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ASSET DIVIDING APPRAISAL MODEL (ADAM)

–Direct Real Estate Investment Evaluation–

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Shrnutí:

Asset Dividing Appraisal Model (ADAM) umožňuje hodnocení přímých investic do nemovitostí a výsledných peněžních toků. Jedná se přitom o hodnotící nástroj, který zohledňuje jak kapitálový trh, speciální vlastnosti investičního majetku nemovitosti (heterogenita, vázanost na určité místo, nekonečná pozemková rendita, atd.), tak také různá majetková pravidla u nemovitostí v Evropské unii. Tím přispívá k harmonizaci kapitálových trhů a hodnocení investic do nemovitostí ve smyslu „Směrnice 2004/39/ES o trzích finančních nástrojů“. ADAM je založen na metodách finanční matematiky a metodách hodnocení nemovitostí různých kulturních kruhů. Přitom kombinuje přístupy hodnocení nemovitostí zemí kontinentální Evropy (německý výnosový postup) a mezinárodní (metoda diskontovaných peněžních toků). I když je vědecky smysluplné, brát metody k hodnocení nemovitostí v úvahu, není cílem modelu hodnocení nemovitosti nebo její aktuální tržní ceny. Spíše je cílem hodnocení přímé investice do nemovitosti a z toho vyplývajících peněžních toků. Matematická analýza, provedená na základě empirických tržních dat, potvrdila platnost modelové metodologie. V rámci analýzy byly vyčísleny vstupní proměnné, které mají na model největší vliv, stejně jako reakce modelu na mezní odchylky těchto proměnných. Analýza byla provedena na základě parciálních derivací a simulační studie. V České republice není v současnosti považována budova za součást pozemku, na kterém leží. Tak mohou být odlišné osoby nebo instituce vlastníky budov a pozemků, na kterých stojí. Od roku 2014 má reforma českého občanského zákoníku konsolidovat vlastnictví nemovitostí. Tím se česká jurisdikce přizpůsobí německé, která považuje pozemky a budovy za hospodářskou jednotku. V rámci této konsolidace by mohl být uvedený model aplikován.

Summary:

The Asset Dividing Appraisal Model (ADAM) enables the appraisal of cash flows resulting from direct real estate investments. The model is an evaluation tool, which takes capital markets and the specific characteristics of real estate as an asset (heterogeneity, site-dependency, eternal land-yield, etc.) into consideration, while also considering different ownership approaches of real estate in the European Union. Thus, it contributes to the harmonization of capital markets and of direct real estate investment evaluation as intended by the “European Directive on Markets in Financial Instruments 2004/39/EC”. ADAM is based on financial mathematical instruments and on the property valuation methods of different cultural areas. It combines continental European (German Gross Rental-Method) and international (Discounted Cash Flow-Method) property valuation approaches. Although it is scientifically reasonable to take property valuation approaches into account, the aim of the model is not to valuate a property or to quantify an objective market value but to evaluate cash-flows resulting from direct real estate investments. A mathematical analysis based on empirical market data confirmed the validity of the methodology of the model. In the course of the analysis the major input variables that determine the results of the model and how the model reacts to marginal deviations of input data, were quantified. This was done using partial derivations and a simulation study. In Czech Republic a building isn’t actually considered as a part of the underlying plot. Consequently, differing persons or institutions can be owner of the building, as of the appropriate plot. From 2014 on, a suitable reformation of the Czech Civil Code is supposed to cause a consolidation of real estate property. Czech law is going to be adjusted to German law, which considers plot and building as an economic entity. This consolidation of real estate could be an approach of the introduced model.

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Glossary

Due to the close reference of the following text to German real estate valuation methodology the subsequent table is supposed to express the original meanings of some special terms, which are well known in German methodology but less in international contexts.

Annuity cash value factor	Rentenbarwertfaktor
Building value	Gebäudewert
Calculation rate	Kalkulationssatz
German commissions of experts	Deutsche Gutachterausschüsse
German gross rental method	Deutsches Ertragswertverfahren
Income value	Ertragswert
Inheritable building right	Erbbaurecht
Inheritable construction interest	Erbbauzins
Land return rate	Bodenrenditesatz
Land value	Bodenwert
Land yield	Bodenwertverzinsung/-rendite
Multiplier	Vervielfältiger
Property value (land + building)	Wert der Immobilie (Boden + Gebäude)
Property yield (Property interest rate)	Liegenschaftszinssatz
Objective market value	Verkehrswert
Situational market value	Marktwert

1 Introduction

In the underlying dissertation paper to the following Auto-Abstract the Asset Dividing Appraisal Model (ADAM), an annuity approach for the evaluation of direct real estate investment, will be presented. This is a procedure of investment calculation for real estate projects, which presents a further development of the methods for value determination of real estate (German gross rental method, international DCF method) as well as a development of methods for investment calculation for real estate. The model refers to direct investments in real estate but not to real estate securitizations. It can however form the basis of the evaluation of an investment in real estate securitizations, as it evaluates the underlying direct real estate investment. Here the Asset Dividing Appraisal Model, (ADAM) expounds the return of real estate investments but does not expound the determination of the objective market value (the value a property has in the real business dealings, preferences and ideals are excluded in the value formation) of real estate according to ImmoWertV (German laws concerning the guidelines for the determination of objective market values of properties). But from an objective perspective it seems appropriate to consider the procedures of the legally nominated (German gross rental method) and the non-legally nominated (international DCF-method) value determinations and to include them in the model. Thus the ADAM provides a method for the complex analysis of a direct real estate investment while complying with the capital market oriented consideration of real estate as an asset and considering the specific characteristics of the commodity real estate. In the context of the different property regimes for real estate within the EU the model presented here can contribute to the aspired harmonization and increase of transparency of European real estate and capital markets according to the "EU-directive 2004/39/EG on markets in financial instruments". In the Czech Republic a building is currently not considered to be a part of the property under it. The result of this is that the owners of the land and the building on it can be different natural or legal entities. From 2014 on a corresponding reformation of the Czech civil code will lead to the consolidation of ownership (land and building) of real estate. Thus the Czech legal position will be adapted to the German law, which considers the land and the building as one economic unit. However, the new regulation will apply only to those buildings that are not on a foreign property on January 1, 2014. For real estate, where the ownership of the land and the building will be separated at this time the owner of the building will have a preemptive right for the property under the building and vice versa. This preemptive right cannot be excluded in the purchase agreement (Hrncier, 2012). In the usual case of the separation of the ownership of land and building in the Czech Republic and the finally aspired consolidation the necessity for the evaluation of the relevant

investment, which the model presented here, can provide, will arise. It seems to be appropriate to consider and evaluate the land and the building separately not only in the Czech Republic. Thus the inheritable building right exists in Germany. It presents a right similar to ownership and thus makes it possible that the land and the constructed buildings can be owned by different legal and natural entities (Kleiber, 2010). In Great Britain and in the USA the concept of "leasehold" (Kopp, Waldner, 2004) or of "leasehold estate" (Gelbtuch, 1999) is also deeply anchored in the respective economic systems. The previously mentioned concepts of "leasehold" and "leasehold estate" also result in the separation of ownership of the land and the constructed buildings.

The underlying dissertation will deal with the before mentioned separation of ownership in real estate (land and building) in the form of a model (ADAM) for direct real estate investment evaluation.

2 Problem

Evaluations of investments in real estate present a complex task. The result and meaningfulness of this task depends on many influence factors. The usual evaluation methods are derived from the methods of general capital budgeting (net present value NPV, internal rate of return IRR) and from methods of business appraisal (Edelhoff, 2011). Among others, Kruschwitz, Hering, Oppitz and Spreemann are known authors on capital budgeting and finance. In the course of time different real estate economists and authors also applied the models of the before mentioned authors to real estate. Due to their general validity the previously mentioned actuarial methods can be applied to real estate but they cannot completely account for the complexity, heterogeneity as well as the special characteristics of the commodity real estate.

3 Objectives of the dissertation and research need

Beside the before mentioned capital budgeting, which is also applied to real estate, the traditional German real estate valuation according to the determination of the objective market value on the basis of the German gross rental methods exists as well as the international real estate evaluation based on the DCF – method. Both procedures are directly related to the methods of capital budgeting. However their application does differ significantly.

In the scope of the underlying dissertation the German and the international methods of real estate evaluation will be considered. Here it is about different culture areas, which are based on different perspectives, market theoretical models and the methods derived from them. The research question, which should be answered by the dissertation, is as follows:
How can the method of the German and the international real estate evaluation, which are based on different culture areas, be unified whithout questioning the correctness of one of the two respective methods?

