DISCOUNT RATE WHEN USING METHODS BASED ON DISCOUNTED CASH FLOW FOR THE PURPOSE OF REAL ESTATE INVESTMENT ANALYSIS AND VALUATION

DISKONTNA MERA PRI UPORABI METOD, KI TEMELJIJO NA DISKONTIRANEM DENARNEM TOKU ZA POTREBE ANALIZE NEPREMIČNINSKIH INVESTICIJ IN VREDNOTENJA NEPREMIČNIN

Igor Pšunder, Andreja Cirman

UDK: 332.64:657.92

Klasifikacija prispevka po COBISS-u: 1.02

ABSTRACT

During the last few decades there has been an increase in the use of methods of real estate investment and other investment analyses based on discounted cash flow. Despite the relatively wide use of discounted cash flow methods, project managers believe their own knowledge of these methods is insufficient even to the extent where this could lead to incorrect decisions (e.g. conflicting indications of the net present value method and the internal rate of return method). One of major drawbacks in the use of investment analysis methods that are based on discounted cash flow is unsatisfactory precision in the determination of the discount or the capitalization rate.

Methods based on discounted cash flow are not only intended for project feasibility analysis; discounted cash flow serves as a basis for assessing special real estate within the mass real estate appraisal system in Slovenia.

The article studies the importance of the discount rate when analysing and assessing real estate projects. The theoretical part presents the basis of discounted cash flow methods and composition of the discount rate or capitalisation rate and presents a simulation of the impact of the discount rate and capitalisation rate on investment evaluation and assessment results.

The empirical part is based on a survey conducted among certified real estate appraisers in Slovenia. The survey was conducted in the second half of February and beginning of March 2011. The response rate was 32.9 percent, indicating that almost one-third of all certified appraisers in Slovenia participated. Survey

IZVLEČEK

Uporaba metod analize nepremičninskih in drugih naložb, ki temeljijo na diskontiranju denarnega toka, se je uveljavila šele v zadnjih nekaj desetletjih. Kljub relativno veliki razširjenosti metod, ki temeljijo na diskontiranju denarnega toka, projektni vodje po lastnem mnenju ne poznajo dovolj posebnosti metod, celo takšnih ne, ki bi lahko privedle do napačnih odločitev (npr. navzkrižne indikacije metode neto sedanje vrednosti in notranje donosnosti). Ena ključnih pomanjkljivosti uporabe metod analize naložb, ki temeljijo na diskontiranju denarnega toka, pa je ne dovolj natančno določena diskontna mera oziroma mera kapitalizacije.

Metode, ki temeljijo na diskontiranju denarnega toka, niso namenjene zgolj analizi ekonomske upravičenosti projektov, temveč je na diskontiranem denarnem toku zasnovano tudi vrednotenje posebnih nepremičnin v sistemu množičnega vrednotenja nepremičnin v Sloveniji.

V tem članku je obravnavan pomen diskontne mere za analizo in vrednotenje nepremičninskih projektov. V teoretičnem delu so predstavljene zasnova metod, ki temeljijo na diskontiranem denarnem toku, sestava diskontne mere in mere kapitalizacije ter simulacija vpliva diskontne mere oziroma mere kapitalizacije na rezultate evalvacije in vrednotenja.

Empirični del sloni na anketi med pooblaščenimi ocenjevalci vrednosti nepremičnin pri nas. Anketa je bila izvedena v februarju in marcu 2011 med pooblaščenimi ocenjevalci vrednosti nepremičnin, v njej je sodelovalo 32,9 % vseh pooblaščenih

data were statistically analysed and the results provide us with the discount rate and calculated risk premium and capital recovery premium for various type of real estate. A statistical analysis of the survey data provides insights into the risk premium and capital recovery premium used for real estate appraisal and investment purposes.

ocenjevalcev vrednosti nepremičnin v Sloveniji. Odgovori so statistično obdelani, iz rezultatov pa so pridobljeni podatki za diskontno mero za različne vrste nepremičnin ter izračunane premije za tveganja ter premije za ohranitev kapitala pri različnih vrstah nepremičnin.

KEY WORDS

discount rate, capitalisation rate, risk premium, capital recovery premium, net present value, real estate investment analysis, special real estate appraisal

KLJUČNE BESEDE

diskontna mera, mera kapitalizacije, premija za tveganja, premija za ohranitev kapitala, neto sedanja vrednost, analiza nepremičninskih naložb

1 INTRODUCTION

Discounted cash flow methods (DCF) have only gained recognition in the last 50 years. Research shows that in large companies in the United States of America their use in projects dealing with expansion in new operations increased from 41 percent in 1970 to 58 percent in 1975 and 71 percent by 1980 (Klammer and Walker, 1984). Similar growth in the use of discounted cash flow methods has been recorded in Great Britain. In 1986 large companies based 84 percent of their investment decisions on either the net present value method (NPV) or the internal rate of return method (Pike, 1988).

