Failure of real estate investment - a contribution to calculate risk assessment[1]

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Abstract

Financing real estate investments is an important area for banks. A central role in project development for real estate investments plays the management of risks that exist in the occurrence of future events for the objective probabilities. The risk potential is dominated in the market for residential property by the general economic and political stability of a country and by legal and fiscal factors.
Banks, which know their risks in the real estate financing, can achieve a significant competitive advantage in the coming years. The aim of the risk calculations is to calculate an interest rate that shows the dependence of the probability of failure due to the risk.

Key words

Real estate investment, risk management, probability of failure

JEL Classification: D80, G31

1. Introduction

Financing real estate investments for banks is an important area. The binding of large amounts of capital and a high number of risks associated with real estate investments is significant for the impact of the risk. With the help of risk quantification, assessment and control these effects are minimized. At real estate financing is long-term security and the creditworthiness of great importance. [1].

Dips in the landscape of interests or sudden changes in the yield and the yield curve not only reduce profits, but often also the capital and thus represent a serious threat to banks. These risks must be identified and controlled through efficient controlling.

2. Goal

The aim of this study is to analyze the real estate financing business of credit institutions and to develop proposals for the management of interest rate as a function of the failure probability of a real estate investment. In addition, here is a concept developed for the banks, calculated taking into account the probability of a failure of the profit of the bank.

3. Real Estate

3.1 Market of real estate

The term real estate is the general term of land and properties and is one of the immovable property [2]. The real estate market is the sum of a large number of sub-markets and market of the sites. The special feature of the estate property, which is available on the market and demand is in its immobility; a real estate object is characterized by its unique location.

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3.2 Functional and economic use of property

The two functions "living" and "economies" are still the key motivations and indicators for the production and management of real estate [3]. With the economic use of property is divided into residential properties, commercial properties and mixed forms. This distinction is an essential criterion in terms of the financing purpose dar.

The group of residential properties include properties such as condominiums, single-family homes, two-family houses or residences in which the satisfaction of human needs for housing is a priority.

The demand for residential property is largely determined by the evolution of the number and structure of households. In contrast, the risk potential is dominated in the market for residential property by the general economic and political stability of a country and by legal and fiscal factors.

Table 1: Risk to residential property

Risk to residential property	Examples
Economic stability	Business cycle
Political stability	Form of government
Rights policy	Rent law, construction law
Tax Policy	Tax changes, privileges
Competition influence	Grants and subsidies

Research and teaching have provided yet no universally accepted definition or description of the **commercial property**. The market for commercial real estate is still by definition, statistically seen more as a residuum, resulting from a negative deferred to the housing market. Properties that are not or not primarily for residential purposes are considered to be commercially [4].

As a special kind of economic use of property, the **hybrids** can be stated. This multi-functional property occupied by objects represents a form of mixed use between residential, service, management and trade [3]. With regard to risk issues examined in this type of property on the one hand instead of a diversification of risks. The letting risk is offset by the concomitant use of other types of commercial or housing items.

4. Risk Management

4.1 Introductory Remarks

A central role in project development plays the management of risks that exist in the occurrence of future events for the objective probabilities. An effective risk management does not fully avoid risks but to achieve in a controlled process to optimize the allocation of resources. A company must take risks calculated in order to generate revenue. It is important to understand these risks carefully and - if necessary - to limit and direct, otherwise there is a threat to the profitability and the company as a whole.

Table 2: Strategies for risk

Strategies for risk	Methods
risk avoidance	Abandonment of a business
risk reduction	Measures of organizational structure
risk transfer	Insurance
Risk provision	Provisions

As fundamental to all investment decisions in addition to the objective of maximizing returns while minimizing the risk of each decision is sought. The success of a real estate investment is thus determined from the ratio of return and the associated risk.

Table 3: Processes of risk managemt

Processes of risk managemt	Explanation	Example
Risk identification	Systematic collection of all the risks	SWOT-Analysis
Risk assessment	Evaluation of the expectation value	Risk Matrix
Risk controlling	Dealing with risks	FMEA-Methods

Risk is the variance of business on the expectation values of the decision maker. The risk is not only a loss of opportunity, but also always the chance of achieving a higher return. Accordingly, risk arises from uncertainty about the development of yield-influencing factors.