The following objectives result from the research question mentioned above and should be achieved in the scope of the dissertation:

1. *Derivation of a model for the complex analysis of direct real estate investments on the basis of the methods for real estate value determination, real estate evaluation, the classic mathematics of finance, the capital budgeting as well as the neo-classical oriented capital market perspective which accounts for the special characteristics of the commodity real estate.*
2. *Mathematical evaluation and analyses of the introduced model*

4 Current Knowledge

4.1 Real estate markets

Generally the real estate market can be subdivided into a space market and an investors market (Geltner, 2007). The investors market is relevant for evaluation purposes. The dependencies of these markets are presented in Image 1:

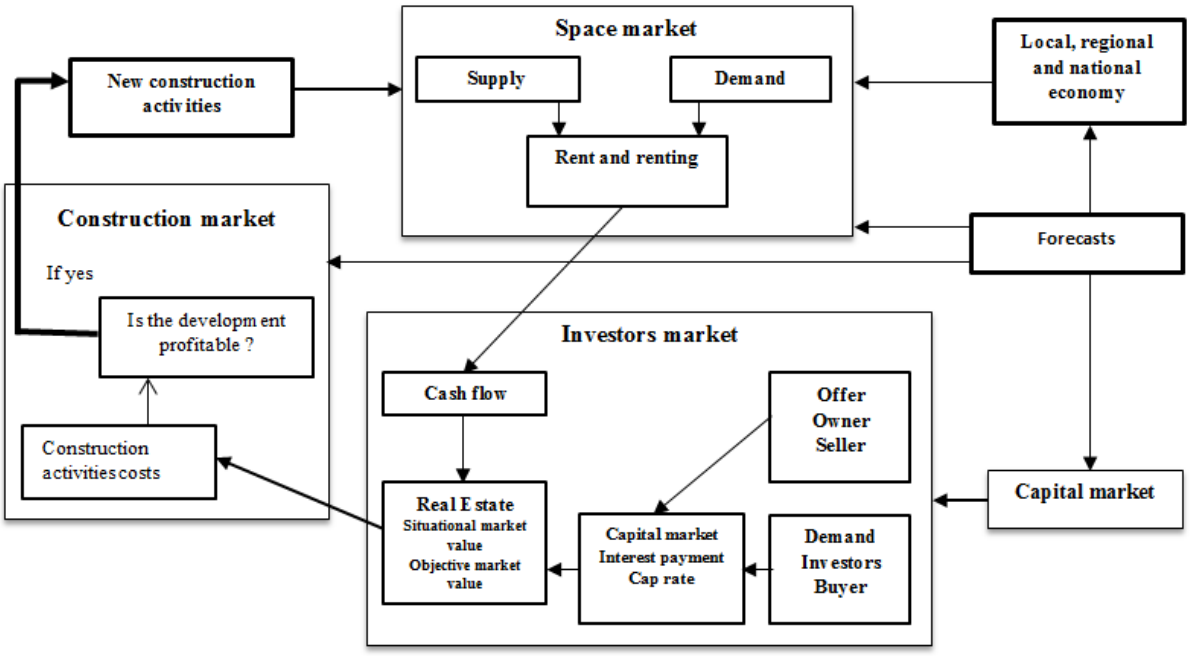

Image 1: The system of the real estate market (Gondring, 2010)

Gondring (2010) describes the real estate market as follows: As a principal, supply and demand meet on the real estate market as is the case on any other market. This means that the real estate market presents a place where real estate goods are traded and many suppliers and buyers are present. Therefore, as a principal, the real estate market is a polypoly. However this polypoly has a major difference compared to other polypolies. This difference can be found in the very specific characteristics of real estate. Here the location fixation is very important. It creates the special characteristic that the offer is locationally bound and thus can only be offered at one specific location. Thus it is possible that a piece of real estate at location A cannot be sold as there is no demand for it while many interested persons would be looking for exactly this offer at location B. This implies that this real estate market is made up of many regional submarkets. These submarkets differ not only because of the geographic location but also because of the deviations of their structure, their population and construction density, the financial power, the property price and the preferred goods. Due to the character-

istics of the piece of real estate the real estate market strongly deviates from the model of the perfect market. An example for this is that the offered goods are heterogeneous. The missing homogeneity of the goods creates preferences for certain offers or suppliers especially in regards to area, time and personal aspects. Due to the naturally long time of realization suppliers can only react to market fluctuations in a delayed manner. Therefor the elasticity of the offer is very low in contrast to the perfect market. Another indicator for the imperfection of the real estate is the fact that the respective submarkets, in connection with the many different organization forms for real estate marketing, have a negative effect on market transparency. In addition to this the number of suppliers and buyers is limited on the submarkets. Summarizing, the following conclusions can be made:

- The "real estate market" does not exist. Instead a high number of submarkets and under markets exist.
- The segmentation of the "real estate market" leads to making this market or rather its submarkets more imperfect.

4.2 The German gross rental method

General gross rental method

In general gross rental methods the net yield of the property ("annual net yield) is reduced by the amount of the amount of the land value interest rate. The resulting building net yield part ("net yield of constructed buildings") is then capitalized over the term of the existence of the building using the decisive "property yield". This in turn results in the building income value ("income value of the constructed building"). Together, the land value and the building value ("building value of constructed buildings") make up the "temporary property income value". This income value must be adjusted to the objective market value after the object specific market adaptation while considering the general market adaptation. When applying the gross rental method the condition of the real estate market is especially taken into account by setting the return ratios, the property yield, the working costs and other value influencing conditions in an appropriate manner. The achievable returns must be determined based on customary conditions, on the basis of a rental contract for example. Since the mentioned figures can be transferred from the property related data of comparable properties into the value determination, which is "market oriented" when the gross rental method is applied correctly, the procedure can be described as a comparing procedure (Metzger, 2010, ImmoWertV § 17).

The formula for the determination of the general income value is stated in the following:

$$IV = (NY - p\ x\ PV)\ x\ D + LV \qquad (4\text{-}1)$$

IV = Income value
NY = Net yield
p = Property yield /100
LV = Land value
D = Multiplier

Formula 4-1: General gross rental method (Metzger, 2010)

Simplified gross rental method

In the context of the simplified gross rental method the income value is determined based on the customarilly achievable returns of the capitalized net yield and on the remaining useful life, which is over the discounted land value.

In the following the formula for calculating the simplified income value is stated:

$$IV = NY\ x\ D + LV\ x\ q^{-n} \qquad (4\text{-}2)$$

IV = Income Value
NY = Net yield
D = Multiplier
q = interest factor (1 + p)
p = Property yield / 100
n = Remaining useful life of the building
LV = Land value

Formula 4-2: Simplified gross rental method (Metzger, 2010)

The simplified gross rental method can be applied without considering the land value when the remaining useful time is more than ca. 40 – 50 years (Metzger, 2010). The land value share of the income value decreases digressively when the remaining useful time increases. For $n \rightarrow \infty$ the land value term disappears completely, while the multiplier turns into the reciprocal of the property interest rate or rather thus turns into the eternal annuity. Thus the anglo American income value formula is produced for an unlimited remaining useful time. In Germany this formula is described as the broker formula (Kleiber, 2004):

$$IV = NY\ x\ \frac{1}{p} \qquad (4\text{-}3)$$

IV = Income value
p = Property yield / 100
NY = Net yield

Formula 4-3: Broker formula (Naubereit, 2009)

However, when the remaining useful time is short then the simplified gross rental method cannot be applied since the land value is seen as everlasting in German evaluation practice.

The land value is profitable forever while the value of the building is only profitable during the economic remaining useful life of the constructed buildings (Metzger, 2010).

Multi periodical gross rental method

When determining the income value on the basis of periodically different yields (§ 18 par. 1 ImmoWertV), this income value is determined by the residual value of the property at the end of the consideration period and the periodically achievable net yields, which are derived from the saved data, within a consideration period. The periodical net yields and the residual value of the property must each be discounted according to § 20 ImmoWertV on the date of the value determination.

The multi periodical gross rental method is also applicable when the returns are the same and always leads to the same results, as does the general gross rental method (Metzger, 2010). However, the gross rental method, which considers periodically different return demands a much more complex calculation.

