The Real Estate Risk Premium in Central and Eastern European Cities

The Real Estate Conundrum in the CEE Office Markets: Thinking Too Big?

John-John D'Argensio, M.Sc.
Director, Economic Research and Investment Strategy
SITQ - Caisse de dépôt et placement du Québec, Canada

Frédéric Laurin, Ph.D.
Professor in economics, Université du Québec à Trois-Rivières, Canada
Research Fellow, International School of Economics at Tbilisi State University, Georgia

Corresponding address:
Frédéric Laurin
Université du Québec à Trois-Rivières
Département des Sciences de la gestion
3351, boul. des Forges, C.P. 500
Trois-Rivières (QC) G9A 5H7, Canada
frederic.laurin@uqtr.ca

Acknowledgement: The work on this interim report was supported by a grant from the Economics Education and Research Consortium (EERC), with funds provided by the Global Development Network (GDN). The authors also acknowledge the work of Thea Goginashvili, research assistant at the International School of Economics at Tbilisi State University (ISET), in the preparation of this paper.

Abstract: In this paper, we investigate the evolution of office market risks and property prices in Central and Eastern European (CEE) cities. We developed a methodology assessing if office property markets have been accurately valuated in CEE cities, using as a benchmark the past evolution of office markets in Western European cities. Using regression methods applied on Western European data, we are able to estimate a predicted property price and capitalization rate for each CEE cites, given their respective actual real estate and economic conditions. Results show that investors' valuations are in fact not too far apart from the predicted value based only on real estate and economic fundamentals. We also find that the macroeconomic environment and the general risk assessment seems to have a stronger effect on property prices in CEE than in Western European cities.

Introduction

Since the collapse of the soviet system in the early 1990s, Central and Eastern European (CEE) countries have had to manage the transition from a centralized to an open-market economy as well as the forces of globalization. To increase their attractiveness to international investors, they have had to embark on massive regulatory reform programs to establish credibility towards the global financial markets. Given that globalization is not a uniform process due to different cultural, social and economic factors, the countries that have succeeded to date, are those that have made the necessary reforms early in the process (Adair *et al*., 1999; McGreal *et al*., 2001; McGreal *et al*., 2002). Moreover, the CEE countries that have newly joined the European Union have had to accelerate the pace of transition and reforms to comply with EU requirements. This has benefited CEE property markets by improving their transparency, their rapid development and their internationalization. The EU membership might also have altered in a positive manner the investors' risk perception towards CEE countries, notwithstanding the evolution of their actual fundamentals (D'Argensio and Laurin, 2009).

Although real estate transactions were registered in the CEE region during the 1990s, investment volumes really gained momentum in the early years of the 21st century as the activities were shifting from a construction and property development focus to a property investment market orientation. The attractiveness in CEE's property markets also coincides with the renewed interest by global investors for real estate assets. It is estimated that investment volumes for all property types in the CEE region increased from around €2.5 billion in 2003 to over €14 billion at the peak of the cycle in 2007[1]. However, investment volumes have come down to their 2003 levels in the aftermath of the 2008 global financial crisis.

One of the three main drivers behind that investment boom were the high yielding properties available in the region during that period compared to those in developed countries. For instance, Adair *et al*. (1999) argued that high yielding properties in the CEE region would have the potential to appeal to institutional and long-term investors. The second driver favouring the investment boom was the high growth prospects reflected by the high levels of inward foreign direct investments (FDI). FDI are considered to be a barometer for investor sentiment in a given country and prospect for future growth (Adair *et al*., 2006). The third driver was the risk perception. The global risk perception declined to historical levels over that period as, one would say, "Greed was taking over fear".

In this paper, we investigate more comprehensively the evolution of office market risk and property prices in Central and Eastern European cities between 1998 and 2009. More specifically, we wish to observe if investors have underestimated the true risk situation in CEE office markets, understanding that risk should be fully priced in the property valuation given the current real estate and economic conditions.

We propose a methodology to estimate a predicted property price and capitalization rate (cap rate) in CEE cities, given their actual real estate and economic variables, but using the past evolution of the office markets in Western European (WE) cities as a benchmark. Indeed, the time span of data availability for CEE markets is too short to implement time-series statistical methodologies to detect under or overvaluation of an asset. But, because real estate characteristics are more homogeneous between European cities themselves than between Europe and the US, especially considering the economic and regulatory convergence implied by the EU accession process, we can instead infer the CEE's predicted values based on the evolution of WE cities, for

[1] CBRE, Market View, CEE Property Investment, January 2010.

which we have longer time observations. Specifically, we estimate an equation explaining the changes in property prices using ordinary least square regressions for a selection of 30 WE cities. Then, by taking the marginal effects obtained from this regression, predicted values for CEE cities are computed. We can thus compare the evolution of these predicted values with the actual evolution of prices and cap rate to see if there is an under or over valuation of the CEE cities' property markets.

Moreover, the determination of office property prices is intimately related to the evolution of office rents. To take into account the cross-correlation between rents and prices, we also estimate an equation explaining rent fluctuations. The price equation is then estimated along with the rent equation in a Seemingly Unrelated Regression (SURE) system. In addition, using the rent and price equations, it will be interesting to compare the impact and significance of the determinants of both equations between WE and CEE cities, characterizing in fact the type of real estate development in each region of Europe.

Overall, our results show that predicted prices seem to follow more or less their actual values in CEE cities. Except in few cases, our model is able to explain quite well the decline of property prices in these markets. With declining rents in CEE cities throughout almost the entire sample period and a sharp improvement in their country risk perception, investors' valuations are in fact not too far apart from the predicted value based only on real estate and economic fundamentals. However, we show that property prices respond to changes in their determinants with a different intensity and significance in CEE cities than in WE. For instance, country macroeconomic risk (as measured by the spread in 10-year government bond yields relative to the US) and the inflows of foreign direct investments tend to have a greater impact on property prices in CEE cities.

The paper proceeds as follow. After a short review of literature on real estate risk and the development of the CEE markets, we present a brief statistical analysis describing the evolution of the office markets in CEE cities. Section 3 outlines the empirical methodology that will be implemented to compute predicted values for CEE cities, based on an inference using WE cities as a benchmark. Section 4 introduces the theoretical model for the price and the rent equations. In section 5, we describe the regression results for the rent and the price equations, comparing the marginal effect of their determinants between WE and CEE cities. Finally, section 6 compares and discusses the evolution of predicted prices and cap rates with their actual values in CEE cities.

1. Review of literature

The number of studies that have analyzed CEE real estate market is quite limited. We find, however, that those papers have focused on three major topics: (1) the evolution of real estate market in CEE markets, (2) the perception of property markets in CEE with a main focus on the constraints (3) the impacts of globalization on CEE property markets.

One of the main reasons behind the limited number of published papers is the lack of property data in terms of quantity and quality within the CEE region. That weakness is explained by the restricted land policy practiced during the socialist era. The ideology of suppression of individual rights during those years has had a major impact on publicly held information in that land registries and cadastres were modified to reflect usage rather than ownership (Adair *et al.*, 2006). However, it has been established that the quality and the transparency of property data has improved since the late 1990s due to the arrival of international agents and the latent demand from international investors (Adair *et al.*, 2006; Mansfield and Royston, 2007). For instance, according to Jones Lang Lasalle's Transparency Index reports, the Czech Republic and Poland improved their transparency status moving from a semi-transparent to transparent market between 2006 and 2008; Hungary also made some improvements, however, it is still considered a semi-transparent market; Eastern European countries such as Slovakia, Russia and Estonia are all considered semi-transparent markets by the Transparency Index with a score well above that of Hungary[2]. Therefore, investors must bear in mind that a number of structural risks still remain in those countries despite this significant progress. Nevertheless, the improvements in the transparency and quantity of property data –which is an essential factor in attracting international investors – since the transition couldn't have been made without the implementation of regulatory reforms. Though we have been able to compile real estate data for CEE cities starting around 2000 (earlier in few cases), there remain indeed many missing values across years and variables.

Regarding the stages in the transformation and evolution of real estate markets in CEE, Ghanbari and Watkins and Merrill (2003) identify stages in the evolution of the real estate market that are interlinked with the level of risk perception. Risk perception is fairly linked with the maturity level of a real estate market. For example, McGreal *et al*. (2001) conducted surveys with UK and European property companies. Their results show that the perception of high risk coupled with the lack of full integration into global system was likely to significantly deter real estate investments into Central Europe. The main sources of risk included the lack of depth and liquidity for large-scale investments, the accuracy of data, the overall economic conditions, the lack of market transparency, the constraints on repatriation of profits, corruption, political risk and bureaucracy. As other barriers to the development of the property investment market from an international standpoint, we can further mention the lack of local financing, the heterogeneity in taxation regimes related to property transfer taxes and land ownership.

The effects of globalization on the development of real estate markets have been well documented by Ghanbari Parsa (1997), Drbohlav and Sykora, (1997), Yeung (1998), Lo and Marcotullio (2000) and Keivani *et al*. (2000). Since globalization is an unsymmetrical process, the outcomes from global economic integration will differ by cities. As noted by McGreal *et al*. (2002), the impacts of global forces on urban areas vary according to their geographical location in the world, the stage of economic development and the level of maturity. The cities failing to adhere to economic reforms and liberalization programs early in the transition process will not attract enough capital flows and will consequently remain with an underdeveloped infrastructure base, impacting the evolution of their property market.

Keogh and D'Arcy (1994) have investigated the attributes that differentiate an emerging from a mature real estate market. The authors have identified four main factors: 1) real estate service provision, 2) market information, 3) property investment market and 4) importance of non-domestic actors and funds. Furthermore, market maturity does not necessarily reflect efficiency, suggesting that the models used by institutional operators for mature property markets may not be appropriate to evaluate emerging markets.

While the risk level (actual or perceived) has made great progress in the CEE region over the last two decades as a result of the evolution of their respective real estate markets, the literature highlights to the existence of many remaining structural risks as perceived by international investors, such as their still immature market status, the lack of market transparency and other barriers to investments.

[2] JLL's scoring methodology: the higher (lower) the score, the less (more) transparent is the country.

2. Data and Statistical Analysis

We use primarily databanks provided by Property and Portfolio Research (PPR) and Property Market Analysis (PMA) which compile real estate data between 1990 and 2009 for 30 major Western European cities (see Appendix 1 for the list of available cities) and three Central European cities (Budapest, Prague, and Warsaw). PPR and PMA offer data on vacancy rates, total inventories, absorption, completions, prime nominal rents, capitalization rates, and property values.

Secondly, real estate data for other CEE cities are provided by Cushman &Wakefield. In general, except for Budapest, Prague, and Warsaw, CEE cities are not covered prior to 1998, and for some smaller markets, real estate brokers started to compile data only around 2001-2002 (see Appendix 1 for the time span of data availability by city). But we were able to complete Cushman &Wakefield's database using individual country reports produced by major real estate brokers such as Colliers, CB Richard Ellis and Oberhaus Real Estate Advisory[3]. Yet, there are still many missing observations among variables and years.

As a measure of property prices, PPR computes an index of capital value appreciation, where year 2004=100. Using an index in the regression estimations does not impact the results since we are focusing on the evolution of the real estate markets in time, and not the levels. For CEE cities, missing values for prices are imputed by dividing rents on the capitalization rate and then re-constructing the price index[4].

Employment at the city level is provided by Cambridge Econometrics. Macroeconomic variables are taken from the IMF's International Financial Statistics, the Economist Intelligence Unit, the World Bank's World Economic Outlook and IHS Global Insight (see Appendix 2 for the list of data sources). All variables except GDP at constant $US prices (which is provided as such by the World Bank) are deflated using a consumer price index (CPI) taken from the International Financial Statistics.

2.1 Statistical Analysis

Even though the availability and transparency of CEE property market data have been improving since the collapse of the soviet system, it is still considered at a relatively inferior level to that of developed property markets. The arrival of international real estate companies which helped to implement common standard valuation methodologies and definitions is greatly responsible for the progress made in the development of the commercial property market over the last two decades. Moreover, the integration of CEE countries into the European Union is also playing an important role in terms of transparency as new entrants are obliged to comply with EU laws.

As described by Ghanbari Parsa (1997), the establishment of real estate markets in the CEE went through three stages. In the early 1990s, CEE property markets were characterized by a lack of suitable office space due to the communist ideology on land policy which modified land registries and cadastres to reflect usage rather than ownership. As foreign firms were establishing themselves in the CEE region (stage 2) in response to market liberalization, property markets were starting to experience a shortage of suitable modern office spaces. That scarcity sparked a small construction boom that was primarily focused on the refurbishment of old office and

---

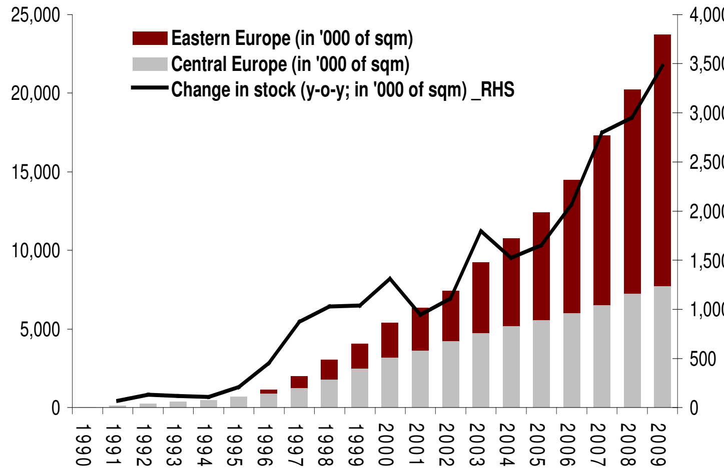
[3] Ober-Haus is the largest and only one real estate agency operating across the Baltic and Central European region including Poland, Estonia, Latvia, Lithuania and Ukraine.

