

UNIVERSITY OF LJUBLJANA  
FACULTY OF ECONOMICS

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**INITIAL PUBLIC OFFERINGS  
IN CENTRAL AND EASTERN EUROPEAN CAPITAL MARKETS**

DOCTORAL DISSERTATION

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## SUMMARY

The main purpose of this doctoral dissertation is to investigate the markets of initial public offerings (IPOs) in Central and Eastern Europe (CEE) and provide empirical results of IPO models, performance and factors that drive IPO activities in this area in the 2000s.

An initial public offering (IPO) refers to the first sale of a company's shares to the public, which results in the listing of these shares on a stock exchange. Despite numerous academic contributions on IPOs, very limited research has been conducted of IPOs in the emerging markets of CEE, especially in the 2000s. The intention of this dissertation is to fill this gap in this part of academic literature.

The doctoral dissertation is based on three scientific articles. The first article provides an overview of IPO activities in the CEE region (Bucharest, Ljubljana, Prague, Vienna, Sofia and Warsaw stock exchanges) in the 2000s. Results are compared with empirical evidence for EU's developed capital markets, showing that the internal characteristics of IPOs are similar in the CEE region to those in the developed European capital markets. Post-IPO ownership typically remains highly concentrated, with the most frequent IPOs being those with only newly issued shares. Bookbuilding is the prevailing method of IPO price determination and allocation, and the role of underwriters has become increasingly important. Furthermore, the article shows that capital market factors do not have a decisive impact on IPO activities in the CEE region and that macroeconomic factors, such as quicker reform development and sizeable pension funds, could have had a positive impact on IPO activities in the Polish capital market, the most distinguished IPO market in the CEE region.

The second article provides original evidence on initial IPOs' underpricing and long-run underperformance in the CEE region and compares results to the EU's developed capital markets. Using both index-adjusted and CAPM-adjusted returns, we find significant first-day positive adjusted returns that are significantly higher than first-day returns of comparable IPOs on the EU's developed capital markets (London SE, Deutsche Boerse, Borsa Italiana and NYSE Euronext). CEE's initial IPO returns also exhibit significantly higher volatility. In line with the asymmetric information theory we indicate that smaller IPOs in the CEE region have greater underpricing than the larger ones. Contrary to the existent literature offering weak and inconclusive results, we unambiguously confirm long-run underperformance toward the benchmarks. In some model specifications we also find that the IPO's average adjusted long-run returns in the CEE region are higher (i.e. less negative) compared to the returns of comparable IPOs in the EU's developed capital markets. This finding might be a reflection of the buoyant environment of the CEE capital

market throughout the studied period, which is also reflected in significantly lower volatility.

With the third article we provide new evidence of incentives that drive IPO activities in small CEE's emerging capital markets in the 2000s. First, we prove the existence of IPO cycles, measured by number of IPOs. Second, similar to many findings for developed capital markets we show that number of IPOs and underpricing are positively correlated. Third, we provide a unique comparison of CEE's IPO cycles with IPO cycles in the EU's developed capital markets, proxied by IPO activities on the Deutsche Boerse; and show that the two cycles are moderately positively correlated. Forth, we study drivers of the IPO cycles. Our results suggest that in addition to macroeconomic conditions, investor sentiment is a very important driver of IPO dynamics. We proxy the latter by the risk aversion of institutional investors (i.e. share of portfolio allocations to equity), growth in assets of pension funds and volume of trading in the market. Lastly, we provide evidence of drivers of IPO underpricing. We again find that the main drivers of underpricing in the CEE region are current conditions of the capital markets, which relate to investor sentiment. In addition, business conditions and company performance also contribute to IPO underpricing. Interestingly, we find that company leverage before an IPO, pre-IPO ownership structure and ownership dilution do not predict underpricing.

*Key Words: IPO underpricing, IPO long-run underperformance, capital market, emerging markets*

## POVZETEK

Osnovni namen doktorskega dela je raziskati prve javne ponudbe na trgih kapitala centralne in vzhodne Evrope. Doktorska disertacija vključuje empirično analizo značilnosti prvih javnih ponudb, analizo njihove donosnosti ter analizo dejavnikov, ki vplivajo na aktivnosti prvih javnih ponudb na tem območju med leti 2000 in 2009.

Prva javna ponudba se nanaša na prvo ponudbo delnic družbe javnosti, ki se zaključi z uvrstitvijo delnic na borzo vrednostnih papirjev. Kljub obsežnemu številu akademskih raziskav na področju prvih javnih ponudb na razvitih kapitalskih trgih, so le-te v centralni in vzhodni Evropi manj raziskane. To še posebej velja za desetletje po letu 2000. Namen doktorskega dela je zapolniti to vrzel v znanstveni literaturi.

Doktorska disertacija temelji na treh znanstvenih člankih. Prvi članek predstavlja pregled prvih javnih ponudb v centralni in vzhodni Evropi, ki vključuje borze v Bukarešti, Ljubljani, Pragi, Sofiji, Varšavi in na Dunaju, med leti 2000 in 2009. Rezultati kažejo, da so karakteristike prvih javnih ponudb primerljive s tistimi iz razvitih kapitalskih trgov Evrope. Lastniška struktura po prvi javni ponudbi ostaja visoko koncentrirana za večino družb, največ prvih javnih ponudb pa se opravi z novo izdanimi delnicami. Vse bolj prevladuje tako imenovana bookbuilding metoda za določanje cene in alokacijo delnic ponudnikom. Prav tako je pri tem vse bolj pomembna vloga investicijskih posrednikov. Analiza tudi kaže, da lastnosti kapitalskih trgov same po sebi ne zadostujejo za pojasnjevanje vplivov zunanjih faktorjev na aktivnosti prvih javnih ponudb v regiji in da sta lahko pozitivna dejavnika razvoja predvsem pospešene gospodarske reforme ter visok delež pokojninskih skladov v bruto domačem proizvodu. Ta dva faktorja sta namreč izstopala v obravnavanem obdobju za poljski trg kapitala, ki je bil tudi trg z največjim številom prvih javnih ponudb v regiji.

Analiza v drugem članku pokaže, da so prve javne ponudbe v centralni in vzhodni Evropi podcenjene, torej imajo v povprečju pozitivno izjemno donosnost prvi dan trgovanja na borzi, na dolgi rok pa imajo nižje donosnosti v primerjavi s primerljivimi delnicami borznih družb na istih trgih. Pri izračunih smo uporabili metode tržne prilagoditve donosnosti in CAPM model prilagoditve donosnosti z različnimi utežmi. Še več, empirični rezultati kažejo, da so bile delnice iz prvih javnih ponudb v tej regiji v obravnavanem obdobju v povprečju statistično značilno bolj podcenjene kot primerljive delnice prvih javnih ponudb na razvitih evropskih trgih (to je na Londonski borzi, na nemški in italijanski borzi ter na NYSE Euronext). Poleg tega je bila volatilitnost teh delnic statistično in ekonomsko višja od primerljivih delnic razvitih evropskih trgov. Skladno s teorijo asimetrije informacij rezultati tudi potrjujejo, da so bile manjše prve javne ponudbe bolj podcenjene v primerjavi z večjimi. V nasprotju s precej mešanimi rezultati glede dolgoročne donosnosti prvih javnih ponudb na razvijajočih trgih, naši rezultati tudi

nedvoumno potrjujejo dolgoročno višjo podcenjenost obravnavanih delnic v primerjavi z drugimi delnicami na istih trgih. Delnice iz prvih javnih ponudb v centralni in vzhodni Evropi so imele namreč na dolgi rok v glavnem nižje donosnosti v primerjavi s primerljivimi delnicami borznih družb na istih trgih, vendar v povprečju višje (to je manj negativne) donosnosti kot primerljive delnice prvih javnih ponudb na razvitih evropskih trgih. So pa ti rezultati manj enoznačni kot pri kratkoročnih donosnostih in so najverjetneje odraz pozitivnega trenda na obravnavanih borzah sredi obdobja 2000-2009, saj so bile delnice prvih javnih ponudb na teh kapitalskih trgih na dolgi rok tudi manj volatilne kot primerljive delnice na razvitih evropskih trgih kapitala.

V tretjem članku je podana podrobna analiza dejavnikov prvih javnih ponudb na trgih centralne in vzhodne Evrope. Najprej na podlagi števila prvih javnih ponudb potrdimo, da so v letih 2000 - 2009 obstajali cikli prvih javnih ponudb tudi na teh manjših, razvijajočih trgih. Podobno, kot velja za mnoge razvite trge prvih javnih ponudb, smo dokazali tudi pozitivno korelacijo med številom prvih javnih ponudb in podcenjenostjo teh delnic. Nadalje smo pokazali, da obstaja zmerena pozitivna korelacija med cikli prvih javnih ponudb v regiji centralne in vzhodne Evrope in nemške borze. Rezultati dejavnikov, ki vplivajo na število prvih javnih ponudb, pa kažejo, da je poleg makroekonomskih ciklov med najpomembnejšimi makro dejavniki sentiment vlagateljev, ki se kaže tako preko naklonjenosti tveganju investicijskih vlagateljev (to je alokacije portfelja investicijskih skladov v delnice), preko rasti sredstev v pokojninskih skladih ter preko rasti obsega trgovanja na borzah. Tudi na podcenjenost prvih javnih ponudb najbolj vplivajo razmere na kapitalskih trgih, kar je ponovno pokazatelj sentimenta vlagateljev, makroekonomski cikli ter tudi poslovanje družbe pred prvo javno ponudbo. Vse druge tipične spremenljivke, kot so lastniška struktura pred prvo javno ponudbo, razpršitev lastništva, zadolženost družbe pred prvo javno ponudbo, pa ne vplivajo na podcenjenost prvih javnih ponudb.

*Ključne besede: podcenjenost prvih javnih ponudb, dolgoročna nizka donosnost prvih javnih ponudb, kapitalski trg, razvijajoči trgi*



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## **INTRODUCTION**

An initial public offering (IPO) refers to the first sale of a company's shares to the public, which results in the listing of these shares on a stock exchange. The going public decision is one of the most important decisions in the life cycle of the company. Companies most often decide to sell equity in the primary public market to raise capital for new investments. There are number of other reasons for going public. Benefits of going public can be alleviation of financial constraints, improved bargaining power vis-à-vis banks, investor recognition, promotion, increased liquidity, portfolio diversification for owners, control transfer, mispricing explanation, added value of monitoring, availability of share price information and enhancing the value of the company (Pagano, Panetta and Zingales, 1998; Huyghebaert and Van Hulle, 2006a; Bodnaruk, Kandel, Massa and Simonov, 2008; Kim and Weisbach, 2008; Alavi, Pham and Pham, 2008).

Theoretical as well as empirical literature on IPOs in various international markets, especially in the United States (US) and other developed capital markets is abundant. According to Jenkinson and Ljungqvist (2001) the main academic research has been driven by the existence of two apparent anomalies: initial underpricing and long-run underperformance.

### **Underpricing**

Underpricing happens when shares of a company that goes public are offered to investors at prices considerably below the prices at which they trade later on the stock market. Thus, the low offer price discount results in substantial initial day returns. Loughran and Ritter (2004) showed that the first-day average returns in the US IPO market was 7% in the 1980's, 15% in years 1990-1998, 65% during the internet bubble years between 1999 and 2000 and 12% during 2001-2003.

The positive first-day returns have been documented by many authors mostly for the US capital markets, European capital markets, Japan and Asian emerging capital markets for different sample periods between 1960 and 1999 (Jenkinson and Ljungqvist, 2001). The minimum average initial return of 4.5% was reported for Israel and 4.8% for France and the maximum average initial return of 289% for China and 166% for Malaysia. In the last two decades the phenomena of IPO underpricing is reported frequently, e.g. by Aussenegg (2006), Benveniste, Seguin and Yu (2008), Bradley, Gonas, Highfield and Roskelley (2009), Chen, Firth and Kim (2004), Durukan (2002), Gregoriou (2006), Ritter and Welch (2002), Zheng and Li (2008), Ritter, Signori and Vismara (2013).

Jenkinson and Ljungqvist (2001) have collected the most important theoretical models that explain the phenomena of underpricing. They divided the models into three main groups: models based upon asymmetric information (adverse selection models: the winner's curse, principal-agent models etc.), models that focus on institutional factors and models that relate underpricing to ownership and control consideration. Ljungqvist et al. (2006) further developed a model of IPO pricing in hot issue markets that elucidates the connection between underpricing and long-run underperformance by tracing them to a common source: the presence of a class of irrationally exuberant investors.

### **Long-run Underperformance**

The second main anomaly studied in IPO literature is long-run underperformance. IPOs have a tendency to underperform benchmarks in the long run. The long-run underperformance is usually calculated for first few weeks and up to 3 or 5-years of IPO listing. A number of studies have proven this anomaly. Jenkinson and Ljungqvist (2001) reported the main results of empirical studies conducted by different authors for different periods in different centuries. The largest wealth losses were reported for Australia (-51%) and Brazil (-47%) in 1980s. Levis (1993) reported negative long-run performance for the UK capital market in 1980s. In the last two decades the phenomena of IPO long-run underperformance is reported by number of authors, among them Aussenegg (2000) for Poland and (2006) for Austria, Eckbo, Masulis and Norli (2000) for USA, Eckbo and Norli (2005) for Nasdaq, Kao, Wu and Yang (2009) for China, Pastor-Llorca and Poveda-Fuentes (2006) for Spain, Ritter (2003) provided international evidence. More recently, Ritter (2011) and Gao, Ritter and Zhu (2013) provided evidence for the US and Vismara, Paleari and Ritter (2012) and Ritter, Signori and Vismara (2013) for developed EU markets.

In contrast to the empirical findings for underpricing, the findings for the long-run IPO performance are not so clear. While long-run underperformance is reported for many developed capital markets, outperformance especially in emerging markets has been reported. Kunz and Aggarwal (1994) reported nonsignificant 2-year abnormal aftermarket performance for Swiss IPO market of 1.8%. Kim et al. (2004) reported that the Korean IPO market showed considerable market adjusted long-run returns in the period 1983-1999. Similarly, Chen et al. (2006) analyzed IPOs in Taiwan in the period from 1991 to 1998 and reported significant positive abnormal returns within 3 years after issuance.

The long-run underperformance has also less explanation in IPO theoretical literature than underpricing. Jenkinson and Ljungqvist (2001) argue that of the asymmetric information based theories for underpricing, only the signaling and bookbuilding theories have anything to say about long-run performance. According to Cornelli, Goldreich and Ljungqvist (2006) behavioral biases have become a popular explanation for a variety of asset-pricing phenomena, also regarding IPO. Ritter and Welch (2002) claim that

overenthusiasm among retail investors may explain high first-day returns and low long-run returns. Pastor-Llorca and Poveda-Fuentes (2006) give similar possible explanation for the poor stock price performance after IPO. They argue that investor are over-optimistic about the earnings potential of issuing firms, so the underperformance occurs as these over-optimistic expectations are gradually corrected in the post-offering period. Another explanation for long-run underperformance is offered by Eckbo et al. (2000) who argues that IPO companies are less risky and, accordingly, have lower returns than non-IPO companies.

## **IPO Cycles**

The substantial part of IPO literature explains another phenomenon, the IPO cycles. Usually IPO's come in waves. "Hot issue" phenomenon is the observation that many companies go public at about the same time. It is also interesting that also volume and underpricing are positively correlated (Yung, Çolak and Wang, 2008; Ritter et al. 2013). Jenkinson and Ljungqvist (2001) reported a positive autocorrelation for the US between 1960 and 1999: periods of high IPO volume are likely to be followed by further heavy IPO activities. They argue that the timing of IPO should depend on factors that determine the trade-off between the costs and benefits of a stock market listing. There are number of factors influencing hot issue markets, such as momentum in share prices, deregulation of listing requirements or business cycles.

Benninga, Helmantel and Sarig (2005) offered a one-step-further explanation regarding the hot issue markets. Namely, they argued that changes in macroeconomic conditions simultaneously affect multiple industries and companies; company profitability tends to be positively correlated. Thus, when one company finds it optimal to issue stocks, so do other firms. Yung et al. (2008) showed theoretically that exogenous shocks to investment opportunities cause time-varying adverse selection in the IPO market. Lowry (2003) using the sample for the US between 1960 and 1996 also showed that companies are more likely to have IPO when adverse selection costs are lower and investor sentiment is high. Similar findings confirming positive impact of the capital market climate were reported recently for developed EU capital markets by Ritter et al. (2013). Some of the most recent studies focus also on regulatory changes, especially Sarbanes-Oxley Act of 2002, which could have an impact on a decline on IPO activities in the last decade. However, Ritter (2011) suggests that although regulatory burdens undoubtedly account for some of the decline of IPOs, much of the decline may be due to a structural shift that has lessened the profitability of small independent companies relative to their value as part of a larger, more established organization that can realize economies of scope. Hence, the literature strongly supports the hypothesis that issuers go public during a temporary window of opportunity, and price information from past IPOs spills over to current and future IPOs (Benveniste, Fu, Seguin and Yu, 2008).

## **Purpose and Goals**

The main purpose of the doctoral dissertation is to investigate the IPO markets in Central and Eastern Europe (CEE) and provide empirical results of IPO models, performance and factors that drive IPO activities in this area. The main goal is to test whether performance and characteristics of IPOs in this region support the most important findings about IPOs in developed markets, i.e. IPOs underpricing, long-term underperformance and IPOs cycles.

Numerous studies have investigated IPOs in various international markets, especially in the US, other developed capital markets and in the last decade the emerging markets in Asia. However, despite numerous academic contributions on IPOs, very limited research has been conducted in the field of IPOs in the CEE's emerging markets, especially in the 2000s. Because the Warsaw Stock Exchange (Warsaw SE) dominated the decade and was often ranked second or third by IPO value in the EU in the late 2000s (IPO Watch, PWC, 2003–2011), most researchers have focused solely on the Polish market (Darmetko, 2009; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba and Kaminski, 2011; Zaremba and Żmudziński, 2014). Apart from statistical data, there is almost no available academic research of IPO characteristics covering the entire CEE region. In the light of the mass privatisation two decades ago, most of the relevant literature covers privatisation processes and their outcomes in the 1990s (Aggestam, 2006; Harper, 2002; Aussenegg and Jelic, 2007; Jelic and Briston, 1999; Jelic, Briston and Aussenegg, 2003).

With the detail analysis of the most important anomalies covered in academic literature: IPO underpricing, long-run underperformance and IPO cycles this doctoral dissertation contributes in several aspects. The first main contribution is the unique dataset of IPOs for six CEE capital markets (Bucharest, Ljubljana, Prague, Sofia, Vienna and Warsaw) in the 2000s, which gives new insights into IPO models and characteristics in smaller capital markets. Further, the research provides original evidences of underpricing, long-run underperformance and IPO cycles in the CEE region in the 2000s. In addition, the research provides the unique comparison of CEE's IPO performance and cycles with IPO performance and cycles of the EU's developed capital markets in the observed period. The very essential part of the research represents also the analysis of drivers of IPO cycles and underpricing in the CEE region, such as investor sentiment, business cycles, pre-issue ownership, capital structure of the company, performance of companies and institutional factors. Since determinants of IPO in the CEE region are less known and under-investigated, the intention of this dissertation is to fill this gap in this part of academic literature and answer the question what factors drove IPOs in the CEE region during the 2000s.



## **Structure of Doctoral Dissertation**

The doctoral dissertation consists of three scientific articles:

### **1. The first article: Internal Characteristics and External Factors of IPO Activities in Central and Eastern Europe: Empirical Analysis and Comparison**

First part of the article is the descriptive and qualitative analysis of IPOs in Central and Eastern Europe in the 2000s. The goal is to get insight into the structure of IPOs according to the IPO models (bookbuilding, fixed prices, underwriters), source of IPO and other characteristics of companies going public (e.g. IPOs with primary shares, IPOs with secondary shares, new companies, family-owned companies, sector classification).

The second part of the article is the analysis of external factors (attractiveness of business environment, investors sentiment and capital markets factors, such as liquidity), which could influence the activities of IPOs in this area. To our knowledge there has been no academic research of IPO characteristics covering the entire CEE region in that period. The results therefore provide new insights into the external factors influencing IPO activities in the CEE region, contributing new evidence to the limited academic literature dealing with IPOs on this territory.

### **2. The second article: Initial and Long-run IPO Returns in Central and Eastern Europe**

The second article focuses on two main anomalies discussing in academic IPO literature: IPO underpricing and long-run underperformance. The article provides original evidence of initial IPO underpricing and long-run underperformance in the CEE region by using four different calculation methods: basic index-adjusted and CAPM-adjusted returns with alternative weightings by IPO value. In addition, a robustness check on the IPOs' long-run performance with the calendar portfolio approach is performed.

The article also provides the unique comparison of CEE's IPO performance with IPO performance of the EU's developed capital markets in the observed period by forming the unique comparable EU's developed IPO sample (from London SE, Deutsche Boerse, Borsa Italiana and NYSE Euronext).

### **3. The third article: IPO Cycles in Central and Eastern Europe: What Factors Drive IPO Activities?**

The last article combines the results of the previous two articles and analyzes the main IPO drivers in the CEE region. Firstly, it provides the evidences of IPO cycles in the CEE

region. Furthermore, it provides a unique comparison of CEE's IPO cycles with IPO cycles in EU's developed capital markets, proxied by IPO activities on the Deutsche Boerse.

The most essential part is the analysis of main micro and macro drivers of IPO cycles and underpricing in this region, such as, investor sentiment, activity of market participants and business cycles. The article quantifiably upgrades the findings of the first article. Hence, with the acknowledging of the role of macro and micro factors in IPO processes, it provides some new explanations of the IPO incentives in small emerging capital markets and therefore provides new insights into IPO activities in smaller emerging (front-tier) capital markets.

# 1 INTERNAL CHARACTERISTICS AND EXTERNAL FACTORS OF IPO ACTIVITIES IN CENTRAL AND EASTERN EUROPE: EMPIRICAL ANALYSIS AND COMPARISON<sup>1</sup>

## 1.1 Introduction

An initial public offering (IPO) refers to the first sale of a company's shares to the public, which results in the listing of these shares on a stock exchange. IPOs are extensively covered by theoretical and empirical literature. In addition to IPO performance, academic researchers analyse IPO factors and methods in order to study IPO characteristics and drivers behind going-public decisions (Jenkinson and Ljungqvist, 2001).

Studies of internal IPO characteristics mainly focus on corporate (pre- and post-IPO) ownership structure, types of shares offered in an IPO, types of IPO price determination and allocation, and the role of underwriters. Some of the main studies of EU's developed capital markets in the 1990s and 2000s have shown that the ownership of companies going public before and after an IPO is highly concentrated (Pagano et al., 1998; Huyghebaert and Van Hulle, 2006a; Hack and Lehmann, 2006), that IPOs with only newly issued shares (primary shares) are the most common (Kim and Weisbach, 2008), and that in developed EU countries bookbuilding with the active role of underwriters was the most used method of IPO price determination and allocation in the 1990s (Huyghebaert and Van Hulle, 2006b, Jenkinson et al., 2006).

Macroeconomic and external business factors are also an interesting object of investigation, especially for emerging markets. Researchers mostly study their impact on capital markets, while the study of their impact on IPO activities is – to our knowledge – very limited and focuses mainly on regulation. For example, Korajczyk and Levy (2003) find that macroeconomic conditions are significant for the choice of capital structure in financially unconstrained firms but less so in financially constrained firms. Bell, Moore and Filatotchev (2012) highlight the importance of three important drivers of foreign IPO success: home country legal institutions, corporate governance, and host capital market choice. On the contrary, Stringham, Peter and Clark (2008), who analyse the impact of regulations in the emerging stock markets of the Czech Republic and Poland, argue that increased government involvement is unlikely to improve the market situation.

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<sup>1</sup> Publication of the Article:

City of London Corporation, Economic Research, Working paper:

<http://colresearch.typepad.com/colresearch/2014/01/internal-characteristics-and-external-factors-of-ipo-activities-in-central-eastern-europe.html>.

Initial Public Offerings in Central and Eastern Europe: Bančni Vestnik 5/2014, 40 – 48 (abridged version).

Despite numerous academic volumes on IPOs, very limited research has been conducted in the field of IPOs in the emerging markets of CEE, especially in the 2000s. Because Warsaw Stock Exchange (Warsaw SE) dominated the decade and was often ranked second or third by IPO value in the EU in the late 2000s (IPO Watch, PWC, 2003–2011), most researchers have focused solely on the Polish market (Darmetko, 2009; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba and Kaminski, 2011; Zaremba and Żmudziński, 2014). Apart from statistical data, there is almost no available academic research of IPO characteristics covering the entire CEE region. Most of the relevant literature related to IPOs in this region covers (mass) privatisation processes and their outcomes in the 1990s, providing assessments of the impact of voucher privatisation on capital market development. The impact of young capital markets on IPO activities, however, is less known and investigated.

The present research is a detailed empirical analysis of IPOs in the CEE region in the 2000s, and it has three main parts. The first part of the paper includes a descriptive overview of IPO activities in the region, including a detailed dataset of all relevant IPOs in seven CEE countries in the period from 2000 to 2009. The second part of the paper provides a comparison of the characteristics of IPO activities in the CEE region with those in developed EU capital markets. We show that the internal characteristics of IPO activities (ownership structure, types of shares offered in an IPO, types of IPO price determination and allocation) in the CEE are comparable with those in developed EU countries. However, our findings do not support the claim that young, small-growth firms tend to issue primary shares as opposed to established firms which tend to offer only secondary shares. We believe instead that this is mainly the result of the specific economic environment in the CEE region and the processes of economic liberalisation and privatisation of mainly mature companies, which had started more than two decades ago. The third part of the paper provides an impact assessment of external factors on IPO activities in the CEE region. We take into account the CEE countries' capital market indicators, financial development, and business and transition indicators. Our findings imply that capital market factors measured by market size, liquidity and market capitalisation-to-GDP ratios do not have a decisive impact on IPO activities in the CEE region. The attractiveness of capital markets as measured by annual index returns and by annual market and turnover growth, however, could have had an impact on IPO decisions in the observed period. Furthermore, our results indicate that macroeconomic factors, such as quicker reform development and sizeable pension funds, could have had a positive impact on IPO activities in Poland, where the IPO market was the most active in the observed period.

The paper's main contribution is the dataset of IPOs for six CEE capital markets from the 2000s, which gives new insights into IPO processes and provides new evidence of IPOs in smaller emerging capital markets. It shows that IPO activities in the CEE region in the

2000s were becoming increasingly comparable with developed EU capital markets in terms of characteristics such as the impact of ownership on the proportion of shares offered. The paper also provides new insights into external factors influencing IPO activities in the region. The presented findings provide a good basis for further IPO research in the CEE region.

The paper is organised as follows. First we review the existing literature for IPO models, their internal characteristics and the related external factors. Section 2 describes data collection and used methodology. This is followed by a descriptive statistics and empirical evidence of IPOs in the CEE region, which includes IPO distribution per capital market and per sector of the economy. Sections 5 and 6 report our main findings: the former focuses on the internal characteristics of IPO activities (newly issued shares versus already existing shares prior to the IPO; privately-owned companies versus state-owned companies; bookbuilding versus fixed pricing), and the latter analyses external factors influencing IPOs in the CEE region (capital market indicators, financial development, and business and transition indicators). The final three sections give our final remarks, proposals for further research, and conclusions.

## **1.2 Review of Literature and Theoretical Background**

### **1.2.1 IPO Models and Internal IPO Characteristics**

An IPO is the first sale of a company's shares to the public, which results in the company's listing on a stock exchange. Companies most often decide to sell equity in the primary public market to raise capital for new investments. Theoretical as well as empirical literature on IPOs in various international markets, especially in the United States and other developed capital markets is abundant (Jenkinson and Ljungqvist, 2001).

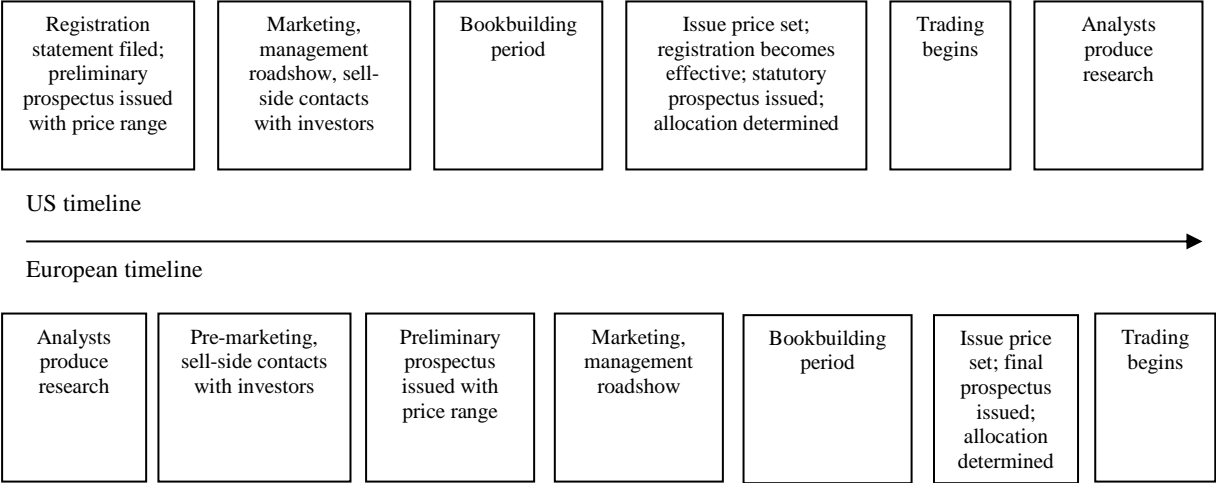
Academic researchers analyse IPO characteristics and methods in order to study IPO factors and drivers behind going-public decisions. Studies of the internal characteristics and models of IPOs mainly focus on corporate (pre- and post-IPO) ownership structure, types of shares offered in an IPO, types of IPO price determination and allocation, the role of underwriters. These studies could be used further to examine internal IPO factors and efficiency.

The IPO process involves several stages, such as producing a prospectus, marketing and road shows, underwriting, IPO price determination, collecting bids, allocation, listing procedures. Jenkinson et al. (2006) point out a major distinction between US and European practices regarding IPOs, as shown in Figure 1-1. Many recent academic papers (Huyghebaert and Van Hulle, 2006b; Jenkinson et al., 2006; Jenkinson and Jones, 2004 & 2007; Cornelli and Goldreich, 2001 & 2003) report that bookbuilding, as an IPO price

determination and allocation process, has spread from the US to most other major countries. Since the second half of the 1990s bookbuilding with the active role of underwriters has been the most used method of IPO price determination and allocation in developed EU countries.

Portfolio diversification is an important factor in making the decision to go public. According to Bodnaruk et al. (2008), who analyses IPOs in Sweden, firms held by less diversified shareholders are more likely to go public. Similarly, Alavi et al. (2008) finds that managerial ownership is significantly related to the proportion of shares offered, to share allocation, and to direct issue-related expenses. Findings for EU's developed capital markets in the 1990s and 2000s show that the ownership of companies going public is highly concentrated before and after the IPO. Evidence from Belgium states that, on average, block holders own 93.31% of the company before an IPO and 64.94% afterwards (Huyghebaert and Van Hulle, 2006a). A similar percentage is reported for Italy (Pagano et al., 1998). Hack and Lehmann (2006) analyse high tech firms in Germany and find that IPO performance cannot be explained by ownership variables. They use a dataset of 285 German IPOs between 1997 and 2002, and find that prior to the IPO 38.6% of equity on average is held by CEOs, 13.3% by venture capitalists, and 13.2% by firms.

Figure 1-1: Timelines for a US and a European IPO.



Source: Adopted after Jenkinson et al. (2006).

With regard to the source of shares in an IPO, shares are primary and secondary (existing prior to the IPO). Primary offerings increase the number of shares outstanding and raise capital for the firm, while secondary offerings keep the number of shares constant and have no revenue consequences for the firm (Kim and Weisbach, 2008). It is also common for companies to opt for the combination of selling primary and secondary shares in an IPO. Kim and Weisbach (2008) examine the motivation for public equity offers with respect to the type of shares sold to the public, using a sample of 17,226 IPOs and 13,142 secondary

equity offerings from 38 countries between 1990 and 2003. The authors discover that Continental European IPOs exhibit relatively higher percentages of secondary-only (12.8%) and combined (33.6%) offerings, and lower percentages of primary-only (53.6%) offerings compared to Asia, but that they are quite similar to the IPOs in the US. Their results suggest that equity offers are used to raise investment capital and spend incremental dollars on both R&D and capital expenditure; however in some instances, firms issue equity to take advantage of favourable valuations.

Huyghebaert and Van Hulle (2006a) report more diverse results. Nevertheless, their findings demonstrate that primary shares prevail over secondary shares in EU's IPOs. The authors report that in Continental Europe the popular IPOs are those that include only primary or secondary shares, and those that combine all. Their results show that in Germany primary and secondary shares on average represent 14.4% and 9%, respectively, of pre-IPO shares, while the figures are 19% and 18.2%, respectively, in the UK. The authors argue that young, small-growth firms tend to issue primary shares whereas established firms tend to offer only secondary shares. Using a sample of Belgian IPOs carried out between 1984 and 2000 they demonstrate that primary and secondary shares on average represent 30% and 17%, respectively, of the total number of shares outstanding before an IPO. Using a similar sample of Italian IPOs, Pagano et al. (1998) document that in 39.8% of the cases only primary shares are offered whereas another 39.8% of IPOs include only secondary shares.

### **1.2.2 External IPO factors**

Research into the impact of external factors on IPO activities is scarce. The available studies often have a very narrow focus, studying only IPO performance or IPO cycles. Others investigate the impact of macroeconomic and other external factors on the development of emerging capital markets in general but not of IPO markets in particular. The impact of external factors on IPO activities in emerging capital markets is, to our knowledge, therefore very limited and focused mainly on the regulatory aspect or privatisation.

The available literature on this topic nevertheless reports some interesting findings. Korajczyk and Levy (2003) analyse how macroeconomic conditions affect capital structure choices for US companies. They find that macroeconomic conditions are significant for the choice of issue in financially unconstrained firms but less so in financially constrained firms. Bell et al. (2012) highlight the importance of three important drivers of foreign IPO success: home country legal institutions, corporate governance, and host capital market choice. On the contrary, Stringham et al. (2008), who analyse the impact of regulations in the emerging stock markets of the Czech Republic and Poland, argue that increased government involvement is unlikely to improve the market situation.

Groh and Liechtenstein (2009) research the attractiveness of CEE countries for risk capital investors. Based on a survey of institutional investors and on socio-economic data, they conclude that the strongest incentive for investors in the CEE is low corporate taxes (on average). Due to the countries' accession to the EU, investor protection and corporate governance rules in the CEE are on an equal level with EU-15, while the human and social environment is also on par. On the other hand, the size and liquidity of the CEE capital markets is the largest investment obstacle, while bribery, corruption and the level of innovation still lag behind Western European benchmarks.

Despite abundant academic literature dealing with IPOs, IPO activities in the emerging markets of the CEE region, especially in the last decade, have been less studied. In the light of the mass privatisation two decades ago, most of the relevant literature covers privatisation processes and their outcomes in the 1990s (Aggestam, 2006; Harper, 2002; Aussenegg and Jelic, 2007; Jelic and Briston, 1999; Jelic et al., 2003).

Mass privatisation has had a strong impact on all stock markets in the countries of Central and Eastern Europe. Mass voucher privatisations gave equity capital markets the basis for development and growth. Deželan (2000), for instance, analyses the Slovenian capital market and emphasises that it started to develop simultaneously with economic system reforms in 1988/89. Privatisation brought a lot of new securities and new capital market participants (investment funds). The other CEE countries report similar privatisation-related developments. According to the 2004 Annual report of the Budapest SE, before 2004 the Hungarian capital market served primarily as the secondary market for large privatised domestic companies, while small and medium sized companies were missing from the trading floor.

One decade later, in the 2000s, development patterns in the CEE capital markets remained diverse. According to statistical data, the Warsaw SE was the dominant market for IPOs and often ranked second or third in the number of IPOs in the EU in the late 2000s (IPO Watch, PwC, 2003–2011). Thus, most researchers have focused solely on the Polish market (Darmetko, 2009; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba and Kaminski, 2011; Zaremba and Żmudziński, 2014). However, to our knowledge there has been no academic research of IPO characteristics covering the entire CEE region in that period. This paper will therefore provide new insights into the external factors influencing IPO activities in the CEE region, contributing new evidence to the limited academic literature dealing with IPOs on this territory.



### 1.3 Data Collection and Methodology

The present research uses a descriptive and qualitative analysis. It involves the collection of data, forming the sample, providing detailed descriptive statistics of all adequate IPOs, and a comparison of results with empirical IPO evidence from developed EU capital markets.

We focus on IPO activities after 2000, which is the second decade of existence for most CEE stock markets. Our sample covers IPOs in the period 2000–2009 on the stock exchanges of Bucharest, Ljubljana, Prague, Sofia, Vienna and Warsaw. Budapest stock exchange was excluded because no IPO was conducted in the observed period. To provide appropriate overview of IPOs Table 1-1 shows IPOs divided into two groups: all 264 IPOs in observed period (Panel A) and the most relevant 94 IPOs with at least EUR 10 million of new funds raised (with primary or/and secondary shares) who are still traded (Panel B). Our detailed analysis of IPO characteristics is focused on 94 IPOs, since the available information for the delisted and smaller IPOs and therefore possible respective analyses are very limited. In order to provide only relevant IPO data, the following additional criteria will be applied. In case of double listings we take into account the IPO in the domestic market. We also include privatisations of public companies, but only if they were public offerings (e.g. privatised initial public offering – PIPO).

Table 1-1: Number of IPOs in CEE capital markets, 2000–2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
<i>Panel A: All IPOs</i>											
<b>Bucharest SE</b>	0	1	0	1	1	3	2	1	0	0	<b>9</b>
<b>Bulgarian SE</b>	0	0	0	0	2	3	3	8	7	1	<b>24</b>
<b>CEESEG - Ljubljana</b>	0	0	0	0	0	0	0	1	1	0	<b>2</b>
<b>CEESEG - Prague</b>	0	0	0	0	1	0	1	1	1	0	<b>4</b>
<b>CEESEG - Vienna</b>	8	2	2	4	1	6	6	5	0	0	<b>34</b>
<b>Warsaw SE</b>	0	0	0	0	5	34	35	64	24	11	<b>173</b>
<b>CEE TOTAL</b>	<b>8</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>46</b>	<b>47</b>	<b>80</b>	<b>34</b>	<b>12</b>	<b>246</b>
<i>Panel B: Tradable IPOs with value &gt;= 10 mio EUR</i>											
<b>Bucharest SE</b>	0	0	0	0	0	0	1	1	0	0	<b>2</b>
<b>Bulgarian SE</b>	0	0	0	0	0	0	1	5	1	0	<b>7</b>
<b>CEESEG - Ljubljana</b>	0	0	0	0	0	0	0	1	1	0	<b>2</b>
<b>CEESEG - Prague</b>	0	0	0	0	1	0	1	1	1	0	<b>4</b>
<b>CEESEG - Vienna</b>	2	1	1	0	0	4	5	4	0	0	<b>17</b>
<b>Warsaw SE</b>	0	0	0	0	5	11	10	26	6	4	<b>62</b>
<b>CEE TOTAL</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>6</b>	<b>15</b>	<b>18</b>	<b>38</b>	<b>9</b>	<b>4</b>	<b>94</b>

Note: CEESEG – Budapest: no IPO in the observed period.  
Source: CEE stock exchanges & companies; own calculations.