In the following the formula for the calculation of the income value based on periodically different returns is presented:

$$IV = \sum_1^b NY \; x \; q^{-b} + NY_i \; x \; (D_n - D_b) + LV \; x \; q^{-n} \qquad (4\text{-}4)$$

Return share of the consideration period

Residual value

IV	= Income value	q	= Interest factor (1 + p)
b	= Period under consideration	p	= Property yield / 100
NY	= Net yield	n	= Remaining useful life of the building
D	= Multiplier	LV	= Land value

Formula 4-4: Income value based on periodically different returns (Metzger, 2010)

In the process of the multi periodical gross rental method the general gross rental method is divided into 2 phases:

1. A consideration period of ca. 10 years, which starts with the date of the value determination
2. A remaining phase until the remaining useful life of the piece of real estate has ended.

While the annual returns for the consideration period are determined periodically, the residual value and the returns are determined by the remaining useful life of the piece of real estate (Metzger, 2010). When the consideration period is 10 years and a remaining phase is 1 year

the Germany gross rental method, after being mathematically converted, has exactly the same methodology as the international DCF-procedure. The difference is merely that the land value is also taken into account in the gross rental method.

4.3 The Discounted-Cash-Flow procedure

The DCF-procedure is directly derived from the net present value method (dynamic investment calculation) and company appraisal and has, as already mentioned above, a methodic connection to the gross rental method on the basis of periodically different incomes. The DCF-method as well as the German gross rental method both go back to the concept of the present-value. It is a dynamic investment calculation procedure which has the goal of revealing the current value of a considered investment by discounting future cash flows. Before the DCF-methods became the decisive evaluation model for company appraisal it was used to examine the advantage of a business investment. The payment surpluses of made investments were projected to a defined period of time and discounted on the term, which was considered. Currently the evaluation of companies for sales purposes is mainly conducted using model-based cash flows. One of the first specialized articles about the DCF-procedure in real estate evaluation appeared in the early 1980 years (Edelhoff, 2011). Since then the DCF-method has been also been used increasingly for the evaluation of real estate and is now deeply anchored in the real estate economy (especially for institutional investors).

Here this the DCF-method is used for the determination of the situational market value or rather the objective market value of a piece of real estate and for the evaluation of a subjective investment decision.

In contrast to the gross rental method described above this is (according to the Germany definition) not a standardized procedure for the evaluation of real estate (Leopoldsberger, Thomas, Naubereit, 2008). Due to this the DCF-method is used much less in Germany than the legally standardized gross rental method. However, in the course of the internationalization of the market the DCF-method is being increasingly used for the evaluation of real estate in Germany. Hersberger (2008) describes the Discounted-Cash-Flow-procedure as a procedure of investment calculation in which future cash flows (income, expenses) are discounted to a unified reference date. The sum of the thusly-received cash values makes up the capital value or the present-value of an investment. One receives the net cash value or rather the net-present value of the payment series after subtracting the initial investment (Herberger, 2008, Spreemann, 2010).

Many times a two phase model is used during real estate evaluation with the DCF-procedure (similar to the German gross rental method considering periodically different returns). In the enter- or prognosis-phase (first phase) the expected cash flows are presented in detail. In the exit- or residual phase (second phase) the situational market value at the end of the first phase is depicted. For real estate evaluation the first phase is mostly ten years. When using the DCF-procedure the difficulty lies in the correct prognosis of the data. As opposed to the German gross rental method the prognosis of the data is not based on customarily achievable rent, instead it is based completely on contractual rent agreements. Usually one year is chosen for the periodization. The situational market value of the piece of real estate results from the sum of the discounted annual cash flows in the period of the prognosis (first phase) and the discounted residual value (second phase) (Hersberger, 2008). Here the mathematical methodology of the American and British approach does not differ. The concept of the present value is the basis for recording the time structure of a cash flow series. Here the time preference of the investor or rather the evaluator is recorded by systematically recording every individual payment by accumulation and disounting. Thus it is expressed, that the value of a certain future payment for the investor or rather the evaluator is higher, the smaller chronological distance of this payment is to the present time. The difference of two identical payments at two different times is calculated via the discounting interest rates. When the chronological difference between the times of payment is more than one period then the discounting interest rate is the same as the compound interest, which is shown in the denominator of the following equation (Ropeter, 1998):

$$MV = \sum_{y=1}^{n} \frac{C_y}{(1+i)^y} + \frac{RV_n}{(1+i)^n} \qquad (4\text{-}5)$$

MV = Situational market value
C_y = Cash flows in year y
RV_n = Residual value of the real estate in the year n
i = Discount rate
n = Amount of the years of the period of prognosis

Formula 4-5: DCF-procedure (Hersberger, 2008; Brown, Matysiak, 2000; Ropeter, 1998)

On the basis of the previous explanation it can be recognized that real estate value determination (objective market value or rather situational market value determination) and real estate investment evaluation cannot be methodically and mathematically clearly separated.

5 Development of a model for evaluating direct real estate investments

5.1 Introduction and empirical based exploration

On the basis of the above presented and discussed methods of real estate evaluation as well as the dynamic investment calculation a model will be introduced that takes the above mentioned methods, the specific criteria of the economic good real estate and the real estate market into account. Based on the micro economically oriented methods for real estate evaluation, mathematic methods of classic financial science as well as the neo-classic oriented capital market perspective an evaluation of real estate investments close to reality is possible.

Exploration is the less or more systematic collecting of information of a research matter, which prepares the formulation of theories and hypothesis. It plays a major role in the context of scientific theories as well as technological theories of applied research. Bortz and Döring (2006) describe and devide four exploration strategies such as

1. Theory based exploration
2. Method based exploration
3. Empirical-quantitative exploration
4. Empirical-qualitative exploration

Theory based exploration

In the course of a systematic review and analysis theory based exploration derives new hypothesis and theories from well-known and established scientific theories. It is basically an analysis of scientific theroies with the objective of developing new explanation-models by synthesis and integration (Bort, Döring, 2006).

In the course of the following development of the model the theory based exploration, as described above by Bortz and Döring (2006) shall be applicated.

In section 4 the reworking and appraisal of well-known theories was conducted. While reworking some own ideas and approaches came up. In sections 5 and 6 the reworked theories shall be integrated in an own theory, which is made clear by a graphical depiction (image 3). In section 7 the mathematical analysis and discussion of the new invented theory is performed. Finally there are some suggestions of improving and further development of the new invented theory.

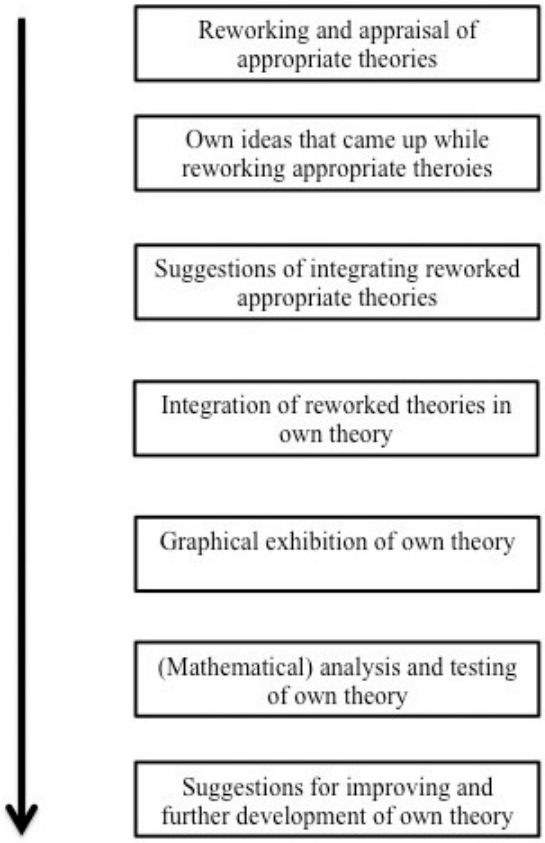

Image 2: The process of theory based exploration (own decpiction)

The "Asset Dividing Appraisal Model" (ADAM) offers the possibility of considering and evaluating the property and the building separately in the context of a direct real estate investment. Thus the evaluation of an investment is adjusted to the underlying sub- or partial market of the real estate market since different land values as well as capital market specific building values can occur in different partial markets. Thus, in the context of the ADAM, the piece of real estate is considered to be an "immobile" economic good consisting of the land and the constructed buildings on it. Here the economic useful life of a piece of real estate is based on rent agreements and refers exclusively to the building of the piece of real estate. Therefore the useful life of the land is separated from the economic useful life of the building and is considered to be everlasting (Metzger, 2010; Kleiber, 2010). Subsequently the economic useful life deviates from the remaining useful life according to the German gross rental method according to § 17 para. 1 (2) ImmoWertV. The economic use of a piece of real estate, which is the basis of the economic useful life, describes a form of use that generates cash flows (rents). Here the economic use itself is based on rental agreements and refers to the land (land annuity, "eternal" annuity) and to the building (usage rent) of a piece of real estate. While the land and the building is evaluated separately in the German gross rental method