[4] As a robustness check, we have applied this same computation for WE cities. We find that these estimated property prices are almost identical in evolution to the ones provided by PPR.

residential buildings due to inexistent and/or poor land planning within the inner cities during that period. The attractive yields in office development projects along with strong real estate fundamentals took the CEE property markets into the third stage. During the mid 1990s, stock of modern office spaces increased rapidly and significantly as a result of the completion of large development projects by domestic and foreign firms, which led to decreases in rents in nominal and real terms.

Office stock

Figure 1: Evolution of the office stock within CEE



Sources: CBRE, PMA, PPR and authors' own calculations

We can observe a significant increase in the stock office space within the CEE region[5] since the mid 1990s. The bulk of new supply (70%), however, was delivered during the last commercial real estate boom (2003-2007) as shown in Figure 1. According to Watkins and Merrill (2003), the 2003-2007 period would be described as one of hyper-supply.

In order to include all the CEE countries in the statistical analysis (Table 1), we took 2003 as our base year. Office stock in the CEE region increased by 121.4% or at a compound annual growth rate (CAGR) of 14.2% between 2003 and 2009, compared to 9.0 % or a CAGR of 1.5% for WE cities. From the same table, we note that despite a high increase in their respective total stock, Central European real estate markets have reached a higher maturity level than their Eastern European counterparts, depicted by lower growth rates than the CEE average. We find that cities – such as Riga (769%) and Tallinn (416%) – that registered the largest increases in office stock during this period are those who have started from very low base levels.

Table 1: Change in Office Stock in the CEE region from 2003-2009

Cities	Stock in 2003 (in sqm)	Stock in 2009 (in sqm)	Change in sqm	Total increase	CAGR
Central Europe	*4,741*	*7,719*	*2,978*	*62.8%*	*8.5%*
Warsaw	2,060	3,093	1,033	50.2%	7.0%
Budapest	1,408	2,361	953	67.7%	9.0%
Prague	1,273	2,265	992	77.9%	10.1%
Eastern Europe	*1,540*	*6,190*	*4,650*	*301.9%*	*26.1%*
Bratislava	280	1,234	954	340.5%	28.0%
Bucharest	453	1,855	1,402	309.3%	26.5%
Kiev	250	1,033	783	313.3%	26.7%
Riga	25	218	193	769.0%	43.4%
Sofia	301	1,110	809	268.8%	24.3%
Talinn	61	313	252	415.9%	31.4%
Vilnius	170	427	257	151.0%	16.6%
CEE	*6,281*	*13,908*	*7,627*	*121.4%*	*14.2%*
WE	*264,695*	*288,649*	*23,954*	*9.0%*	*1.5%*

Source: CBRE, C&W, PMA, PPR. Authors' own calculations

Cap Rates

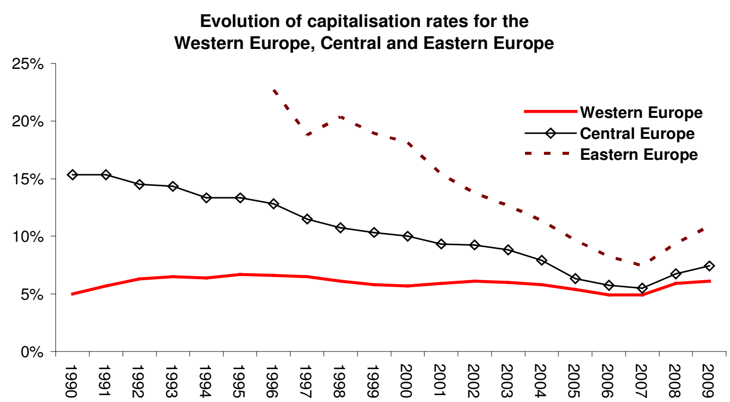
Figure 2 compares the evolution of office cap rates in CEE cities with those of WE between 1990 and 2009. Over the last two decades, real estate yields within the CEE region have declined rapidly towards the WE average. In 1990, the yield spread between CE and WE office property markets was 1030 basis points (bps). By 1996, it had decreased to 620 bps as the CEE economies were benefiting from the

[5] **Central and Eastern Europe (CEE)** includes Bulgaria, The Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Ukraine. **Central Europe (CE):** Czech Republic, Hungary and Poland. **Eastern Europe (EE):** Bulgaria, Latvia, Lithuania, Romania, Slovakia and Ukraine.

transition period. That year also marked the beginning of investment data for EE property markets – which shows a yield spread of 1610 bps against WE property markets.

Despite a succession of global financial and economic crises since the mid 1990s, yield spreads continued their aggressive downward trend within the CEE region, reaching historical lows of 210 and 560 bps for CE and EE respectively in 2004. Following their entry into the European Union in 2004, we note an even sharper decline in yield spreads against WE cities. In 2007, CE and EE yield spreads reached respective new historical lows of 60 bps and 260 bps. One would assume that the oversupply of office stock would had negatively impacted investment yields in the short and mid-term; however, Watkins and Merrill's (2003) explanation on the emergence of real estate markets in CEE corroborates the observed pattern in the region. The authors argue that when property markets reach the hyper-supply phase, investors' risk perception tends to diminish which by ricochet puts downward pressure on cap rates.

Figure 2: Evolution of Capitalization Rates for WE and CEE



Sources: CBRE, PMA, PPR, authors own calculations

However, the 2007-2008 financial crisis had a predominant impact on CEE property markets illustrated by the increase of 310 bps in the cap rate for the whole region between 2007 and 2008, compared with 120 bps for WE cities. This crisis has had the worst impact on property prices in history due to the liquidity crisis, which constrained investment activities and put a halt on new or ongoing development schemes, the growing wariness of international investors to invest in relatively higher-risk countries compared to mature markets and finally the weak demand for office space.

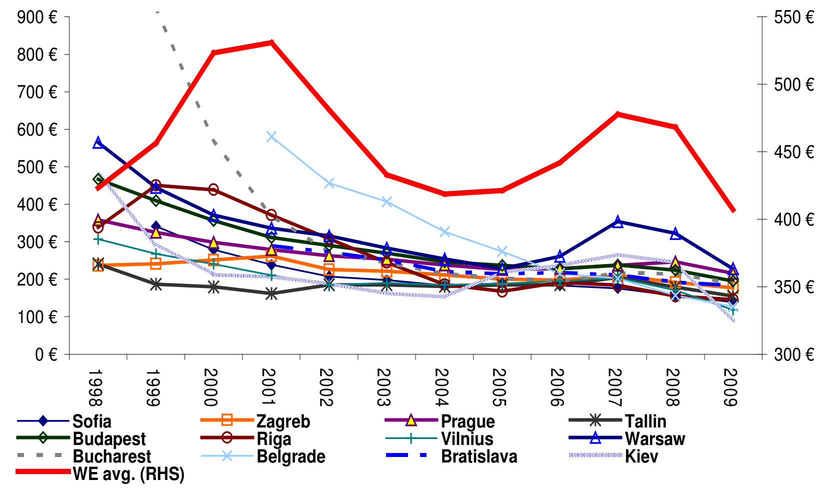
Prime Office Rents

Figure 3 demonstrates the trend of asking prime office real rents for CEE cities between 1998 and 2009 compared to that of WE[6]. While we observe the common physical market cycle pattern (Mueller, 1999) for WE's average prime office rent over that period, the same cannot be said about those of CEE cities. We note a considerable disconnection between the physical and capital market cycles, as illustrated by the downward spiral in prime real rents and cap rate compressions between 1998 and 2005. CEE property markets averaged a total real rental loss of 38% or 4.8% per annum, in comparison to 8% or 1% per annum for WE property markets. As previously mentioned, most CEE property markets were in their "hyper-growth" phase. Hence, the oversupplied markets, combined with fierce competition from landlords, led to this negative rental growth.

[6] The Western European average has been normalized to fit in the graph (1998 = 30).

Over the 2005-2007 period, which was characterized as the highest synchronized real estate boom in history, prime office real rents within the CEE region only increased by a slight margin. While they post a total gain of 13% in WE, we note a 7% total gain for the CEE region, ranging from -7% for Sofia to 55% for Warsaw. Since the beginning of the global financial crisis, prime office real rents in CEE property markets came down by a cumulative average of 29%, while WE has registered half that loss.

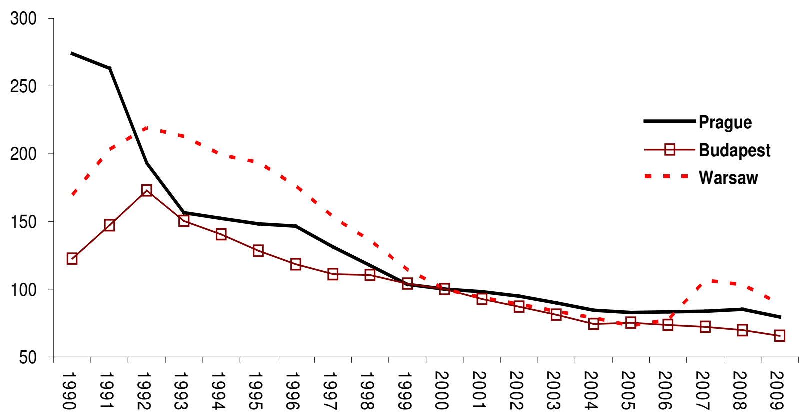
Figure 3: Prime Office Real Rents in CEE and WE (EUR/sqm pa)



Sources: CBRE, PMA, C&W, PPR, authors' own calculations

The specific case of Budapest, Prague and Warsaw (Figure 4) – for which data goes back to 1990 – confirms the expected rent cycle patterns described by Ghanbari Parsa (1997). After the transition, the liberalization of prices and rents led to a sharp increase in real prime office rents. Shortly after, we observe a downward trend in real rents, as property markets were supplied by a large influx of new modern office buildings. Fifteen years after the transition, we observe a shift in the physical market since prime office real rents seem to have stabilized, which indicates that they may have achieved a new maturity level. As those property markets seek equilibrium, we expect that they will mimic the rental cycle pattern observed in WE.

Figure 4: Prime Office Real Rents for Budapest, Prague and Warsaw (Index 2000=100)



Source: Property Market Analayis (PMA)

3. Empirical Methodology

The objective of this study is to assess if international investors have properly evaluated the true risk in CEE cities, which would have led them to over-invest in these markets. The challenge with the identification of an under or over valuation of an asset is to find an appropriate benchmark to calculate what should be the "true" asset valuation given the economic fundamentals.

The same methodological difficulty is encountered when trying to test the existence of an asset bubble (see Chan *et al.*, 2001; Roche, 2001; Hott and Monnin, 2008; Wheaton and Nechayev, 2008). This literature suggests some statistical methodologies that are interesting but not totally satisfying. Essentially, the period during which the bubble occurs is benchmarked against other time sequences in the price of a given asset. Using for instance a Markov Switching Model, we can then assess if the bubble period evolves in a significantly different manner from other periods which are characterized by similar fundamentals.

However, in our case, with very few yearly observations for CEE property markets, we cannot rely on those methodologies. Instead, we choose to compare CEE cities to the past evolution of WE cities, exploiting the complete and longer time series on WE urban markets from 1990 to 2009. The logic is the following. Firstly, we believe that it is more sensible to compare European cities with themselves rather with those in the US market. Moreover, most of the CEE countries are now members of the European Union. The membership process implies tremendous political, economic, social and regulatory reforms that are imposed by the European Union as pre-conditions for joining the Union. These reforms bring the CEE countries closer to WE countries on all terms, while favoring economic convergence. And because of the intense competition between countries to attract foreign investment, non-EU CEE countries have been obliged to follow similar reforms. Secondly, with the exception of London, Paris and Frankfurt, WE property markets hadn't fully matured in the nineties as they were developing rapidly. From that standpoint, the evolution of WE office real estate markets since 1990 could represent a benchmark for CEE countries, but understanding that, in the latter case, real estate and economic variables will evolve with much greater intensity.

In econometric terms, this assumption implies similar elasticities (measured by the regression coefficients) between WE and CEE property markets. This means that the greater development of the CEE's property markets will be taken up not by regression coefficients, but rather by the intensity in the evolution of their independent variables (the fundamentals). For instance, the average annual real GDP growth in WE is about 2.0% between 1990 and 2009, compared with 4.7% for the CEE region. Hence, everything else kept constant, we expect greater growth in rents and property values in CEE cites than in WE, conditional to identical elasticities. In practical terms, regression coefficients will not be equal between WE and CEE cities because their stage of development are different for the period 1998-2009. However, the assumption is that, in the longer term, coefficients for CEE markets should converge to the ones in WE. Hence, we are able to compare the current period to their hypothesized long term "equilibrium" market evolution, as imputed from the WE's past experience.

Hence, our methodology involves two steps. First, we estimate the model for WE cities only. Second, taking the coefficients obtained from this regression, we can then compute the "true" real estate market values for CEE cities given the value of their independent variables. Thus, given their fundamental economic and real estate conditions, we can evaluate what should be the "true" property price, based on the past evolution of WE cities.

However, as preliminary and interesting results, we first show a comparison of the marginal effects between WE and CEE cities. As explained previously, the coefficients are most likely to be different because CEE cities are characterized by a different stage of development than their WE counterparts. Even though we impose the WE's regression coefficients on CEE cities to compute predicted property prices, it is still interesting to see what will be the impact and significance of each independent variable according to their stage of development. To do so, we first show some regression results using the full sample (all WE and CEE cities). Here, we assume that each independent variable has an identical marginal impact on the evolution of the real estate markets in WE and CEE cities. Second, we relax this hypothesis by allowing for different coefficients for some variables between WE and CEE cities. More precisely, suppose that we have a simple model with three independent variables X1, X2 and X3:

(1) $Y_i = \beta_1 X1_i + \beta_2 X2_i + \beta_3 X3_i$ where $i = 1,\ldots,N$

We could estimate (1) separately for WE and CEE. However, the estimation for CEE cities will not be as efficient because of their much shorter time span and the high amount of missing values. Instead, we can estimate (1) on the full sample, but allowing for a different coefficient only for X3, while imposing homogeneous coefficients on all other X variables:

(2) $Y_i = \beta_1 X1_i + \beta_2 X2_i + \beta_{3WE}\left(D_{we} * X3_i\right) + \beta_{3CEE}\left(D_{CEE} * X3_i\right)$

where:

D_{WE} = 1 if the city is in WE, zero otherwise.
D_{CEE} = 1 if the city is in CEE, zero otherwise.