4.2 Risk minimization and yield maximization

The investor has to choose between competing objectives: Minimize risk and maximize return. The optimal ratio between risk and return depends on his individual risk attitude; real estate investors are relatively risk averse.

Table 4: Risk and return

Risk	Return
High	High
Low	Low

The risk may be considered with normally distributed returns (Figure 1). Because of their individual expectations about future environmental conditions to determine their expected return investors μ. This return comes in with the highest probability, which means that the environmental conditions that determine these rates in the future are most pronounced.

Figure 1: Normally distributed returns [5]

As investors, however, about the nature of the environmental conditions that will occur, are uncertain, there are chances for the deviation from this expected return. Deviations σ may both negatively and positively fail This deviation from the expected value is referred to an economic risk.

Table 5: Feature of the investors

Feature of the investors	Risk behaviour
Risikoavers	Gering
Risikoaffin	Hoch
Risikoneutral	Erwartungswert

5. Real Estate Risks

5.1 Preliminary remarks

The real estate business and the risks involved can be divided into three sections below:

a) Business risks
b) Market and industry risks und
c) Property risks.

5.2 Business risks

5.2.1 Management risk

The management of risk is highly dependent on the usage and the level of service. The economic success is influenced in particular by the quality and reliability of management.

5.2.2 Risks of legal form

The risks of legal form is largely determined by the borrower liabilities. For example, the risk of lending to a company with limited liability because their liability limit is generally higher than for a loan to a public institution.

5.2.3 Risk of investment

The investment risk is the strategic risk which a buyer with a particular business. It plays a role in this regard, as investing in real estate have a long lasting bond and capital cash flows and thus exert a profound influence on the liquidity burden on investors.

5.2.4 Liquidity risk

Liquidity risk is the risk that the borrower is unable to pay obligations due to increasing or decreasing deposits is to meet its credit obligations as agreed.

5.2.5 Bankruptcy risk

The bankruptcy risk is defined as the risk that the economic situation worsens if the debtor that he no longer meet its financial obligations. The coverage of the bankruptcy risk is managed through the realization of a pledge in payment default.

Table 6: Corporate risks

Corporate risks	Examples
Management risk	Corporate misconduct
Risks of legal form	Limitation of Liability
Risk of investment	Vacancy
Liquidity risk	Loss of rent
Bankruptcy risk	Insolvency

5.3 Risks of branch and market

5.3.1 Risk of tax law

The tax laws for the State has the function of providing funding. There are different laws in municipalities and taxation principles. This may be the decisive criterion for the choice of location, as the taxation of income affects the profitability of the property.

Table 7: Different rates of tax

City	Inhabitants	Rate of Taxe
Dessau-Roßlau	87,347	443%
Magdeburg, Landeshauptstadt	230,446	450%
Arendsee (Altmark), Stadt	5,883	326%
Fleetmark	824	300%

5.3.2 Economic risk

The economic risk arises from fluctuations in the overall economic situation. It is a macroeconomic and systematic risk, an influence is generally difficult. A significant impact on the economy have the socio-cultural and economic development.

5.3.3 Financial risk

The financial risk of the industry will be influenced by commercial law and tax risks. It concerns the dangers and opportunities that occur in connection with the provision of necessary financial resources to bear.

Table 8: Risks of branch

Risks of branch	Beispiel
Tax legislation	Different tax laws
Business cycle	Population growth
Financing	Capital Structure

5.4 Reisks of objects

5.4.1 Risk of usage concept

A bad usage concept is reflected back into the sustainability of earnings. An object life cycle should be available. This risk is put in time at the beginning and measured with use of comparisons.

5.4.2 Risk of return

The risk of return is available from the ground up for every industry and every company. The rental rate risk depends on the particular micro-and macro-structure. Most leases contain rent adjustment in some form, but most of the rent adjustment in relation to the price level of late and often not enforced completely. Reasons for these contractual arrangements are the realities of the market, which can usually only enforce certain rent adjustment.