(Moll-Amrein, 2009; Metzger, 2010; Kleiber, 2010) the international DCF-method considers the land and the building as a unit and does not pay special attention to the land annuity. The German gross rental method obtains the objective market value of a piece of real estate according to ImmoWertV. Here it abstracts the imperfection of the real estate markets by doing justice to their segmentations methodically (local sub markets) by using parameters like the local specific property interestt rate. The economic useful life of the building is assumed to be between 60 and 80 years and is thus limited. The value of the land is regarded as everlasting and eternally profitable (Metzger, 2010; Kleiber, 2010; Moll-Amrain, 2009). The progressing connectivity of the asset real estate to the capital markets is ignored by the gross rental method. The DCF-method evaluats the piece of real estate as an asset from a capital market oriented perspective. Here it can obtain different results depending on the choice of the discount rate. Thus it is possible for example to discount with a "risk-free capital market interest rate" plus a risk premium. This evaluation of an asset from the international capital market perspective assumes an economic useful life of the piece of real estate of generally ten years (according to the rental agreements) (Kleiber, 2010). When discounting with the opportunity interest rate the DCF-method can also determine a subjective decision value for or against the real estate investment (Engel, 2002 and 2003). Kleiber (2004) concludes the following concerning the DCF-method: "Despite all of this the Discounted Cash Flow method has certain advantages and there are fields where it can be applied. The method originates from entrepreneurial investment analyses and has always been used in Germany, especially when the objective was to evaluate company values on the basis of entrepreneurial targets. According to this understanding cases of applications are also highlighted in English literature, when it is about the subjective value of a special investment." The international DCF-method (Spreemann, 2010), which results from the neo-classic theory of public finance as well as company appraisal does not take the specific characteristics of the economic goods real estate as well as the eternal annuity of the land value (Kleiber, 2010), which is anchored in German literature, into account. The highly different and complex characteristics of real estate (location fixation, heterogeneity, uniqueness, limited substitutability, interdependence and long production time, etc.) show that they are very complicated and strongly segmented markets, which in addition to this are not organized or standardized (Moll-Amrein, 2009). This fact makes a real estate evaluation corresponding to the relevant submarkets indispensable. However, the progressing globalization, internationalization and capital market orientation or rather capital market consolidation of the real estate markets (Beyerle, 2007) also demands a consideration as internationally comparable asset. Thus real estate is turning into capital market based investment

products like real estate joint stock companies, Real Estate Investment Trusts (Reits), Real Estate Private Equity (REPE), special fonds, etc. (Gantenbein, 2011). The two principally opposing effects describe the necessity of the model introduced here. It is therefore possible to evaluate a real estate investment in accordance to the requirements of the capital markets and the special characteristics of the asset real estate.

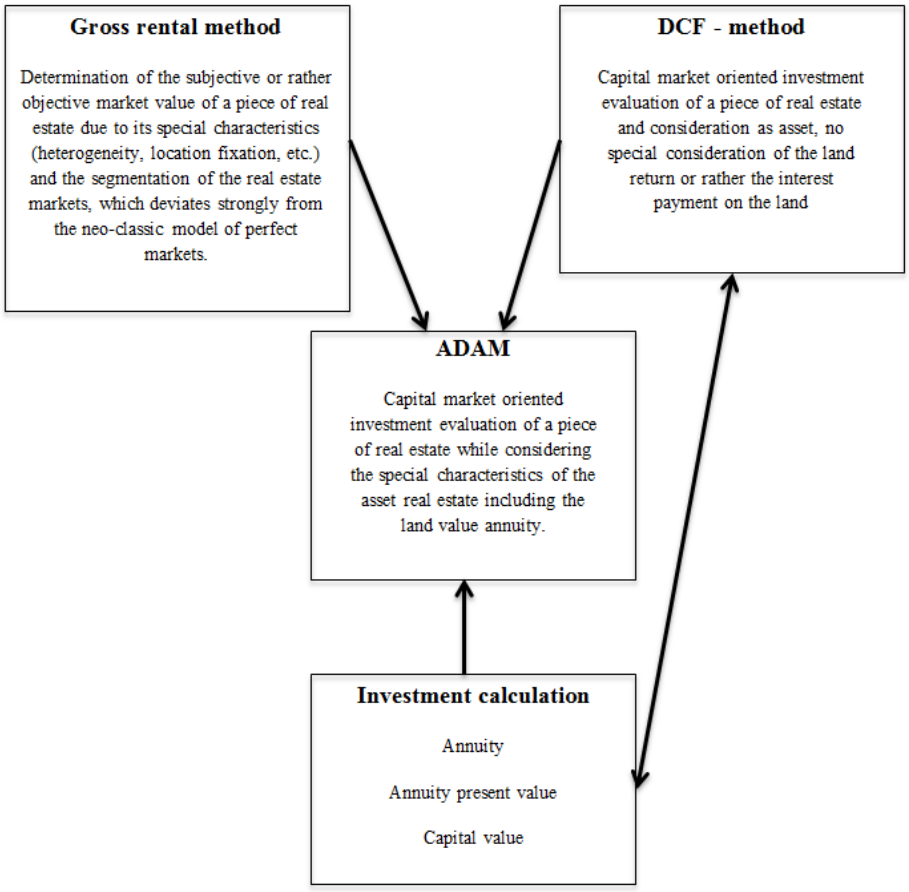

Image 3: Strategic positioning of the ADAM (own depiction)

In the contexts of the ADAM the absolute and relative return expectations of a direct investment in real estate, while taking the returns from the ownership of the land into account, and the usage of the building, will be considered. The presented annuity model for direct real estate investments belongs to the branch of capital budgeting, investment calculation and financial and cost accounting including the reasons for the rental and lease agreements. It forms the synthesis of the "land return rate z" for the classical middle-European or rather German method and the "calculation rate p" of the anglo-american system for real estate evaluation. Its essential purpose is to offer investors a clear evaluation of the annual Asset Rent Generation ARG and of the capital investment K_0 for the investment on the basis of the Asset Rate of Return ARR to broaden the decision preparation for a real estate investment and to include

chances and risks much more. The model approach starts from the two main components of real estate investment and real estate evaluation:

1. from the land value and its interest return or rather its rent returns, which useful life is "eternal" (Metzger, 2010; Kleiber, 2010).
2. from the cash flows that are obtained through using (renting) the building. A rental agreement, which is usually signed for a period of 10 to 15 years, is the basis for creating cash flows (Hersberger, 2008; Kleiber, 2010). Thus the economically relevant useful life corresponds to the period of the rental agreement.

The ADAM aims for:

1. The consolidated evaluation of direct real estate investments, which are based on the land on the one hand and on the capital returns resulting from using (renting) the building the other hand.
2. Finding the most favourable direct real estate investments when alternatives are available.
3. Obtaining the best time to sell existing buildings or rather usage forms or substituting them with new buildings or rather new usage forms.
4. The better analysis of chances and risks of a direct real estate investment, which results especially from the separated use of perspective data concerning the land and the usage of the building. This also affects especially the design of the usage expenses for the property compared to the customary rents or leases.

5.2 Methodological foundations and inductive derivation

5.2.1 Calculation rate *p*

There are many different ways to quantify the calculation rate *p*:

- The interest yield of a risk-free government bond (eventually plus a risk premium) (Naubereit, 2009; Kleiber, 2010; Hering, 2008).
- An interest yield derived from comparable transactions like for example the British ARY (All Risks Yield) (Naubereit, 2009).
- The interest yield of an investment, which cannot be conducted due to the chosen real estate investments (opportunity interest rate) (Rolfes, 2003; Hering, 2008).
- The weighted average cost of capital (WACC) (Wöhe, 2010; Liapis et al., 2011).

5.2.2 Land return rate z

The property yield known from the value determination of real estate is maintained regarding the land. In the context of calculating the land annuity R_B using the land value B and the eternal useful life T the land return rate z takes the place of the property yield.

From the viewpoint of the separation of the land and the building in the context of evaluating direct real estate investments with the ADAM the land return rate z should include three essential components. It must

1. balance the decrease of the cash capital tied to the land, which occurs with the usual discounting (for non-separation) of the economic useful life.
2. reflect the increase of the profitable land value during the economic useful life of the piece of real estate at the considered location on the basis of the previous developments of the price index of the land as a scarce good.
3. guarantee the annual annuity on the capital tied to the land. Here the tied capital corresponds to the investment in valued assets with fixed interest rates.