Research carried out by Pšunder and Ferlan (2008) among project managers in 44 Slovenian companies shows that the use of discounted cash flow methods depends on the managers' field of education. Among project managers who have an education in civil engineering, only 50 percent use the net present value method and 66.7 percent the internal rate of return. This result is interesting for comparison purposes: the net present value method is used by 70.6 percent of project managers who received their education in other technical fields and by 87.5 percent of project managers who have a non-technical education. The internal rate of return method is used by 60 percent of project managers who have been educated in other technical fields and by 81.3 percent of project managers with a non-technical education.

The rapid spread of discounted cash flow methods is certainly connected to the development of computers and software since functions for calculating net present value and internal rate of return come as standard in financial calculators and electronic spreadsheets. Yet this common use also leads to insufficient knowledge about specific characteristics of the methods. Research shows that, in their own opinion, only 50 percent of project managers with a civil engineering education are familiar with the indication of a conflict between the net present value method and internal rate of return. The same share of managers is familiar with a multiple internal rate of return. It also needs to be stressed that project managers who have an education in technical fields outside civil engineering are even less acquainted with the specifics of the abovementioned methods (29.4 percent are familiar with the indication of a conflict between the two methods, and 35.3 percent know about the multiple internal rate of return). The same applies to project managers who have a non-technical education, where only 43.8 percent are familiar with the

indication of a conflict between the two methods, and 18.8 percent know about a multiple internal rate of return (Pšunder and Ferlan, 2008).

The common spread of discounted cash flow methods is not only restricted to real estate investment analysis, but is also commonly used to assess investments and investment projects in other fields, for example for feasibility studies when acquiring machinery and equipment. Discounted cash flow methods are also used for business valuation and the valuation of other income-generating assets. With a multi-period real estate analysis, the discounted cash flow method also serves as a basis for real estate appraisals within the mass appraisal system in Slovenia. The Mass Real Estate Valuation Office (*Urad za množično vrednotenje nepremičnin*) employs the direct capitalisation method and the discounted cash flow method (Suhadolc, 2009). Both methods are closely connected to the net present value method and therefore the results and conclusions of this article also apply to these two methods, especially to the use of an appropriate discount rate.

Over the last few decades, the utilisation of discounted cash flow methods has also been spreading due to the wider use of the life cycle costing concept in Life Cycle Cost Analysis (LCCA). LCCA is a method for assessing all costs connected to ownership of a facility (e.g., a building) and it takes all costs of acquiring, owning and disposing of a building or building system into account (Fuller, 2009).

2. THE PRESENT VALUE OF FUTURE CASH FLOWS

Discounted cash flow methods are based on the conversion of future cash flows to their value at the time of an initial investment. This process is known as discounting. With the net present value method, the initial investment is compared to the present value of future cash flows associated with the investment project. The time of the initial investment is the point at which the present values of future cash flows are discounted; for this reason, the initial investment is not subject to discounting. The initial investment carries a negative sign since it is an outflow of

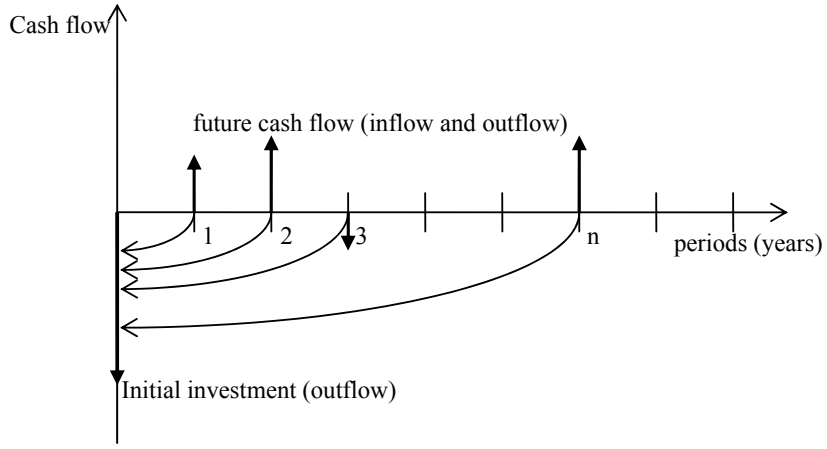

Figure 1: Discounting future cash flows to the time of the initial investment

cash. Future cash flows are discounted to the time of the initial investment. Since we expect them to be an inflow of cash they carry a positive sign. Nevertheless, there may be some exceptions, for example in the case of huge investments in a building restoration or in parts of buildings for which present values are calculated. Figure 1 presents the points illustrated above.

Ling and Archer (2008) emphasise that it is necessary to also take account of the cash flow from the sale of a property and not only the periodic investment inflows of cash. In such cases, it is important to include in the last projected cash flow any potential (marketable) residual value of an investment. The latter usually appears as a positive cash flow, but in some cases it can also be a negative one; for example, if we are dealing with the removal of a completely derelict property or of a property with a very low value, then the cash outflows for the removal are greater than the inflows from the liquidated property.

