

Charles University in Prague

Faculty of Social Sciences

Institute of Economic Studies

BACHELOR THESIS

Determinants of Commercial Real Property Prices
in the CR during the Financial Crisis

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Prague, May 18, 2012

Signature

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Determinants of Commercial Real Property Prices in the CR during the Financial Crisis

Preliminary outline

In my thesis I will analyze the hitherto unexamined area of market as for the impact of recent financial crisis.

In the first part I will work out a brief introduction to the environment of the Czech commercial real estate market and a basic overview of observed variables. I will summarize the circumstances concerning the financial crisis.

Next I intend to set up the methodology of the research and describe the theoretical framework which I will work along. On the basis of the composed model I will try to explain the macroeconomic factors affecting the prices of the real estate, amount of building / sales, allocation of investments and other relevant characteristics of the Czech market in the given period. I will divide the market by defining the specificities of several segments (office, retail, lodging). I shall assess my conclusions with papers investigating the financial crisis itself or behavior of the given market in 'common' circumstances.

I will work on the basis of publicly accessible data and information of agencies acting on the Czech real estate market. My goal and contribution will be the interconnection of processes on the examined market with the general background of financial crisis and the explanation of external factors affecting it.

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ABSTRACT

This thesis examines macroeconomic factors which influenced the Czech commercial real estate market between the years 2007 to 2010, dividing it in three basic segments – loading, office and retail. First we focus on describing the character of the market, how it differs from other areas of economic activities and what are these differences caused by. Next we create several models for particular real estate market quantities and from the results we conclude some fundamental facts about the functioning of the market. We interpret the role of the real estate yield as an instrument of the financial market which moderates the real estate market's reactions to changes in the economic environment.

KEYWORDS

Commercial real estate, financial crisis, real estate yield, three-sector model of metropolitan economic growth

ABSTRAKT

Tato práce zkoumá makroekonomické faktory ovlivňující český trh komerčních nemovitostí v letech 2007 až 2010, přičemž ho dělíme na tři základní segmenty – trh logistických, kancelářských a obchodních prostor. Nejprve se soustředíme na popis charakteru trhu, jak se liší od ostatních oblastí ekonomické činnosti, a čím jsou tyto odlišnosti způsobeny. Poté vytváříme několik modelů pro jednotlivé veličiny trhu nemovitostí a z výsledků odvozujeme základní fakta důležitá pro fungování tohoto trhu. Vyvozujeme roli výnosu investic do nemovitostí (real estate yield) jakožto nástroje finančního trhu, který ovlivňuje reakce trhu nemovitostí na změny v ekonomických podmínkách.

KLÍČOVÁ SLOVA

Komerční nemovitosti, finanční krize, výnos investic do nemovitostí, třísektorový model metropolitního ekonomického růstu

Rozsah práce: 78 508.

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1. INTRODUCTION

The link between the financial crisis of the late 2000's, the worst one since the Great Depression¹, and the real estate market is evident. The situation on the US real estate market affected the conditions in all economies worldwide. But what was the following phase, the impact of global changes on the real estate in other countries, particularly in the Czech Republic? Was there any direct influence at all or did the situation in the real estate market change vicariously, as it followed some secondary indicators, for example trends in the financial sector's willingness to invest? In this paper we will try to explain what macroeconomic values, including the investment, the real estate agents reacted to when they decided about their behavior during the crisis.

It is the relationship between the financial sector and the real estate market that needs to be stressed – its relatively high value, long-term character and a high level of rigidity are only some of the features that make the real estate market a perfect allocation for portfolio diversifying investments (or at least so it was believed prior to the crisis). Also, the American housing bubble, which was at the beginning of the recession and is discussed for both its reasons and effects, was caused by the predatory lending and the financial sector's unregulated combining of risky mortgages into derivatives with an unclear level of risk. What was wrong with the concept of the 'safe and predictable real estate'? We will try to answer this question in the theoretical framework of this paper.

When examining the impact of changes in the economy on the conditions on the real estate market, we can, similarly to other areas, decide whether we are interested in a section that concerns individuals more closely, in this case housing, or rather the main income-producing segment – commercial real property. In our study we will consider in most cases the second possibility, mainly because the character of the factors we intend to employ – macroeconomic indicators – better corresponds to the character of the commercial real estate, which is closer to the industrial sphere than housing (open

¹ REUTERS.COM:

<http://www.reuters.com/article/2009/02/27/idUS193520+27-Feb-2009+BW20090227>
(28.4.2012)

rather to a microeconomic research). However, when deciding about the attitude towards the specific phenomena of the commercial real estate, we will show regard to the results of papers dealing with housing too – for practical reasons (as there is only a very limited amount of research done in this field of study so far, it would be disadvantageous to restrict our theoretical review only to one subsequent part), but of course very carefully not to merge the assumptions from these two fields, which definitely differ.

2. INTENDED STRUCTURE

In the first part of this paper we will define some basic quantities that are monitored on the real estate market. We will try to characterize their purpose and detail their basic properties and ways of interaction. We will additionally mention several financial instruments whose existence and nature is one of the sources of the divergence of the real estate market from the rules that hold in many less complicated markets.

In the second part we will summarize present sporadic evidence from the examined field. We also intend to employ several articles investigating related problems that will be useful when trying to understand specificities of the real property market and the difference between its interaction with the financial sector under 'usual' conditions and during the crisis.

Next we aim to describe the theoretical background of the issue – first of all, the structure and properties of the market. In order to be able to create valid expectations about the results and to interpret them once the research is done, we will further detail the decision-making process behind the real estate market agents' behavior; implications of the physical characteristics and constraints of the real estate are also to be mentioned. Furthermore, we will divide the commercial real estate market into two basic segments – office and loading (usually there is considered a third segment, retail; however, due to practical limitations, the model will deal only with office and loading). In this part we are generally going to capture the logic behind the market's functioning and the nature of major incentives.

The empirical research will be done in the consequent part. We will describe the data available, try to compensate some deficiencies and explain our expectations about the results of the regressions. We are going to perform the regressions and interpret the results on the basis of the theoretical part. Our intention is to create a model for both the supply and demand side factors in the office and loading segment and by that to find out the main determinants of the commercial real estate prices.

In the final part, the summary of results will be presented and we will briefly review how the outcome corresponds with hypotheses stated before.

3. BASIC QUANTITIES

When evaluating the situation on a particular commercial real estate market investors take into account several descriptive quantities.

3.1 REAL ESTATE MARKET STATISTICS

Supply	the total amount of space available; total stock
New supply	the amount of newly created space during particular period. Usually consists of both space intended for sale after construction and space pre-agreed (built on order)
Net demand	the total amount of space currently occupied by renters
New demand	<i>"the difference between the square meters of companies that moved-in and expanded and companies that moved-out or decreased their rented space in the same period of time"</i> (Jones Lang LaSalle, Q3 2011)
Vacancy rate	the rate of vacated space with respect to total supply; percentage excess supply
Gross take-up	the amount of all lease transactions during a given period according to the date when the contract is made (not when it starts); includes renegotiations, sub-leases and all kinds of pre-leases
Net take-up	gross take-up without renegotiations, but still including sub-leases
Prime rent	<i>"the top open-market tier of rent that could be expected for a unit of standard size commensurate with demand in each location. The unit is of the highest quality and specification and in the best location in a market at the survey date. It is assumed that the occupier will also be agreeing to a package of incentives that is typical of the market at the time"</i> ²

² CBRE.EU:

http://portal.cbre.eu/portal/page/portal/research/publications/EMEA_FPR_PORTUGAL_RENT_S_YIELDS_SNAPSHOT_Q2_2011.pdf (28.4.2012)

3.2 FINANCIAL INSTRUMENTS

CMBS	Commercial Mortgage-Backed Security – security that is secured by a loan on commercial property; not standardized, thus more specification is needed to evaluate; usually a lower risk investment than RMBS, residential alternative ³
CMBX	a group of indices consisting of 25 CMBS tranches; credit default swap (CDS) of corporate credit risk ⁴
REIT	Real Estate Investment Trust; way of direct investment in real estate, possibly in property (return from rent, may also serve to purchase MBS) or in mortgage (return from interests) ⁵

³ INVESTOPEDIA.COM:

<http://www.investopedia.com/terms/c/cmbs.asp#axzz1cMtaMRfC> (28.4.2012)

⁴ SECURITIZATION.NET:

http://www.securitization.net/pdf/Nomura/CMBX_23Mar06.pdf (28.4.2012)

⁵ INVESTOPEDIA.COM:

<http://www.investopedia.com/terms/r/reit.asp#axzz1cMtaMRfC> (28.4.2012)

4. CURRENT STATE OF RESEARCH

Reinhart & Rogoff (2009) found in their paper *The Aftermath of Financial Crises* on general dealing of markets with recession after financial crises (Spain 1977, Norway 1987, Finland 1991, Sweden 1991, Japan 1992) that after the economies experience a collapse of a bubble on any market or similar kind of shock, the reaction can be divided into three consecutive periods: first, collapse of asset markets, second, fall in output level and increase in unemployment rate and finally, rapid accumulation of government debt. What we are interested in is the first part, in which they found that on average, real housing price dropped by 35% and real estate markets dealt with such consequences for six years on average (the discussion of the dissimilarities between the commercial real estate and the housing market will take place later; for now it is adequate to consider this particular result from the research on housing too as we attempt to create only very general notion of the market). For this paper it means that we can expect the reaction of the examined market to be very prompt (relatively to other Czech republic markets, as the absolute level is determined indirectly rather by strength of connection with the countries where the initial bubble emerged), the impact on the determinants of prices to be close to the mentioned intensity (although this expectation might come out as quite inaccurate because of possible different sensibility of commercial real estate and housing markets) and the consequences to be evident even in the present state.

The results of the research of Hoffmann, Post & Pennings (2011) on how were investors' behavior and perceptions changed by the credit crunch can help form expectations about the strength of the crisis' impact and the structure of fluctuations during it based on our assumption that firstly the new demand and later the new supply were mostly driven by the investors' willingness to finance during the examined period. This will also help to estimate the level of rigidity as the crisis itself did not last really long in comparison with the long-term character of the construction contracts.