5.2.3 Annuity cash value factor (multiplier) *v*

In regards to the economic useful life T the capital return K_T in arrears of the investment initially appears at its end and depends on the calculation rate p as well as the annual annuity R and the capital investment K_0:

$$\begin{aligned} K_T &= R \cdot \left[(1+p)^0 + (1+p)^1 + \ldots + (1+p)^{T-2} + (1+p)^{T-1} + (1+p)^T\right] && \cdot\left[-(1+p)\right] \rightarrow \\ -K_T \cdot (1+p) &= R \cdot \left[-(1+p)^1 - \ldots - (1+p)^{T-2} - (1+p)^{T-1}\right] && \rightarrow \\ \hline K_T \cdot \left[1-(1+p)\right] &= R \cdot \left[1-(1+p)^T\right] && \rightarrow \end{aligned}$$

$$K_T = R \cdot \frac{(1+p)^T - 1}{p} = (1+p)^T \cdot K_0 \quad \rightarrow \quad R = K_0 \cdot \frac{p \cdot (1+p)^T}{(1+p)^T - 1} \tag{5-1}$$

Formula 5-1: Annual annuity R (annuity factor) (Oppitz, 2011; Wöhe, 2010; Hering, 2008)

Now it is customary to introduce the annuity cash value factor v "in arrears", which is called the multiplier in the real estate branch and has been described above:

$$R = \frac{K_0}{v} = K_0 \cdot p \cdot \frac{(1+p)^T}{(1+p)^T - 1} \quad \rightarrow \quad v = \frac{(1+p)^T - 1}{p \cdot (1+p)^T} \tag{5-2}$$

Formula 5-2: Annuity cash value factor (multiplier) (Oppitz, 2011; Wöhe, 2010; Hering, 2008)

This and the land return rate z as well as the land value B produces the "eternal" land annuity R_B, which shows a useful life going towards infinity: $T \to \infty$:

$$R_B = \frac{B}{v_B} = z \cdot B \cdot \lim_{T\to\infty} \frac{(1+z)^T}{(1+z)^T - 1} \quad \text{with} \quad \lim_{T\to\infty} \frac{(1+z)^T}{(1+z)^T - 1} = \frac{1}{1 - \frac{1}{(1+z)^{T\to\infty}}} = 1 \quad \to \quad R_B = z \cdot B$$

(5-3)

Formula 5-3: Eternal (land-) annuity (Oppitz, 2011; Hering, 2008)

Due to its eternal useful life T -> ∞ the land annuity R_B will be used as a fixed evaluation figure in the model described in the following.

5.2.4 Asset Rent Generation *ARG* und Asset Rate of Return *ARR*

Cash flows that originate from the usage of the building (usage rent) are almost always manageable time periods, based on the current rental agreement. The evaluation problem lies in the strength of the future of the assumed scenarios for it and occurs when relatively secure data is needed for quite broad time frames. It concerns especially the future changes of the annual receivable payments and investments, which primarily determine the flow of capital. It is a relieving affect on gaining this future data that exactly the continuous payments of real estate have a certain steadiness concerning their developement, which has some dents but is generally quite stable. This applies especially when sound investment knowledge flows into the prognostic data.

The evaluation of the usage of the building is the determination of the calculation rate p as well as the cash flows and their term. Instead of the term of the cash flows a medium annual difference of the investments E_t and the receivable payments A_t can be placed:

$$Z_0 = \sum_{t=1}^{T} \frac{E_t - A_t}{(1+p)^t} \approx T \cdot \sum_{t=1}^{T} \frac{D_\mu}{(1+p)^t}, \quad D_\mu = E_t - A_t \quad \text{if} \quad D_t \approx D_{t+1} \quad \text{for} \quad t = 0,1,\ldots,T-1$$

(5-4)

Formula 5-4: Discounted payment flows (Oppitz, 2011; Wöhe, 2010; Hering, 2008; Rolfes, 2003; Liapis et al., 2011)

The Asset Rate of Return *ARR* is obtained as follows: Besides the "eternal annuity" R_B on the land value B and the land return rate z, the flows of the receivable payments and investments A_t, E_t from the usage of the building on the property and their useful life T are included into the model. The therefrom resulting payment surpluses are referred to the cash capital Z_0 with the economic useful life T and the calculation rate p at the time of the investment and are then converted to the Asset Rate of Return, *ARR*, with the annuity cash value factor (multiplier) v:

$$ARR = \frac{R_B + R_N}{A_0} = \frac{z \cdot B + \frac{Z_0}{v}}{A_0} = \frac{v \cdot z \cdot B + Z_0}{v \cdot A_0} \quad \text{with} \quad v = \frac{1}{p} \cdot \frac{(1+p)^T - 1}{(1+p)^T}, \quad Z_0 = \sum_{t=0}^{T} \frac{E_t - A_t}{(1+p)^t} \quad (5\text{-}5)$$

ARR	= Asset Rate of Return	Z_0	= Cash Capital
R_B	= Land annuity	v	= Multiplier (annuity cash value factor)
R_N	= Usage rent	p	= Calculation rate
z	= Land return rate	T	= Economic useful time

Formula 5-5: Asset Rate of Return *ARR*

As can be seen above the interest rate for the land value *B* is based on the eternal annuity or rather is made profitable with the eternal annuity. The cash value Z_0 is initially calculated from the sum of the periodic discounted difference of the investment E_t and the receivable payments A_t. Then the cash capital Z_0 is divided by the annuity cash value factor (multiplier) v and thus distributed evenly, as annuity, over the economical useful life. The approach is obtained from the annually different payment surpluses. For payments surpluses that remain the same over the years this step can be excluded as the annually constant surpluses don´t have to be converted to an annual annuity. However in order to monitor the development of the discounted payment surpluses over the course of the term the method mentioned above should also be used for periodically constant payment surpluses.

The objective of the model is to determine the Asset Rate of Return, *ARR* as well as the Asset Rent Generation *ARG*. For this the model is based on an arithmetically, exponentially weighted mean.

The model is designed as follows:

$$Z_0 = \sum_{t=1}^{T} \frac{E_t - A_t}{(1+p)^t}, \quad A_0 = B + G, \quad ARR = \frac{\left[(1+p)^T - 1\right] \cdot z \cdot B + Z_0 \cdot p \cdot (1+p)^T}{\left[(1+p)^T - 1\right] \cdot A_0}, \quad ARG = ARR \cdot A_0$$

Formula 5-6: Asset Dividing Appraisal Model, ADAM

(5-6)

6 Hypotheses

The hypotheses, which were derived from the considerations above and which will be examined in the scope of the dissertation are:

Hypothesis 1:

The land has an independent value, which has a direct influence on the investment evaluation of a piece of real estate and must therefore be definitely included in the evaluation of a real estate investment. So when the land return rate increases the Asset Rate of Return *ARR* also increases.

Hypothesis 2:

The calculation *p* presents the costs of debt capital as well as the annuity claim. Thus it expresses a minimum return of the invested equity capital. The higher the calculation rate *p* is, the higher the Asset Rate of Return *ARR* must be in order to cover the costs and to generate profit.

Hypothesis 3:

The influence of the land return rate *z* on the Asset Rate of Return *ARR* is smaller than the influence of the calculation rate *p* on the Asset Rate of Return *(ARR)*.

7 Methodology

7.1 Simulation study and data collection

The mathematical analysis will be conducted using the design of a simulation calculation. For this the values of the five independent variables land value *B*, the building value *G*, the land return rate *z*, the calculation rate *p* and the economic useful life *T* will be anticipated using a distribution. Different data sources will be used in order to determine the boundary and mean values of the data material:

Land value B

The real estate market report of the expert commissions 2012 publishes the land values for bad, mediocre and good locations. Thus the data basis can be concluded over a beta-, a chi-square or a normal distribution. The revenue volume of properties that have no construction, ordered by cities and districts can be found in the real estate market report of the expert commissions.

$$D_B = \{B \in \mathbb{R} \mid 10.000 \leq B \leq 450.000\} \qquad (7\text{-}1)$$

Formula 7-1: Domain of the land value *B* (own presentation)

The following picture results from considering the statistical distribution of the land value *B* for commercial construction areas in mediocre locations and from presenting it graphically:

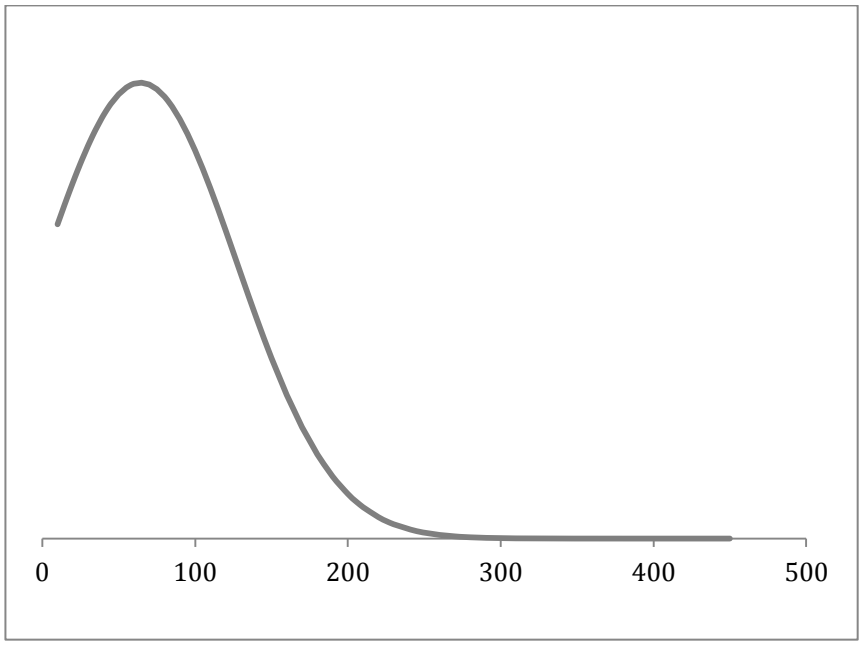

Image 4: Statistical distribution of the land value B – interpolated (own presentation)

The image above presents the normal distribution shifted to the left side. After considering the fluctuation margin of the land value *B* for commercial construction areas in mediocre locations (appendix A) it can be ascertained that the amount of construction areas with lower values is much higher than the amount of construction areas with higher values. Thus the probability of high value construction areas occurring is much lower than lower value construction areas occurring. This also explains why the curve shown above is shifted to the left. Nevertheless it seems that the values of the commercial construction areas are distributed relatively normal. The mean as well as the standard deviation of the data for commercial construction area in medium locations is as follows:

Mean: 64,302799

Standard deviation: 62,9554745

Building value G

The revenue volume of properties with constructions can also be found in the real estate market report of the expert commissions 2012 so that the building value (separated from the land value) can be concluded.

$$D_G = \{ G \in \mathbb{R} \mid 38.000 \leq G \leq 2.272.000 \} \qquad (7\text{-}2)$$

Formula 7-2: Domain of the building value *G* (own presentation)

Land return rate z

Since the land return rate is closely connected to the ground rent and is defined as the property interest rate minus the share of the return that does not refer to the land but to the constructed buildings, the land return rate can be calculated by subtracting a disagio from the property interest rate. Property interest rates are also published in the real estate market reports of the expert commissions.

$$D_z = \{ z \in \mathbb{R} \mid 1{,}11 \leq z \leq 2{,}76 \} \qquad (7\text{-}3)$$

Formula 7-3: Domain of the land return rate *z* (own presentation)

Calculation rate p

In the context of the simulation study described here the calculation rate *p* will be used in the form of the average capital costs. The German Real Estate Magazine regularly publishes debt capital rates of chosen institutes, which shall be the basis for calculating *p*. Here initially an

equity capital return demand of 10 % to 15 % and a financing structure between 10 % and 40 % equity capital is assumed. In addition to this the cost rate of debt capital is primarily influenced by the economic *useful life T*, which will be described in the following. This influence also flows into the quantification of the *calculation rate p.*

$$D_p = \{ p \in \mathbb{R} \mid 2{,}52 \leq p \leq 8{,}56 \} \qquad (7\text{-}4)$$

Formula 7-4: Domain of the calculation rate *p* (own presentation)

Economic useful life T

The economic useful life is oriented on the boundary and medium values of customary rental agreements in the commercial branch. The range reaches from one year in the logistics real estate branch up until 20 years in the office real estate area. A detailed analysis of the terms of 50.000 rental agreements can be found in the IPD German Annual Lease Review 2012.

$$D_T = \{ T \in \mathbb{R} \mid 1 \leq T \leq 20 \} \qquad (7\text{-}5)$$

Formula 7-5: Domain of the economic useful life *T* (own presentation)

7.2 Conducting the mathematical analysis

The following calculation example will be the foundation for the following mathematical analysis of a direct real estate investment in combination with empirical values.

Land	B	=	120667,00	€
Building	G	=	195213,00	€
Calculation rate	p	=	6,50	%/a
Land return rate	z	=	2,50	%/a
Economic useful life	T	=	14	a

Table 1: Calculation example(own depiction)

In the main-dissertation the mathematical analysis was conducted as described above: In a first step the model was presented in a three-dimensional space depending on two different input variables respectively. Afterwards the partial derivations of the independent variables were formed and visualized over the domain of the respective variable. In conclusion a simulation study was conducted, which, based on empirical values, simulated the input factors of these values. Based on the simulated values empirical correlations between the simulated data

of the input variables and the therefrom resulting Asset Rate of Return *ARR* could be calculated in order to evaluate the intensity and the direction of the connections.
In conclusion non-parametric Spearman correlations between the simulated values of the independent input variables and the respectively resulting Asset Rate of Return *ARR* were calculated.

Variable	***z***	***p***	***B***	***G***	***T***
ARR	0,011	0,304	0,617	-0,641	0,003

Table 2: Spearman correlations between *ARR* and the input factors (own depiction)

Here it can be clearly seen that *G*, *B (*which in turn determines *z)* and *p* are the determining input variables for the Asset Rate of Return *ARR*. In the present simulation the effect of *T* is comparably low or rather zero. Here it must be considered that the simulated values are based on the calculation example.

7.3 Discussion of the mathematical analyses and the hypotheses

Hypothesis 1
The land has an independent value, which has a direct influence on the investment evaluation of a piece of real estate and must therefore be definitely included in the evaluation of a real estate investment. So when the land return rate increases the Asset Rate of Return ARR also increases.

A simple positive effect on *ARR* is produced by the combination of *p* and *z*. Thus initially hypothesis 1 can be confirmed. The consideration is substantiated by the analysis of the partial derivation. Here there is an almost steady marginal effect of *z* on *ARR*. Thus the observed marginal effect can be described as being consistent and can be expressed by the partial derivation itself:

$$b / (b+g). \qquad (7\text{-}6)$$

Formula 7-6: Marginal effect of *z* on *ARR*

It can be seen that the effect of *z* on *ARR* does not depend on *z* itself but only on *B* and *G*. This means that in the end *z* is caused by *B*. Thus *z* can be described as the factor that determines the strength of the constant influence of the land value *B* on the Asset Rate of Return *ARR*. This is confirmed by the low correlation of *z* and *ARR* as well as the high correlation of *B* and *ARR* .

Hypothesis 2

The calculation rate p forms the costs for debt capital as well as the return demand of the equity capital provider. Thus it expresses the minimum return of the invested equity capital. The higher the calculation rate p is, the higher the Asset Rate of Return ARR must be in order to cover the costs and to earn the surplus.

A positive linear effect of *p* in combination with *z* could be found. The marginal effect of *p* on *ARR* is degressively negative. This means that an increasing *p* has a negative marginal effect on *ARR*, which decreases when *p* increases continuously (develops degressively). The Spearman correlation between *p* and *ARR*, which was calculated is 0,0304, which means that *ARR* is significantly determined by *p*. It shows that *p*, with its function as balanced capital costs, significantly determines the return demand toward a real estate investment. The higher *p* is, the higher *ARR* must be. This requirement originates from the necessity to cover costs and earn surplus. Thus from the cost perspective there is a positive connection between *p* and *ARR*. From the perspective of returns an increasing *p* influences the return of a real estate investment negatively in the scope of the ADAM. This is expressed by the marginal effect (partial derivation) of *p* on *ARR*. Thus hypothesis 2 can be confirmed.

Hypothesis 3

The influence of the land return rate z on the Asset Rate of Return ARR is smaller than the influence of the calculation rate p on the Asset Rate of Return ARR.

Initially the analysis of the influence of *p* and *z* shows a simple linear connection. However, when analyzing the marginal effect on *ARR* over the partial derivation of *p* and *z* the conlusion must be different. The calculation rate *p* has a decreasing negative marginal effect on *ARR*. The land return rate *z* however, has a constant marginal effect on r_E *(ARR)*. The non-parametric Spearman correlation with *ARR* is 0,011 for *z* and 0,304 for *p*. Thus it can be assumed that hypothesis 3 is also correct in the scope of the ADAM.

