel C :	*Seasoned offering*						
Up	IPO under-pricing	28	0.378	0.941	0.119	-0.167	4.813
LogIPO	Logarithm of IPO volume	28	17.886	1.903	17.431	15.425	22.510
AbRet1	First 20 day abnormal return	28	-0.025	0.187	-0.046	-0.355	0.418
AbRet1	Second 20 day abnormal return	28	-0.006	0.199	-0.011	-0.624	0.445
PDA	Dummy for Rights to share	28	0.571	0.504	1	0	1
LogSPO	Logarithm of SPO volume	28	17.266	2.493	17.322	4.654	22.105
SPO/IPO	SPO size over IPO size	28	1.453	1.784	0.761	0.001	8.101
LogDays	Logarithm of time between IPO and SPO	28	6.127	0.653	6.198	9.010	6.932
Panel D :	*No Seasoned offering*						
Up	IPO under-pricing	142	0.127	0.245	0.061	-0.741	1.313
LogIPO	Logarithm of IPO volume	142	17.505	1.432	17.405	11.814	21.710
AbRet1	First 20 day abnormal return	142	0.006	0.203	-0.021	-0.270	1.792
AbRet1	Second 20 day abnormal return	142	0.013	0.134	-0.009	-0.319	0.521
PDA	Dummy for Rights to share	142	0.613	0.489	1	0	1

Source: Author´s computations

Thus we can see that mean value of IPO under-pricing is higher for Private IPOs (17.4 %) than Privatized IPOs (9.3 %) and also IPOs with seasoned offering have higher mean value of IPO under-pricing (37.8 %) in comparison to IPOs with no SPO (12.7 %) . The mean values are significantly influence by possible outliers (Inwestcom) with IPO under-pricing equal to 481 %. With respect to this we turn our attention to median which is more appropriate statistics for comparison. The median value of under-pricing of private IPOs is equal to 6.6 % which is lower than median of Privatized IPOs (8.4 %). But we have to be careful with interpretation because there is relatively large difference between number of observations. Thus if we compare the median value of IPOs with and without seasoned offering, we conclude that median for IPOs with seasoned offering (11.9 %) is higher than IPOs without issue of SPO (6.1 %).

Now we look at the additional variable as logarithm of IPO volume (LogIPO) or a dummy for rights to share (SPO). We can see that the mean value of LogIPO is larger for Privatized IPOs (20.132) than Private (17.373. On the other hand for IPOs with or without SPOs there is no significant difference. Also the median value of LogIPO is much higher for Privatized IPOs than for Private IPOs. If we provide simple t-test for mean of public and privatized IPOs thus we find out that the hypothesis about no difference in mean between these two variables is rejected on 5 % significant level (the test output is enclosed in Appendix as Table 17). It seems obvious that public offering made by State Treasury has larger value of offering than public offering. If we look at a dummy SPO and compare statistics across Private an Privatized IPOs then we figure out that more than 41 % of Privatized IPOs issue seasoned offering within 3 years that is more in comparison with 25 % of Private IPOs. But again we have to take into account different number of observations.

After brief interpretation of descriptive stats, we look closer at IPO under-pricing of our sample that is consisting from 170 companies listed on WSE over period 2005 – 2009. Table 3 presents the stats of newly listed companies in examining years as well as their distribution between public IPOs and privatized IPOs across each year. We can see that mean of first day return over whole period is 16.79 %. The total aggregate proceeds are equal to 38.23 billions of PLN and the total amount of money leave on the table for investors is equal to 4.03 billions of PLN. For better comparison of mean first day return

we can use the proceeds weighted instead of equal-weighted. The proceeds-weighted mean of first day return is equal to 10.56 % that is lower than equally-weighted mean but still significantly non-negative. This implies that in mean the polish IPOs are under-priced around 10 %. The mean of IPO under-pricing for corresponding years are positive except the year 2008. We can see that our sample consisted from small number of observation and the outliers affect the equal weighted mean of first day return. The level of mean of equal-weighted first day return for year 2007 is significantly affected by positive outliers (Inwestcom shows the level of IPO under-pricing 418 %). On the other hand the negative level of mean of equally weighted first day return in year 2008 is biased by the negative outlier (IZNS under-pricing -74 %).

Table 3: IPO under-pricing

Year	Number of IPOs	Mean First-day return		Aggregate amount money left on the table	Aggregate proceeds	IPOs	PIPOS
		Equal-weighted	Proceeds-weighted				
2005	35	9.28%	13.94%	0.97 billions	6.98 billions	28	7
2006	35	37.57%	20.24%	0.69 billions	3.42 billions	34	1
2007	65	17.03%	8.19%	1.40 billions	17.05 billions	64	0
2008	24	-2.10%	0.60%	0.02 billions	3.78 billions	22	2
2009	12	14.51%	13.59%	0.95 billions	6.99 billions	10	2
Total	170	16.79%	10.56%	4.03 billions	38.23 billions	158	12

Source: Author´s computations

If we look at proceeds weighted mean of first day returns then for all years is positive but the value in 2008 is close to zero. The reason is that the value is influence by large Privatized IPO, more preciously ENEA, that had a negative first day return (-1 %) and ENEA proceed was more than 50 % of total proceeds in 2008.

7. Empirical results

The following sections provides a detailed overview of results of signaling model hypotheses as well as results of hypotheses about privatized IPOs. In line with signaling model, we are particularly interested in relations between level of IPO under-pricing and second public offering. In case of privatized IPOs we check the possible differences between pricing public and privatized IPOs as well as test the building up reputation by government to support its privatization policy. We supplement the discussion of results with existing empirical literature.

7.1. Signaling models

This section is dedicated to empirically tests of hypotheses about signaling model (i) firms with higher under-pricing are more likely to issue SPOs, (ii) a large proportion of shares as SPO issue, (iii) firms whose IPO is more under-priced issue SPOs more quickly after the IPO and (iv) the announcement effect is less unfavorable for firms that under-priced their IPOs more. Based on our dataset we provide our analysis (Model 1) on three different samples: Full Sample, Subsample I and Subsample II. Firstly we analyze Full Sample that consist of 170 IPOs and 45 SPOs and is without any restriction

The Subsample I is subset of Full Sample with restriction that SPO must occur within 3 years after IPO date. So if the lag between initial and second public offering is higher than 1095 days (3 years) then we don't recognize the issue as SPO in the Subsample I. We can look at this subsample as asymmetric because not all companies in subsample were traded at least 3 years after IPO date. It implies that some companies don't exceed 3 years (1095 days) between IPO and SPO issue and hypothetically they have still time to issue SPO and meet restriction (SPO within 3 years). Hence the Subsample I is consisting of 170 IPOs and 28 SPOs.

Finally we construct the Subsample II which meets the requirement about SPOs, (i.e. SPO issue within 3 years after IPO) and all companies included in subsample were traded at least 3 years. Thus Subsample II covers only period from 2005 to 2007 and there are 134 IPOs and only 18 SPOs. For Subsample II we don't use the variables PIPO and LogPIPO as independent variables because of low number of privatized IPOs in this subsample. With

respect to small number of observation in Full sample (170), we control the sensitivity of results on outliers of IPO under-pricing. Thus we define a variable trim IPO under-pricing (Trim Up) which is defined as IPO under-pricing (UP) but we replace the outliers identify using the 1 % and 99 % [18] percentiles by nearest values. Then we provide whole analysis again using this new variable Trim Up instead of variable UP (Models 2).

Before we present the empirical result of individual hypotheses we turn our attention to correlation matrices of variables used for testing of signaling model. The Tables of correlation are enclosed in Appendix (as Tables 12 – 14). In line with Signaling theory we are interested in correlation of variables of SPO activity (SPO, LogDays, SPO/IPO) and other variables. Hence we can see that probability of SPO issue (SPO) or a size of SPO as a fraction of IPO (SPO/IPO) is significantly correlated with IPO under-pricing (Up). On the other hand the abnormal market returns (AbRet1 and AbRet2) seem to be uncorrelated with these variables (correlations are not significantly different from zero). For instance, the correlation of the IPO under-pricing (UP) with above mentioned variables for Subsample I (SPO within 3 years) are as follows: SPO (0.209), SPO/IPO (0.191). All these correlations are and significantly different from zero at 5 % level. This implies that there exist some significant relation between SPO issue and IPO under-pricing and that it is reasonable to test signaling hypotheses on our dataset.