Our calculations show that 26% of IPOs in the total sample of 246 IPOs completed in CEE in the observed period were offerings below EUR 10 million and 34% of companies that executed IPOs out of 246 IPOs had been delisted by the end of 2012. Taking into account these criteria, the final data set consists of 94 companies that went public in six CEE countries between 2000 and 2009 (Table 1-1).

Despite the exclusion of small value IPOs and double listings, statistics provided by PricewaterhouseCoopers (PwC; IPO Watch 2003–2009, Appendix 1) and the Federation of European Securities Exchanges (FESE) report a considerably larger number of IPOs in this period (232 IPOs only for the Warsaw SE). These numbers should be interpreted with caution. Namely, available public statistics often report a considerable larger number of IPOs, which we believe is exaggerated. We believe that in a large part the discrepancy is attributable to the fact that the stock exchanges' IPO data include certain listing statistics that can by definition not be treated as real IPO data. This is due to the lack of IPO practice in this region and the fact that different definitions were used for selling shares to the public in IPOs. We believe that the most discrepancy in definitions comes from coupon privatizations. During the privatization the shares of companies were differently signed (class A, B, C, D e.g. being reserved for employees etc.) A lot of listings were only technical listings, meaning that all shares were renamed to one class and listed, without the cash flow or change of ownership or public character of transaction.

We collected data from the stock exchanges' internal documentation and from the websites of the stock exchanges, FESE and PwC, double checking the obtained figures against the detailed case-by-case IPO information on companies' web sites, in IPO prospectuses and companies' annual reports. Capital market and GDP statistics and indicators were collected from the websites of stock exchanges, FESE, the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB).

Setting our research results against the reviewed literature, we will draw a comparison of our findings about internal IPO characteristics with the empirical evidence on IPOs in developed EU capital markets. In order to analyse external IPO factors, we will draw a comparison of external IPO factors, where we will look at capital market parameters and variables, such as equity market capitalisation, equity turnover, the number of listed shares, annual market capitalisation and turnover growth, turnover velocity, the market capitalisation-to-GDP ratio, and annual index returns. A comparison of macroeconomic and business factors will include financial development, business and transition indicators. We will convert monetary values, such as IPO value, the value of newly issued shares and market capitalisation, into euros using exchange rates on the last day of the respective month (i.e. on the last day of the month of the first trading day).

## 1.4 Descriptive Statistics and Empirical Findings

### 1.4.1 Descriptive Statistics

The total value of the 94 IPOs was EUR 15.2 billion, of which newly issued shares represented EUR 6.1 billion (Table 1-2). The largest IPO (almost EUR 2 billion) was the PIPO concluded in Poland in 2004 (PKO Bank). The average IPO size (median) was EUR 162.6 (24.0) million, with capital increasing by 23% (22%). The average post-IPO company size (median) in terms of market capitalisation was EUR 1.7 billion (169.6 million). The average post-IPO free float was 31%.

Table 1-2: Descriptive statistics of numeric variables.

	SUM	Mean	Median	Std. Dev.	Min	Max
<b>Value of IPO shares in EUR</b>	15,282,218,168	162,576,789	45,880,858	326,060,961	10,751,162	1,895,309,124
<b>Value of new shares in EUR</b>	6,057,060,425	64,436,813	23,980,513	135,801,292	0	656,853,831
<b>Market capitalization in EUR</b>	156,454,879,464	1,664,413,611	169,606,213	10,798,943,172	34,391,179	104,695,683,810
<b>% of new shares in IPO</b>		71%	86%	35%	0%	100%
<b>% of primary shares</b>		23%	22%	15%	0%	75%
<b>% of secondary shares</b>		13%	4%	19%	0%	85%
<b>Free float after IPO</b>		31%	30%	13%	5%	77%

Summary statistics for the total sample of  $N = 94$  IPOs.

The **value of IPO shares** represents the total amount of raised capital (with primary and secondary shares), whereas the **value of new shares** represents the value of newly issued shares (primary shares); both are calculated by multiplying the number of shares and the IPO price. **Market capitalisation** is the multiple of the post-IPO number of shares and the IPO price. **% of new shares in IPO** is the ratio of new (primary) shares to the total number of offered (primary + secondary) shares in an IPO. **% of primary (secondary) shares** is the ratio of new (existing) shares in an IPO to the total number of shares outstanding before the IPO. **Free float after IPO** is the percentage of shares not held by majority shareholders and available in the market; data was provided by companies.

Source: CEE stock exchanges & companies; own calculations.

With regard to pre-IPO ownership structure (Table 1-3), companies fall into three groups: privately owned, state-owned, and family-owned, whereby the latter may include more than one owner or block holder. Results show that the majority (62%) of IPOs were executed by private companies, 22% by family businesses and 16% by state-owned companies. The largest IPOs were privatisation cases, with six out of the nine IPOs worth more than EUR 500 million being PIPOs in Poland and Austria.

Table 1-3: Ownership structure of IPO companies and IPO model.

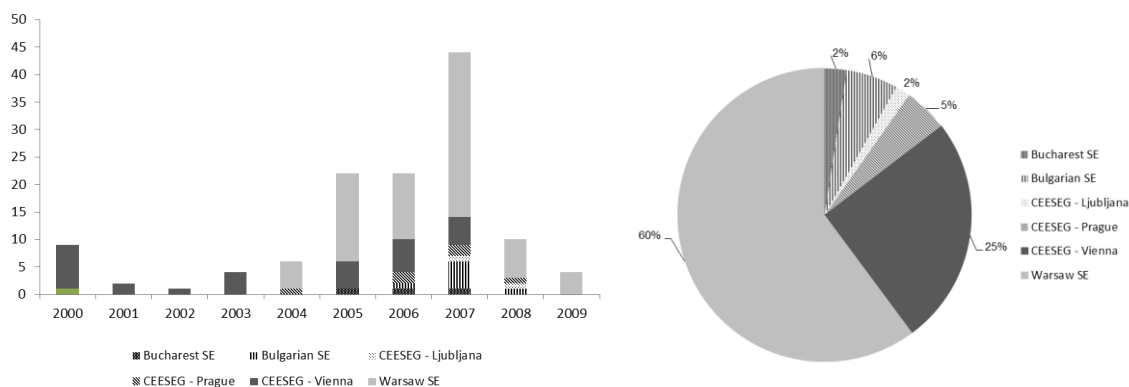
Company	N	Average market capitalisation in EUR	Average value of new shares in EUR
State-owned	15	8,329,055,292	123,550,213
Private	58	462,076,375	58,377,632
Family- owned	21	224,696,207	38,947,837
<b>Total</b>	<b>94</b>	<b>1,664,413,611</b>	<b>64,436,813</b>

Source: CEE stock exchanges & companies; own calculations.

## 1.4.2 IPO Distribution per Capital Market

In order to provide comparable year-by-year statistics on IPO activities according to capital markets, this section supplements our dataset with IPO companies that had been delisted by the end of 2012. The majority of IPOs were executed in the years 2005, 2006 and 2007. The prevailing capital market for IPOs was the Warsaw SE, which hosted 60% (70% including also IPOs with less than EUR 10 mio IPO value) of all IPOs in the CEE region, followed by the Vienna SE with a 25% share (14% respectively) (Figure 1-2).

Figure 1-2: Number of IPOs in the CEE region per capital market, 2000–2009.



Source: CEE stock exchanges & companies; own calculations.

With a 46% overall share, the Warsaw SE was also dominant in terms of the total value of money raised via IPOs. IPOs in the CEE region raised EUR 18.0 billion during the observed period, EUR 9.4 billion from newly issued shares (Table 1-4). In addition, the available data suggest that IPO markets in Bulgaria, the Czech Republic, Hungary, Romania and Slovenia were undeveloped, as the average number of IPOs per year in the observed period was much lower than one in each country.

In the period between 2000 and 2009, CEE capital markets hosted approximately 10% of Europe's IPOs and 8% of the new money raised through IPOs in Europe (Appendix 1). Taking into account that CEE capital markets represent only approximately 4% of equity

market capitalisation and 2% of equity turnover in European capital markets (Appendix 2), the number of IPOs in the CEE region was fairly high. However, it has to be emphasised that this was mainly due to the active IPO market on the Warsaw SE.

Table 1-4: Value of IPOs in the CEE region, 2000–2009.

	Value of IPOs		Value of new shares	
	EUR	% in total	EUR	% in total
<b>WSE</b>	8,249,571,005	46%	4,789,548,132	51%
<b>CEE - except WSE</b>	9,743,834,619	54%	4,615,414,572	49%
<b>Total</b>	<b>17,993,405,624</b>	<b>100%</b>	<b>9,404,962,704</b>	<b>100%</b>

Source: CEE stock exchanges & companies; own calculations.

### 1.4.3 Sector Distribution

We have established that in the 2000s the “old economies” were the dominating industries in the CEE region. Although the distribution of IPO companies among industries was rather dispersed, a decline of the “new economies” is evident. According to the results shown in Table 1-5, 16% of companies that completed an IPO were manufacturers (e.g. of building materials, plastic materials, sports equipment). The following four industries that represent approx. 10% each were construction, trade, energy & electricity, and other services (e.g. developers, hotels). Financial institutions and high tech companies followed on 7% and 6%, respectively.

As many as 34% of companies that had gone public in the observed period were delisted by the end of 2012, and are therefore not included into the statistics in Table 1-5. One could assume that they were mainly from the high tech sector, but one would be wrong; industry distribution among the delisted companies is evenly spread out and the high tech sector is not prevalent. It therefore appears that a strong impact on the distribution of IPOs in the CEE region with respect to industry segment came from privatisation in the 2000s, as 16% of the studied IPOs were PIPOs, all originating in real economies.

The industry distribution of IPO companies in the CEE region and in the total EU was similar in the observed period. According to PwC (2009), the top performing sectors (industrial goods & services, investment companies, technology, financial services, construction & materials, real estate) in terms of the number of IPOs in 2009 remained the same as in 2008. By contrast, Jenkinson and Jones (2004) report that in the bookbuilding analyses of 27 IPOs in Europe in the late 1990s, around half were from the “old economies” and half from the “new economies”.

Table 1-5: Distribution of IPOs by sector.

	N	%
<b>Manufacturing</b>	15	16%
<b>Construction</b>	10	11%
<b>Trade</b>	10	11%
<b>Energy &amp; electricity</b>	9	10%
<b>Other services</b>	8	9%
<b>Financials</b>	7	7%
<b>High tech</b>	6	6%
<b>Oil &amp; gas</b>	5	5%
<b>Real estate</b>	5	5%
<b>Automobiles</b>	4	4%
<b>Food</b>	4	4%
<b>Chemicals</b>	3	3%
<b>Media</b>	3	3%
<b>Mining and hard coal</b>	2	2%
<b>Post</b>	1	1%
<b>Pharmaceuticals</b>	1	1%
<b>Telecommunication</b>	1	1%
<b>Total</b>	<b>94</b>	<b>100%</b>

Source: CEE stock exchanges & companies; own calculations.

## 1.5 Internal Characteristics of IPO Activities in the CEE Region

The results presented in the previous section indicate that the internal characteristics of IPO activities in CEE are comparable with those in the developed countries of the EU. Let us now examine this claim by looking at each characteristic individually.

### **Post-IPO ownership structure of companies going public remains highly concentrated**

We measure the post-IPO ownership structure of companies going public with the shares' free float factor after the listing on the local stock exchange. Free float indicates that post-IPO ownership was still highly concentrated in most of the companies that had gone public. The average (median) post-IPO free float of companies' shares is quite low at 31% (30%) (Table 1-6). This illustrates the modest post-IPO diversification of shareholder structure in the CEE region. Developed EU markets show a similar image; Huyghebaert and Van Hulle (2006a) report that on average blockholders own 64.94% of shares after an IPO on the Belgian capital market, and similar percentages were also established for Italy (Pagano et al., 1998) and Germany (Hack and Lehmann, 2006).

Table 1-6: Free float and share increase distribution by type of IPO company ownership structure.

	Share increase*				Free float			
	Mean	Median	Max	Std. Dev	Mean	Median	Max	Std. Dev
<b>State-owned</b>	19%	18%	48%	18%	29%	28%	49%	12%
<b>Private</b>	23%	22%	75%	15%	32%	30%	77%	15%
<b>Family-owned</b>	26%	24%	60%	13%	31%	32%	54%	11%
<b>Total</b>	<b>23%</b>	<b>22%</b>	<b>75%</b>	<b>15%</b>	<b>31%</b>	<b>30%</b>	<b>77%</b>	<b>13%</b>

Notes: \*Share increase equals % of primary shares (see Table 1-2).

Source: CEE stock exchanges & companies; own calculations.

A further comparison of free float indicators with ownership types in companies (Table 1-6) shows that post-PIPO state-owned companies had the lowest free float (29%) on average, which could be related to the fact that PIPO share increases are also the smallest on average. However, the differences relative to privately- and family-owned companies are not essential. On the contrary, the relevant results indicate that regardless of the ownership type the pre-IPO owners tended to remain the relevant owners also after the IPO. The resulting relatively low free float could have had a negative impact on the liquidity of these shares in the market in the observed period. This raises interesting additional research questions and could be analysed into more detail.

### **IPOs with newly issued shares are the most frequent**

Our results show that 44 IPOs, which is 47% of all, included only primary shares, and that 10 IPOs, which is 11% of all, included only secondary shares (Tables 1-2 and 1-7). One half of the IPOs with only secondary shares were PIPOs, and only one was a family-owned company. The majority (55%) of IPOs with only primary shares were concluded by privately-held, 25% by family-owned and 20% by state-owned companies. The majority of family-owned (43%) and state-owned (60%) companies undertook IPOs with only newly issued shares. By contrast, privately-held companies mainly opted for a combination of primary and secondary shares (Table 1-7). The average (median) primary and secondary portion in pre-IPO shares amount to 23% (22%) and 13% (4%), respectively (Table 1-2).

We can therefore confirm that IPOs with only newly issued shares (primary shares) were the most frequent IPO type in the CEE region in the observed period, which is similar to the rest of Continental Europe. The distribution of primary versus secondary shares in IPOs in the CEE region was comparable with the findings for Continental Europe established by Kim and Weisbach (2008), and similar to the findings for the Belgian market as analysed by Huyghebaert and Van Hulle (2006a). The IPOs of the CEE region of the 2000s have one more common characteristic with IPOs in the other European markets. Primary and

secondary shares issued in an IPO represent only 23% and 13%, respectively, of pre-IPO shares on average. This again indicates the high average concentration of ownership structure in the CEE region and the modest post-IPO diversification of shareholder structure, both of which further imply a quite conservative position of pre-IPO shareholders towards opening up the company's ownership in an IPO process.

Table 1-7: Distribution of newly issued shares.

<b>% of new shares in IPO</b>	<b>PIPO</b>	<b>Private</b>	<b>Private-family</b>	<b>Total no. of companies</b>	<b>Average market cap (EUR)</b>
0%	33%	9%	24%	10	11,793,939,540
<100%	7%	76%	33%	40	502,346,024
100%	60%	16%	43%	44	418,693,671

Source: CEE stock exchanges & companies; own calculations.

**Bookbuilding with the active role of underwriters is the most used method of IPO price determination and allocation**

Bookbuilding was the prevailing method of price determination and allocation (Table 1-8). 74% of IPOs used bookbuilding and 26% used fixed pricing. As these percentages are rather equally distributed over the most vibrant years for IPOs in the region, i.e. 2005–2008, we cannot state that bookbuilding, although being the main method, completely replaced the fixed pricing method. The role of underwriters was important in the IPO process in the CEE region in the observed period. We managed to collect data for 68 IPOs, 53% of which engaged international underwriters. The fact that more than one third of them engaged local underwriters indicates that companies mainly targeted local investors and that the presence of foreign investors was not essential for them. This mainly refers to smaller IPOs, as the majority of larger IPOs were carried out with international underwriters and the use of bookbuilding. Our results are similar to the findings for other European markets reported by Jenkinson et al. (2006), Almeida and Duque (2006) and Huyghebaert and Van Hulle (2006b). All indicate that bookbuilding came to be increasingly used in Europe in the mid-1990s, with customs and practice in some countries continuing to reflect the previous fixed pricing method. We claim that since 2000 the methods used in IPO procedures (e.g. bookbuilding, role of underwriters) in the CEE region have become very similar to IPO procedures in the rest of developed European countries. This can be attributed to the fact that all CEE countries joined the EU in the mid-2000s and therefore went through the process of harmonisation their national regulations with the EU rules and practices, in particular the Prospectuses Directive, Market Abuse Directive and related regulations. The commonly used IPO methods and models were thus transposed from developed capital markets to CEE markets as well.



Table 1-8: Ownership structure of IPO companies, and IPO model.

Company	Ownership structure		IPO pricing		Underwriters*	
	N	%	Bookbuilding	Fixed price	International	Local
State-owned	15	16%	13	2	9	3
Private	58	62%	37	21	20	19
Family- owned	21	22%	20	1	7	10
<b>Total</b>	<b>94</b>	<b>100%</b>	<b>70</b>	<b>24</b>	<b>36</b>	<b>32</b>

Note: \*Data available for 68 IPOs.

Source: CEE stock exchanges & companies; own calculations.

### **The internal characteristics of IPO activities in CEE are comparable with those in developed markets of the EU**

The findings reported in this section support our assumption that the internal characteristics of IPO activities (ownership structure, types of shares offered, types of IPO price determination and allocation) in CEE are comparable with those in the developed markets of the EU.

The analysis of the type of shares used in IPOs (newly issued shares versus already existing shares prior to the IPO) also supports the assumption that the majority of companies decide to sell equity in the primary public market to raise fresh capital; however the amount of newly issued shares is rather small (23%). As shown in Table 1-3, the amount of new capital depends on the ownership structure, since the highest average capital increase per company (26%) was reported for family-owned companies and the lowest for state-owned companies (19%). This is in comparable limits with the findings for developed EU markets (Germany 14.4%, the UK 19%, Belgium 30%, Italy 39.8% (Huyghebaert & Van Hulle, 2006a; Pagano et al., 1998), and in line with the assumption that the ownership structure and size of IPO companies in CEE have an impact on the proportion of shares offered in an IPO.

An important driver of IPOs in the CEE region in the 2000s was privatisation. Our results show that in some cases mature, large companies that had gone through privatisation also decided to offer in the IPO only newly issued shares. In this respect the claim that young, small-growth firms tend to issue primary shares whereas established firms tend to offer secondary shares is not entirely true for CEE markets. Our results show instead that mature, large companies also decided to offer only primary shares. We believe this is mostly because of the specific economic environment in the CEE region, which lacks the tradition of raising funds via the capital markets, and the economic liberalisation processes which included mostly mature companies. The situation could be related to the limited financial resources that owners and consequently companies have due to the region's lack

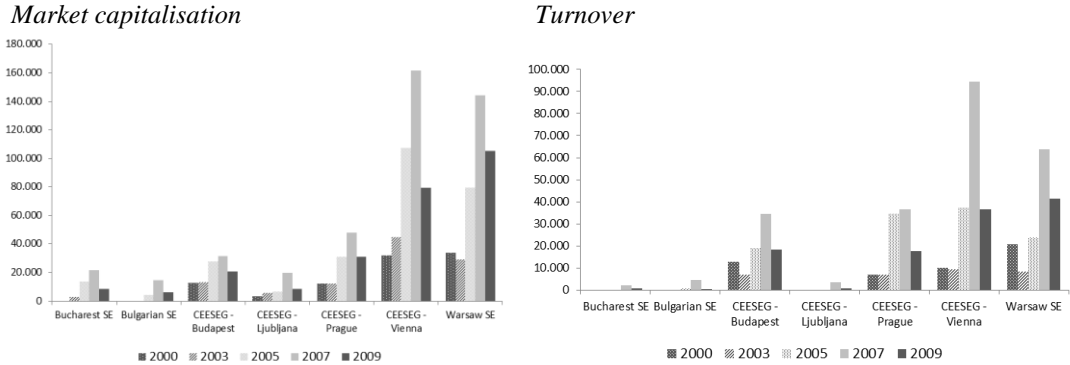
of advanced institutional and private investors, such as venture capital firms; however, a further analysis is required to prove this claim.

## 1.6 External Factors of IPO Activities in the CEE Region

### 1.6.1 CEE and Developed European Capital Markets: A Comparison

As most of the capital markets in the CEE region were established two decades ago, they are relatively young. Due to joining the EU in the mid-2000s, their national regulations and structures quickly became similar to those in Western Europe. However, a comparison of market capitalisations and turnovers in absolute terms reveals that CEE markets remain considerably smaller from their developed European counterparts<sup>2</sup>. In the peak year of 2007 the total market capitalisation in the studied markets amounted to EUR 11,089 billion, of which CEE markets represented only 4%. In terms of annual turnover, the share of CEE turnover in the total European turnover was lower even than 2% in the observed period. However, the number of domestic listed companies in CEE markets represented 15% of total domestic listed companies in the EU capital markets (Appendix 2). In terms of size, the Vienna SE and Warsaw SE were dominant in the CEE region; holding over 30% shares each in market capitalisation and turnover on average (Figure 1-3).

Figure 1-3: Comparison of CEE capital markets (in EUR m).



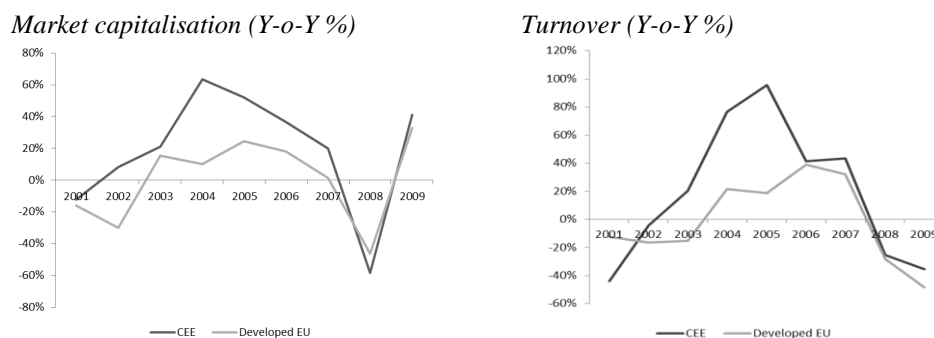
Source: FESE, Bucharest SE, Prague SE; own calculations.

The annual market capitalisation and turnover growth, as well as the annual local benchmark index returns in the CEE region, outperformed developed European countries until 2007 (Figures 1-4 and 1-5). After the onset of the financial crisis in 2008, the declines and growths recorded in the CEE region had slightly stronger magnitudes than those in the EU on average. The majority of the studied CEE capital markets witnessed similar market trends in the last decade: the rise of market capitalisation and turnover by 2007, and

<sup>2</sup> We compared CEE capital markets (Bucharest SE, Budapest SE, Bulgarian SE, Ljubljana SE, Prague SE, Vienna SE and Warsaw SE) with the more developed capital markets of Western Europe (BME – Spanish Exchange Madrid, Borsa Italiana, Deutsche Boerse, London Stock Exchange, NASDAQ OMX Nordic, NYSE Euronext and SIX – Swiss Exchange).

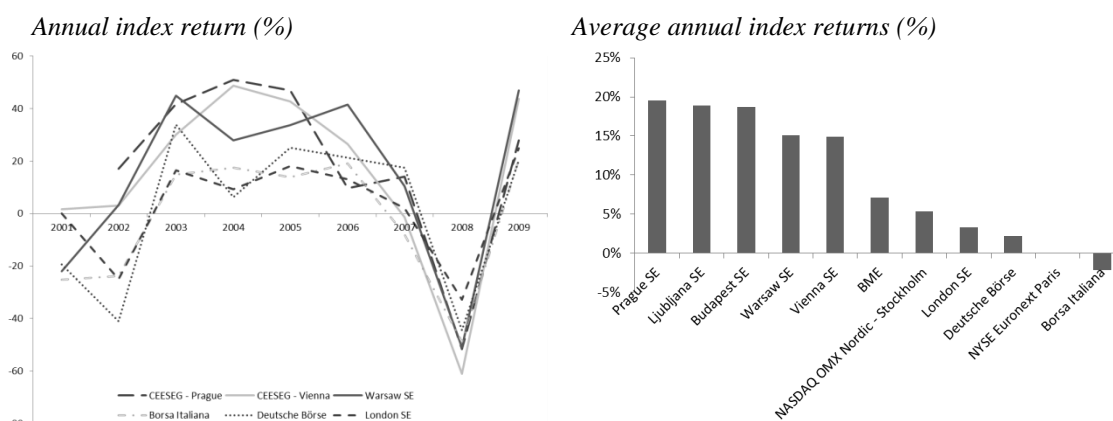
declines after the onset of global financial crisis (Figure 1-3). The majority of CEE capital markets also reported some of the highest average annual benchmark index returns, standing out in comparison with developed EU countries (Figure 1-5).

Figure 1-4: Equity market capitalisation and turnover growth rates in CEE and developed European capital markets Y-o-Y (%) in the period 2001–2009.



Source: FESE, World Federation of Exchanges, Prague SE, London SE; own calculations.

Figure 1-5: Annual index returns in the period 2001–2009.

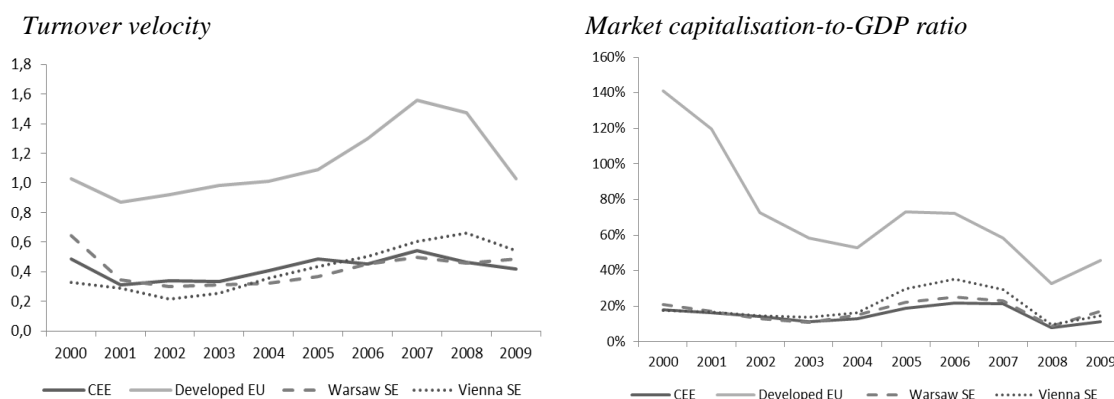


Source: FESE, WFE, Prague SE, London SE; own calculations.

The relatively higher number of domestic listed companies and the relatively lower turnover in CEE capital markets as compared to Western Europe show that liquidity was lower in CEE capital markets. This is even more evident when we compare turnover velocity<sup>3</sup>. Turnover velocity in CEE markets (including the Warsaw SE) in the observed period was considerably lower than in developed European countries (Figure 1-6).

<sup>3</sup> Turnover velocity is the ratio between yearly turnover and average market capitalisation. It shows how often equities are traded per year. Value one (1) represents a theoretical situation when all equities are traded once per year.

Figure 1-6: Average turnover velocity per capital market, and the stock exchange market capitalisation-to-GDP ratio, (%).



Source: WB, FESE, WFE, Bucharest SE, Prague SE, Prague SE, London SE; own calculations.

Comparing the turnover velocities of the Warsaw SE and NYSE Euronext, which had one of the lowest turnover velocities among developed markets, we see the significant deviation in terms of liquidity between all CEE markets, including the Warsaw SE, on the one hand, and developed capital markets on the other. The comparison of stock exchange market capitalisation-to-GDP ratios, which measure stock market significance in the national economy, reveals a similar relationship. The ratio did not exceed 35% in any CEE market, which was substantially lower than for developed EU countries. Figure 1-6 includes data for Borsa Italiana, the stock exchange with one of the lowest ratios among developed EU countries, which had nevertheless been higher than the ratios of all CEE markets before 2007 and has been on par with them since.

### 1.6.2 The Impact of Capital Market Factors on IPO Activities

Let us sum up our main findings. The Warsaw SE recorded 60% and the Vienna SE 25% of IPOs in the CEE region in the observed period. These two stock exchanges were also the dominant players in terms of market size in the CEE region, the two of them being very comparable in size. However, they were on par with the other CEE markets in terms of their significance in the national economy measured by market capitalisation-to-GDP. In addition, all CEE capital markets reported similar annual market capitalisation and turnover growth, and comparable annual index returns. All this indicates that capital market factors in Poland did not decisively accelerate IPO activities in the Polish capital market, since this market is comparable with the Vienna SE and all other CEE markets in terms of all main capital market parameters.

Furthermore, our results show that all CEE capital markets, including the Warsaw SE, are characterised by lower quality in terms of fundamental capital market indicators, such as market size, liquidity and market capitalisation-to-GDP ratios, as compared with developed

EU markets. This suggests that IPO activities (e.g. in Poland) could be accelerated despite the unattractive market conditions (e.g. smaller, less liquid market, less important in the national economy than in developed EU markets). This, in turn, somehow contradicts the findings of Groh and Liechtenstein (2009), who, on the basis of a survey among institutional investors and by analysing socio-economic data, concluded that the size and liquidity of the CEE capital markets is the largest investment obstacle.

To sum up, in their fundamental characteristics the CEE capital markets are, on the one hand, mostly comparable with each other and, on the other, they (including the Polish capital market) differ from developed EU markets. The comparability of CEE capital markets, where IPO activities are very diverse, and at the same time their diversity as opposed to developed EU markets, imply that capital market factors do not have a decisive impact on IPO activities in the CEE region.

Certain CEE capital market parameters, however, such as the annual index returns and the annual market capitalisation and turnover growth, stand out in comparison with developed EU capital markets before 2008, as shown in Figures 1-4 and 1-5. If we take these parameters (annual index returns and the annual market capitalisation and turnover growth) to reflect capital market attractiveness for investors and consequently to companies considering an IPO, we can say that the attractiveness a capital market has for investors is an important factor of IPO activities in the CEE region. This finding should be additionally examined, and further research is required to better interpret these outcomes.

### **1.6.3 The Impact of Macroeconomic Factors on IPO Activities**

Because of the liberalisation of economic environments two decades ago, capital markets and consequently IPO activities had a strong potential for growth in the CEE region. The only exception in Central and Eastern Europe in this respect was Austria, which had by then already had a longer stock market tradition and a liberal economic regime. EU's enlargement after 2004, which included the Czech Republic, Bulgaria, Hungary, Poland, Romania and Slovenia joining, was another significant distinguishing factor. However, as we see in this paper, IPO development patterns in CEE markets have remained diverse. In order to examine the distinctive macroeconomic and business factors that could also have had an important impact on IPO activities in the observed period, we additionally included into our study the EBRD transition indicators and the WB financial development and doing business indicators (EBRD and WB, 2013).

Table 1-9 shows the most distinctive changes in EBRD transition indicators in the 1990s and in the 2000s for five CEE countries. We can see that Hungary and Poland had a quicker reform development in terms of governance, enterprise restructuring and competition policy in both decades, but especially in the first one. The main difference

between these two countries is that large scale privatisation unfolded in Hungary already in the 1990s, mainly by selling shares to foreign investors. This may be an important reason for the lack of IPOs in Hungary in the 2000s. The World Bank Doing Business publication (2013) reports similar findings, stating also that Poland has implemented 20 institutional and regulatory reforms since 2005 and that it stands out in improving business regulation, focusing on reducing the complexity and cost of regulatory processes.

Table 1-9: Transition indicators.

Transition indicators (1989–2009)	1989–1999			2000–2009		
	Hungary	Poland	Slovenia	Hungary	Poland	Slovenia
<b>Assesments of discrepancy</b>						
<b>Large scale privatisation</b>	++	+		+		
<b>Small scale privatisation</b>	+	+	+			
<b>Governance and enterprise restruct.</b>	++	+++		++	++	
<b>Price liberalisation</b>	+	+	+			
<b>Trade &amp; Forex system</b>	++	+	+			
<b>Competition Policy</b>	++	+++		++	++	

Note: Romunia and Bolgaria are not stated, since the indicators are weaker.

Source: EBRD; own calculations.

The comparison of financial development and doing business indicators (Table 1-10) also illustrates some of the main differences between macroeconomic factors in CEE countries. To emphasise the potential factors that had an impact on numerous IPO activities in Poland, let us highlight for Poland four deviations in average indicator values from the corresponding CEE indicators: the lower bank private credit-to-GDP ratio, the lower mutual fund-to-GDP ratio, the highest pension fund-to-GDP ratio, and the highest paid-in minimum capital for companies measured as a percentage of income per capita.

As shown by two indicators, bank private credit-to-GDP ratio and mutual fund-to-GDP ratio, financial markets in the majority of CEE (not only Poland) lack private credit lines and mutual funds. This is in line with our analysis of ownership structures, where no significant venture capitalists or mutual funds were observed in CEE IPOs. This is again related to the fact that the capital markets in the CEE region, which evolved from mass privatisation processes, are relatively young and have modest IPO and portfolio investment traditions. In addition, all CEE countries, like other countries in Continental Europe, are bank-based. As a result, IPOs in the CEE region were undertaken mostly by companies from the real economy with traditional shareholder infrastructures.

The main macroeconomic and business indicators that significantly stand out for Poland are the pension fund-to-GDP ratio (100% above the CEE average and 50% above the Euro area average) and paid-in minimum capital measured as a percentage of income per capita (200% above the CEE average and 360% above the Euro area average). We can therefore

conclude that macroeconomic factors, such as quicker reform development in terms of governance and enterprise restructuring, competition policy, improved business regulations and sizeable pension funds, could have had a positive impact on IPO activities in Poland in the indicated period. Although one of the business indicators, i.e. paid-in minimum capital for companies, stands out significantly for Poland, the potential relationship with IPO activities is not clear. Further research is therefore required to better interpret the interdependence of these parameters.

Table 1-10: Financial development and doing business indicators.

Indicator name/Country	Austria	Bulgaria	Czech Republic	Hungary	Poland	Romania	Slovenia	Euro area	CEE average
(1) Bank capital to total assets (%)	5	11	6	9	8	11	9	6	8
(2) Bank concentration (%)	69	66	70	65	64	71	64	76	67
(3) Bank private credit to GDP (%)	107	27	44	39	28	16	48	95	44
(4) Mutual fund assets to GDP (%)	33	0	4	7	4	0	6	27	8
(5) Pension fund assets to GDP (%)	4	2	4	6	8	0	1	5	4
(6) Percentage of foreign banks among total banks (%)	8	54	55	84	65	64	28	27	51
(7) Return on equity (%)	6	16	12	19	11	3	10	10	11
(8) Volatility of stock price index**	26	28	28	33	32	34	20	22	29
(9) Paid-in min. Capital (% of income per capita)	60	68	39	69	213	2	34	46	69
(10) Strength of investor protection index (0-10)	5	6	5	4	6	6	6	6	6
(11) Total tax rate (% profit)	54	40	49	57	45	50	39	50	48

Notes: Averages 1997-2009 for (1)-(8) – euro area and 2004-2009 for (9)-(11) \* - UK, Germany & France;

\*\* - own calculation for Austria (2003 -2011).

Source: WB; own calculations.

## 1.7 Findings

We can sum up our findings in four categories: first two focuses on internal characteristics and models, and the second two on external factors. These findings are:

1. The internal characteristics of IPO activities (ownership structure, types of shares offered in an IPO, types of IPO price determination and allocation) in CEE are comparable with those in developed EU capital markets:
  - 1.1. The post-IPO ownership structure of companies going public remains highly concentrated.
  - 1.2. IPOs with newly issued shares are the most frequent.
  - 1.3. Bookbuilding with the active role of underwriters is the most used method of IPO price determination and allocation.
2. Ownership structure and the size of IPO companies in CEE have an impact on the proportion of shares offered in an IPO. However, the claim that young, small-growth firms tend to issue primary shares whereas established firms tend to offer secondary shares is not true for CEE markets.
3. Capital market factors do not have a decisive impact on IPO activities in the CEE region. However, the capital markets' attractiveness for investors could have had an impact on IPO activities in the CEE region in the observed period.
4. Macroeconomic factors, such as quicker reform development and sizeable pension funds, could have had a positive impact on IPO activities in Poland in the observed period.

## **1.8 Limitations**

Aiming to provide a thorough overview of IPO activities in the CEE region in the 2000s, our research was based on a qualitative analysis. The paper is limited to a qualitative comparison, since it broadly covers the internal and external factors and characteristics of IPOs. The impact of these characteristics and factors could be further used in researching IPO efficiency and performance, which is mainly related to two apparent IPO anomalies: initial underpricing and underperformance in the long run. Further, future studies of external IPO factors (such as the attractiveness of young capital markets, capital requirements for young companies, openness to foreign investors, and efficient business regulations and pension systems) could provide a basis for the analysis of IPO driving factors and IPO cycles.

## **1.9 Conclusion**

This paper investigates IPOs and their characteristics in the CEE region, using the sample of 94 IPOs from six CEE capital markets in the period 2000–2009. The available public statistics often report a considerably larger number of IPOs, which we believe is exaggerated, as shown by our critical review of the obtained data. The examined IPO



sample confirms that the most active IPO market in the CEE region in the observed period was the Warsaw SE, followed by the Vienna SE, all the other CEE capital markets remaining undeveloped in this respect. Moreover, our results show that companies that went public in the 2000s were mainly from the real economy. This can be attributed to the post-high tech bubble and to the fact that the largest IPOs in the CEE region were privatisation cases, all originating in real economies.

Our first main set of conclusions is that the internal characteristics of IPOs in the CEE region are similar to those in many other EU capital markets. Post-IPO ownership remains highly concentrated for most companies that go public. These resulting relatively low free float after IPO could have had a negative impact on the aftermarket liquidity of these shares. The results also show that most frequent IPOs were those with only newly issued shares. These results indicate that the majority of companies decide to sell equity in the primary public market to raise fresh capital; however the size of newly issued shares is rather small.

In addition, our results show that mature, larger companies can also decide to offer only primary shares in an IPO, which is not in line with the claim that young, small-growth firms tend to issue primary shares whereas established firms tend to offer secondary shares. We believe this is mostly because of the specific economic environment in the CEE region, which lacks the tradition of raising funds via the capital markets, and the economic liberalisation processes which included mostly mature companies. The situation could be further related to the limited financial resources that owners and consequently companies have due to the region's lack of advanced institutional and private investors, such as venture capital firms.