This process is shown in the following equation:

$$NPV = -I_0 + PV; \tag{1}$$

where NPV stands for the net present value, I_0 stands for the initial investment and PV for the present value of future cash flows. The present value of future cash flows can be recapitulated according to Damodaran (1996). So the equation for calculating the net present value takes the following form:

$$NPV = -I_0 + \sum_{i=1}^{n} \frac{CF_i}{(1+r)^i}, \tag{2}$$

where CF_i is the cash flow in period i, n is the number of periods and r is the discount rate.

2.1 Significance of the discount rate

The key factor in estimating the present value of future cash flows is the discount rate. If it were 0, equation 2 would be reduced merely to the addition and subtraction of cash flows during different periods, without considering the time value of money. The discount rate determines »the cost of funds« (to be precise, the required rate of return) which an investor demands for a certain investment in accordance with the risk associated with the investment and it has a profound impact on the net present value. A higher discount rate results in a reduction of the net present value, whereas a lower one results in its increase, an effect that is evident in Figure 2.

Along with an increase in the discount rate, the net present value decreases. When it reaches 0, the discount rate is equal to the internal rate of return (IRR). In this case, the equation takes the following form:

$$0 = -I_0 + \sum_{i=1}^{n} \frac{CF_i}{(1+IRR)^i}. \tag{3}$$

The denotations used in equation 3 are explained above.

The internal rate of return is otherwise more difficult to calculate than the net present value. Despite its drawbacks, it is frequently used since the calculated value is easier to understand than the interpretation of the result with the net present value.

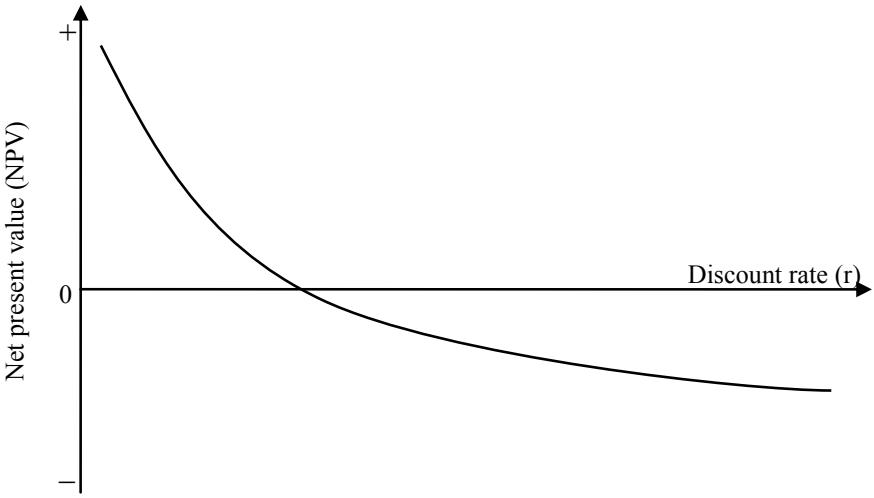

Figure 2: Influence of the discount rate on the net present value

2.2 Structure of the discount rate

The discount rate is the rate at which future cash flows are converted into their present value. The discount factor used in this process must reflect the total required return on the investment position – both income and capital appreciation – as well as the degree of risk associated with the investment (Riggs, 1996). A frequent practice in the analysis of real estate investments is a practices-based determination of the discount rate or the determination of the discount rate according to reference data. Thus, in analyses of the improvement of spatial data infrastructure Cetl, Rioć and Mastelić Ivić (2008) adopt the rate of the central (national) bank as a discount rate. To establish the optimal thickness of thermal insulation layers in flat roofs, Kunič and Krainer (2010) use a discount rate of 5 percent. Contrary to stated discount rates, the discount rate in the field of public finance is defined at 7 percent (Decree on uniform methodology for the preparation and treatment of investment documentation in the field of public finance/ *Uredba o enotni metodologiji za pripravo in obravnavo investicijske dokumentacije na področju javnih financ*, 2006). The differences between the abovementioned discount rates would lead to significantly different results when used to evaluate the same investments. How significant the impact of the discount rate can be on investment analyses is shown in the empirical part of this article.

The contemporary theory of the determination of the discount rate favours a more precise definition of the discount rate, mainly on account of its risk dependence. When wasting (depreciating) assets are assessed, the capital recovery premium must also be taken into account. Friedman and Ordway (1989) state that "in real estate appraisal and investment terminology, a capitalisation rate is defined as being composed of a return on and a recovery of investment; whereas in finance and economic terminology, a capitalisation rate is defined as simply a rate of return on investment". Thus, the discount rate does not include capital recovery and so it can only be used for assessing an investment where we do not expect changes in the value of the investment, or where we can expect that changes in the value of the investment will be considered

when selling property or at the termination of the investment (adopted from Friedman and Ordway, 1989, and The Appraisal of Real Estate, 1996). Therefore, in the case of assessing wasting assets and where this wasting cannot be accounted for in the equation (e.g. by a real estate appraisal with direct capitalisation, or in a going-concern investment appraisal), these characteristics should be included in the capitalisation rate.

