DISCOUNT RATE FOR GOVERNMENT PROJECTS: THE CASE OF GOVERNMENT REAL ESTATE IN ESTONIA

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Abstract

Government often faces decisions, which concern choosing between projects carrying different risk level and timing of cash flows. For calculating government real estate investment discount rate, we can apply social opportunity cost approach and derived from that the capital asset pricing model (CAPM). Several aspects have to be addressed when using CAPM: liquidity of assets, transaction costs and selection of appropriate comparative sector. Taking into account mentioned aspects, government discount rate for real estate investment in the long term investment horizon was found to be 8.9% according to CAPM. In case the lessee of real estate is government, then given discount rate overestimates payment risk level and actual discount rate should be between the price of loans taken by government and discount rate found using CAPM.

Keywords: government projects, discount rate, real estate, CAPM

JEL Classification: G31, G32, G38

Introduction

Public sector faces investment decisions as commonly as private, whereas previous research and methodologies have mostly been focused on private sector (either firms or individuals). Cost of capital on government[2] level has remarkable importance not only from theoretical viewpoint, but has also important practical implications by guaranteeing most efficient allocation of public resources in the long run. Several studies have considered discount rate for Estonian firms (e.g. Sander 2003, Jegorov 2010), but literature lacks of thorough theoretical considerations from the viewpoint of Estonian government.

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[2] Under the term "government" we understand the general government sector given in ESA95 (2002). In specific cases central government, municipalities and public enterprises should be viewed separately, but this exceeds the scope of current study and will be addressed in future papers.

Current paper focuses on determining the most appropriate long term[3] discount rate for government projects on the example of government real estate[4]. Government real estate strategy of Estonia from the year 2007 (Riigi … 2007) sets clear guidelines for government real estate management for the following years. The summarized conception is to sell all general purpose buildings to private investors and give special purpose buildings (except those which cannot be dispossessed) under government owned real estate firm Riigi Kinnisvara AS (afterwards *State Real Estate Ltd*) administration. The exact net surface area of buildings to be sold has not been determined, but according to Ministry of Finance expertise the figure can be approximately 524 thousand m^2 (Riigi … 2010). In case of buildings, income method is frequently applied and that method in turn demands calculating an appropriate discount rate. Previously mentioned fact is only one of many contributing to the need to extend knowledge about theoretical considerations of government discount rate in Estonian context and make specific calculations on the example of government owned real estate. Without necessary discussion, policies concerning government real estate can result in additional costs or smaller revenue receipts for state budget, altogether decreasing welfare.

The article is structured as follows. Firstly, theories and previous studies about the discount rate of government investments are considered. It is followed by a section, which introduces possible government discount rate calculation methods. In the third part of paper a suitable method is found, which in current study is capital asset pricing model (CAPM). General considerations of CAPM are followed by specific analysis of all its components – risk free rate of return, market risk premium and systematic risk. Third part is finalized with calculating the value of discount rate for government real estate investments using CAPM, which is followed by study limitations and conclusive remarks.

1. Theoretical background

In order to compare cash flows occurring at different time periods and/or cash flows with different risk level, discount rate derived from the concept of time value of money is used. As there is no uniform approach for the assessment of firm's discount rate, then the discrepancies in the approaches of different scholars for government project discount rate valuation are even bigger. Most commonly two approaches are brought out for government projects: social opportunity cost and social rate of time preference.

For social opportunity cost the assumption is that discount rate applied on government level should not differ from the discount rate that would be used by private investors for the same project. This has been explained by the idea that risk

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[3] Real estate as an asset has long life cycle, so it is reasonable and justified to calculate long-term discount rate. Additionally, different variables used for calculations can have extreme values in short run (for instance because of economic crisis or boom), which will result in false conclusions in long run.