What their research shows is that although investors tend to be very consistent in behavior during 'calm' periods and not to learn from past failures or successes, with the start of the crisis they become much less risk tolerant and reduce their return expectations significantly. However, as the crisis comes close to its end and first hopes about better times appear, the investors' willingness to risk recovers and the return

expectations change again to the original level. Nevertheless, Hoffmann, Post & Pennings did not find any substantial general portfolio changes aimed at risk reducing, thus the temporary risk aversion was reflected probably mostly in increased caution when creating new commitments. What is important for this paper is that the investors' approach to the market during the crisis is a valid factor of the real estate market agents' decisions about the supply. At the same time, it influences also the demand side by determining what level of production are possible lenders or buyers capable of.

The research of Quan & Titman (1997) also offers similar positive results concerning the interconnection between the commercial real estate prices and the situation on the financial market. They focus on a verification of the extension of a hypothesis that the covariance between the U.S. stock prices and the real estate prices is low (which fact was discovered also in terms of several other countries, but always individually), to the international level. By this they try to explain the considerable amount of the real estate present in companies' portfolios. However, as they combine data from 17 countries and examine the above mentioned connection, the results – contrary to those from the U.S. – show that the relationship is on aggregate in fact quite strong (and positive). As a possible explanation for this discrepancy they offer the existence of different quality of commercial real estate in different countries. This relationship makes it legitimate to interconnect the situations on the real estate market and financial market, firstly to include the influence of investments that is considerably strong in the examined field, and secondly to utilize the financial markets ability to regulate real estate market's rigidity (to be discussed in the theoretical part of this paper).

Hiang & Webb (2007) also studied the level of the real estate markets' international integration. They did so by the means of the correlation between the returns from each of them and the returns from all others. They found that when predicting the future level of returns in a real estate market, the same country's lagged returns from previous periods (K-map) are (not surprisingly) more significant than those of other countries (Z-map), but when combining K-map and Z-map, the resulting predictions show considerably lower level of chaos. I.e., it is reasonable to take into consideration the situation on adjacent markets when either predicting the future

situation, or as in our case when trying to explain the past development, especially in the case of any of EU markets where the conditions for interconnection are much better than generally on the global scale.

Paul Hilbers, Qin Lei & Lisbeth Zacho (2001) in their paper Real Estate Market Development and Financial Sector Soundness, which greatly explains the mutual interactions of those two sectors, mention in our opinion a very fundamental characteristic of real estate market that causes a lot of imperfections, irregularities and basically differs it from other markets: *"... in markets where collateralized lending is widespread, real estate prices affect the availability of the resources to finance real estate, which may again affect the price of real estate."* (Hilbers, Lei, & Zacho, 2001) In other words, the interconnection of the real estate and the financial market creates cycles in the real estate prices to which is very sensitively bound whole scale of other markets (via financial sector). Even more elaborately, those cycles are subject to general real estate market rigidities – slow supply adjustment (construction in range of years), expectations about the future demand built on imperfect (out-of-date) information (also due to the long-term character), structural changes of financial sector – any influence on the financial sector's conditions affects also real estate and is reflected in a price fluctuation, its consequences being prolonged and spread in other areas.

This creates an impression of the real estate market as a kind of mirror, or rather magnifier, that multiplies any otherwise negligible shock or imperfection into dangerous extent, making it much more important to keep the real estate market in a healthy environment and protected from the financial sector's ferocity.

5. THEORETICAL FRAMEWORK – THE FUNCTIONING AND SPECIFICITIES OF THE REAL ESTATE MARKET

First of all, it is important to take in mind what market are we operating in – its internal properties and external relationships, few remarkable specificities are to be mentioned and discussed. Second, different branches of industry have different level of influence, for example the situation in the construction field of industry will probably be the closest to real estate market. Next important factor is the state policy concerning directly construction, lease or sale of new objects, but also its indirect impact on supply and demand sides (via tax policies, property rights definitions, legal background of any possible use of new buildings etc.).

As was already mentioned, the real estate market operates in cycles and is volatile to emergence of bubbles in case of any external or internal distortion. The pulls to create such bubbles can be divided into several groups, some of them by character directly a specificity of the real estate market, others rather originated in the financial sector.

5.1 CHARACTERISTICS RESULTING FROM THE PHYSICAL CHARACTER (INTERNAL)

The first specificity is a fundamental one and relates to the long-term character of construction and the prevailing use of pre-contracting to purchase after completion. Carey (1990) called it a *Fixed supply and the optimistic investor* problem. The core is a high level of supply rigidity, due to which only a small number of so called *optimistic investors* that are willing and able to offer a price slightly above the replacement cost (which would be an equilibrium cost in case of a perfectly flexible market) can in fact influence the whole-market price of the land or any real property under only one condition, that they will clear the market even at this higher price. Even as the supply is assumed originally rigid, in the long-term a certain amount of new space will be constructed and the rise of prices created by the optimistic investors will be reduced or even reversed. In that moment, these investors will exit the market, which will then return to the original state of slow supply increase. Optimistic investors are more

probable to enter the market in case of already increasing prices (with respect to construction costs). As the term optimistic investors implies, it is certain speculative reaction judging on possible positive future development and thus only a temporary incentive, an example of the financial sector's access.

Next specificity is somewhat implied by the previous one: however confusing it may seem, the rigidity of supply which initially causes the excess demand can eventually end in over-supply. The process was described by Herring and Watcher (1999) and is following: in the previously detailed situation of rising prices the reaction of demand on slow adjustment of supply may be gradual decrease of its excess (in absolute terms; in other words, optimistic investors are not so optimistic – if it is not possible to allocate their money into the real estate, they will choose different, more 'liquid' option). The supply side will strive to equal level of demand which is not up-to-date. Illustrative example is a situation in which more than adequate number of constructors react and after finishing their projects, the market remains uncleared and the prices fall. This lag the reaction of supply causes a cycle of stretching and contracting vacancy rates reverse to the cycle of prices (or rather following the cycle of prices with the period delayed by the time that it takes to construct – the level of rigidity).

Except for the durability and long duration of construction, there is one more basic characteristic of the real estate with important consequences for the market – buildings are not portable. It may seem silly to mention such an obvious thing, but when we think about what it could mean for the market mechanics and what the situation actually is, we find an interesting contradiction. However, first it is important to realize that the commercial real estate market is not evenly dispersed over whole area of any country (especially as small as the Czech Republic). Most illustrative example is the office market – offices are mostly bound to the location of companies' headquarters which together create several spatially separated economic hubs in every country. Thus, we can distinguish between the intra-regional (in any particular hub) and inter-regional (between several separated hubs) competition. But, to get back to the above mentioned contradiction implied by the non-portable character of the real estate, is there really such thing as an inter-regional (or inter-urban) competition? *“While inter-urban competition for industrial, office or retail space exists, customer choice depends upon a*

number of economic factors beyond the price and quality of the space.” (Case, Goetzmann, & Rouwenhorst, 2000) In other words, operating a business is an activity connected to some specific region and buildings supplied in that region can not be replaced by those in any other. Due to the spatial separation combined with non-portability, one could intuitively expect low level of interconnection between different markets and low correlation between the price developments on each of them; and it counts also in the bigger scale – international commercial real property markets. This theory is very important, as the investment in the international real estate is one of the basic approaches to portfolio diversification – if one region is hit by a drop in prices, real estate in another region should be safely isolated from it.

The empirical studies have, however, proved this theory wrong (Quan & Titman (1999), Renaud (1997), Goetzmann & Wachter (2001)). The rationale of this situation is that either the change in performance of economies of two countries has a common source – returns from two spatially separated real estate markets generally show a higher correlation if the two economies have for example the same major trade partner or if they have the same core production branch – or if a portfolio is diversified through the global real estate investments, its riskiness is derived from the condition of global production (correlation between the real estate returns through their link to world GDP), which again means that there is nowhere to hide from a particular market’s failure. This is almost exactly what has recently happened – the real estate market in one part of the world has started a global crisis. The difference is that the shock was magnified and the negative development stimulated by the link to the financial sector.

5.2 CHARACTERISTICS RESULTING FROM THE CONNECTION WITH THE FINANCIAL SECTOR (EXTERNAL)

The previous problems concerned rather the real estate price creating mechanism. But to better understand implications which follow from them, we want to look at real estate market on a bigger scale in the next problem.

Cycles and bubbles are not only domain of the real estate. Bubbles in general may actually emerge even from different reasons than some kind of financial discrepancy or without causing any further distortions. However, what we see as a specificity of the real estate is the susceptibility to end in severe complications even from reasons that would

cause no trouble in other areas of economy. The phenomena is that the *“Increases in the price of real estate may increase the economic value of bank capital to the extent that the banks own real estate.”* (Herring & Wachter, 2005) The strength of the consequences depends on several factors. First, the role of banks – the share of total assets held by them and the share of real estate, because it affects the impact of the real estate price changes on their risk perception. In banks’ analysis of value, real estate stands on both sides – it may become a source of higher income and at the same time increase the theoretical loss caused by the potential risk. So it may seem that the real estate prices deserve permanent attention of banks. The problem is following: when we get back to the Carrey’s Optimistic Investor Model, it shows that an important factor determining the size of a bubble and the strength of its consequences is how much financial reserves the investors have available to allocate in the real estate (where the prices are rising). Why then banks, who should be aware of the role of real estate prices in the risk analysis, did not limit them (optimistic investors) in exposing themselves to the perils of the real estate market’s steeply increasing risk / return ratio? The answer could be in the above mentioned bank’s perception of risk, as it is a determinant to what profit they require to judge the level of loan-concentration favorable.

In fact, here have influence the real estate developers, who would like to draw the investors’ money. In an usual situation, banks defend against the developers’ aggressive behavior by strict lending conditions such as low loan-to-value ratio. However, during the time of a market heating they are pushed to soften these requirements, mostly by the strong competition of less cautious institutions (that are still operating as if the prices were on the fundamental level), and it results in that problematic lack of limits to investors. (Herring & Wachter, 2005) What we meant when we called the real estate developers ‘aggressive’ was their (to a certain extent rational) endeavor to devolve the risk to their creditors. More dangerously, in such situation they miss the incentives to contribute to the projects with their own resources even when such projects are close to lapse, because they would bear the costs of saving them, but potential benefits (most probably in the form of reduced loss) would go to their creditors. This is quite classic case of complications caused by separated decision taking and risk taking entities. Not speaking about investors who are in even more precarious situation, isolated from the information by banks’ own interest.