5.4.3 Construction risks

Each construction carries with it the risk that it will not completed because of incorrect calculations or due to insolvency of contractors.

5.4.4 Micro location risk

The micro location risk refers to the location of its forms. Here the immediate vicinity of the object is considered.

5.4.5 Macro location risk

The macro-location risk is the growth prospects of the region through economic, demographic and political processes

5.4.6 Risk of tenant structure

The risk of tenant structure developed already during the preparation of the concept and use is related to the leasing of real property. It is possible that tenants are insolvent and can no longer pay the rent.

Table 9: Risks of object

Risks of object	Examples
Use concept	Influence of macro location
Return	Adjustments to the rent
Construction	Cost, quality, deadlines
Micro location	Economic growth in the region
Macro location	Demographic Processes
Tenant structure	High costs due to modifications

6. Financing of real estate

6.1 Choice of the optimal financing from the perspective of the investor

Financing is raising capital for the realization of an investment. Here, the capital raising of capital to, capital and time of origin is different.

Table 10: Capital

Capital	Origin of the capitas	Term
Equity	External financing	Short-term
Borrowing	Internal financing	Long-term

The creation or acquisition of real estate is a relatively high capital investment connected. The high capital investment, which is obtained at the beginning of the investment are, in the form of deposits against rental income, subsidy benefits or profits from sales. Chosen for the evaluation of what type of financing is, profitability, liquidity, risk and independence must be observed.

6.1.1 Return

The foreign investors are interested in the profitability of the company regarding the statement about the risk associated with the provision of capital [6]. Profitability is determined by the ratio of profit to equity. In the case of a real estate investment is the ratio of net repayments to the sum of the capital [6].

6.1.2 Liquidity

A company is liquid if it is able to meet its payment obligations at any time. On the other hand has a high level of cash the company a negative impact on profitability. Between liquidity and profitability, so there is a conflict. The improvement in profitability is possible due to a low level of cash. There is then a danger, however, that the existence of the company due to insufficient liquidity could be called into question [6].

6.1.3 Risk

To risk is to be noted that the pursuit of risk prevention in companies complementary to the pursuit of profitability, that means the higher the profitability, the greater the risk to be illiquid and the lower the security. The company's management is responsible for the profitability of sufficient liquidity to improve [1].

6.1.4 Independence

The question of the independence of the borrower to the lender in selecting the type of financing is answered by the fact that the higher the leverage, the higher will be the influence of the investor. At high external financing is a part of the company is a risk to the lender on the other hand, the possibility of various adverse influences on the corporate autonomy of the borrower [1].

Table 11: Trade-Off

Trade-Off	Explaination
Return versus liquidity	liquidate assets have lower returns
Return versus risk	Safe assets have lower risk

6.2 Interest income and revenue management of credit institutions

6.2.1 Revenue management

In the profit and loss account of a bank, the result is determined by periodic income on interest rate. The bank management can control the setting of minimum margins customer behavior. The margin thus serves both as information about the profitability of a business and also control the behavior [7].

6.2.2 Management of interests

Interest management includes targeted tax cash flows because of uncertainty as a function of interest rate expectations, risk tolerance, risk capacity of the borrower as well as the planning horizon and the planning volume.

There are new challenges for the partners in the field of real estate finance caused by increasing volatility in the financial market. Increasing rate or yield fluctuations require the design of financial conditions in addition to the use of traditional methods of risk management and better integration of financial innovation. These allow it to act on threats and opportunities of interest area separately [4].

6.3 Funds Transfer Pricing

Methods of yield control of the bank as part of the costs and income statement are usually the market interest rate method as a basis. The market interest rate method attempts to refer to the current market rate for such products for measurement and evaluation. The bank success is measured by the opportunity cost principle.

The difference between customer and market interest rates by an equivalent alternative is down or spreads the interest income of a single transaction for the bank dar. The market is thus the benchmark interest rate or the marginal interest rate, to be made to the transactions with customers.