We can then test if β_{3WE} is different from β_{3CEE}. We can also check if the difference in the significance level using the t-student. In this way, we gain some degrees of freedom by imposing an identical coefficient for X1 and X2, while assessing the differential impact and significance of X2 on Y between WE and CEE.

Alternatively, we have almost complete data across a longer time sample (1990 to 2009) for Budapest, Prague, and Warsaw. We could then estimate model (1) only for this sub-sample and compare the results to WE. However, the sample size for WE cities is much larger (30 cities) and this will bias the comparison of t-students. To avoid such a bias, we undertake the following algorithm. First, we draw randomly 3 WE cities out of the total sample and then estimate model (1) using this sub-sample alone. We repeat that operation 10,000 times and save all the coefficients and t-students. Second, we compute the average coefficients and t-students across these 10,000 regressions, which can be compared with the results obtained for the three CEE cities. Hence, we compare sub-samples having the same size with very few missing values.

4. Theoretical Model

The property value can be based on the market sale price of the property at time *t*. If investors are rational, this price should exactly reflect the sum of present value cash flows they expect to receive in the present and future years:

(3) $$P_t = \sum_{t=1}^{T}\left[\frac{CF_t}{(1+d_t)^t}\right] + \sum_{t=Z+1}^{T}\left[\frac{CF_t}{(1+d_t)^t}\right]$$

where T is the property's life expectancy, CF_t stands for cash flows, d_t is the discount rate and the second expression in brackets represents the resale value of the property at time Z+1 (holding period). Simplifying equation (3):

(4) $$P_t = \sum_{t=1}^{T}\left[\frac{CF_t}{(1+d_t)^t}\right]$$

We can assume that NOI is equal to actual cash flows, that cash flows can be approximated by rents and that future rents are expected to grow at a rate g_t:

$$(5) \qquad NOI = \gamma RENT$$

$$(6) \qquad CF_t = \gamma RENT_t (1 + g_t)$$

where γ is simply an approximation parameter. Inserting the cash flow CF_t approximation (6) in equation (4):

$$(7) \qquad P_t = \gamma RENT_t \left\{ \sum_{t=1}^{T} \left[\frac{(1+g_t)^t}{(1+d_t)^t} \right] \right\}$$

From equation (7), the property price depends on three factors: the rent level, the discount factor d_t and the expectation of rent growth g_t. The discount factor should appropriately evaluate the investors' opportunity cost of investing in real estate in a particular market, including the market and real estate risk. Hence, if investors are rational, risk should be completely priced in the value of property.

As a discount rate, we use the spread in the 10-year government bond yield with respect to the U.S. 10-year T-Bond. (SPREAD). The government bond yield can be considered as a relevant opportunity cost of capital, since the bond market is perceived as a low-risk safe investment. We expect that an increase (decrease) in the risk premium will put downward (upward) pressure on office property prices.

We also construct a real estate specific risk variable. *Ceteris paribus*, investors may prefer to operate in a larger market to minimize transaction costs and hedge out the variability in price (Bernoth, von Hagen & Schuknecht, 2004; Favero, Pagano & von Thadden, 2004). To measure the depth of a property market, we use a variable called OCCEMP which is obtained by dividing the city's total annual occupied space (in sqm) by its respective annual office-using employment figures[7]. In order to simplify the comparison analysis between property markets, we rebase each city's OCCEMP by using Frankfurt as the benchmark city[8]. We expect that an increase of the market's depth will be positively interpreted by investors and thus raise the property values.

The model also attempts to capture the level of liquidity of each property market by taking the gross volume of domestic credit as a percentage of GDP (CREDIT), at the country level. The amount of domestic debt reflects the fluctuation of financial intermediation over time. We find that, for almost all CEE countries, CREDIT follows an upward trend starting from around 1998, which coincides with the end of the Asian financial crisis. Prior to this period, we find that CEE countries depict different credit cycle trends, probably reflecting their respective economic maturity level. We expect that CREDIT should positively (negatively) influence property prices during the expansion (contraction) phase of the credit cycle.

Investors tend to appraise the time path of rental growth by looking myopically backward and not forward. Hence, to measure rent growth expectations, we first use a series of lagged values of

[7] Employment in the industry of financial intermediation, real estate, renting and business activities at the city level, as defined by the NACE industrial classification. Data is provided by Cambridge Econometrics.
[8] Frankfurt is chosen as the benchmark because it is one of WE's most matured property market with the closest OCCEMP ratio to the total sample average.

prime office real rent growth for each market (RENT). We expect that past positive (negative) rent growth will eventually materialize in a higher (lower) property price. To measure growth expectations, we also use lagged values of real GDP growth for the city's country (GROWTH). However, investors are not wholly myopic in the way they build expectations. To proxy the actual demand for real estate assets, we use the country's net FDI inflows. In emerging markets, real estate investments represent an important share of total inward FDI. In fact, the pair-wise correlation between office real estate investments and FDI is 0.4537 in our data sample. Although we have some data on total office investments, too many data points are missing for CEE cities to be used efficiently in the econometric estimations. Therefore, we have to rely on FDI inflows. Finally, to take into account a European real estate trend (TREND), we use the evolution of average property price across all cities.

Since we are interested in the evolution of prices in time, we estimate equation (7) using a first-difference equation:

$$(8)\ \Delta \log\left(price\right)_{it} = \delta + \alpha_1 \Delta \log(rent)_{it-1} + \alpha_2 \Delta \log(rent)_{it-2} + \alpha_3 \Delta SPREAD_{it-1} + \alpha_4 \Delta \log(OCCEMP)_{it-1} + \alpha_5 \Delta \log(CREDIT)_{it-1} + \alpha_5 \Delta \log(FDI)_{it} + \alpha_6 \Delta \log(FDI)_{it-1} + \alpha_7 GROWTH_{it-1} + \alpha_8 \Delta TREND_{Europe_t}$$

All variables that are not in percentage or in ratios are transformed in logs in equation (8). In Appendix 3, we show the correlation table between the variables of equation (8).

5. Rent Equation

As seen in equation (7), an estimation of property prices depends heavily on rents and a precise approximation of its future growth. Furthermore, rents and the proxies used for rent growth might be endogenous variables in the price equation (8). For those reasons, we choose to follow a two-step estimation procedure. First, we introduce an equation estimating the growth of rents in time. Second, we estimate this rent equation along with the property price equation (8) using a Seemingly Unrelated Regressions Estimation (SURE) system. The SURE procedure estimates both equations taking into account the cross-correlation that is likely to occur between rents and property prices.

In fact, we are explicitly investigating the evolution of two related markets: a space market for offices that will affect rents, and an asset market (office properties). Both markets, even if they are interlinked, evolve according to different economic dynamics. Notably, the demand for office space is derived from the firms' demand for inputs, and prices (rents) will be set depending on the disequilibrium between supply and demand. The demand for assets is rather influenced by the opportunity costs of capital, the expected return on alternative investment instruments, the perceived risk attached to the investment and growth expectations.

Therefore, we need to build an appropriate model characterizing rents. In the literature, the growth in rents is commonly viewed as being the response to an adjustment process between supply and demand. In particular, the first-difference of rents is modeled using the lagged vacancy rate which measures the extent of the disequilibrium between supply and demand (Sanderson *et al.*, 2006).

$$(9)\ \Delta rents_t = \beta\left(vacancy\right)_{t-1}$$

Alternatively, some studies use the difference between the vacancy rate and its average in time, to take into account the existence of a natural vacancy rate, the level of which should not affect the evolution of rents (Wheaton and Torto, 1988 and Tse *et al.*, 2003).

$$(10)\ \Delta rents_t = \beta\left(vacancy_{t-1} - vacancy_{AVERAGE}\right)$$

This formulation expresses the fact that real estate markets follow a cycle around some equilibrium state. However, there are two major drawbacks with this formulation. First, the natural vacancy rate might not be constant in time. In Europe, the office real estate markets are generally much less mature than in the US. In fact, vacancy rates in most WE cities do not evolve as stationary variables. In this case, a constant time average does not have any empirical meaning. The second drawback is a purely statistical artifact. In an OLS estimation of equation (10) individually city by city, the value of the β coefficients and their t-student will be exactly the same as in equation (9), except for the constant term. In the absence of a good methodology for estimating a moving natural vacancy rate in time, we prefer to separate demand and supply using respectively net absorption (ABSORB) and net completions (COMPLETION), both variables taken as a ratio of total inventory (Sivitanidou and Sivitanides, 1996). We expect demand/absorption to have a positive effect on rent growth, and inversely for supply/completion.

However, absorption reflects the observed demand. Because the matching between tenants and landlords might be imperfect and take some time, a part of the actual demand might not be totally fulfilled at any given period. But this latent demand is unobserved. To proxy this actual demand, we use the lagged growth in office-using employment for each city (EMP). Rents might also be affected by nationwide growth expectations. Thus, we add the lagged value of real GDP growth (GROWTH) to the model. Both variables should have a positive effect on rent growth.

Similarly to demand, supply might respond to demand with a lag. Hence, current new constructions might be triggered by past demand expansion. To take into account this effect, we use the lagged difference between absorption and completion (NET). If past absorption is greater than completion, developers might be enticed to start the construction of new office buildings. In the mean time, this excess demand should drive rents upward. Finally, to take into account a European real estate trend, we use the evolution of average rents across all cities.

$$\begin{aligned}(11)\ \Delta\log(rents)_{it} = \alpha + \beta_1 ABSORB_{it} + \beta_2 COMPLETION_{it} + \beta_3 NET_{it-1} + \beta_4 \Delta\log(EMP)_{it-1} \\ + \beta_5 \Delta\log(EMP)_{it-2} + \beta_6 GROWTH_{it-1} + \beta_7 \Delta TREND_{Europe_t}\end{aligned}$$

All variables that are not in percentage or in ratios are transformed in logs in equation (11).

6. Results

We begin by presenting the estimation results for the rent equation (11) separately, using simple OLS regressions. From this first step, we get some very interesting results on the determination of prime office real rents in Europe. Then, the model for property prices is estimated separately, using OLS regressions, followed by the SURE system in which the price equation is estimated along with the rent equation.

6.1 Results for the Rent Equation

In Table 2, we show the effects of only the market disequilibrium between demand and supply on rent growth. In regression 1, demand (ABSORB) and supply (COMPLETION) both have a strong and significant effect on rent deviations, with supply having a negative coefficient, and inversely for demand, as expected. Looking at the R^2, supply and demand can explain 24% of the evolution of rents in Europe.

Table 2 : results for the rent equation – completion, absorption and vacancy

Variable	1	2	3
COMPLETION	-2,2261	-	-
	*-8,590****		
ABSORB	2,0503	-	-
	*7,610****		
VACANCY	-	-0,7046	-
		*-4,030****	
VACANCY-M	-	-	-0,6919
			*-4,280****
Constant	-0,0190	0,0177	-0,0444
	*-3,540****	*1,190*	*-8,330****
Nb of Obs,	717	724	724
R²	0,2416	0,0890	0,0576

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

On the other hand, using vacancy alone results in a much lower fit of 8.9% (regression 2). The fit is even worse (5.7%) in regression 3 when using the difference between vacancy and its time average at the city level (VACANCY-M).

In Table 3, we include the proxy for past unfulfilled demand, as measured by the growth in office-using employment (EMP) and the nationwide real GDP growth (GROWTH), plus a European trend, as measured by the European average evolution of prime office real rents in time (TREND). Surprisingly, the lagged values of EMP have no significant effect on rents, though the coefficients are positive as expected. But local real estate markets tend to significantly follow the European-wide evolution.

Table 3 : Results for the Rent Equation

Variable	4	5	6
COMPLETION	-1,4186	-1,3452	-0,9672
	*-5,520****	*-5,140****	*-3,190****
ABSORB	1,1004	0,9190	0,5985
	*4,160****	*3,350****	*1,800**
ΔlogEMP(t-1)	0,1132	0,0548	-0,0576
	1,210	*0,600*	*-0,980*
ΔlogEMP(t-2)	0,0754	0,0412	0,0304
	1,180	*0,700*	*0,550*
GROWTH(t-1)	-	0,0095	0,0080
		*2,600****	*2,470***
NET(t-1)	-	-	0,9079
			*3,260****
ΔTREND	0,5573	0,5229	0,5031
	*9,310****	*8,470****	*7,940****
Constant	-0,0189	-0,0380	-0,0274
	*-3,480****	*-4,020****	*-3,330****
Nb of Obs,	651	651	639
R²	0,3386	0,3582	0,4043

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

On the other hand, in regression 5, we note that rents seem to be affected by the nationwide economic environment, the coefficient of GDP growth being positive and significant.

Finally, we complete the model in regression 6 by adding the effect of past disequilibrium, as measured by the lagged difference between absorption and completion (NET). As expected, this variable has a positive and significant effect on rent growth. With the full model, we are now capable of explaining about 40% of rents.

In Table 4, the rent equation (11) is estimated allowing for different coefficients between WE and CEE cities for some variables, while constraining all other coefficients to be identical. Regression 1 shows that the office space disequilibrium does not have a significant effect on rents in CEE cities, the t-students being outside the 10% significance level for both COMPLETION and ABSORPTION, while they are strongly significant for WE cities. We get a similar result for office-using employment growth (regression 2). Oddly, the national real GDP growth does not plays a significant role in explaining the growth in rents for both WE and CEE[9]. The coefficient is even negative for CEE countries, contrary to the expected sign.