Results also show that, like in EU's developed countries, bookbuilding is the prevailing IPO method of price determination and allocation, and that the role of underwriters has become increasingly important in the 2000s. This could be attributed to the fact that all CEE countries have joined the EU in the mid-2000s and went through the process of harmonising their national regulations with the EU rules and practices.

The second main conclusion is that factors much broader than capital market characteristics (such as market size, liquidity and market capitalisation-to-GDP ratios) should be taken into account in order to assess the role of external factors in IPO activities in the CEE region. Nevertheless, our findings indicate that the attractiveness of a capital market for investors, as measured by annual index returns and annual market and turnover growth, appears to be an important factor for IPO activities.

Finally, we have shown that the other macroeconomic and business factors that stand out in the Polish capital market – the most distinguished IPO market in the CEE region – are

quicker reform development in terms of governance and enterprise restructuring, and a significantly higher share of pension fund assets in GDP. We argue that these macroeconomic factors have had a positive impact on IPO activities in Poland; however, further research is required to better interpret the interdependence of these parameters.

These outcomes provide welcome implications for policy makers. In order to provide capital-raising function of stock exchanges in emerging region the functioning basic capital markets are not sufficient. Policy maker shall provide attractive investment environment for established investment fund industry, especially pension funds.

## 2 INITIAL AND LONG-RUN IPO RETURNS IN CENTRAL AND EASTERN EUROPE<sup>4</sup>

### 2.1 Introduction

An initial public offering (IPO) is the first sale of a company's shares to the public, which results in the company's listing on a stock exchange. Companies most often decide to sell equity in the primary public market to raise capital for new investments. Theoretical as well as empirical literature on IPOs in various international markets, especially in the United States (US) and other developed capital markets is abundant (Jenkinson and Ljungqvist, 2001; Loughran and Ritter, 1995; Ritter, 1998; Eckbo and Norli, 2000). The main subject of comprehensive academic IPO research has been performance of companies that had gone public. According to Jenkinson and Ljungqvist (2001) the main academic research has been driven by the existence of two apparent anomalies: initial underpricing and long-run underperformance.

Initial underpricing is a reflection of the fact that IPO shares are initially offered to investors at prices considerably below the prices at which they are traded later on the stock exchange. Thus, the low offer price discount results in substantial initial day returns. The positive first-day returns have been documented by many authors mostly for US capital markets, European and Japanese capital markets for different sample periods between 1960 and 1999 (Jenkinson and Ljungqvist, 2001). Minimum average initial return was recorded in Israel (4.5%) and France (4.8%), in all other countries initial returns were higher. Loughran and Ritter (2004) showed that the first-day average returns in the US IPO market were 7% in the 1980s, 15% in years 1990-1998, 65% during the internet bubble 1999-2000 period and 12% during 2001-2003. Goergen et al. (2009) reported first-day underpricing of 52.89% in Germany (Neuer Markt) and 21.06% in France (Nouveau Marché) in the period 1996-2000. In the 2000s the phenomena of IPO underpricing was reported frequently, e.g. by Benveniste et al. (2008), Bradley et al. (2009), Gregoriou (2006), Ritter and Welch (2002), Zheng and Li (2008). The results of underpricing were compiled by Ritter (2011b) and the results for EU capital markets are provided in Table 3 in Appendix.

The long-run underperformance on the other hand happens when IPO underperform benchmark in the long run and is usually calculated for up to 5-years of IPO listing. Levis (1993) reported a negative long-run performance for UK capital market in 1980s. Jenkinson and Ljungqvist (2001) reported wealth losses in Australia ranging up to -51 percent. In the last two decades the phenomena of the IPO long-run underperformance is reported by number of authors, among Eckbo et al. (2000) for the US, Eckbo and Norli (2005) for Nasdaq, Pastor-Llorca and Poveda-Fuentes (2006) for Spain, Ritter (2003)

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provided international evidence. However, the presence of long-run underperformance is sometimes not confirmed. Kunz and Aggarwal (1994) and Ritter (1998) even report outperformance for Swiss and Swedish market, respectively (see Table 4 in the Appendix).

In parallel to the two phenomena, IPO performance is also frequently studied regarding their size, whereby scholars relate differential performance to the asymmetric information theoretical arguments. They argue underpricing should be lower for bigger offerings, which offer better quality data to investors before the IPO. Ritter (1991) showed that initial returns are lower for larger firms (measured by annual sales). In contrast, Alvares-Otero & Gonzalez-Mendez (2006) showed that larger firms (in terms of IPO value) that executed IPOs on Spanish market had greater initial returns in the period 1985-1997. They argue that Spanish firms going public, as in other countries of Continental Europe, are larger and older than US firms and that this different degree of establishment of the firms going public may explain these results. This is also in line with Lyn and Zychowicz (2003), who reported no significant relation between the magnitude of IPO underpricing and the IPO value for Polish and Hungarian IPOs. More recently, Ritter et al. (2013) studied the IPO activities on developed EU markets from 1995-2011 and showed that on the long-run large firm IPOs outperform small firm IPOs. On average, the three-year buy and hold return (BHR) was 14.6% for large and -2.9% for small companies (defined threshold was 30 euro million in pre-IPO annual sales). With few exceptions (1997 and 2006), the poorer long-run performance of small-firm IPOs exists across all of the sample period. Their findings are consistent for the findings for the US in Ritter (2011a) and Gao et al. (2013). Gao et al. (2013) analysing US IPOs in the last decade reported that the post-IPO abnormal returns earned by investors on small company IPOs (pre-IPO inflation-adjusted annual sales of less than \$50 million) have been low, underperforming a style benchmark by an average of 17.3% in the three years after going public, compared to outperformance of 3.1% for large company IPOs. The underperformance of small company IPOs has not been restricted to the United States. Vismara et al. (2012) report an average three-year buy-and-hold abnormal return of -27.5% for European IPOs from 1995-2008 with pre-IPO annual sales of less than EUR 30 million.

Similar findings were reported for penny stocks in US. Bradley et al. (2006) examined underpricing, long-run returns, lockup periods, and gross spreads for penny stock IPOs over the 1990–1998 period. They found that penny stock IPOs have higher initial returns than ordinary IPOs, but significantly worse long-run performance. Similarly, Konku and Bhargava (2012) extended the work of Bradley et al. (2006) by looking not only at NASDAQ small capitalisation issues, but also those issued on the bulletin boards and pink sheets (OTC trading). These stocks exhibit average first-day excess returns of 128% relative to the NASDAQ Decile 1 index. Consistent with the information asymmetry hypothesis, pink sheet issues have higher first-day returns than equities issued in the more

exposed and more regulated environments of the NASDAQ small capitalisation markets and the OTC markets.

Similarly, different level of underperformance for exchange-regulated markets with different level of regulation (i.e. less regulated second markets; e.g. AIM in London, Neuer markt in Germany and Nouveau Marche in France vs. main markets), in developed EU was also reported. Vismara et al. (2012) found that the average long-run performance of IPOs on second markets is dramatically worse than for main market IPOs. This is in line with Ritter et al. (2013), who reported average, the three-year buy-and-hold return of 15.1% for main markets (5.1% for small firms, 18.3% for large firms) and -3.8% for second markets (-4.0% for small firms, -2.9% for large firms) in the period 2001-2008.

IPO delistings (i.e. companies that decided to delist from the exchange after the IPO was conducted) are most often included in the calculations of IPO performance; however the calculation of underpricing for delistings alone to our knowledge is usually not performed or is analyzed in the scope of acquisition activity. According to Ritter et al. (2013), 46% of IPOs on developed EU markets in the period from 1995-2011 were part of acquisition activity, out of which 3.5% of IPOs were delisted. The highest yearly percentage of delistings was in 2008 (8.4%), which may be influenced by the advent of the financial crisis. Brau et al. (2012) analysed 3,547 IPOs from 1985 through 2003 to determine the impact of acquisition activity on long-run stock performance. The results show that IPOs that acquire within a year of going public significantly underperform for 1- through 5-year holding periods following the 1st year, whereas non-acquiring IPOs do not significantly underperform over these time frames. Their results suggest that the acquisition activity of newly public firms plays an important and previously unrecognized role in the long-run underperformance of IPOs. Liu et al. (2013) studied the determinants of firms' post-IPO trajectory in terms of three outcomes: delisting; acquisition with change of corporate control; and acquisition without such change, and found that delisting is predominantly influenced by issue-specific information, by the issuer's financial status leading up to the eventual outcome, and by corporate ownership and governance structure.

The role of capital markets and their capital-raising function was recognized by many authors, whereby IPOs play important role. This function is very important for emerging economies as companies get less support from an institutional framework. Bekaert et al. (2005) illustrate how equity market liberalizations lead to an increase in annual real economic growth. Similarly, Mendelson and Peake (1993) argue that in emerging economies the sooner sound equity markets are established, the sooner there will be sound benchmarks for evaluating privatized or private firms. Levine and Zervos (1996) argue that the cumulative effect on deeper capital markets has a positive impact on innovation and growth. In addition, IPO markets can have a strong impact on development of investment culture in emerging economies. Studying IPO markets in emerging economies can thus

provide valuable insights for potential investors and issuers in such economies, whose activities in turn have significant implications for general well-being.

Studies of IPO underpricing and long-run underperformance in emerging market are not uncommon. Regarding underpricing, results are very similar to the ones for developed markets, whereby this phenomenon is even more exaggerated (Durukan, 2002, Chen et al., 2004, Kim et al., 2004). In their international comparison, Jenkinson and Ljungqvist (2001) report maximum average initial return of 166% for Malaysia, and even 289% for China. Lee et al. (1996) analyzed initial and long-run returns for Singapore IPOs between 1973 and 1992 and showed that initial returns are around 30 percent. On the other hand, based on emerging markets long-run underperformance studies more mixed conclusions are drawn. Jenkinson and Ljungqvist (2001) reported wealth losses for Brazil in range of 47% in 1980s. Kao et al. (2009) also reported underperformance for China. However, Kim et al. (2004) reported that the Korean IPO market showed considerable positive market adjusted long-run returns in the period 1983-1999. Similarly, Chen et al. (2006) analyzed IPOs in Taiwan in the period from 1991 to 1998 and reported significant positive abnormal returns within 3 years after issuance, but also insignificant negative weighted average modified IPO returns when using alternative model specification.

In the CEE region the negative long-run performance of IPOs in the 1990s has been evidenced for private sector IPOs in Hungary (Jelic & Briston, 1999), Poland (Aussenegg, 2000) and Austria (Aussenegg, 2006). Aussenegg (2006) showed that the first-day average return in Austria was 6.5% and the average long-run underperformance was in the range of 74% throughout the period 1984-1996. Lyn and Zychowicz (2003) reported first-day underpricing of 15.12% in Hungary and 54.45% in Poland in the period 1991-1998; however the long-run performance measurement of these IPOs offers inconclusive results. More recent papers focus on the Polish capital market that provides a lower level of first-day underpricing in comparison to the previous studies, and mostly more moderate long-run underperformance (Darmetko, 2009; Gajewski and Gresse, 2006; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba and Kaminski, 2011; Zaremba and Szyszka, 2014; Zaremba and Żmudziński, 2014).

Our study focuses on IPO performance in emerging markets of Central and Eastern Europe (CEE) in the 2000s. Despite the numerous academic papers on IPOs, very limited research has been conducted of IPOs in the emerging markets of CEE, especially in the 2000s. Because the Warsaw Stock Exchange dominated the decade and was often ranked second or third by IPO value in the EU in the late 2000s (IPO Watch, PWC, 2003–2011), most researchers have focused solely on the Polish market. Apart from statistical data, there is almost no available academic research of IPO performance covering the entire CEE region in the 2000s. Most of the relevant literature related to IPOs in this region covers (mass)

privatisation processes and their outcomes in the 1990s, providing assessments of the impact of voucher privatisation on capital market development. The impact of young capital markets on IPO activities and performance, however, is less known and underinvestigated. Our intention is to fill the gap in this part of academic literature.

Our paper contributes in several aspects. The first important contribution is the dataset of IPOs for six CEE capital markets (Bucharest, Bulgaria, Ljubljana, Prague, Vienna and Warsaw) in the 2000s, which gives new insights into IPO performance of IPOs in smaller capital markets. We provide new evidence of IPO underpricing and long-run (up to 3-years) underperformance in the CEE region by using four (4) different calculation methods: basic index-adjusted and CAPM-adjusted returns, both presented in an unweighted and IPO value-weighted manner. In addition, we perform a robustness check on the IPOs' long-run performance with the calendar portfolio approach. With this, we show the sensitivity of the results on different methods of calculation. In addition, we provide results for smaller firms that go public (with IPO value less than euro 10 million) and delisted IPOs in this region. Furthermore, we provide results for emerging CEE capital markets by excluding the Vienna SE as well, in order to investigate the IPO behaviour on CEE capital markets, which went through economic transition in the beginning of the nineties. One of the paper's main contributions however, is also the unique comparison of CEE IPO performance with IPO performance of the EU's developed capital markets (London SE, Deutsche Boerse, Borsa Italiana and NYSE Euronext) in the observed period. Countries in the CEE region have strong economic links with the developed EU regions, especially with the Continental Europe, which have similar continental bank-based financial environment. Those markets have however, only recently started to provide a channel for acquisition of sources of finance for companies and were throughout the study period much less developed. Common EU capital market regulation having effect on those markets (particularly Prospectuses Directive and Market Abuse Directive) was only introduced in 2004, after CEE countries joined the EU. Finally, contrary to the IPO long-run underperformance literature (for developed and emerging markets), our results unambiguously confirm long-run underperformance.

The paper is organized as follows. First we provide an overview of CEE capital markets and hypotheses. In chapter 3 we describe our data collection and used methodology. We report our findings in the fourth chapter and in the last chapter we conclude.

## **2.2 CEE Capital Markets Overview and Hypotheses**

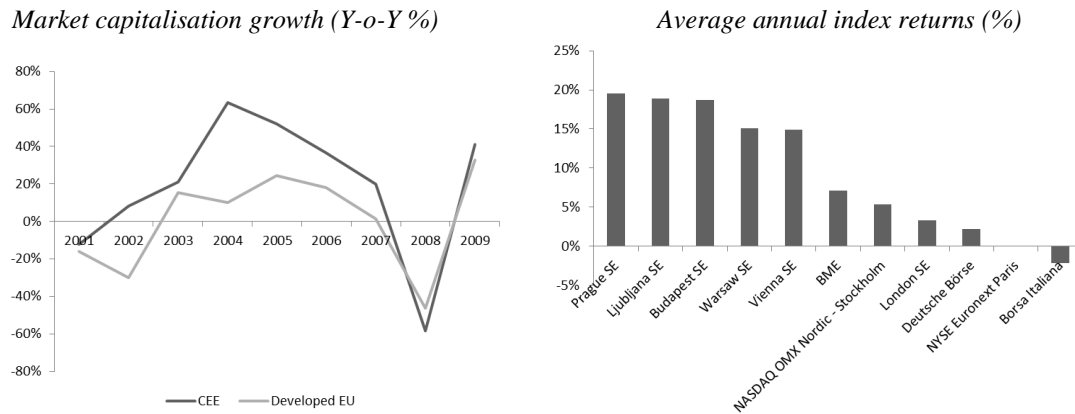
### **2.2.1 CEE Capital Markets**

Our research focuses on capital markets in the Central and Eastern region of Europe (CEE). Those capital markets are immature, as most of them were established in parallel with liberalisation of economic environments of CEE countries somewhat more than two decades ago. The only partial exception in the CEE region in this respect is Austria. Austria already had a long stock market tradition and a liberal economic regime. However, the Austrian stock market before the early 1990s did not play a significant role in providing sources of equity finance because bonds were the predominantly traded instrument (Kaszuba, 2010). Table 5 in the Appendix shows the comparison of financial and institutional development indicators for this region (World Bank Doing Business publication, 2013). The comparison illustrates that in some respects Austrian indicators are more similar to indicators for Euro area than to indicators for CEE region (e.g., presence of institutional investors, banks' private credit to GDP, and foreign ownership of domestic market capitalization). Yet, some indicators are quite similar to the CEE (e.g., investor protection, volatility of the stock index, turnover velocity, and market capitalization-to-GDP). We thus include Austria so that we can provide a comprehensive description of the IPOs' performance in the CEE region, even though Austria is in some aspects more advanced. The EU's enlargement in May 2004 that added the Czech Republic, Hungary, Poland, and Slovenia and in January 2007 that added Bulgaria and Romania moved the CEE countries even closer to Austria and Western Europe as their national regulatory environment and some institutional structures quickly became very similar.

After liberalization took place, CEE capital markets attracted quite some attention of the international investors. During the 1990s there were relatively large inflows in a form of foreign direct investment (FDI) into the region, and at the end of the 1990s transition environment, coupled with favourable macroeconomic effects, still relatively low stock valuations, institutional investors started to become attracted by portfolio investments (Koeke, 2000). EU accession has only magnified the phenomenon. Market capitalizations started to increase and reached relatively high levels at the beginning of the global financial crises. Companies were offered unprecedented access to capital markets not seen before, and there were excessive optimism present in CEE markets providing windows of opportunity for issuing companies (Ritter, 1991), which can be seen from market trends (see Figure 2-1).



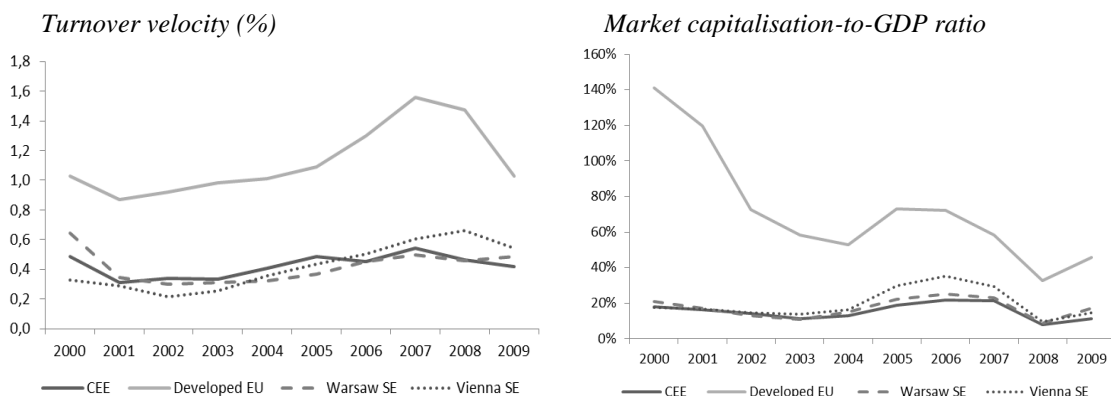
Figure 2-1: Equity market capitalisation growth rates in CEE and developed European capital markets (left) and average annual index returns in the period 2001–2009 (right)



Source: FESE, WFE, Prague SE, London SE; own calculations.

As we can see from Table 5 in the Appendix, CEE markets are institutionally different from the developed EU markets in terms of financial depth (in terms of banks and market capitalization-to-GDP), presence of institutional and foreign investors, and the net investment position (see outward to inward FDI position<sup>5</sup>). Further, stock market liquidity (i.e. turnover velocity; see Figure 2-2), which is according to recent research in the CEE region, conducted by Todea and Plesoianu (2013) very important determinant of market efficiency, remained substantially lower throughout the 2000s compared to developed EU countries, even though it was gradually increasing. The same holds for investor protection, which was in the EU roughly 14% higher in 2006 than in the CEE countries, and still 11% higher in 2010.

Figure 2-2: Average turnover velocity within CEE and EU capital market (left) and stock exchange market capitalisation-to-GDP ratio in % (right).



Source: WB, FESE, WFE, Bucharest SE, Prague SE, Prague SE, London SE; own calculations.

<sup>5</sup> Very same holds for portfolio investments (not shown).

To provide a comprehensive description of IPO performance in CEE region, we perform analysis of CEE capital markets including the Vienna SE (Austrian market is not just geographically, but also institutionally close to emerging CEE markets in some respects). In order to investigate the IPO behaviour on emerging CEE markets, we also provide separate results for emerging capital markets of the Czech Republic, Bulgaria, Poland, Romania and Slovenia only (i.e. by excluding Austria).

### 2.2.2 Hypotheses

Based on the above introduction and characteristics of the CEE capital markets, we structure our research around six hypotheses about IPO returns in the CEE region in the 2000s. Similarly to the existing studies in the developed as well as other emerging markets and most recently for the Polish capital market (Darmetko, 2009; Gajewski and Gresse, 2006; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Zaremba and Szyszka, 2014), we expect to find underpricing in the entire CEE region in the 2000's. Due to the emerging nature and specific characteristics of institutional environment in the CEE capital markets compared to the EU's developed capital markets (such as a much lower presence of institutional and foreign investors, lower investor protection, lower market capitalization-to-GDP ratio, and a lower turnover velocity), we expect *first*, to find significant underpricing, that should for reasons of greater expected information asymmetry be greater than on the developed capital markets in the same period. *Second*, for much the same reasons of greater anticipated information asymmetry, we also expect small firms to exhibit higher underpricing and thus higher initial (i.e. first day returns). In addition, because the average annual performance of benchmark indices across the Europe in the 2000's is comparable (see Figure 1-5), despite of anticipated differences in the magnitude of underpricing, we expect to find some positive correlation between IPO initial returns in the CEE capital markets and EU's developed capital markets. We can thus state four hypotheses relating to underpricing as follows:

**Hypothesis 1:** IPOs in the CEE capital markets are underpriced, having average positive first-day returns. **Hypothesis 2:** Smaller IPOs in the CEE capital markets exhibit higher underpricing compared to their larger counterparts. **Hypothesis 3:** The average IPO initial returns in the CEE capital markets and the average IPO initial returns in EU's developed capital markets are equal. **Hypothesis 3a:** There is a positive correlation between IPO initial returns in the CEE capital markets and EU's developed capital markets.

In terms of long-run underperformance, we expect the same effect as found and reported in the developed market and most recently for the Polish capital market, and combined with the anticipated higher underpricing compared to the developed market's IPOs, also lower subsequent (i.e. long-term) returns. Nevertheless, for much the same reasons as for underpricing we expect to find some positive correlation between IPO long-run returns in the CEE capital markets and EU's developed capital markets. We also expect that size

effect is reflected in the long-run returns and that small value IPOs yield lower (more negative) long-run returns. We thus work with additional four hypotheses: **Hypothesis 4:** In the long run IPOs in the CEE capital markets underperform benchmark companies. **Hypothesis 5:** Smaller IPOs in the CEE capital markets exhibit higher long-run underperformance compared to their larger counterparts. **Hypothesis 6:** The average IPO long-run returns in the CEE capital markets and the average IPO long-run returns in EU's developed capital markets are equal. **Hypothesis 6a:** There is a positive correlation between IPO long-run returns in the CEE capital markets and EU's developed capital markets.

## 2.3 Data and Methodology

### 2.3.1 Data Collection

Our sample covers all 172 IPOs with pricing data in the period 2000–2009 on the stock exchanges of Bucharest, Sofia, Ljubljana, Prague, Vienna and Warsaw (Table 2-1). Budapest stock exchange has to be excluded because no IPO was conducted in the observed period. In case of double listings we took into account the IPO in the domestic market only. We also included privatisations of public companies (14 examples of such IPOs), but only if they were public offerings (i.e. privatised initial public offering – PIPO). The original sample included 246 IPOs; however number of IPOs was reduced due to the limited data of share prices for delisted and smaller IPOs. In addition, we identified the outliers with scatterplots for initial and 3-years long-run adjusted returns in relation to IPO value and reduce sample with some outliers (3-years long-run adjusted returns over 150%). To provide appropriate overview of IPOs, Table 2-1 shows separately delisted IPOs until the end of 2012 and smaller IPOs with less than EUR 10 million of new funds raised (with primary or/and secondary shares). 27% of companies (22% in terms of IPO value) that executed IPOs had been delisted by the end of 2012; similar percentage of delisted companies were in the group of small IPOs (29% of companies and 29% of IPO value).

For the comparison of CEE and EU IPO data we use the most relevant CEE IPOs, i.e. those who are tradable with at least EUR 10 million of new funds raised (with primary or/and secondary shares) via an IPO. The reason is that IPOs in developed EU region are on average much larger<sup>6</sup> and in order to provide reliable comparison we therefore used the most relevant IPOs in the CEE region that we were able to match them with comparable EU IPO. Namely, a sample of similar IPOs on developed (Western) EU capital markets was formed (Table 2-2) in the way that for each IPO on CEE capital market a similar IPO on developed EU capital market London SE, Deutsche Boerse, Borsa Italiana or NYSE

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<sup>6</sup> There were 173 IPOs on Deutsche Boerse with total IPO value of EUR 37.9 billion between 2000 and 2009; i.e. on average 219 million eur IPO value per company.

Euronext were included. The vast majority of developed EU IPOs were taken into account from regulated markets; only in several examples IPOs on AIM as exchange-regulated market were included due to the lack of other adequate IPOs. An IPO on developed EU capital market was chosen according to industry (Figure 2-3) and a comparable market capitalization size or IPO value size in the period of one year before or after CEE IPO (in few cases period of 1.5 year was chosen). The original sample included 81 IPOs, however by excluding 5 CEE and developed EU IPO outliers identified with scatterplots for initial and 3-years long-rung adjusted returns, the final sample was reduced to 76 IPOs in the period 2000–2009 (Table 2-2 and Table 10 in Appendix). In case of analyzing emerging CEE capital markets the sample was reduced to 63 IPOs by excluding 13 IPOs listed on the Vienna SE.

Table 2-1: CEE IPO sample, 2000 – 2009.

IPO Total Sample				Small IPOs in the Sample (< 10 mio EUR IPO value)			Delisted IPOs in Total Sample		
	N	IPO Value in EUR	Market Cap in EUR	N	IPO Value in EUR	Market Cap in EUR	N	IPO Value in EUR	Market Cap in EUR
<b>2000</b>	6	551,696,871	1,280,787,456	0	0	0	5	281,950,000	562,699,582
<b>2001</b>	2	59,220,000	330,840,000	0	0	0	1	10,920,000	57,840,000
<b>2002</b>	2	15,500,000	82,074,500	1	4,500,000	38,074,500	1	4,500,000	38,074,500
<b>2003</b>	1	30,141,198	180,847,188	0	0	0	1	30,141,198	180,847,188
<b>2004</b>	2	31,775,817	121,009,267	1	7,252,182	46,161,000	0	0	0
<b>2005</b>	24	805,824,592	2,488,499,464	10	49,737,025	140,238,556	8	257,560,559	516,032,923
<b>2006</b>	38	1,430,967,388	4,616,458,299	13	72,959,696	215,705,875	9	564,411,064	1,646,139,823
<b>2007</b>	63	2,399,867,224	9,632,979,067	20	102,800,179	591,414,263	13	243,785,756	1,103,332,239
<b>2008</b>	23	1,360,096,743	4,614,733,862	10	39,989,720	170,435,540	7	148,225,810	251,847,285
<b>2009</b>	11	246,763,496	930,330,840	7	19,541,162	134,043,885	2	11,199,997	27,267,733
<b>Sum</b>	<b>172</b>	<b>6,931,853,329</b>	<b>24,278,559,942</b>	<b>62</b>	<b>296,779,965</b>	<b>1,336,073,618</b>	<b>47</b>	<b>1,552,694,385</b>	<b>4,384,081,273</b>

Sources: CEE stock exchanges & companies; own calculations.

We collected the list of companies that went public from the internal documentation of stock exchanges and from the websites of stock exchanges, double checking the obtained figures against the detailed case-by-case IPO information on companies' web sites, in IPO prospectuses and companies' annual reports. The industry classification of IPOs was taken from individual stock exchange classification. We used Datastream for market share prices, indices prices and yields to maturity of government bonds for each capital market.

The prevailing IPO capital market in the CEE region is the Warsaw SE with 62% of total IPO value and 67% of total IPO market capitalization (Figure 2-4). Similarly, the prevailing capital markets in the subset of 76 the most relevant IPOs are the Warsaw SE in the CEE region, which contributed 60% of IPOs market capitalisation, and the Vienna SE

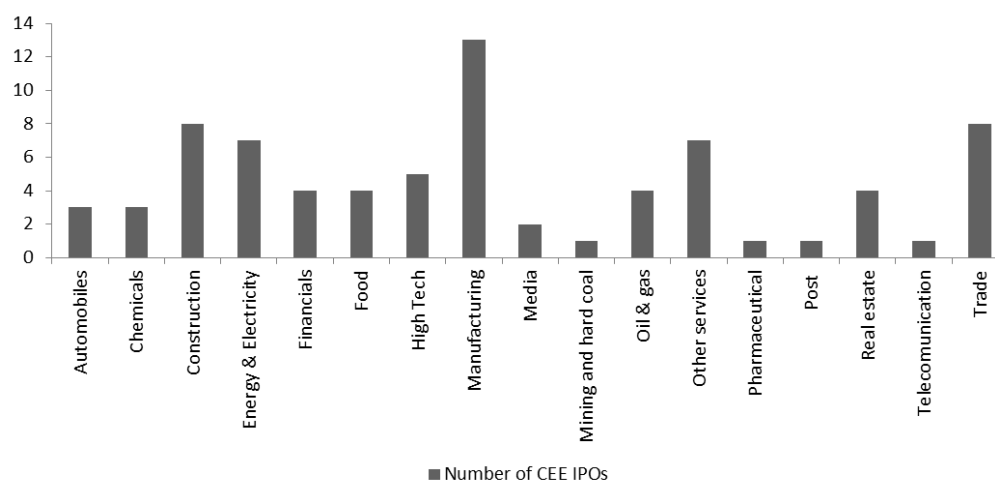
with a 30% share. Majority of IPOs in EU sample are IPOs on the London SE (60% of IPO market capitalisation of the sample) and Deutsche Boerse (36%) (Figure 2-5).

Table 2-2: CEE IPO and respective EU IPO sample, 2000 – 2009.

	CEE IPO			EU IPO		
	N	IPO value in EUR	Market Cap in EUR	N	IPO value in EUR	Market Cap in EUR
<b>2000</b>	2	1,277,746,871	4,858,087,874	2	450,490,000	2,567,460,000
<b>2001</b>	1	48,300,000	273,000,000	2	30,752,680	106,502,183
<b>2002</b>	1	11,000,000	44,000,000	0	0	0
<b>2003</b>	0	0	0	0	0	0
<b>2004</b>	1	24,523,635	74,848,267	0	0	0
<b>2005</b>	12	1,317,192,106	6,423,401,604	11	1,298,973,019	2,803,559,255
<b>2006</b>	16	1,946,562,132	4,860,891,268	19	3,276,367,532	13,063,628,218
<b>2007</b>	34	2,035,516,386	7,991,026,236	35	4,283,524,080	12,967,359,923
<b>2008</b>	6	904,642,174	3,726,967,246	3	529,168,819	2,054,326,511
<b>2009</b>	3	216,477,750	785,542,371	3	237,024,516	505,243,453
<b>2010</b>				1	5,559,330	52,939,330
<b>Sum</b>	<b>76</b>	<b>7,781,961,054</b>	<b>29,037,764,866</b>	<b>76</b>	<b>10,111,859,976</b>	<b>34,121,018,872</b>

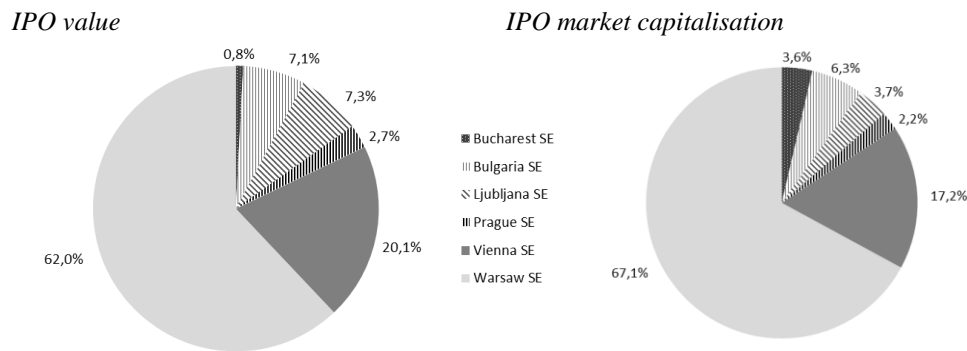
Source: CEE & EU stock exchanges & companies; own calculations.

Figure 2-3: Distribution of CEE IPOs by sector.



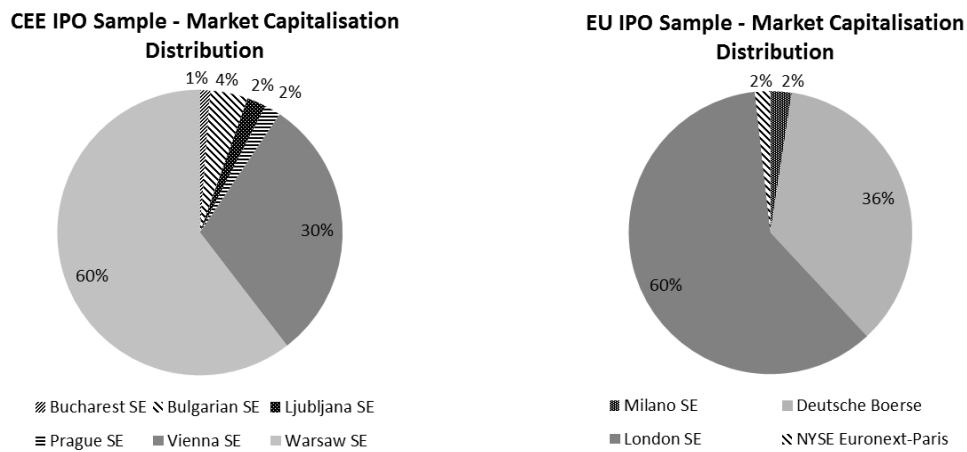
Source: CEE stock exchanges & companies; own calculations.

Figure 2-4: Distribution of CEE IPOs by capital markets (N=172).



Sources: CEE stock exchanges & companies; own calculations.

Figure 2-5: Distribution of IPOs by capital markets (N=76).



Source: CEE & EU stock exchanges & companies; own calculations.

## 2.3.2 Methodology

### Initial and long-run IPO returns

For studying IPO underpricing an abnormal initial return of IPO is defined as the difference between the observed return of IPO and the normal return that can be expected from an investment in IPO:

$$IR_i = R_i - E(R_i),$$

where  $IR_i$  is the abnormal initial return of IPO  $i$ ,  $R_i$  is the observed IPO return, and  $E(R_i)$  is the expected return (Aussenegg, 2006). Both returns are calculated for the time period from the IPO offer (e.g. the first day of subscription period) to the first trading day (close price).

Similar to initial returns, long-run abnormal returns are calculated as the difference between the observed return of an IPO from the first day in the aftermarket (i.e. from the second trading day) to specific time period (in our case 1, 2 weeks, and 1, 2 and 3 years), and its expected return (Loughran and Ritter, 1995).

### **Index and CAPM-adjusted returns**

We use two methods to determine expected initial and long-run returns. *Firstly*, we adjust IPO returns for stock index returns. *And secondly*, we use standard single factor CAPM-adjusted returns as expected returns that are adjusted for appropriate risk.

### **Initial index-adjusted return of an IPO**

The initial return for IPO is defined as the difference between its observed return and the corresponding return of the market index:

$$IR_{i,t} = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} - \frac{I_{i,1} - I_{i,0}}{I_{i,0}},$$

where  $IR_{i,t}$  is the market index-adjusted initial return of IPO  $i$ ,  $P_{i,1}$  is the closing price of IPO  $i$  at the end of first trading day,  $P_{i,0}$  is the offer price of IPO  $i$ ,  $I_{i,1}$  is the respective main market share index at the end of first trading day of IPO  $i$ , and  $I_{i,0}$  is the index on the first day of the subscription period of IPO  $i$  (or date of IPO price determination if subscription period was unknown). The benchmark price index for each capital market (i.e. market, where IPO shares are listed) is taken into account in each calculation model. Calculations are conducted in local currencies.

The average index-adjusted initial return for a sample of  $n$  IPOs is then measured as:

$$AIR_n = \frac{1}{n} \sum_{i=1}^n IR_{i,t}.$$

The same formula is used for the average index-adjusted initial return for a sample of  $m$  IPOs on a specific capital market.

### **Long-run index-adjusted return of an IPO**

The buy-and-hold abnormal return measure (BHAR) is probably the most frequently used method for the measurement of long-run performance (Gajewski and Gresse, 2006). For instance, Loughran and Ritter (1995) and Brav et al. (2000) use it, and the studies on the CEE markets use it as well (Ausenagg, 2006; Jewartowski and Lizińska, 2012; Sieradzki,

2013, Lizińska and Czapiewski, 2014). The buy-and-hold return ( $BHR_{i,T}$ ) for issue  $i$  is calculated as:

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

where  $R_{i,t}$  is the return of IPO  $i$  in the period  $t$  starting as of the second trading date. The  $BHRs$  are calculated for the following time periods:  $T = 1$  week, 2 weeks, 1 year, 2 years, 3 years from the second trading date of IPO  $i$ . In the case of a delisting prior to three years, the last trading date is taken into account. If  $T$  is not a trading date, the first next trading date is used. We again use prices in the local currencies.

The same formula is used for the returns of the benchmark price indices of every capital market where IPOs are listed ( $BHRI_{i,T}$ ) for the same time periods:

$$BHRI_{i,T} = \prod_{t=2}^T (1 + RI_{i,t}) - 1,$$

where  $RI_{i,t}$  is the return of the benchmark price index of the capital market where IPO  $i$  is listed. The  $BHRI$ s are calculated for the same time periods as for IPO  $i$ :  $T = 1$  week, 2 weeks, 1 year, 2 years, 3 years as of the second trading date.

By subtracting the  $BHRI$ s from the  $BHR$ s, we obtain the  $BHAR$ s (index-adjusted). The  $BHAR_{i,T}$  is thus the cumulative abnormal return for IPO  $i$  over the period  $T$  and is calculated for each IPO  $i$  as:

$$BHAR_{i,T} = BHR_{i,T} - BHRI_{i,T}.$$

The average abnormal return for a sample of  $n$  IPOs ( $ABHAR_T$ ) is thus measured as:

$$ABHAR_T = \frac{1}{n} \sum_{i=1}^n BHAR_{i,T}.$$

The same formula is used for the average abnormal return for a sample of  $m$  IPOs on a specific capital market.