[4] Results are applicable for all cases – property owned, sold or purchased.

level of cash flows is not dependent on whether the owner is public or private investor (Hirshleifer 1966, Baumol 1968), but also with the idea that in case of government projects final investors are still individuals (Arrow and Lind 1970). This approach has been suggested in case of projects, for which the project executor can be public or private investor (Young 2002). The approach is also suitable for deciding in which way it would be optimal to offer some product or service (*Ibid.*). Some scholars (e.g. Arrow and Lind 1970) have noted that government projects carry lower risk, as risks have been divided between all members of society. This implies to the necessity to use lower required rate of return in case of government investments compared to private investments.

The other possibility would be to use social rate of time preference as discount rate. On individual level, rate of time preference is the rate of return, after obtaining which consumers are ready to exchange their present consumption against future consumption. Scholars believe that in case of government investments, social rate of time preference should be used instead of individual rate of time preference (Kohyama 2006). Social rate of time preference can be either higher or lower than individual rate of time preference. Unfortunately, social rate of time preference cannot be directly monitored at market. According to theory, social rate of time preference (SRTP) should be composed of two parts (Young 2002, p. 7):

(1) $SRTP = \rho + \mu \cdot g$,

where ρ is the rate of pure time preference, μ is the elasticity of marginal utility of consumption and g is the annual growth in per capita consumption.

Typically, social rate of time preference is lower than social opportunity cost. In practice, social rate of time preference is often equalled with government bond yields. In USA the Government Accountability Office suggests to use very low discount rate (about zero real interest rate) when dealing with projects with large intergenerational effects involving human life (Kohyama 2006, p.17).

Krishnaswamy *et al.* (1994) argue that possible agency costs are much higher in public enterprises compared to private ones, mainly because of extreme ownership and control separation in public ones, and that is why higher discount rate should be used in case of government projects. Some scholars (see e.g. Sandmo and Dreze 1971) have proposed an idea that in case of government projects, discount rate should be calculated as the arithmetical average of two previously mentioned approaches, where the weights should reflect in what proportion does public investment decrease private investments and consumption.

Also the shadow price approach (see e.g. Bradford 1975) has been suggested, which helps to avoid dilemma occurring because of the differences in social opportunity cost and social rate of time preference values. Unfortunately, the mentioned approach is highly sensitive to technical presumptions and includes subjective assessments (Mendelsohn 1981).

After analysing the practice of different USA government institutions and previous theoretical approaches, Kohyama (2006) concluded that there can be no single discount rate for discounting government cash flows. Theoretically it would be correct to choose such discount rate that takes into account risk level and timing of cash flows.

2. Estimating the opportunity cost for government investments

Derived from discussion in previous section, authors of current paper apply social opportunity cost for government real estate investments' valuation or in other words use the same rates as for private investors. Although government does not raise equity capital from investors for real estate purchases and derived from that there can be argumentation to use only the price of debt as discount rate, in most cases such approach would not be appropriate. In case government would use remarkably lower discount rate for real estate valuation than market participants (because debt is normally cheaper than equity), then in the situation of same return expectations the value of real estate would always be higher for government than for private investors and this would make it impossible to sell any real estate objects, as potential buyers value it less than seller. Although government as investor has special features, authors of current paper believe that market based indicators should be used no matter of the legal status of investor.

According to finance theory the applicable discount rate should include risk free rate of return (which compensates the investor for postponing consumption and decrease in purchasing power), risk premium (which compensates risk level of cash flows, whereas most scholars agree that only that part of risk should be considered, which cannot be diversified) and other costs (transaction costs that incur in the process of raising the capital on both, demand and supply side). Both, direct and indirect methods can be used to calculate investor's required rate of return (see figure 1).
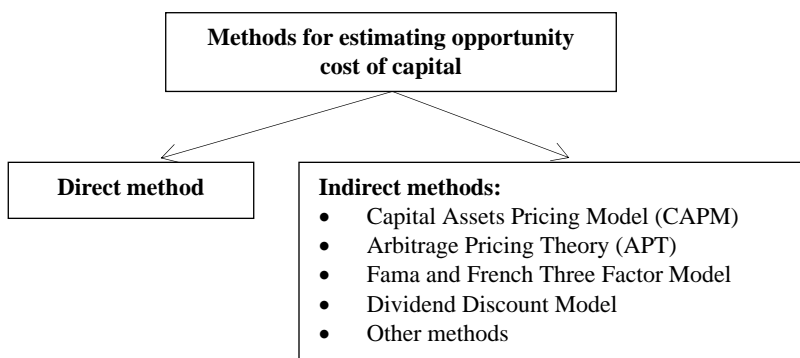
Figure 1. Different methods for estimating opportunity cost of capital (Source: composed by authors).