The listed constituent parts can be divided into three categories: the risk-free rate of return, an additional allowance for associated risks, and – in the case of investments subject to depreciation and which cannot be expressed in the cash flow– in an allowance for replacement of the reduction in the value of an asset, which is often described as a premium for the capital recovery. The above is shown in Figure 3.

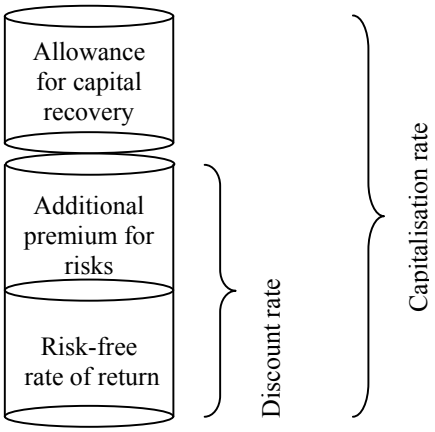

Figure 3: Structure of the discount rate: required rate of return and premium for capital recovery

By definition, the discount rate represents the rate of return that can be obtained in the financial market for a similar investment with comparable risk. What rate of return will be required for a certain investment depends on the risk associated with the specific investment and on the rate of return on investments with a comparable risk (Mramor, 1993). Bruggeman and Fisher (2002) illustrate the trade-off between the expected return relative to risk for different asset classes with the following diagram (Figure 4).

An additional premium for risks (which also includes an extra allowance for reduced liquidity and investment management) and the capital recovery premium can only be abandoned in the case of an investment in risk-free securities, whereas in the area of real estate investments risk-free investments are non-existent. Therefore, different risks can be taken into account for different real estate projects, enabling us to also compare two quite different projects. Certainly, real estate investments are mostly subjected to deterioration and obsolescence, which are the reasons an investment loses value in the long run. The loss of value can be included in cash flow from the residual value (the last cash flow in the equation when individual cash flows can be considered; e.g. net present value in real estate analyses).When the loss of value cannot be included in the equation (e.g. in a real estate appraisal with the direct capitalisation method),

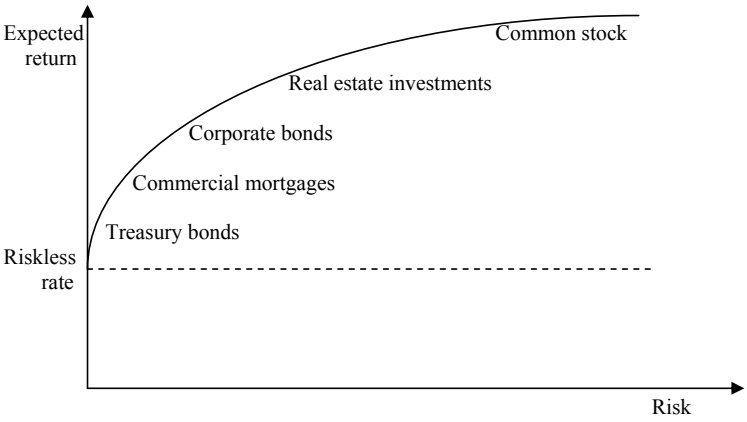

Figure 4: Risk and return trade-off by type of investment (source: Bruggeman & Fisher, 2002)

this loss of value has to be considered by an allowance for the capital recovery.

The risk-free rate of return for construction projects is adapted from the rate of return of government bonds with a similar duration to that of the project. The rate of return of government bonds can be obtained from public Internet portals (e.g. MTS Slovenia Daily Fixing, 2010), or from investment departments of financial institutions. In practice, an additional risk premium is often determined experientially or cited from theoretical references.

The premium for capital recovery in the capitalisation rate can be calculated by three methods: Ring's (straight line) method, Hoskold's (sinking fund) method and Inwood's (compound interest) method. Although use of the latter two methods is easier to justify, not many mistakes are made if Ring's method (straight line method) is applied to determine the capital recovery premium.

Otherwise, the discount rate can be determined with more complex methods such as the Capital Asset Pricing Model (CAPM), the Dividend Growth Model and Arbitrage Pricing Theory (Brigham and Gapenski, 1996).

The discount rate has a significant influence on the result of the present value method; that is why the correct choice of a discount rate is a precondition for an appropriate analysis.

3 ANALYSES OF THE DISCOUNT RATE'S IMPACT: THE NET PRESENT VALUE

The analysis of the impact of the discount rate on projects is carried out using the net present value method. Because this method is founded on a comparison of an initial investment outlay with the present value of future cash flows, and because the initial investment is known, the results of the analysis can also be applied to real estate appraisal methods, even those that will be used for the appraisal of special real estate within the mass real estate appraisal system in Slovenia (Suhadolc, 2009).