### **CAPM-adjusted initial and long-run returns**

In addition to calculating the  $BHAR$ s of the index, we also calculate the standard single factor adjusted long-run returns of the standard CAPM (Sharpe, 1964 and Lintner, 1965) and thus adjust the risk level of each IPO. The abnormal initial returns and abnormal long-run returns ( $AR_{i,T}$ ) are calculated in the following manner:



$$AR_{i,T} = R_{i,T} - R_{f,T} - \beta_i \times (R_{m,T} - R_{f,T}),$$

where  $\beta_i$  is calculated for the time period from the first trading date to the end of the fifth year of the respective IPO  $i$  (or 31.12.2012 in the case of the shorter listing period; e.g., listings after 2008); where the risk free returns  $R_{f,T}$  are the yields at the maturities of the government bonds for each capital market over period  $T$ ; the returns of market  $R_{m,T}$  are the benchmark price index returns for the respective IPO market; and  $R_{i,T}$  are IPO  $i$ 's returns for  $T$  = the first trading date, 1 week, 2 weeks, 1 year, 2 years, 3 years that start on the second trading date of IPO  $i$ . In the case of a delisting prior to three years after the IPO, the last trading date is taken into account. If  $t$  is not a trading date, then the first next trading date is taken into account. We again use stock prices in the local currencies.

The average CAPM-adjusted initial return and the CAPM-adjusted long-run returns for a sample of  $n$  IPOs are measured in the same manner as presented above for index-adjustments.

### **IPO value -weighted returns**

Because IPOs substantially differ in size, we also test the IPO value-weighted returns (both for initial returns and for long-term returns). Namely, Brav and Gompers (1997) show that weighting significantly reduces performance differences and substantially reduces underperformance for non-venture-backed IPOs. We thus recalculate the initial and long-run returns using the IPOs' values as weights.

The contribution of the value-weighted initial index-adjusted return of IPO  $i$  on a specific capital market  $m$  is calculated as:

$$IRw_{i,t} = IR_{i,t} \times w_{i,m},$$

where  $IRw_{i,t}$  is the index-adjusted  $IR_{i,t}$  for IPO  $i$  at time  $t$ , and  $w_{i,m}$  is the value of IPO  $i$  (calculated by multiplying the number of IPO shares and the IPO subscription (offer) price). The IPO value-weighted average abnormal initial return for an IPO sample on the capital market  $m$ ,  $WIR_{m,t}$ , is then measured as:

$$WIR_{m,t} = \sum_{i=1}^M IRw_{i,t},$$

where  $M$  is the number of IPOs.

The average IPO value-weighted index-adjusted initial return for a sample of  $n$  IPOs,  $WIR_t$ , is then measured as:

$$WIR_t = \sum_{m=1}^S WIR_{m,t} \times w_m,$$

where  $w_m$  is the total IPO value of the observed IPOs in capital market  $m$  divided by the total value of the IPOs in the sample.

The same method of weighting is used for the calculation of the weighted average abnormal (index-adjusted) long-run (buy-and-hold) returns ( $WBHAR$ ). The CAPM-adjusted initial returns and long-run returns can be weighted using the same method as described above.

### **Robustness check of long-run returns**

An alternative approach for measuring the long-term price performance of an IPO is to use the cumulative abnormal returns CARs (e.g., Brav et al., 2000; Jewartowski and Lizińska, 2012). As Brav et al. (2000) point out; the choice between CARs or BHARs largely depends on the implicit trading strategy that is being assumed. In addition, a calendar-time portfolio approach that tracks the performance of an event portfolio in calendar time relative to either an explicit asset pricing model or some other benchmark can be used as an alternative approach as well. Brav and Gompers (1997) and Darmetko (2009) use this approach for instance. As a robustness check we therefore use both the CARs and the mean monthly calendar-time abnormal return (CTAR) together with the standardized time abnormal return (SCTAR) as clarified by Dutta (2014).

#### *Mean monthly CTAR*

The calculation of the mean monthly calendar time abnormal return (CTAR) is the following:

$$CTAR = \frac{1}{T} \sum_{t=1}^T CTAR_t, \text{ where}$$

$$CTAR_t = PR_t - IR_t.$$

Within this framework,  $PR_t$  is the monthly return for the portfolio of IPOs on an individual market, and  $IR_t$  is the expected return represented by the respective index of the main market shares. The  $T$  is the total number of months in the sample period ( $H = 12, 24, \text{ or } 36$ ).

### *Standardized calendar time approach (SCTA)*

In addition we estimate the IPO-portfolio residual variances using the H-month residuals computed as monthly differences of the  $i$ -th IPO returns and the returns of the index of the main market share.

On the individual IPO level we compute the  $\varepsilon_{it} = R_{it} - IR_t$ , where  $i = 1 \dots H$ , by dividing it by the standard deviation that yields the corresponding standardized abnormal return to get  $z_{it}$  for IPO  $i$  in time  $t$ . The  $N_t$  refers to the number of event companies in the calendar month  $t$ . We then calculate the CTAR for portfolio  $t$  as:

$$CTAR_t = \frac{1}{N_t} \sum_{i=1}^{N_t} z_{it}.$$

The grand mean monthly abnormal return is denoted by SCTAR and is then calculated as:

$$SCTAR = \frac{1}{T} \sum_{t=1}^T CTAR_t.$$

### *Cumulative abnormal return (CAR)*

The general formula for the abnormal market-adjusted return for each IPO  $i$  for a month  $t$  is calculated as

$$AR_{i,t} = R_{i,t} - IR_{i,t},$$

where  $R_{i,t}$  is the IPO  $i$  return for month  $t$ , and  $IR_{i,t}$  is the respective return for the index of the main market shares for month  $t$  and the CAR of IPO  $i$  is obtained by adding together the monthly abnormal returns from month 1 to  $T$ . Then, the average cumulative market-adjusted return is calculated as the equally weighted arithmetic mean of the CARs for all of the IPOs.

## **2.4 Results**

The hypotheses are tested with the following 4 models:

- MODEL 1 – average (unweighted) index-adjusted returns (IR/BHAR);
- MODEL 2 – average (unweighted) CAPM-adjusted returns (CIR/CAPM);
- MODEL 3 – average IPO value-weighted index-adjusted returns (WIR/WBHAR);
- MODEL 4 – average IPO value-weighted CAPM-adjusted returns (WCIR/WCAPM).

The results are split into two sections: 1) we present results for initial returns using all 4 models and providing the answers regarding Hypothesis 1, 2, 3 and 3a; and 2) we present results for long-run returns using all 4 models and providing the answers regarding Hypothesis 4, 5, 6 and 6a. In addition, we check Hypothesis 4 and 5 with alternative methods.

#### **2.4.1 Underpricing**

Table 2-3 firstly provides results for individual CEE capital markets. It shows that average adjusted initial IPO returns are positive for all individual CEE capital market, with exception of the Bulgarian SE for the model 1 and of the Vienna SE for CAPM-adjusted and weighted models. Further, it shows that average adjusted initial returns for CEE IPO sample are positive for all 4 models, ranging from 5.0 to 11.3 percent. A significant first-day underpricing in range of 11.3% for CEE IPOs is reported for model 1 and 8.6% and 5.4% for models 2 and 3, respectively. These results reject the hypothesis that initial returns are zero with high statistical significance. Therefore, the Hypothesis 1, stating that IPOs on CEE capital markets are underpriced and thus having average adjusted positive first day returns, is confirmed. Thus, same phenomenon as reported for developed markets (Loughran and Ritter, 2004; Ritter, 2011; Goergen et al., 2009; Dimson, 2012; Aussenegg, 2006), as well as for Hungary and Poland for the 1990's (Lyn and Zychowicz, 2003), existed also on the CEE markets in the 2000's. In addition, our findings for Polish IPOs are similar to recent studies (e.g., Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Zaremba and Żmudziński, 2014), which provide a lower level of first-day underpricing in comparison to the previous studies.

In order to test robustness of results and to perhaps find some patterns that might be related to certain subgroups of IPOs, we have tested for underpricing in the group of the most relevant IPOs (defined as all IPOs with IPO values above EUR 10 mln, which were not subsequently delisted), in the group of IPOs in the emerging CEE region (i.e. excluding IPOs in somewhat specific and more developed Austrian CEE market), and lastly (because of such a large proportion of delisted IPO companies) in the group of IPOs that subsequently went through delisting procedure. We see that results of the total sample are predominantly driven by the most relevant IPOs, as the results in the two groups are very similar, both in terms of economic and statistical meaning. Results for the 63 emerging CEE markets IPOs (i.e. excluding IPOs on Austrian market) show that underpricing is noticeably higher for emerging CEE capital markets than for the CEE region as a whole. The significant first-day positive adjusted returns in the emerging CEE region range from 8.4 to 13.0 percent. The last part of Panel A of Table 2-3 report average adjusted initial IPO returns for delisted IPOs. Interestingly, we see that not all delisted IPOs (in models 3 and 4) have statistical significant initial returns and that in case of model 4 its average is even negative. As models 3 and 4 report IPO value-weighted returns, results show that this

effect is predominantly caused by larger cases. This is an interesting finding worth researching further.

Table 2-3: CEE IPO initial returns.

Market	Number of IPOs	Model 1 (IR)	Model 2 (CIR)	Model 3 (WIR)	Model 4 (WCIR)
<b>Panel A: Hypothesis 1</b>					
<b>CEE capital markets</b>					
Bucharest SE	4	22.4%	26.8%	0.2%	0.3%
Bulgarian SE	13	-4.5%	0.0%	0.1%	0.5%
Ljubljana SE	2	20.1%	56.0%	1.7%	3.7%
Prague SE	2	0.6%	0.3%	0.0%	0.0%
Vienna SE	23	4.0%	-0.5%	-2.0%	-2.9%
Warsaw SE	128	13.9%	9.9%	5.3%	3.5%
<b>ALL</b>	<b>172</b>	<b>11.3%***</b>	<b>8.6%***</b>	<b>5.4%**</b>	<b>5.0%</b>
<b>Most relevant IPOs (Tradeable &amp; &gt; EUR 10 mln)*</b>					
<b>ALL</b>	<b>76</b>	<b>11.0%***</b>	<b>8.2%***</b>	<b>5.6%**</b>	<b>3.5%</b>
<b>Emerging CEE Relevant IPOs (excluding Vienna SE)</b>					
<b>ALL</b>	<b>63</b>	<b>13.0%***</b>	<b>10.3%***</b>	<b>8.1%**</b>	<b>8.4%**</b>
<b>Delisted IPOs</b>					
<b>ALL</b>	<b>47</b>	<b>12.2%**</b>	<b>8.2%*</b>	<b>0.3%</b>	<b>-3.2%</b>
<b>Panel B: Hypothesis 2</b>					
<b>Small IPOs (&lt; 10 mio EUR IPO value)</b>					
<b>ALL</b>	<b>62</b>	<b>13.5%***</b>	<b>9.1%***</b>	<b>12.5%***</b>	<b>8.6%***</b>
<b>Significance of differences (&gt; EUR 10 mln minus &lt; EUR 10 mln)</b>					
<b>ALL</b>	<b>76/62</b>	no	no	yes (<1%)	yes (<10%)

Notes: IR – index-adjusted initial return; CIR – CAPM-adjusted initial return; WIR – IPO value-weighted initial return; WCIR – IPO value-weighted initial return; \* Sample excludes 5 outliers. Test t-statistics indicate the level of significance that average adjusted initial returns are greater than zero for the sample. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

According to the Hypothesis 2, we find that small IPOs (i.e. IPOs with IPO values smaller than EUR 10 mln) exhibit positive initial returns in range between 8.6 and 13.5 percent (see Panel B of Table 2-3). We see that underpricing is somewhat higher in case of every separate model compared to total sample. To test the differences, we have additionally run t-tests between smaller IPOs and only their larger counterparts (i.e. IPOs with IPO values greater than EUR 10 mln). Differences were found significant in both IPO value-weighted model specifications. This finding is consistent with asymmetric information theory (Ritter, 1991; Bradley et al., 2006; Konku and Bhargava, 2012) and provides piece of evidence for the CEE markets similar to ones reported by Ritter (1991), Ritter et al. (2013), Gao et al. (2013), Bradley et al. (2006) and Konku and Bhargava (2012) for developed

markets. For the region, such evidence are so far non-existent. Namely, for continental Europe Alvares-Otero and Gonzalez-Mendez (2006) did not find such differences. Just the opposite, they showed that larger firms (in terms of IPO value) that executed IPOs on Spanish market are the ones that had greater initial returns in the period 1985-1997. Lyn and Zychowicz (2003) for the CEE report size of the offering as an insignificant determinant of underpricing for Polish and Hungarian IPOs during 1991-1998 periods. Similarly, Jewartowski and Lizińska (2012) documented higher initial returns for “smaller” Poland issuers; however the difference in the average returns was again not statistically significant.

To further analyze the comparison of underpricing for CEE markets with developed EU markets we have compared initial adjusted returns of an individual CEE IPO in the sample of 76 most relevant IPOs calculated by all 4 models with initial adjusted returns of the chosen IPO on developed EU capital market calculated by the respective model. The Hypothesis 3 that initial returns on CEE and developed EU capital markets are equal is rejected with statistical significance for model 1 and 2 (Table 2-4). Again, larger IPOs drive results in models 3 and 4 (because of the weighting). Overall, results indicate that underpricing for CEE region is higher than that for developed EU region in case of smaller IPOs and for emerging CEE market (see Table 2-4). The statistical significant difference between average adjusted emerging CEE initial returns and developed EU IPO initial returns range from 5.4 to 8.7 percentage points.

Performing the t-tests also led us to an interesting finding. Namely, when checking whether t-test should be run with variances assumed equal or different, we have found that volatility of initial returns within the CEE region is significantly higher than volatility within developed EU region, regardless of how initial returns are measured (see the last two columns of Table 2-4). All significance levels are all below 1%. Higher initial returns can thus be interpreted as remuneration for the higher risk borne in markets than are institutionally less developed (see description of the CEE capital markets) and exhibit higher volatility of returns.

In general, our results for underpricing are consistent with the findings reported by many studies on IPO underpricing (Jenkinson and Ljungqvist, 2001). In general however, underpricing in the 2000s was noticeably lower (both within EU markets as well as within CEE markets) than for developed EU countries a decade before the 2000s (see Table 3 in the Appendix). This is perhaps due to the post high-tech bubble effect and to the fact that the most of observed IPOs were conducted by companies from real sector (i.e. non IT/high-tech; see Figure 2-3).

Table 2-4: CEE and EU IPO initial returns comparison.

	CEE	EU	CEE - EU	t-stat	St. dev. CEE/ St. dev. EU	F-stat
<i>CEE capital markets</i>						
<b>Model 1 (IR)</b>	11.0%	5.2%	5.8 pp	1.812 (.036)**	>1	3.124***
<b>Model 2 (CIR)</b>	8.2%	2.7%	5.4 pp	1.686 (.047)**	>1	3.155***
<b>Model 3 (WIR)</b>	5.6%	6.5%	-0.9 pp	-0.278 (.391)	>1	2.522***
<b>Model 4 (WCIR)</b>	3.5%	4.3%	-0.7 pp	-0.196 (.422)	>1	3.792***
<i>Emerging CEE capital markets (excluding the Vienna SE)</i>						
<b>Model 1 (IR)</b>	13.00%	4.30%	8.7 pp	2.379 (.010)***	>1	3.747***
<b>Model 2 (CIR)</b>	10.30%	1.70%	8.6 pp	2.339 (.011)**	>1	3.885***
<b>Model 3 (WIR)</b>	8.10%	6.40%	1.8 pp	1.505 (.307)	>1	2.209***
<b>Model 4 (WCIR)</b>	8.40%	3.90%	4.4 pp	1.012 (.157)	>1	4.796***

Notes: IR – index-adjusted initial return; CIR – CAPM-adjusted initial return; WIR – IPO value-weighted initial return; WCIR – IPO value-weighted initial return; Test t-statistics and p-values (in parentheses) indicate the level of significance that the CEE average adjusted initial returns are lower/greater than EU average adjusted initial returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%. The F-statistics tests the null hypothesis that the variances of CEE average adjusted initial returns are lower/greater than the variances of EU average adjusted initial returns.

To test Hypothesis 3a we have compared initial adjusted returns (calculated by all 4 models) of an individual CEE IPO with initial adjusted returns of the chosen IPO from developed EU capital market (calculated by respective model) by using Pearson's correlation and testing with the one-tailed *t*-test. Table 2-5 reports the correlation coefficients for adjusted initial returns between CEE and developed EU IPO sample. The main finding is that correlations between these two samples in general are very low and insignificant; therefore the hypothesis 3a that there is a positive correlation between IPO initial returns on CEE capital markets and developed EU capital markets is rejected.

Table 2-5: CEE and EU IPO initial returns correlation.

	Correlation Coef. (CEE)	Correlation Coef. (Emerging CEE)
<b>Model 1 (IR)</b>	0.053	0.07
<b>Model 2 (CIR)</b>	0.035	0.063
<b>Model 3 (WIR)</b>	-0.082	-0.084
<b>Model 4 (WCIR)</b>	-0.214**	0.028

Notes: IR – index-adjusted initial return; CIR – CAPM-adjusted initial return; WIR – IPO value-weighted initial return; WCIR – IPO value-weighted initial return; Test t-statistics indicate the level of significance of differences of correlations between the CEE and EU average adjusted initial returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test.

## 2.4.2 Long-run Underperformance

Table 2-6 summarizes the aftermarket IPO performance for the CEE region. The hypothesis 4 that average adjusted long-run returns are negative is confirmed with statistical significance for the total sample for the 3-years period for all models, having returns from -14.5 to -31.3 percent, and for 3 models (except for Model 1) for 2 years, having returns from -10.5 to -20.8 percent. In general, we find evidence of long-run underperformance in shorter periods after the IPO as well. Overall, our results unambiguously support the Hypothesis 4 that IPOs on CEE capital markets in the long run underperform benchmark companies, measured both by abnormal returns towards the local market benchmark and by using CAPM risk adjustment. Interesting though is that larger subgroup of IPOs did exhibit higher returns (i.e. not much negative).<sup>7</sup> This might be a reflection of the two facts. *First*, that such IPOs are more easily investable, and *second*, by the time CEE capital markets enjoyed period of enthusiasm and bullish sentiment among investors.

Very interesting results are obtained by analyzing the samples of small IPOs to test Hypothesis 5. Smaller IPOs have higher (more negative) 3-years underpricing that in case of bigger IPOs (see Panel B in Table 2-6). All models yield statistically significant returns. The same results are obtained when we compare results in model 1 (or 2) to respective IPO value-weighted underpricing model 3 (or 4) in the same sample (i.e. unweighted vs IPO value-weighted). Even more interestingly, smaller IPOs have statistical significant negative return already after 1 and 2 weeks of trading. However, when we run t-tests to test significance of the differences, differences in one and two weeks are too volatile to show up as significant. But differences throughout three-year horizon in Model 3 and Model 4 specifications (CAPM risk adjustment) are nevertheless significant. Results of higher long-run underperformance for smaller IPOs (H5) are consistent with many findings for developed capital markets in the 2000s (Ritter, 2011; Gao et al., 2013; Vismara et al., 2012; Ritter et al., 2013) and also Poland (Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014).

In addition, we were testing behavior of IPOs that subsequently delisted. When we compare the magnitude of underperformance of such IPOs, we see that there is much higher underperformance for delisted IPOs (see middle section of Table 2-6) than for the survivor IPO companies (i.e. those that remain listed). What is interesting though is that bigger delisted IPOs have higher underperformance in 1, 2 and 3 years than smaller delisted IPOs. Namely, when we compare results of Model 1 to Model 3 (and similarly Model 2 to Model 4) Model 3 and Model 4 show much higher magnitude of underperformance.

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<sup>7</sup> See results under section CEE capital markets (> EUR 10 mln IPO value) in Table 2-6.



Table 2-6: CEE IPO long-run returns.

	<b>Model 1 (BHAR)</b>	<b>Model 2 (CAPM)</b>	<b>Model 3 (WBHAR)</b>	<b>Model 4 (WCAPM)</b>
<i>Panel A: Hypothesis 4</i>				
<i>CEE capital markets (N=172)</i>				
<b>1 week</b>	0.8%	-2.9%***	0.9%	-2.0%
<b>2 weeks</b>	0.5%	-3.0%***	1.1%	-1.9%
<b>1 year</b>	3.6%	-3.5%	-7.7%**	-13.7%***
<b>2 years</b>	-4.7%	-16.7%***	-10.5%***	-20.8%***
<b>3 years</b>	-17.2%***	-31.3%***	-14.5%***	-27.0%***
<i>CEE capital markets (&gt; EUR 10 mln IPO value) (N=76)</i>				
<b>1 week</b>	1.2%	-2.6%**	0.2%	-3.2%**
<b>2 weeks</b>	2.5%	-1.3%	1.5%	-2.6%*
<b>1 year</b>	6.9%	0.4%	-1.0%	0.0%
<b>2 years</b>	3.4%	-8.8%	-2%	0.3%
<b>3 years</b>	-2.4%	-16.9%**	-0.8%	-9.8%
<i>Delisted IPOs (N=47)</i>				
<b>1 week</b>	3.2%*	-0.7%	4.2%	0.7%
<b>2 weeks</b>	1.9%	-1.6%	1.0%	-2.0%
<b>1 year</b>	-3.0%	-12.6%	-21.5%***	-28.3%***
<b>2 years</b>	-14.2%*	-27.5%***	-32.1%***	-51.3%***
<b>3 years</b>	-26.8%***	-41.8%***	-39.8%***	-55.8%***
<i>Panel B: Hypothesis 5</i>				
<i>Small IPOs (&lt; EUR 10 mln IPO value) (N=62)</i>				
<b>1 week</b>	-1.8%*	-5.9%***	-1.0%***	-4.7%***
<b>2 weeks</b>	-3.2%**	-6.9%***	-2.2%***	-5.6%***
<b>1 year</b>	9.4%	3.9%	14.8%	9.7%
<b>2 years</b>	4.2%	-2.3%	5.3%	-2.0%
<b>3 years</b>	-15.2%***	-25.3%***	-13.4%***	-24.5%***
<i>Differences (&gt; EUR 10 mln minus &lt; EUR 10 mln IPO value)</i>				
<b>1 week</b>	no	no	no	no
<b>2 weeks</b>	no	no	no	No
<b>1 year</b>	no	no	<10%(wrong s.)	No
<b>2 years</b>	no	no	No	No
<b>3 years</b>	no	no	yes (<10%)	yes (<5%)

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics indicate the level of significance that average adjusted returns are greater/lower than zero. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

Our findings regarding delisted IPOs raise very interesting research question about why companies in the CEE region decide to delist. We have run the logit regressions (with dependent variable: delisted IPO (=1) or tradable IPO (=0) and tested whether initial returns (i.e. IPOs considered as flops from the very beginning of trading) have any predicting power regarding the survivorship status of IPOs. With the exception of statistical significant negative relation between delisted IPO and 2-year buy-and-hold abnormal return, we haven't found any significant relations. Since underpricing and underperformance in general is not the reason for delisting, an interesting research question is what is then the main reason? Due to our limited data for delisted IPO in the CEE region, we weren't able to address this question further. Perhaps, delisting decisions are related to firm performance and M&A activities in this region as was indicated in academic literature for delistings in developed EU IPO markets (Brau et al., 2012; Liu et al., 2013). So this question remains to be addressed and calls for further research both within CEE region as well as within developed markets.

In order to test the robustness of our results we use three additional methods: the mean monthly CTARs, the SCTARs, and the CARs on the same groups of IPOs as presented in Table 2-6. Our results for one-, two-, and three-year long-run returns are additionally confirmed (Table 2-7). Further, the results with the calendar-time approach (especially SCTAR) are more statistically significant compared to our original models. This is in contrast to Darmetko's (2009) finding of no existence of abnormal returns when using the calendar-time abnormal returns. However, we can argue that the claim that the existence of the IPOs' long-run abnormal performance is also highly dependent on the method used. Less conclusive results are namely provided by a CAR method, which is in contrast to Jewartowski and Lizińska (2012) who report results for that method that are slightly lower results than the BHARs for the Polish IPOs.

Table 6 in the Appendix presents also the results of long-run returns for the most relevant 76 IPOs compared to 63 IPOs excluding Austrian market (i.e. including only emerging CEE IPOs with IPO values above EUR 10 mln). Results indicate that IPOs in emerging CEE markets yielded higher long-run returns compared to the sample where IPO cases from somewhat more developed Austrian market are included (see also Tables 7 and 8 in the Appendix for individual capital markets). This might be due to the fact that CEE capital markets enjoyed period of favorable market sentiment throughout the mid-2000s. Namely, EU accession provided increased interest by international investment community and as a consequence windows of opportunities for companies to acquire funds in the market appeared. Market capitalizations in the CEE markets increased significantly throughout this period and stock markets provided relatively long periods of sustained high performance.

Table 2-7: CEE IPO long-run returns – calendar portfolio and cumulative approach.

	CTAR	SCTAR	CAR
<b>Panel A: Hypothesis 4</b>			
<i>CEE capital markets (N=172)</i>			
<b>1 year</b>	-1.5%***	-18.8%***	-0.4%
<b>2 years</b>	-1.7%***	-18.1%***	-4.5%
<b>3 years</b>	-1.5%***	-16.6%***	-13.5%**
<i>CEE capital markets (&gt;10 mio EUR IPO value) (N=76)</i>			
<b>1 year</b>	-0.3%	-8.5%**	0.1%
<b>2 years</b>	-0.5%	-12.1%**	4.8%
<b>3 years</b>	-0.3%	-9.7%**	3.1%
<i>Delisted IPOs (N=47)</i>			
<b>1 year</b>	-2.1%**	-22.5%***	-11.7%
<b>2 years</b>	-1.6%**	-17.9%***	-27.8%**
<b>3 years</b>	-1.8%***	-19.2%***	-43.7%***
<b>Panel B: Hypothesis 5</b>			
<i>Small IPOs (&lt; 10 mio EUR IPO value) (N=62)</i>			
<b>1 year</b>	-0.2%	-8.7%*	9.3%*
<b>2 years</b>	-1.0%	-16.1%***	6.5%
<b>3 years</b>	-1.0%**	-17.8%***	-3.5%
<i>Differences(&gt;10 mio EUR minus &lt; 10 mio EUR IPO value)</i>			
<b>1 year</b>	no	no	<5% (wrong s.)
<b>2 years</b>	no	no	no
<b>3 years</b>	no	no	no

*Notes:* CTAR = mean monthly Calendar Time Abnormal Return, SCTAR = Standardized Time Abnormal Return, CAR = cumulative abnormal returns; Test t-statistics indicate the level of significance that average adjusted returns are greater/lower than zero. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

To test Hypothesis 6 we have used the same method as in case of the comparison of CEE and developed EU IPO initial returns. We have compared long-run adjusted returns (calculated by all 4 models) of an individual CEE IPO with long-run adjusted returns of the chosen benchmark IPO on developed EU capital market. The results in Table 2-8 show in general average adjusted long-run returns for all observed periods are higher (i.e. less negative or even positive) on CEE capital markets compared to the developed EU capital markets (model 1 and model 2). However, only in some examples statistically significant results are obtained. Again, more diverse results are reported for emerging CEE capital markets (Table 9 in the Appendix). Hypothesis 6 (stating that average long-run adjusted returns on CEE and developed EU capital markets are equal) is rejected with statistical significance for model 1 and 2 for 1 year and for model 1 and 4 for 2 years. Results however, are here not very robust.

Table 2-8: CEE and EU IPO long-run returns comparison.

	CEE	EU	CEE-EU	St. dev. CEE/ St. dev. EU	F-stat	CEE	EU	CEE-EU	St. dev. CEE/ St. dev. EU	F-stat
	<b>Model 1 (BHAR)</b>					<b>Model 2 (CAPM)</b>				
<b>1 week</b>	1.20%	0.10%	1.10pp	>1	2.86***	-2.60%	-2.60%	0.00pp	>1	3.246***
<b>2 weeks</b>	2.50%	-0.30%	2.80pp*	>1	3.047***	-1.30%	-2.80%	1.50pp	>1	3.383***
<b>1 year</b>	6.90%	-10.20%	17.1pp**	>1	1.163	0.40%	-15.10%	15.5pp**	>1	1.794***
<b>2 years</b>	3.40%	-7.70%	11.10pp*	<1	0.674**	-8.80%	-20.70%	12.00pp	>1	1.392*
<b>3 years</b>	-2.40%	-13.70%	11.30pp	<1	0.808	-16.40%	-24.70%	8.30pp	<1	0.92
	<b>Model 3 (WBHAR)</b>					<b>Model 4 (WCAPM)</b>				
<b>1 week</b>	0.20%	-1.00%	1.20pp	>1	5.181***	-3.20%	-3.30%	.10pp	>1	3.154***
<b>2 weeks</b>	1.50%	-.70%	2.20pp	>1	7.061***	-2.60%	-3.00%	.40pp	>1	4.169***
<b>1 year</b>	-1.00%	-8.30%	7.3pp	<1	0.568***	.00%	-11.20%	11.3pp	>1	1.067
<b>2 years</b>	-0.20%	-3.60%	3.4pp	<1	0.396***	.30%	-17.20%	17.50pp*	<1	0.582***
<b>3 years</b>	-0.80%	-6.90%	6.1pp	<1	0.2792	-9.80%	-17.50%	7.70pp	<1	0.907

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics (showed in column CEE-EU) indicate the level of significance that the CEE average adjusted returns are lower/greater than EU average adjusted returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test. The F-statistics tests the null hypothesis that the variances of CEE average adjusted returns are lower/greater than the variances of EU average adjusted returns.

The most interesting evidence however is, that the volatility of adjusted returns in the CEE region is significantly higher than that in the developed EU region for 1 and 2-weeks adjusted returns and very consistent and significantly lower for 1, 2 and 3-years adjusted returns for all calculation models (Table 2-8). The results are similar for CEE market or emerging CEE markets (Table 9 in the Appendix). We assume that in the shorter time period (1 and 2-weeks after IPO listing) IPO adjusted return are more volatile due to characteristics of these (emerging) CEE capital markets (i.e. higher uncertainty, lower liquidity, lack of institutional investors as shown in Table 5 in the Appendix and Figure 2-2), however the fluctuation of prices is stabilized in the long run. We argue that this results might be a reflection of bullish capital markets, as CEE markets were in the most of the 2000s (i.e. before 2008; see Figure 2-1) experiencing increasing stock prices. Thus, the long-run IPO performance is higher (i.e. less negative or in some cases even positive) and also less volatile than respective returns of comparable IPOs on the developed EU capital markets. This is in line with empirical findings that price volatility is lower in bullish capital markets (Kumar and Dhankar, 2010 and Engle and Ng, 1993).

Results in this paper thus provide comprehensive and consistent results. CEE markets exhibit higher initial returns that are more volatile, which is in line with the emerging character of these markets. This holds even more for IPOs of smaller IPO value that are plagued with information asymmetry issue to a greater extent than larger issues. Regarding long-run performance, bullish market sentiment, coupled with EU accession provided very favorable environment for issuers and investors alike, resulted in trending stock prices, IPO long-run outperformance and low volatilities of stock returns over longer holding periods.

To test Hypothesis 6a we have again compared respective long-run adjusted returns of an individual CEE IPO with long-run adjusted returns of the chosen IPO on developed EU capital market by using Pearson's correlation and by testing with the one-tailed *t*-test. Table 2-9 reports the correlation coefficients for adjusted long-run returns between CEE and developed EU IPO sample for a specific time period. The results are so diverse that the Hypothesis 6a (stating that there is a positive correlation between IPO long-run returns on CEE capital markets and developed EU capital markets) cannot be confirmed.

Table 2-9: CEE and EU IPO long-run returns correlation.

	1 week	2 weeks	1 year	2 years	3 years
<i>CEE capital markets</i>					
<b>Model 1 (BHAR)</b>	-0.016	-0.057	-0.042	-0.199**	-0.068
<b>Model 2 (CAPM)</b>	-0.013	-0.015	0.057	0.062	-0.009
<b>Model 3 (WBHAR)</b>	0.151*	-0.010	-0.242**	-0.271***	0.074
<b>Model 4 (WCAPM)</b>	0.210**	0.128	-0.013	0.174*	0.058
<i>Emerging CEE capital markets (excluding the Vienna SE)</i>					
<b>Model 1 (BHAR)</b>	-0.075	-0.099	-0.039	-0.149	0.036
<b>Model 2 (CAPM)</b>	-0.052	-0.071	0.047	0.091	0.013
<b>Model 3 (WBHAR)</b>	0.010	-0.290	-0.177*	-0.212**	-0.064
<b>Model 4 (WCAPM)</b>	-0.015	0.069	0.070	0.431***	0.026

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return. Test t-statistics indicate the level of significance of differences of correlations between the CEE and EU average adjusted returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test.

## 2.5 Conclusions

This paper provides unique insight into IPO performance of six CEE capital markets in the 2000s. Using a database of 172 CEE IPOs we have confirmed initial-day underpricing using both, index-adjusted and CAPM-adjusted returns with alternative weightings. We proved significant first-day positive adjusted returns in the CEE region and even more

positive significant average first-day adjusted IPO returns for smaller IPOs, and for emerging CEE capital markets (i.e. CEE markets excl. the Vienna SE). In general, the unweighted index and CAPM-adjusted initial returns provide higher CEE IPO initial returns than respective weighted-adjusted returns. Distribution of IPO transaction sizes and their respective performance convince us that size importantly drives the differences in initial returns.

Moreover, we have proven that during the 2000-2009 period average adjusted initial returns on CEE capital markets were statistical significantly higher than on developed EU capital markets for index-adjusted and CAPM-adjusted calculation methods. We have compared the performance of each of the most relevant 76 IPO on CEE capital market with a similar (according to industry and a comparable market capitalization size or IPO value size) IPO on developed EU capital market. This difference is even more significant in case of emerging CEE markets (i.e. CEE excl. the Vienna SE). Furthermore, we have shown that volatility of adjusted initial returns for CEE region is statistically and economically significantly higher than that for developed EU region. This result is intuitive as emerging markets have higher volatility of macroeconomic and institutional environment that is also reflected in the stock return volatility. Such greater uncertainties obviously translate to the IPO transactions that are by their nature highly uncertain.

This paper also provides the evidence of the long-run underperformance of CEE IPOs. We have shown that IPOs in CEE capital markets underperform benchmark companies in the long run. Results are more obvious and significant for smaller IPOs and the ones that are later delisted. For the most relevant and bigger IPOs the results are less clear-cut. We obtain negative cumulative returns for this group, but significance level is only confirmed in CAPM-adjusted model and in standardized calendar portfolio approach. BHAR and CAT approaches provide weaker results; therefore we can argue that the existence of IPOs' long-run abnormal performance is also highly dependent on the methodology used.

In contrast to results for initial returns, the comparison of CEE and developed EU IPO adjusted long-run returns, where delisted and small IPOs were not taken into account, does not provide clear conclusions. Namely, average adjusted long-run returns are in general higher (i.e. less negative) on CEE capital markets than on developed EU capital markets, but only in some examples we obtain statistically significant results for the period of one and two years. The volatility analysis however provides interesting piece of evidence. We have shown that the volatility of adjusted returns for CEE region is significantly higher than that for developed EU region for 1 and 2-weeks adjusted returns and in very consistent and significantly lower for 1, 2 and 3-years adjusted returns. We argue that in the shorter time period (1 and 2-weeks) after IPO listing, IPO adjusted returns are higher and more volatile due to characteristics of these CEE capital markets such as highly volatile macroeconomic and business environment, lower liquidity, lower amount of

information available, and perhaps lack of institutional investors (relative to the more developed capital markets). However, the fluctuation of prices is stabilized in the long run. We assume this could be a result of the fact that CEE capital markets were in a bullish period in the most of the 2000s and the annual local benchmark index returns in the CEE region significantly outperformed developed European countries. This outperformance impacted (i.e. increased) the IPO long-run performance in the long run. Consistent with the empirical studies that price volatility is lower in bullish capital markets, we have shown that in general long-run performance of IPOs is both higher (i.e. less negative or in some cases even positive) and less volatile compared to the developed EU markets. Our mixed results about long-run performance of IPOs in the emerging CEE markets thus are highly likely a result of the character of emerging markets, which typically in some buoyant years significantly outperform developed markets.

We can sum up the analysis on emerging CEE capital markets (excl. the Vienna SE) with the finding that in general IPOs on emerging CEE markets have higher underpricing and lower underperformance, compared to the entire CEE region (i.e. incl. the Vienna SE). This is because the performance of IPOs on the Vienna SE is more similar to those on the developed EU markets, having on average lower underpricing and higher underperformance than that on emerging CEE markets. However, when comparing the volatility of respective IPO return we did not find considerably different results for emerging CEE market to those for entire CEE market; which we believe is because the Austrian capital market also shares some common characteristics with emerging CEE capital markets.

Additionally, paper provides interesting results regarding the performance of CEE IPOs of different size and for those that are delisted. Smaller IPOs have higher (more negative) 3-years underperformance that in case of the total sample. Even more interestingly, smaller IPOs have statistical significant negative return already after 1 and 2 weeks of trading. We have shown that bigger delisted IPOs on average don't record substantial initial positive returns; while smaller delisted IPOs do and in addition, these smaller IPOs also record higher (i.e. less negative) long-run performance compared to bigger delisted IPOs. Delisted companies in general exhibit much higher magnitude of negative long-run performance compared to survivor IPO companies. These findings raise a very relevant research question about why companies in the CEE region (and IPO companies in general) decide to delist. Running logit regressions using underpricing and underperformance as independent variables, we have concluded that they are not the reason for delisting decisions. Perhaps, delisting decisions are related to firm performance and M&A activities in this region as was indicated in academic literature for delistings in developed EU IPO markets.

Our results provide welcome implications for both issuers, who decide to execute an IPO on an emerging capital market, as well for investors in IPO stocks. In case of emerging CEE capital markets issuers might want to influence the expected higher initial IPO underpricing compared to the developed markets, in order to soften the dilution of the current shareholders. This is especially important for smaller IPOs, for which issuing company should provide as much information as possible to alleviate information asymmetry. In times of the bullish emerging stock markets issuers might enjoy less unstable long-run performance, which avoids potential financial distress and the need to further tap the capital market. For investors emerging IPOs are even more attractive than IPOs in the developed markets. This holds for both initial returns as well as for long-run performance; however investors shall be especially cautious in case of smaller IPOs and riskier firms with potential to be removed from trading (i.e. delisted), since they can record substantial long-run underpricing.



### **3 IPO CYCLES IN CENTRAL AND EASTERN EUROPE: WHAT FACTORS DRIVE IPO ACTIVITIES?<sup>8</sup>**

#### **3.1 Introduction**

The substantial part of initial public offering (IPO) literature explains the phenomenon of IPO cycles, i.e. the fact that IPOs most often come in waves. Jenkinson and Ljungqvist (2001) reported a positive autocorrelation for the US between 1960 and 1999: periods of high IPO volume are likely to be followed by further heavy IPO activities. This is known as “hot issue” phenomenon. The evidence of IPO cycles have been documented by many authors mostly for the US and developed European capital markets (Ritter, 1984; Lowry and Schwert, 2002; Benveniste et al., 2003; Yung et al., 2008).