In case of direct method, the required rate of return value will be given by investor(s). The problem with direct method is that different investors have varying return expectations and levels of risk aversion. When the investor is government, an additional problem is that all tax payers can be seen as (final) investors. Officials responsible for investment decisions are only representatives of tax payers. In theories the concept of marginal investor's required rate of return has been used (Damodaran 2010, p. 71), but still it is not clear, who should be that hypothetical marginal investor.

In case of indirect methods the discount rate is calculated using current or historic data. The major difficulty here is that actual required rate of return cannot be observed from market data and that is why scholars can calculate different rates of return. One of the most well-known methods for calculating required rate of return is capital asset pricing model (CAPM), formulated by Sharpe (1964), Treynor (1961)[5], Lintner (1965) and Mossin (1966). It is equilibrium model based on Markowitz's portfolio theory; Tobin's separation theorem and a number of restricting presumptions (see e.g. Sander 2003). Although many of those presumptions are not fulfilled in practice, CAPM has developed to be one of the most utilized methods in the world for discount rate calculation (Bruner *et al*. 1998; Pereiro 2002). Arbitrage pricing theory (APT) was formulated in 1976 by Ross and it has less restricting presumptions when compared with CAPM. Still the practical application of model is much more difficult, as APT does not list the factors influencing required rate of return and scholars have to create the model based on empirical data. In case of Fama-French three factor model, discount rate is beside systematic risk (used in CAPM) dependent on firm size and the ratio of firm book and market value (Fama and French 1992). Dividend discount model allows assessing discount rate reflected in the market price of asset in case we know expected dividends and their growth rate (see e.g. Vernimmen *et al.* 2005, p. 434). There are other methods for discount rate calculation, whereas specific models have been created for real estate market (see e.g. D'Argensio and Laurin 2009). Still it can be concluded that CAPM has been most widely used by practitioners because of its simplicity. CAPM is being used in case of firms subject to price regulation in Estonia[6] as well as in other world countries (Jenkinson 2008). The required rate of return for Estonian government owned real estate firm State Real Estate Ltd has also been calculated using CAPM[7].

3. CAPM for calculating real estate investment discount rate in Estonia

CAPM is financial market equilibrium model. According to model, the required rate of return (R_i) is dependent on risk free rate of return (R_F), beta reflecting the systematic risk (β_i) and market risk premium (RP_m):

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[5] The Treynor manuscript, where mentioned results were achieved, has not been published.
[6] See e.g. Estonian Competition Authority instructions for weighed average cost of capital (WACC) calculation [http://www.konkurentsiamet.ee/file.php?17216]
[7] Ministry of Finance report about shares' administration, founder and member rights execution in 2009 [http://www.fin.ee/doc.php?106032]

(2) $R_i = R_F + \beta_i \cdot RP_m$

Several CAPM modifications have been developed to account for small-firm risk premium, overall risk level, liquidity risk etc.

Assessing risk free rate of return. As risk free rate of return, the long-term yield of government bond and in the absence of it several alternative approaches have been used. As Estonia has currently not issued long term bonds, then risk free rate of return (R_F) can be calculated by adding Estonia's country risk premium (RRP_{EE}) to German long term (10-year) government bond yield (R_{FDE}):

(3) $R_F = R_{FDE} + RRP_{EE}$,

Bond yield to maturity can be calculated by using the following formula in case of bonds with traditional characteristics:

(4) $P = \sum_{t=1}^{n} \dfrac{I_t}{\left(1 + R_F\right)^t} + \dfrac{M}{\left(1 + R_F\right)^n}$,

where P denotes market value of bond, I_t denotes periodic interest payment and M the principal value of the bond.