7.1.1. Probability of seasoned equity issued

We test the hypotheses that the probability of issue of SPO is positively related to level of IPO under-pricing using the logit model defined by Eq. (7) in methodology part. Table 4 presents the logit regression estimates for all our subsamples. The slope coefficient on the variable UP or trimmed Up is highly significant for all models at least 10 % significant level and its value varies between 1.085 and 2.05. Thus we can conclude the positive and significant relationship between the level of under-pricing and probability of issue of SPO. The after market returns (AbRet1 and AbRet2) seem no evidence about effect of after market returns on probability of issue SPO because of they are insignificant at 5 %

[18] The percentiles are presented in Appendix as Table 15. We choose these levels of percentile with respect to size of sample.

significant level for all samples. In line with Jegadeesh, Weinstein and Welch (1993) the after market returns are used as control variables for alternative market feed-back hypothesis. Based on our results we can reject the alternative hypotheses that issuers do not deliberately leave money on the table but rather use aftermarket information in their decision to issue seasoned equity predicted by the market-feedback hypothesis. On the other hand we cannot reject the signaling hypothesis H_1 that more under-priced IPO issue second public offering more likely than less under-priced IPOs.

If we look at variables connected to IPO volume then we can see that these variables are insignificant at 5 % significant for all subsamples. On the other hand there is difference between values of slope coefficient which mean the effect on probability of issue SPO but we have to take into account the insignificance of variables for models. The negative sign of slope coefficient of variable PDA can be interpreted as proxy for investors' interest and could indicate investors´ estimate of firm's quality. If the firm's shares are traded as right to share after IPO it can imply the low interest about this shares that can signal the lower quality of firm from investors point of view. The effect of PDA variable is negative for all subsamples but only for Full Samples this effect is significant (at 10 % significant level). If we look at effects of variables PIPO and LogPIPO on probability of SPO issue then for a dummy PIPO the effect is strongly negative and for LogPIPO is positive. Unless both effects are not statistically significant at 5 % level. To sum it up we can see that the results are qualitatively same for both specification (Model 1 and Model 2) but the analysis using the trimmed IPO under-pricing indicates the stronger positive relation between IPO under-pricing and probability of SPO issue.

Now we evaluate and compare the overall models for each samples proposed here using the R-squared and chí(2) statics. First one measure the fit of model and second one tests the hypothesis about zero value of all slope coefficients. Thus if we compare the R-squared of individual models we can see that best ones are for Subsample I which is so called asymmetric and contains all IPOs over examine period but time between SPO and IPO is restricted to maximum value 1095 days. The value of Pseudo R-squared statistics is 0.162 (Model 1) and 0.145 (Model 2). The results of testing the hypothesis about presence of zero of all slope coefficients are for most of the subsamples we can reject this null

hypothesis at least 10 % significant level. The only exception is Full Sample (Model 2) where we cannot reject this null hypothesis at 10 % level.

Table 4: Logit Regression of Estimates of the Probability of SPO

This table presents the logit regression estimates of the relation between stock returns at the time of the IPO and the probability of a subsequent second public offering (SPO) for Polish IPO market in 2005 - 2009. The dependent variable is a dummy variable taking the value one if a firm issues SPO within three years of its IPO, and zero otherwise. The independent variables are UP or Trim. Up which is the degree of under-pricing, AbRet1 and AbRet2 is the abnormal after market returns in the two 20-day periods after the IPO. LogIPO is the natural logarithm of the IPO size, PDA is a dummy variable and equal to 1 when shares are traded as right to shares after IPO date and 0 otherwise, LogPIPO is a dummy on LogIPO and it is equal to LogIPO value if company is privatized and 0 otherwise and a dummy PIPO that is equal to 1 if company was privatized and 0 otherwise. p-values are reported in parentheses and the symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels respectively.

	Model 1			Model 2		
	Full Sample	Subsample I	Subsample II	Full Sample	Subsample I	Subsample II
Constant	0.110	-2.592	3.326	0.115	-2.526	3.707
	(0.969)	(0.458)	(0.441)	(0.968)	(0.462)	(0.393)
UP	1.085 *	1.573 **	1.425 **	-	-	-
	(0.057)	(0.029)	(0.048)			
Trim Up	-	-	-	1.294 **	2.005 **	1.809 **
				(0.044)	(0.010)	(0.021)
LogIPO	0.004	0.149	-0.259	-0.001	0.136	-0.289
	(0.981)	(0.445)	(0.270)	(0.995)	(0.475)	(0.219)
PIPO	-21.814	-22.980	-	-21.989	-22.863	-
	(0.158)	(0.233)		(0.156)	(0.233)	
LogPIPO	1.112	1.123	-	1.122	1.121	-
	(0.151)	(0.231)		(0.148)	(0.230)	
PDA	-0.79 *	-0.488	-0.973	-0.737 *	-0.395	-0.862
	(0.065)	(0.369)	(0.123)	(0.081)	(0.459)	(0.165)
AbRet1	0.183	-0.932	-1.654	0.123	-1.023	-1.765
	(0.829)	(0.483)	(0.276)	(0.884)	(0.435)	(0.240)
AbRet2	-0.855	-0.747	-0.885	-0.724	-0.432	-0.396
	(0.527)	(0.646)	(0.648)	(0.584)	(0.787)	(0.832)
Year Dummy	YES	YES	YES	YES	YES	YES
N	170	170	134	170	170	134
Prob>chi2	0.060	0.010	0.047	0.102	0.024	0.098
Pseudo R2	0.097	0.162	0.135	0.088	0.145	0.114

Source: Author´s computations

Finally when we compare our results with other study then we can find out the significant relationship between under-pricing and probability of SPO issue as well as no evidence of effect of aftermarket return on the probability of SPO issue is consistent with findings proposed by Francis et al. (2008). On the other hand they also give the proof about presence of significant effect of size of IPO on probability of SPO issue.

7.1.2. The size of second public offering

We use the Tobit regression in order to test the hypothesis that the size of SPO is positively related to level of IPO under-pricing. The Tobit model is constructed according to Eq. (8). The Tobit specification explicitly assumes that data are left-censored. The result of Tobit estimation is presented in Table 5. The effect of under-pricing on size of SPO as a fraction of IPO is positive and significant at least 5 % level for all samples. We can also see that if we use the trimmed IPO under-pricing instead of IPO under-pricing then the slope coefficient of trim IPO under-pricing (Trim Up) is higher than normal under-pricing (Up) for all subsamples. It implies that the effect of under-pricing is even stronger for Model 2 using trimmed IPO under-pricing. Thus we cannot reject hypothesis H_3 that firms with higher IPO under-pricing are likely to issue larger amounts of SPO. The slope coefficient of LogIPO has negative sign for all subsamples but unfortunately for all subsamples this variable is insignificant at 5 % level. In the opposite the relationship of LogPIPO and explanatory variable seems to be positive but the effect is insignificant for our models at 5 % level. The effect of dummy PDA on explanatory variables is negative and again can be interpreted as signal of investors´ estimate of firm's quality. The trading of shares as right to shares after IPOs signals the insufficient interest of investors and this effect the decision of managers about size of SPO in negative way which is in line with our expectations. The effect is negative for all samples (varies between -1.019 and -1.990) but only for Full Sample and Subsample II are the effects of variable PDA on size of SPO significant at 10 % significant level. The dummy PIPO again shows the negative relationship to SPO size.

Table 5: Tobit regression Estimates of the fraction of SPO/IPO

This table presents the Tobit regression analysis of the relation between stock returns at the time of the IPO and the size of SPO as a fraction of IPO during the period from 2005 to 2009. The dependent variable is the ration of size of SPO to IPO (SPO/IPO).The dependent variable is a dummy variable taking the value one if a firm issues SPO within three years of its IPO, and zero otherwise. The independent variables are UP or Trim. Up which is the degree of under-pricing, AbRet1 and AbRet2 is the abnormal after market returns in the two 20-day periods after the IPO. LogIPO is the natural logarithm of the IPO size, PDA is a dummy variable and equal to 1 when shares are traded as right to shares after IPO date and 0 otherwise, LogPIPO is a dummy on LogIPO and it is equal to LogIPO value if company is privatized and 0 otherwise and a dummy PIPO that is equal to 1 if company was privatized and 0 otherwise. p-values are reported in parentheses and the symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels respectively.