Table 4 : Results for the Rent Equation – Restricted Regressions

	1		2		3	
Variable	**Total/WE**	**CEE**	**Total/WE**	**CEE**	**Total/WE**	**CEE**
COMPLETION	-2,0717	-0,2721	-0,9872	-	-1,0481	-
	*-8,410****	*-0,900*	*-3,430****		*-3,670****	
ABSORB	1,1574	-0,0049	0,8544	-	0,9526	-
	*3,600****	*-0,010*	*2,670****		*3,010****	
ΔlogEMP(t-1)	1,9986	-	3,3941	0,7780	2,0730	-
	*3,580****		*4,260****	*1,460*	*3,130****	
ΔlogEMP(t-2)	-0,6808	-	-1,6998	-0,2624	-0,9160	-
	*-1,790**		*-2,740****	*-0,550*	*-2,170***	
GROWTH(t-1)	0,0000	-	-0,0021	-	0,0019	-0,0047
	-0,010		*-0,620*		*0,360*	*-1,490*
NET(t-1)	0,7150	-	0,6672	-	0,6207	-
	*3,170****		*2,300***		*2,190***	
ΔTREND	0,4529	-	0,4293	-	0,4517	-
	*8,450****		*7,870****		*8,000****	
Constant	-0,0078	-	-0,0215	-	-0,0257	-
	-0,960		*-2,970****		*-2,520***	
Nb of Obs,	619		619		619	
R²	0,4840		0,4566		0,4395	

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

These results are confirmed by the comparison of WE cities with Budapest, Prague and Warsaw. We start by estimating equation (11) only for the three latter cities, as shown in the left panel of Table 5. We get similar results as in the previous estimations using the whole sample, except that absorption does not appear as being significant and past country growth is negative. Then, to get results for WE cities, as explained previously, we have sampled randomly 3 cities out of the 30 WE cities and equation (11) is estimated with this sub-sample only. This is repeated 10,000 times and the average coefficients and t-students are then computed and shown in the right panel of Table 5.

[9] In Table 3, GDP growth has a positive and significant effect. Since this variable is not significant when estimated separately for WE and CEE cities, it indicates that the coefficient in Table 3 essentially captures the significant growth difference between WE and CEE in explaining rent deviations, while differences across cities within each of these two parts of Europe do not have a significant effect.

Table 5 : Results for the Rent Equation – Unrestricted Regressions

			WE			
Variable		**CEE**	**Average value**	**Std. Dev.**	**Min**	**Max**
COMPLETION	Coefficient	-0,8611	-1,9862	1,4640	-11,6267	2,3635
	t-student	*-2,310***	*-1,821**	*1,226*	*-7,056*	*2,138*
ABSORB	Coefficient	0,5310	1,9840	1,4165	-1,6257	9,0290
	t-student	*1,190*	*2,288***	*1,277*	*-1,890*	*7,317*
NET(t-1)	Coefficient	0,9983	0,8455	1,2147	-2,5508	7,5006
	t-student	*2,340***	*0,932*	*1,101*	*-3,476*	*4,799*
ΔlogEMP(t-1)	Coefficient	0,4061	0,1125	0,4244	-1,4778	2,5796
	t-student	*1,230*	*0,259*	*1,068*	*-4,714*	*3,574*
ΔlogEMP(t-2)	Coefficient	0,3664	0,1145	0,4345	-1,0018	1,9106
	t-student	*1,440*	*0,209*	*1,142*	*-3,339*	*4,899*
GROWTH(t-1)	Coefficient	-0,0154	0,0083	0,0113	-0,0510	0,0505
	t-student	*-1,950**	*0,970*	*1,236*	*-2,933*	*6,105*
ΔTREND	Coefficient	0,4623	0,3821	0,2120	-0,3750	1,2186
	t-student	*2,400***	*2,333***	*1,152*	*-1,818*	*5,901*
Constant	Coefficient	0,0145	-0,0313	0,0274	-0,1189	0,0967
	t-student	*0,420*	*-1,359*	*1,214*	*-5,397*	*2,757*
Nb of Obs,		46	1000	-	-	-
R^2		0,5528	0,5941	0,0994	0,2059	0,8455

Notes: Estimation using White heteroscedasticity robust standard errors. Estimations for WE based on a random draw of three cities repeated 10 000 times. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

As in Table 4, the evolution of rents seems to respond less to current market disequilibrium in CEE cities than in WE: the marginal effect of supply/completions and demand/absorption is much lower for Budapest, Prague and Warsaw. However, note that the significance of completion and past net completions (NET) are higher than in WE, but not significant for absorption. At the same time, for CEE, we see again a negative coefficient for real GDP growth where a positive effect was expected. In fact, as described in section 2.1, prime real rents are actually decreasing in these three CEE cities in a time of high growth rates of GDP and economic development. These results, combined with those of Table 4, are coherent with the view that international investors have heavily invested in CEE markets to benefit from future expected growth opportunities. Within WE cities, GDP growth is again not a significant variable, as in Table 4.

Moreover, Table 5 also shows that the growth of office-using employment has a greater impact (marginal effect and t-student) in CEE's property markets than those of WE, though they are not significant. Provided this insignificance[10], this result may hint to the fact that property markets are responding to the rapid development of economic activities in CEE. Finally, it is interesting to note that the fit for the CEE regression (0.55) is as high and very close to the average fit for the WE sub-samples (0.59).

[10] Significance may be difficult to obtain with very few time observations (17) and cross-units (3).

6.2 Results for the Price Equation

Results for the property price equation are presented in Table 6. We first show the effect of past rent growth on price in regression 1. As expected, the one-period lagged value of rent growth has a highly significant and positive effect on current prices. However, the second period lag has an unexpected negative coefficient. This might indicate that rents are following a return-to-equilibrium cyclical behavior.

Table 6 : Results for the Price Equation

	1	2	3	4	5	6
ΔlogRENT(t-1)	0,6733	0,5945	0,6757	0,5925	0,6343	0,3478
	*7,240****	*6,610****	*7,130****	*6,430****	*6,660****	*4,550****
ΔlogRENT(t-2)	-0,4250	-0,3276	-0,4013	-0,3684	-0,4076	-0,1578
	*-6,520****	*-5,330****	*-6,380****	*-5,720****	*-6,140****	*-2,950****
ΔSPREAD(t-1)	-	-0,0347	-	-	-	-0,0085
		*-5,340****				*-1,730**
ΔlogOCCEMP(t-1)	-	0,1354	-	-	-	0,0780
		0,960				*0,680*
ΔlogCREDIT(t-1)	-	-	*-0,2528*	-	-	*-0,1034*
			*-2,310***			*-1,930**
ΔlogFDI	-	-	-	0,1938	-	-0,0336
				*6,940****		*-1,490*
ΔlogFDI(t-1)	-	-	-	0,1685	-	-0,0182
				*5,880****		*-0,710*
GROWTH(t-1)	-	-	-	-	0,0065	0,0050
					*1,770**	*1,730**
ΔTREND	-	-	-	-	-	0,9096
						*15,510****
Constant	-0,0076	-0,0098	0,0028	-0,0111	-0,0269	-0,0189
	-1,060	*-1,510*	*0,400*	*-1,610*	*-2,310***	*-2,100***
Nb of Obs,	623	600	617	623	623	600
R^2	0,1526	0,2125	0,1660	0,2111	0,1594	0,5055

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

In regression 2, we include SPREAD and OCCEMP. The former represents the country's overall risk measured by the spread between the 10-year government bond yield and the US yield. As the risk premium increases (decreases), cap rates should move upward (downward). Indeed, the coefficient of SPREAD has the expected negative and significant coefficient.

The latter, OCCEMP, is a proxy estimating the real estate liquidity risk, measured by dividing a city's total occupation by its office-using employment. We assume that investors prefer to operate in larger markets in order to minimize transaction costs, hedge out price variability and exploit the availability of a larger pool of exit strategies. In that respect, as real estate liquidity increases within a market, so should property prices. We do obtain a positive sign, despite being insignificant.

In regression 3, we show the effect of the total volume of domestic credit as a proportion of GDP (CREDIT), measuring the debt availability (liquidity) within a country. CREDIT has a significant but negative coefficient, where a positive sign was expected. In fact, the variable is strongly significant and positive when the model is estimated in level (instead of taking the first difference)[11]. This shows that the amount of domestic credit explains differences in property price levels across cities (e.g. in the "between" panel dimension). However, taken in evolution in time (e.g. in the "within" panel dimension), the domestic credit seems to have a negative effect on the evolution of property price. One factor that could explain this negative sign is that an increase of credits in the market might trigger more property developments, notwithstanding the demand side. Hence, there is an increase in supply that is not necessarily met by the demand in the short term, thereby lowering property prices.

Table 7 : SURE results

Rent equation		Price equation	
COMPLETION	-0,2430	ΔlogRENT(t-1)	0,0201
	*-1,850**		*0,480*
ABSORB	0,0701	ΔlogRENT(t-2)	-0,0695
	0,490		*-1,790**
ΔlogEMP(t-1)	0,0125	ΔlogSPREAD(t-1)	-0,0082
	0,300		*-2,460***
ΔlogEMP(t-2)	-0,0008	ΔlogOCCEMP(t-1)	0,0342
	-0,020		*0,330*
GROWTH(t-1)	0,0068	ΔlogCREDIT(t-1)	-0,0489
	*3,670****		*-1,010*
NET(t-1)	0,4404	ΔlogFDI	-0,0086
	*3,450****		*-0,400*
ΔTREND	0,6604	ΔlogFDI(t-1)	-0,0062
	*15,710****		*-0,290*
Constant	-0,0301	GROWTH(t-1)	0,0096
	*-4,930****		*4,270****
		ΔTREND	0,8888
Nb of Obs,	599		*19,750****
R^2	0,3940	Constant	-0,0384
			*-4,680****
		Nb of Obs,	599
		R^2	0,4698

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

Current and lagged value of FDI inflows (regression 4), representing a proxy for investments in the office real estate markets, have a significant and positive effect on prices as higher demand for real estate assets tends to put upward pressure on prices.

The effect of the nationwide real GDP growth is shown in column 5 of Table 6. As expected, higher GDP growth expectations tend to boost prices, the coefficient of GROWTH being significant and positive.

Finally, in the last column of Table 6, all the determinants of property prices are all estimated in the same regression, adding the European average property price trend. We obtain very similar results as in the previous regressions, except that the coefficients of the two lagged FDI are not significant anymore. The positive and highly significant coefficient of TREND indicates that the local real estate markets tend to significantly follow the European trend.

However, the regression results of Table 6 might not be efficient since rents might be an endogenous variables in the property price equation. To solve for this problem, as explained previously, we estimate both rent and price growth equations in a system using the SURE estimation method. The SURE takes into account the cross-correlation between both equations. SURE results are presented in Table 7. Concentrating on the price equation regressions, all variables have the expected signs except for CREDIT and FDI inflows – but these have an insignificant t-student. Moreover, the first lag of rents is also insignificant. Note that the total fit of the regression is relatively high as we are able to explain about 46% of property price changes.

Akin to the rent equation, we can now compare in Table 8 the coefficients of given RHS variables between WE and CEE cities, using the complete SURE model. To save space, we only show the results for the price equation in what follows[12].

[11] Panel results in levels not shown but available upon request.
[12] SURE results for the rent equation in Table 8 are available upon request.

Table 8: SURE Results – Restricted Regressions

	1		2		3		4	
	Total/WE	**CEE**	**Total/WE**	**CEE**	**Total/WE**	**CEE**	**Total/WE**	**CEE**
ΔlogRENT(t-1)	-0,0255	0,2452	0,0095	-	0,0260	-	0,0120	-
	-0,570	*2,480***	*0,230*		*0,620*		*0,280*	
ΔlogRENT(t-2)	-0,0523	-0,1501	-0,0747	-	-0,0684	-	-0,0711	-
	-1,260	*-1,650**	*-1,950**		*-1,770**		*-1,820**	
ΔlogSPREAD(t-1)	-0,0068	-	-0,0029	-0,0092	-0,0079	-	-0,0082	-
	*-2,030***		*-0,560*	*-2,230***	*-2,380***		*-2,460***	
ΔlogOCCEMP(t-1)	0,0325	-	0,0964	-1,2591	0,0426	-	0,0403	-
	0,320		*0,920*	*-2,790****	*0,410*		*0,390*	
ΔlogCREDIT(t-1)	-0,0615	-	-0,0570	-	-0,0510	-	-0,0453	-0,0991
	-1,270		*-1,190*		*-1,060*		*-0,900*	*-0,570*
ΔlogFDI	-0,0076	-	-0,0042	-	-0,0067	0,9100	-0,0082	-
	-0,350		*-0,190*		*-0,310*	*2,510***	*-0,380*	
ΔlogFDI(t-1)	-0,0046	-	-0,0033	-	-0,0026	0,1417	-0,0074	-
	-0,210		*-0,150*		*-0,120*	*0,350*	*-0,340*	
GROWTH(t-1)	0,0102	-	0,0114	-	0,0093	-	0,0114	0,0095
	*4,460****		*4,890****		*4,100****		*3,690****	*3,650****
ΔTREND	0,8965	-	0,8766	-	0,8735	-	0,8837	-
	*19,970****		*19,190****		*19,330****		*19,470****	
Constant	-0,0386	-	-0,0400	-	-0,0375	-	-0,0419	-
	*-4,710****		*-4,880****		*-4,590****		*-4,590****	
Nb of Obs,	599		599		599		599	
R^2	0,4734		0,4784		0,4750		0,4715	

Notes: SURE estimated with small sample adjustment for the variance-covariance matrix. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

We first note that the lagged values of rent growth are significant for CEE cities only (regression 1): past rent growth in WE do not seem to affect future property prices. But the most telling result probably concerns the 10-yr bond yield spread in regression 2 of Table 8. As expected, an increase of the spread in CEE, which indicates a rise in country risk perceptions, has a negative effect on property prices, while the coefficient is not significant for WE cities. This result is similar as in D'Argensio and Laurin (2009). In fact, WE countries in general are not considered as risky markets and the spread is minimal. Hence, this variable has not much effect on the evolution of WE property prices. But for CEE countries, the general country risk perception is a very important determinant influencing investors' investment decisions. As risk must be priced in the valuation of property, a higher risk leads to a lower property price. In the same vein, the density of the office market (OCCEMP), measuring a particular type of real estate risk, is significant for CEE cities alone (regression 2).