Yields of German 10-year bonds during 01.01.1993-01.10.2010 have been given on figure 2. As the yields of government bonds have in recent years been remarkably lower than the historic level (in October 2010 the yield of 10-year German bond was only 2.35%), it is reasonable to use historic average values instead of current values in long term models (on figure 2 the ca 17.5 year average yield of 10-year German bond is ca 4.76%, but the average of last 10 years is 3.95%)[8].

There are several possibilities for calculating country risk premium. In the following analysis bond risk premiums of countries having similar credit rating to Estonia's rating (i.e. A1) have been in used, comparing them to AAA rating countries. It has been assumed that in case the amount of government debt is in the limits set for Eurozone countries, then it will not result in changes of credit rating and derived from that in changes of risk premium.

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[8] As an alternative one can also estimate the risk-free rate by using the historical average real risk-free rate (which has been 2.57% for the last 10 years in Germany) and expected future inflation. In the long-run the European Central Bank has set the target inflation rate to be around 2%. A reasonable estimate of nominal risk-free rate would therefore be 4.55%.
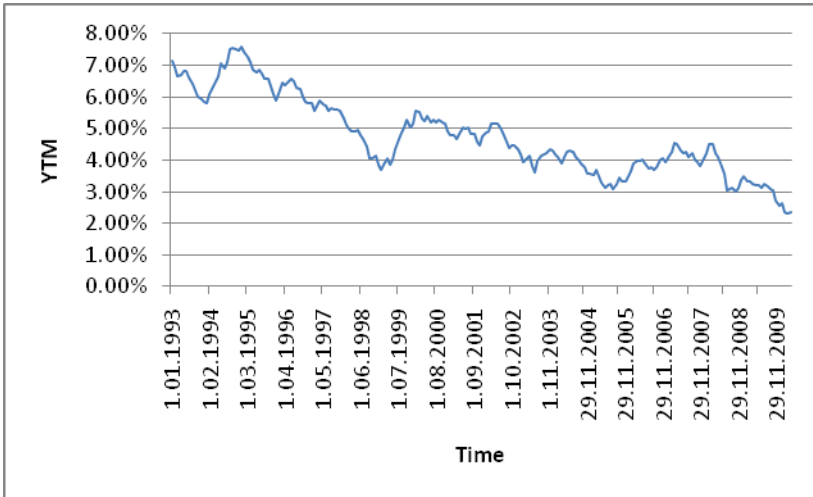
Figure 2. Yield to maturity of German 10-year bond (Source: European Central Bank).

On figure 3 below, risk premium (in base points) for Estonian current country rating A1 and some higher or lower ratings for years 2001-2010 have been given.
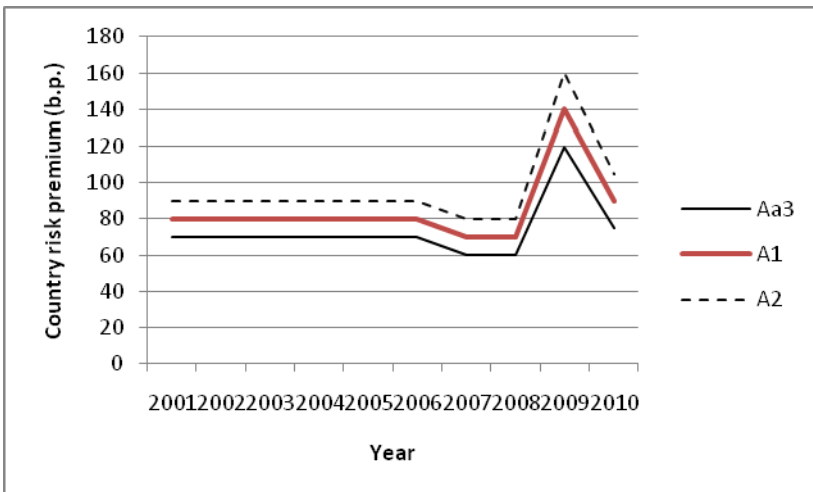
Figure 3. Credit risk premium corresponding to country risk rating in base points during 2001-2010. (Source: Datasets 1998-2010).