	Model 1			Model 2		
	Full Sample	Subsample I	Subsample II	Full Sample	Subsample I	Subsample II
Constant	3.151	-0.186	8.060	2.738	-0.660	7.984
	(0.383)	(0.971)		(0.444)	(0.896)	(0.263)
UP	1.120 **	1.816 ***	1.751 **	-	-	
	(0.015)	(0.005)	(0.017)			
Trim Up	-	-	-	1.936 **	3.169 ***	3.067 **
				(0.013)	(0.005)	(0.018)
LogIPO	-0.207	-0.038	-0.581	-0.195	-0.031	-0.596
	(0.301)	(0.893)	(0.141)	(0.323)	(0.911)	(0.126)
PIPO	-20.486	-28.280	-	-20.010	-27.201	-
	(0.178)	(0.213)		(0.183)	(0.223)	
LogPIPO	1.058	1.386	-	1.034	1.335	-
	(0.160)	(0.211)		(0.165)	(0.220)	
PDA	-1.118 **	-1.037	-1.990 *	-1.019 *	-0.860	-1.796 *
	(0.045)	(0.204)	(0.066)	(0.063)	(0.278)	(0.087)
AbRet1	-0.114	-1.479	-2.579	-0.239	-1.509	-2.596
	(0.915)	(0.399)	(0.241)	(0.820)	(0.365)	(0.212)
AbRet2	-1.794	-2.140	-1.250	-1.459	-1.542	-0.391
	(0.270)	(0.338)	(0.667)	(0.364)	(0.479)	(0.890)
Year Dummy	YES	YES	YES	YES	YES	YES
N	170	170	134	170	170	134
Prob>chi2	0.144	0.064	0.041	0.141	0.0724	0.047
Pseudo R2	0.051	0.081	0.091	0.051	0.079	0.088

Source: Author´s computations

The slope coefficients of PIPO are highly negative (around -20) for all subsample but insignificant for this model at 10 % level. The negative effect of a dummy PIPO on size of SPO is consistent with Perotti (1995) and his market-oriented government hypotheses. It assume that the government sold the privatized IPOs at higher stake (give up the control rights) to increase the credibility of its privatization program. Thus as we can see that the proportion of SPO volume to IPO volume is larger in case of public IPOs than for Privatized IPOs.

If we are interest in alternative market-feedback hypothesis then we have to attract our attention to aftermarket returns (AbRet1 and AbRet2) which are negative but also insignificant at 10 % significant level for all samples. For assess of the models we again use the R-squared and chi2 stats. We can figure out that we can reject the null hypothesis about zero values of slope coefficients for all samples at 10 % level for Subsamples I and II. On the other hand we cannot reject the null hypotheses for Full Samples. In case of comparing the pseudo R-squared we figure out that highest pseudo R-squared is for Subsample II (SPO within 3 years and companies traded at least 3 years), otherwise R-squared vary between 0.051 and 0.091 with respect on chosen sample.

Thus in contrast to findings proposed in the paper Jegadeesh, Weinstein and Welch (1993) our results indicate that the only statistically significant variable for decision about SPO size as a portion of IPO is IPO under-pricing (positive effect) and the right of share variable (PDA- negative effect) in case of Full Sample or Subsample II. Except the positive relationship between IPO under-pricing and SPO size Jegadeesh, Weinstein and Welch also suggest positive and significant relation between SPO size and aftermarket returns then also between SPO size and natural logarithm of IPO size.

7.1.3. Time between the IPO and the first SPO

Consistently with Francis et al. (2008) we use the Tobit model to analyze the hypothesis about effect of level of under-pricing on time lag between IPO and SPO. This is in opposite to Jegadeesh, Weinstein and Welch (1993) that use the Ordinary least square as method to test this. The Tobit regression follows Eq. (9) presented in Methodology. The results estimate based on our subsamples for the hypothesis about time between IPO and

SPO are shown in Table 6. We don't report the results of Full Sample because these results are same as from Subsample I with respect to model construction (When the IPOs do not issue SPOs in three years, LogDays equals the natural logarithm of the maximum value of 1095 days (three years)).

Firstly we can see that the relation of IPO under-pricing and lag between IPO and SPO issue is statistically significant at 5 % level for all samples and that the effect of IPO under-pricing is negative. The negative effect is between -0.765 and -1.264 and it is stronger for trimmed IPO under-pricing (Trim. Up). The negative relation is in line with signaling theory, because the hypothesis H_2 assumes that firms that more under-priced issue SPO more quickly. In case of Subsample II the variable PDA is also significant at 10 % level for a model and has positive and significant effect. The variables about size of IPOs and PIPOs in logarithmic form are insignificant for all subsamples at 5 % level. In comparison with Francis et al. (2008) the values of slope coefficients for IPO under-pricing is also positive and significant for the models. On the other hand the variables focused on size of volume (LogIPO and LogPIPO) are insignificant at 5 % level in our estimation that is in contrast with above mentioned study. The positive slope coefficients of aftermarket returns is in contrast to findings provided by Francis et al. al (2008) but the slope coefficient is not statistically differ from zero at 10 % significant level. The strongly positive effect of PIPO dummy on LogDays is as we excepted. The government has no incentive to issue SPO within 3 years because the government can build its reputation also by issuing another privatized IPO. For this purpose the slope coefficient is positive and the incentive issue SPO within 3 years is much higher in case of public IPO than privatized IPOs. But this finding is statistical insignificant.

To evaluate the models we check the pseudo R-squared and chí(2). The pseudo R-squared is between 0.090 and 0.137 for Subsamples I ad II. The null hypothesis about the zero values of all slope coefficients could be rejecting at 10 % significant level for all samples. For the subsample 3 and 6 we cannot reject this hypothesis.

Table 6: Tobit regression Estimates of the Time between IPO and SPO

This table presents the Tobit regression analysis of the relation between stock returns at the time of the IPO and the time between the IPO and SPO during the period from 2005 to 2009. The dependent variable is the natural logarithm of the time between the IPO and the SPO (LogSPO). When the IPOs do not issue SPOs in three years, the dependant variable equals the natural logarithm of the maximum value of 1095 days (three years). With respect to construction of model, the results of Full sample will be identical with Subsample I and we present them only once as Subsample I. For regressions including the Subsample I, there are 28 uncensored observations and 142 right-censored observations when the gap is greater than 3 years. The independent variables are UP or Trim. Up which is the degree of under-pricing, AbRet1 and AbRet2 is the abnormal after market returns in the two 20-day periods after the IPO. LogIPO is the natural logarithm of the IPO size, PDA is a dummy variable and equal to 1 when shares are traded as right to shares after IPO date and 0 otherwise, LogPIPO is a dummy on LogIPO and it is equal to LogIPO value if company is privatized and 0 otherwise and a dummy PIPO that is equal to 1 if company was privatized and 0 otherwise. p-values are reported in parentheses and the symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels respectively.