Concerning the national macroeconomic variables in regressions 3 and 4 of Table 8, the first lag of FDI inflows is positive and significant in the CEE case only. The FDI coefficients for WE are of the wrong sign and not significant. This is not surprising knowing the importance of FDI inflows for economic development of CEE countries in the last decade. However, past GDP growth has a very similar impact (coefficient value and significance) on WE property prices than in CEE. Finally, the CREDIT coefficients are not significant in either sample.

Table 9 : OLS Results for the Price Equation – Unrestricted Regressions

Variable		Warsaw, Budapest, Prague	WE Average value	WE Std, Dev,	WE Min	WE Max
ΔlogRENT(t-1)	Coefficient	0,6370	0,2992	0,2745	-0,4680	1,3915
	t-student	*2,100***	*1,298*	*1,245*	*-1,829*	*7,382*
ΔlogRENT(t-2)	Coefficient	-0,2711	-0,1711	0,2092	-1,0862	0,4671
	t-student	*-1,010*	*-1,053*	*1,234*	*-5,624*	*2,313*
ΔSPREAD(t-1)	Coefficient	0,0011	-0,0091	0,0271	-0,0991	0,1170
	t-student	*0,150*	*-0,476*	*0,965*	*-3,395*	*2,921*
ΔlogOCCEMP(t-1)	Coefficient	3,6268	0,1383	0,7202	-5,1943	3,1507
	t-student	*2,800****	*0,314*	*1,105*	*-3,584*	*4,092*
ΔlogCREDIT(t-1)	Coefficient	*0,3234*	-0,1945	0,2471	-1,3198	1,1560
	t-student	*0,610*	*-0,885*	*0,968*	*-5,437*	*3,427*
ΔlogFDI	Coefficient	1,1622	-0,0336	0,1282	-1,0866	1,0764
	t-student	*2,020***	*-0,289*	*1,172*	*-4,271*	*3,644*
ΔlogFDI(t-1)	Coefficient	0,8077	0,0105	0,1368	-0,6107	1,9049
	t-student	*1,670**	*0,049*	*1,260*	*-3,534*	*6,472*
GROWTH(t-1)	Coefficient	0,0024	0,0058	0,0161	-0,0917	0,0581
	t-student	*0,220*	*0,528*	*1,185*	*-4,894*	*3,774*
ΔTREND	Coefficient	0,8984	0,8025	0,2825	0,1480	1,6977
	t-student	*4,340****	*4,078****	*1,422*	*0,820*	*10,578*
Constant	Coefficient	-0,1029	-0,0083	0,0494	-0,1078	0,3313
	t-student	-1,530	-0,447	1,297	-4,199	6,506
Nb of Obs,		38	10000	-	-	-
R²		0,6875	0,5852	0,0970	0,2959	0,8463

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%.

Finally, in Table 9, we compare the OLS estimation of the price equation (8) for Budapest, Prague and Warsaw with the average results for WE cities, using 10,000 random draws of three WE cities, as explained previously. Recall that, in this case, we do not constrain the coefficients to be homogeneous between WE and the three CEE cities.

When comparing the restricted results of Table 8 with the unrestricted ones of Table 9, we observe some differences between the coefficients of WE cities and the sample Budapest/Prague/Warsaw. The impact of the first lag of rent growth (coefficient value and significance) is still higher for the three CEE cities than in WE. Also, past FDI inflows keep their significant and positive coefficient in the former case and our real estate liquidity measure OCCEMP now shows a positive and significant effect on property prices in the CEE sample, while still being insignificant in WE. However, GDP growth and CREDIT have insignificant coefficients in either sample. The R^2 statistics, in average, are also pretty close. These results comfort us in the use of WE coefficients to estimate the long term evolution of CEE markets.

7. Estimated Capitalization Rate

In this section, we estimate a predicted value of the capitalization rate for CEE cities. To do so, we estimate the SURE estimation system, but using only the sample of WE cities. Results are presented in Table 10. The variable CREDIT is removed from the model since it was rarely significant in previous results. Then, using the coefficients obtained for the price equation), we compute the predicted values of the first difference of property prices for all CEE cities.

Table 10 : SURE Results for the Price Equation on the Sample of WE Cities

Variable	
ΔlogRENT(t-1)	0,0012
	0,030
ΔlogRENT(t-2)	-0,0765
	*-1,870***
ΔSPREAD(t-1)	-0,0087
	*-1,670**
ΔlogOCCEMP(t-1)	0,0834
	0,740
ΔlogCREDIT(t-1)	-
ΔlogFDI	0,0207
	0,960
ΔlogFDI(t-1)	0,0191
	0,890
GROWTH(t-1)	0,0164
	*4,830****
ΔTREND	0,7560
	*14,550****
Constant	-0,0477
	*-4,970****
Nb of Obs,	507
R2	0,4350

Notes: SURE estimated with small sample adjustment for the variance-covariance matrix. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%,

To reconstruct a price series in levels, we need to apply forward the predicted first difference prices from a beginning-of-a-period price level. But which one? We could just use an index on a base of 100 for the first year available for each city. In this case, we could only evaluate our predicted values in evolution, and not in levels. We could instead use the actual first-period price level for each city, and then reconstruct the time-series using the predicted first difference. But then, we would have to assume that the first-period price level is not itself under or overvalued. Therefore, we choose another strategy. We estimate by OLS the price equation in level, with no lags except for rents (since they are assumed to be endogenous) and a lagged value of FDI inflows along with its contemporaneous value. Moreover, we add a group fixed effect for Budapest, Prague and Warsaw (CEE1) and a group fixed effect for all other CEE cities (CEE2). The results are shown in Table 11. Then, we take the predicted value of property prices in level for the first year available for each city. We use this initial price level to reconstruct the price series using the predicted first difference obtained from the results of Table 10.

Finally, we can calculate an estimated capitalization rate for each CEE city by dividing the actual prime office real rent by this reconstructed predicted property price. Of course, actual cap rates are computed using NOI, not rents. Thus, to evaluate the extent of over or under evaluation, we rather compare these estimated cap rates with the ratio of actual rent divided by actual price.

Results are illustrated in Appendix 4, where the actual values are compared with that of the predicted property prices and cap rates. For both variables, we show the values in level, but also in an index where 1 = first year, in order to compare the evolution in time of the predicted compared to the actual values. For Bucharest and Zagreb, due to missing values, we are only able to predict few annual values, as shown in Table A4 of Appendix 4.

Overall, predicted prices tend to follow more or less closely their actual values, especially for Riga, Sofia, Budapest (after 1999) and Vilnius. This is surprising knowing that we are wholly using the coefficient results for WE cities.

In level, cap rates should have been higher than their actual values - when considering the real estate and macroeconomic conditions - in Warsaw (in 2006-2009), Kiev (since 2005) and Bratislava (since 2004) and Zagreb (Table A4). For Budapest, the predicted price might have been over evaluated before 1999 - which should give a higher predicted cap rate than the actual one, but predicted values then converge towards their actual values.

For other cities or other time periods, we get that cap rates should have been even lower that their actual values, especially for Prague (after 1998) and Sofia. For Budapest (after 1999) and Riga, the predicted cap rates follow more or less closely their actual values. No specific pattern can be outlined for Bucharest (Table A4) with predicted values obtained for only two years.

These results tend to invalidate the hypothesis that investors may have underestimated the true risk situation in CEE markets, except for specific time periods and cities. This hypothesis might be true, to some extent, only for the last 4 years in some cities (Warsaw, Kiev, Bratislava, Tallinn). But it remains that the hypothesis of an undervaluation of risk cannot be generalized to all CEE property markets. Investors may not have been as short-sighted as expected by the rapid decline of cap rates in CEE.

Table 11 : OLS Panel Results for the Price Equation in level

Variable	
logRENT(t-1)	0,7720
	*5,690****
logRENT(t-2)	-0,4953
	*-3,720***
SPREAD	-0,0219
	*-4,990****
logOCCEMP	-0,0570
	-1,510
logCREDIT	-
logFDI	0,2872
	*3,330****
logFDI(t-1)	0,1585
	*1,830**
GROWTH	0,0044
	1,040
TREND	0,3427
	*3,330****
Constant	3,0012
	*3,740****
CEE1	-0,7831
	*-13,100****
CEE2	-0,2540
	*-4,620***
Nb of Obs,	646
R2	0,5820

Notes: Estimation using White heteroscedasticity robust standard errors. Below coefficient: t-statistics, * = significant at 10%; **=significant at 5%; ***= significant at 1%,

In fact, looking at the data, we have observed in section 2.1 that prime office real rents in CEE cities generally have a downward trend throughout almost the entire sample period. Since rents have a positive effect on prices, as expected and as estimated by our regression coefficients, the decrease in rents explains the decline in prices, everything else held constant. As for risk, the premium has also decreased tremendously for CEE countries in the same period. We thus have a second motive for the rapid decline in cap rates. At the same time, growth expectations in terms of GDP or employment have been very high in CEE countries, at least before the 2008 crisis. Therefore, investors kept investing in these markets, in spite of decreasing rents.

One can wonder if it is not rather the general country risk, as measured here by the government bond spread, that is not properly valued by the markets (see D'Argensio & Laurin, 2009). In particular, since the entry of some CEE countries into the European Union, we have noted a sharp decline in 10-year government bond yields that are not totally explained by their actual macroeconomic fundamentals. However, we leave this issue for future research.

Conclusion

In this paper, we attempted to determine whether investors have properly appraised the "true" risk level associated to CEE property markets. Using as a benchmark the past evolution of the office markets in Western Europeans cities, we are able to estimate a predicted property price and capitalization rate for Central Eastern European cities, given their respective current real estate and economic conditions. Our results show that for Warsaw, Kiev, Bratislava, Tallinn and Zagreb, their respective predicted cap rates should have been higher than their actual values in specific period (especially the last 4 years), whereas for other cities they should have been lower. On the other hand, predicted and actual values for the cities of Budapest and Riga were quite similar indicating that investors had properly appraised those property markets. Therefore, the hypothesis of an undervaluation of risk cannot be generalized to all CEE property markets. We also find that the macroeconomic environment and the general the risk assessment seems to have a stronger effect on property prices in CEE than in Western European cities.

However, the use of WE cities as a benchmark to infer the true risk appraisal in CEE cities is far from satisfying. The continuation of this research will involve the implementation of statistical techniques to identify in the evolution of the Western European markets particular phases that could mimic more realistically the evolution of CEE markets.

Moreover, in a companion study, we are investigating the over or undervaluation of the CEE 10-year government bond yield relatively to their actual macroeconomic fundamentals. If the general country risk perception is not properly evaluated at the onset by international investors, other assets will be also mispriced accordingly. Hence, any inaccurate valuation of office property prices may actually come from faulty perceptions affecting the value of the independent variables in our empirical model, and specifically here the 10-year government bond yield. A "predicted" bond yield, estimated using appropriate estimation methods and hypothesis, and based on actual macroeconomic fundamentals, could be used in the price equation regressions instead of its actual value.

Appendix 1: List of Cities and Data Availability

Table A1: list of cities and data availability

Western Europe			Central and Eastern Europe		
Country	**City**	**Data availability starting in**	**Country**	**City**	**Data availability starting in**
Austria	Vienna	1990	Bulgaria	Sofia	1998
Belgium	Brussels	1990	Croatia	Zagreb	2003
Denmark	Copenhagen	1990	Czech Rep.	Prague	1990
Finland	Helsinki	1990	Estonia	Tallinn	1998
France	Paris	1990	Hungary	Budapest	1990
France	Paris-La Defense	1990	Latvia	Riga	2000
Germany	Berlin	1990	Lithuania	Vilnius	1998
Germany	Frankfurt	1990	Poland	Warsaw	1990
Germany	Hamburg	1990	Romania	Bucharest	1998
Germany	Munich	1990	Serbia	Belgrade	2000
Germany	Stuttgart	1990	Slovakia	Bratislava	2000
Greece	Athens	1990	Ukraine	Kiev	2000
Ireland	Dublin	1990			
Italy	Milan	1990			
Italy	Rome	1990			
Netherlands	Amsterdam	1990			
Netherlands	Rotterdam	1990			
Norway	Oslo	1990			
Portugal	Lisbon	1990			
Spain	Barcelona	1990			
Spain	Madrid	1990			
Sweden	Stockholm	1990			
Switzerland	Geneva	1990			
Switzerland	Zurich	1990			
UK	Birmingham	1990			
UK	Edinburgh	1990			
UK	London-City	1990			
UK	London-Docklands	1990			
UK	London-West End	1990			
UK	Manchester	1990			

Appendix 2: Sources of Data

Table A2: list of variables and source.