The historical average country risk premium corresponding to current Estonian risk rating (A1) is 0.97%. Risk premium based on country rating has several shortages.

Firstly, rating agencies might not react quickly enough when risk level changes. Secondly, government can borrow funds on more favourable conditions than market interest rate (e.g. from different international investment banks or organizations). Possible alternatives to the use of country credit rating would be:

- Using CDS (*Credit Default Swap*) market quotations. Still CDS of Estonia is exceptional, as those contracts have no underlying assets (i.e. government bonds). CDS quotations react to changes in risk level more quickly than credit rating, but at the same time they are remarkably more dependent on market participants' emotions.
- Average difference of Talibor and Euribor quotations (this methodology has also been used in the guidelines composed by Estonian Competition Authority for determining cost of capital for firms subject to price regulation), but the problem is that they show short term interest rate differences and secondly Talibor and Euribor spread includes currency risk premium. Talibor shows interest rates of intra-bank EEK loans, while Euribor is quoted in EUR. It is not justified to consider previously mentioned approach after 01.01.2011 because of the currency reform (adoption of EUR). Starting from 01.01.2011 Bank of Estonia also finished quoting Talibor.

According to given methodology, long-term risk free rate of return in Estonia would be ca 5%-6% (historical 10-year German bond yield (3.95%-4.76%) plus historical risk premium for country with A1 rating (0.97%)). However, in the context of CAPM model, risk premium corresponding to country risk rating is used as part of market risk premium. So for CAPM model the long term risk free rate of return would correspond to the average long-term yield of German government bonds (3.95%-4.76%)[9].

Assessing market risk premium. In theory, market risk premium should be forward-looking (Damodaran 2008). In practice, most analysts use either historical average or fixed rates (Bruner *et al.* 1998). Historically, the market risk premium (calculated as geometric average) has been around 3%-5% (Dimson *et al.* 2006). However, during the financial crises forward-looking risk premiums escalate (e.g. in January of 2009 they were almost double of their historical averages). The historical or ex-post risk premium is calculated as the difference between the actual return of a stock market index and actual return of risk-free instrument (usually government bond). The fundamental linkage between forward-looking and historical risk premiums is the following. The uncertainty about future prospects of financial markets or investors' risk aversion increases and that will lead to higher forward-looking risk premiums and discount rates. Higher discount rates cause share prices to drop and realized rates to decrease. This, in turn, means that historical risk premium, calculated as showed in the text above, decreases. (Sander 2009)

Market risk premium for AAA rating countries during the last 10 years was *ca* 4.92%. Derived from Estonian country rating (A1), it should be added 1.35% as

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[9] In the following calculations we use 4% as the estimate for long-term risk free rate.

suggested by Damodaran (2010)[10]. According to such approach total market risk premium in Estonia would be 6.27%[11].

Assessing systematic risk. Systematic risk of asset is reflected by beta. Beta is calculated either using historic rates of return of object and market portfolio or sector specific levered beta. In current case sector specific indicator should be used, as government real estate or shares of government real estate company State Real Estate Ltd are not traded at stock market. In case of ordinary firm, levered beta should be calculated, as systematic risk of shares is dependent on firm's capital structure. Equation for calculation of levered beta, taking into account the assumption that debt does not create systematic risk and tax advantage[12], would be:

$$(5) \qquad \beta_L = \beta_U \cdot \left[1 + \frac{D}{E} \right],$$

where β_L denotes unlevered beta, β_U denotes sector unlevered beta, D value of debt and E value of equity. Still, the usage of such formula in case of government investments is complicated as we do not know D/E ratio. The usage of financial structure of specific project is problematic as lenders finance government, not a specific project. There is information about government debt amount (as of 2010 Estonia has borrowed 990 million EUR, which accounts for 7.1 % of GDP, making Estonia the lowest debt-burden country in European Union), but no information about the fair value of government-owned assets. That is why it is more reasonable to use unlevered beta.