8 Practical implementation of the Model

In the following two examples from practice will be analyzed in an investment-related manner using the ADAM. The respective market-value evaluations, (Willers, 2013), form the basis for this analysis.

Practical example

The practical example is a factory building with offices.

The property has a size of 1.551 m^2 as well as a building space of 590,15 m^2. This corresponds to a land value *B* of 69.795 € as well as a building value *G* of 184.205 €.

In the case of the practical example economic useful lifes *T* of 14 years are assumed. The calculation rate *p* will be 3,35 %. This corresponds to a borrowed capital interest rate of 1,69 % as well as a return demand of 10 % on the own capital. The financing structure in this case will be 80 % borrowed capital as well as 20 % own capital (appendix B). The land return rate *z* will be 2 %, 5 % and 9 %.

Therefore the property has the following relevant data:

B : 69.795 € *G* : 184.205 € *T :* 14 years *p* : 3,35 %

E_t-A_t : 19.139,44 €

z_1 2%

z_2 5%

z_3 9%

Evaluation of the investment with z_1 = 2 %, the owner of the land as well as the building is a natural or legal person

Land	*B*	=	69.795,00	€
Building	*G*	=	184.205,00	€
Calculation rate	*p*	=	3,35	%/a
Land return rate	z_1	=	2,00	%/a
Economic useful life	*T*	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	20.535,34	€/a
Cash surplus	*Z*	=	211.131,56	€
Asset Rate of Return (*ARR*)	*ARR*	=	8,08478	%/a

Table 3: Evaluation of the investment with z_1, unified ownership (own depiction)

Evaluation of the investment with z_2 = 5 %, the owner of the land as well as the building is a natural or legal person

Land	*B*	=	69.795,00	€
Building	*G*	=	184.205,00	€
Calculation rate	*p*	=	3,35	%/a
Land return rate	z_2	=	5,00	%/a
Economic useful life	*T*	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	22.629,19	€/a
Cash surplus	*Z*	=	211.131,56	€
Asset Rate of Return (*ARR*)	*ARR*	=	8,90913	%/a

Table 4: Evaluation of the investment with z_2, unified ownership (own depiction)

Evaluation of the investment with z_3 =9 %, the owner of the land as well as the building is a natural or legal person

Land	*B*	=	69.795,00	€
Building	*G*	=	184.205,00	€
Calculation rate	*p*	=	3,35	%/a
Land return rate	z_3	=	9,00	%/a
Economic useful life	*T*	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	25.420,99	€/a
Cash surplus	*Z*	=	211.131,56	€
Asset Rate of Return (*ARR*)	*ARR*	=	10,00826	%/a

Table 5: Evaluation of the investment with z_3, unified ownership (own depiction)

As can be seen from the investment-related evaluation of the practical example 1 *ARR* rises with the increase of *z*. Thus the land return rate *z* is paid to the owner of the real estate and increases his *ARR* as well as his *ARG*. Even though *z* has no liquid influence unlike *p* it does influence *ARR* and *ARG* notionally. If one assumes that *B* and *G* have different owners then *z* would be paid to the owner of *B*. In this case a liquid influence would be created on the cost side. This means that *z* must be a monetary part of *Et-At* and that the costs for *z* must be covered by *Et-At)*. These costs are not paid to the owner of the building in a liquid manner but increase his notional *ARR* on the basis of the return of the land.

Evaluation of the investment with z_1 = 2 %, the owners of the land as well as the building are different natural or legal persons

The amount that must be paid for the land value return z_1 is 1.395,90 € p.a.. Thus E_t- A_t amounts to 17.743,54 € p.a.

Land	B	=	69.795,00	€
Building	G	=	184.205,00	€
Calculation rate	p	=	3,35	%/a
Land return rate	z_1	=	2,00	%/a
Economic useful life	T	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (ARG)	ARG	=	19.139,44	€/a
Cash surplus	Z	=	195.733,07	€
Asset Rate of Return (ARR)	ARR	=	7,53521	%/a

Table 6: Evaluation of the investment with z_1, seperated ownership, no arbitrage (own depiction)

Evaluation of the investment with z_2 = 5 %, the owners of the land as well as the building are different natural or legal persons

The amount that must be paid for the land value return z_2 is 3.489,75 € p.a.. Thus E_t- A_t amounts to 15.649,57 € p.a.

Land	B	=	69.795,00	€
Building	G	=	184.205,00	€
Calculation rate	p	=	3,35	%/a
Land return rate	z_2	=	5,00	%/a
Economic useful life	T	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (ARG)	ARG	=	19.139,44	€/a
Cash surplus	Z	=	172.635,33	€
Asset Rate of Return (ARR)	ARR	=	7,53521	%/a

Table 7: Evaluation of the investment with z_2, seperated ownership, no arbitrage (own depiction)

Evaluation of the investment with z_3= 9 %, the owners of the land as well as the building are different natural or legal persons

The amount that must be paid for the land value return z_3 is 6.281,55 € p.a.. Thus E_t- A_t amounts to 12.857,77 € p.a.

Land	B	=	69.795,00	€
Building	G	=	184.205,00	€
Calculation rate	p	=	3,35	%/a
Land return rate	z_3	=	9,00	%/a
Economic useful life	T	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	19.139,44	€/a
Cash surplus	Z	=	141.850,58	€
Asset Rate of Return (*ARR*)	*ARR*	=	7,53521	%/a

Table 8: Evaluation of the investment with z_3, seperated ownership, no arbitrage (own depiction)

As can be seen, *ARR* remains unchanged with a deviating z and when the owners of the land and the building are different. The basis for this is the amount, which is caused by z and is paid to the owner of the building notionally and must be transferred by him to the owner of the land directly. This scenario requires that no arbitrage profits can be achieved. If, however, it is possible to make a notionally higher z than the amount, which must be paid to the owner of the land then a different scenarios develops.

Evaluation of the investment with z = 9 %, the owners of the land as well as the building are different natural or legal persons, arbitrage = 1 %.

The payable amount for land value return z is 6.281,55 € p.a.. With an arbitrage possibility of 1 % E_t- A_t amounts to13.557,84 € p.a..

Land	B	=	69.795,00	€
Building	G	=	184.205,00	€
Calculation rate	p	=	3,35	%/a
Land return rate	z	=	9,00	%/a
Economic useful life	T	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	19.838,55	€/a
Cash surplus	Z	=	149.550,38	€
Asset Rate of Return (*ARR*)	*ARR*	=	7,81045	%/a

Table 9: Evaluation of the investment with z, seperated ownership, arbitrage 1% (own depiction)

Evaluation of the investment with z = 9 %, the owners of the land as well as the building are different natural or legal persons, arbitrage = 3 %.

The payable amount for the land value return *z* is 6.281,55 € p.a.. With an arbitrage possibility of 3 % E_t- A_t amounts to 14.951,74 € p.a..

Land	*B*	=	69.795,00	€
Building	*G*	=	184.205,00	€
Calculation rate	*p*	=	3,35	%/a
Land return rate	*z*	=	9,00	%/a
Economic useful life	*T*	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	21.233,29	€/a
Cash surplus	*Z*	=	164.936,08	€
Asset Rate of Return (*ARR*)	*ARR*	=	8,35956	%/a

Table 10: Evaluation of the investment with z, seperated ownership, arbitrage 3% (own depiction)

Evaluation of the investment with z = 9 %, the owners of the land as well as the building are different natural or legal persons, arbitrage = 5 %.

The payable amount for the land value return *z* is 6.281,55 € p.a.. With an arbitrage possibility of 5 % E_t- A_t amounts to 16.347,64 € p.a..