	Model 1			Model 2		
	Full Sample	Subsample I	Subsample II	Full Sample	Subsample I	Subsample II
Constant	-	9.048 ***	6.006 *	-	9.138 ***	5.969 *
		(0.000)	0.059		(0.000)	(0.064)
UP	-	-0.778 ***	-0.765 **	-	-	-
		(0.008)	0.021			
Trim Up	-	-	-	-	-1.296 **	-1.264 **
					(0.011)	(0.032)
LogIPO	-	-0.135	0.100	-	-0.132	0.113
		(0.304)	0.564		(0.307)	(0.514)
PIPO	-	11.347	-	-	11.091	-
		(0.280)			(0.288)	
LogPIPO	-	-0.544	-	-	-0.534	-
		(0.304)			(0.294)	
PDA	-	0.499	0.890 *	-	0.434	0.814 *
		(0.180)	0.067		(0.235)	(0.090)
AbRet1	-	0.258	0.580	-	0.281	0.629
		(0.74)	0.527		(0.710)	(0.485)
AbRet2	-	0.892	1.032	-	0.643	0.666
		(0.377)	0.435		(0.519)	(0.611)
Year Dummy	-	YES	YES	-	YES	YES
N	-	170	134	-	170	134
Prob>chi2	-	0.004	0.071	-	0.006	0.102
Pseudo R2	-	0.137	0.098	-	0.132	0.090

Source: Author´s computations

7.1.4. Market anticipation of SPOs

Finally we examine the relation between the stock price reaction on the announcement of SPOs and IPO under-pricing. The signaling theory expects that the market should be less surprised by the announcement of secondary public offering by companies that more under-priced their IPOs. For testing this hypothesis of the signaling model we used the ordinary least square method. The construction of model follows Eq. (10). Table 7 presents the OLS estimates of the regression model. We do not estimate the model for Subsample II because of the number observations with respect to number of independent variables is low. This can also influence the overall evaluation of model for Full Sample and Subsample I and we have to take into account if we make conclusions from estimated results.

With respect to construction of dependent variable AnnReact as the three-day abnormal returns of firms that announce SPOs. The abnormal return is computed as raw return minus beta times market return. We use the WIG index as market proxy and and the parameters for the market model are estimated over the (-266, -11) interval. To be included in the event study, issuing firms must have at least 100 days' stock returns for the estimation period. This data requirement reduces the number of observations from 45 to 42 in case of Full Sample. The estimate of the slope coefficient on the under-pricing variable is positive for both models in case of Subsample I and negative in case of Full Sample. For all samples the slope coefficient on under-pricing is not significantly different from zero at 10 % significant level.

Consistently with Francis et al. (2008) and Jegadeesh, Weinstein and Welch (1993), we can see the positive effect of IPO under-pricing on abnormal return of SPO announcement in case of Subsample I but Francis et al. prove this effect as statistically significant at 1 % level. We can see that also the rest of explanatory variables are not significantly different from zero at 10 % significance level. Thus we can see that the market reaction to announcement of second public offering is not significantly influenced neither by stock returns around the time of IPOs (IPO under-pricing, Abnormal returns) nor by variables related to SPO issue (Logarithm of SPO size, logarithm of lag between IPO and SPO issue).

Table 7: OLS Regression of the SPO Announcement Effect and IPO Underpricing
The dependent variable is the abnormal SEO three-day announcement price reaction. UP is IPO under-pricing. AbRet1 and AbRet2 are the abnormal returns in the two 20-day periods after the IPO. LogIPO is the natural logarithm of IPO size. LogDays is the natural logarithm of the time between SPO and IPO. LogSPO is the natural logarithm of SPO issue size. SPO/IPO is a proportion of the SEO issue size to the IPO size. UP 05-08 is a dummy on variable IPO under-pricing. To control potential heteroskedasticity, we use the robust standard errors. p-values are reported in parentheses and the symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels respectively.

	Model 1			Model 2		
	Full Sample	Subsample I	Subsample II	Full Sample	Subsample I	Subsample II
Constant	0.086	-0.131	-	0.090	-0.111	-
	(0.687)	(0.599)		(0.694)	(0.669)	
UP	-0.076	0.070	-	-	-	-
	(0.631)	(0.716)				
Trim Up	-	-	-	-0.077	0.065	-
				(0.625)	(0.741)	
LogIPO	-0.004	-0.011	-	-0.004	-0.012	-
	(0.772)	(0.650)		(0.775)	(0.635)	
PDA	0.014	-0.008	-	0.014	-0.014	-
	(0.485)	(0.732)		(0.452)	(0.582)	
AbRet1	-0.041	0.085	-	-0.041	0.092	-
	(0.636)	(0.481)		(0.634)	(0.477)	
AbRet2	0.034	0.047	-	0.035	0.057	-
	(0.583)	(0.688)		(0.576)	(0.657)	
LogDays	-0.012	0.032	-	-0.012	0.032	-
	(0.533)	(0.557)		(0.532)	(0.552)	
LogSPO	0.004	0.008	-	0.004	0.008	-
	(0.519)	(0.431)		(0.529)	(0.426)	
SPO/IPO	-0.005	0.007	-	-0.005	0.008	-
	(0.703)	(0.828)		(0.705)	(0.799)	
UP05	0.060	-0.275	-	0.058	-0.308	-
	(0.716)	(0.410)		(0.716)	(0.432)	
UP06	0.075	-0.077	-	0.072	-0.096	-
	(0.614)	(0.681)		(0.581)	(0.614)	
UP07	0.113	0.023	-	0.113	0.030	-
	(0.564)	(0.911)		(0.559)	(0.890)	
UP08	-0.370	-0.631	-	-0.370	-0.638	-
	(0.385)	(0.335)		(0.382)	(0.350)	
N	42	25	-	42	25	-
Prob>F	0.372	0.849	-	0.738	0.909	-
R-squared	0.146	0.199	-	0.146	0.204	-

Source: Author´s computations

Therefore the announcement date stock return is probably affected by some exogenous variables. The possible explanation of this can be fact that the examining period covers the financial crisis period that significantly influence the company's decision about timing of SPO issue as well as market reaction on SPO announcement. Hence the expected relation between the level of under-pricing and reaction of market to announcement of SPO is not significantly proved. To control the possible differences across years we decide to include the dummy on IPO under-pricing as additional independent variable. This extension improves models[19] but we still cannot reject the null hypothesis that all slope coefficients are equal to zero at least 10 % significance level.

7.2. Privatized Initial public offerings in Poland

The presence of Privatized IPOs on Warsaw Stock Exchange arise the question about comparison of under-pricing of public IPOs vs. privatized IPOs as well as question about long-run performance of both groups of initial public offerings. The table 8 summarizes the descriptive statistics of under-pricing defined as initial raw return and also the variant of initial market adjusted returns. The returns are compute consistently with equations (1) and (2). Firstly we can see that both mean values of returns for all subsamples are significantly positive and differ from zero. Around 70 % of IPOs and PIPOs have positive first day return. The mean value of initial raw returns for whole sample is equal to 0.1686 and mean of market-adjusted return is nearly same 0.1687.

If we compare the mean value of initial raw return between IPOs and PIPOs then we can conclude that the mean value of public IPOs under-pricing is 0.1743 which is higher than mean of PIPOs under-pricing (0.930). Despite of positive difference between mean of raw initial return of IPOs and PIPOs (0.0813) this difference is statistically insignificant. Using the two-sample t test with unequal variances we test the null hypothesis that mean value of IPOs is not different from PIPOs[20]. The result is that we cannot reject the null hypothesis at 5 % significant level (t-stats is 1.43). Thus in line with (Aussenegg (2000))

[19] For instance: Without including the dummy on IPO under-pricing the Prob>F is equal to 0.771 and R-squared = 0.068 for Full Sample .
[20] The results of t-test are enclosed in Apendix as Table 16.

we reject the hypothesis 5 which assumes that the raw initial return of PIPOs is lower than for private IPOs.

With respect to small sample it is more appropriate use median value for comparison. The median values of returns are also positive for all subsamples, for instance median values of initial raw return are 0.0665 for all IPO, 0.0665 for IPOs and 0.844 for PIPOs.

Table 8: Descriptive statistics of Initial Returns

	Initial Market-Adjusted Returns		
	All	IPOs	PIPOs
Mean	0.1687	0.1741	0.0977
Median	0.0657	0.0657	0.0882
Minimum	-0.7261	-0.7261	-0.1745
Maximum	4.7821	4.7821	0.3216
Number of firms:			
Positive	128	119	9
Negative	42	39	3
Zero	0	0	0
TOTAL	170	158	12

Note: Mean and median values of initial market-adjusted returns for the samples: all issues (All), privatization IPOs (PIPOs) and private sector IPOs (IPOs). The initial raw returns and initial market-adjusted returns

Source: Author´s computations

The aftermarket performance for three samples (All, IPOs and PIPOs) is presented in Table 9. The average BHR over first two weeks for All issues and public IPOs is significantly affected by outlier[21] and results presented in Table 10 are without outlier. The mean values of Buy-and-hold adjusted reruns over first two weeks are equal to +0.04 % (1W) and +0.40 % (2W) for All issues and +0.36 % (1W) and -0.04 % (2W) for public IPO for dataset without outlier. If we compare these results with dataset with outlier then the average BHAR over first two weeks are equal to +23.98 % (1W) and 2.03 % (2W) for All issues, +25.71 % (1W) and 2.17 % (2W) for public IPOs.