Variables	Source
Interest rates	
10-year Bond Yields (or equivalent long-term rate) at country level	Global Insight; Bloomberg; Eurostat.
Economic Variables	
Office-Using Employment Data at city level	Cambridge Econometrics
GDP (at constant $US prices) at country level	World Economic Outlook, Global Insight
CPI (2005=100) at country level	IMF
Gross Domestic Credit Volume (in euros)	IMF
Other variables	
Foreign Direct Investments (Inward; US Dollars at current prices and current exchange rates in millions) at country level	UNTACD and Economist and Intelligence Unit
Real estate variables	
Inventory by city (sqm/yr) Rents by city (€/sqm/yr) Price index (2004=100) Absorption by city (in sqm) Completions in city (in sqm) Vacancy rate by city (in %) Capitalization rate by city (in %)	Property and Portfolio Research, Cushman and Wakefield, CB Richard Ellis, Colliers Office Global Insights and Ober Haus Real Estate Adivsors

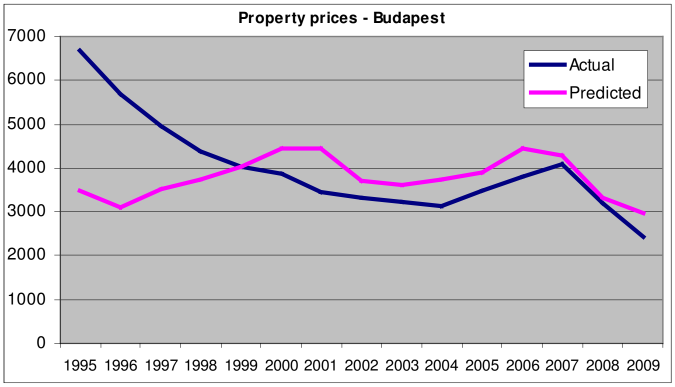
Appendix 3: Correlation Matrix

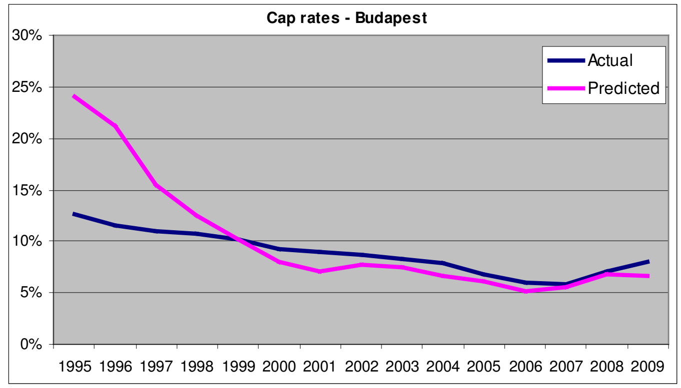
Table A3 : Correlation Matrix

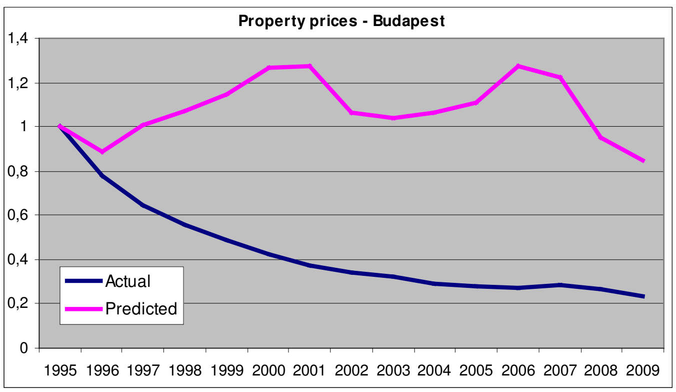
	ΔlogRENT (t-1)	ΔlogRENT (t-2)	ΔSPREAD (t-1)	ΔlogOCCEMP (t-1)	ΔlogCREDIT(t-1)	GROWTH (t-1)	ΔlogFDI	ΔlogFDI (t-1)
ΔlogRENT(t-1)	1,000							
ΔlogRENT(t-2)	0,526	1,000						
ΔSPREAD(t-1)	0,029	0,221	1,000					
ΔlogOCCEMP(t-1)	-0,086	-0,146	0,015	1,000				
ΔlogCREDIT(t-1)	0,116	0,205	0,100	-0,041	1,000			
GROWTH(t-1)	0,321	0,102	-0,093	0,021	0,133	1,000		
ΔlogFDI	0,050	-0,070	-0,121	0,003	-0,107	0,021	1,000	
ΔlogFDI(t-1)	0,129	0,025	-0,072	0,019	0,048	0,116	-0,235	1,000
ΔTREND	0,147	-0,129	-0,351	0,016	-0,097	0,134	0,362	0,258

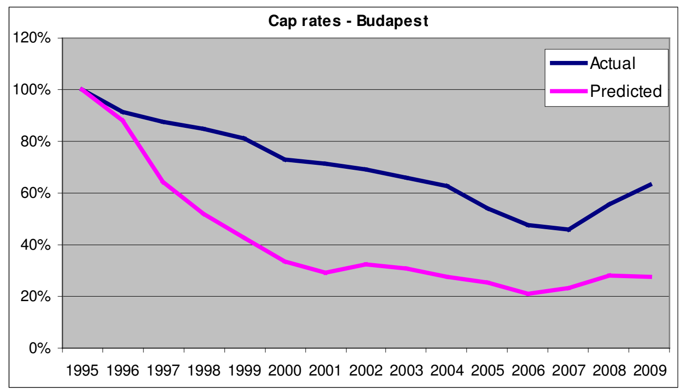
Appendix 4: Comparison between Current and Predicted Values

Budapest

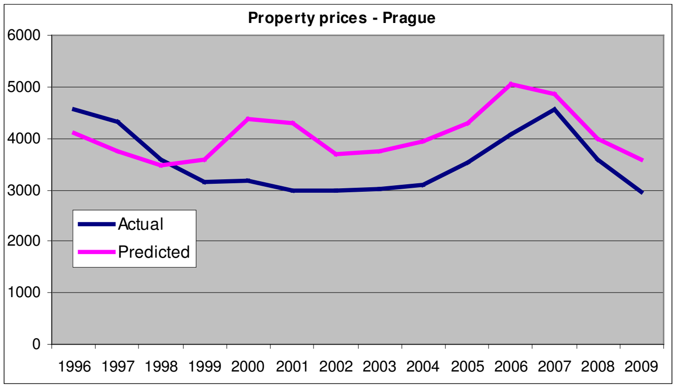


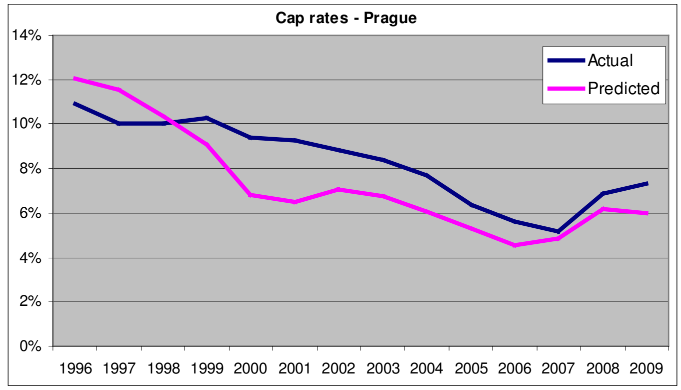


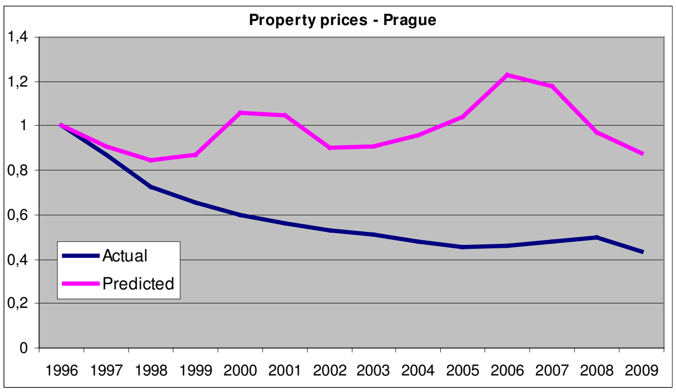


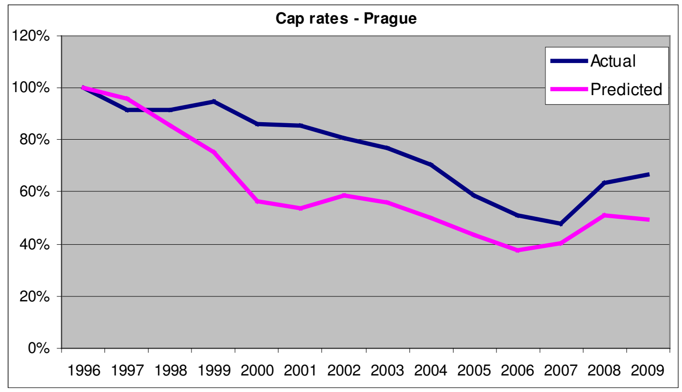


Prague

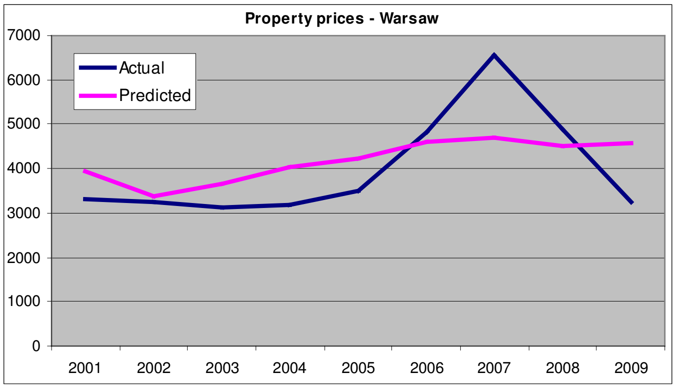

Property prices - Prague
6000
5000
4000
3000
2000
1000
0
Actual
Predicted
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

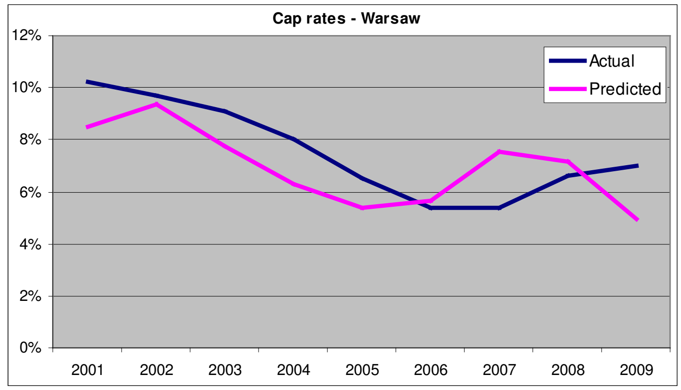

Cap rates - Prague
14%
12%
10%
8%
6%
4%
2%
0%
Actual
Predicted
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

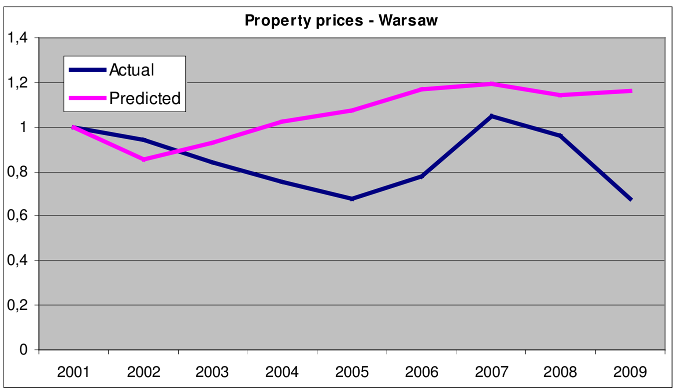

Property prices - Prague
1,4
1,2
1
0,8
0,6
0,4
0,2
0
Actual
Predicted
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

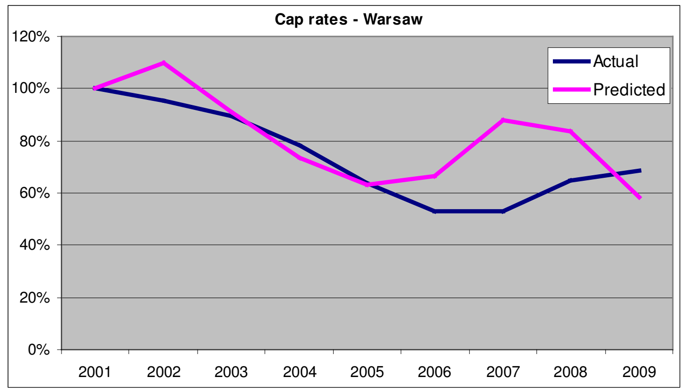

Cap rates - Prague
120%
100%
80%
60%
40%
20%
0%
Actual
Predicted
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

Warsaw

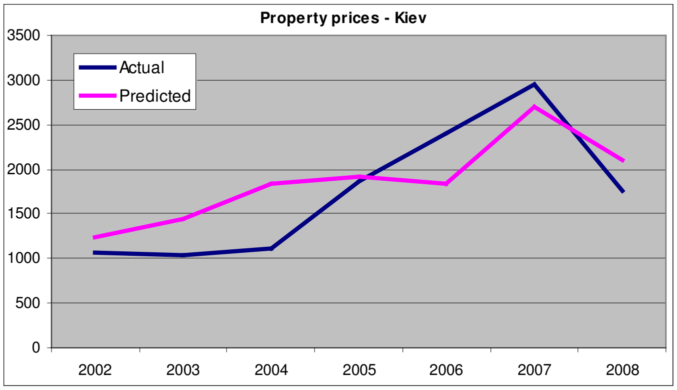

Property prices - Warsaw
7000
6000
5000
4000
3000
2000
1000
0
Actual
Predicted
2001
2002
2003
2004
2005
2006
2007
2008
2009

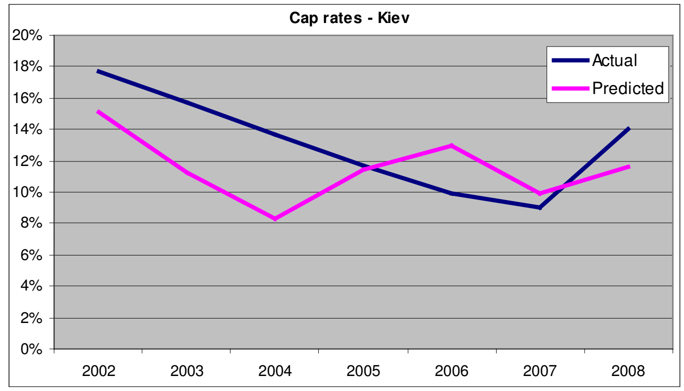

Cap rates - Warsaw
12%
10%
8%
6%
4%
2%
0%
Actual
Predicted
2001
2002
2003
2004
2005
2006
2007
2008
2009