Regarding the IPOs, the 2000s exhibited a very dynamic period on developed capital markets. First we have witnessed the fall of the dot-com bubble, which was followed by buoyant capital market environment until 2007, when financial turmoil hit capital markets tremendously. Since IPOs play an important role through the capital-raising function of capital markets, a fluctuation of IPOs was exhibited as well in this period. Loughran and Ritter (2004) and Günther and Rumber (2006) showed this phenomenon during the dot-com bubble period. Furthermore, Ritter et al. (2013) studied the IPO activities on developed EU markets from 1995-2011 and showed that European IPO volume had been depressed by lower market valuation following the collapse of the technology bubble, the “panic” of 2008 and the Eurozone crisis.

In the 2000s, Capital markets in the Central and Eastern Europe (CEE) region were in the second decade of their existence, as most of the capital markets in the CEE region were established in parallel with liberalisation of economic environments of CEE countries approximately two and a half decades ago. The only exception in the CEE region in this respect was Austria, which had by then already had a longer stock market tradition and a liberal economic regime. For many reasons the development of such relative young capital markets together with their capital-raising function is very important for emerging economies. Bekaert et al. (2005) illustrate how equity market liberalizations lead to an increase in annual real economic growth. Similar Mendelson and Peake (1993) argue that in emerging economies the sooner sound equity markets are established, the sooner there will be sound benchmarks for evaluating privatized or private firms. Perotti and Guney (1993) also emphasized the role of large-scale privatization programs that have contributed to non-debt financing of the public deficit, attracted foreign capital and technology, and promoted the return of flight capital.

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To our best knowledge, IPOs in the CEE region, especially in the 2000s, have been poorly documented in the existing literature. Because the Warsaw Stock Exchange was dominating and was often ranked second or third by IPO value in the EU in the late 2000s (IPO Watch, PWC, 2003–2011), most researchers have focused on Polish market solely (Darmetko, 2009; Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba and Kaminski, 2011; Zaremba and Żmudziński, 2014). Most of the relevant literature related to IPOs in this region covers (mass) privatisation processes and their outcomes in the 1990s, providing assessments of the impact of voucher privatisation on capital market development (Perotti and Guney 1993, Aggestam, 2006; Aussenegg and Jelic, 2007; Jelic et al., 2003). The studies showed some evidence of underpricing and underperformance; however determinants of IPO in the CEE region are less known and under-investigated.. Therefore, our intention is to fill this gap in this part of academic literature and answer the question what factors drove IPOs in the CEE region during the 2000s.

Our paper contributes in several aspects. We provide original evidence of IPO cycles in the period 2000–2009 in the CEE region (stock exchanges of Bucharest, Sofia, Ljubljana, Prague, Vienna and Warsaw). Results show that number of IPOs and underpricing are positively correlated. In addition, we provide a unique comparison of CEE IPO cycles with IPO cycles in developed EU capital markets, represented by IPO activities on the Deutsche Boerse, whose bank-based financial environment is similar to those in CEE countries. Countries in the CEE region have strong economic links with the developed EU regions, especially with the Continental Europe. CEE markets have however, only recently started to provide a channel for acquisition of sources of finance for companies and were throughout the study period much less developed. We show cycles are moderately correlated. The most essential part of our study is the analysis of main drivers of IPO cycles and drivers of underpricing in the CEE region. In line with some previous findings for Poland, we show that apart from macroeconomic conditions, investor sentiment is the most important driver of both IPO activities and IPO underpricing. These results provide valuable insights for potential investors, issuers and policy makers in this region and other emerging capital markets.

The paper is organised as follows. First we review the existing literature for IPO cycles and IPO main macro and micro driving factors. Chapter three provides hypotheses. In the fourth chapter data collection and its description are presented, and in the fifth we describe our methodological approach. In chapter six we report our main findings and in the last chapter we conclude.

## 3.2 Literature Review

### 3.2.1 IPO Cycles

Usually IPOs come in waves. “Hot issue” phenomenon is the observation that many companies go public at about the same time. Jenkinson and Ljungqvist (2001) reported a positive autocorrelation for the US between 1960 and 1999: periods of high IPO volume are likely to be followed by further heavy IPO activities. Authors argue that the timing of IPO should depend on factors that determine the trade-off between the costs and benefits of a stock market listing.

Hot and cold IPO periods can be classified in terms of variables commonly used in the literature, i.e. number of IPOs and average underpricing. Underpricing happens when shares that go public are offered to investors at prices considerably below the prices at which they trade later on the stock exchange. There is much evidence in IPO literature that IPO volume and underpricing are positively correlated (Ritter, 1984; Lowry and Schwert, 2002; Benveniste et al., 2003). Ritter (1984) analyzed hot market of 1980 and reported the first order autocorrelation for the time series of monthly average of initial returns of 0.62. The autocorrelation of monthly IPO volume (i.e. number of IPOs) was even stronger, with a first order autocorrelation of 0.88. He suggested that if high-risk offerings represent an unusually large fraction of IPOs in some periods, these periods should also have unusually high average initial returns. Similarly, Lowry and Schwert (2002) indicate that IPO volume tend to be higher following periods of especially high initial returns. Their findings suggest that both the cycles in initial returns and the lead-lag relation between initial returns and IPO volume are predominantly driven by information learned during the registration period. More positive information results in higher initial returns and more companies filing IPOs soon thereafter. Benveniste et al. (2003) also provided evidences that hot and cold markets tend to alternate and generate clustering of IPOs. They argue that issuers go public during a temporary window of opportunity and price information from past IPOs spill over to current and future offerings, affecting the decision to go public. More recently Ritter et al. (2013) using sample for developed EU capital markets from 1995 to 2011 confirmed the positive correlation between IPO volume and the average initial IPO returns one quarter before observed IPOs. Similarly, Zaremba and Kaminski (2011) reported the hot issue market for Poland, showing positive correlation between average arithmetical rates of return on IPO investments and the number of IPOs of 0.65 in particular years in the 2000s.

Using the sample for the US between 1960 and 1996 Lowry (2003) showed that IPO volume fluctuates substantially over time and reported the first-order autocorrelation of quarterly IPO volume of 0.87. However, in contrary to many other evidences, she did not find a significant relation between abnormal IPO returns and IPO volume. IPO volume was

found to be significantly negatively related to both raw IPO post-issue returns and to post-issue market returns. Benveniste et al. (2003) also show that initial returns and IPO volume are positively correlated in the aggregate. However, similar to Lowry's findings the correlation is negative among contemporaneous offerings subject to a common valuation factor.

More recent studies focus on a decline of IPOs after 2000s. Gao et al. (2013) reported that during 1980-2000, an average of 310 IPOs occurred each year in the US, but this has fallen to an average of only 99 IPOs per year during 2001-2012. Even more dramatically, an average of 165 small company (pre-IPO inflation-adjusted annual sales of less than \$50 million) IPOs occurred each year, and this number has dropped by more than 80% to an average of only 28 deals per year during 2001-2012. Ritter et al. (2013) studied the IPO activities on developed EU markets from 1995-2011 and showed that European IPO volume had been depressed by lower market valuation following the collapse of the technology bubble, the "panic" of 2008 and the Eurozone crisis.

### **3.2.2 IPO Drivers**

According to comprehensive academic research on IPO drivers there could be a number of factors influencing hot issue markets, such as pre-issue ownership, information asymmetry, ex-ante uncertainty, investor sentiment, rising of share prices, deregulation of listing requirements, attractiveness of business environment or business cycles. Based on Günther and Rumber (2006) there are basically two explanations for the cyclical nature of IPO market. There are periods when a large number of firms need fresh capital to invest new projects, or there are periods when investors have a lot of money to invest or might be specifically optimistic. Similarly we can divide IPO drivers into two main categories, i.e. macro and micro IPO factors.

Benninga et al. (2005) offered macro explanation regarding the hot issue markets. Namely, they argue that changes in macroeconomic conditions simultaneously affect multiple industries and companies. Thus, when one company finds it optimal to issue stocks, so do other firms. In their model, the entrepreneur trades-off the gains of diversification against the benefits of being private. During times in which cash flows are sufficiently high, the potential advantages from diversification outweigh these private benefits and the firm goes public. Similarly, Lowry (2003) argued that not only firms' demand for capital but also investor sentiment is an important factor of IPO volume. She argued that firms seem to successfully go public when a broad class of firms, often the entire market, is valued especially high. She showed that companies are more likely to have IPO when adverse selection costs are lower and firms' demands for capital and investor sentiment is high. This is in line with the information asymmetry theory arguing that when information asymmetry is very high, adverse selection costs of issuing capital are greater, and firms

rarely decide to go public or they postpone an IPO until decreases in the costs of issuing capital. Similar findings confirming positive impact of the capital market climate were reported recently for developed EU capital markets by Ritter et al (2013). Using sample from 1995 to 2011 the positive correlation between IPO activity and the equity index stood out in their regression model. Gajewski and Gresse (2006) analyzed various features of the European IPO market over the period from 1995 to 2004 and also confirmed that initial underpricing is positively linked to information asymmetry in the after-market.

Some of the most recent studies focus also on regulatory changes, especially Sarbanes-Oxley Act of 2002, which could have an impact on a decline on IPO activities. Ritter (2011) suggests that although regulatory burdens undoubtedly account for some of the decline of IPOs, much of the decline may be due to a structural shift that has lessened the profitability of small independent companies relative to their value as part of a larger, more established organization that can realize economies of scope. In line with Ritter's findings, Gao et al. (2013) analyzing US IPOs in the last decade argue that regulatory overreach hypothesis is unable to explain many facts, and many of its predictions are not supported. They supported economies of scope hypothesis saying that there has been a fundamental change in many sectors of the economy whereby the importance of bringing products to market quickly has increased. They predicted that independent small companies shall have lower profits relative to their potential profits generated as part of a larger organization that can realize economies of scope and rapidly expand production. They predicted that fewer firms are going public and staying independent because greater value is created in a sale to a strategic buyer in the same or a related industry.

Majority of academic research studying micro IPO factors analyse initial IPO returns and models to explain the level of underpricing. Among the first Rock's (1982) model illustrated positive relations between risk and initial return. He suggests that the level of underpricing required to attract uninformed investors increases with the ex-ante uncertainty about the true value of the firm. Similarly, Ritter (1984) argues that adverse selection models can explain IPO time-series patterns in case the risk composition of firms (measured by annual sales figures) changes across time. Pagano et al. (1998) analysed some additional determinants of IPOs by comparing the ex-ante and ex- post characteristics of IPOs with those of private firms using a large database of private firms in Italy. They indicated that the going-public decision is strongly influenced by the pre-IPO and post-IPO ownership. They suggested that companies appear to go public not to finance future investments and growth, but to rebalance their accounts after high investment and growth. Similarly, Habib and Ljungqvist (2001) developed a model which relates underpricing with the magnitude of dilution insiders suffer on the shares they retain. They show that the larger the sale of secondary shares in IPO, the lower is underpricing. Further, the greater the increase in the shares outstanding (as the result of the issuance of primary shares), the smaller is the level of underpricing. They also suggest that owners can affect

the level of underpricing through the choices they make in promoting an issue, such as which underwriter to hire or on what stock exchange to list IPO shares.

More recently, Alavi et al. (2008) also investigated the impact of pre-issue ownership structure on the key decisions surrounding an IPO. They found out that managerial ownership before IPO is significant related to the proportion of shares offered, share allocation and direct-issue related costs. Namely, when managers are important owners, the IPO tends to be smaller and allocation is performed in the way that managers can retain their control in the company. They also showed that firms held by less diversified shareholders are more likely to go public and suffer a higher underpricing. Huyghebaert and Quan (2009) investigated share issuing privatizations in China during 1994–2005 and found only little evidence that uncertainty over the value of firm assets influences first-day abnormal returns. In contrast, variables measuring government commitment to privatization were found to significantly affect underpricing.

Loughran and Ritter (2004) analyzed the trend in firm characteristics such as sales, assets, ownership structure, industry, underwriter prestige in the USA IPO sample over 1980 – 2003. They conclude that the reasons that IPOs are underpriced vary depending on environment and that variation in firm characteristics are not sufficient to explain underpricing trends during the observed period. A small part of the increase of underpricing can be attributed to the changing risk composition of firms going public. The second tested explanation was a realignment of incentives, where authors argue that managerial incentives to reduce underpricing have decreased during time due to reduced CEO ownership and a high fraction of IPOs with no secondary shares. They found only weak cross-sectional relations between underpricing and both the fraction of the firm sold and a dummy variable for a pure primary offering. They attribute much of the higher underpricing during the bubble period to a changing issuer objective function (analyst coverage and side payments to CEO and venture capitalists). IPO literature also generally assumes that a high degree of pre-IPO leverage serves as a positive signal of firm quality as it forces a firm's managers to adhere to tough budget constraints. Impact of firm leverage on IPO activities was studied by Kim et al. (2008). They found that debt only serves as a signal of better firm quality for low-tech IPOs, as reflected in lower underpricing. For high-tech IPOs, the effect of leverage is reversed: for these firms, higher leverage is associated with increased risk and uncertainty as reflected by greater underpricing.

Studies for the continental EU region report similar finding. Lyn and Zychowicz (2003) analysed underpricing of IPOs in Hungary and in Poland in the period 1991-1998. Their cross-section regression analysis found that market momentum measured by the percentage change in the local market index one month prior to the offering day, was a significant and primary determinant of initial returns in both countries. The evidence suggested that over

the study period, the degree of underpricing was determined by the intensity of demand driven by investor interest where offering prices did not fully adjust to the prevailing market conditions. Similarly, Aussenegg (2006) argued that the initial abnormal returns in Austria can be best explained by the ex-ante uncertainty similar to the model of Rock (1982) and the market climate, i.e. the relationship between underpricing and the performance of the stock market. Correspondently, Jewartowski and Lizińska (2012) documented strong explanatory power of early aftermarket volatility, issuer's size, growth opportunities, and profitability before the offering and Lizińska and Czapiewski (2014) provided evidence on the relation between both the company size and profitability and the aftermarket price performance for Poland IPOs in the 2000's. In contrary, Sieradzki's (2013) observation goes against information asymmetry theories of Poland IPOs underpricing, since he found no significant relationship between the initial return and the size of the offer. He also reported that market conditions at the time of the IPO are not significant either. Contrary, Meluzin et al. (2013) identified stock market conditions, conditions in the business sector and investors' interest as determinants of IPOs timing on the Warsaw stock exchange in that period.

Guidici and Roosenboom (2006) provided similar results for European new markets until 2000s. They showed that market returns, the IPO firm's risk and price revision in the premarket are positively related to first-day returns, whereas IPO deal flow is inversely related to underpricing. Goergen et al. (2009) reported first-day underpricing in Germany (Neuer Markt) and in France (Nouveau Marché) in the period 1996-2000. They found that the high underpricing in these two markets – contrary to the evidence on the US – is not driven by insiders' selling behaviour. However, the large underpricing is caused by the high degree of riskiness of the issuing firms and by the partial adjustment phenomenon of offer prices to compensate institutional investors for the truthful revelation of their demand for the shares.

Ljungqvist et al. (2006) also show that the underpricing puzzle can be explained by the presence of sentiment investors. They model an IPO company's optimal response to the presence of sentiment investors. "Regular" investors are allocating stock that they subsequently sell to sentiment investors. Because sentiment demand may disappear prematurely, carrying IPO stock in inventory is risky, so for regular investors to break even the stock must be underpriced. The issuer still gains as the offer price capitalizes part of the expected trading gain by regular investors. Similarly, Günther and Rumber (2006) analysed the hot-issue period during dot-com bubble in Germany and confirmed by using different cross-sectional regressions that investor sentiment was a driving factor of IPO underpricing. In addition, Yung et al. (2008) showed that exogenous shocks to investment opportunities cause time-varying adverse selection in the IPO market. They illustrated that economic expansions are associated with a dramatic increase in the number of firms going public.

Corporate governance regulatory changes in the beginning of the 2000s, routed in Sarbanes-Oxley Act of 2002, could also have an impact on underpricing as well. Akyol et al. (2014) used a sample of 3,677 European IPOs during the period 1998–2012 to examine how the adoptions of corporate governance codes by Member States of the EU have affected IPO underpricing on Member State-regulated markets. They find that, on average, IPO underpricing declined on Member State-regulated markets after Member States adopted corporate governance codes containing Sarbanes-Oxley Act-like provisions. They did not find a similar reduction in IPO underpricing on exchange-regulated markets (i.e. less regulated second markets; e.g. AIM in London, Neuer markt in Germany and Nouveau Marche in France vs. main markets – Member State-regulated markets). Similarly, Ekkayokkaya and Pengniti (2012) argued that underpricing of IPOs in Thailand significantly drops following the country's major governance reform, indicating less price-protection by investors, which is associated with fewer instances of absolute control retention by pre-issue insiders during the post-reform period, not reduction in the expropriation risk. Authors indicated that while corporate disclosure does not reveal issuers' true risk type before the reform, it does so after the reform.

### 3.3 Hypotheses

Based on the characteristics of the CEE capital markets (see chapters 1.6 and 2.2.1), we test five hypotheses regarding IPOs in the CEE region in the 2000s. First three are related to IPO cycles. Our first main research question is oriented at existence of IPO cycles in the CEE capital markets, i.e. the existence of hot and cold IPO market, similar to ones reported for various developed markets. Zaremba and Kaminski (2011) reported the hot issue market for Poland. We test hypothesis for the CEE region as a whole during the buoyant ten-year period and compare results to the existing literature. Further, we are interested in relations between IPO cycles and underpricing in the CEE markets. Thirdly, since the countries in the CEE region have strong economic links with the EU's developed regions (especially with the Continental Europe with similar bank-based financial environment) we test whether IPO cycles in the CEE markets (if they exist) are related to cycles in the capital markets of developed Europe. Hypotheses, related to the existence of IPO cycles are thus: **Hypothesis 1:** There are hot and cold issue markets in the CEE capital markets. **Hypothesis 2:** Number of IPOs and underpricing of IPOs in the CEE capital markets are positively correlated. **Hypothesis 3:** There is a positive correlation between number of IPOs in the CEE capital markets and EU's developed capital markets.

*Further*, we analyze factors that influence the occurrence of IPOs (drivers of IPOs) and factors that influence IPO initial returns (i.e. underpricing). After some interesting findings were reported for Poland (Jewartowski and Lizińska, 2012; Lizińska and Czapiewski, 2014; Meluzin et al. 2013), we want to test hypotheses for the CEE region as a whole and compare results to the existing literature. We work with two hypotheses here:



**Hypothesis 4:** Main (macro) factors influencing hot issue IPO markets (i.e. number of IPOs) are investor sentiment, share prices, market liquidity and business cycles.

**Hypothesis 5:** Main (micro and macro) factors influencing IPO underpricing are information asymmetry, market climate, pre-IPO ownership structure, performance and leverage of companies and ex-ante uncertainty.

### 3.4 Data Collection and General Data Description

#### 3.4.1 Data Collection

Our sample covers 246 IPOs in the period 2000–2009 on the stock exchanges of Bucharest, Sofia, Ljubljana, Prague, Vienna and Warsaw (Table 3-1). Budapest stock exchange was excluded because no IPO was conducted in the observed period. To provide appropriate overview of IPOs Table 3-1 shows IPOs divided into three groups: IPOs that were delisted till the end of 2012, smaller IPOs with less than EUR 10 million of new funds raised and those IPOs with at least EUR 10 million of new funds raised (with primary or/and secondary shares). In case of double listings we took into account the IPO in the domestic market. We also included privatisations of public companies (14 examples of such IPOs), but only if they were public offerings (e.g. privatised initial public offering – PIPO). We have divided IPOs into three groups, since the available information for the first two groups and therefore possible respective analyses are limited. The most relevant IPOs tradable, with at least EUR 10 million of IPO value represent 36% of IPOs and 71% of total IPO value. 36% of companies that executed IPOs had been delisted by the end of 2012 (Table 3-1).

Table 3-1: CEE IPO sample, 2000 – 2009.

	IPO delistings		IPO value < 10 mio EUR		IPO value >= 10 mio EUR		Total	
	No of IPOs	IPO value	No of IPOs	IPO value	No of IPOs	IPO value	No of IPOs	IPO value
2000	6	302,740,000			2	1,277,746,871	8	1,580,486,871
2001	2	23,070,000			1	48,300,000	3	71,370,000
2002	1	4,500,000			1	11,000,000	2	15,500,000
2003	5	1,181,892,698			0	0	5	1,181,892,698
2004	3	173,106,447	2	9,580,977	5	2,083,021,257	10	2,265,708,681
2005	19	459,192,567	12	64,616,148	14	2,468,880,705	45	2,992,689,420
2006	14	874,859,085	17	134,946,200	16	1,946,562,132	47	2,956,367,417
2007	22	1,332,871,004	21	127,751,830	37	2,132,406,087	80	3,593,028,921
2008	15	306,693,311	10	94,430,202	9	2,504,062,177	34	2,905,185,690
2009	2	11,199,997	7	24,355,744	3	216,477,750	12	252,033,492
Sum	89	4,670,125,109	69	455,681,102	88	12,688,456,979	246	17,814,263,190

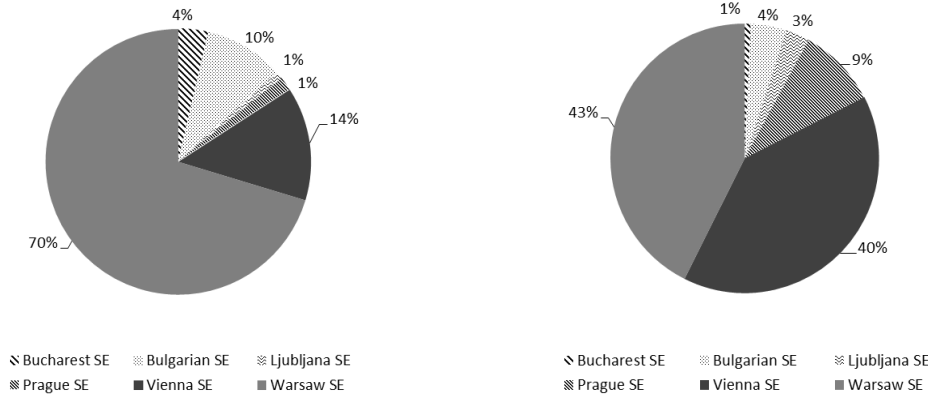
Sources: CEE stock exchanges & companies; own calculations.

We collected the list of companies that went public from the stock exchanges' internal documentation and from the websites of the stock exchanges, double checking the obtained figures against the detailed case-by-case IPO information on companies' web sites, in IPO prospectuses and companies' annual reports. Datastream provided the market share prices, indices prices and the fundamental micro and macro valuation factors, such as companies' yearly sales and leverage figures, GDP growth and private consumption growth per countries. OECD and World Bank databases provided macro indicators, such as pension, investment and mutual fund assets per countries.

**3.4.2 Descriptive Statistics**

The prevailing capital markets in CEE IPO sample are the Warsaw SE (70% of IPOs and 43% of IPO value in the sample) and the Vienna SE (with 24% and 40% of respective shares) (Figure 3-1). 22% of companies that completed an IPO were manufacturers (e.g. building materials, plastic materials, sports equipment) and 19% other services (e.g. developers, hotels) (Figure 3-2). The following four industries that represent approx. 10% each were high tech companies, financial institutions, trade and construction. The most delistings were in industries other services and high tech. This result shows that the “old economies” were the dominating industries in the CEE region. Although the distribution of IPO companies among industries was rather dispersed, a decline of the “new economies” is evident. The industry distribution of IPO companies in the CEE region and in the total EU was similar in the observed period. According to PwC (2009), the top performing sectors (industrial goods & services, investment companies, technology, financial services, construction & materials, real estate) in terms of the number of IPOs in 2009 remained the same as in 2008.

Figure 3-1: Distribution of IPOs by capital markets; no. of IPO (left) & IPO value (right), 2000 – 2009.

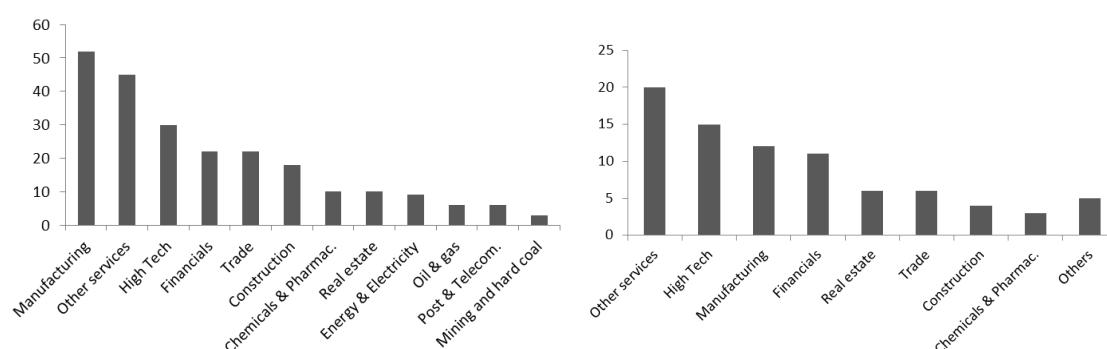


Sources: CEE stock exchanges & companies; own calculations.

Due to the limited company-specific data for delisted and smaller IPOs, descriptive statistics is divided into two parts: for the total sample of 246 IPOs and for the sample of

tradable 88 IPOs (Table 3-2). The average IPO size for sample of 246 (88) IPOs was EUR 72.4 (144.2) million. The average index-adjusted initial IPO return was 12% (13%), with the average volatility 30 days after the first trading day of 3% for both samples.<sup>9</sup> Index return as the measurement for the performance of the benchmark index at respective stock market in the 3-months period before the beginning of the subscription period was on average 3% for both samples. Performance of companies one year before IPO was on average positive (e.g. income to assets ratio of 10% and 7%, sales to assets ratio of 163% and 136% and quite low leverage, measured by net debt to assets ratio, of 11% and 17% for sample of largest 88 IPOs and total sample, respectively. Additional data for the sample of largest 88 IPOs show that on average capital was increased by 23%, resulting in the average post-IPO company size of EUR 512.5 million.

Figure 3-2: Distribution of IPOs by sector, total (left) & delistings (right), 2000 – 2009.



Sources: CEE stock exchanges & companies; own calculations.

Table 3-2: Descriptive statistics of numeric IPO variables.

<b>Panel 1</b> <b>(Total sample)</b>	<b>Sum</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Value of IPO shares in EUR*</b>	17,814,263,190	72,415,704	209,308,263	35,138	1,895,309,124
<b>Index-adjusted initial return**</b>		12%	31%	-79%	194%
<b>Index return**</b>		3%	12%	-43%	38%
<b>Volatility***</b>		3%	3%	0%	25%
<b>Net debt/assets****</b>		11%	26%	-65%	69%
<b>Income/assets****</b>		10%	12%	-11%	98%
<b>Sales/assets****</b>		163%	140%	0%	823%

Notes: \*Total sample of  $N = 246$ ; Due to limited data availability calculations are limited to: \*\*  $N = 231$  (Data provided by individual stock exchange); \*\*\*  $N = 214$  (Data provided by Datastream); \*\*\*\*  $N = 149$  (Data provided by Datastream); \*\*\*\*\* IPOs.

(table continues)

<sup>9</sup> More detailed analysis of IPO underpricing in the CEE region in the 2000s was provided by Berk and Peterle (2014). They provided evidence of IPO underpricing in CEE in the 2000s by using both, index-adjusted and CAPM-adjusted initial returns with alternative weightings.

(continued)

<b>Panel 2</b> <b>(IPO value &gt;= 10 mio EUR)</b>	<b>Sum</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Value of IPO shares in EUR</b>	12,688,456,979	144,187,011	301,385,956	10,751,162	1,895,309,124
<b>Market capitalization in EUR</b>	45,097,660,444	512,473,414	1,029,476,965	34,391,179	5,027,345,157
<b>% of primary shares (Share increase)</b>		23%	15%	0%	75%
<b>% of secondary shares</b>		14%	19%	0%	85%
<b>Index-adjusted initial return</b>		13%	30%	-20%	194%
<b>Index return</b>		3%	11%	-41%	37%
<b>Volatility</b>		3%	2%	0%	18%
<b>Net debt/assets</b>		17%	27%	-65%	69%
<b>Income/assets</b>		7%	7%	-5%	28%
<b>Sales/assets</b>		136%	113%	0%	523%

Notes: Total sample of  $N = 88$  IPOs; The **value of IPO shares** represents the total amount of raised capital (with primary and secondary shares), calculated by multiplying the number of shares and the IPO price.

**Market capitalisation** is the multiple of the post-IPO number of shares and the IPO price. **% of primary (secondary) shares** is the ratio of new (existing) shares in an IPO to the total number of shares outstanding before the IPO. **Index return** is the performance of the benchmark index at respective stock market in the 3-months period before the beginning of the subscription period. **Volatility** is standard deviation of the first 30 daily returns. **Financial ratios** (Net debt/assets; Income/assets; Sales/assets) are company's financial ratios one year before an IPO.

Sources: Datastream; CEE stock exchanges & companies; own calculations.

### 3.5 Methodology

Using similar model as Ritter (1984) and Lowry (2003), we calculate the first order autocorrelation for the time series of number of IPOs and monthly average of initial returns to test Hypothesis 1 and 3. We group IPOs into 119 monthly cohorts. We calculate a correlation coefficient by using Pearson's correlation of the stationary time-series (tested with the augmented dickey-fuller test) and testing with the one-tailed  $t$ -test.

In order to find relations and possible explanations of IPO drivers, a multiple regression analysis with a range of independent variables is used. Thus, for *Hypothesis 4* we test the dependence between monthly number of IPO per capital market and various yearly macro determinants per respective country. If available we also use quarterly data (e.g. bond yields, industrial production change). For testing *Hypothesis 5* we use index-adjusted initial return as dependent variable and different proxies for micro and macro determinants of underpricing. We use OLS multiple regression. Table 3-3 provides complete list of determinants which we use in multiple regressions for *Hypothesis 4* and *Hypothesis 5*.

In order to analyze macro drivers for number of IPO we use different proxies for investor sentiment, i.e. investment funds as a percentage of equities in total assets of investment

funds and growth in pension funds one year before IPO in the respective country. Similarly, we could have used mutual funds as a proxy, but due to high correlation with investment funds variable we excluded this variable. According to Benninga et al. (2005) and Lowry (2003) there are many possible proxies for business cycles, as GDP growth, productivity, consumption, sales growth, etc. We focus on those, which are available for the CEE region. Thus, we use GDP growth one year or two quarters before IPO and government bond yields in the respective country as business cycle proxies.

Table 3-3: Variables used in the testing of Hypothesis 4 and 5.

<b>Hypothesis</b>	<b>Proxy</b>	<b>Variable</b>
<b>Macro IPO factors – monthly IPO number per capital market as independent variable (Hypothesis 4)</b>		
Business cycles	GDP 2	GDP growth change 2 quarters before an IPO
	GDP 2q	GDP % change 2 quarters before an IPO
	IP 1	Industrial production change 1 quarter before an IPO
	Bond 2	Yields to maturity of government bonds 2 quarters before an IPO
Capital market performance	Index	Average benchmark index return 90 days before respective month
Activity of market participants	Turnover	Ln(yearly absolute change in respective market turnover (USD) 1 year before an IPO)
Investor sentiment/risk aversion	Investment funds	% change of assets, shares and other equity in total financial assets in investment funds one year before an IPO (for OECD countries)
	Pension funds	Ln(yearly absolute change in pension funds in respective country (USD) 1 year before an IPO)
<b>Macro and micro underpricing factors - index-adjusted initial return as independent variable (Hypothesis 5)</b>		
Pre-IPO company's performance	ROE	ROE 1 year before an IPO
	Income	Net profit (income)/assets 1 year before an IPO
Ex-ante uncertainty	Volatility	Share volatility 30 days after first trading date (standard deviation of returns)
Capital market performance	Index	Benchmark index return 90 days before an IPO subscription period
Business cycles	GDP	Yearly GDP growth 1 year before an IPO
	Bond 3	Yields to maturity of government bonds 3 quarters before an IPO
	IP 2	Industrial production change 2 quarter before an IPO

In line with many authors (Lowry 2003; Lyn and Zychowicz 2003; Aussenegg, 2006; Guidici and Roosenboom, 2006; Ritter, 2013) we use the average performance of the stock market 90 days (authors use various time periods; e.g. 30, 45 days or 3 months) before the beginning of the subscription period as a proxy for the market climate. We also add the absolute yearly change in respective market turnover for market climate proxy. All above listed authors indicate that market returns are also positively related to first-day returns, frequently this is even a significant and primary determinant of initial returns. The index returns could be also a proxy for investment sentiment.

Similar to Loughran and Ritter (2004) we use several proxies for analyzing relationship between underpricing and performance of companies before their going-public decision, i.e. ROE and income to assets ratio one year before IPO. In addition, we add the share volatility (standard deviation of daily returns for the first 30 days after the first trading date) as a proxy for the ex-ante uncertainty, i.e. IPO company's risk. Similar proxy was used by many authors (Rock, 1982; Ritter, 1984; Ausenagg, 2006, Goergen et al., 2009), showing that the IPO company's risk is positively related to first-day returns. In addition, we add market climate, proxied by performance of the stock market 90 days before the beginning of the subscription period, and some macro indicators (i.e. yearly GDP growth one year before IPO, bond yields three quarters before IPO).

For *Hypothesis 4* and *Hypothesis 5* we firstly identified the outliers with scatterplots for dependent and various independent variables and reduce sample excluding a small number of outliers (index-adjusted initial returns over 150% and ROE below -100%). Next we run regressions with univariates to identify relevant variables to be included in multivariate regressions. To verify that different groups of proxies do capture distinct factors, we examined the correlation between independent values as well. Taking into account the correlations between independent variables and in order not to combine correlated independent variables in the same regression, we have developed several model specifications for *Hypothesis 4* and *Hypothesis 5*.

The choice of proxies in many ways depends on available data and available micro and macro indicators for the CEE region for the observed period. We could also use other determinants as proxies, e.g. the same macro indicators but for different time periods, mutual funds as a proxy for investment sentiment, but due to high correlation with the chosen ones, we ignore them in regression analysis and we use those proxies, which reported the highest statistical significance.

We haven't reported the results for the indicators, which have not provided statistical significant relationship with number of IPOs or underpricing or had provided mixed results, such as micro performance factors (i.e. sales to assets ratio, leverage measured by net debt to assets ratio); indicator for asymmetric information (proxied by IPO value and measured as a product of the IPO (offering) price and the number of shares being offered (primary and secondary shares included), and also by IPO market capitalization); pre-IPO structure (dummy of family/state owned IPOs); the significance of ownership dilution (measured by the share of secondary and primary shares in IPO). These results are in line with Lyn and Zychowicz (2003), who for instance reported no significant relation between the magnitude of IPO underpricing and the value of offering for Polish and Hungarian IPOs and in line with Loughran and Ritter (2004) who argue that in general variation in firm characteristics are not sufficient to explain underpricing trends during the observed period.

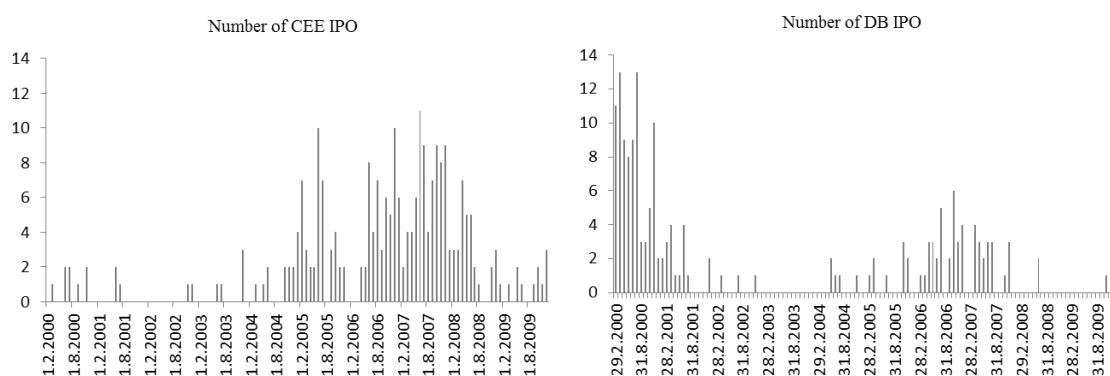
## 3.6 Results

### 3.6.1 IPO Cycles

To answer our first question, i.e. to test if IPOs in the CEE region are cyclical, we have calculated autocorrelations for number of IPOs and average underpricing on a monthly frequency. Figure 3-3 and Table 3-4 report that there are IPO cycles in the CEE region, having the first order autocorrelation for the time series of monthly average of number of IPOs of 0.68 for period between 1.2.2000 and 31.10.2009, which confirms our *Hypothesis 1* regarding the existence of IPO cycles in the CEE region. The results are similar to those for developed capital markets reported by Ritter (1984) or Lowry (2003). We calculated also the first order autocorrelation separately for the most active period after 1.5.2004 and 1.1.2005 (Table 3-4), in order to omit the effect of months with no IPOs. Namely, before 1.5.2004 there are many months without IPOs. The first order autocorrelation for the time series of monthly average of number of IPOs are all statistical significant and amounted to 0.58 and 0.39 respectively. These coefficients are a bit lower compared to the total sample, because months without IPOs had positively impacted autocorrelation measure for the entire period between 1.2.2000 and 31.10.2009. We have also calculated the first order autocorrelation for the time series of monthly equally weighted average of index-adjusted initial returns, similar to many empirical contributions to the literature (Ritter, 1984, Lowry and Schwert, 2002). Table 3-5 and Figure 11 in the Appendix show that this autocorrelation is much lower than for number of IPOs and is statistical significant only for the total sample. This result could be partly related also to the fact that samples for all three observed periods in Table 3-5 are in some extent reduced comparing to the sample in Table 3-4 due to missing data on index-adjusted initial returns. Figure 11 in the Appendix showing monthly IPO value also indicates that IPO value is not an indicator for IPO cycles. We have checked the autocorrelation of IPO monthly volume and results are very diverse, which shows that IPO volume is not relevant for IPO cycles determination. Small and large IPOs are conducted in hot and cold issues period.

In order to test the *Hypothesis 2* (i.e. that the number of IPOs and underpricing of IPOs in CEE capital markets are positively correlated), we have calculated correlation coefficient for the same samples, as for autocorrelations of initial returns (see Table 3-5). Similar to Ritter (1984) and Lowry and Schwert (2002) we have determined a positive moderate correlation between numbers of IPOs and underpricing. Result is robust across all three time periods. We can thus confirm our *Hypothesis 2* that volume (i.e. number of IPOs) and underpricing of IPOs in CEE capital markets are positively correlated.

Figure 3-3: Number of IPOs in CEE (left) and on Deutsche Boerse (right), 2000–2009.



Sources: CEE stock exchanges & companies; Deutsche Boerse; own calculations.