Interest income must be at least operating costs, cash costs, capital costs and risk costs the bank to cover. This gain is caused by lack of market transparency, the preferential binding of the customer, the potential of the acquisitive bank, or as a result of the transfer deadline [7].

7. Calculations

7.1 Goal of calculations

The aim of these calculations is to calculate an interest rate that the dependence of the probability of failure p_f due to the risk.

7.2 Scattering of the input variables

The principle that scatter the incoming data and boundary conditions. A failure of an investment project is given if the costs exceed the cumulative investment income, which means the present value of cash inflows, (defined as the yield value) is smaller than the output of investment (defined as real value). Considering a divergence in the real value (R) and yield value (Y) a distance as a performance indicator between the two quantities are not accurately predicted.

Table 12: Balance between yield and real value

Balance	Assessment
Yield value more than real value	No failure of the investment
Yield value less than real value	Failure of the investment

A forecast is only possible on probability theory; it can indicate the likelihood for a sufficient distance between R and Y, an absolute certainty $p_f = 0$, it is not possible. An investor must expect a failure of the entire system, if:

$$Y < R;\ Y - R < 0$$

This means that the investment costs exceed the expected return of the investor, resulting in an economic failure.

7.3 Protection of banks against failure admission

The legal merits of the credit protection through land ownership are characterized by a stable contract and land law with a strong partner in the legal protection of a relatively simple but time-consuming implementation of creditor claims.

Banks generally provide property as security to the classic for its lending operations. Thus, the majority of the loans and loans from banks secured by liens on domestic real estate mortgages and mortgages secured [8].

If there is a failure of the entire system or to engage in the loan collateral by the bank, they are usually not interested in a takeover or management of the property. There is often a forced sale of the property with a recovery value of approximately 30% to 50% of the total investment. This recovery value is highly dependent on the previously constructed buildings, the real estate situation, the conversion capability and the number of interested parties.

7.4 Calculation of profitability

Economy is defined as the rational principle in the economic sphere (economic principle). Efficiency is achieved when a certain goal with the lowest possible cost (minimum principle), or when is achieved with a given cost, a very high yield (maximum principle). The profit is derived from the proceeds minus costs:

$$G = E - K$$

G Gain
Y Yields
K Cost

In calculating the profit of banks is expected from an annuity.

7.5 Annuity

The annuity of the capital expenditure is the annual uniform amount for principal and interest on a capital called KE. By the time the loan repayment advancing the future interest payments are always lower.

This is in interest over the previous year amount saved for each annuity used to increase the repayment of the current year, so that the sum of annual interest and principal payments will remain constant. The banks collect money as a borrower (financing activities). These guide them as a lender in the form of loans to companies on (lending business). The proceeds of the credit institutions in an active business are the rate at which capital is remunerated.

In addition to them is periodically capital in the amount of annuity available, which can be brought back into circulation in the form of a loan.

7.6 Contribution to the calculation of profit under risk

Below is a model for determining a gain of the credit institution, taking into account the risk factors responsible investment with the interest rate issue, central bank interest rate, payment level and the recovery value (of foreclosure).

For the following mathematical derivation there are the following symbols:

G	Gain
q_b	Central bank interest rate
α	Recovery value
n	Remaining life of object
p_f	Failure probability
q_z	Output rate

First there is the financing needs of the investment to K_0. It is not funded at 100%, but the funding level and disbursement φ is limited by the bank. Any additional capital requirements from its own funds of the borrower shall be submitted. The initial credit K_i is calculated as so:

$$K_i = \varphi \cdot K_0$$

Starting from the initial amount credit K_i results in the amount of return flow (A) under consideration, the first year from annuity by

$$A = K_i \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1}$$

This return is to reduce the risk of reciprocal, since only the part of not failing in the form of loan repayment from flowing back:

$$A = (1 - p_f) K_i \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1}$$

This flowing back part of the loan will be invested by the bank again (safe assumption: interest on the reinvestment of interest to the procurement q_b):

$$A = (1 - p_f) K_i \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1} \cdot \frac{q_b^n - 1}{q_b - 1}$$