Investors may also give up on gathering information about potential risks on their own. It could come in case of overly confidence in state safety net (state-owned banks) or deposit insurance (privately owned banks). However, these systems have dual influence, because also banks can rely on them too much and tend to lend recklessly and generally loose discipline otherwise guaranteed by market risk. This problem (government's influence disturbing market conditions, leading to reduced risk perception in branches with assets of unclear liquidity, such as real estate) was one of the arguments in discussion about role of the US government in the recent credit crunch.

What we have dealt with in the previous section were mostly the imperfections on the supply side and their implications. They are probably the most obvious, as they relate to the easily imaginable real world problem – physical limits of construction. Previous arguments fairly document that supply is not purely market-driven even from more reasons than this particular one. But we believe that in the case of the real estate neither the demand has its origin strictly in the agents' consideration of value, price and plain use of asset (*in production etc.*). This our belief is supported by the theories that deal with the all-complicating common position of the real estate as a loan collateral. Moreover, in many countries there are only few substitutes for the real estate in this position and even fewer of them are more acceptable than it despite its complicated nature, probably because the problem of construction-caused lags is, to a certain degree, compensated by the estate's lasting character. In such situation emerge incentives for the *demand side agents* to award contracts on construction not from the actual need for practical use of those new buildings, but to facilitate more extensive loans to finance expansion. In this scenario the market is overly filled with unused and actually not demanded (supposed that these new buildings were purchased only to enable the expansion in the financial respect, not in the physical (for production)) new buildings, available only to lease.

We called the theoretical part The Functioning and Specificities of the Real Estate Market while the subject of our paper implies that we refer specifically to the commercial real estate market. The discussion of dissimilarity of the commercial real estate with respect to housing is in place (within the framework of the functioning under non-standard conditions). According to Gyourko (2009) (whose research concerns US

market; however, for now we will somewhat unrealistically assume at least certain degree of resemblance to the European market and try to conclude the most general rules) the correlation between the commercial real estate and housing appreciation is almost 40% (using annual data since 1978). The subdivision into the private and public commercial real estate is not of high importance to this paper, but it is worth mentioning that as for prices the public market has certain leading role for the private one during the cycle. The question that arises here is whether these two parts of the commercial real estate tend to follow the housing or not. In the short run, the appreciations in both areas tend to be persistent. However, the development in longer run supports the mean reversion theory. The theoretical answer given by the spatial equilibrium model for urban economics is that the movements in the commercial real estate and housing should happen together and in a very similar magnitude, as the situation of both of them is given by the price of land. On the other hand, it seems that housing prices tend to diverge from their fundamental level more easily (due to some non-market specificities of housing, most importantly social costs). Contrary to the housing sector of the market, in the case of the commercial real property the problem of high transaction costs as a limit to arbitrage, which strongly influences the price-creating mechanism, can be at least partially avoided by the use of REITs.

It is important to keep in mind that on the European market the REITs, which cause probably the biggest difference between the behavior of the commercial real estate market and housing market (excluding social features of housing), are not commonly used yet. They are still mainly domain of the US real estate market and thus we suppose that the arbitrage is more limited on our and adjacent markets. To generate a profit using price fluctuations is not so easy or not so non-risky as there is a limit to accelerating or delaying purchase and as the precise timing is core requirement. This fact poses, opposite to what Gyourko concludes for the US, a similarity between the housing and commercial real estate. But another difference between them, implicated by the size of a share of a housing unit in a household's wealth, risk aversion, holds for local market as well as for the US. This is not to imply that there are no obstacles in evaluating the commercial real estate – its quality varies amongst regions as well as amongst different developers. We believe that on our market the limits to arbitrage in the commercial real estate are stronger than those of the commercial real estate in the US,

but still weaker than those of any housing market. The risk neutrality in the commercial real estate and the risk aversion in housing is probably the major difference. The meaning of the market characteristics is much clearer for commercial real estate investors and thus their reactions should be more promptly responding. But are their reactions ready enough to manage such incoming change as was the wave created by the collapse of the US housing bubble? That should be revealed in the empirical part.

We will construct and interpret all pertinent models with the assumption of market openness. In case of a global study, such an assumption would probably cause misinterpretation of results, because openness is rather characteristic for the regional real estate markets. On a world scale there are too many barriers (currency, administrative limits etc.) to suppose free flow of production factors and output, but as we will work with a country with economy closely bound to others – to our neighbors, who are all members of EU, which guarantees (of course to a certain degree) free movement of goods, labor and especially investments – those barriers fall and the situation is closer to the regional competition than to the international market.

Our view on the real estate market will follow the DiPasquale-Wheaton three sector model of regional economic growth (Figure 7). It means that we consider the real estate market together with labor market as markets for factors of production of the regional output. That is probably a fairly adequate classification in the case of the industrial and lodging real estate; in the case of the office real estate it is quite simplified definition, but we believe that product representation and especially administration of production can still be considered valid production factors. The most important feature of the model is that in the end, it is the level of demand for the regional output that determines the amount of labor and real estate demanded by the producer of that output, and not the rental price / effective wage. Still, an expansion – output increase – will enhance the demand for the real estate ‘input’ (and labor) and thus also the rent and efficient wages.

From these mechanics we can see that the rent (commercial real estate price) is determined indirectly by the interaction of the demand for the region’s output and the size of the region’s real estate stock and that it determines the region’s additional production costs / comparative advantage. So in the previous case of a rent increase

induced by rising demand for output, the production in our region loses part of its advantages as the growth in price of output returns market to the equilibrium. To explain the situation on the real estate market, we have to realize and understand its position as an intermediary in the balance between the demand for output and a region's production costs. The producer (supply side of the output market and demand side of the real estate market) does not deal with the magnitude of the rent himself, he is only an intermediary who conveys the communication between the output consumers and the real estate holders. The supply of the real estate in the region is driven by the demand for its product. (DiPasquale & Wheaton, 1996)

6. EMPIRICAL PART

6.1 DATA DESCRIPTION AND EXPECTATIONS ABOUT RESULTS

We created our own dataset by collecting data that are available either publicly or free on demand (EUROSTAT, Czech Statistical Office, Czech National Bank, reports of companies operating on the local real estate market)). The first component are variables describing the real estate market and the second group are general macroeconomic indicators. Real estate market variables are further divided into two segments, office and loading. Commonly, there is a third segment considered – retail; however, we were obliged to omit it as we were not able to get any representative data concerning our market. On the other hand we do not suppose that this third segment would be as useful for our research as the other two – we assume a connection of the office market with services performance (or with more general economic performance) and a connection of the loading market with industrial production and transportation. We do not see any specific field connected to retail real estate market (possibly households savings or some other consumer characteristic, but the relationship would be too fuzzy to allow closer interpretation of results).

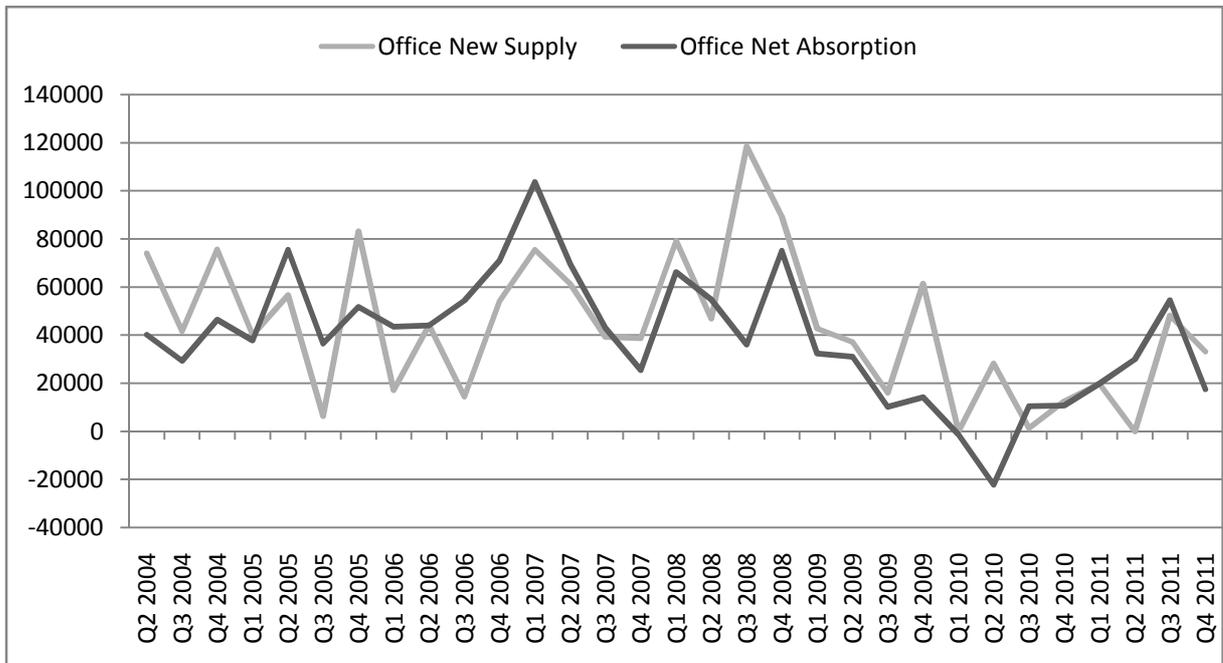
Because the data come from various sources, there is a different number of observations for most variables. Majority of them is in a quarterly form. We will mention the particular availability in the description and we will respect it when using these data when performing regressions.

We would like to stress the scarcity of data concerning the topic of our interest. Although we call them ‘publicly available’, it definitely does not mean that they are easy to obtain. There are no empirical studies yet dealing with our subject in the same point of view as we are – employing the commercial real estate market characteristics – for the Czech Republic market.⁶

⁶ To justify the low number of observations: the data are not only hard to find – the time preceding the period of our concern can be still labeled a period of market emergence; the situation was not stable and the amounts constructed – especially of offices – are not representative for our problem.

Now we will describe some of the core variables. First the information about the availability of the data will be given, after that a general discussion of the character of the variable will follow and finally we will express our expectations about the results of the model for that particular variable.

Figure 1: Office New Supply and Net Absorption (m²)



Office New Supply – source: King Sturge and Jones Lang LaSalle reports. Availability: Q2 2004 – Q4 2011. (See the definition in the Basic Quantities section.) First it ought to be mentioned that the extent of operations of the two companies (merged into one during the time this paper was written) presents a representative majority of all operations in Czech commercial real estate. It is due to the small size of Czech Republic real estate market and in the case of office market also because it exists practically only in a few major Czech cities.