The second step for systematic risk valuation is the choice of appropriate sector and region. The average beta (reflecting systematic risk) of firms varies among different real estate subsectors, different world regions and in time. The following table shows betas in different parts of the world for some real estate subsectors (see table 1).

Table 1 shows that similar sectors have different systematic risk level in different parts of the world and risk level varies between sectors in a specific region also. Additionally, the differences in firm betas in sectors and regions are large. For instance unlevered betas of European real estate sector firms where from -0.05 to

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[10] For further details see:
http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html
[11] Obviously, different types of real property have different risk profiles and therefore require different risk premiums (see e.g Young and Graff 1995). However these cannot be estimated based on data available to the authors at this point of time. Therefore our estimate of discount rate applies only to the portfolio of government real property as a whole.
[12] Since year 2000 Estonia uses so called distributable profit system, in case of which the usage of debt does not create tax advantage (see e.g. Sander 2005).

1.1[13] in 2010. Betas can differ a lot in time also. In the following figure 4 historic unlevered betas for USA REITs have been shown.

Table 1. Unlevered betas by industry and region in 2010

Sector	Area			
	USA	Europe	Emerging markets	Global
Real Estate Investment Trusts	0.96	0.3	0.42	0.31
Real estate	na	0.19	0.5	0.45
Property management	0.59	na	na	na
Real estate (development)	na	0.3	0.56	0.57
Real estate (Operations and Services)	na	0.25	0.37	0.31

Source: Levered and unlevered betas by industry (Damodaran Online).

According to figure 4, systematic risk level of USA REITs has been higher in recent years (the level of unlevered beta was 0.88 for year 2009 and 0.96 for year 2010) than historic average (*ca* 0.65). In case of long term forecasts it would be reasonable to use historic average (i.e. 0.65).
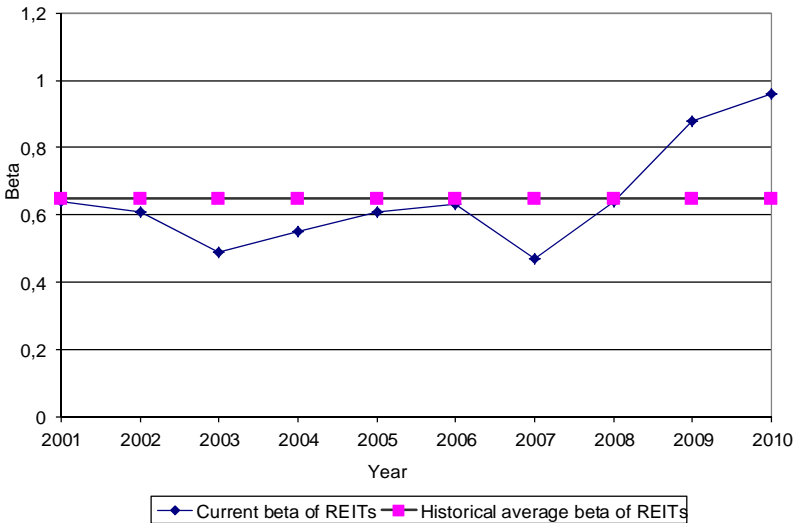
Figure 4. Unlevered betas of USA REITs in period 2001-2010.
(http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html)

[13] Calculations of authors based on firm-level data given on Damodaran webpage
(http://www.stern.nyu.edu/~adamodar/pc/datasets/Eurocompfirm.xls).

It would be most appropriate to use such firms for valuation, which have relatively similar asset portfolio when compared to government (or State Real Estate Ltd) portfolio. Still this demands very specific information and thorough analysis. Followingly, it has been assumed that REITs as institutions having broad real estate portfolio and exemption from tax fit those criteria well.