[21] PCGUARD with 1 week BHR more than 4066 %, asimilation of shares

Table 9: Short and Long-Run Aftermarket Performance (without outlier)

			BHR (%)			BHAR (%)			
Samples	Period	N	Issues	WIG	WR	Mean	Median	>0	<=0
All	1 week	169	0.43	0.39	1.00	0.04	-0.70	78	91
			(0.59)	*(1.88)*		*(0.06)*	*(1.18)*		
	2 weeks	169	0.82	0.43	1.00	0.40	-0.96	74	95
			(0.76)	*(1.28)*		*(0.37)*	*(1.25)*		
	1 year	169	4.08	1.77	1.02	2.32	-4.29	78	91
			(0.61)	*(0.56)*		*(0.42)*	*(1.15)*		
	2 years	159	1.54	4.80	0.97	-3.26	-18.95	46	113
			(0.17)	*(1.02)*		*(0.49)*	*(3.43)*		
	3 years	136	-19.35	-6.04	0.86	-13.31	-29.14	37	99
			(2.67)	*(2.07)*		*(2.08)*	(*4.49)*		
IPOs	1 week	157	0.36	0.39	1.00	-0.04	-0.62	75	83
			(0.45)	*(1.81)*		*(0.05)*	*(1.21)*		
	2 weeks	157	0.72	0.30	1.00	0.42	-0.96	72	86
			(0.63)	*(0.88)*		*(0.37)*	*(1.06)*		
	1 year	157	3.07	-0.77	1.04	3.85	-1.91	74	84
			(0.43)	*(0.24)*		*(0.65)*	*(0.76)*		
	2 years	149	-3.31	0.06	0.97	-3.36	-19.03	42	107
			(0.36)	*(0.01)*		*(0.48)*	(*3.45)*		
	3 years	129	-24.18	-7.88	0.82	-16.29	-29.43	32	97
			(3.44)	*(2.76)*		*(2.53)*	*(4.91)*		
PIPOs	1 week	12	1.47	0.36	1.01	1.11	-1.03	5	7
			(1.03)	*(0.50)*		*(0.65)*	*(-0.24)*		
	2 weeks	12	2.12	2.03	1.00	0.09	-3.02	3	9
			(0.83)	*(1.74)*		*(0.03)*	*(-1.50)*		
	1 year	12	17.31	34.99	0.87	-17.68	-7.94	5	7
			(2.16)	*(4.13)*		*(-1.96)*	*(-1.41)*		
	2 years	10	73.82	75.53	0.99	-1.72	-13.13	4	6
			(2.64)	*(3.97)*		*(-0.08)*	*(-0.36)*		
	3 years	7	69.61	27.85	1.33	41.77	17.84	5	2
			(1.53)	*(1.55)*		*(1.29)*	*(1.18)*		

Note: Buy-and-hold abnormal returns (BHARs) and wealth relatives (WR) during the first three years of aftermarket trading for all issues (All), privatization IPOs (PIPOs) and private sector IPOs (IPOs). BHARs are defined as the difference between the buy-and-hold return (BHR) of issue and the BHR of the benchmark over the same period. BHRs are measured by Eqs. (3) and (4). It is tested whether the BHRs and the BHARs are significantly different from zero. We used t in parentheses. * Significant at the 1% level. ** Significant at the 5% level. WIG = Warsaw Stock Exchange Index -test for means and for the medians a Wilcoxon-Signed-Rank-Test. Test statistics

Source: Author´s computations

Here we present only the differences for first two weeks that are the highest ones. Despite the differences between mean values of BHAR with and without outlier for the whole sample, the outlier does not affect the significance. We can see the influence of outlier on whole sample from Table 18 which presents the Buy-and-Hold returns with outlier.

The mean values of Buy-and-hold adjusted return indicate the positive value but statistically insignificant. On the other hand the median values of BHAR are negative for all samples but again statistically insignificant. The results of short-run aftermarket performance may indicate that for Polish IPO market there is full price adjustment on the first trading day. Analogical conclusion was provided by Aussenegg (2000) for Poland or by Jelic and Briston (1999) for Hungary.

With respect to our dataset, the number of observation for long-run buy-and-hold returns declines with increasing range of measurement of aftermarket returns (169 (1Y) →159 (2Y) →136 (3Y)). The decline of number of observations is caused by (i) de-listing of some company and (ii) insufficient duration of trading for recently listed companies (less than 3 years). If company is de-listed within 3 years after IPO, then we include all available company's buy-and-hold returns[22], the same logic is applied on recently listed company.

In opposite to short-run aftermarket performance, the long-run aftermarket performance (first three years) indicates the difference across the samples. For the sample of all IPOs the mean (median) of BHAR is – 13.31 % (-29.14 %) for 3 years and the wealth relative is 0.85. The mean as well as median are significantly different from zero at 1 % significant level. More than 70 % of all IPOs (99 of 136) exhibit a negative abnormal long-run performance for 3 years. The finding about negative long-run abnormal return is in line with other empirical literature, for instance Loughran and Ritter (1994) or Ljungqvist (1993).

Now we compare the abnormal long-run performance of public IPOs with the privatized ones. We can see that 3-year abnormal performance of PIPOs indicates the positive return. The mean (median) of BHAR is + 41.77 % (+17.84 %) but both statistics are not significantly different from zero at used significance levels. Thus the hypothesis 7 that for PIPOs the 3-years long-run aftermarket performance is non-negative cannot be rejected. Consistently with Perotti (1995) the non-negative long-run abnormal return of

[22] For instance, company is delisted after 2 years and 2 months after IPO date, thus we include all available BHR returns (i.e. 1W, 2W, 1Y and 2Y) into our sample.

Polish PIPO can be evidence for a market-oriented government. Jelic and Briston (2003) as well as Aussenegg (2000) also provide the evidence of market-oriented government for Poland using PIPOs data from 90´s.

The mean (median) of 3-years long-run abnormal performance is negative -16.29 % (-29.43 %) and significantly differs from zero at 1 % significance level. About 75 % of public IPOs experience the negative BHAR for 3 years duration. Hence the Polish public IPOs are underperformed in a long-run. This finding is consistent with evidence documented by Jelic and Briston (1999) for Hungarian private sector.

The results of testing the hypothesis 8 that Polish PIPOs outperform the Polish public sector in long-run are shown in Table 10. The difference between PIPOs and the public IPOs is positive for 2-years and 3-years period. These difference of BHR is also statistically significant at 5 % level. In case of BHAR the difference is not significantly different from zero at 5 % level for 2 and 3 years. But the BHAR for 1 year is negative and significant at 5 % level of significant. This result must be interpreted carefully with respect to different number of PIPOs and IPOs observations in the sample. Also the distribution across time is different for both groups. We can see that results are not affected by presence or no-presence of outlier. Finally the hypothesis about positive difference of PIPOs performance and public IPOs performance measured by BHAR in a long-run can be rejected at 5 % significance level.

Table 10: Test for Difference in the Long-Run Aftermarket Performance

Panel A :	*Difference between mean of PIPOs and IPOs with outlier*			
	BHR (%)		BHAR (%)	
Period	Issues	WIG	Mean	Median
1 year	13.17	35.54	-22.37	-6.19
	(1.22)	*(3.92)*	*(2.07)*	
2 years	77.74	74.93	2.81	6.02
	(2.64)	*(3.83)*	*(0.13)*	
3 years	94.37	35.60	58.78	47.59
	(2.04)	(1.96)	(1.78)	
Panel B :	*Difference between mean of PIPOs and IPOs without outlier*			
	BHR (%)		BHAR (%)	
Period	Issues	WIG	Mean	Median
1 year	14.24	35.76	-21.53	-6.03
	(1.32)	*(3.94)*	*(1.99)*	
2 years	77.12	75.47	*1.65*	5.90
	(2.62)	*(3.85)*	*(0.07)*	
3 years	93.79	35.73	58.06	47.28
	(2.03)	*(1.96)*	*(1.76)*	

Note: Mean and median differences between privatized IPOs and public IPOs (PIPOs - IPOs) for BHRs and BHARs. For means a t-test is used and test statistics are in parentheses.