Table 3-4: Autocorrelation of monthly IPO number in the CEE region.

Period	No. of IPOs	Autocorr.	t-stat	Stationary test <sup>1</sup>
1.2.2000 – 31.12.2009	246	0.684***	10.139 (0.000)	true
1.5.2004 – 31.12.2009	227	0.579***	5.773 (0.000)	true
1.1.2005 – 31.12.2007	172	0.393***	2.490 (0.003)	true

Notes: Test t-statistics and p-values (in parentheses) indicate the level of significance for autocorrelation for monthly IPO number. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test.

<sup>1</sup>Stationary test is an augmented dickey-fuller (ADF) test at the 5% level for constant and trend.

Table 3-5: Autocorrelation of adjusted initial returns and correlation of monthly IPO number and adjusted initial returns in the CEE region.

Period	No. of IPOs*	Autocorr. Index-adjusted	t-stat Initial return	Stationary test <sup>1</sup>	Corr. coef No of IPOs/index-adjusted IR	t-stat
1.2.2000 – 31.12.2009	231	0.250***	2.779 (0.003)	true	0.276***	3.089 (0.001)
1.5.2004 – 31.12.2009	217	0.138	1.130 (0.131)	true	0.268**	2.263 (0.014)
1.1.2005 – 31.12.2007	166	0.044	0.0257 (0.340)	true	0.269*	1.628 (0.056)

Notes: \* Sample reduced due to missing data of index-adjusted initial returns. Test t-statistics and p-values (in parentheses) indicate the level of significance for autocorrelation for monthly average index-adjusted initial returns and correlations between the number of CEE IPOs and average index-adjusted initial returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test.

<sup>1</sup>Stationary test is an augmented dickey-fuller (ADF) test at the 5% level for constant and trend.

In order to test *Hypothesis 3*, thus to compare IPO activities in CEE region with the ones on developed (Western) EU capital markets; we added the IPO data for Deutsche Boerse in the observed period. In contrast to Anglo-Saxon countries, Germany has continental bank-



based financial environment, where listed companies represent only a small segment of all companies, similar to all CEE countries. We believe that Germany is the most suitable market to compare CEE capital markets with, as Germany market was also often used as a role model for CEE countries by the time they were rebuilding their capital markets in the beginning of transition.

There were 173 IPOs on Deutsche Boerse with total IPO value of EUR 37.9 billion between 2000 and 2009 (see Figure 3-3). Figure 3-3 and Table 3-6 report that there are IPO cycles on Deutsche Boerse, having the first order autocorrelation for the time series of monthly average of number of IPOs of 0.72 for period between 1.2.2000 and 31.10.2009 (0.41 for the period between 1.5.2004 and 31.10.2009 and 0.22 the period between 1.1.2005 and 31.12.2007). According to autocorrelation results the IPO cycles were stronger on German capital market than on CEE capital markets when considering the total sample. The IPO hot issue period in Germany in 2000 is evident due to dot-com bubble. This was not the case in the CEE region, where high tech IPO bubble due to relative recent liberalisation of economic environments did not have a potential to develop. Namely, at that time period there was almost no IPO market in the CEE, as capital markets have only existed for a very limited time-period, were quite immature with non-existent institutional investment tradition.

Table 3-6: Autocorrelation of IPO monthly number on Deutsche Boerse and CEE and Deutsche Boerse monthly number of IPO correlation.

Period	No. of DB IPOs	No. of CEE IPOs	Deutsche Boerse			CEE /Deutsche Boerse	
			Autocorr.	t-stat	Stat. test <sup>1</sup>	Correl.	t-stat
1.2.2000 – 31.12.2009	173	246	0.722***	11.297 (0.000)	true	0.079	0.852 (0.198)
1.5.2004 – 31.12.2009	66	227	0.405***	3.603 (0.000)	true	0.400***	3.541 (0.000)
1.1.2005 – 31.12.2007	58	172	0.223*	1.335 (0.095)	false	0.217*	1.296 (0.102)

Notes: Test t-statistics and p-values (in parentheses) indicate the level of significance for autocorrelation for monthly IPO number and correlations between the CEE and Deutsche Boerse monthly IPO number. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test.

<sup>1</sup>Stat. test is an augmented dickey-fuller (ADF) test at the 5% level for constant and trend.

Table 3-6 also provides a comparison of the CEE and Deutsche Boerse monthly IPO volume, measured by monthly number of IPOs for the whole observed period and for shorter period, where the effect of dot-com bubble was omitted and after the accession of CEE countries to EU. The main finding is that correlation between these two samples is positive moderate and significant in the most relevant period between 1.5.2004 and 31.10.2009 (without dot-com bubble on Deutsche Boerse and after the CEE accession to EU) and also in the most active buoyant period between 1.1.2005 and 31.12.2007. In

accordance with this result we argue that positive IPO trends on developed EU capital markets (i.e. Deutsche Boerse) have had some positive spillover effect on IPO activities in the CEE region in the beginning of the second half of 2000s, which resulted in emergence of an IPO cycle (i.e. hot IPO market) in the CEE countries. This result supports our *Hypothesis 3* that there is a positive correlation between number of IPOs in CEE capital markets and in developed EU markets.

In addition, autocorrelation IPO coefficients on the German capital market after high-tech bubble are lower compared to results for the total period of the 2000s and for developed IPO markets until 2000s (Ritter, 1984; Lowry, 2003). Thus, our results support recent findings (Gao et al., 2013; Ritter et al., 2013) that IPO volume had been depressed on developed capital markets in 2000s by lower market valuation following the collapse of the technology bubble. Moreover, higher autocorrelation coefficients of number of IPOs for the CEE region than for German capital markets after dot-com bubble (Table 3-4 and Table 3-6) indicate that in contrary to decline of European IPO volume, the hot issue market in the CEE region has blossomed in the mid-2000s (especially the Warsaw SE; although other CEE markets recorded the highest number of IPOs as well). However, CEE IPO volume had also been depressed after 2008 due to the financial turmoil.

In contrary to findings for developed capital markets that show that regulatory burdens are to be blamed for the decline of IPOs, we could even claim that since the middle of the 2000s (i.e. after the CEE accession to the EU) the common (and in many respect more rigorous) regulation that was transposed from developed capital markets to CEE markets, had helped to foster IPO activities in the CEE region. Namely all CEE countries joined the EU in the mid-2000s and therefore went through the process of harmonisation of their national regulations with the EU rules and practices (e.g. the Prospectuses Directive, the Market Abuse Directive and related regulatory frameworks).

### **3.6.2 Drivers of IPO Cycles**

In Table 3-7 we report regression results for *monthly number of IPO per capital market* as dependent variable and various macro drivers. Taking into account the correlations between independent variables and in order not to combine correlated independent variables within the same regression, we have developed five different model specifications. In addition in Model 6 we report results when taking into account all dependent variables.

Table 3-7: IPO drivers in the CEE region (N=231).

N=231 (1.2.2000 – 31.12.2009)

Dependent variable	Monthly number of IPOs per capital market					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Indep. variables						
Constant	-17.28 (-7.4)***	-18.67 (-7.6)***	5.56 (10.5)***	3.91 (6.3)***	-20.62 (-8.04)***	-8.6 (-2.63)*
GDP 2				1.89 (8.6)***		0.67 (2.09)**
GDP 2q					14.84 (3.58)***	9.28 (1.82)*
IP 1		0.22 (2.53)***			0.26 (3.19)***	0.07 (0.63)
Bond 2	-50.14 (-5.23)***		-58.87 (-5.65)***	-42.9 (-4.19)***		-54.8 (-5.5)***
Index				0.99 (0.83)		1.17 (0.17)
Turnover	0.88 (10.46)***	0.82 (8.99)***				-0.32 (-0.95)
Invest. funds			0.18 (9.32)***			0.09 (4.3)***
Pens. funds					0.89 (9.16)***	0.98 (2.7)***
Adj. R-squared	0.390	0.336	0.346	0.314	0.390	0.517
Sample	216	216	201	223	211	188
P-value (F stat)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: GDP 2 = GDP growth change 2 quarters before an IPO; GDP 2q = GDP % change 2 quarters before an IPO; IP 1 = Industrial production change 1 quarter before an IPO; Bond 2 = Yields to maturity of government bonds 2 quarters before an IPO; Index = Average benchmark index return 90 days before respective month; Turnover = Ln(yearly absolute change in respective market turnover (USD) 1 year before an IPO); Invest. funds = % change of assets, shares and other equity in total financial assets in investment funds one year before IPO (for OECD countries); Pens. funds = Ln(yearly absolute change in pension funds in respective country (USD) 1 year before IPO). See Table 3-3 for further specification of variables. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

The Model 1 and the Model 2 in Table 3-7 show strong support for the importance of yearly turnover growth before an IPO, which shows activity of market participants and market volume and thus proxies for investor sentiment. As shown in Model 4 also capital market performance, measured by average benchmark index return before an IPO, has a positive yet insignificant impact. The important factor obviously is business cycle,

measured by different proxies: GDP growth and GDP growth change two quarters before an IPO (see Model 4 and Model 5), industrial production change one quarter before an IPO (see Model 2 and Model 5) and yields to maturity of government bonds 2 quarters before IPO (see Model 1, Model 3 and Model 4). We have checked different lag-specifications (one-to-four quarters before an IPO) in regressions with GDP growth, industrial production change and bond yields. We found that results were the most significant for indicators for 2 quarters before an IPO. All models in Table 3-7 support the thesis that investor sentiment and business cycles have a positive impact on IPO activities.

Finally, with the Model 3 in Table 3-7 we estimated the impact of investment funds' relative portfolio allocations into equity, which is a measure of risk aversion and again proxies for investor sentiment. Impact was found to be positive and highly significant. The Model 5 in Table 3-7 also proves positive impact of growth in pension funds one year before IPO, which is again proxy for investor sentiment. The results in Model 6 show that the strongest IPO drivers are business cycles, proxied by government bonds price movements and investor sentiment. The results thus strongly support positive relation between investor sentiment and business cycles by different variables and number of IPOs, which is in line with many reported findings (Lowry, 2003; Benninga et al., 2005; Meluzin et al. 2013).

We have checked the heteroscedasticity-consistent standard errors and run the regressions with the robust standard errors for the original sample (Table 12 in the Appendix), which provided even more robust results with the higher R-squared results.

In addition, to check the robustness of the sample we run the regression also for the sample, which covers the most active buoyant period between 1.1.2005 and 31.12.2007. Exercise confirmed our results (Table 3-8). Therefore, we can conclude that apart from macroeconomic cycle, the most relevant macro driver for IPOs in the CEE region in the 2000s was investor sentiment, proxied by either activities of market participants, or by aggressiveness of capital allocations of investment funds, or size of portfolios of pension funds.

Table 3-8: IPO drivers in the CEE region (N=166).

N=166 (1.1.2005-31.12.2007)

Dependent variable	Monthly number of IPOs per capital market					
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-25.01 (-8.03)***	-28.64 (-9.32)***	6.29 (10.95)***	4.80 (5.75)***	-25.62 (-8.85)***	-13.87 (-2.61)***
GDP 2				1.52 (4.83)***		0.83 (1.89)*
GDP 2q					12.57 (2.06)**	17.88 (2.35)**
IP 1		-0.07 (-0.58)			0.02 (0.15)	-0.08 (-0.51)
Bond 2	-34.27 (-3.21)***		-80.19 (-6.35)***	-38.31 (-3.03)***		-57.30 (-4.68)***
Index				-3.70 (-1.65)		-1.12 (-0.43)
Turnover	1.15 (10.43)***	1.23 (10.71)***				-0.06 (-0.12)
Invest. funds			0.21 (7.62)***			0.08 (2.32)**
Pens. funds					1.11 (9.99)***	0.76 (1.65)*
Adj. R-squared	0.448	0.418	0.320	0.241	0.425	0.461
Sample	97	98	86	97	97	85
P-value (F stat)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: GDP 2 = GDP growth change 2 quarters before an IPO; GDP 2q = GDP % change 2 quarters before an IPO; IP 1 = Industrial production change 1 quarter before an IPO; Bond 2 = Yields to maturity of government bonds 2 quarters before an IPO; Index = Average benchmark index return 90 days before respective month; Turnover = Ln(yearly absolute change in respective market turnover (USD) 1 year before an IPO); Invest. funds = % change of assets, shares and other equity in total financial assets in investment funds one year before IPO (for OECD countries); Pens. funds = Ln(yearly absolute change in pension funds in respective country (USD) 1 year before IPO). See Table 3-3 for further specification of variables. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

### 3.6.3 Drivers of IPO Underpricing

Table 3-9 summarizes the results of multiple regressions for *Hypothesis 5*. We have performed the regression on the total available sample for *initial index-adjusted returns* of

231 IPOs as the dependent variable, and various micro as well as macro drivers of IPO underpricing.

Table 3-9: Drivers of IPO underpricing in the CEE region (N=231).

*N=231 (1.2.2000 – 31.12.2009)*

Dependent variable	Index-adjusted initial return					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Independent variables						
Constant	0.14 (1.39)	0.13 (1.32)	-0.11 (-1.84)*	-0.11 (-1.90)*	0.22 (2.98)***	0.08 (0.70)
ROE		0.001 (1.81)*		0.001 (1.76)*		0.001 (0.74)
Income	0.26 (1.72)*		0.26 (1.67)*			0.13 (0.55)
Volatility	2.34 (2.62)***	2.45 (2.77)***	2.60 (2.90)***	2.70 (3.04)***	2.28 (3.63)***	2.42 (2.69)***
Index	0.52 (2.90)***	0.54 (3.00)***	0.46 (2.54)**	0.48 (2.65)***	0.52 (3.82)***	0.51 (2.81)***
GDP	0.46 (1.70)*	0.51 (1.89)*	0.63 (2.37)**	0.68 (2.55)**		0.53 (1.90)*
Bond 3	-3.59 (-2.60)***	-3.56 (-2.6)**			-3.85 (-2.86)**	-3.00 (-2.00)**
Ind. prod. 2			0.02 (1.95)*	0.02 (1.92)*		0.01 (1.98)
Adj. R-squared	0.129	0.131	0.111	0.113	0.125	0.126
Sample	147	147	148	148	208	147
P-value (F stat)	0.000	0.000	0.000	0.001	0.000	0.000

Notes: ROE = ROE 1 year before an IPO; Income = Net profit (income)/assets 1 year before an IPO; Volatility = Share volatility 30 days after first trading date; Index = Benchmark index return 90 days before an IPO subscription period; GDP = Yearly GDP growth 1 year before an IPO; Bond 3 = Yields to maturity of government bonds 3 quarters before an IPO; Ind. prod. 2 = Industrial production change 2 quarter before an IPO. See Table 3-3 for further specification of variables. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

We found that underpricing is the most significantly impacted by performance of the stock market 90 days before IPO, which relates to market climate and investor sentiment. This result is very robust and present in all six tested models. This is in line with the findings of Lyn and Zychowicz (2003) for Hungary and Poland, Aussenegg (2006) for Austria and Jewartowski and Lizińska (2012) for Poland. Therefore, we can argue that primary determinant of initial returns and therefore IPO driver in the CEE region in the observed

period was the market climate, measured by performance of benchmark indices prior of IPO subscription period. Thus, the higher performance of the market before IPO, the higher is underpricing, which consequently could result in the higher number of IPOs. The results are consistent with many empirical findings for developed markets as well (Lowry 2003; Guidici and Roosenboom, 2006; Goergen et al., 2009).

Equally to market climate factor, also volatility indicating the degree of riskiness of the issuing companies has very strong effect on underpricing. All Models show that underpricing is significantly higher in case the higher volatility of the share price, which is again in line with many studies (Rock, 1982; Ritter, 1984; Ausenagg, 2006, Goergen et al., 2009; Jewartowski and Lizińska, 2012). This result supports ex-ante uncertainty theory; hence riskier companies are more underpriced. However, this result should be interpreted with some caution. Namely, in order to check the robustness of our results, we performed the same regressions including the dependent variables only for the largest 88 IPOs. These variables were calculated by multiplying each independent variable with dummy 1 in case the respective IPO is part of the IPOs with IPO values above EUR 10 mln (sample N=88) and 0 otherwise. We added these variables into all of our models. Results are reported in the Table 3-10. We see that for larger IPOs, volatility effect is much weaker than for their smaller counterparts. Volatility coefficients are still positive, but significantly lower than the ones within the smaller group of IPOs. We could argue that in the case of larger (i.e. most probably also more transparent) IPOs the level of riskiness of companies is less of a decisive factor of underpricing<sup>10</sup>. Since smaller and delisted IPOs are most probably less transparent than other IPOs, this result is intuitive logical and confirms ex-ante uncertainty when delisted and smaller IPOs are included in the sample. We have checked the same regressions for only small IPOs and found significant positive results for volatility, which confirms this assumption.

The first four models in Table 3-9 also show some modest significant effects of company's performance on underpricing, measured either by ROE or income performance 1 year before IPO. Due to relative high correlations those indicators are used separately in different regressions. Companies with higher ROE or higher income performance exhibit higher level of underpricing, which is similar to the findings of Jewartowski and Lizińska (2012) and Lizińska and Czapiewski (2014) for Poland. Finally, based on results for all fix models we also confirmed that business cycles, measured by yearly GDP growth one year before IPO, interest rates 3 quarters before IPO and industrial production 2 quarters before IPO, have a significant positive impact on underpricing. Perhaps, this is a reflection of the investor structure in the capital market during periods of economic boom, when higher

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<sup>10</sup> This is also in line with the observation made by Peterle (2014) that the majority of larger CEE IPOs in the 2000s were carried out with international underwriters, who apparently require higher transparency standards and thus reduce asymmetry of information.

proportion of uninformed investors are participating in the IPO market, which might result in higher underpricing as well as consequently in higher number of IPOs.

Both, business cycles and company performance are also confirmed as underpricing drivers in case of IPOs with IPO values above EUR 10 mln (sample N=88) (Table 3-10), although these results are somewhat weaker (i.e. yearly GDP growth one year before IPO, interest rates 3 quarters before IPO and ROE). Thus, our results for *Hypothesis 5* are mostly confirmed for both subsamples. In addition, we have checked the heteroscedasticity-consistent standard errors and run the regressions with the robust standard errors for the original sample (Table 13 in the Appendix), which provided less significant results for company's performance (ROE and income) and volatility, but more robust overall results with the higher R-squared results.

We have checked other typical and reasonably assumed determinants of IPO activities, i.e. pre-IPO ownership structure, ownership dilution and leverage of companies before IPO, which however provided mixed or insignificant results. Therefore, we can conclude that in addition to current conditions of capital markets, which relate to investor sentiment, business cycles and company performance before IPO are significant indicators of IPO underpricing. Other indicators often reported in the literature, are however not.

Table 3-10: Drivers of IPO underpricing in the CEE region (N=88).

*N=88 (1.2.2000 – 31.12.2009)*

Dependent variable	Index-adjusted initial return					
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.17 (1.05)	0.15 (0.88)	-0.20 (-1.68)*	-0.22 (-1.84)*	0.27 (2.42)**	0.08 (0.42)
Constant_88	-0.13 (-0.60)	-0.12 (-0.56)	0.20 (1.44)	0.21 (1.47)	-0.12 (-0.67)	-0.12 (-0.49)
ROE		0.001 (2.5)**		0.001 (2.53)**		0.001 (1.36)
ROE_88		-0.002 (-1.8)*		-0.002 (-1.90)*		-0.001 (-0.58)
Income	0.35 (2.08)**		0.34 (1.99)**			0.006 (0.02)
Income_88	-0.69 (-1.73)*		-0.74 (-1.83)*			-0.64 (-1.06)
Volatility	4.65 (3.0)***	5.00 (3.3)***	5.88 (3.99)***	6.15 (4.25)***	3.00 (3.4)***	5.09 (3.24)***
Volatility_88	-4.00 (-2.1)**	-4.37 (-2.3)**	-5.15 (-2.80)***	-5.48 (-3.0)***	-1.09 (-0.66)	-4.40 (-2.30)**

*(table continues)*



(continued)

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Index	0.68 (2.8)***	0.67 (2.7)***	0.68 (2.75)***	0.68 (2.75)***	0.61 (3.2)***	0.68 (2.77)***
Index_88	-0.32 (-0.90)	-0.33 (-0.92)	-0.42 (-1.17)	-0.44 (-1.20)	0.16 (0.46)	-0.40 (-1.06)
GDP	0.31 (0.56)	0.39 (0.70)	0.52 (0.94)	0.60 (1.08)		0.46 (0.83)
GDP_88	0.21 (0.32)	0.12 (0.18)	0.02 (0.04)	-0.07 (-0.12)		0.11 (0.18)
Bond 3	-5.34 (-2.8)***	-5.12 (-2.7)***			-5.34 (-2.6)***	-4.46 (-2.13)**
Bond 3_88	4.98 (1.81)*	4.81 (1.75)*			3.52 (1.07)	5.16 (1.71)*
Ind. prod. 2			0.02 (1.75)*	0.02 (1.78)*		0.01 (0.86)
Ind. produ.2_88			-0.001 (-0.05)	-0.003 (-0.15)		0.01 (0.47)
Adj. R-squared	0.173	0.179	0.155	0.163	0.119	0.175
Sample	147	147	148	148	208	147
P-value (F stat)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: ROE = ROE 1 year before an IPO; Income = Net profit (income)/assets 1 year before an IPO; Volatility = Share volatility 30 days after first trading date; Index = Benchmark index return 90 days before an IPO subscription period; GDP = Yearly GDP growth 1 year before an IPO; Bond 3 = Yields to maturity of government bonds 3 quarters before an IPO; Ind. prod. 2 = Industrial production change 2 quarter before an IPO. See Table 3-3 for further specification of variables.. Variables X\_88 represent product of variable X and dummy 1 in case IPO is part of the Sample N=88 and 0 if IPO is not part of the sample N=88. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

### 3.7 Conclusions

Based on the sample of 246 IPOs we have shown the existence of IPO cycles in the CEE region in the 2000s. Many companies in this region decide to go public at about the same time, meaning that their IPOs are clustered. This was proven with the autocorrelation of number of IPOs in the observed period. Results proving cycles with the autocorrelation of initial returns however are more diverse, not confirming statistical significance in the case of the shorter buoyant periods. Still, in line with many findings for developed capital markets we have proven the positive correlations between number of IPOs and underpricing. Thus, periods with the higher number of IPOs also have higher average adjusted initial returns.

Furthermore, we have provided a unique comparison of CEE IPO cycles with IPO cycles in developed EU capital markets, proxied by IPO activities on the Deutsche Boerse, since German bank-based financial environment is similar to the environment in the CEE countries having relative small number of companies listed on exchange. *Firstly*, in line with the recent studies (Ritter et al., 2013) we have indicated that the magnitude of IPO cycle on developed EU capital markets (i.e. Deutsche Boerse) has declined in the 2000s after dot-com bubble. *Secondly*, we have shown the positive and significant correlation between number of IPOs in the CEE region and Deutsche Boerse in the period after 1.5.2004, when dot-com bubble effect on Deutsche Boerse was long vanished and CEE accession to EU was coming into force. We argue that in contrary to some recent findings for developed capital markets that regulatory burdens are to be blamed for the decline of IPOs, the common regulation that was transposed from developed capital markets to CEE markets due to the gradually CEE accession to EU since middle of 2000s had helped to foster IPO activities in the CEE region. That happened for the first time, as most of the capital markets in the CEE region were established in parallel with liberalisation of economic environments of CEE countries approximately two and a half decades ago. However after 2008 also CEE IPO volume had been depressed following the financial turmoil.

Confirming hot and cold issue markets leads to the next interesting question, i.e. what are the drivers for hot issue markets in the CEE region. To answer this question we have divided potential factors into two groups, those that relate to broader economic factors (macro factors) and those relate directly to companies taking “going public” decision (micro factors). Our results for macro IPO determinants show that the most relevant macro driver for the number of IPOs in the CEE region in the 2000s was investor sentiment, proxied either by activities of market participant, growth of assets in pension funds or by aggressiveness of investment fund portfolio managers’ asset allocation decisions (i.e. risk aversion), and positive macroeconomic conditions, i.e. business cycles. Our results strongly support positive relation between investment sentiment, measured by yearly share of equities in the investment funds, yearly growth in assets of pension funds and yearly turnover growth before IPO, and the number of IPOs, which is in line with many reported findings (Lowry, 2003; Benninga et al., 2005; Meluzin et al. 2013).

As often in IPO academic literature and based on our confirmed hypothesis that underpricing and IPO volume are positively correlated, we have used underpricing to study IPO factors. Our results suggest that the primary determinant of underpricing and therefore IPO driver in the CEE region in the observed period was the market climate. We have indicated that the higher performance of the capital market before IPO, which relate to investor sentiment, leads to higher underpricing, which could again further result in the higher number of IPOs. Furthermore, our results show that underpricing is significantly

higher in the case of the higher volatility of the share price, which confirms ex-ante uncertainty theory that riskier companies are more underpriced. Results are however stronger within the group of smaller companies. The result is intuitive logical and confirms ex-ante uncertainty in case we consider small IPOs, which are most probably less transparent or riskier than other IPOs. Therefore, we could argue that during hot issue period when underpricing is higher, riskier and usually smaller companies decide for IPO.

In additions, our results show some positive significant effects of company performance, measured by ROE, and of business cycles, measured by yearly GDP growth and quarterly interest rates, on underpricing. We interpret these results in a manner that in the case of economic boom, more uninformed investors are participating in IPO market, which is resulting in higher underpricing and consequently higher number of IPOs. All other determinants for explaining underpricing in our regression model (an also reported in the IPO literature), i.e. pre-IPO ownership structure, ownership dilution and leverage of companies before IPO, have shown mixed or insignificant results.

We can conclude that main IPO drivers in the CEE region are similar to those for developed capital markets, since our results are in general consistent with the vast evidence found by many IPO studies. Our outcomes also provide welcome implications for policy makers, issuers and investors on smaller, emerging markets. We shall highlight the investor sentiment as one of the most important IPO drivers. Therefore, in order to provide efficient capital-raising function of stock exchanges in emerging regions the basic functioning of capital markets is not sufficient. Policy makers shall provide attractive investment environment and develop the strong investment culture with established investment and pension fund industry. Namely, besides favorable business conditions and investor sentiment the main positive indicator for potential new IPOs is the positive market climate on local emerging capital markets (i.e. AUM of institutional investors and volume of trading). Consequently, also issuers who decide for an IPO in the CEE region shall focus on buoyant market periods and use these periods as a window opportunity to conduct IPO. For issuers is also valuable to assure as much as possible information during IPO to reduce the riskiness of the company. Based on our results, we argue that this is more relevant factor than company's performance before the IPO transaction. On the other hand, investors shall be aware that also in emerging CEE IPO markets the riskier (usually smaller) companies tend to execute IPOs during the hot issue periods; therefore they can expect the higher volatility of such IPO share prices after their listing.

## CONCLUSIONS

The results of IPO study in the CEE region in the 2000 show that the IPOs in this region are similar to those in other EU capital markets in many respects. On the other hand we have provided evidence of some interesting distinguishing factors for these small, emerging (front-tier) IPO markets in the observed period.

The first article shows that the internal characteristics of IPOs in the CEE region are similar to those in many other EU capital markets. Post-IPO ownership remains highly concentrated for most companies that go public. These resulting relatively low free float after IPO could have had a negative impact on the aftermarket liquidity of these shares. The results also show that most frequent IPOs were those with only newly issued shares. These results indicate that the majority of companies decide to sell equity in the primary public market to raise fresh capital; however the size of newly issued shares is rather small.

Results also indicate that, like in EU's developed countries, bookbuilding is the prevailing IPO method of price determination and allocation, and that the role of underwriters has become increasingly important in the 2000s. Our results are similar to the findings for other European markets. We claim that since 2000 the methods used in IPO procedures in the CEE region have become very similar to IPO procedures in the rest of developed European countries. This can be attributed to the fact that all CEE countries joined the EU in the mid-2000s and therefore went through the process of harmonisation their national regulations with the EU rules and practices, in particular the Prospectuses Directive, Market Abuse Directive and related regulations.

Furthermore, the first article shows that factors much broader than capital market characteristics (such as market size, liquidity and market capitalisation-to-GDP ratios) should be taken into account in order to assess the role of external factors in IPO activities in the CEE region. Our findings indicate that the attractiveness of a capital market for investors, as measured by annual index returns and annual market and turnover growth, appears to be an important factor for IPO activities. The other macroeconomic and business factors that stand out in the Polish capital market – the most distinguished IPO market in the CEE region – are quicker reform development in terms of governance and enterprise restructuring, and a significantly higher share of pension fund assets in GDP. These results are further elaborated in the third article.

The objective of the second article was to provide a new insight of IPO performance in the CEE region. We have confirmed initial-day underpricing in the CEE region and even more positive significant average first-day adjusted IPO returns for smaller IPOs, and for emerging CEE capital markets (i.e. CEE markets excl. the Vienna SE). Moreover, we have proven that during the 2000-2009 period average adjusted initial returns on CEE capital

markets were statistically significantly higher than on EU's developed capital markets. Furthermore, we have shown that volatility of adjusted initial returns for the CEE region is statistically and economically significantly higher than that for EU's developed region. This result is intuitive as emerging markets have higher volatility of macroeconomic and institutional environment that is also reflected in the stock return volatility. Such greater uncertainties obviously translate to the IPO transactions that are by their nature highly uncertain.

In addition, we have provided the evidence of the long-run underperformance of CEE IPOs. We have shown that IPOs in CEE capital markets underperform benchmark companies in the long run. Results are more obvious and significant for smaller IPOs and the ones that are later delisted. For the most relevant and bigger IPOs the results are less clear-cut. We obtain negative cumulative returns for this group, but significance level is only confirmed in CAPM-adjusted model, which is more relevant than index-adjusted model due to the risk adjustment, and in standardized calendar portfolio approach. BHAR and CAT approaches provide weaker results, therefore we can argue that the existence of IPOs' long-run abnormal performance is also highly dependent on the methodology used.

In contrast to results for initial returns, the comparison of CEE and EU's developed IPO adjusted long-run returns, where delisted and small IPOs were not taken into account, does not provide clear conclusions. Namely, average adjusted long-run returns are in general higher (i.e. less negative) on the CEE capital markets than on EU's developed capital markets, but only in some examples we obtain statistically significant results for the period of one and two years. The volatility analysis however provides interesting piece of evidence. The fluctuation of prices is namely stabilized in the long run. We assume this could be a result of the fact that the CEE capital markets were in a bullish period in the most of the 2000s and the annual local benchmark index returns in the CEE region significantly outperformed developed European countries. This outperformance impacted (i.e. increased) the IPO long-run performance in the long run. Consistent with the empirical studies that price volatility is lower in bullish capital markets, we have shown that in general long-run performance of IPOs is both higher (i.e. less negative or in some cases even positive) and less volatile compared to the developed EU markets. Our mixed results about long-run performance of IPOs in the emerging CEE markets thus are highly likely a result of the character of emerging markets, which typically in some buoyant years significantly outperform developed markets.

The third, final article combines the results of the previous two articles in order to determine IPO cycles and the main IPO drivers in the CEE region. Firstly, we have shown the existence of IPO cycles in the CEE region in the 2000s. Similar to many findings for developed capital markets, we have also proven the positive correlations between IPO

volumes and underpricing, which is especially evident for bullish capital markets. Thus, periods with the higher number of IPOs also have higher average adjusted initial returns.

Furthermore, we have provided a unique comparison of CEE IPO cycles with IPO cycles in developed EU capital markets, proxied by IPO activities on the Deutsche Boerse, since German bank-based financial environment is similar to the environment in the CEE countries having relative small number of companies listed on exchange. *Firstly*, in line with the recent studies (Ritter et al., 2013) we have indicated that the magnitude of IPO cycle on developed EU capital markets (i.e. Deutsche Boerse) has declined in the 2000s after dot-com bubble. *Secondly*, we have shown the positive and significant correlation between number of IPOs in the CEE region and Deutsche Boerse in the period after 1.5.2004, when dot-com bubble effect on Deutsche Boerse was long vanished and CEE accession to EU was coming into force. We argue that in contrary to some recent findings for developed capital markets that regulatory burdens are to be blamed for the decline of IPOs, the common regulation that was transposed from developed capital markets to CEE markets due to the gradually CEE accession to EU since middle of 2000s had helped to foster IPO activities in the CEE region. That happened for the first time, as most of the capital markets in the CEE region were established in parallel with liberalisation of economic environments of CEE countries only approximately two and a half decades ago. However, after 2008 also CEE IPO volume had been depressed following the financial turmoil.

Our results for macro IPO determinants show that the most relevant macro driver for the number of IPOs in the CEE region in the 2000s was investor sentiment, proxied either by activities of market participant, growth of assets in pension funds or by aggressiveness of investment fund portfolio managers' asset allocation decisions (i.e. risk aversion), and positive macroeconomic conditions, i.e. business cycles. Our results strongly support positive relation between investment sentiment, measured by yearly share of equities in the investment funds, yearly growth in assets of pension funds and yearly turnover growth before IPO, and the number of IPOs, which is in line with many reported findings (Lowry, 2003; Benninga et al., 2005).

Finally, our results suggest that the primary determinant of underpricing and therefore IPO driver in the CEE region in the observed period was the market climate. We have indicated that the higher performance of the capital market before IPO, which relate to investor sentiment, leads to higher underpricing, which could again further result in the higher number of IPOs. Furthermore, our results show that underpricing is significantly higher in the case of the higher volatility of the share price, which confirms ex-ante uncertainty theory that riskier companies are more underpriced. Results are even stronger within the group of smaller companies. The result is intuitive and confirms ex-ante uncertainty in case we consider small IPOs, which are most probably less transparent or riskier than other

IPOs. Therefore, we could argue that during hot issue period when underpricing is higher, riskier and usually smaller companies decide for IPO. In addition, our results show some positive significant effects of company performance and of business cycles on underpricing. We interpret these results in a manner that in the case of economic boom, more uninformed investors are participating in IPO market, which is resulting in higher underpricing and consequently higher number of IPOs.

Our outcomes provide welcome implications for policy makers, issuers and investors on smaller, emerging markets. We shall highlight the investor sentiment as one of the most important IPO drivers. Thus, in order to provide efficient capital-raising function of stock exchanges in emerging regions the basic functions of capital markets are not sufficient. Policy makers shall provide attractive investment environment and develop the strong investment culture with established investment fund industry. Namely, besides favorable business conditions and investor sentiment the main positive indicator for potential new IPOs is the positive market climate on local emerging capital markets (i.e. AUM of institutional investors and volume of trading). Consequently, also issuers who decide for an IPO in the CEE region shall focus on buoyant market periods and use these periods as a window opportunity to conduct IPO.

In addition, in case of emerging CEE capital markets those issuers who decide for an IPO might want to influence the expected higher initial IPO underpricing compared to the developed markets, in order to soften the dilution of the current shareholders. This is especially important for smaller IPOs, for which issuing company should provide as much information as possible to alleviate information asymmetry. Based on our results, we argue that this is more relevant factor than the issuing company's performance before the IPO transaction. In addition, in times of the bullish emerging stock markets issuers might enjoy less unstable long-run performance compared to the developed markets, which avoids potential financial distress and the need to further tap the capital market.

The main conclusion for investors is that emerging IPOs are even more attractive than IPOs in the developed markets. This holds for both initial returns as well as for long-run performance. However investors shall be especially cautious in case of smaller IPOs and riskier firms with potential to be removed from trading (i.e. delisted), since they can record substantial long-run underperformance. They can also expect the higher volatility of such IPO share prices immediately after their listing.

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## Appendix 1: Annual distribution of IPOs in the EU

	Total		EU regulated		SE regulated		WSE		WSE -EU regulated		WSE regulated	
	N	Value in EUR (m)	N	Value in EUR (m)	N	Value in EUR (m)	N	Value in EUR (m)	N	Value in EUR (m)	N	Value in EUR (m)
<b>2001</b>	309	32										
<b>2002</b>	175	10										
<b>2003</b>	149	6,763	68	5,413	81	1,35	6	76	6	76		
<b>2004</b>	420	27,299	147	23,763	273	3,536	36	2,988	36	2,988		
<b>2005</b>	598	51,617	229	44,756	369	6,861	35	1,74	35	1,74		
<b>2006</b>	653	65,39	251	57,227	402	8,163	33	953	33	953		
<b>2007</b>	819	80,473	360	65,292	459	15,181	104	2,021	80	1,98	24	41
<b>2008</b>	295	13,957	115	11,74	180	2,217	91	2,502	30	2,455	61	47
<b>2009</b>	126	7,112	41	4,34	85	2,772	38	1,594	12	1,584	26	10
<b>Total</b>	<b>3,544</b>	<b>294,611</b>	<b>1,211</b>	<b>212,531</b>	<b>1,849</b>	<b>40,08</b>	<b>343</b>	<b>11,874</b>	<b>232</b>	<b>11,776</b>	<b>111</b>	<b>98</b>

Notes: **EU regulated markets** are capital markets regulated by EU regulations (all main markets of stock exchanges), whereas **SE regulated markets** are regulated only by stock exchanges (e.g. AIM at London SE, NewConnect at Warsaw SE).

**WSE** – Warsaw SE.

Source: PWC, City of London Economic Development Office.