Land	*B*	=	69.795,00	€
Building	*G*	=	184.205,00	€
Calculation rate	*p*	=	3,35	%/a
Land return rate	*z*	=	9,00	%/a
Economic useful life	*T*	=	14	a
Purchase price	A_0	=	254.000,00	€
Asset Rent Generation (*ARG*)	*ARG*	=	22.629,19	€/a
Cash surplus	*Z*	=	180.334,57	€
Asset Rate of Return (*ARR*)	*ARR*	=	8,950913	%/a

Table 11:Evaluation of the investment with z, seperated ownership, arbitrage 5% (own depiction)

9 Conclusion and implications for practice

The methodology for real estate investment analysis presented here (ADAM) is a further development of known methods for real estate evaluation and for real estate investment calculations. Pieces of real estate are goods with special characteristics (heterogeniety, no possibility of duplication, location fixation, etc.). Thus the offer is "immobile and unelastic", which means that the demand on real estate markets must fulfill this function. Real estate markets (for direct real estate investments) are strongly segmented and locally oriented markets. Due to location, the type of real estate, the type of usage etc. many sub markets exist. Therefore it can be concluded that real estate and real estate markets differ strongly from the assumptions of the neo-classic microeconomy, which assumes homogenous goods and perfect markets. The German gross rental method abstracts these special characteristics by including regional specific parameters such as the property interest rate or the land value. Thus, in order to establish an investment model that does the economic good real estate justice, it is inevitable to take the approaches for value determination into account. However the gross rental method does not consider the increasing internationalization of real estate market as well as the increasing interlinking of the piece of real estate with the international capital markets. The DCF approach embodies a capital market oriented approach but it does not consider the special characeristics of the economic good real estate as well as the eternal interest payments or rather putting the land value up for rent. The previous statements justify the establishment of a complex model for the evaluation of direct real estate investments such as the here presented ADAM. As was already mentioned the ADAM can, in light of the different ownership regulations for real estate within the EU, e.g. the separataion of ownership of the land and the building (Handbuch Immobilienrecht in Europa, 2004), according to the „EU-guideline 2004/39/EC on markets in financial instruments", contribute to the aspired harmonization and increase of the transparency of European real estate and capital markets. Due to its general applicability the model can be applied in individual practical cases and thus supplies results relevant for practice.

The evaluated practical examples show, that a piece of real estate achieves a different investment result, when the land return rate z is considered (in the case that the owner of the land and the building is one and the same person), than when the land value or rather the land return rate is not considered. Especially the possibility (with the separation of ownership of land and building) of achieving potential arbitrage profits on the basis of the land return rate z could present an interesting method for evaluating real estate investments in the course of the imminent ownership consolidation in the Czech Republic starting in 2014 (Hrncir, 2012).

Due to the conducted mathematical analysis the calculation rate p (which reflects the capital market side) as well as the land value B or rather the land return rate z (which originate from the classic real estate evaluation or rather the objective market value determination) were determined to be the most important influence factors for the evaluation of a direct real estate investment in the scope of the model presented here. Therefore the derivation of the model from evaluation-, finance mathematical- as well as investment theoretical literature was found to be appropriate. For the evaluation practice of real estate investments it can be concluded that the value of the land and the therefrom-resulting partial return must be taken into account for the complete evaluation of a real estate investment. Of course the rental agreement is also the decisive influence factor for the return of a real estate investment in the scope of the AD-AM. However, in order to be able to make a complete statement it has been shown that the value of the land must not be ignored.

Thus the value increase of the land presents a significant value that must be taken into account in an investive analysis of a real estate investment.

With this the connection of capital market oriented and micro economical oriented evaluation or rather investment evaluation was successfully conducted. With exactly this connection (microeconomic and capital market oriented) the special asset “real estate” can be completely, investively evaluated.

In summary there are several new implications that are introduced by the model:

- The model is suitable for analyzing investments in real estate in a complex manner
- The model is also suitable for analyzing investments in real estate with separated ownership e.g. in the Czech Republic
- For this, the model can help to harmonize investment evaluation with unified and separated ownership in several countries and the European Union as described above
- The model enables comparisons
- The model considers land return, which is essential when it comes to real estate and investing in real estate
- In summary the model is a further development of Real Estate Investment Evaluation as mentioned several times.

There are several natural and legal persons who could be interested in the described model, such as:

- Private Investors in several countries (e.g. the Czech Republic) and the EU
- Institutional Investors in several countries (e.g. the Czech Republic) and the EU
- Owners of real estate in several countries (e.g. the Czech Republic) and the EU

- Independent public organizations in several countries (e.g. the Czech Republic) and the European Union

Due to the increased complexity the possible correlations between the input variables were not considered in the conducted mathematical analysis. For further research it would be possible to include the correlations between the input variables in the consideration and analysis. In order to improve the analytical results the quantity and the direction of the correlations of the input variables should be determined. Since this would present a considerable empirical research effort of high complexity it could be the object of further scientific work.

Summarized the possible further scientific work could embrace the following:

- Consideration of correlations of input variables in order to improve analytical results
- Analysis of relation of input variables before they enter the model
- Analysis of the relation of correlations of input variables to correlations of output variables.

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Prof. Dr. rer. oec. habil. Volker Oppitz; Status: June 20, 2011

Microsoft-Excel – spreadsheet analysis

Wolfram Research Mathematica Version 9.0 – Software for mathematical application

11 Appendix

11.1 List of Publications

Student: Dipl.-Kfm. Carsten Schäfer

University of Economics, Prague

Faculty of Business Administration, Department of Management

2012

Conferences:

International scientific conference of doctoral students of the faculty of management of university of economics, Bratislava – Economics, finance and management of enterprises VI. 08.11.2012, ISBN 978-80-225-3500-7
Title: *„Supply functions in competitive markets and segmented real estate space markets“*

Journals:

Science Reflector Volume 9, 2012, International Tenerife College, Los Cristianos, Zurich,
ISSN 1664-9664
peer-reviewed
Title:
„Asset Dividing Appraisal Model (ADAM) – Investitionsbewertung bei Immobiliendirektanlagen“ ,
page 253-278

2013

Conferences:

IMEA Conference 2013, University of Pardubice, Faculty of Economics and Administration, 26.-27.9.2013, ISBN 978-80-7395-696-7
Title: *„A Simulation Study of Approaching Direct Real Estate Investment“*

International scientific conference of doctoral students of the faculty of management of university of economics, Bratislava – Economics, finance and management of enterprises VII. 14.11.2013, ISBN 978-80-225-3651-6
Title: *„Quantitative instruments in real estate investment valuation methodology“*

Journals:

Science Reflector Volume 10, 2013, Eastern Institute for Integrated Learning in Management University, Los Cristianos, Zurich,
ISSN 1664-9664
peer-reviewed
Title:
„Immobilienökonomie und Bewertungsmethodologie" , page 103-140

Human Resource Management Research Volume 3, Number 3, 2013, Rosemead, California, USA, p-ISSN 2169-9607, e-ISSN 2169-9666, http://journal.sapub.org/hrmr , peer-reviewed
Title:
„How Individual Beliefs Impact Individual Performance", page 71-81

International Journal of Banking Policy and Finance Volume 1, Number 3, 2013, New York, USA, e-ISSN TBD (requested at the USA ISSN-Office), http://www.scitecpub.com/International%20Journal%20of%20Banking%20Policy%20and%20Finance/Current%20Issues.php,
peer-reviewed
Title:
„Mathematical Analysis of Modeled Direct Real Estate Investment", page 14-28

June 2014

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Carsten Schäfer Date

11.2 Curriculum Vitae

Personal Data	
Name	Carsten Schäfer
Adress	Alpenstr. 10 36119 Neuhof / Germany
Email	mail@carsten-schaefer.com
Date of Birth	October 7th 1982
Place of Birth	Fulda, Germany
School Education	
1999 - 2002	University-Entrance Diploma at Richard-Müller-School, Fulda
Professional Education	
2004- 2005	Business Informatics University of Mannheim, Germany
2005 - 2010	Business and Economics (Goethe-) University of Frankfurt, Germany Academic Degree: Diplom-Kaufmann
2011 - 2014	Ph.D.-Program – Business Economics and Management University of Economics Prague, Czech Republic
Professional Experience	
2000 - 2007	Stockholder of "Willi Schäfer GmbH & Co. Bedachungs-fachhandel KG" *Wholesaling of construction materials (especially for roofing); 14 Branches in Germany*
2011 - 2012	Private Real Estate Development *Conceptual Design, project planning, marketing and construction management of an inner city commercial building; 2900 m^2 floor space*
2012 - 2014	KAIRONOS Invest AG c/o Sal. Oppenheim jr. & Cie AG & Co. KGaA, Cologne/Krefeld *Structuring and management of real estate developments from an equity-partner perspective, financial-modelling, evaluation of economic efficiency, negotiation with devel-*

	opers, banks and private and institutional investors
2014	immero immobilien holding GmbH Founder and managing partner *Investment in inner city retail real estate* *Development of inner city retail real estate* *(Site-Acquisition, Business and Technical Management, Financing, Negotiation of Lease Agreements, Investment and Cost Evaluation, Tax- and Legal Structuring of Investments)*
Language skills	English (fluently) Spanish (Level A2/B1)
Memberships	Schools for Burkina Faso e.V. Society of Property Researchers e.V. Private Real Estate Investors Club Germany/Austria/Switzerland German Council of Shopping Centers
Further Interests	Economy, Biographies of thrilling personalities, Music, Sports, Golf

June 2014

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Carsten Schäfer Date