Source: Own computation

With respect to low number of Privatized IPOs in our sample, we cannot statistically test the Hypothesis 6 about building up the government reputation over the privatization program. Hence for the purpose of making several suggestion about validity of hypothesis 6, we decide to extend our current dataset of privatized IPOs and SPOs by all privatized SPOs over examined period 2005 – 2010. The data are obtain from Polish Ministry of Treasury. We include into sample all transaction with value over 1 000 000 zl. Finally our sample of Polish privatized transaction is presented as Table 19 in Appendix. We assume that government privatization policy is stable across the electoral terms. We also assume that the government tries to build up its reputation by timing IPOs as well as SPOs transaction.

If we look at the Table 19 then we can see that the activity of privatization through capital market (using IPO or SPO) varies across time. There were relatively large IPO activity in 2005, 8 Privatized IPOs were introduced to trading. Following two years means only 3 privatized transactions. After 2008 we identify steep increase of Privatized transaction activity, mainly driven by SPOs issues. The increase of activity could be simply explained by creation of new privatization program for years 2008 to 2011. The reason for this privatization program could be financial crisis and afford of government to improve of state income. We can also consider the increasing activity of Privatization through capital market as attempt to recovery Polish capital market after global recession. Consistently with Perroti (1995) definition of market-oriented government, the attempt of government to build up the reputation before others privatization can be observable as larger fraction of sold share capital (give up the control rights) and higher PIPO under-pricing at the beginning of privatization program. With respect to our data sample we see that development of stakes sold by Treasury is not consistent with above mentioned hypothesis that stake of sold will be decrease as privatization plan continues. If we look at IPO transaction then nearly half of them raised capital through IPO and the rest usually sold less then 50 % of share capital. The exceptions are Tauron and GPW in 2010. The reason for this can be that the government wants to maintain the control rights and sell the control stake in more favorable time. On the other hand they might want to stimulate market or decrease the state deficit. In order to accomplish both targets they transfer only small part of control rights through capital rising.

If we focus on development of level of IPO under-pricing that the conclusion about Hypothesis 6 is same, we cannot identify any systematic decline of IPO under-pricing over time that is expected in Hypothesis 6. But we have take into account small number of PIPOs observation in our sample.

8. Conclusion

The aim of this diploma thesis is to extend empirical literature about the signaling by IPO under-pricing by examining the IPO under-pricing in Polish capital market. We utilize the country's specifics as post communism past, privatization through IPOs into research of signaling by IPO under-pricing. We provide standard research of signaling by IPO under-pricing as signal models developed by Welch (1989) when we use the higher expected information asymmetry associated with post-communism past and include the privatized IPOs variable into model as specific of Polish market. With respect to presence of privatized IPOs we analyze signaling by IPO under-pricing as tool for building up the government reputation.

Application of testable hypotheses about signaling theory on Polish capital market with its unique settings and Polish post-communism past enable us the examination of signaling theory from slightly different perspective with respect to existing studies (for instance Francis et all (2008) U.S. data or Yu and Tse (2003) Chinese data). Consistently with existing literature we use the testable hypotheses formulated in Jegadeesh, Weinstein and Welch (1993). We find evidence of significant positive relation between probability of second public offering and level of under-pricing. In contrast to Jegadeesh, Weinstein and Welch (1993) the abnormal aftermarket return is not significantly important determinant for decision about issue of SPO. Further the level of under-pricing of IPO is also statistically significant for size of second public offering. For restricted samples we can identify the negative relation between level of under-pricing and time between issue of IPO and SPO. This relation is statistically significant and in line with signaling theory, when more under-priced IPOs issue the second public offering quickly. The rest of variables for estimation are insignificant at 5 % significant level. Finally we examine the market anticipation of SPOs.

Our results suggest that the market reaction to announcement of second public offering is not significantly influenced neither by stock returns around the time of IPOs (IPO under-pricing, Abnormal returns) nor by variables related to SPO issue (Logarithm of SPO size, logarithm of lag between IPO and SPO issue). All independent variables used in previous researches are insignificant in explanation of market reaction to SPO

announcement. Therefore the announcement date stock return is probably affected by some exogenous variables. The estimation can be biased by occurring the financial crisis during examine period. Thus the evidence of the signaling theory as possible explanation for IPO under-pricing is mixed

If we focus on Privatized IPOs then we conclude that the mean value of under-pricing is lower for privatized IPOs (9.30 %) than for private ones (17.43 %). However, the difference is not statistically significant at 5 % level. The analysis of IPOs short and long-run after-market performance indicates significantly negative long-run abnormal returns in case of full sample. On the other hand findings of PIPOs long-run aftermarket performance suggest the positive 3-year abnormal return (41.77 %) but the findings are not significantly differ from 0. Thus we cannot reject the hypothesis that PIPOs 3-year long-run aftermarket performance is non-negative. In line with previous research this supports the view of Polish government as market-oriented. The hypothesis about over-performance of Privatized IPOs in comparison with public IPOs is rejected at conventional significance level. We find out the positive difference of PIPOs and private IPOs performance in a long run for 2-years and 3-years period, but unfortunately the evidence is not statistically significant. There is no statistical significant evidence that the Polish government, trying to build up reputation for its privatization policy over time by under-pricing, selling a high fraction at the initial offer.

Overall, we document that on average IPOs are under-priced in Poland and provide the mixed evidence for signaling theory. We conclude that the signaling hypothesis can partly explain of IPO under-pricing in Warsaw Stock Exchange. We also identify certain differences in private IPOs performance and privatized IPOs performance, but with respect to number of PIPOs in dataset these are only pieces of evidence. For future research the extension of dataset can be useful in order to obtain more statistically significant results as well as to obtain more equal ration between number of private and state IPOs observations.

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10. Appendix

Table 11: Dual listed companies in WSE

Company	Country of origin	Sector	Primary exchange
ATLASEST (2006)	Channel Islands/UK	developers	London SE
CEDC (2006)	USA	wholesale	NASDAQ
CEZ (2006)	Czech Republic	energy production	PragueSE
PEGAS (2006)	Czech Republic	chemical	PragueSE
PLAZACNTR (2007)	Netherlands	developers	London SE
IMMOEAST (2007)			
OLYMPIC (2007)	Estonia	casinooperator	NASDAQ OMX TALLINN
ORCOGROUP (2007)	Luxembourg	construction	NYSE EURONEXT PARIS
SILVANO (2007)	Estonia	lightindustry	NASDAQ OMX TALLINN
WARIMPEX (2007)	Austria	construction	Wiener Borse
UNICREDIT (2007)	Italy	banking	BorsaItaliana
BELVEDERE (2008)	France	food	NYSE EURONEXT PARIS
NEWWORLDR (2008)	Czech Rep./Netherlands	mining company	London SE