In our discount rate simulation we presume that we are dealing with constant annual cash flows of a project (CF). According to this presumption, equation 2 can be used in the following form:

$$NPV = -I_0 + CF \cdot \sum_{i=1}^{n} \frac{1}{(1+r)^i} \cdot \tag{4}$$

The denotations are explained in the previous text.

On the right side of the equation, a geometrical sequence is seen $\sum_{i=1}^{n} \frac{1}{(1+r)^i}$, whose sum can be written at *n* number of articles as $\frac{(1+r)^n - 1}{(1+r)^n \cdot r}$, also called a factor of the present value of future annuities [as in Baum, Mackmin and Nunnington (1998)].

Equation 4 can also be rewritten using the factor of the present value of future annuities.

$$NPV = -I_0 + CF \cdot \frac{(1+r)^n - 1}{(1+r)^n \cdot r} \cdot \tag{5}$$

To allow a better discussion, we will indicate the present value factor as PVIFA (the present value of invested future annuities). Now equation 5 changes into the following form:

$$NPV = -I_0 + CF \cdot PVIFA \tag{6}$$

The present value factor depends on the duration of a project and substantially on the discount rate. Based on equations 5 and 6, we will show the impact of the discount rate on an investment and real estate appraisal in the empirical part of this paper.

3.1 Impact of the discount rate on the present value factor

When a certain project is analysed, the size of the initial investment, expected cash flows and estimated duration of the project are known. The key factor that influences the result of the analysis (or its valuation, if the basis of the calculation is such) is the discount rate. The discount rate is a decisive factor when evaluating whether projects even with the same initial investment, the same expected cash flows or of the same duration are acceptable or not. The impact of the applied discount rate significantly increases with the duration of a project. The impact of the discount rate on the factor of the present value of future annuities with regard to the duration of a project is shown in Figure 5.

The above figure shows that the difference in the discount rate exerts a greater impact on projects with a longer duration, and that the differences are larger when using lower discount rates that result in higher factors of the net present value of constant future cash flows. In the case of an investment with a 20-year depreciation period (shorter investment periods are not common for real estate projects) where the duration of the investment is adapted to the depreciation period, it can be established that the present value of annuities at a 3 percent discount rate totals 14.88, which is over 50 percent greater than at a 9 percent discount rate with a present value factor of 9.13. This is twice the factor of the present value at a 13 percent discount rate. At the same time, this means that in the interval of discount rates between 3 percent and 13 percent large errors can be made in the assessment of the present value of cash flows, which can certainly result in an incorrect decision based on the analysis. Factors of the present value of future annuities using discount rates of 3 percent to 15 percent for selected investment durations are shown in Table 1.

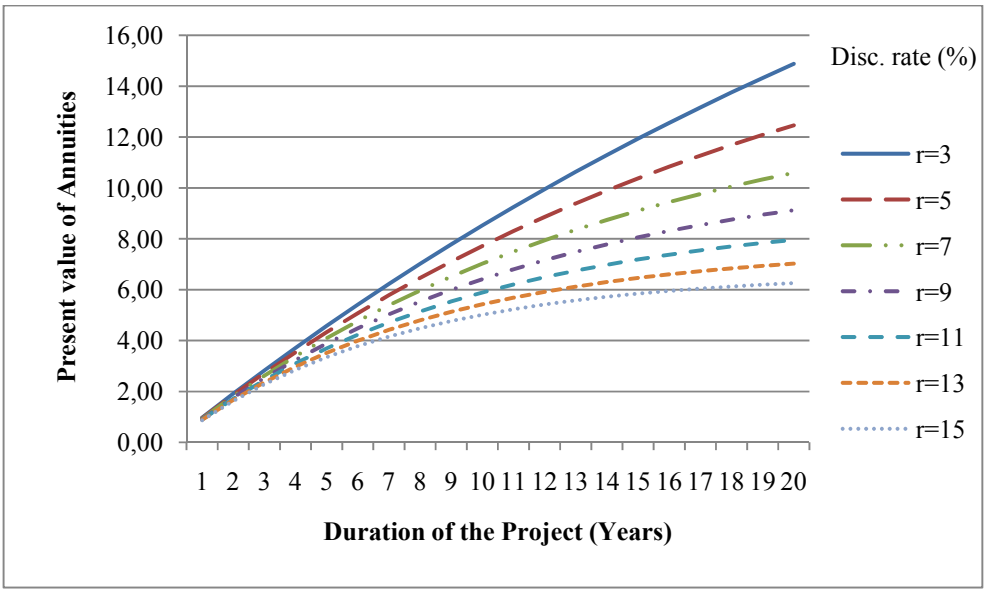

Figure 5: Factor of the present value of future annuities in relation to the discount rate (r) and the duration of a project (n)