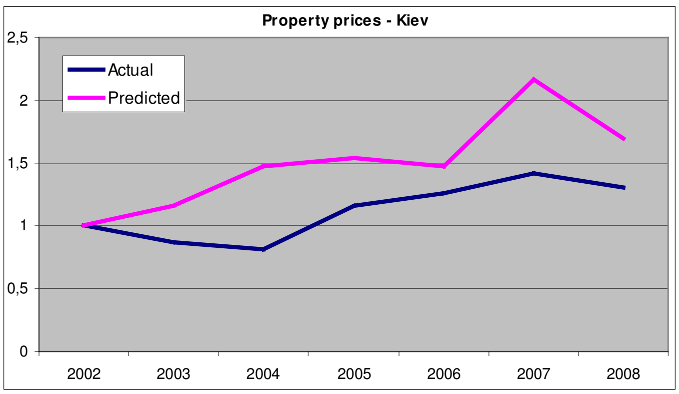

Property prices - Warsaw
1,4
1,2
1
0,8
0,6
0,4
0,2
0
Actual
Predicted
2001
2002
2003
2004
2005
2006
2007
2008
2009

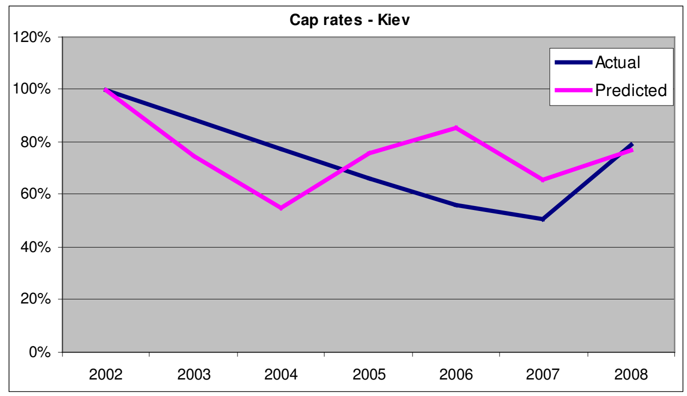

Cap rates - Warsaw
120%
100%
80%
60%
40%
20%
0%
Actual
Predicted
2001
2002
2003
2004
2005
2006
2007
2008
2009

Kiev

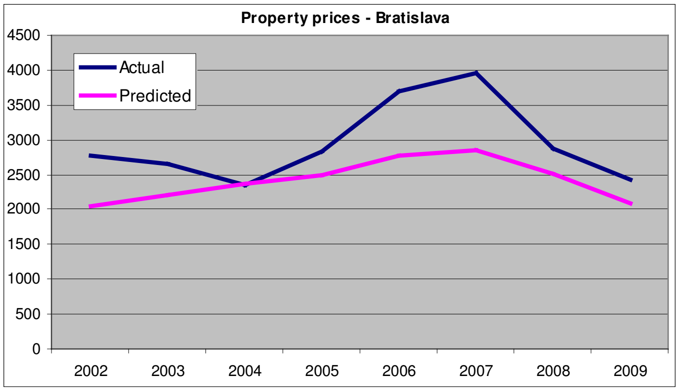

Property prices - Kiev
3500
3000
2500
2000
1500
1000
500
0
2002
2003
2004
2005
2006
2007
2008
Actual
Predicted

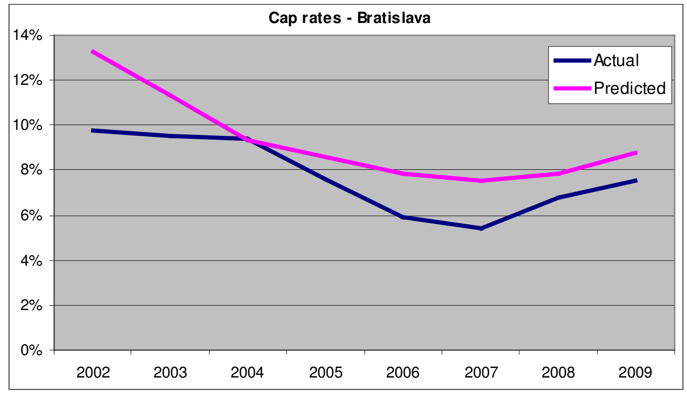

Cap rates - Kiev
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
2002
2003
2004
2005
2006
2007
2008
Actual
Predicted

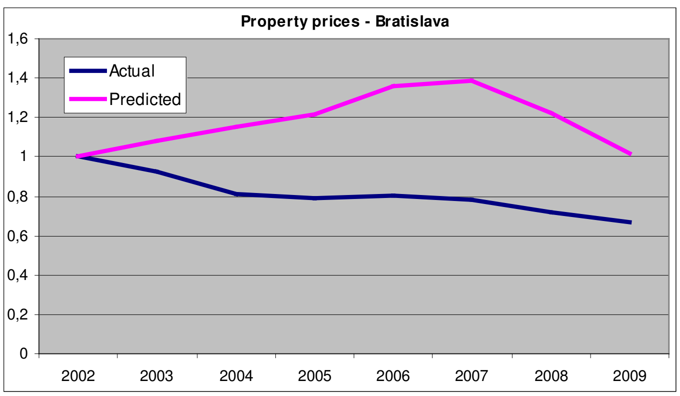

Property prices - Kiev
2,5
2
1,5
1
0,5
0
2002
2003
2004
2005
2006
2007
2008
Actual
Predicted

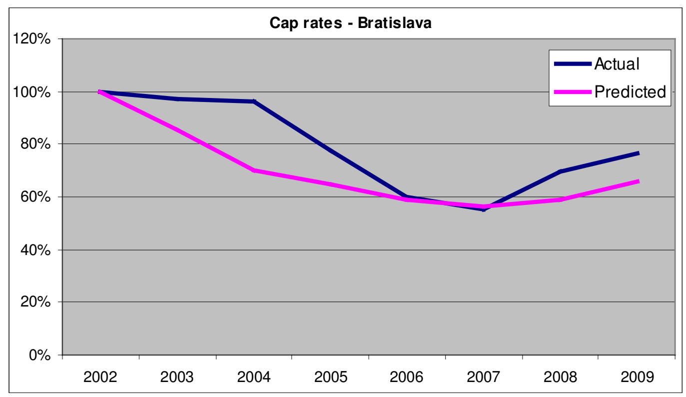

Cap rates - Kiev
120%
100%
80%
60%
40%
20%
0%
2002
2003
2004
2005
2006
2007
2008
Actual
Predicted

Bratislava

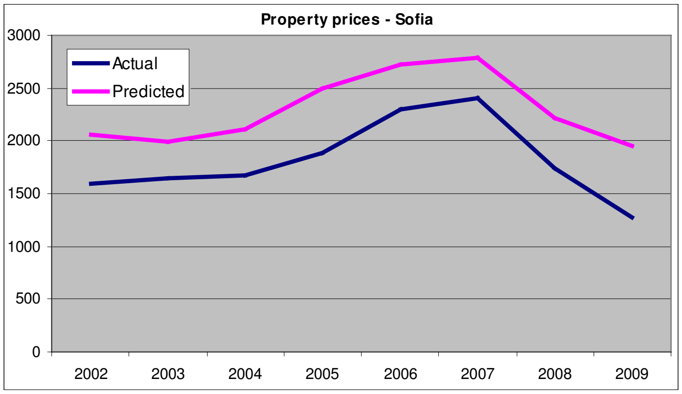

Property prices - Bratislava
Actual
Predicted
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2002
2003
2004
2005
2006
2007
2008
2009


Cap rates - Bratislava
Actual
Predicted
14%
12%
10%
8%
6%
4%
2%
0%
2002
2003
2004
2005
2006
2007
2008
2009

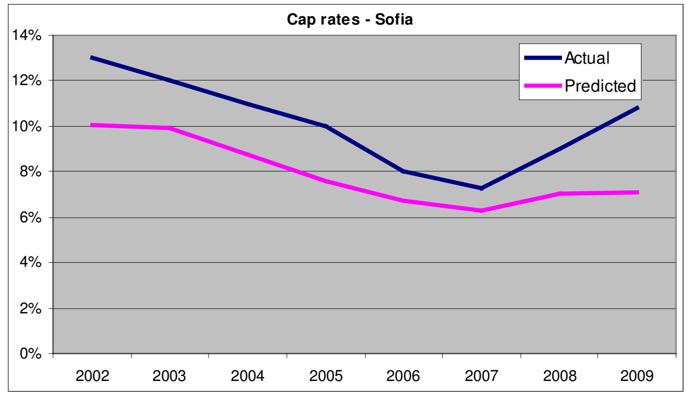

Property prices - Bratislava
Actual
Predicted
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
2002
2003
2004
2005
2006
2007
2008
2009


Cap rates - Bratislava
Actual
Predicted
120%
100%
80%
60%
40%
20%
0%
2002
2003
2004
2005
2006
2007
2008
2009

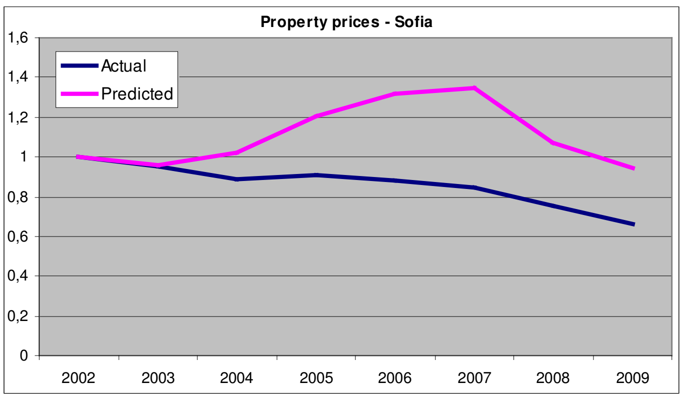
Sofia



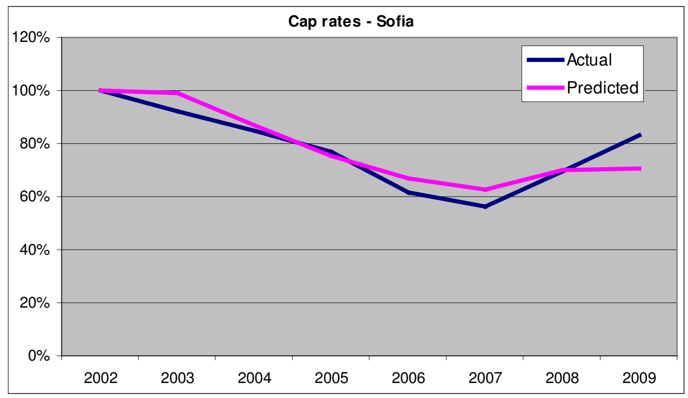
Property prices - Sofia
Actual
Predicted
3000
2500
2000
1500
1000
500
0
2002
2003
2004
2005
2006
2007
2008
2009



Cap rates - Sofia
Actual
Predicted
14%
12%
10%
8%
6%
4%
2%
0%
2002
2003
2004
2005
2006
2007
2008
2009

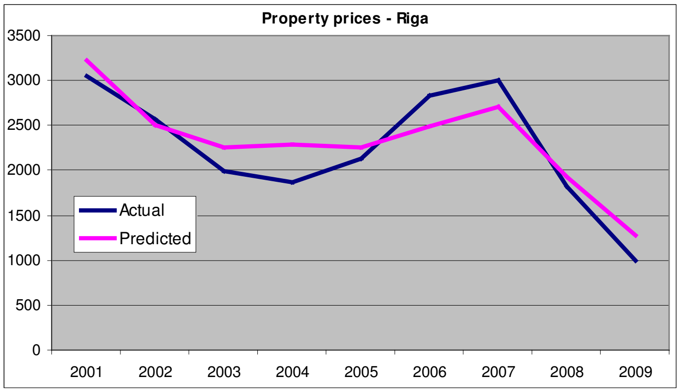


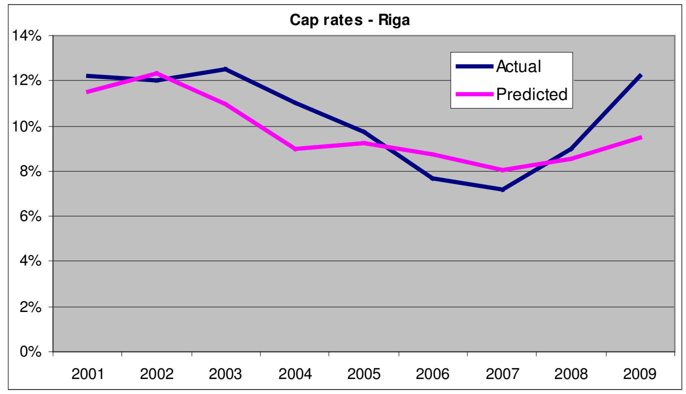
Property prices - Sofia
Actual
Predicted
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
2002
2003
2004
2005
2006
2007
2008
2009