Source: WSE

Table 12: Correlation matrix – Full Sample for period 2005 – 2009 no restriction

	up	logipo	pipo	logpipo	pda	abret1	abret2	spo	spo_ipo	annreact
up	1	-0.049 (0.527)	-0.059 (0.449)	-0.058 (0.455)	-0.050 (0.519)	0.129 * (0.093)	-0.058 (0.450)	0.168* (0.029)	0.203* (0.008)	0.101 (0.524)
logipo	-0.061 (0.429)	1	0.466* (0.000)	0.477* (0.000)	-0.326* (0.000)	-0.015 (0.842)	-0.103 (0.182)	0.107 (0.165)	-0.085 (0.273)	-0.015 (0.925)
pipo	-0.047 (0.545)	0.466* (0.000)	1	0.998* (0.000)	-0.107 (0.166)	-0.013 (0.868)	-0.066 (0.392)	0.095 (0.218)	0.035 (0.654)	0.046 (0.772)
logpipo	-0.046 (0.550)	0.477*** (0.000)	0.998* (0.000)	1	-0.103 (0.182)	-0.011 (0.890)	-0.067 (0.386)	0.104 (0.178)	0.036 (0.640)	0.046 (0.771)
pda	0.012 (0.881)	-0.326 (0.000)	-0.107 (0.166)	-0.103 (0.182)	1	-0.069 (0.375)	-0.021 (0.790)	-0.144* (0.062)	-0.072 (0.351)	0.149 (0.347)
abret1	0.062 (0.422)	-0.015 (0.842)	-0.013 (0.868)	-0.011 (0.890)	-0.069 (0.375)	1	-0.067 (0.389)	0.041 (0.596)	-0.045 (0.558)	-0.109 (0.494)
abret2	-0.006 (0.935)	-0.103 (0.182)	-0.066 (0.392)	-0.067 (0.386)	-0.021 (0.790)	-0.067 (0.389)	1	-0.060 (0.439)	-0.086 (0.264)	0.104 (0.513)
spo	0.181 ** (0.018)	0.107 (0.165)	0.095 (0.218)	0.104 (0.178)	-0.1437* (0.062)	0.041 (0.596)	-0.060 (0.439)	1	0.552* (0.000)	N.A.
spo_ipo	0.184 ** (0.016)	-0.085 (0.273)	0.035 (0.654)	0.036 (0.640)	-0.072 (0.351)	-0.045 (0.558)	-0.086 (0.264)	0.552* (0.000)	1	-0.063 (0.692)
annreact	0.072 (0.650)	-0.015 (0.925)	0.046 (0.772)	0.046 (0.771)	0.149 (0.347)	-0.109 (0.494)	0.104 (0.513)	N.A.	-0.063 (0.692)	1

Note: Upper triangel of correlation matrix is with UP defined as Trim Up. Lower triangel used UP. P-value in parenthesis.

Source: Author´s computations

Table 13: Correlation matrix – Subsample I (SPO within 3 years) - 2005 - 2009

	up	logipo	pipo	logpipo	pda	abret1	abret2	spo	spo_ipo	logdays	annreact
up	1	-0.049 (0.527)	-0.059 (0.449)	-0.058 (0.455)	-0.050 (0.519)	0.129* (0.093)	-0.058 (0.450)	0.174* (0.024)	0.202* (0.008)	-0.109 (0.157)	0.083 (0.693)
logipo	-0.061 (0.429)	1	0.466* (0.000)	0.477* (0.000)	-0.326* (0.000)	-0.015 (0.842)	-0.103 (0.182)	0.093 (0.227)	-0.070 (0.364)	-0.172* (0.025)	-0.025 (0.907)
pipo	-0.047 (0.545)	0.466* (0.000)	1	0.998* (0.000)	-0.107 (0.166)	-0.013 (0.868)	-0.066 (0.392)	0.063 (0.412)	0.013 (0.871)	-0.050 (0.514)	0.076 (0.718)
logpipo	-0.046 (0.550)	0.477* (0.000)	0.998* (0.000)	1	-0.103 (0.182)	-0.011 (0.890)	-0.067 (0.386)	0.074 (0.335)	0.015 (0.843)	-0.061 (0.429)	0.074 (0.725)
pda	0.012 (0.881)	-0.326* (0.000)	-0.107 (0.166)	-0.103 (0.182)	1	-0.069 (0.375)	-0.021 (0.790)	-0.031 (0.685)	-0.046 (0.553)	0.051 (0.510)	0.152 (0.469)
abret1	0.062 (0.422)	-0.015 (0.842)	-0.013 (0.868)	-0.011 (0.890)	-0.069 (0.375)	1	-0.067 (0.389)	-0.058 (0.456)	-0.062 (0.422)	-0.003 (0.969)	-0.057 (0.787)
abret2	-0.006 (0.935)	-0.103 (0.182)	-0.066 (0.392)	-0.067 (0.386)	-0.021 (0.790)	-0.067 (0.389)	1	-0.047 (0.540)	-0.099 (0.198)	0.086 (0.265)	0.115 (0.584)
spo	0.209* (0.006)	0.093 (0.227)	0.063 (0.412)	0.074 (0.335)	-0.031 (0.685)	-0.058 (0.456)	-0.047 (0.540)	1	0.604* (0.000)	-0.771* (0.000)	N.A.
spo_ipo	0.191* (0.013)	-0.070 (0.364)	0.013 (0.871)	0.015 (0.843)	-0.046 (0.553)	-0.062 (0.422)	-0.099 (0.198)	0.604* (0.000)	1	-0.383* (0.000)	-0.092 (0.663)
logdays	-0.090 (0.243)	-0.172* (0.025)	-0.050 (0.514)	-0.061 (0.429)	0.051 (0.510)	-0.003 (0.969)	0.086 (0.265)	-0.771* (0.000)	-0.383* (0.000)	1	0.067 (0.750)
annreact	0.046 (0.827)	-0.025 (0.907)	0.076 (0.718)	0.074 (0.725)	0.152 (0.469)	-0.057 (0.787)	0.115 (0.584)	N.A.	-0.092 (0.663)	0.067 (0.750)	1

Note: Upper triangel of correlation matrix is with UP defined as Trim Up. Lower triangel used UP. P-value in parenthesis.

Source: Author´s computations

Table 14: Correlation matrix – Subsample II (SPO within 3 years) - 2005 - 2007

	up	logipo	pda	abret1	abret2	spo	spo_ipo	logdays
up	1	-0.151* (0.082)	-0.028 (0.753)	0.150* (0.083)	-0.068 (0.437)	0.212* (0.014)	0.216* (0.012)	-0.140 (0.108)
logipo	-0.182* (0.035)	1	-0.357* (0.000)	-0.137 (0.115)	-0.028 (0.749)	-0.086 (0.323)	-0.127 (0.144)	-0.061 (0.485)
pda	0.026 (0.766)	-0.357* (0.000)	1	-0.023 (0.793)	0.017 (0.847)	-0.053 (0.540)	-0.103 (0.236)	0.072 (0.409)
abret1	0.079 (0.362)	-0.137 (0.115)	-0.023 (0.793)	1	-0.060 (0.494)	-0.088 (0.311)	-0.088 (0.310)	0.000 (0.999)
abret2	0.025 (0.775)	-0.028 (0.749)	0.017 (0.847)	-0.060 (0.494)	1	-0.070 (0.419)	-0.050 (0.567)	0.134 (0.124)
spo	0.257* (0.003)	-0.086 (0.323)	-0.053 (0.540)	-0.088 (0.311)	-0.070 (0.419)	1	0.625* (0.000)	-0.707* (0.000)
spo_ipo	0.206* (0.017)	-0.127 (0.144)	-0.103 (0.236)	-0.088 (0.310)	-0.050 (0.567)	0.625* (0.000)	1	-0.361* (0.000)
logdays	-0.117 (0.178)	-0.061 (0.485)	0.072 (0.409)	0.000 (0.999)	0.134 (0.124)	-0.707* (0.000)	-0.360* (0.000)	1

Note: Upper triangel of correlation matrix is with UP defined as Trim Up. Lower triangel used UP. P-value in parenthesis.

Source: Author´s computations

Table 15: IPO under-pricing percentiles

variable	p99	p95	p90	p50	p10	p5	p1
Under-pricing	1.599	0.714	0.481	0.067	-0.064	-0.104	-0.191

Source: Author´s computations

Table 16: Two sample t-test with unequal varinces - LogIPO vs LogPIPO

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	158	17.373	0.108	1.359	17.160	17.587
1	12	20.132	0.342	1.185	19.379	20.884
combined	170	17.568	0.117	1.520	17.338	17.798
diff		-2.758	0.359		-3.531	-1.985

diff = mean(0) - mean(1) t = -7.691

H_0: diff = 0 Satterthwaite's degrees of freedom = 13.300

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.000 Pr(|T| > |t|) = 0.000 Pr(T > t) = 1.000

Note: Group 0 is public IPOs and Group 1 is privatized IPOs.