As was already mentioned above, we expect office market to reflect the general ‘health’ of economy. Major lever are services, among them financial institutions, any intermediaries and representatives of producers. We expect the reaction of those to the change in the economic environment to be prompt and so the shift on office market to come sooner than that in the loading market. As we are dealing with supply, we still expect some lag compared to demand – according to what was described in the theoretical part – this expectation comes from the

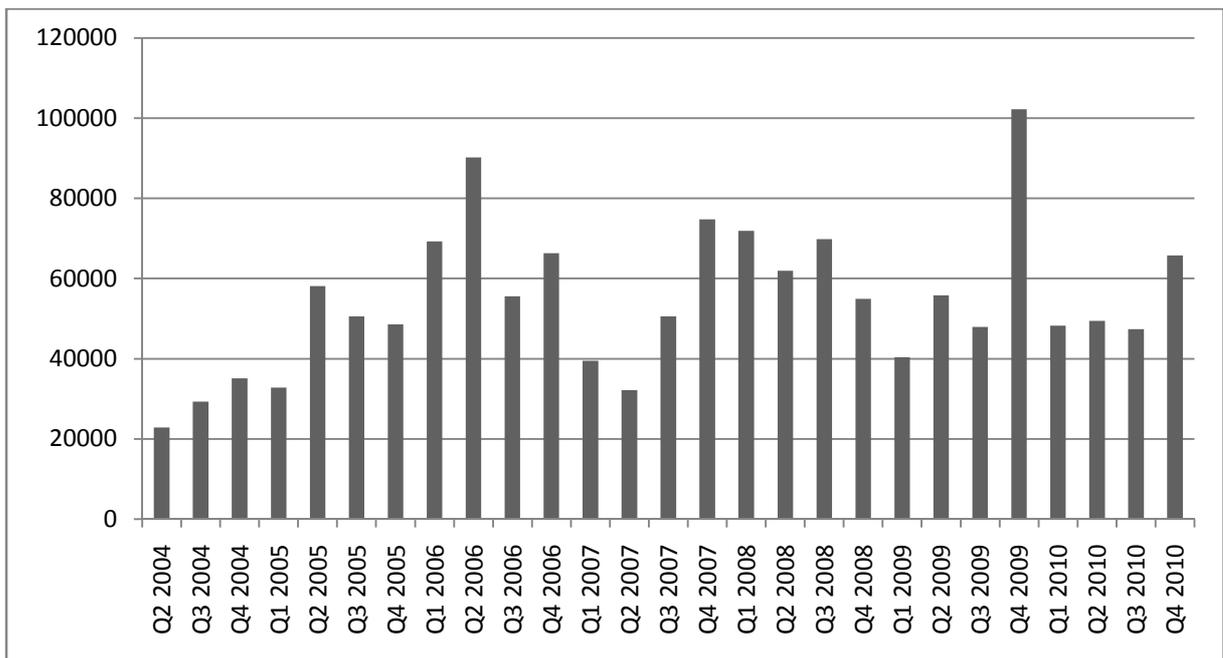
existence and frequent usage of pre-leases and building on order (although not so influencing as in the case of loading). When we suppose that the crisis we are dealing with started in the end of 2007 (peak of the housing bubble) and ended in the late 2009, even from the graphical depiction (Figure 1) can be seen that a noticeable fall came with a delay and in the middle of crisis, third quarter of 2008, when expectations on the global scale were depressed by the situation on US financial market, supply in Czech Republic office market peaked.

Office Net Absorption - source: King Sturge and Jones Lang LaSalle reports. Availability: Q2 2004 – Q4 2011. On the contrary to supply, which is on the real estate market relatively easily measurable (new space available with respect to either time of completion or time of sale / lease), demand is a more complicated term. The fact why we explain Net Demand and New Demand in the Basic Quantities section is that they are discussed already in the theoretical part; on the theoretical level, we usually suppose that we know the true value of these indicators. Now on the practical level this is an unrealistic assumption and the situation on the real estate market is that demand is estimated by other (measurable) values. What indicators are the best is a subject to discussion and probably often depends on the purpose of research, but the most commonly used estimator is absorption – generally defined as *“the amount of inventory or units of a specific commercial property type that become occupied during a specified time period (usually a year) in a given market”* (CCIM Institute, 2005), implicating the definition of Net Absorption – the amount that became occupied minus the amount that lost the renters. An alternative that is sometimes used is the take-up (later in this section).

We expect this quantity to be more appropriate for interconnecting the situation on the real estate market with the progress of crisis than the previous one: demand (absorption) reflects what renters actually can afford – supply represents rather what developers expect of them or what do investors expect. Decline in condition of occupants leads to decrease of the amount of space they need for their functioning, possibly even termination of agreements. In fact, as offices often serve as a mean of representation and thus are not so crucial for the production, we expect the level of their utilizing to reflect the state of the economy

as one of the first indicators. As described in the DiPasquale-Wheaton model (DiPasquale & Wheaton, 1996), demand for real estate is driven by the demand for products offered by agents operating in it. Following from this we expect the development of the demand for offices (absorption) to reflect the shifts on product markets from different fields of economy. We intend to use price and sales indices and/or GDP from those fields to examine if there is any statistically observable divergence between the relationship of the office market demand to each of them.

Figure 2: Office Gross Take-up (m²)

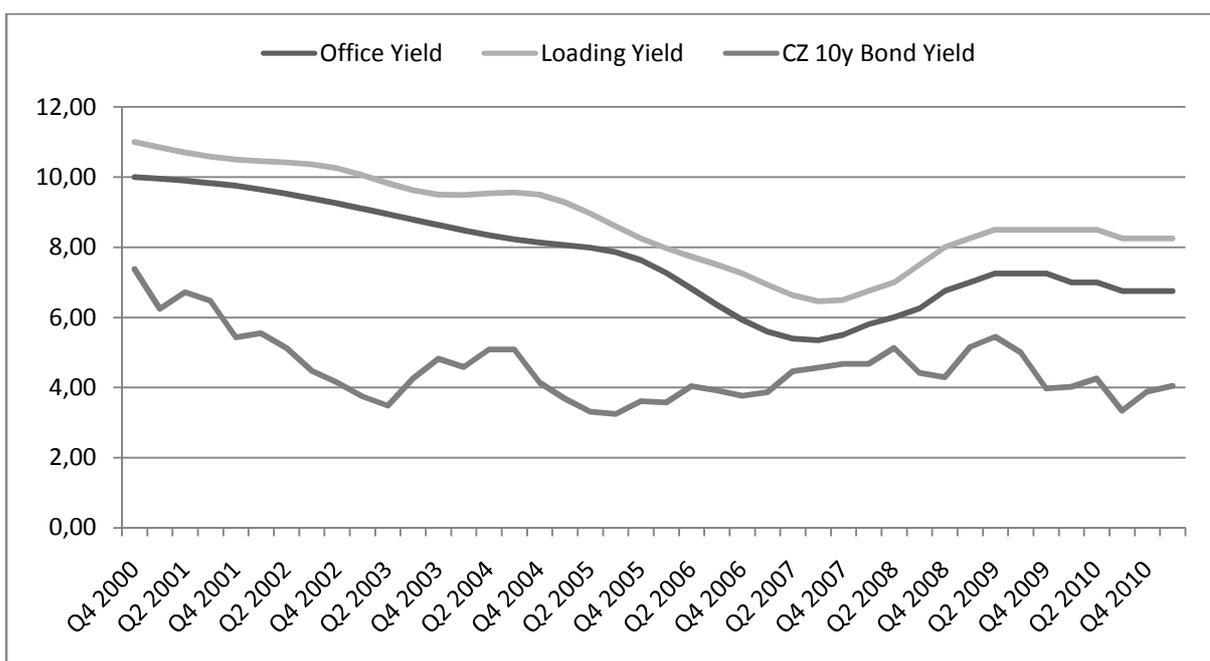


Office Gross Take-Up - source: King Sturge and Jones Lang LaSalle reports. Availability: Q2 2004 – Q4 2011. (See the definition in the Basic Quantities section.) Compared to the absorption, the meaning of gross take-up is somewhat more general – it rather expresses the level of activity on the market (as it includes sub-leases) than some condition of renters. Sometimes it is used as an estimate of demand, although it is more complicated to interpret (inner incentives of the market – competition between developers, merges etc.) – which is also the reason why we will mostly focus on the net absorption. However, we will still try to utilize some information given by the gross take-up indicator.

Even from the depiction of the gross take-up (Figure 2), it can be seen that over such a short period the trend or any regularity in its behavior will be hard to

find. Of course we expect to find some significant influence of any determinants of the absorption term, but firstly, the difference from the absorption will render the strength of the above mentioned inner incentives and secondly, there will presumably be also a certain time disparity (i.e. a difference in the lag of the reaction, either positive or negative) due to the inclusion of all pre- and sub-leases because of which the gross take-up tracks also all projects with the construction in process.