**Appendix 2: Equity market capitalisation, turnover and number of domestic listed companies in European capital markets in 2000, 2004, 2007 and 2009.**

	Market Capitalization in EURm (Dec Y)				Turnover in EURm				Domestic Listed Companies (Dec Y)			
	2000	2004	2007	2009	2000	2004	2007	2009	2000	2004	2007	2009
Bucharest Stock Exchange	451	8,819	21,524	8,402	93	598	1,990	640	114	60	54	64
Bulgarian Stock Exchange	n/a	2,062	14,821	6,031	n/a	438	4,641	358	n/a	n/a	369	399
CEESEG - Budapest	12,810	21,039	31,528	20,888	13,091	10,763	34,610	18,463	59	45	39	46
CEESEG - Ljubljana	3,335	7,115	19,740	8,462	707	934	3,382	720	149	140	87	76
CEESEG - Prague	12,180	21,720	47,987	31,265	7,431	15,073	36,581	17,565	142	53	24	25
CEESEG - Vienna	31,884	64,577	161,731	79,511	10,497	19,401	94,489	36,449	97	99	102	115
Warsaw Stock Exchange	33,761	51,888	144,323	105,157	21,054	13,147	63,876	41,415	211	211	352	486
<b>CEE</b>	<b>94,420</b>	<b>177,221</b>	<b>441,654</b>	<b>259,717</b>	<b>52,872</b>	<b>60,354</b>	<b>239,570</b>	<b>115,609</b>	<b>772</b>	<b>608</b>	<b>1,027</b>	<b>1,211</b>
BME (Spanish Exchanges)	537,044	692,053	1,231,086	999,875	660,785	963,368	2,160,321	1,148,570	1,020	n/a	3,498	3,472
Borsa Italiana	818,384	580,881	733,614	457,126	1,013,633	772,961	1,680,200	673,141	291	269	301	296
Deutsche Börse	1,352,936	849,717	1,439,955	900,772	2,296,156	1,237,673	3,144,150	1,243,420	744	660	761	783
London Stock Exchange*	2,744,691	2,071,775	2,634,577	1,950,048	4,943,465	4,150,660	7,544,970	2,247,075	2,428	2,486	2,588	2,792
NASDAQ OMX Nordic	786,479	542,290	849,923	569,604	857,408	639,539	1,321,807	542,369	745	645	825	797
NYSE Euronext	2,483,040	1,796,036	2,888,313	1,999,967	2,533,295	1,987,298	4,086,811	1,469,542	1,286	999	1,043	1,160
SIX Swiss Exchange	845,865	609,929	869,377	738,707	692,258	48,307	1,368,852	543,943	252	282	257	318
<b>Developed EU</b>	<b>9,568,439</b>	<b>7,142,682</b>	<b>10,646,846</b>	<b>7,616,099</b>	<b>12,997,000</b>	<b>9,799,806</b>	<b>21,307,110</b>	<b>7,868,060</b>	<b>6,766</b>	<b>5,341</b>	<b>9,273</b>	<b>9,618</b>
<b>TOTAL</b>	<b>9,662,859</b>	<b>7,319,903</b>	<b>11,088,500</b>	<b>7,875,816</b>	<b>13,049,872</b>	<b>9,860,160</b>	<b>21,546,680</b>	<b>7,983,669</b>	<b>7,538</b>	<b>5,949</b>	<b>10,300</b>	<b>10,829</b>
<b>CEE/TOTAL</b>	<b>1.0%</b>	<b>2.4%</b>	<b>4.0%</b>	<b>3.3%</b>	<b>0.4%</b>	<b>0.6%</b>	<b>1.1%</b>	<b>1.4%</b>	<b>10.2%</b>	<b>10.2%</b>	<b>10.0%</b>	<b>11.2%</b>

Source: FESE, WFE, Prague SE, London SE; own calculations.



### Appendix 3: EU evidence on IPO underpricing.

<b>Country</b>	<b>Source</b>	<b>Sample Size</b>	<b>Period</b>	<b>Aver. Initial Return</b>
<b>Austria</b>	Aussenegg	96	1971-2006	6.5%
<b>Belgium</b>	Rogiers, Manigart & Ooghe; Manigart, DuMortier; Ritter	114	1984-2006	13.5%
<b>Bulgaria</b>	Nikolov	9	2004-2007	36.5%
<b>Denmark</b>	Jakobsen & Sorensen; Ritter	145	1984-2006	8.1%
<b>Finland</b>	Keloharju	162	1971-2006	17.2%
<b>France</b>	Husson & Jacquillat; Leleux & Muzyka; Paliard & Belletante; Derrien & Womack; Chahine; Ritter; Vismara	686	1983-2009	10.6%
<b>Germany</b>	Ljungqvist; Rocholl; Ritter; Vismara	704	1978-2009	25.2%
<b>Greece</b>	Nounis, Kazantzis & Thomas; Thomadakis, Gounopoulos & Nounis	373	1976-2009	50.8%
<b>Ireland</b>	Ritter	31	1999-2006	23.7%
<b>Italy</b>	Arosio, Giudici & Paleari; Cassia, Paleari & Redondi; Vismara	273	1985-2009	16.4%
<b>Netherlands</b>	Wessels; Eijgenhuijsen & Buijs; Jenkinson, Ljungqvist, & Wilhelm; Ritter	181	1982-2006	10.2%
<b>Norway</b>	Emilsen, Pedersen & Saettem; Liden; Ritter	153	1984-2006	9.6%
<b>Poland</b>	Jelic & Briston; Ritter	224	1991-2006	22.9%
<b>Portugal</b>	Almeida & Duque; Ritter	28	1992-2006	11.6%
<b>Spain</b>	Ansotegui & Fabregat; Alvarez Otera	128	1986-2006	10.9%
<b>Sweden</b>	Rydqvist; Schuster; Simonov; Ritter	406	1980-2006	27.3%
<b>Switzerland</b>	Kunz, Drobetz, Kammermann & Walchli; Ritter	159	1983-2008	28.0%
<b>United Kingdom</b>	Dimson; Levis	4,205	1959-2009	16.3%

Sources: Adopted after Loughran et al (1994), Ritter (an update 2011b).

**Appendix 4: EU evidence on long-run IPO underperformance.**

<b>Country</b>	<b>Author(s)</b>	<b>Number of IPOs</b>	<b>Issuing years</b>	<b>Total Abnormal (3 – years) Return</b>
<b>Austria</b>	Aussenegg	57	1965-93	-27.3%
<b>Finland</b>	Keloharju	79	1984-89	-21.1%
<b>Germany</b>	Ljungqvist	145	1970-90	-12.1%
<b>Sweden</b>	Loughran, Ritter	162	1980-90	+1.2%
<b>United Kingdom</b>	Levis	712	1980-88	-8.1%

Sources: Adopted after Ritter (1998), *Initial Public Offerings*.

## Appendix 5: Financial and institutional development indicators.

Indicator name/Country	Austria	Bulgaria	Czech Republic	Hungary	Poland	Romania	Slovenia	Euro area	CEE average	CEE-AUT average
(1) Bank capital to total assets (%)	5	11	6	9	8	11	9	6	8	9
(2) Bank concentration (%)	69	66	70	65	64	71	64	76	67	67
(3) Bank private credit to GDP (%)	107	27	44	39	28	16	48	95	44	33
(4) Mutual fund assets to GDP (%)	33	0	4	7	4	0	6	27	8	3
(5) Pension fund assets to GDP (%)	4	2	4	6	8	0	1	5	4	4
(6) Percentage of foreign banks among total banks (%)	8	54	55	84	65	64	28	27	51	58
(7) Return on equity (%)	6	16	12	19	11	3	10	10	11	12
(8) Volatility of stock price index**	26	28	28	33	32	34	20	22	29	29
(9) Paid-in min. Capital (% of income per capita)	60	68	39	69	213	2	34	46	69	71
(10) Strength of investor protection index (2006)	5.0	6.0	5.0	4.3	5.7	5.7	6.3	6.1	5.3	5.4
(11) Strength of investor protection index (2010)	5.0	6.0	5.0	4.3	6.0	6.0	6.7	6.1	5.5	5.5
(12) 2001 domestic market capitalization in USD mln***	85,270	505	9,331	18,773	26,017	2,124	6,326	5,051,041	-	-
(13) 2007 domestic market capitalization in USD mln***	236,448	21,793	73,420	46,196	207,332	44,925	28,860	9,807,455	-	-
(14) 2010 domestic market capitalization in USD mln***	126,032	7,276	43,056	27,708	190,235	32,385	9,428	6,781,385	-	-
(15) Foreign ownership of domestic market capitalization (2004)	33.8	3.4	19.8	45.6	14.0	4.7	3.9	33.5	16.5	14.1
(16) Foreign ownership of domestic market capitalization (2010)	36.1	9.3	24.9	41.7	17.2	7.1	6.8	50.0	18.8	16.3
(17) Outward-to-inward FDI in 2010 (in %)**	103.5	2.8	11.6	68.4	20.6	6.0	77.0	143.3	37.1	27.6
(18) Total tax rate (% profit)	54	40	49	57	45	50	39	50	48	47

Notes: Averages 1997-2009 for (1)-(8) – euro area and 2004-2009 for (9)-(11)

\* - UK, Germany & France; \*\* - own calculation for Austria (2003 -2011); \*\*\* Euro Area data jointly for Germany, UK, France and Italy.

Sources: The World Bank: World Development Indicators and Doing Business; World Federation of Exchanges: Monthly reports (market capitalization data for Hungary, Slovenia, Austria and Germany); \*\*\*\* IMF eLibrary Data; own calculations.

**Appendix 6: CEE IPO long-run returns (76 vs. 63).**

	<b>Model 1 (BHAR)</b>	<b>Model 2 (CAPM)</b>	<b>Model 3 (WBHAR)</b>	<b>Model 4 (WCAPM)</b>
<i>CEE capital markets (N=67)</i>				
<b>1 week</b>	1.2%	-2.6%**	0.2%	-3.2%**
<b>2 weeks</b>	2.5%*	-1.3%	1.5%	-2.6%*
<b>1 year</b>	6.9%	0.4%	-1.0%	0.0%
<b>2 years</b>	3.4%	-8.8%	-0.2%	0.3%
<b>3 years</b>	-2.4%	-16.4%**	-0.8%	-9.8%
<i>Emerging CEE capital markets (excluding the Vienna SE) (N=63)</i>				
<b>1 week</b>	2.3%*	-1.7%	1.5%	-1.5%
<b>2 weeks</b>	3.3%**	-0.5%	2.8%*	-0.8%
<b>1 year</b>	9.8%*	1.0%	-5.0%	-8.2%
<b>2 years</b>	8.5%*	-5.6%	2.9%	3.5%
<b>3 years</b>	3.9%	-12.0%*	5.8%	-3.2%

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics indicate the level of significance that average adjusted returns are greater/lower than zero. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

**Appendix 7: CEE IPO long-run returns per capital markets (N=172).**

Market	No. IPOs	1 week	2 weeks	1 year	2 years	3 years	1 week	2 weeks	1 year	2 years	3 years
		<b>Model 1 (BHAR)</b>					<b>Model 2 (CAPM)</b>				
<b>Bucharest SE</b>	4	4.0%	6.0%	2.7%	-10.6%	-28.8%	3.3%	5.4%	-0.4%	-32.2%	-49.8%
<b>Bulgarian SE</b>	13	8.5%	9.1%	25.4%	8.5%	6.2%	5.9%	7.7%	-5.0%	-34.5%	-36.0%
<b>Ljubljana SE</b>	2	2.2%	4.5%	-8.5%	-12.8%	-12.1%	6.1%	8.7%	-12.5%	-12.0%	-18.7%
<b>Prague SE</b>	2	0.2%	-2.1%	10.1%	0.2%	3.9%	-4.9%	-5.6%	-15.6%	-29.2%	-20.7%
<b>Vienna SE</b>	23	-2.2%	-2.2%	-30.1%	-51.1%	-63.8%	-5.5%	-5.5%	-26.0%	-45.6%	-49.8%
<b>Warsaw SE</b>	128	0.4%	-0.1%	7.6%	2.6%	-11.3%	-3.6%	-4.1%	1.0%	-9.2%	-27.3%
<b>ALL</b>	<b>172</b>	<b>0.80%</b>	<b>0.50%</b>	<b>3.60%</b>	<b>-4.70%</b>	<b>-17.2%***</b>	<b>-2.9%***</b>	<b>-3.0%***</b>	<b>-3.50%</b>	<b>-16.7%***</b>	<b>-31.3%***</b>
		<b>Model 3 (WBHAR)</b>					<b>Model 4 (WCAPM)</b>				
<b>Bucharest SE</b>	4	28.9%	16.0%	15.6%	26.7%	6.9%	-14.6%	33.8%	13.6%	13.4%	39.6%
<b>Bulgarian SE</b>	13	1.4%	23.0%	23.1%	20.9%	7.9%	5.6%	6.4%	20.5%	22.1%	-12.8%
<b>Ljubljana SE</b>	2	22.6%	3.6%	6.1%	-8.2%	-11.8%	-10.7%	50.5%	6.5%	9.2%	-14.1%
<b>Prague SE</b>	2	0.8%	-0.8%	-3.0%	-4.6%	-10.8%	-3.8%	0.6%	-4.3%	-5.2%	-17.1%
<b>Vienna SE</b>	23	-9.9%	-3.9%	-4.5%	-29.8%	-43.3%	-56.3%	-14.5%	-7.4%	-8.4%	-31.4%
<b>Warsaw SE</b>	128	8.6%	-0.5%	-0.3%	-4.3%	-2.1%	-4.2%	5.7%	-4.0%	-4.0%	-8.6%
<b>ALL</b>	<b>172</b>	<b>0.90%</b>	<b>1.10%</b>	<b>-7.7%**</b>	<b>-10.5%***</b>	<b>-14.5%***</b>	<b>-2.00%</b>	<b>-1.90%</b>	<b>-13.7%***</b>	<b>-20.8%***</b>	<b>-27.0%***</b>

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics indicate the level of significance that average adjusted returns are greater/lower than zero for the entire sample. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

**Appendix 8: CEE IPO long-run returns per capital markets (N=76).**

Market	N IPOs	1 week	2 weeks	1 year	2 years	3 years	1 week	2 weeks	1 year	2 years	3 years
		<b>Model 1 (BHAR)</b>					<b>Model 2 (CAPM)</b>				
<b>Bucharest SE</b>	1	27.2%	24.1%	56.4%	25.2%	3.2%	23.5%	20.4%	83.3%	-4.3%	-39.7%
<b>Bulgarian SE</b>	6	12.4%	15.6%	59.0%	16.4%	17.0%	11.7%	15.7%	56.4%	-9.1%	-8.2%
<b>Ljubljana SE</b>	1	8.6%	11.7%	-7.1%	-8.1%	-5.7%	7.9%	11.0%	-19.7%	-20.2%	-19.0%
<b>Prague SE</b>	2	0.2%	-2.1%	10.1%	0.2%	3.9%	-4.9%	-5.6%	-15.6%	-29.2%	-20.7%
<b>Vienna SE</b>	13	-4.0%	-1.3%	-7.5%	-21.3%	-33.2%	-7.2%	-5.0%	-2.6%	-24.0%	-37.7%
<b>Warsaw SE</b>	53	0.6%	1.6%	3.7%	7.9%	2.7%	-3.8%	-2.8%	-5.8%	-4.1%	-11.4%
<b>ALL</b>	<b>76</b>	<b>1.2%</b>	<b>2.5%*</b>	<b>6.9%</b>	<b>3.4%</b>	<b>-2.4%</b>	<b>-2.6%**</b>	<b>-1.3%</b>	<b>0.4%</b>	<b>-8.8%</b>	<b>-16.4%**</b>
		<b>Model 3 (WBHAR)</b>					<b>Model 4 (WCAPM)</b>				
<b>Bucharest SE</b>	1	27.2%	24.1%	56.4%	25.2%	3.2%	23.5%	20.4%	83.3%	-4.3%	-39.7%
<b>Bulgarian SE</b>	6	35.1%	39.1%	38.9%	12.8%	11.6%	34.6%	39.5%	34.9%	-13.3%	-14.1%
<b>Ljubljana SE</b>	1	8.6%	11.7%	-7.1%	-8.1%	-5.7%	7.9%	11.0%	-19.7%	-20.2%	-19.0%
<b>Prague SE</b>	2	-0.8%	-3.0%	-4.6%	-10.8%	-3.8%	-4.3%	-5.2%	-17.1%	-34.9%	-22.5%
<b>Vienna SE</b>	13	-1.9%	-0.7%	5.5%	-5.2%	-11.5%	-6.0%	-5.6%	13.5%	-5.0%	-20.5%
<b>Warsaw SE</b>	53	-0.8%	0.4%	-7.6%	3.6%	6.8%	-4.1%	-3.7%	-9.9%	8.0%	-0.3%
<b>ALL</b>	<b>76</b>	<b>0.2%</b>	<b>1.5%</b>	<b>-1.0%</b>	<b>-0.2%</b>	<b>-0.8%</b>	<b>-3.2%**</b>	<b>-2.6%*</b>	<b>0.0%</b>	<b>0.3%</b>	<b>-9.8%</b>

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics indicate the level of significance that average adjusted returns are greater/lower than zero for the entire sample. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* level for the one-tailed test significant at the 10%.

**Appendix 9: Emerging CEE and EU IPO long-run returns comparison (N=63).**

	CEE	EU	CEE-EU	St. dev. CEE/ St. dev. EU	F-stat	CEE	EU	CEE-EU	St. dev. CEE/ St. dev. EU	F-stat
<b>Model 1 (BHAR)</b>						<b>Model 2 (CAPM)</b>				
<b>1 week</b>	2.3%	0.6%	1.6pp	>1	2.609***	-1.7%	-2.1%	0.4pp	>1	3.024***
<b>2 weeks</b>	3.3%	-0.3%	3.6pp**	>1	3.252***	-0.5%	-2.9%	2.4pp	>1	3.820***
<b>1 year</b>	9.8%	-9.2%	19.1pp**	>1	1.278	1.0%	-14.8%	15.8pp*	>1	1.947***
<b>2 years</b>	8.5%	-7.2%	15.7pp**	<1	0.738	-5.6%	-21.2%	15.5pp*	>1	1.698**
<b>3 years</b>	3.9%	-16.4%	20.3pp**	<1	0.773	-12.0%	-27.6%	15.6pp	>1	1.029
<b>Model 3 (WBHAR)</b>						<b>Model 4 (WCAPM)</b>				
<b>1 week</b>	1.5%	-0.4%	1.9pp	>1	4.494***	-1.5%	-2.7%	1.3pp	>1	3.464***
<b>2 weeks</b>	2.8%	-1.1%	3.9pp**	>1	6.232***	-0.8%	-3.6%	2.8pp	>1	4.584***
<b>1 year</b>	-5.0%	-3.7%	-1.3pp	<1	0.669*	-8.2%	-8.4%	0.2pp	<1	0.825
<b>2 years</b>	2.9%	2.8%	0pp	<1	0.310***	3.5%	-9.5%	13.0pp	<1	0.864
<b>3 years</b>	5.8%	-5.5%	11.3pp	<1	0.572**	-3.2%	-16.1%	12.9pp	<1	0.877

Notes: BHAR – index-adjusted buy-and-hold abnormal return; CAPM – CAPM-adjusted cumulative abnormal return; WBHAR – IPO value-weighted index adjusted buy-and-hold abnormal return; WCAPM – IPO value-weighted CAPM-adjusted cumulative abnormal return; Test t-statistics (showed in column CEE-EU) indicate the level of significance that the emerging CEE average adjusted returns are lower/greater than developed EU average adjusted returns. \*\*\* Significant at the 1% level for the one-tailed test; \*\* significant at the 5% level for the one-tailed test; \* significant at the 10% level for the one-tailed test. The F-statistics tests the null hypothesis that the variances of emerging CEE average adjusted returns are lower/greater than the variances of developed EU average adjusted returns.

## Appendix 10: List of CEE and developed EU IPOs.

CEE IPOs					Developed EU IPOs				
Company	Market	First Trading Date	Value of IPO Shares in EUR	Market Capitalisation in EUR	Company	Market	First Trading Date	Value of IPO Shares in EUR	Market Capitalisation in EUR
HEAD N.V.	Vienna SE	29.9.2000	269,746,871	718,087,874	BORUSSIA DORTMUND GMBH & CO. KGAA	Deutsche Boerse	30.10.2000	148,500,000	214,500,000
TELEKOM AUSTRIA AG	Vienna SE	21.11.2000	1,008,000,000	4,140,000,000	QSC AG	Deutsche Boerse	19.4.2000	301,990,000	2,352,960,000
ANDRITZ AG	Vienna SE	25.6.2001	48,300,000	273,000,000	DR. HÖNLE AG	Deutsche Boerse	24.1.2001	24,000,000	90,963,345
CONWERT IMMOBILIEN INVEST AG	Vienna SE	28.11.2002	11,000,000	44,000,000	TELFORD HOMES	London SE	14.12.2001	6,752,680	15,538,838
PEKAES	Warsaw SE	26.11.2004	24,523,635	74,848,267	ENOVA SYSTEMS INC	London SE	26.7.2005	17,038,217	49,899,988
ZELMER	Warsaw SE	27.1.2005	41,791,903	49,166,945	SAFT	NYSE Euronext-Paris	29.6.2005	280,139,964	479,887,980
EUROCASH	Warsaw SE	4.2.2005	54,978,853	122,175,229	TIPP24 SE	Deutsche Boerse	12.10.2005	85,834,443	177,446,380
CIECH	Warsaw SE	10.2.2005	68,008,215	164,867,493	METAL-TECH	London SE	13.5.2005	15,553,251	73,900,163
BIOTON	Warsaw SE	16.3.2005	10,751,162	119,460,188	PAION AG	Deutsche Boerse	11.2.2005	46,000,000	120,044,416
ECO BUSINESS-IMMOBILIEN AG	Vienna SE	17.3.2005	26,500,000	62,010,000	AXA PROPERTY TRUST	London SE	23.5.2005	148,126,204	148,126,204
LOTOS	Warsaw SE	9.6.2005	249,508,619	810,546,569	SERICA ENERGY	London SE	13.12.2005	95,266,448	201,579,564
AMBRA	Warsaw SE	22.6.2005	14,691,852	58,782,901	UKRPRODUCT GROUP	London SE	11.2.2005	8,887,572	32,661,828
POLICE	Warsaw SE	14.7.2005	37,929,438	189,647,192	OXFORD CATALYSTS GROUP	London SE	26.4.2006	23,915,862	93,032,212
BARLINEK	Warsaw SE	22.9.2005	41,755,061	157,644,919	GPE GROUP PIZZORNO	NYSE Euronext-Paris	8.7.2005	27,000,000	120,000,000
CENTURY CASINOS INC.	Vienna SE	12.10.2005	41,226,815	129,359,677	HOGG ROBINSON GROUP PLC	London SE	12.10.2006	358,943,907	407,995,565
PULAWY	Warsaw SE	19.10.2005	73,196,358	253,698,710	URALS ENERGY PUBLIC CO	London SE	9.8.2005	95,267,639	295,377,681
POLYTEC HOLDING AG	Vienna SE	28.4.2006	90,024,434	173,054,284	VISCOM AG	Deutsche Boerse	10.5.2006	49,500,450	184,008,000
PAMAPOL	Warsaw SE	20.6.2006	16,218,613	62,621,957	PURECIRCLE LTD	London SE	11.12.2007	34,612,871	315,669,020



ACTION	Warsaw SE	24.7.2006	13,269,774	48,390,444	H & T GROUP	London SE	8.5.2006	71,525,176	79,267,293
FAMUR	Warsaw SE	4.8.2006	72,035,781	364,918,795	BDI - BIOENERGY INTERNATIONAL AG	Deutsche Boerse	25.9.2006	72,500,000	222,300,000
ASTARTA HOLDING	Warsaw SE	17.8.2006	23,344,973	116,724,867	CHERKIZOVO GROUP(OJSC)	London SE	15.5.2006	189,190,504	189,190,504
TRANSELECTRICA	Bucharest SE	29.8.2006	34,479,318	344,793,162	PETROTEC AG	Deutsche Boerse	6.11.2006	94,949,590	178,500,000
ASSECO SLOVAKIA	Warsaw SE	10.10.2006	23,437,390	103,124,518	XING AG	Deutsche Boerse	7.12.2006	68,172,030	156,051,000
DOM DEVELOPMENT	Warsaw SE	24.10.2006	109,299,440	532,362,517	BAUER AKTIENGESELLSCHAFT	Deutsche Boerse	4.7.2006	145,411,088	284,374,600
CHIMIMPORT AD- SOFIA	Bulgarian SE	30.10.2006	22,610,255	113,051,277	HAHN-IMMOBILIEN- BETEILIGUNGS AG	Deutsche Boerse	30.10.2006	20,000,000	122,400,000
BENE AG	Vienna SE	3.11.2006	70,570,374	133,910,436	PRIMION TECHNOLOGY AG	Deutsche Boerse	13.2.2006	40,600,000	81,862,500
FOTA	Warsaw SE	28.11.2006	25,818,629	68,982,490	COBRA	Milano SE	12.12.2006	46,747,500	144,900,000
CINEMA CITY	Warsaw SE	8.12.2006	90,538,712	255,020,162	RIGHTMOVE	London SE	15.3.2006	110,459,202	617,675,680
PEGAS NONWOVENS SA	Prague SE	18.12.2006	136,154,250	249,193,800	FRANCOTYP-POSTALIA HOLDING AG	Deutsche Boerse	30.11.2006	159,133,835	279,300,000
MONNARI TRADE	Warsaw SE	20.12.2006	13,671,811	72,992,558	DELTICOM AG	Deutsche Boerse	26.10.2006	40,773,960	146,019,760
MONBAT AD-SOFIA	Bulgarian SE	3.1.2007	16,708,276	69,321,571	BLUESTAR SECUTECH INC	London SE	18.6.2007	16,508,299	51,789,923
WARIMPEX FINANZ UND BETEILIG. AG	Vienna SE	26.1.2007	99,000,000	396,000,000	UK COMMERCIAL PROPERTY TRUST LTD	London SE	22.9.2006	226,628,895	790,219,174
TEAK HOLZ INTERNATIONAL AG	Vienna SE	29.3.2007	17,077,500	56,169,288	ASIAN BAMBOO AG	Deutsche Boerse	16.11.2007	82,586,000	230,775,000
TELFORCEONE	Warsaw SE	29.3.2007	16,275,966	49,304,509	BIALETTI INDUSTRIE	Milano SE	27.7.2007	46,875,000	187,500,000
ELEKTROTIM	Warsaw SE	11.4.2007	17,343,669	45,468,538	SMT SCHARF AG	Deutsche Boerse	11.4.2007	17,100,000	39,900,000
NTT SYSTEM	Warsaw SE	12.4.2007	12,940,662	64,921,572	INVISION AG	Deutsche Boerse	18.6.2007	34,464,000	72,637,500
RADPOL	Warsaw SE	10.5.2007	21,486,746	43,182,949	HELLENIC CARRIERS LTD	London SE	30.11.2007	40,856,358	136,188,881
ERBUD	Warsaw SE	11.5.2007	45,073,117	166,651,554	ZHONGDE WASTE TECHNOLOGY AG	Deutsche Boerse	6.7.2007	108,816,864	390,000,000
KAOLIN AD-SENOVO	Bulgarian SE	21.5.2007	31,617,431	172,560,873	AEFFE	Milano SE	24.7.2007	142,680,000	440,186,266
AUTOMOTIVE COMPONENTS EUROPE	Warsaw SE	1.6.2007	67,878,460	120,202,800	HANSEYACHTS AKTIENGESELLSCHAFT	Deutsche Boerse	9.3.2007	75,900,000	230,400,000
J.W.CONSTRUCTION HOLDING	Warsaw SE	4.6.2007	206,097,593	1,029,676,243	WACKER NEUSON SE	Deutsche Boerse	15.5.2007	404,777,670	1,254,600,000
CB CORPORATE COMMERCIAL BANK AD-SOFIA	Bulgarian SE	18.6.2007	29,910,551	179,463,308	POLIS IMMOBILIEN AG	Deutsche Boerse	21.3.2007	89,777,794	164,659,900

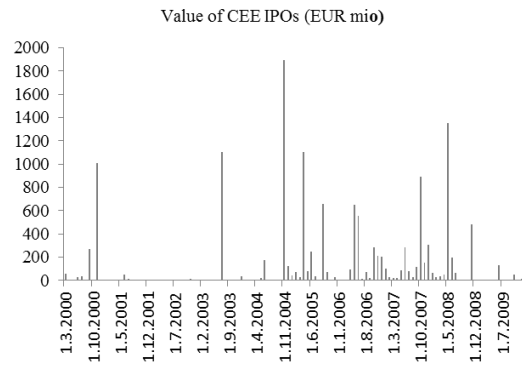
CB FIRST INVESTMENT BANK AD-SOFIA	Bulgarian SE	25.6.2007	90,268,510	601,790,066	ESTAVIS AG	Deutsche Boerse	2.4.2007	82,533,192	218,601,284
KAPSCH TRAFFICOM AG	Vienna SE	26.6.2007	70,400,000	390,400,000	CENTROTHERM PHOTOVOLTAICS AG	Deutsche Boerse	12.10.2007	185,092,500	640,000,000
LC CORP	Warsaw SE	29.6.2007	280,911,575	769,591,402	XCHANGING PLC	London SE	30.4.2007	340,997,611	724,080,099
KOMPUTRONIK	Warsaw SE	9.7.2007	16,897,912	99,234,790	SEPURA PLC	London SE	3.8.2007	80,908,951	294,214,365
MAKRUM	Warsaw SE	10.7.2007	11,241,766	58,584,349	PV CRYSTALOX SOLAR PLC	London SE	11.6.2007	80,051,366	799,502,561
PETROLINVEST	Warsaw SE	16.7.2007	31,814,250	332,080,585	ROXI PETROLEUM PLC	London SE	22.5.2007	57,197,767	93,915,437
MERCOR	Warsaw SE	19.7.2007	64,464,186	159,309,173	FERREXPO PLC	London SE	20.6.2007	151,121,157	1,262,835,526
P.A. NOVA	Warsaw SE	20.7.2007	27,202,952	100,751,674	STYLES & WOOD GROUP PLC	London SE	7.11.2006	107,488,863	144,626,194
ABM SOLID	Warsaw SE	24.7.2007	13,687,645	48,372,138	KROMI LOGISTIK AG	Deutsche Boerse	8.3.2007	30,000,000	82,500,000
POLAQUA	Warsaw SE	30.7.2007	81,661,883	561,427,488	HOMAG GROUP AG	Deutsche Boerse	13.7.2007	195,283,291	502,016,000
BOMI	Warsaw SE	20.8.2007	26,243,268	109,657,507	EXPANSYS PLC	London SE	11.4.2007	14,760,148	34,546,518
ARCUS	Warsaw SE	10.9.2007	10,824,862	34,391,179	CRANWARE PLC	London SE	13.9.2007	30,070,885	46,734,528
ENERGOINSTAL	Warsaw SE	25.9.2007	22,956,365	89,829,253	OPG POWER VENTURE PLC	London SE	30.5.2008	83,057,967	219,859,394
ORZEL BIALY	Warsaw SE	22.10.2007	13,973,439	128,995,254	TALVIVAARA MINING CO LTD	London SE	1.6.2007	309,479,276	639,456,612
ASBISC ENTERPRISES PLC	Warsaw SE	30.10.2007	38,214,428	100,018,219	CVS GROUP PLC	London SE	10.10.2007	134,229,287	153,107,074
RONSON EUROPE	Warsaw SE	5.11.2007	73,332,832	361,350,185	LOCAL SHOPPING REIT PLC(THE)	London SE	2.5.2007	235,397,970	245,637,781
ASSECO BUSINESS SOLUTIONS	Warsaw SE	19.11.2007	22,546,386	92,149,493	MEVIS MEDICAL SOLUTIONS AG	Deutsche Boerse	16.11.2007	37,365,130	100,100,000
KERNEL HOLDING	Warsaw SE	23.11.2007	151,490,381	421,472,201	HILTON FOOD GROUP PLC	London SE	17.5.2007	76,545,789	153,091,576
WIELTON	Warsaw SE	28.11.2007	19,407,555	117,173,111	VTG AKTIENGESELLSCHAFT	Deutsche Boerse	28.6.2007	177,136,974	406,388,891
SECO/WARWICK	Warsaw SE	5.12.2007	27,540,104	107,467,884	GREENKO GROUP PLC	London SE	7.11.2007	44,848,232	94,860,522
VGP NV	Prague SE	7.12.2007	49,999,992	283,391,513	ASEANA PROPERTIES LTD	London SE	5.4.2007	188,045,208	188,045,208
NOVA KBM	Ljubljana SE	10.12.2007	309,026,124	630,665,568	ALSTRIA OFFICE REIT-AG	Deutsche Boerse	3.4.2007	412,453,184	912,800,000
ENEMONA AD-KOZLODUY	Bulgarian SE	23.1.2008	17,179,601	102,507,241	KENTZ CORPORATION LTD	London SE	5.2.2008	84,210,852	168,867,117
TRAKCJA POLSKA	Warsaw SE	1.4.2008	47,717,297	276,886,154	LSR GROUP OJSC	London SE	16.11.2007	20,419,659	444,438,998
UNIBEP	Warsaw SE	8.4.2008	21,204,374	91,317,533	LXB RETAIL PROPERTIES PLC	London SE	23.10.2009	119,669,220	119,669,220

CYFROWY POLSAT	Warsaw SE	6.5.2008	250,073,120	1,298,629,358	MONEYSUPERMARKET.COM GROUP PLC	London SE	31.7.2007	267,736,725	1,253,842,629
ZA W TARNOWIE	Warsaw SE	30.6.2008	87,910,235	315,393,565	TYRATECH INC	London SE	1.6.2007	36,894,923	162,337,825
ENEA	Warsaw SE	17.11.2008	480,557,546	1,642,233,395	SMA SOLAR TECHNOLOGY AG	Deutsche Boerse	27.6.2008	361,900,000	1,665,600,000
LW BOGDANKA	Warsaw SE	25.6.2009	127,548,061	366,086,244	EXILLON ENERGY PLC	London SE	17.12.2009	68,980,296	213,789,233
ARCTIC PAPER	Warsaw SE	23.10.2009	36,492,655	242,582,871	FINTEL ENERGIA GROUP	Milano SE	23.3.2010	5,559,330	52,939,330
ASSECO SOUTH EASTERN	Warsaw SE	28.10.2009	52,437,033	176,873,255	VTION WIRELESS TECHNOLOGY AG	Deutsche Boerse	1.10.2009	48,375,000	171,785,000
ZUMTOBEL AG	Vienna SE	12.5.2006	553,388,377	891,750,000	TEREX MATERIAL HANDLING & PORT SOLUTIONS AG	Deutsche Boerse	23.6.2006	264,538,736	472,157,744
ÖSTERREICHISCHE POST AG	Vienna SE	31.5.2006	651,700,000	1,330,000,000	EXPERIAN GROUP LTD	London SE	11.10.2006	1,185,887,935	8,469,747,992
PGNIG	Warsaw SE	23.9.2005	656,853,831	4,306,041,781	PETROFAC	London SE	7.10.2005	479,859,281	1,104,635,052

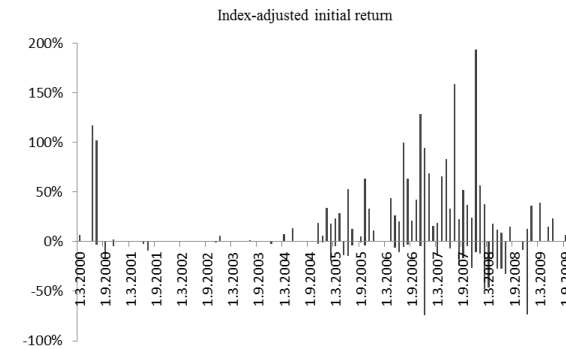
Source: CEE & EU stock exchanges & companies; own calculations.

**Appendix 11: IPO Value (left) and average index-adjusted initial return (right) in CEE, 2000–2009.**

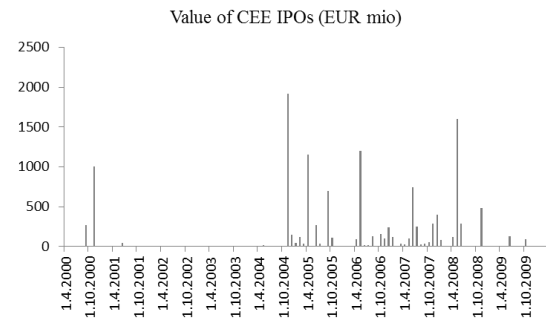
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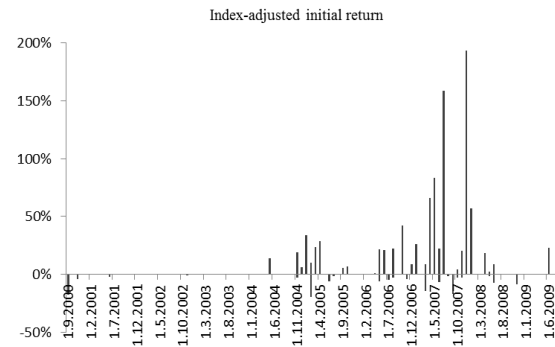
N=231



N=88



N=88



Sources: CEE stock exchanges & companies; Deutsche Boerse; own calculations.

## Appendix 12: IPO drivers in the CEE region – robust test (N = 231).

*N=231 (1.2.2000 – 31.12.2009)*

Dependent variable	Monthly number of IPOs per capital market					
Indep. variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-17.28 (-8.9)***	-18.67 (-8.6)***	5.56 (7.3)***	3.91 (5.3)***	-20.62 (-12.3)***	-8.6 (-2.63)*
GDP 2				1.89 (9.6)***		0.67 (2.30)**
GDP 2q					14.84 (4.32)***	9.28 (1.97)**
IP 1		0.22 (2.66)***			0.26 (3.28)***	0.07 (0.71)
Bond 2	-50.14 (-5.71)***		-58.87 (-3.94)***	-42.9 (-3.63)***		-54.8 (-4.1)***
Index				0.99 (1.19)		1.17 (0.75)
Turnover	0.88 (12.15)***	0.82 (9.91)***				-0.32 (-1.01)
Invest. funds			0.18 (10.09)***			0.09 (4.5)***
Pens. funds					0.89 (13.32)***	0.98 (3.3)***
Adj. R-squared	0.395	0.336	0.353	0.324	0.398	0.517
Sample	216	216	201	223	211	188
P-value (F stat)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: GDP 2 = GDP growth change 2 quarters before an IPO; GDP 2q = GDP % change 2 quarters before an IPO; IP 1 = Industrial production change 1 quarter before an IPO; Bond 2 = Yields to maturity of government bonds 2 quarters before an IPO; Index = Average benchmark index return 90 days before respective month; Turnover = Ln(yearly absolute change in respective market turnover (USD) 1 year before an IPO); Invest. funds = % change of assets, shares and other equity in total financial assets in investment funds one year before IPO (for OECD countries); Pens. funds = Ln(yearly absolute change in pension funds in respective country (USD) 1 year before IPO). See Table 3-3 for further specification of variables. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

### Appendix 13: Drivers of IPO underpricing in the CEE region – robust test (N=231).

N=231 (1.2.2000 – 31.12.2009)

Dependent variable	Index-adjusted initial return					
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.14 (1.27)	0.13 (1.11)	-0.11 (-1.40)	-0.11 (-0.09)	0.22 (0.10)	0.08 (0.71)
ROE		0.001 (1.10)		0.001 (0.001)		0.001 (0.98)
Income	0.26 (0.93)		0.26 (0.88)			0.13 (0.47)
Volatility	2.34 (1.58)	2.45 (1.50)*	2.60 (1.58)	2.70 (1.64)*	2.28 (2.18)**	2.42 (1.59)
Index	0.52 (3.26)***	0.54 (3.26)***	0.46 (3.02)***	0.48 (3.02)***	0.52 (3.70)***	0.51 (3.12)***
GDP	0.46 (1.78)*	0.51 (1.93)*	0.63 (2.31)**	0.68 (2.45)**		0.53 (1.94)*
Bond 3	-3.59 (-1.94)*	-3.56 (-1.93)*			-3.85 (-2.04)**	-3.00 (-1.70)*
Ind. prod. 2			0.02 (1.82)*	0.02 (1.78)*		0.01 (1.15)
R-squared	0.159	0.161	0.142	0.143	0.137	0.168
Sample <sup>1</sup>	147	147	148	148	208	147
P-value (F stat)	0.014	0.016	0.015	0.018	0.000	0.037

Notes: ROE = ROE 1 year

before an IPO; Income = Net profit (income)/assets 1 year before an IPO; Volatility = Share volatility 30 days after first trading date; Index = Benchmark index return 90 days before an IPO subscription period; GDP = Yearly GDP growth 1 year before an IPO; Bond 3 = Yields to maturity of government bonds 3 quarters before an IPO; Ind. prod. 2 = Industrial production change 2 quarter before an IPO. See Table 3-3 for further specification of variables. <sup>1</sup> Sample N=231 reduced due to missing data of independent variables. The figures in parentheses are t-statistics. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

## **Prve javne ponudbe na trgih kapitala centralno vzhodne Evrope**

### **Povzetek**

#### **Uvod**

Prva javna ponudba (angleški izraz: *Initial Public Offering* ali krajše *IPO*) se nanaša na prvo ponudbo delnic družbe javnosti, ki se zaključi z uvrstitvijo delnic na borzo vrednostnih papirjev. Odločitev družbe, da javnosti ponudi delnice in se uvrsti na borzo, je ena najpomembnejših odločitev v njenem življenjskem obdobju.