Discount	Project duration (years)						
rate (r)	1	3	5	7	10	15	20
3	0.97	2.83	4.58	6.23	8.53	11.94	14.88
4	0.96	2.78	4.45	6.00	8.11	11.12	13.59
5	0.95	2.72	4.33	5.79	7.72	10.38	12.46
6	0.94	2.67	4.21	5.58	7.36	9.71	11.47
7	0.93	2.62	4.10	5.39	7.02	9.11	10.59
8	0.93	2.58	3.99	5.21	6.71	8.56	9.82
9	0.92	2.53	3.89	5.03	6.42	8.06	9.13
10	0.91	2.49	3.79	4.87	6.14	7.61	8.51
11	0.90	2.44	3.70	4.71	5.89	7.19	7.96
12	0.89	2.40	3.60	4.56	5.65	6.81	7.47
13	0.88	2.36	3.52	4.42	5.43	6.46	7.02
14	0.88	2.32	3.43	4.29	5.22	6.14	6.62
15	0.87	2.28	3.35	4.16	5.02	5.85	6.26

Table 1: Factors of the present value of constant cash flow series (future annuities) in relation to the discount rate and the duration of an investment

3.2 The required constant annual cash flow for a feasible investment

As an example, a 20-year investment is taken into consideration. Since the investment is feasible when the NPV is equal to or higher than 0, the constant future cash flow at a discount rate of 3 percent must amount to at least 6.7 percent of the investment on the annual level in order for the analysis to provide a positive indication. Meanwhile, at a 15 percent discount rate, it needs to be twice as high. It can be established that a 20-year investment with the same initial outlay and the same constant annual cash flows in the future (at 7.4 percent of an investment on an annual basis) is no longer feasible at a 5 percent discount rate. The annual cash flows that are necessary for the approval of an investment with the chosen duration of a project and discount rates between 3 percent and 15 percent are presented in Table 2.

Discount	Project duration (years)						
rate (r)	1	3	5	7	10	15	20
3	1.030	0.354	0.218	0.161	0.117	0.084	0.067
4	1.040	0.360	0.225	0.167	0.123	0.090	0.074
5	1.050	0.367	0.231	0.173	0.130	0.096	0.080
6	1.060	0.374	0.237	0.179	0.136	0.103	0.087
7	1.070	0.381	0.244	0.186	0.142	0.110	0.094
8	1.080	0.388	0.250	0.192	0.149	0.117	0.102
9	1.090	0.395	0.257	0.199	0.156	0.124	0.110
10	1.100	0.402	0.264	0.205	0.163	0.131	0.117
11	1.110	0.409	0.271	0.212	0.170	0.139	0.126
12	1.120	0.416	0.277	0.219	0.177	0.147	0.134
13	1.130	0.424	0.284	0.226	0.184	0.155	0.142
14	1.140	0.431	0.291	0.233	0.192	0.163	0.151
15	1.150	0.438	0.298	0.240	0.199	0.171	0.160

Table 2: Constant annual cash flows necessary for a positive indication of the present value analysis (as a proportion of the initial investment outlay)

4. EMPIRICAL RESEARCH ON THE USE OF DISCOUNT AND CAPITALISATION RATES BY CERTIFIED REAL ESTATE APPRAISERS IN SLOVENIA

4.1 Research framework

Since the literature review revealed a variety of discount and capitalisation rates are used in different publications, we decided to empirically investigate the use of discount and capitalisation rates among experts in Slovenia. The purpose of the research was to establish which discount and

capitalisation rates are used in appraisals in investment evaluations of selected types of real estate. In addition, we also inquired about the real and nominal risk-free rate. The aim of the research was to systematically establish the relationship between the discount rate, the capitalisation rate and the risk-free rate and, based on a statistical analysis of the data, also identify the risk premiums and capital recovery premiums for different types of real estate.

4.2 Data gathering

The data for our empirical research were collected via an Internet survey. In addition, the survey was also sent to the surveyed individuals as an attached document. The target group for our research was certified real estate appraisers registered in an official register of certified real estate appraisers with the Slovenian Institute of Auditors, and 70 appraisers were invited to participate in the survey. The survey was conducted in the second half of February and beginning of March 2011. The response rate was 32.9 percent, indicating that almost one-third of all certified appraisers in Slovenia participated, adding salience to the conclusions.

The survey consisted of three parts. In the first part we asked about the real and nominal risk-free rate in Slovenia in February 2011 and which of the categories they predominantly use. The collected data also enable us to calculate the expected long-term annual inflation rate which the respondents use in their appraisals.

The second part refers to use of the discount rate for specific types of real estate: land, residential apartments, residential houses, offices, retail and industrial real estate and investments in the following categories: improvements (additions to buildings etc.), construction for a known customer, and construction for the market. For real estate we also distinguished between specific real estate located in better and worse locations. The purpose of this distinction was to establish the difference in the future long-term growth of the value of real estate expected by the respondents.