Figure 3: Office, Loading and 10y bond yields (%)



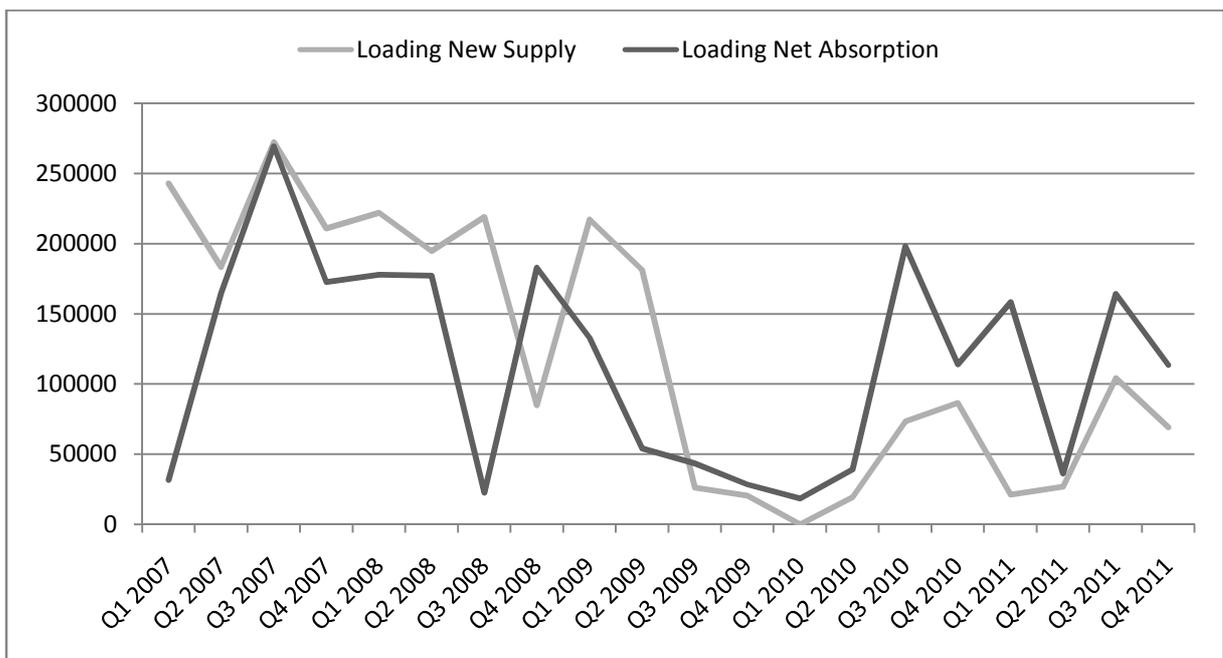
Office Yield – source: Czech National Bank’s Report on the Financial Stability. Availability: 2000 – 2007 yearly, Q1 2008 – Q1 2011 quarterly. We used the Cubic Spline Interpolation method⁷ to create the missing quarterly data between years 2000 and 2007. The character of this variable – the percentage profitability of an investment to the real estate – implies that its behavior over shorter periods of time is probably not very erratic (additionally, the partition of years in quarters is not an extreme change as for example the partition of years in days would be) and thus it is tenable to use this method, which usually estimates more smooth

⁷ CHAMBERLAINECONOMICS.COM:
<http://chamberlaineconomics.com/2010/01/20/how-economists-convert-quarterly-data-into-monthly-cubic-spline-interpolation/> (28.4.2012)

progress than the actual one. (The difference between the actual quarterly development and that estimated from the annual data by this method can be seen in the Figure 4, where the office yield curve is only very little smoother in its first part - the fluctuations are in fact very moderate; moreover, we will use the Newey-West standard errors while performing regressions with this variable to deal with the autocorrelation caused by the cubic spline interpolation.)

Explaining the real estate yield is not very complicated. Its development basically follows that of the yield of the Czech 10-year government bond as the profitability of real estate competes with the profitability of all other investments allocation possibilities with similar level of risk, represented by the government bonds (the risk premium of the real estate compared to the 10-year bond is, if we disregard the time lag, almost constant over time – Figure 3). More interesting is the role of the real estate yield as an explanatory variable of other real estate market’s quantities, first of all the new supply. We assume that a lack of investment (brought by the disproportional decline in office yield to the fall of bond yield) would hold the supply more rigid; the link to the yield of bonds represents the connection of the real estate market with the government’s policy. We will employ the office yield percentage in an attempt to support these assumptions.

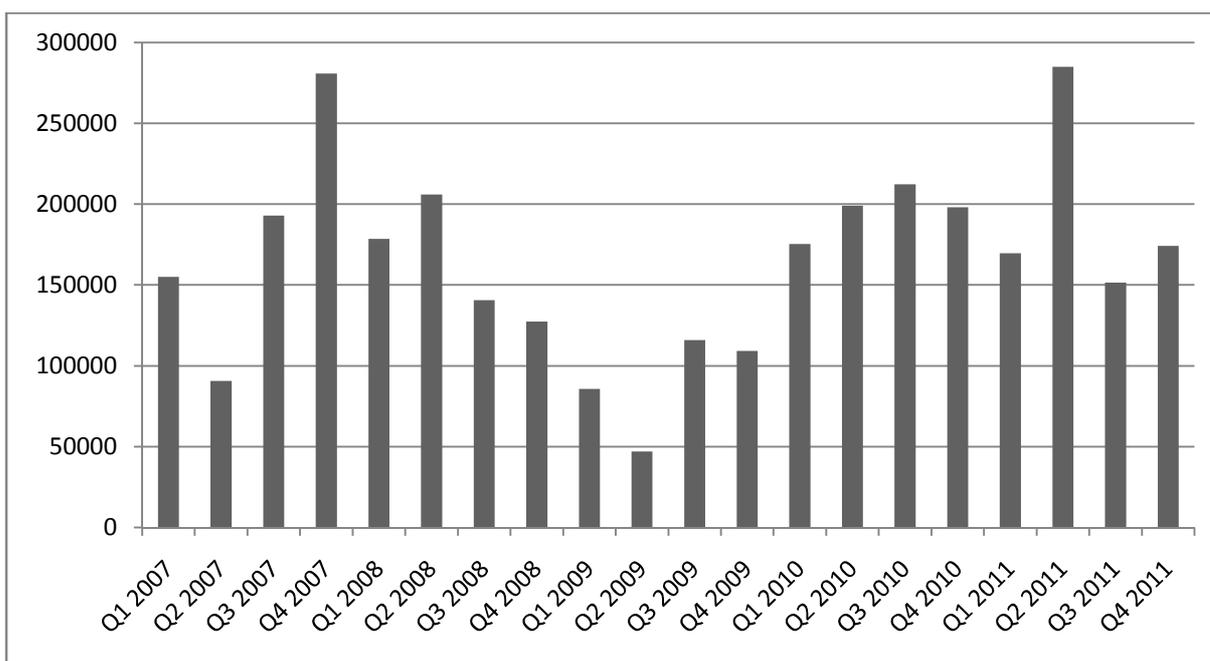
Figure 4: Loading New Supply and Net Absorption (m²)



Loading New Supply – source: King Sturge and Jones Lang LaSalle reports. Availability: Q1 2007 – Q4 2011. The expectations about behavior do not substantially differ from those about the office market. However, significance of the determinants will be most probably distinct – here it is suitable to apply the DiPasquale-Wheaton three sector model again: what holds for the whole economy will also hold for a particular segment, industry. Demand for transportation, loading and industrial real estate will be driven by the demand for the industrial output. We see no reason why the segmentation in the real estate should be different from that in other parts of economy. Analogically to the interconnection of office market with the services, we will examine the relationship to different fields of industry (indices of production). Additionally, for both loading and office, we expect a difference between supply and demand in the link to investments – of foreign and domestic origin. This relates also to the yield. The influence of the investments will be respected in the majority of models.

Loading Net Absorption – source: King Sturge and Jones Lang LaSalle reports. Availability: Q1 2007 – Q4 2011. Contrary to the office absorption (demand), loading and transportation capacities do not have the peripheral character – they are necessary for production and distribution of output. If such evidence is found in the data, it would mean that loading is more resistant to decreases in investments. Of course there is a possibility that there exist certain speculative capacities ‘waiting’ for a rise in prices, but those should not be included in the net absorption quantity. We assume that generally the loading with its connection to the industry is more dependent on the actual level of production than on expectations (which can bring down whole branches of services). The shift brought by the decrease of investments comes vicariously via the decrease in production (which can be alternatively induced by the decrease of demand instead of investments; however, the origin of those two possibilities is the same).

Figure 5: Loading Gross Take-up (m²)



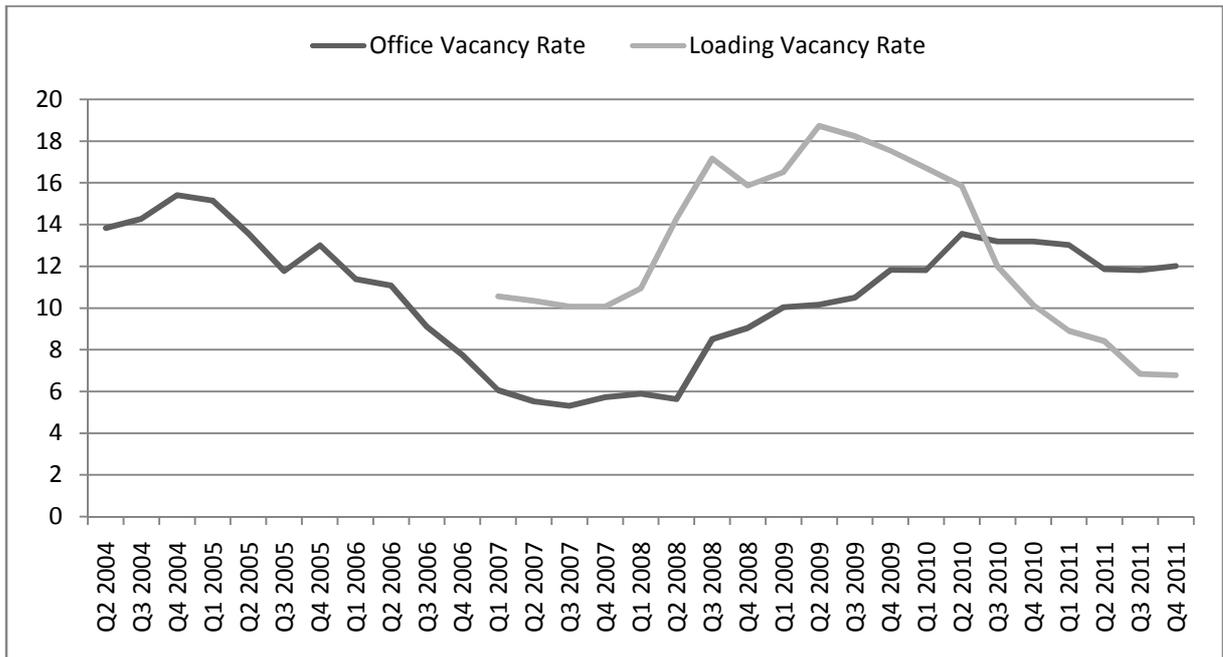
Loading Gross Take-up – source: King Sturge and Jones Lang LaSalle reports.

Availability: Q1 2007 – Q4 2011. As concerns the take-up term, we do not expect any considerable differences from the office segment. The relationship between the take-up and the absorption is more or less the same. The data from the loading segment are even more scarce and thus the behavior of the loading gross take-up term appears more chaotic (Figure 5). As was mentioned above, we will try to express the dissimilarity between the take-up and the absorption rather than to find the determinants of the take-up, as there are (especially concerning the gross take-up) too strong inner movements on the market.

Loading Yield – source: Czech National Bank’s Report on the Financial Stability.