The non-flowing back part of the loan must be considered, however, still:

$$B = p_f \cdot K_i$$

As a part of the recovery value (of foreclosure) again flows back to the lender and so therefore is available again:

$$B = p_f \cdot \alpha \cdot K_i$$

This amount can then be reinvested to reflux, occurs analogously to the reinvestment of not failing credit component A. However, since the above-defined credit failure after one year is to reduce the term of the interest:

$$B = p_f \cdot \alpha \cdot K_i \cdot q_b^{n-1}$$

The total return is thus obtained from the addition of reflux from the reflux of part *A* and Part *B*:

$$C = A + B$$

$$C = (1 - p_f) \cdot K_i \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1} \cdot \frac{q_b^n - 1}{q_b - 1} + p_f \cdot \alpha \cdot K_i \cdot q_b^{n-1}$$

On the cost side, the costs are for the supply of capital as interest costs on the central bank:

$$D = K_i \cdot q_b^n$$

Applies to the gain *G*:

$$G = C - D$$

Relative to the loan amount:

$$G = \frac{C}{D} \cdot 100[\%]$$

So:

$$G = \frac{(1 - p_f) \cdot K_i \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1} \cdot \frac{q_b^n - 1}{q_b - 1} + p_f \cdot \alpha \cdot K_i \cdot q_b^{n-1}}{K_i \cdot q_b^n} \cdot 100[\%]$$

This formula can be set to change after simplification. The first part of the counter can be summarized. This results in:

$$G = \frac{(1 - p_f) \cdot \frac{q_z^n \cdot (q_z - 1)}{q_z^n - 1} \cdot \frac{q_b^n - 1}{q_b - 1} + p_f \cdot \alpha \cdot q_b^{n-1}}{q_b^n}$$

$$G = \frac{(1 - p_f) \cdot q_z^n \cdot (q_z - 1) \cdot (q_b^n - 1)}{(q_z^n - 1) \cdot (q_b - 1) \cdot q_b} + \frac{p_f \cdot \alpha \cdot q_b^{n-1}}{q_b^n}$$

Separate out q_b^n

$$I = \frac{(1 - p_f) \cdot q_z^n \cdot (q_z - 1) \cdot (q_b^n - 1)}{(q_z^n - 1) \cdot (q_b - 1) \cdot q_b} + \frac{q_b^n \cdot (p_f \cdot \alpha \cdot q_b^{-1})}{q_b^n}$$

Cancel q_b^n

$$I = \frac{(1-p_f)\cdot q_z^n \cdot (q_z - 1)\cdot (q_b^n - 1)}{(q_z^n - 1)\cdot (q_b - 1)\cdot q_b} + \frac{1\cdot (p_f \cdot \alpha \cdot q_b^{-1})}{1}$$

Simplify

$$I = \frac{(1-p_f)\cdot q_z^n \cdot (q_z - 1)\cdot (q_b^n - 1)}{(q_z^n - 1)\cdot (q_b^{n+1} - q_b^n)} + p_f \cdot \alpha \cdot q_b^{-1}$$

7.7 Evaluation and example

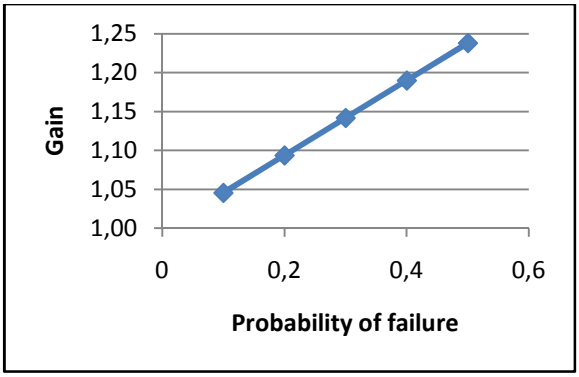
The banks will be made available a concept that controls various investment decisions on debt financing. . It is a useful help in the increase in yield achieved while reducing risk.