Source: Author´s computations

Table 17: Two sample t-test with unequal variance - IPO under-pricing

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	158	0.174	0.108	1.359	17.15977	17.58687
1	12	0.093	0.342	1.185	19.37903	20.88437
combined	170	0.169	0.117	1.520	17.33795	17.7981
diff		0.081	0.057		-0.035	0.197

diff = mean(0) - mean(1) t = 1.430

H_0: diff = 0 Satterthwaite's degrees of freedom = 31.226

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.919 Pr(|T| > |t|) = 0.163 Pr(T > t) = 0.081

Note: Group 0 is public IPOs and Group 1 is privatized IPOs.

Source: Author´s computations

Table 18: Short and Long Aftermarket performance (with outlier)

			BHR (%)			BHAR (%)			
Samples	Period	N	Issues	WIG	WR	Mean	Median	>0	<=0
All	1 week	170	24.35	0.38	1.24	23.98	-0.66	80	90
			(1.02)	*(1.83)*		*(1.00)*	*(-1.04)*		
	2 weeks	170	2.42	0.39	1.02	2.03	-0.96	75	95
			(1.26)	*(0.88)*		*(1.04)*	*(-1.11)*		
	1 year	170	5.07	1.95	1.03	3.11	-3.10	79	91
			(0.75)	*(0.63)*		*(0.56)*	*(-1.01)*		
	2 years	160	0.93	5.28	0.96	-4.35	-18.99	46	114
			(0.11)	(1.13)		(-0.65)	(-3.53)		
	3 years	137	-19.94	-5.93	0.85	-14.01	-29.31	37	100
			(2.77)	*(-2.05)*		*(-2.20)*	*(-4.57)*		
IPOs	1 week	158	26.10	0.38	1.26	25.71	-0.58	75	83
			(1.01)	(1.76)		(1.00)	(-1.06)		
	2 weeks	158	2.44	0.27	1.02	2.17	-0.89	72	86
			(1.18)	*(0.78)*		*(1.04)*	*(-0.91)*		
	1 year	158	4.14	-0.56	1.05	4.69	-1.75	74	84
			(0.57)	*(-0.17)*		*(0.79)*	*(-0.62)*		
	2 years	150	-3.93	0.60	0.96	-4.53	-19.15	42	108
			(-0.43)	*(0.13)*		*(-0.64)*	*(-3.55)*		
	3 years	130	-24.76	-7.75	0.82	-17.01	-29.74	32	98
			(-3.54)	*(-2.74)*		*(-2.65)*	*(-5.00)*		
PIPOs	1 week	12	1.47	0.36	1.01	1.11	-1.03	5	7
			(1.03)	*(0.50)*		*(0.65)*	*(-0.24)*		
	2 weeks	12	2.12	2.03	1.00	0.09	-3.02	3	9
			(0.83)	*(1.74)*		*(0.03)*	*(-1.50)*		
	1 year	12	17.31	34.99	0.87	-17.68	-7.94	5	7
			(2.16)	*(4.13)*		*(-1.96)*	*(-1.41)*		
	2 years	10	73.82	75.53	0.99	-1.72	-13.13	4	6
			(2.64)	*(3.97)*		*(-0.08)*	*(-0.36)*		
	3 years	7	69.61	27.85	1.33	41.77	17.84	5	2
			(1.53)	*(1.55)*		*(1.29)*	*(1.18)*		

Note: Buy-and-hold abnormal returns (BHARs) and wealth relatives (WR) during the first three years of aftermarket trading for all issues (All), privatization IPOs (PIPOs) and private sector IPOs (IPOs). BHARs are defined as the difference between the buy-and-hold return (BHR) of issue and the BHR of the benchmark over the same period. BHRs are measured by Eqs. (3) and (4). It is tested whether the BHRs and the BHARs are significantly different from zero. We used t in parentheses. * Significant at the 1% level. ** Significant at the 5% level. WIG = Warsaw Stock Exchange Index -test for means and for the medians a Wilcoxon-Signed-Rank-Test. Test statistics

Source: Author´s computations

Table 19: List of Privatization Transaction in Poland

Year	Name of entity	Stake sold by Treasury	Transaction value	IPO or SPO	IPO Under-pricing
2005	ZELMER S.A.	85.00%	169 038 000	IPO	33%
2005	CIECH	N.A.	277 317 024	IPO	17%
2005	"ŚRUBEX" S.A.	25.01%	16 042 100	IPO	N.A.
2005	POLMOS BIAŁYSTOK S.A.	32.14%	303 705 896	IPO	-3%
2005	LOTOS	N.A.	1 015 000 000	IPO	3%
2005	Zak. Chemiczne POLICE S.A.	Raising capital	154 000 000	IPO	4%
2005	PGNIG	Raising capital	2 700 000 000	IPO	28%
2005	PUŁAWY S.A.	Raising capital	297 000 000	IPO	-5%
2006	JELFA S.A.	3.91%	24 706 659	SPO	-
2006	RUCH S.A.	Raising capital	248 800 000	IPO	21%
2007	KPPD	15.68%	18 575 945	SPO	-
2007	STALEXPORT S.A.	0.38%	3 481 021	SPO	-
2008	Zakł. Azotowe w Tarnowie S.A.	Raising capital	294 770 209	IPO	-18%
2008	Enea S.A.	Raising capital	1 989 323 726	IPO	-1%
2008	Pol. Towar. Reasekuracji S.A.	11.88%	20 000 000	SPO	-
2009	KOGENERACJA S.A.	3.68%	44 429 404	SPO	-
2009	Lubelski Węgiel "Bogdanka" S.A.	Raising capital	528 000 000	IPO	20%
2009	Energomontaż Południe S.A.	0.77%	1 749 765	SPO	-
2009	REMAK SA	3.67%	3 320 008	SPO	-
2009	BANK PEKAO S.A	3.48%	1 245 407 745	SPO	-
2009	BANK ZACHODNI-WBK S.A.	1.93%	167 361 600	SPO	-
2009	BANK PEKAO S.A	0.48%	189 076 350	SPO	-
2009	MONDI PACKAGING	5.00%	167 500 000	SPO	-
2009	Grupa KĘTY S.A.	4.52%	42 958 416	SPO	-
2009	PGE S.A.	Raising capital	5 968 810 500	IPO	13%
2009	Bank Handlowy S.A.	2.49%	215 479 913	SPO	-
2009	CERSANIT SA	1.95%	43 935 840	SPO	-
2009	Lubelski Węgiel "Bogdanka" S.A.	4.97%	116 606 371	SPO	-
2009	KOPEX S.A.	2.92%	54 207 500	SPO	-
2010	Elektrobudowa S.A.	3.50%	28 949 946	SPO	-
2010	RAFAMET S.A.	1.22%	1 156 231	SPO	-
2010	KGHM "Polska Miedź" S.A.	10.00%	2 060 000 000	SPO	-
2010	Grupa Lotos S.A.	10.78%	406 000 000	SPO	-

Table 19 (Continued)

2010	Energoaparatura S.A.	3.91%	1 301 356	SPO	-
2010	Enea S.A.	16.05%	1 133 624 528	SPO	-
2010	Lubelski Węgiel "Bogdanka" S.A.	46.69%	1 119 681 000	SPO	-
2010	WsiP	0.30%	1 262 428.65	SPO	-
2010	Mennica Polska S.A.	31.64%	261 968 490	SPO	-
2010	PZU S.A.	5.00%	1 349 254 687	IPO	15%
2010	Telekomunikacja Polska S.A.	0.01%	1 193 890	SPO	-
2010	Telekomunikacja Polska S.A.	1.34%	299 064 357	SPO	-
2010	Tauron Polska Energia S.A.	51.66%	3 984 728 012	IPO	-2%
2010	Telekomunikacja Polska S.A.	2.80%	584 631 879	SPO	-
2010	RUCH S.A.	56.84%	357 787 231	SPO	-
2010	Lubelski Węgiel "Bogdanka" S.A.	2.15%	62 543 395	SPO	-
2010	PGE S.A.	10.00%	3 982 631 409	SPO	-
2010	GPW S.A.	63.82%	1 208 072 503	IPO	14%

Source: GPW and Ministry of Treasure