Availability: 2000 – 2007 yearly, Q1 2008 – Q1 2011 quarterly. Again the same method was used to deal with the varying periodicity. See the discussion above (Office Yield) for the justification. (Figure 2)

Figure 6: Office and Loading Vacancy Rates (%)



Additionally, the variables Office and Loading Vacancy are going to be used. They are the result of the preceding absorption and supply (combined with total stock) and thus the expectations about vacancy can be derived from the expectations about the Net Absorption and New Supply. In some cases it is more suitable to use the vacancy term, for example in the relation to the yield as the meaning of coefficients is much clearer when regressing two proportional variables.

We found a problem of non-stationary and unit-root processes in several of the variables, unfortunately in most of the above described, which are of the highest importance to us. To ensure the accuracy of the results we were obliged to differentiate those variables, which solved the problem in most cases, but some information was lost. In two cases the first differentiation weakened the evidence of the non-stationary behavior but did not remove it completely and thus the second differentiation should be performed to be perfectly accurate. However, if we did so it would be almost impossible to find any relations between the examined variables. Still, the office and loading yield, afflicted by this problem, are never used simultaneously in one model or to explain each other, and thus we suppose that as we have got rid of the evidence of the unit roots and non-stationarity of other variables, the danger of spurious regression was removed.

Branches of index of services sales and of index of industrial production are divided according to the CZ-NACE classification of economic activities⁸. The price indices are divided according to NACE Rev. 2 classification⁹.

From the character of the market and the variables used there arises a risk of endogeneity as well. Two or more of variables in some of the regressions could have a common influential factor (that is not included in the regression) whose change would cause an over/underestimation to the coefficient between them. For the macroeconomic analysis of the real estate market are more usually employed the VAR or VECM methods rather than the general time series OLS. However, these models make conditions on the quality of data, especially on the number of observations, which in our case is definitely not sufficient. Moreover, for the VECM method to be valid, it would be necessary for the cycle of prices to be complete. As can be seen from the figures, neither this condition is fulfilled – the temporal extent of our data covers only the impact of crisis and immediately preceding / following situation.

Despite these complications, to guarantee at least some defense against the critique of not dealing with the possible endogeneity, we have performed several more regressions in which we use more explanatory variables than in the reported models (for an example, see the Table 1, results of the estimation of Model 1). The results – estimated coefficients and levels of significance – proved a comforting robustness to these changes and the possibility of endogeneity has been at least partially averted.

⁸ Available at <http://www.businessinfo.cz/cz/nace/> (28.4.2012)

⁹ Available at http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-07-015/EN/KS-RA-07-015-EN.PDF (28.4.2012)

6.2 RESULTS AND INTERPRETATION

In this section we will describe the models, state the results and interpret their meaning. In the end the outcome of the tests performed to support the validity of results will be reported.

6.2.1 OFFICE MARKET

In the Model 1 for the office market we try to explain the determinants of the vacancy rate. As was mentioned in the previous part, when explaining variables from the office market, we focus on the difference between the influence of various branches of services. We do so with the help of indices of the amount of sales in those particular fields.

Table 1

Model No.	(1) Office Vacancy (%) (d)		Office Vacancy (%) (d)	
Office Yield (%) (d)	3.134 ^{***}	(3.35)	3.782 ^{**}	(2.91)
Sales index Administration (77-82)	-0.174 ^{***}	(-4.29)	-0.154 [*]	(-2.28)
Sales index Legal activities (69)	-0.0908 ^{**}	(-2.24)	-0.0710	(-1.39)
Sales index Managerial activities (70)	0.105 ^{***}	(3.33)	0.0768	(1.62)
Sales index Accommodation (58-63)	0.137 ^{***}	(2.96)	0.146 ^{**}	(2.48)
Industry Prod. Index Manufacturing	0.0475 [*]	(1.83)	0.0117	(0.17)
Industry Prod. Index Utilities supply	0.0625 [*]	(1.98)	0.0758 [*]	(2.07)
Sales index Transport & Storage (49-53)			0.0823	(0.67)
Sales index RE (68)			-0.0298	(-0.44)
Sales index Advertisement (73)			-0.0234	(-0.59)
Industry Prod. Index Mining and quarrying			-0.0335	(-1.04)
Constant	-7.690 [*]	(-1.94)	-7.344	(-1.16)
Observations	27		27	
Adjusted R^2	0.603		0.540	
DW	2.502			

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first interesting information is the relation to the office yield. It reflects the fact that in the situation of rising prices also the costs that different providers of services must pay for inputs increase. Thus the ability of those providers to pay for real estate is weakened. We interpret the reported correlation between the vacancy rate and yield in

the following way: In order to compensate for the worse conditions, the real estate investors reduce the profit they demand from their investments. The impact of rising costs is softened and the real estate market does not have to deal with even stronger decline in demand. In other words, falling yield slows down the rise of vacancy rate (also by their influence on the new supply, which will be described by the Model 2) – according to the model, for each percentage point of decline in yield, the rise in vacancy was reduced by approximately 3,1%. That seems to be impressively efficient; however, we have to realize that the office yield can not be freely adjusted as it is bound to yields of other allocations for investments (this situation will be further described by the Model 3). The change of yield ranged between -0,5% and 0,5% during the examined period, however rich was it on dramatic events. As we know, the vacancy rate was mostly rising during the examined period. It means that in spite of the real estate investors' endeavor, other factors influencing the net absorption were too strong and its decline outran that of the new supply.

Sales indices can be divided in two groups, according to the sign of their correlation with the change of vacancy rate. The reason why we think it is possible that the performance of some branches could have an opposite impact on the change of vacancy rate than the performance of others is the different importance of offices for their functioning. From the results it can be seen that the decreasing sales of administrative and legal activities were correlated with stronger fall of vacancy rate – we can hardly imagine an expansion of legal or administrative business without it extending its office, where it both performs and offers the services, and thus the worsening of conditions logically led to decline of the room demanded. On the other hand, the product of branches like accommodation, manufacturing or utilities is mostly created without the necessity of some kind of office that serves only optionally for representation and management. Thus the change of sales can have very impenetrable consequences depending on the firm's policy and particular situation. The Model 1 implies that the decline of sales of the above mentioned three branches plus of the management activities was either correlated with a boost to their need of offices or that it relates to a decline in office supply (both possibilities could mean falling vacancy). We favor the latter, but the relationship is too fuzzy and the argumentation would be very difficult.

Table 2

Model No.	(2)		Office New Supply (log)	
	Office New Supply (m ²)			
Office Yield (%) (d)	35480.0*	(1.95)	1.246*	(1.83)
GDP from RE Activities	42.62**	(2.71)	0.000966	(1.66)
Sales index Legal activities (69)	-3044.0**	(-2.75)	-0.0879**	(-2.17)
Sales index Managerial activities (70)	2786.0***	(3.75)	0.0810***	(2.98)
Time	-4542.6***	(-3.30)	-0.123**	(-2.40)
Constant	41688.8	(0.45)	11.08***	(3.27)
Observations	28		27	
Adjusted R ²	0.556		0.436	
DW	2.473		2.194	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the Model 2 is detailed the office new supply. In this case the data did not provide much information about the relationships with various branches of services. However, the model confirms our interpretation of the influence of the performance of legal and managerial activities on the supply. The signs of the coefficients correspond with those estimated for the vacancy rate (an increase in supply without the corresponding change in demand means surge in the vacancy rate). From the logarithmic version of the model it can be seen that a one point change in the index of legal services sold corresponds to a 9% change in the same direction to the office supply, which is approximately 3000 m². The correlation with the sales of the managerial branch has almost the same magnitude, but opposite sign. The discussion of meaning of the signs remains the same as in the Model 1.

The relation to the change of yield supports our interpretation mentioned in the previous model. Moreover, when we apply the same logic, the reported correlation with the new supply can be explicated as follows: Not only that the lower yield eases the burden of rising prices that providers of services must bear; there could be an impact on the vacancy rate through its both components. Lower yield means that the real estate is less attractive allocation for investments and thus the supply will not increase as much in the next period. If it is so, we can say that one percentage point inter-quarter drop in yield would have induced a 124% fall in the new supply (that is of course a highly

unrealistic scenario¹⁰; still, the strength of the influence of the yield – i.e. vicariously investments – is remarkable). The aim of the market’s agents is the lowest vacancy rate possible – it would mean a perfect efficiency and the most accurate response of the supply to the changes in demand. However, as was described in the theoretical part, there are many factors that cause lags to individual reactions and thus the vacancy rate often escapes the control of real estate investors and developers, especially when their responses via yield are limited by the competition on the financial market.

Table 3

Model No.	(3)	
	Office Yield (%) (d)	
CZ 10y Bond Yield	0.0703 ^{***}	(2.74)
Sales index Transport & Storage (49-53)	-0.0278 ^{***}	(-5.24)
Sales index Legal activities (69)	-0.00959 ^{**}	(-2.12)
Sales index Managerial activities (70)	0.0128 ^{***}	(4.58)
Sales index Advertisement (73)	0.00925 ^{**}	(2.24)
Constant	1.292 ^{***}	(3.48)
Observations	41	
	Newey-West standard errors (Cubic spline interpolation)	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the third model we try to explain the office yield. The results do not contradict the statement about the role of yield of bonds from the Model 1 and by that support the theory about the influence of the government’s policy on the real estate market. The sign of the coefficient needs almost no explanation – this relationship can be also seen in the Figure 3 – the co-movement of yields is caused by the competition amongst them for the investors’ money. The magnitude of the coefficient expresses the strength of the link. It is necessary to be very careful when trying to understand the results of this model as the office yield is in the dynamic form – additional percentage point of the bond yield would correspond to a 0,07% increase of the office investments yield. It seems to us that when the bond yield was falling, it slightly induced also the decrease of the office yield. The joint development of the two variables implies that there are some common incentives for their changes and that the competition is only one of them. The expressed relation of the office yield to the sales indices suggests only an explanation of one side of this

¹⁰ Mean of the office yield change was -0,07% over the period. That is, in our logic it deviated the new supply on average by less than 10%.

problem. We would need more important variables to look for similar factors influencing the bond yield than only those which we suppose that are source of the co-movement.

However, the estimated role of the sales indices in the development of yield suggests that also their influence and the influence of the office yield on the vacancy rate could be more complicated than we expected in the Model 1. That is a reason to create a supplementary model that will use the Model 3 as an instrument for the role of office yield in the Model 1.