Examples will be shown below, as is the gain with varying parameters. The following three scenarios to determine a profit of the bank can be calculated:

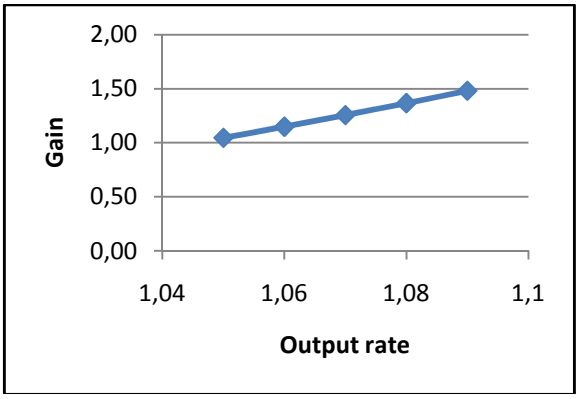
a) Change of the probability of failure: 10% to 50% (constant: q_z, α, n, q_b)
b) Change of the output rate: 5% to 9% (constant: p_f, α, n, q_b)
c) Change of des Recovery value: 50% to 10% (constant: p_f, q_z, n, q_b)
d) Change of Loan term: 5 to 25 years (constant: p_f, q_z, α, q_b)

Figure 2: Different parameters and gain in example

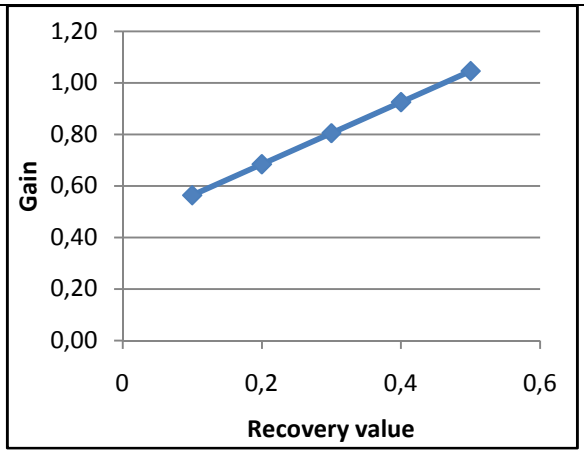
constant: q_z, α, n, q_b	
Probability of failure	**Gain**
10%	5%
20%	9%
30%	14%
40%	19%
50%	24%



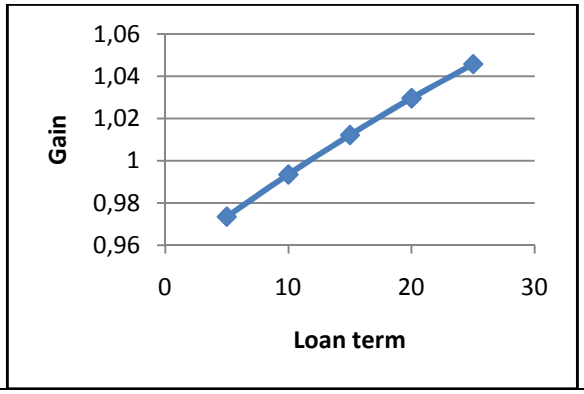
constant: q_z, α, n, q_b	
Output rate	**Gain**
5%	26%
6%	43%
7%	61%
8%	79%
9%	98%



constant: q_z, α, n, q_b	
Recovery value	**Gain**
10%	5%
20%	9%
30%	14%
40%	19%
50%	24%



constant: q_z, α, n, q_b	
Loan term	**Gain**
10	5%
20	9%
30	14%
40	19%
50	24%



8. View

Focus of this work is not the risk assessment of each individual funding, but the presentation of the issue of risk in mortgage lending and the ability to handle them. The competitive pressure among financial institutions has intensified and increase the financing needs of customers, service and consulting services. The result of increasing pressure on margins makes it difficult to ensure a balance between risk and return.

Banks, which know their risks in the real estate financing can achieve a significant competitive advantage in the coming years.

This concept will contribute to develop risk management in real estate financing of credit institutions on the basis of the tools presented.

The instruments are intended to help the hazards and risks, but also the opportunities to understand better. Ultimately, the success of risk management is not dependent on the development and implementation of new and better tools, but the development of an appropriate risk culture.

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