Discount rate according to classical CAPM and necessary modifications. Based on previous information and formula 2, it is possible to value discount rate. The long term discount rate would be:

$$R_i = 0.04 + 0.65 \cdot 0.0627 = 8\%$$

Still several additional aspects should be taken into account. Compared with REITs traded at stock market, direct investment in real estate carries remarkably higher liquidity risk. Investors seek liquidity (especially during difficult times) and that is why they are ready to pay higher price for liquid instruments or in other words require lower rate of return from such instruments. This demands the usage of additional risk premium (RP_{liq}) in real estate investment discount rate calculation, which would compensate liquidity risk. Discount rate taking into account liquidity risk can be calculated with following formula:

$$(6) \qquad R_i = R_F + \beta_i \cdot RP_m + RP_{liq}$$

When assessing liquidity risk, important aspects are costs and time for exiting the investment and length of typical investment period. In case of apartments, the summed round-trip costs have been estimated to be 3.8% (Country … 2010), which is lower than international average. The impact of round-trip costs on real estate value (in other words illiquidity discount – ILD) on the assumption of perpetuity is followingly dependent on the typical investment period (in other words how often real estate changes owner) length t [14]:

$$(7) \qquad ILD = RTC + \frac{RTC}{(1+r)^t} + \frac{RTC}{(1+r)^{2 \cdot t}} + \frac{RTC}{(1+r)^{3 \cdot t}} + ... + \frac{RTC}{(1+r)^{\infty \cdot t}}$$

The results using different parameters have been given in appendix 1. The illiquidity discount can be converted to equivalent liquidity risk premium (RP_{liq}). In case of perpetuity we can use the following formula:

$$(8) \qquad RP_{liq} = \frac{r}{1 - ILD} - r$$

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[14] The logic of this approach is based on the article „Liquidity and Cost of Capital: Implication for Corporate Management" by Amihud (1993).

The liquidity risk premiums dependent on different parameters have been given in appendix 1. Authors believe that it is appropriate to use 0.8% as liquidity risk premium.

So in case we take into account that direct investment to real estate portfolio carries same systematic risk as REITs do, then long term rate of return for real estate could be 8.8%.

Another needed modification is the compensation of costs necessary for raising capital. In case of private investor, there can be fees for investment bank organizing issue of securities; flotation costs, preparation of prospectus etc. (see Lee *et al.* 1996). In case of government using tax revenues for investments we cannot consider such costs, but costs arise when using debt. At the same time government cannot collect tax income without collection costs. In 2006-2009 costs of Estonian Tax and Customs Board were ca 1% of tax revenues.

In case previously given costs would account for 1% of capital raised and we consider perpetuity, the discount rate for real estate investments would be:

$$k_A = \frac{8.8\%}{1 - 0.01} = 8.89\%$$

That discount rate (8.89%) would also be unlevered cost of equity capital (k_U) in case of real estate investments.

In previous years one modification was to add currency risk premium to required rate of return in Estonia (see e.g. Sander 2009). As Estonia will start using EUR since 01.01.2010, there is no need to account for that risk premium.

4. Limitations of CAPM for finding suitable discount rate for government investments

There are several problems when using CAPM for calculating suitable discount rate for government investments. Some are derived from model presumptions, which are not met in practice, some arise from difficulties with calculating input variables and some come from specific features of government as subject. When analysing the last ones, it must be accounted that such methodology makes it possible to find required rate of return for real estate asset class as a whole. Still mentioned asset class is composed of assets with different risk level, derived from which discount rates should differ. For such differentiation other valuation methods should be used (for instance expert opinions).

Another problem is the characteristics of government as lessee and contractor. Government default risk is remarkably lower and that is why lease revenues from real estate objects vary less and carry smaller risk. In case lessor could sign a contract, in which all business risks have been carried over to lessee, discounting

such cash flows should be done with risk free rate for specific country. For such contracts the long term discount rate should be around 5-6%.