Table 4

Model No.	(4a) Office Vacancy (%) (d)	(4b) Office Yield (%) (d)	
INSTRUMENTED Office Yield (%) (d)	2.453 [*]	(1.83)	
Sales index Administration (77-82)	-0.174 ^{***}	(-5.03)	
Sales index Legal activities (69)	-0.0859 ^{**}	(-2.43)	-0.00959 ^{**} (-2.12)
Sales index Managerial activities (70)	0.112 ^{**}	(3.84)	0.0128 ^{***} (4.58)
Sales index Accommodation (58-63)	0.122 ^{***}	(2.64)	
Industry Prod. Index Manufacturing	0.0429 [*]	(1.85)	
Industry Prod. Index Utilities supply	0.0574 ^{**}	(2.05)	
CZ 10y Bond Yield			0.0703 ^{***} (2.74)
Sales index Transport & Storage (49-53)			-0.0278 ^{***} (-5.24)
Sales index Advertisement (73)			0.00925 ^{**} (2.24)
Constant	-6.498 [*]	(-1.68)	1.292 ^{***} (3.48)
Observations	27		41
R ²	0.702		
Adjusted R ²	0.592		

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The major difference between the Model 1 and Model 4 is in the estimated relation to the office yield. The instrumental variable model suggests that its slackening impact on the increasing vacancy rate was previously overrated. However, none of the other indices is substantially different (the change is reflected in the intercept) – because of that it is unlikely that in the Model 4 the distribution of influence between the office yield and size of output (represented by sales indices) on the vacancy rate is expressed better. The only positive of the use of the instrumental variables is that we avoid the inaccuracy caused by the deficiencies of the Office Yield variable (autocorrelation induced by the cubic spline, possible non-stationarity or unit root). If a better model for the office yield was available, we could avoid them completely. In this

situation we tend rather towards the Model 1 and the three-percentage elasticity of office yield on the vacancy rate.

There are two types of rigidity mentioned in the theoretical part: first is the one brought about by the physical character of the real estate – slow construction and immovability. There can hardly be any evidence of dealing with its consequences. However, the second type is more connected to the market – the problem of developers acting according to an out-of-date information (the Herring-Wachter process (Herring & Wachter, Bubbles in Real Estate Markets, 2005)). As we can incur from the results, the interconnection of the real estate with the financial sector does not bring only complications and distortions, but also moderates the impact of this lack-of-information based rigidity. The inefficiency of the market, excess supply measured by the vacancy rate, is according to our interpretation of the correlations reduced by the intervention of the financial sector’s instrument – office yield – as the reaction of the financial sector is more prompt than the response of the real estate developers. The fall in demand is lowered as well as the future supply and the market does not move away from the optimum as far as it would if the decision making process was fully in the hands of the real estate developers.

Table 5

Model No.	(5)	
	Office Gross Take-up (m ²) (log)	
Office New Supply (m ²) (log)	0.186 ^{***}	(3.11)
Sales index Legal activities (69)	0.0751 ^{***}	(6.42)
Sales index Managerial activities (70)	-0.0453 ^{***}	(-4.08)
Sales index Advertisement (73)	-0.0174 ^{**}	(-2.22)
Sales index Administration (77-82)	0.0198 ^{**}	(2.79)
Time	0.0444 ^{***}	(6.33)
Constant	4.267 ^{***}	(3.71)
Observations	26	
Adjusted R ²	0.769	
DW	1.878	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Model 5 for the office gross take-up represents two issues from the previous parts of this paper. First, it fits into the framework of the Wheaton-DiPasquale model – demand for the real estate is determined by the level of the region’s output – the sales

indices seem to have a significant influence on the gross take-up, similarly to the new supply. Second, it confirms the structure of the gross take-up term in the sense of a demand indicator that involves certain inner movements on the market. It is reasonable that the more the market grows (i.e. the higher is the new supply – even if it grows in response to the increased demand rather in the notion of the net absorption), the more will rise the number of sub-leases and renegotiations, which are tracked by the gross take-up. This problem (the influence of the new supply on the market’s activity) was not included in the Model 1, as the vacancy rate consists of the net absorption instead of the gross take-up.

6.2.2 LOADING

Unfortunately, the models of the loading segment do not provide as consistent results as were those from the office segment. The basic notion about the functioning of the market is the same, however some models contradict others and even the logic behind the real estate market quantities, such as vacancy. This problem is caused by the low quality of several indicators, on top with the loading yield, and mainly by the very limited number of observations. When deciding about the validity and credibility of particular results, we will follow the concept of market powers described in the Office section.

Table 6

Model No.	(6) Loading Vacancy (%) (d)	
Loading Yield (%) (d)	2.027*	(1.77)
FDI	-0.0000205*	(-1.95)
Price Index Construction (F)	0.389***	(5.29)
Price Index Financial activities (K)	-0.0892*	(-2.12)
Constant	-0.402	(-0.95)
Observations	16	
Adjusted R^2	0.753	
DW	2.154	

t statistics in parentheses
 * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As in the previous section we start with the analysis of the vacancy rate. Behind the first loading model the same logic that we found behind the office vacancy rate: the role of the investments’ yield is still present. Its influence in the loading segment seems

to be weaker, but its function can be interpreted analogously: the increase in the level of yield would boost the appreciation of the vacancy rate – or as was the situation during the first phase of the crisis, the increasing vacancy rate (due to the worsening conditions of the lenders of loading capacities) was moderated by the financial sector's reducing of the level of the yield. Each percentage point of fall in yield would have brought a 2 percentage point weakening of the vacancy's growth. The loading yield change ranged within the borders of 0,5 percentage point from zero and the mean was only -0,06%, a fact that is adequately reasoned in the office section.

In the model of the loading vacancy has reflected its influence also the level of foreign direct investment (FDI); however, the magnitude and sign of the coefficient is difficult to interpret, as the competition with the foreign investments is even more complicated than with the Czech investments – the allocation possibilities are wider. But it is still a useful information that both foreign and Czech investors have some influence on the situation on local market – the opposite would be in conflict with the assumption of market openness described in the theoretical part.

We use the price indices from NACE subgroups of economy to describe the loading segment instead of the sales indices as in the office segment. Our interpretation remains similar: applying the same logic as in the previous models, the Model 6 implies that the rising prices of construction processes (or in better words rising *costs* of construction) brought about a steeper increase of vacancy. Such evolvement of prices only indicates the development of the crisis. A legitimate explanation is that the construction costs shift upwards the prices set by the developers and make the loading premises less affordable. Such effect would be moderated if the developers readjusted their profit margin – we believe that did not happen (or at least not fast enough) and such reaction occurred only on the side of investors. The price of financial activities represents only another cost between the investors and developers. Rising price of transactions, loans, fees on investments and similar obstacles means a stiffening to the development of the situation. That is how we interpret the negative sign of the coefficient of the financial activities' price index.

Table 7

Model No.	(7)	
	Loading Yield (%) (d)	
CZ 10y Bond Yield	0.0927 ^{**}	(2.18)
Price Index Industry (B,D,E)	0.0393 [*]	(1.83)
Price Index Manufacturing (C)	-0.0371 ^{**}	(-2.05)
Price Index Transport & Storage (H)	0.0309 ^{**}	(2.57)
Price Index NACE O-Q	-0.0131 [*]	(-2.01)
Constant	-0.519 ^{**}	(-2.68)
Observations	41	
Newey-West standard errors (Cubic spline interpolation)		

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The relationship of the development of Czech ten-year government bond yield with the development of the loading yield is almost the same as it was in the case of office. As the loading yield is a differentiated variable (and a second differentiation would be in place if we wanted to get completely rid of the suspicion about non-stationarity) the coefficient means again that a one percentage point change of bond yield corresponds to the shift of the loading yield in the same direction approximately by two percentage points.

Even as the notion behind the influence of the bond yield is easy to understand, the coefficients of significant price indices appear chaotic. Those positive could mean that an increase of prices in the particular branch increases the positive or reduces the negative change of the loading yield, those indices with negative coefficient have probably an opposite effect. We can only guess what is the difference for example between the manufacturing and industry causing that their influence appears contending; possibly the data contain some kind of complicated multicollinearity which produces misleading results, or, which is most probable, the problem is a consequence of the low number of observations (or any of other deficiencies of the loading yield variable).

Table 8

Model No.	(8) Loading Gross take-up (log)	
Loading Yield (%) (d)	-1.626 ^{***}	(-3.77)
Price Index Industry (B,D,E)	-0.0849 ^{***}	(-4.89)
Price Index Construction (F)	-0.0396 [*]	(-2.00)
Price Index Transport & Storage (H)	-0.0836 [*]	(-2.17)
Price Index Info. and commun. (J)	-0.141 ^{***}	(-3.96)
Price Index Real estate activities (L)	0.0619 ^{**}	(2.56)
Price Index NACE M-N	0.0835 ^{***}	(3.26)
Constant	11.91 ^{***}	(151.86)
Observations	17	
Adjusted R^2	0.813	
DW	2.341	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Model 8 of the loading gross take-up has a similar structure as the office gross take-up model, which is good, as we do not assume any substantial structural differences. Our interpretation of the correlation of yield with the demand (net absorption) component of the gross take-up follows the intuition of the yield moderating the real estate market inefficiency we describe in the office section: Declining yield stimulates the demand for the real estate (1,63 percent for each percentage point). When we are dealing with the gross take-up, which is more general, and not only with the net absorption term, we may also discuss the possible effect of the yield on the short- and long-term arbitrage, as the gross take-up includes even such operations (although these are not performed as often on the European markets as in the US, where the use of REITs and other real estate financial derivatives has a longer tradition; see the section 5.2 for the considerations of these facts). We believe that with its relatively steady development (Figure 3), the loading yield is not a very useful tool in the short run. However, we would say that in the long run the amount of sub-leases (which are exactly component of the gross take-up) reflects the amount of investments in the real estate, i.e. vicariously also the level of the loading yield. A decomposition of the influence of the yield on the gross take-up from the Model 8 would help to explain whether the amount (or the volume) of sub-leases opposes the development of the net demand term or whether it reacts in a similar way. Unfortunately the net demand and new supply models are not of a high quality in the case of loading (as will be described

later). Still, from the comparison of the coefficients of the loading yield in the Model 6 (2,02, effect on the vacancy rate, which is defined on the basis of the net absorption term) and the Model 8 (1,63, effect on the gross take-up)¹¹ we deduct that the volume of components of the gross take-up other than the net demand diminishes with the decrease of the loading yield¹².