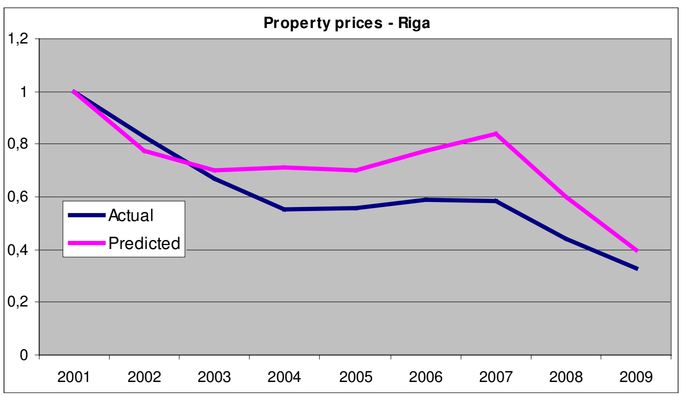


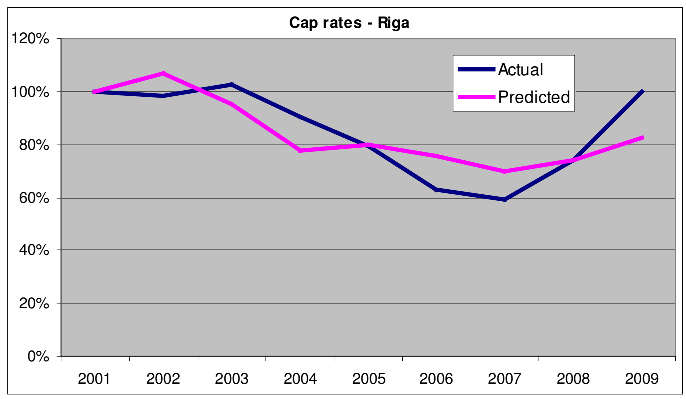
Cap rates - Sofia
Actual
Predicted
120%
100%
80%
60%
40%
20%
0%
2002
2003
2004
2005
2006
2007
2008
2009

Riga


Property prices - Riga
3500
3000
2500
2000
1500
1000
500
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

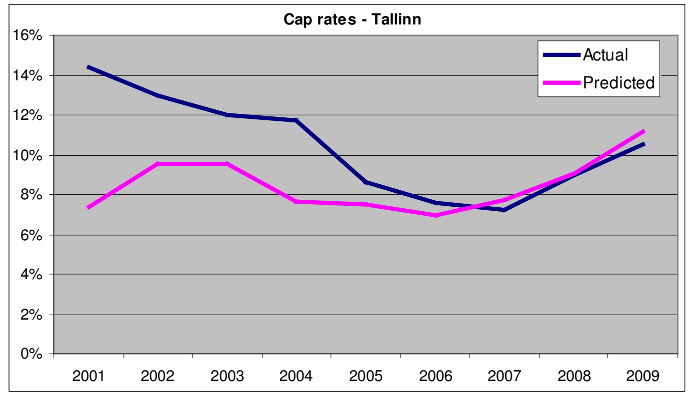

Cap rates - Riga
14%
12%
10%
8%
6%
4%
2%
0%
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted


Property prices - Riga
1,2
1
0,8
0,6
0,4
0,2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

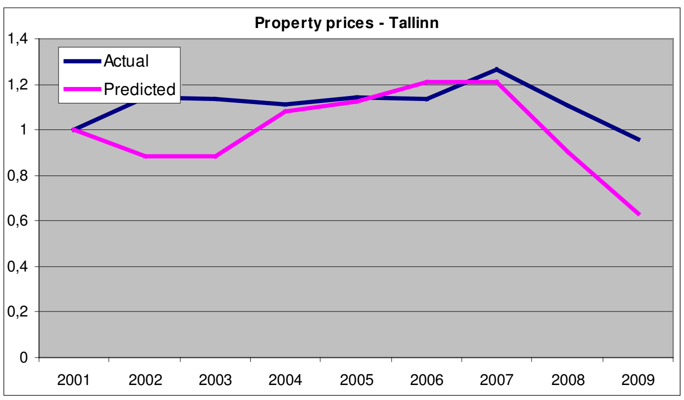

Cap rates - Riga
120%
100%
80%
60%
40%
20%
0%
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

Tallinn

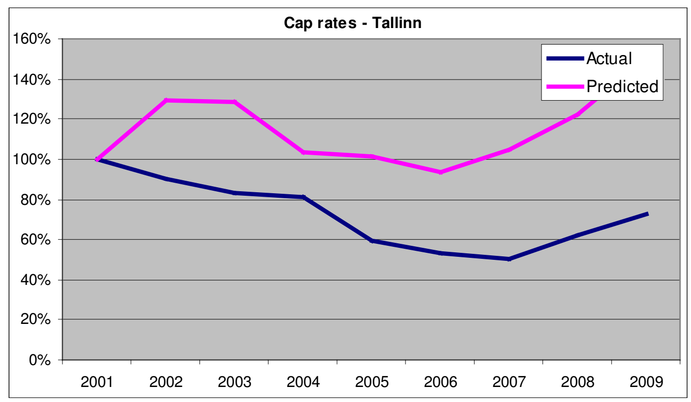
Property prices - Tallinn
3000
2500
2000
1500
1000
500
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted



Cap rates - Tallinn
16%
14%
12%
10%
8%
6%
4%
2%
0%
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

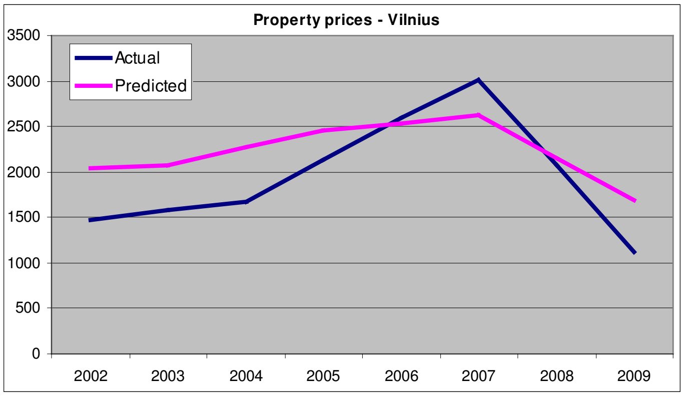


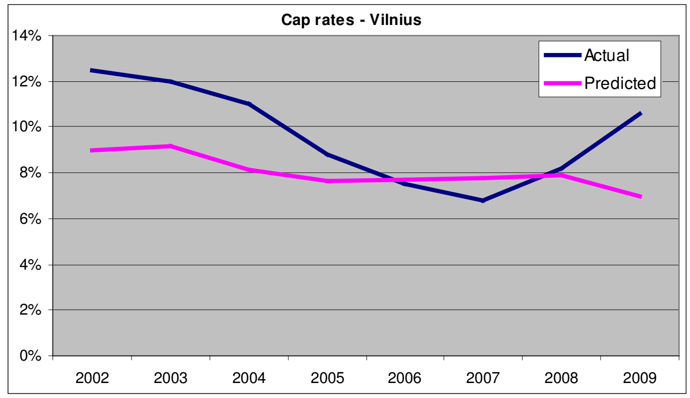
Property prices - Tallinn
1,4
1,2
1
0,8
0,6
0,4
0,2
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

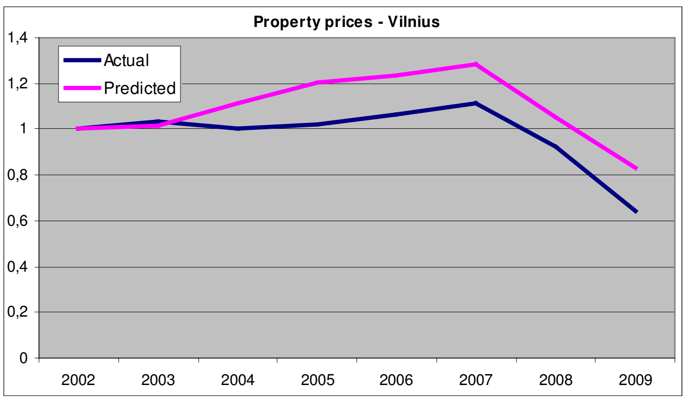


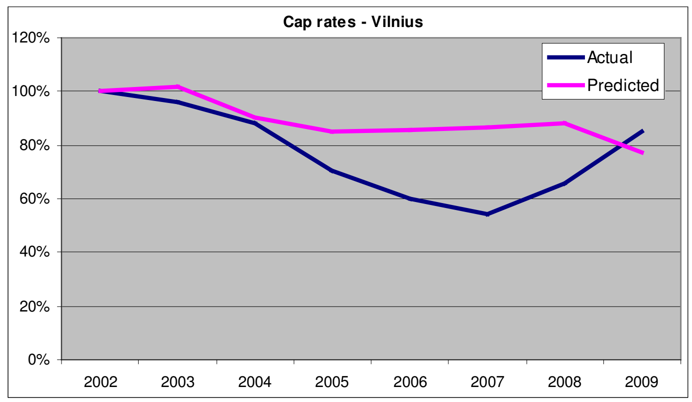
Cap rates - Tallinn
160%
140%
120%
100%
80%
60%
40%
20%
0%
2001
2002
2003
2004
2005
2006
2007
2008
2009
Actual
Predicted

Vilnius









Bucharest and Zagreb

Table A4: Results for Bucharest and Zagreb

		Property prices		Cap rates	
	year	Actual	Predicted	Actual	Predicted
Bucharest	2008	2518,69	2086,43	8,50%	10,26%
	2009	1985,30	2267,92	9,50%	8,32%
Zagreb	2007	2864,88	2374,41	6,70%	8,08%
	2008	2486,31	1941,66	7,50%	9,60%
	2009	2039,32	1733,31	8,50%	10,00%

Bibliography

Adair, A.S., Berry, J.N., McGreal, W.S., Sykora, L., Ghanbari Parsa, A. & B. Redding (1999). Globalization of Real Estate Markets in Central Europe. European Planning Studies, Vol. 7, No.3, pp. 295–305.

Adair, A.S., Allen, S., Berry, J.N., & S. McGreal (2006). Central and Eastern European Property Investments Markets: Issues of Data and Transparency. Journal of Property Investment & Finance, Vol. 24, No. 3, pp. 211-220.

Bernoth, K., von Hagen, J. & L. Schuknecht (2004). Sovereign Risk Premia in the European Government Bond Market. European Central Bank Working Paper series no. 369, June 2004.

CBRE Market View: CEE Property Investments, January 2010.

Chan, H.L., Lee, S.K. & K.Y. Woo (2001). Detecting Rational Bubbles in the Residential Housing Markets of Hong Kong. Economic Modelling, Vol. 18, pp. 61-73.

D'Argensio, J.-J. & F. Laurin (2009). The Real Estate Risk Premium: A Developed/Emerging Country Panel Data Analysis. The Journal of Portfolio Management, Vol. 35, No. 5, pp. 118-132.

Drbohlav, D. & L. Sykora (1997). Gateway cities in the process of regional integration in central and Eastern Europe: the case of Prague. In: Migration, Free Trade & Regional Integration in Central and Eastern Europe, pp. 215-237. Vienna: Verlag Osterreich.

Favero, C., Pagano, M. & E.-L. von Thadden (2004). Valuation, Liquidity and Risk in Government Bond Markets. Working Paper, First Draft. March 2004.

Ghanbari Parsa, A. R. (1997). Impact of Globalization on Urban Development in Central Europe. Paper presented at the International Conference, Land, RICS, London.

Hott, C. & P. Monnin (2008). Fundamental Real Estate Prices: An Empirical Estimation with International Data. Journal of Real Estate Finance and Economics, Vol. 36, pp. 427–450.

Jones Lang Lasalle Transparency Index, New Europe Joins the Race, September 2008.

Keogh, G. & E. D'Arcy (1994). Market Maturity and Property Market Behavior: a European comparison of Mature and Emergent Markets. Journal of Property Research, Vol. 11, 215–35.

Keivani, R., Parsa, A. & S. McGreal (2000). Globalization of Real Estate Markets and Urban Development in Central Europe. Paper presented at the RICS Cutting Edge Conference, September 6-7.

Lo, F. & P.J. Marcotullio (2000). Globalization and Urban Transformations in the Asia–Pacific Region: A Review. Urban Studies, Vol. 27, No.1, pp. 77–111.

Mansfield, J.R. & P.J. Royston (2007). Aspects of Valuation Practice in Central and Eastern European Economies. Journal of Property Management, Vol. 35, No. 2, pp.150-163.

McGreal, S., Parsa, A. & R. Keivani (2001). Perceptions of Real Estate Markets in Central Europe: A Survey of European Investors. Journal of Real Estate Literature, 2002, Vol. 9, No.2, pp. 147-160.

McGreal, S., Parsa, A. & R. Keivani (2002). Evolution of Property Investment Markets in Central Europe: Opportunities and Constraints. Journal of Property Research, 2002, Vol. 19, No.1, pp. 213-230.

Mueller, G.R. (1999). Real Estate Rental Growth Rates at Different Points in the Physical Market Cycle. Journal of Real Estate Research, Vol. 18, No.1, pp. 130-150.

Roche, M.J. (2001). The rise in house prices in Dublin: Bubble, Fad or just Fundamentals. Economic Modelling, Vol. 18, pp. 281-295.

Sanderson, B., Farrelly, K. & C. Thoday (2006). Natural Vacancy Rates in Global Office Markets. Journal of Property Investment & Finance, Vol. 24, No. 6, pp. 499-520.

Sivitanidou, R.C. & P.S. Sivitanides (1996). Office Capitalization Rates. Why do they Vary Across Metropolitan Markets. Real Estate Issues, Vol. 21, pp. 34-39.

Tse, R.Y.C. & D. Fisher (2003). Estimating Natural Vacancy Rates in Office Markets Using a Time-Varying Model. Journal of Real Estate Literature, Vol.11, No.1, pp.37-45.

Watkins, D. & C. Merrill (2003). Central Europe: A Brief Introduction to Participating in Reemerging Real Estate Markets. Heitman Real Estate Investment Management, Chicago, IL.

Wheaton, W.C. & R. Torto (1988). Vacancy Rates and the Future of Office Rents. AREUEA Journal, Vol. 16, No. 4, pp. 430-436.

Wheaton, W.C. & G. Nechayev (2008). The 1998-2005 Housing 'Bubble' and the Current 'Correction': What's Different this Time? Journal of Real Estate Research, Vol. 30; No.1, pp. 1-26.

Yeung, H.W.C. (1998). Transnational Economic Synergy and Business Networks: the Case of Two-Way Investment between Malaysia and Singapore. Regional Studies, Vol. 32, No. 8, pp. 687–706.