The third part of the survey included questions about the use of capitalisation rates for the same type of real estate as used in the second part of the survey. The rationale for this set of questions was to determine the capital recovery rate the respondents use for various types of real estate.

4.3 Data analysis

The collected data were analysed using the statistical package PASW. For the variables we calculated basic univariate statistics (means and standard deviations), for specific variables also separately for those using real and for those using nominal rates of return. The calculated differences between the required returns and the risk-free rate revealed the average risk premium and the average capital recovery rate for various types of real estate.

5. RESULTS

In the first part of the survey the respondents were asked about their use of real and nominal rates of returns. The results reveal that 28.6 percent of appraisers participating in the survey

use real rates of return in their appraisals and investment evaluations – a result in line with the expectations and theoretical foundations. Namely, the lion's share of appraisals and investment analyses is based on real prices (prices not adjusted for inflation) and therefore the nominal rates of return must also be translated into real rates of return by using the Fischer equation.

The average nominal risk-free rate in our survey is 4.20 percent. This average corresponds to the returns on bonds issued by the Republic of Slovenia with a maturity of seven to eight years (e.g. SI0002102794). By using the calculated average real rate of return (2.00 percent) we can also establish that the respondents' average expected future inflation is 2.25 percent, which means the respondents expect slightly higher inflation in Slovenia than the target inflation set by the European Central Bank (2.00 percent). The univariate statistics on risk-free rates of return are presented in Table 3.

Risk-free rate	Mean	Std. Dev
Nominal rate	4.20	1.25
Real rate	1.91	0.74
Expected inflation	2.25	

Table 3: Univariate statistics on risk-free rates of return and expected inflation (calculated using the Fischer equation)

Based on the answers about the discount rates and risk-free rates used by our respondents we calculated the risk premium (including the premium for reduced liquidity and managing the investment). The calculated premiums are summarised in Table 4.

We can determine that the calculated risk premium arising from the answers (including the premium for reduced liquidity and managing the investment) is in accordance with the theoretical basis. We can establish that land is, according to the respondents, a real estate investment with the lowest risk. Land is followed by residential apartments, residential houses, offices, retail and industrial real estate. The results also show that certain types of real estate involve less risk if positioned in a better location.

Analyses of the answers referring to real estate investments show that, according to the respondents, the risk premium varies from 4.91 percent for improvements or additions to a building to 5.95 percent for market constructions.

Based on the difference between capitalisation rates and discount rates we calculated the capital recovery premium shown in Table 5.

The capital recovery premiums vary from 0.84 percent to 1.24 percent for all types of real estate except for land. The calculated capital recovery premium from some respondents was even negative, which is very interesting. This is theoretically only acceptable when physical deterioration and functional and economic obsolescence is less than the capital gain in the real estate market (established using a constant quality price index or repeated sales index). We may conclude that some of the respondents expect real estate market growth to recover.

Type of Real Estate	Mean	Std. Dev.
Land (better location)	3.61	2.79
Land (worse location)	3.93	2.58
Residential apartment (better location)	3.60	1.98
Residential apartment (worse location)	4.15	2.10
Residential houses (better location)	4.14	2.13
Residential houses (worse location)	4.69	2.37
Offices (better location)	4.71	1.90
Offices (worse location)	5.30	2.32
Retail (better location)	5.04	2.16
Retail (worse location)	5.79	2.60
Industrial real estate	5.98	2.86
Improvements (additions to buildings etc.)	4.91	3.07
Construction for a known customer	5.42	2.46
Market construction	5.95	3.30

Table 4: Risk premium (difference between the discount rate and risk-free rate) for various types of real estate

Type of Real Estate	Mean	Std. Dev.
Land (better location)	0.45	0.98
Land (worse location)	0.40	1.04
Residential apartment (better location)	1.09	0.86
Residential apartment (worse location)	1.20	0.84
Residential houses (better location)	1.06	0.89
Residential houses (worse location)	1.08	0.75
Offices (better location)	0.98	0.79
Offices (worse location)	1.12	0.80
Retail (better location)	1.11	0.98
Retail (worse location)	1.12	1.01
Industrial real estate	1.24	0.87
Improvements (additions to buildings etc.)	1.05	1.34
Construction for a known customer	0.93	1.06
Market construction	0.84	1.00

Table 5: Capital recovery (difference between the capitalisation rate and the discount rate)

The capital recovery premium for land is less than for other types of real estate, although still positive. Since land is not exposed to physical deterioration, the conclusion is – contrary to our expectations – that, according to the respondents, a long-term decrease in the value of land is expected. The expected decline in value varies from 0.45 percent for better locations to 0.40 percent for worse locations.

The respondents estimate the capital recovery of improvements (additions to buildings) to be on average 1.05 percent, which leads us to the conclusion that, in their opinion, additions to buildings on average deteriorate quite similarly to buildings.