It would also be appropriate to assess risk level of each real estate object separately and in this way find out suitable discount rate. Market equilibrium models (incl. CAPM) cannot take into account specifics of each investment, but still give generalized understanding of the value of required rate of return.

Conclusions

Similarly to other economic subjects, government must make decisions, which concern choosing between projects carrying different risk level and timing of cash flows. As in case of firms, discounted cash flow approach is being used. There are two remarkably different philosophical approaches concerning discount rate on government level: social opportunity cost and social rate of time preference. In case of social opportunity cost, discount rate used by government equals the rate that would be used by private investors in the same circumstances; in case of social rate of time preferences such rate is being used, for which consumers would be ready to shift their consumption to future. For government real estate investments the social opportunity cost approach should be used or in other words the same rate as for private investors. To find out the discount rate, different methods are used in firms: e.g. CAPM, APT, Fama-French Three Factor Model, and Dividend Discount Model.

The most widely used method in practice is the capital asset pricing model (CAPM), according to which discount rate is dependent on risk free rate of return, systematic risk and market risk premium. Still several aspects have to be considered when using that model for calculating suitable discount rate for government real estate investments. CAPM has been created to value liquid securities. Real estate is not as liquid as publicly traded securities, which makes it necessary to use additional liquidity premium. Also the model does not take into account transaction costs necessary for raising capital, which should be taken into account in order to find correct discount rate. Still there are several problems connected with calculating main components of the model. The model is especially sensitive for the choice of comparative sector. Average betas of sectors related to real estate in different regions of the world were 0.19-0.96 at the beginning of year 2010. In addition, those figures are changing in time. Despite those limitations, CAPM is still suitable for assessing government discount rate for real estate investment. For long term investment horizon the appropriate annual discount rate was found to be in an average *ca* 8.9%. In case the lessee of real estate is government, then given discount rate overestimates payment risk level and actual discount rate should be between the price of loans taken by government and discount rate found using CAPM.

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APPENDIX 1. Value of risk premium compensating liquidity risk dependent of roundtrip costs and investment period length

Length of investment period (years)

	Share of roundtrip costs in transaction (%)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	1.2%	3.0%	5.4%	9.4%	16.6%	34.1%	137.5%	n.a.	n.a.	n.a.
3	0.4%	0.9%	1.4%	1.9%	2.6%	3.3%	4.1%	5.1%	6.2%	7.5%
5	0.3%	0.5%	0.8%	1.1%	1.5%	1.9%	2.2%	2.7%	3.1%	3.6%
7	0.2%	0.4%	0.6%	0.8%	1.1%	1.3%	1.6%	1.9%	2.2%	2.5%
9	0.2%	0.3%	0.5%	0.7%	0.9%	1.1%	1.3%	1.5%	1.8%	2.0%
10	0.2%	0.3%	0.5%	0.6%	0.8%	1.0%	1.2%	1.4%	1.6%	1.8%
12	0.1%	0.3%	0.4%	0.6%	0.7%	0.9%	1.1%	1.2%	1.4%	1.6%
14	0.1%	0.3%	0.4%	0.5%	0.7%	0.8%	0.9%	1.1%	1.3%	1.4%
15	0.1%	0.2%	0.4%	0.5%	0.6%	0.8%	0.9%	1.1%	1.2%	1.4%
16	0.1%	0.2%	0.4%	0.5%	0.6%	0.7%	0.9%	1.0%	1.2%	1.3%
18	0.1%	0.2%	0.3%	0.5%	0.6%	0.7%	0.8%	1.0%	1.1%	1.2%
20	0.1%	0.2%	0.3%	0.4%	0.5%	0.7%	0.8%	0.9%	1.0%	1.2%
22	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.8%	0.9%	1.0%	1.1%
24	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%	1.0%	1.1%
25	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%

Source: composed by authors by using formulas (7) and (8) and assuming that the required rate for liquid investment is 8%.