V prvi javni ponudbi se lahko ponujajo delnice, ki so v tem postopku izdane prvič, ali pa se ponujajo delnice, ki so že izdane. Običajno se družba odloči za prvo javno ponudbo novozdanih delnic z namenom povečanja lastniškega kapitala družbe za financiranje novih poslovnih investicij. Razlogi za prvo javno ponudbo in uvrstitve delnic na borzo so lahko tudi drugi. Koristi prve javne ponudbe in uvrstitve na borzo so med drugim razširitev možnih oblik financiranja, izboljšanje pogajalskih pozicij pri bankah, povečanje prepoznavnosti med vlagatelji, promocija, povečanje likvidnosti delnic, razpršitev lastništva, predaja lastniške kontrole, boljše oblikovanje cene delnic, večja razpoložljivost in lažje spremljanje poslovnih informacij družbe ter povečevanje vrednosti družbe (Pagano et al. (1998), Huyghebaert in Van Hulle (2006a), Bodnaruk et al. (2008), Kim in Weisbach (2008), Alavi et al. (2008)).

Na temo prvih javnih ponudb na razvitih trgih kapitala je literatura zelo obsežna tako na teoretičnem kot empiričnem področju. Glavno področje obširnih akademskih raziskovanj je učinkovitost procesov prvih javnih ponudb in analiza donosnosti delnic po njihovi uvrstitvi na borzo. Večina najpomembnejših akademskih raziskav se loteva treh področij: podcenjenosti delnic v prvi javni ponudbi, njihovi dolgoročni nizki donosnosti ter cikličnosti pojavljanja prvih javnih ponudb.

#### **Podcenjenost**

O podcenjenosti v prvi javni ponudbi govorimo, kadar je cena delnic v prvi javni ponudbi nižja, kot je kasneje cena, po kateri se trgujejo te delnice prvi dan na borzi. To pomeni, da se lahko zaradi nizko postavljene cene delnic v prvi javni ponudbi doseže izdatne donose prvi dan njihovega trgovanja na borzi. Loughran in Ritter (2004) sta pokazala, da je bila povprečna donosnost prvega dne trgovanja na borzi za delnice na trgih v ZDA 7% v 80-ih

letih, 15% med leti 1990 in 1998, 65% v obdobju internetnega balona med leti 1999 in 2000 ter 12% med leti 2001 in 2003.

Pozitivno donosnost prvega dne trgovanja na borzi za različna obdobja med 1960 in 1999 so dokazali mnogi avtorji, in sicer najpogosteje za področje trgov kapitala v ZDA, na razvitih trgih Evrope, na Japonskem in razvijajočih kapitalskih trgih Azije (Jenkinson in Ljungqvist, 2001). Najmanjša povprečna donosnost prvega dne v višini 4,5% je bila dokumentirana za Izrael in 4,8% za Francijo, medtem ko so bile maksimalne povprečne prve donosnosti dosežene na Kitajskem (289%) in Maleziji (166%). Fenomen podcenjenost v prvi javni ponudbi je pogost tudi v obdobju po 1990. O njem so poročali mnogi avtorji, kot so Aussenegg (2006), Benveniste et al. (2008), Bradley et al. (2009), Chen et al. (2004), Durukan (2002), Gregoriou (2006), Ritter in Welch (2002), Zheng in Li (2008), Ritter, Signori in Vismara (2013).

### **Dolgoročna nizka donosnost**

Druga najbolj pogosta anomalija, ki jo je moč zaslediti v akademskih raziskavah na temo prvih javnih ponudb, je dolgoročna nizka donosnost. Ta pomeni, da praviloma delnice iz prve javne ponudbe na dolgi rok dosegajo nižje donosnosti glede na ostale primerljive delnice na istem trgu. Številne analize so dokazale ta fenomen. Jenkinson in Ljungqvist (2001) v svoji knjigi navajata glavne empirične rezultate tega pojava mnogih avtorjev za različne regije in obdobja. Največje dolgoročne izgube so zabeležene za Avstralijo (-51%) in Brazilijo (-47%) v 80ih letih. Levis (1993) prav tako poroča o negativni dolgoročni donosnosti na trgih kapitala v Angliji v 80ih letih. Tudi v zadnjih dveh desetletjih mnogi avtorji poročajo o dolgoročni nižji donosnosti delnic iz primarnih javnih ponudb, med drugim Aussenegg (2000) za Polsko in (2006) za Avstrijo, Eckbo et al. (2000) za ZDA, Eckbo in Norli (2005) za Nasdaq, Kao et al. (2009) za Kitajsko, Pastor-Llorca in Poveda-Fuentes (2006) za Španijo, Ritter (2003) za internacionalne kapitalске trge. V zadnjem času so dolgoročno nizko donosnost prvih javnih ponudb na trgih kapitala v ZDA raziskovali Ritter (2011) ter Gao, Ritter in Zhu (2013), na evropskih razvitih trgih pa Vismara, Paleari in Ritter (2012) ter Ritter, Signori in Vismara (2013).

### **Cikličnost prvih javnih ponudb**

Pomemben del literature, ki pokriva področje prvih javnih ponudb, obravnava še en fenomen, to je cikličnost prvih javnih ponudb. Običajno se prve javne ponudbe pojavljajo v ciklih. Tako imenovan fenomen »vročega« trga pomeni, da se veliko družb odloča za prvo javno ponudbo v istem obdobju. Zanimivo je tudi to, da sta pogosto število družb in podcenjenost korelirana (Yung et al., 2008; Ritter et al. 2013). Jenkinson in Ljungqvist (2001) pojasnjujeta pozitivno avtokorelacijo za ZDA v obdobju med 1960 in 1999. Obstaja velika verjetnost, da obdobjem velikega števila prvih javnih ponudb sledi obdobje



nadaljnega obsežnega števila prvih javnih ponudb. Avtorja trdita, da odločitev, kdaj bo družba izvedla prvo javno ponudbo, v veliki meri zavisi od razlike med stroški in koristi, ki jih uvrstitev na borzo prinaša. Obstajajo številni faktorji, ki vplivajo na obdobje »vročega« trga, med drugim dvigovanje cen na borzi, zmanjševanje proceduralnih zahtev za uvrstitev na borzo ali poslovni cikli.

Benninga et al. (2005) ponujajo nadaljnjo razlago »mrzlega in vročega« trga. Trdijo, da spremembe makroekonomskega okolja simultano vplivajo na industrijske panoge in podjetja, zaradi česar je dobičkonosnost podjetij pozitivno korelirana. Tako velja, da ko eno podjetje ugotovi, da je optimalen čas za izdajo delnic, to ugotovijo tudi druga podjetja. Druga teorija »vročega« trga razlaga, da zunanji šoki, ki vplivajo na investicijske priložnosti, povzročijo, da je model napačne izbire, ki vpliva na trg prvih javnih ponudb, odvisen od časovne komponente in zato pride do ciklov (Yung et al., 2008). Lowry (2003) je na vzorcu za ZDA v obdobju med 1960 in 1996 pokazala, da se podjetja lažje odločajo za prvo javno ponudbo, ko so stroški napačne izbire nižji in je sentiment investitorjev višji. To je v skladu s teorijo asimetrije informacij, ki trdi, da ko je asimetrija informacij velika, so stroški napačne izbire izdaje kapitala višji, zato se podjetje težje odloči za izdajo delnic. Podobno so v zadnjem času na pozitiven vpliv pozitivnih razmer na kapitalskih trgih na prve javne ponudbe pokazali Ritter et al. (2013) za razvite evropske kapitalske trge. Strokovna literatura torej v veliki meri podpira hipotezo, da se družbe odločajo za uvrstitev na borzo v obdobju pozitivnih priložnosti in na podlagi informacij o cenah preteklih in sedanjih prvih javnih ponudb (Benveniste et al., 2008).

## **Raziskovalno področje**

Osnovni namen doktorskega dela je raziskati prve javne ponudbe na trgih kapitala centralne in vzhodne Evrope. Kljub obsežnemu številu akademskih raziskav na področju prvih javnih ponudb na razvitih kapitalskih trgih so prve javne ponudbe v centralni in vzhodni Evropi manj raziskane. To še posebej velja za desetletje po letu 2000. To gre pripisati relativno mladim trgom kapitala z majhnim številom prvih javnih ponudb in skromno tradicijo investiranja v vrednostne papirje. V luči obsežnih privatizacij na tem območju dve in pol desetletji nazaj večina relevantne literature pokriva postopke privatizacije iz devetdesetih (Aggestam, 2006, Harper, 2002, Aussenegg in Jelic, 2007, Jelic in Briston, 1999, Jelic et al. 2003) oziroma prve javne ponudbe na poljskem trgu, kjer je bilo v drugi polovici desetletja 2000 zabeleženih relativno veliko število prvih javnih ponudb v Evropi (Darmetko, 2009; Jewartowski in Lizińska, 2012; Lizińska in Czapiewski, 2014; Meluzin et al. 2013; Sieradzki, 2013; Zaremba in Kaminski, 2011; Zaremba in Żmudziński, 2014). Namen doktorskega dela je zapolniti vrzel na področju raziskovanja prvih javnih ponudb na razvijajočih trgih.

Prvi del doktorskega dela vključuje analizo kapitalskih trgov, institucionalnih in drugih makro ter mikro dejavnikov, ki lahko vplivajo na aktivnosti prvih javnih ponudb na tem območju. Obstaja vrsta faktorjev, ki lahko preko trga kapitala vplivajo na družbo in zato tudi na uspešnost procesa prve javne ponudbe ter na donosnost delnic po tem, ko se družba uvrsti na borzo. Pomemben del raziskave vključuje tudi podroben pregled strukture prvih javnih ponudb v regiji (na primer glede na primarne oziroma sekundarne javne ponudbe delnic, glede na lastniško strukturo ter delitev glede na način določanja cene).

Glavni fokus disertacije pa je analiza najpomembnejših anomalijah prvih javnih ponudb, ki jih pokriva strokovna literatura: podcenjenost delnic, dolgoročna nizka donosnost in cikličnost prvih javnih ponudb. Pomemben del raziskovalnega dela vključuje tudi podrobnejšo analizo mikro in makro razvojnih faktorjev prvih javnih ponudb v regiji, kot so tip lastniške strukture in struktura kapitala pred javno ponudbo, informacijska asimetrija, stopnja investitorskega sentimenta, privlačnost poslovnega okolja, institucionalni faktorji in poslovni cikli.

Doktorsko delo prispeva k boljšemu poznavanju značilnosti prvih javnih ponudb na trgih kapitala centralne in vzhodne Evrope v več pogledih. Prvič, predstavlja podrobno analizo značilnosti prvih javnih ponudb za celovito območje centralne in vzhodne Evrope, ki ga prištevamo med razvijajoče oziroma v tudi med obrobne kapitalske trge, v obdobju med leti 2000 in 2009. Drugič, doktorska disertacija podaja originalne empirične dokaze podcenjenosti, dolgoročne nižje donosnosti ter cikličnosti prvih javnih ponudb na trgih kapitala centralne in vzhodne Evrope. Tretjič, doktorska disertacija vključuje primerjalno analizo podobnosti prvih javnih ponudb na trgih centralne in vzhodne Evrope z razvitimi kapitalskimi trgi po Evropi. Četrtrič, analiza vpliva institucionalnih faktorjev, trgov kapitala, ter drugih mikro in makro faktorjev na procese prvih javnih ponudb podaja nove razlage razlogov za razvoj prvih javnih ponudb na razvijajočih trgih kapitala. Ker je to raziskovalno področje slabo pokrito v obstoječi literaturi, lahko rezultati doktorskega dela pomembno prispevajo k večjemu razumevanju dejavnikov, ki vplivajo na uspešnost prvih javnih ponudb na manjših, razvijajočih kapitalskih trgih.

## **Hipoteze**

Doktorska disertacija temelji na dokazovanju hipotez, ki so predstavljeni v treh člankih:

### **1. Notranje lastnosti in zunanji faktorji aktivnosti prvih javnih ponudb v centralni in vzhodni Evropi: empirična analiza in primerjava**

Prvi članek vključuje kvalitativno analizo prvih javnih ponudb na območju centralne in vzhodne Evrope v obdobju od 2000 do 2009. Analiza vključuje vpogled v strukturo in modele prvih javnih ponudb (način določanja cene preko bookbuilding metode ali uporabe

fiksne cene in vključevanja finančnih posrednikov), v panožno in lastniško strukturo ter vpogled v druge lastnosti prve javnih ponudb (kot so: javna ponudba z novo izdanimi ali že obstoječimi delnicami). Drugi del vključuje analizo zunanjih faktorjev (privlačnost poslovnega okolja, sentiment vlagateljev in lastnosti kapitalskega trga, kot je likvidnost), ki lahko vplivajo na aktivnosti prvih javnih ponudb na tem območju.

## **2. Podcenjenost in dolgoročna donosnost prvih javnih ponudb na trgih kapitala v centralni in vzhodni Evropi**

Glavni fokus drugega članka je na dveh glavnih anomalijah, ki ju pokriva strokovna literatura prvih javnih ponudb: podcenjenost in dolgoročna nizka donosnost. Glavne hipoteze so:

*Hipoteza 1:* Prve javne ponudbe v centralni in vzhodni Evropi so podcenjene in imajo v povprečju pozitivno donosnost prvi dan trgovanja na borzi.

*Hipoteza 2:* Delnice iz manjših prvih javnih ponudb v centralni in vzhodni Evropi so bolj podcenjene kot večje prve javne ponudbe.

*Hipoteza 3:* Povprečna donosnost delnic iz prvih javnih ponudb prvi dan trgovanja v centralni in vzhodni Evropi in v razviti Evropi je enaka.

*Hipoteza 3a:* Obstaja pozitivna korelacija med donosnostjo delnic iz prvih javnih ponudb prvi dan trgovanja v centralni in vzhodni Evropi in razviti Evropi.

*Hipoteza 4:* Delnice iz prve javne ponudbe v centralni in vzhodni Evropi imajo na dolgi rok nižje donosnosti v primerjavi s primerljivimi delnicami borznih družb.

*Hipoteza 5:* Povprečna dolgoročna donosnost delnic iz manjših prvih javnih ponudb v centralni in vzhodni Evropi je nižja kot pri večjih prvih javnih ponudbah.

*Hipoteza 6:* Povprečna dolgoročna donosnost delnic iz prvih javnih ponudb v centralni in vzhodni Evropi in razviti Evropi je enaka.

*Hipoteza 6a:* Obstaja pozitivna korelacija med dolgoročno donosnostjo delnic iz prvih javnih ponudb v centralni in vzhodni Evropi in razviti Evropi.

## **3. Cikli prvih javnih ponudb na trgih kapitala centralne in vzhodne Evrope. Kateri faktorji pospešujejo aktivnosti prvih javnih ponudb?**

Tretji članek združuje ugotovitve prvih dveh člankov in jih nadgradi z nadaljnjo analizo faktorjev, ki vplivajo na aktivnosti prvih javnih ponudb. Glavne hipoteze so:

*Hipoteza 1:* Obstajajo cikli prvih javnih ponudb na kapitalskih trgih v centralni in vzhodni Evropi.

*Hipoteza 2:* Število in podcenjenost prvih javnih ponudb na kapitalskih trgih v centralni in vzhodni Evropi sta pozitivno korelirana.

*Hipoteza 3:* Obstaja pozitivna korelacija med številom prvih javnih ponudb na kapitalskih trgih v centralni in vzhodni Evropi in v razviti Evropi.

*Hipoteza 4:* Glavni makro faktorji, ki pospešujejo trg prvih javnih ponudb in vplivajo na število prvih javnih ponudb, so sentiment vlagateljev, cene delnic, likvidnost trga in poslovni cikli.

*Hipoteza 5:* Glavni makro in mikro faktorji, ki vplivajo na podcenjenost prvih javnih ponudb, so asimetrija informacij, razmere na trgu kapitala, lastniška struktura pred prvo javno ponudbo, zadolženost in poslovanje podjetja ter tveganost podjetij.

## Baza podatkov

Baza podatkov vključuje prve javne ponudbe, ki so se izvršile na borzah vrednostnih papirjev v Bukarešti, Ljubljani, Pragi, Sofiji, Varšavi in na Dunaju v obdobju med 2000 in 2009 (Tabela 1). Pri tem so bile izključene dvojne kotacije in v določenih primerih družbe, ki so bile izključene iz trgovanja po letu 2012. V nekaterih analizah so bile namreč vključene le prve javne ponudbe z vrednostjo izdaje vsaj 10 milijonov evrov (novo izdane ali obstoječe delnice) in s katerimi se še trguje na borzah, ker za manjše prve javne ponudbe ali izključene delnice ni bilo na voljo vseh podatkov. Borza v Budimpešti je bila izključena, saj v izbranem obdobju ni zabeležila nobene prve javne ponudbe.

Tabela 1: Število prvih javnih ponudb na trgih na trgih kapitala centralne in vzhodne

Leto	Izključene IPO delnice		IPO vrednost < 10 mio EUR		IPO vrednost >= 10 mio EUR		Skupaj	
	Število	Vrednost	Število	Vrednost	Število	IPO Vrednost	Število	IPO Vrednost
2000	6	302.740.000			2	1.277.746.871	8	1.580.486.871
2001	2	23.070.000			1	48.300.000	3	71.370.000
2002	1	4.500.000			1	11.000.000	2	15.500.000
2003	5	1.181.892.698			0	0	5	1.181.892.698
2004	3	173.106.447	2	9.580.977	5	2.083.021.257	10	2.265.708.681
2005	19	459.192.567	12	64.616.148	14	2.468.880.705	45	2.992.689.420
2006	14	874.859.085	17	134.946.200	16	1.946.562.132	47	2.956.367.417
2007	22	1.332.871.004	21	127.751.830	37	2.132.406.087	80	3.593.028.921
2008	15	306.693.311	10	94.430.202	9	2.504.062.177	34	2.905.185.690
2009	2	11.199.997	7	24.355.744	3	216.477.750	12	252.033.492
<b>Skupaj</b>	<b>89</b>	<b>4.670.125.109</b>	<b>69</b>	<b>455.681.102</b>	<b>88</b>	<b>12.688.456.979</b>	<b>246</b>	<b>17.814.263.190</b>

Vir: Borze v regiji & podjetja; lastne kalkulacije.

Podatki o prvih javnih ponudbah so bili pridobljeni iz prospektov, spletnih strani obravnavanih borz, njihove statistike in spletnih strani posameznih družb. Statistike trgov kapitala, kot so uradni tečajji, promet delnic, vrednost indeksov in likvidnost, so bile pridobljene s strani posameznih borz. Drugi podatki (makro podatki, vrednosti delnic razvitih trgov) so bili pridobljeni s strani OECD, EBRD, FESE, Svetovne banke in Datastream baze podatkov.

## Opis znanstvene metode

Največji del raziskovanja predstavlja kvantitativni del. Za analizo podcenjenosti delnic v prvih javnih ponudbah je izjemna donosnost prvega dne trgovanja definirana kot razlika med izmerjeno donosnostjo delnic prve javne ponudbe in normalno donosnostjo, ki bi jo lahko investitor pričakoval od investiranja v prvo javno ponudbo:

$$IR_i = R_i - E(R_i),$$

kjer je  $IR_i$  izjemna donosnost prve javne ponudbe  $i$ ,  $R_i$  je izmerjena donosnost in  $E(R_i)$  je pričakovana donosnost (Aussenegg (2006)). Obstaja nekaj alternativnih modelov za določanje pričakovane donosnosti za nazaj (ex-ante), pri čemer je najbolj uporabljena metoda prilagoditve donosnosti s tržnim indeksom (Aussenegg (2006)). Tako je prilagojena donosnost prvega dne trgovanja delnice iz prve javne ponudbe definirana kot razlika med izmerjeno donosnostjo in donosnostjo ustreznega borznega indeksa:

$$IR_{i,t} = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} - \frac{I_{i,1} - I_{i,0}}{I_{i,0}},$$

kjer je  $IR_{i,t}$  prilagojena donosnost prvega dne trgovanja delnice iz prve javne ponudbe  $i$ ,  $P_{i,1}$  je cena delnice prve javne ponudbe  $i$  konec prvega trgovalnega dne,  $P_{i,0}$  je cena delnice v prvi javni ponudbi  $i$ ,  $I_{i,1}$  je vrednost borznega indeksa konec prvega trgovalnega dne delnice prve javne ponudbe  $i$  in  $I_{i,0}$  je vrednost borznega indeksa na prvi dan vpisa delnic v prvi javni ponudbi  $i$  (Aussenegg, 2006).

Tudi za določanje dolgoročne donosnosti je pomembno opredeliti ustrezno primerljive tržne kazalnike. V primeru manjših trgov kapitala je ustrezna metoda, da se za primerljivost vzame ustrezen borzni indeks. Dolgoročna donosnost (t.i. »Kupi-in-drži« donosnost) ( $BHAR_{i,T}$ ) za delnico  $i$  se izračuna na naslednji način:

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

pri čemer se  $BHAR$  izračuna za časovna obdobja  $T = 1$  teden, 2 tedna, 1 leto, 2 leti, 3 leta. Tudi pri dolgoročni donosnosti se podobno kot pri kratkoročni izvede prilagoditev donosnosti izvede z upoštevanjem borznih indeksov.

Poleg tržne prilagoditve donosnosti smo v analizo vključili tudi model prilagoditve s tako imenovanim CAPM modelom (Capital Asset Pricing Model), ki sta ga razvila Sharpe (1964) in Lintner (1965) in je prikazan z naslednjo formulo:

$$AR_{i,T} = R_{i,T} - R_{f,T} - \beta_i \times (R_{m,T} - R_{f,T}),$$

kjer je  $AR_{i,T}$  donosnost prvega dne ali kumulativna donosnost za  $T = 1$  teden, 2 tedna, 1 leto, 2 leti, 3 leta,  $\beta_i$  koeficient se računa za obdobje od prvega dne trgovanja do konca petega leta izbrane prve javne ponudbe  $i$ , netvegana obrestna mera  $R_{f,T}$  predstavlja donosnost do dospelja 10 ali 15- letne državne obveznice za izbrano državo, za donosnost na kapitalskem trgu  $R_{m,T}$  se upošteva donosnost izbranega indeksa za posamezni kapitalski trg  $m$  in  $R_{i,T}$  je donosnost delnic prve javne ponudbe  $i$  šteto od drugega trgovalnega dne.

Za analizo podcenjenosti ali precenjenosti delnic prvih javnih ponudb se je poleg zgoraj navedenih metod računanja donosnosti uporabila metoda prilagoditve z utežmi, in sicer z vrednostjo prve javne ponudbe. Pri analizi dolgoročne donosnosti prvih javnih ponudb se je upoštevala tudi metoda kumulativnih prilagojenih donosnosti (t.i. cumulative abnormal return oz. CAR) in metoda analize portfelja v času (t.i. calendar-time portfolio approach). Za analiziranje korelacije med primarno in dolgoročno donosnostjo delnic iz prve javne ponudbe trgov centralne in vzhodne Evrope in razvitih trgov Evrope se je vzorec prvih javnih ponudb grupiralo v 120 mesečnih skupin in primerjalo podatke obeh glavnih tržnih skupin. Za analizo razlik med povprečnimi primarnimi in povprečnimi dolgoročnimi donosnostmi delnic iz prve javne ponudbe trgov centralne in vzhodne Evrope in razvitih trgov Evrope se je upoštevala t statistika. Za določanje cikličnosti prvih javnih ponudb se je uporabila metoda avtokorelacije ter analiza stacionarnosti z uporabo augmented dickey-fullerjevega testa. Za ugotavljanje povezav in dejavnikov »vročih« trgov pa se je uporabila metoda eno in več variantne multiple regresije z oceno t.i. robustne standardne napake ocene parametrov ter logit regresija.

## Rezultati

Rezultati prvega članka kažejo, da so karakteristike prvih javnih ponudb centralne in vzhodne Evrope primerljive s tistimi iz razvitih kapitalskih trgov Evrope v obdobju med leti 2000 in 2009. Lastniška struktura po prvi javni ponudbi ostaja visoko koncentrirana za večino družb, ki se uvrstijo na borzo, kar posledično vpliva na kasnejšo slabšo likvidnost delnic na borzi. Rezultati prav tako kažejo, da se največ prvih javnih ponudb opravi z novo izdanimi delnicami, pri čemer pa je velikost izdaje običajno relativno majhna.

Rezultati tudi potrjujejo, da podobno kot pri razvitih evropskih kapitalskih trgih, vse bolj prevladuje tako imenovana bookbuilding metoda za določanje cene in alokacije v prvi javni ponudbi. Prav tako je pri tem vse bolj pomembna vloga investicijskih posrednikov. Po letu 2000 so namreč metode prvih javnih ponudb v obravnavani regiji postale vse bolj primerljive tistim na razvitih evropskih trgih. To je najverjetneje posledica dejstva, da so se vse države iz regije sredi 2000 pridružile Evropski Uniji in so zato morale skozi proces

harmonizacije svoje nacionalne zakonodaje z evropsko, med drugim prospektne direktive in direktive o zlorabah trga, ki pomembno vplivata na proces izvedbe prvih javnih ponudb.

Analiza makro faktorjev prvih javnih ponudb je tudi pokazala, da lastnosti kapitalskih trgov (kot so velikost, likvidnost in delež tržne kapitalizacije v bruto domačem proizvodu) same po sebi ne zadostujejo za pojasnjevanje vplivov zunanjih faktorjev na aktivnosti prvih javnih ponudb v regiji. Kljub temu rezultati nakazujejo, da ima lahko prav privlačnost kapitalskih trgov, merjena z letno donosnostjo borznih indeksov in letno rastjo borznega prometa, pomemben vpliv na aktivnosti prvih javnih ponudb. Med ostalimi makroekonomskimi dejavniki, ki so izstopali v obravnavanem obdobju za poljski kapitalski trg, ki je bil trg z največjim številom prvih javnih ponudb, pa so še hitrejša gospodarska reforma in prestrukturiranje podjetij ter visok delež pokojninskih skladov v bruto domačem proizvodu. Ti rezultati so dodatno potrjeni v kvantitativnem modelu v tretjem članku.

Glavni fokus drugega članka je analiza podcenjenosti in dolgoročne nizke donosnosti prvih javnih ponudb na trgih centralne in vzhodne Evrope. Pokazali smo, da so prve javne ponudbe v tej regiji podcenjene, torej imajo v povprečju izjemno pozitivno donosnost prvi dan trgovanja na borzi. Poleg tega smo pokazali, da so skladno s teorijo asimetrije informacij manjše prve javne ponudbe bolj podcenjene v primerjavi z večjimi. Še več, dokazali smo, da so bile v obdobju 2000-2009 delnice iz prvih javnih ponudb v tej regiji v povprečju statistično značilno bolj podcenjene kot primerljive delnice prvih javnih ponudb na razvitih evropskih trgih. Poleg tega smo dokazali, da je bila tudi volatilitnost teh delnic statistično in ekonomsko višja. Za to lahko podamo intuitivno razlago. Ker so pri razvijajočih trgih makroekonomski in institucionalni dejavniki bolj volatilni, se to odraža tudi na večjih nihanjih cen delnic na teh kapitalskih trgih. Ta večja negotovost se prenaša tudi na transakcije prvih javnih ponudb, ki so že po svoji naravi bolj tvegane.

V nasprotju z dokazi različnih avtorjev o precej mešanih rezultatih glede dolgoročne donosnosti prvih javnih ponudb na razvijajočih trgih, naši rezultati nedvoumno potrjujejo dolgoročno višjo podcenjenost obravnavanih delnic v primerjavi z drugimi delnicami na istih trgih. Tako smo v drugem članku tudi pokazali, da imajo delnice iz prve javne ponudbe v centralni in vzhodni Evropi na dolgi rok nižje donosnosti v primerjavi s primerljivimi delnicami borznih družb na istih trgih, vendar v povprečju višje (to je manj negativne) donosnosti kot primerljive delnice prvih javnih ponudb na razvitih evropskih trgih. Rezultati so sicer manj enoznačni kot pri kratkoročnih donosnostih, saj je bila v kar nekaj primerih zabeležena tudi pozitivna dolgoročna donosnost glede na izbran borzni indeks. Še posebej pa so zanimivi rezultati analize volatilitnosti cen delnic iz prvih javnih ponudb v centralni in vzhodni Evropi na daljši rok, saj se volatilitnost teh delnic na dolgi rok (do treh let) stabilizira. Predpostavljamo, da je to rezultat bikovskega trenda na obravnavanih borzah sredi obdobja 2000-2009, ko so borzni indeksi centralne in vzhodne

Evrope zabeležili najvišje donosnosti v Evropi. To je gotovo vplivalo na višje donosnosti delnic prvih javnih ponudb v primerjavi s primerljivimi delnicami razvitih trgov Evrope. V skladu z empiričnimi študijami, da je volatilitnost delnic nižja, ko borzni trgi rastejo, smo tako pokazali, da je v povprečju donosnost delnic prvih javnih ponudb na dolgi rok višja (torej manj negativna oziroma v določenih primerih celo pozitivna) in manj volatilna v primerjavi z razvitimi evropskimi trgi. Mešani (torej v nekaterih primerih tudi pozitivni) rezultati dolgoročne donosnosti pa so najverjetneje tudi rezultat posebnosti razvijajočih trgov, na katerih običajno delnice v času rasti dosežajo višje donosnosti kot na razvitih trgih.

Zadnji, tretji, članek nadgradi ugotovitve prvih dveh člankov s podrobno analizo faktorjev, ki pospešujejo aktivnosti prvih javnih ponudb. Najprej na podlagi mesečnega števila prvih javnih ponudb dokažemo, da so v obdobju od 2000 do 2009 obstajali cikli prvih javnih ponudb na kapitalških trgih v centralni in vzhodni Evropi. Podobno, kot velja za mnoge razvite trge prvih javnih ponudb, smo dokazali tudi pozitivno korelacijo med številom prvih javnih ponudb in podcenjenostjo teh delnic, kar še posebej velja za čas bikovskega trenda na borzah. Torej tudi za kapitalške trge v centralni in vzhodni Evropi velja, da je v obdobjih z večjem številom prvih javnih ponudb tudi podcenjenost teh delnic oziroma njihova izjemna donosnost na prvi dan trgovanja višja.

Nadalje smo pokazali, da so cikli prvih javnih ponudb v regiji centralne in vzhodne Evrope pozitivno korelirani s cikli prvih javnih ponudb na nemški borzi, ki je bila vzeta za primerjavo. To še posebej velja za obdobje po maju 2004, torej precej po zaključku borznega balona, ki so ga leta 2000 povzročila visoko tehnološka podjetja na razvitih kapitalških trgih ter po postopni vključitvi držav iz te regije k Evropski uniji. Do leta 2004 je bil trg prvih javnih ponudb centralne in vzhodne Evrope zelo nerazvit in je deloval bistveno slabše v primerjavi z razvitimi kapitalškimi trgi po Evropi, kar gre pripisati relativno kratkemu obstoju teh kapitalških trgov, manjši likvidnosti v primerjavi z razvitimi trgi in pomanjkanju storitev finančnega posredništva. Po priključitvi k Evropski uniji pa so se s harmonizacijo nacionalnih zakonodaj z evropsko, med drugim prospektne direktive, postopki prvih javnih ponudb precej poenotili, kar je lahko poleg drugih dejavnikov pospešilo tudi razvoj prvih javnih ponudb, ki pa se je praktično zaustavil po letu 2008 zaradi mednarodne finančne krize.

Makro dejavniki, ki so vplivali na število prvih javnih ponudb v regiji centralne in vzhodne Evrope med 2000 in 2009, so predvsem sentiment vlagateljev, izražen bodisi z aktivnostjo udeležencev na trgih kapitala ali z agresivnostjo upravljavcev investicijskih skladov do naložb v delnice, ter makroekonomski dejavniki (kot so gospodarski cikli). Naši rezultati namreč kažejo močno pozitivno relacijo med sentimentom vlagateljev, merjenim bodisi z letno rastjo prometa delnic na posamezni borzi, z letno rastjo premoženja pokojninskih



skladov bodisi z letnim deležem delnic v investicijskih skladih posamezne obravnavane države, in številom prvih javnih ponudb.

Analiza faktorjev, ki vplivajo na podcenjenost in posredno torej tudi na število prvih javnih ponudb, je podobno pokazala, da na podcenjenosti prvih javnih ponudb pomembno vplivajo razmere na kapitalskih trgih, kar je ponovno pokazatelj sentimenta vlagateljev. Rezultati namreč kažejo, da višja donosnost borznih indeksov 90 dni pred prvo javno ponudbo vodi v višjo izjemno donosnost delnic iz prve javne ponudbe prvega dne trgovanja. Poleg tega rezultati kažejo, da je podcenjenost statistično višja v primeru višje volatilnosti delnic prvi mesec trgovanja, kar še posebej velja za manjše prve javne ponudbe. To potrjuje teorijo o ex-ante negotovosti, da so bolj tvegana podjetja bolj podcenjena, kar še posebej velja za manjše prve javne ponudbe, ki običajno v javni ponudbi ne dosežejo tak visok nivo razkritja informacij kot večja podjetja, ki običajno prvo javno ponudbo izvedejo s pomočjo priznanih mednarodnih finančnih posrednikov. Tako lahko trdimo, da se v času »vročega« trga, ko je podcenjenost višja, za prvo javno ponudbo odločajo tudi bolj tvegana in manjša podjetja.

Naši rezultati kažejo, da na podcenjenost vplivajo tudi poslovanje podjetij pred prvo javno ponudbo, merjeno z ROE, ter gospodarski cikli, merjeni z letno rastjo BDP in povprečnimi obrestnimi merami pred prvo javno ponudbo. Vse druge tipične spremenljivke za tovrstne analize, kot so lastniška struktura pred prvo javno ponudbo, razpršitev lastništva, zadolženost družbe pred prvo javno ponudbo in asimetrija informacij, v našem regresijskem modelu niso značilne ali kažejo mešane rezultate. Kljub temu so naši rezultati v glavnem konsistentni z mnogimi študijami za prve javne ponudbe na razvitih kapitalskih trgih. Lahko torej zaključimo, da so glavni dejavniki, ki pospešujejo trg prvih javnih ponudb v centralni in vzhodni Evropi, v veliki meri podobni tistim na razvitih kapitalskih trgih.

## **Zaključki**

Rezultati študije prvih javnih ponudb v centralni in vzhodni Evropi med leti 2000 in 2009 kažejo, da so prve javne ponudbe na teh razvijajočih trgih v marsikaterem pogledu podobne tistim na razvitih kapitalskih trgih Evrope. Po drugi strani študija ponuja dokaze nekaterih zanimivih razlikovalnih dejavnikov, ki izstopajo za majhne, razvijajoče oziroma obrobne kapitalske trge.

Študija ponuja zanimive implikacije tako za regulatorje, izdajatelje kot vlagatelje na manjših razvijajočih ali obrobnih kapitalskih trgih. Kot ene izmed pomembnih dejavnikov razvoja prvih javnih ponudb smo izpostavili sentiment vlagateljev ter razmere na kapitalskih trgih. Če torej želijo regulatorji in politiki zagotoviti učinkovit trg prvih javnih ponudb, torej učinkovit kapitalski trg za izdajo svežega kapitala podjetij, zgolj

zagotavljanje njegovih osnovnih funkcij delovanja ni dovolj. Regulatorji in oblikovalci politike bi morali za to zagotoviti privlačno investicijsko okolje in omogočiti razvoj široke investicijske kulture ter razvejane mreže investicijskih in pokojninskih skladov. Velik obseg borznega prometa in velik deleža sredstev v pokojninskih ter investicijskih skladih so namreč pomemben predpogoj, da se bodo podjetja lažje odločala za financiranje svojih novih investicij z izdajo novih delnic.

Prav tako se morajo tega zavedati izdajatelji, ki se odločijo za prvo javno ponudbo na razvijajočih trgih centralne in vzhodne Evrope, in morajo znati izkoristiti priložnost za izvedbo uspešne izdaje novih delnic predvsem v času bikovskega trenda na kapitalnem trgu. Prav tako se morajo zavedati, da je pritisk na višjo podcenjenost delnic v javni ponudbi na razvijajočih trgih praviloma običajno višji, kot to velja na razvitih kapitalnih trgih. Za izdajatelja delnic v prvi javni ponudbi, še zlasti v primeru manjših ponudb, je zato pomembno, da zagotovi čim več poslovnih informacij v času javne ponudbe, da s tem zmanjša možnosti asimetrije informacij in višje podcenjenosti. Sodeč po rezultatih naše analize je to celo bolj pomemben faktor, kot sta na primer zadolženost in poslovanje družbe pred prvo javno ponudbo. Po drugi strani rezultati tudi kažejo, da v času, ko borze na razvijajočih trgih beležijo trend rasti, ti izdajatelji praviloma dosegajo bolj stabilne dolgoročne donosnosti svojih delnic kot primerljivi izdajatelji na razvitih kapitalnih trgih. To izdajateljem lahko prinaša komparativno prednost v primerjavi s podobnimi podjetji na razvitih kapitalnih trgih, saj jim zmanjšuje morebitno finančno stisko in potrebo po poseganju na kapitalni trg.

Glavni zaključek za vlagatelje je, da so prve javne ponudbe na razvijajočih trgih praviloma bolj privlačne kot na razvitih trgih, saj lahko dosegajo višje tako kratkoročne kot dolgoročne donosnosti. To velja še posebej v času daljše rasti tečajev na borznih trgih. Po drugi strani naj se vlagatelji na manjših, razvijajočih kapitalnih trgih zavedajo, da se v času »vročega« trga prvih javnih ponudb za izdajo novih delnic in uvrstitev na borzo odločajo tudi bolj tvegano (in praviloma manjša) podjetja. Torej lahko pričakujejo večja nihanja cen delnic iz prvih javnih ponudb v začetnem obdobju trgovanja.