6 DISCUSSION AND CONCLUSION

The discount and the capitalisation rate are key factors in investment analysis, as well as in a real estate appraisal when based on discounting cash flows. This is why their determination needs experience and but should not be left to practice-based approximations. Moreover, it is vital to apply scientifically-based and professionally proven methods when establishing the discount and capitalisation rates. Only this will ensure that the results of the analysis and assessment using methods based on the discounting of cash flow will be reliable and credible.

The empirical part of the article is based on a survey about the use of the discount rate and capitalisation rate among certified real estate appraisers in Slovenia. The key findings are that certified real estate appraisers predominantly use the real component of the rate of return on government securities as a basis for the build up of the discount rate and capitalisation rate. The average, calculated from the answers, is in line with the market rate of return on government bonds at the time of the survey. From a comparison of the nominal and real rates of return we can establish that the respondents expect slightly higher inflation than the target inflation set by the European Central Bank.

The calculated risk premium is the lowest for land with 3.61 percent, and the highest for industrial real estate with 5.98 percent. In accordance with the expectations, the risk premium is slightly higher for worse locations for all types of real estate.

The capital recovery premium lies within the range of 0.40 percent and 1.24 percent. Further, the capital recovery premium is the lowest for land and the highest for industrial real estate and again lower for better locations. One exception here is land where the capital recovery premium does not differ much between better and worse locations.

Despite the wide use of investment analysis methods based on discounted cash flow, there is still incomplete knowledge about and incorrect use of them. The proper application of the methods is based on the accuracy of the input elements: cash flows associated with an investment, and the applied discount rate. The size of the latter rate can greatly influence decisions about an investment since even small changes in the discount rate can dramatically change a decision about the acceptance or rejection of an investment.

References

Baum A., Mackmin D., Nunnington N. (1998). The Income Approach to Property Valuation, 4th Ed. Thomson Business Press.

Brigham E.F., Gapenski L. C. (1996). Intermediate Financial Management, 5th Ed. The Dyrden Press.

Bruggeman W.B., Fisher, J.D. (2002): Real Estate Finance and Investments- McGraw-Hill Irwin.

Cetl V., Roić M., Mastelić Ivić S. (2008). Cost-Benefit Analysis of the Improvement of Spatial Data Infrastructure – Case Study Croatia. Geodetski vestnik, 52(3), 475-86.

Damodaran A. (1996). Investment Valuation. John Wiley & Sons.

Friedman J. P., Ordway, N. (1989). Income Property Appraisal and Analysis. American Society of Appraisers.

Fuller, S. (12.7.2009). Life-Cycle Cost Analysis (LCCA). National Institute of Standards and Technology (NIST). Accessed on 23.3.2010 at: http://www.wbdg.org/resources/lcca.php

Klammer T. P., Walker M. C. (1984). The continuing increase in the use of sophisticated capital budgeting techniques. California Management Review, 27 (1), 137-48.

Kunič R., Krainer A. (2010). Ekonomična debelina slojev toplotnih izolacij v ravnih strehah /Economical Thickness of Thermal Insulation Layers in Flat Roofs. Gradbeni vestnik. Januar 2010 (59), 6-12.

Ling D. C., Archer W. R. (2008). Real Estate Principles: A Value Approach, 2nd Ed. McGraw-Hill/Irwin.

Mramor D. (1993). Uvod v poslovne finance, Gospodarski vestnik.

MTS Slovena Daily Fixing (2009). Dostopno: http://www.mtsdata.com/content/data/public/rsl/fixing/.

Pike R. H. (1988). An empirical study of the adoption of sophisticated capital budgeting practices and decision making effectiveness. Accounting and Business Research, 18 (72), 341 – 51.

Pšunder I. (2007). Ali dobro poznamo diskontno mero in mero kapitalizacije?V: Poslovanje z nepremičninami: 18. tradicionalno strokovno srečanje (str. 286-293). Ljubljana: Inštitut za nepremičnine.

Pšunder I., Ferlan N. (2008). Use of Capital Budgeting Methods for Investment Project Evaluation in the Field of Civil Engineering. American Journal of Applied Sciences, 5 (1), 18 – 21.

Riggs, K. J. Jr. (1996). Pricing risk: Choosing a discount rate, Real Estate Issues, 21(2), 16-22.

Suhadolc M. (2009). Uporaba načina kapitalizacije donosa v sistemu množičnega vrednotenja posebnih nepremičnin. Geodetski vestnik, 53 (3), 580-89.

Uredba o enotni metodologiji za pripravo in obravnavo investicijske dokumentacije na področju javnih financ(2006) Uradni list RS, 60/2006.

Received for publication: 29 July 2010
Accepted: 11 May 2011

Asist. Prof. Dr. Igor Pšunder, Univ. Grad. Civil Eng.
University of Maribor, Faculty of Civil Engineering
E-mail: igor.psunder@uni-mb.si

Assoc. Prof. Dr. Andreja Cirman, Univ. Grad. Econ.
University of Ljubljana, Faculty of Economics
E-mail: andreja.cirman@ef.uni-lj.si