Rising index of prices in industry (mining and utilities) constrains the possibilities of the companies operating in those fields. We explicate the problem as in the Model 6: They can afford to sign up for a lower capacity and thus the gross take-up is declining. A similar effect is brought about by the rise of prices of construction and transportation & storage. According to our interpretation, increase in costs strengthens the obstacles between the real estate developers (investors) and a potential leaseholder. The influence of the price level of information & communication could be more complex. The Model 8 says that it relates to the development of the gross take-up as if the increasing prices in this subgroup imposed higher cost as well as the previous price indices. The group represents except others prices of all IT providers and information services. These could actually mean an increasing cost to the renters. The last two subgroups, professional activities – legal, administrative, technical, support service etc. – and real estate activities, have a reverse effect on the gross take-up. The Model 8 indicates that the rise of prices in these branches corresponds with an increase of the gross take-up. Here we would refer again to components of the explained variable other than the net absorption. The volume of sold products like sub-leases, pre-leases and of other products not directly bound to construction can be positively influenced by the increase of price of the real estate and professional activities, as this rise of prices can mean an increased profit margin of their providers. This would provide a logical explanation to the signs of the coefficients in the case that the Model 8 is reliable. The problem of low number of observations is still present and because of it we do not think that the magnitude of the coefficients can be somehow reasonably interpreted, even if the ratio between the coefficients seems to make some sense.

¹¹ We are aware of the fact that in the Model 6 the explained variable is in the differentiated form and in the Model 8 it is not. However, the effect is expressed in percents and thus the comparison is valid.

¹² The vacancy rate is not determined by the gross take-up, but by the net demand (which is only one of its components).

Table 9

Model No.	(9) Loading Net Absorption (log)	(10) Loading New Supply (m ²) (d)
Loading Yield (%) (d)	1.950* (2.12)	-306818.4** (-2.30)
FDI (log)	0.870* (1.98)	
Industry Prod. Index NACE B	0.158** (3.11)	
Price Index Construction (F)	-0.209** (-3.00)	15731.3* (1.87)
Price Index Transport & Storage (I)		31795.4** (2.77)
Price Index Info. and commun. (J)		-20538.9** (-2.44)
Direct Investments in CR		-12.32* (-1.86)
Time	-0.150** (-2.46)	36576.1* (2.07)
Constant	-7.555 (-0.96)	-287652.8 (-1.05)
Observations	14	16
Adjusted R ²	0.488	0.208
DW	1.362	2.725

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Even after only a brief look at the Models 9 and 10 it is obvious that they are not highly reliable. For the mentioned low number of observations, which is present almost in all the loading models, the Durbin-Watson statistics reports the presence of autocorrelation in the residuals in both of them. Additionally, the adjusted R² in the Model 10 is very low compared to other models (20%). Except for these deficiencies of the econometric kind, the logic behind the coefficients in the two models is also corrupt (as an implication of the structural deficits). What we explicate from the office section and also from the Model 6 for the loading vacancy rate is that the effect of the yield in both examined segments is the moderation of the inefficiency of the real estate market by reducing the vacancy rate, as it affects the two terms from which the indicator of vacancy consists. However, the effect of the yield described in Models 9 and 10 is exactly the opposite if we use the same logic as previously: According to the Model 9, the decreasing yield brings about a lower net absorption, and according to the Model 10 it also strengthens the new supply. Except the fact that a lower yield could hardly attract more investors and by that increase the new supply, the combination of those two results would be a boost to the vacancy rate – such influence of the yield term is in a contradiction with what we have deduced until now and also with the intuition that we apply to the problem. As a result of all the above mentioned facts we conclude that these two models are not valid and we will stay with the information provided by the others.

7. CONCLUSION

What we consider a core information provided by our model is the description of the role of yield, understood in our interpretation as a tool of the financial sector in the moderation of the real estate market activities.

First, the data support our expectations about the role of investments. If we consider the real estate yield a valid indicator of the volume of investments, we can say that the amount of new supply is, in the case of the office market, moderated by the investments in it. In the case of loading the interpretation of the results is not so clear. Second, from the role of yield in the office net demand (deduced from the behavior of new supply and vacancy rate) we conclude that the development of yield eases the burden the renters must bear in time of crisis - contrary to the general conditions on the market. Together, these two facts indicate that the connection with the financial market, except all complications that it causes, brings also a reduction to the inefficiency (vacancy rate) of the commercial real estate market.

From the results of the yield model itself we infer the influence that has the government's policy on the real estate market; setting the level of the real estate yield is restricted by the yield of the ten-year government bond.

The influence of different branches of services and industry does not exactly fulfill our expectations in most cases. At least, the basic notion that we have assumed does not contradict with the negative correlation of the administrative and legal services with the office vacancy rate (corroborated by the model of the new supply), which we explicate as an effect of changes in construction costs on the loading vacancy rate and as an impact of the transportation & storage price changes on the loading gross take-up.

As concerns the gross take-up term in both segments, it seems to cover wider areas of market activities than new supply and net absorption, as was supposed. We still believe that despite the relatively small size of our real estate market and the limited use of financial instruments, the gross take-up term is more directly influenced by the financial market than is the net absorption.

Except for the above mentioned results, our contribution also lies in gathering the data. Despite its imperfections, our dataset is an useful tool to examine this topic. In case of an extension in the future when new data are available, the subject can be studied

more deeply, using more advanced methods to prove or disprove our conclusions about the functioning of the Czech commercial real estate market.

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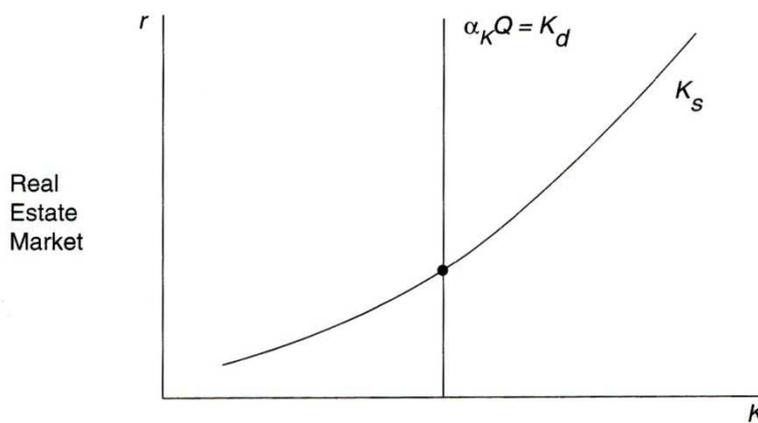
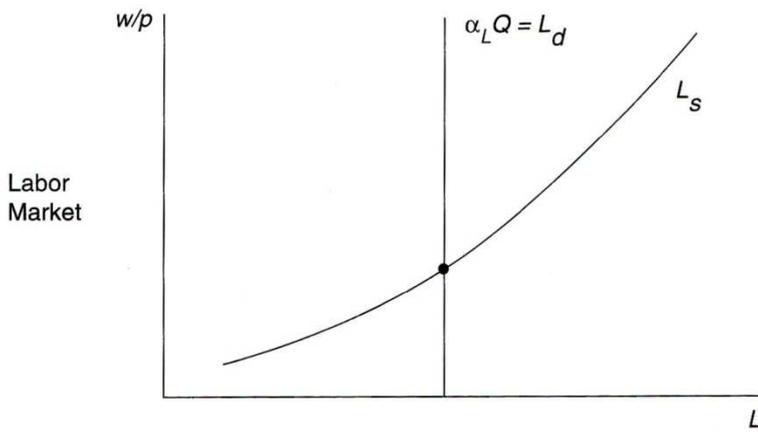
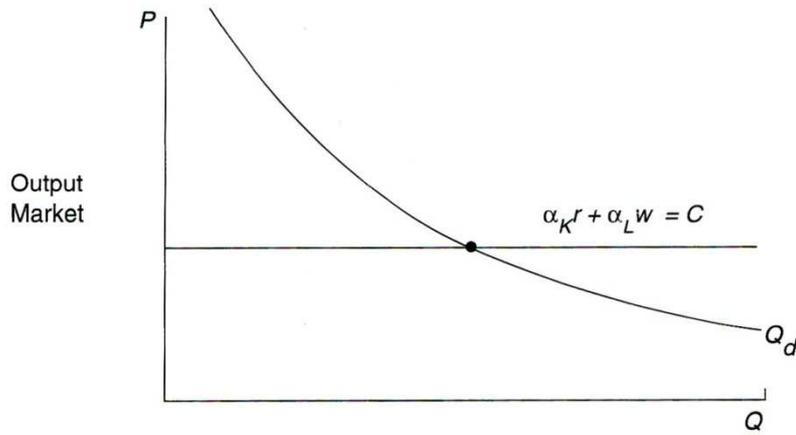
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APPENDIX

Figure 7 - The Three-sector Model



C	production cost per unit of output
α_L, α_K	amounts of RE and L required to produce each unit of output
w/p	effective wage
r	rent for real estate
K_d, K_s	RE demand and supply
L_d, L_s	labor demand and supply

(DiPasquale & Wheaton, 1996)

Table 10: Tests of residuals

Model No.		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KPSS lag order	0	.0395	.0246	.113	.0321	-	.0443	.156	.0331
	1	.0554	.0274	.0898	.0447	-	.0471	.115	.0366
	2	.0755	.0318	.0762	.0612	-	.0703	.0973	.0504
	3	.0837	.038	.072	.066	-	.0917	.0884	.0533
Dickey - Fuller	Test stat	-6.369	-7.145	-4.857	-6.502	-5.498	-3.902	-3.042	-5.069
	10%	-2.629	-2.62	-2.612	-2.629	-2.630	-2.630	-2.612	-2.630
	5%	-2.997	-2.994	-2.958	-2.997	-3.000	-3.000	-2.958	-3.000
	1%	-3.743	-3.736	-3.648	-3.743	-3.750	-3.750	-3.648	-3.750

KPSS: Kwiatkowski, Phillips, Schmidt, Shin test for stationarity of a time series. H0: variable is trend stationary. In the Model 5 it could not be performed because of the gaps in the observations (caused by the log form).

Critical values: 10%: 0.119, 5% : 0.146, 2.5%: 0.176, 1% : 0.216.