Risk Management for Residential Property
Hedging Alternatives for Small Investors

Master thesis in Economics
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Abstract

This thesis has the intention to investigate the risk situation for small investors in the domestic residential property market in Sweden, and discuss some alternatives for reducing that risk. Focus will be on risk reduction by diversification.

Residential property is considered to be a rather safe investment for the long term investor. The return is determined by the change of value for the property (capital growth), and the direct return through net rental income. When investments in residential property are compared with other types of investments, they have high returns compared to their standard deviation. Diversification gains are described in the frame of the Capital Assets Pricing Model (CAPM).

The CAPM shows that portfolios based on residential property can reduce their risk and maintain the same level of returns through diversification. To get the best effect out of this diversification this should be done with assets that are least correlated with residential property. This thesis has tested with other residential property, other real estate and equities/bonds. Of which equities/bonds gave the best results. An optimal portfolio based on historical data from 1984 – 2003 suggests a portfolio with 40 -60 % residential property, 30 – 60 % bonds and 0 – 10 % equities. This is with a risk free rate between 3 – 11 %. The debt ratio for this portfolio is determined by the investor’s risk-aversity and utility function.

The positive effects from diversification have to be compared to the increased scale effect from investing in more residential property when choosing new investment items. Investors can get a good diversification performance even with a few stakes. The main point in this thesis is that investors with residential property can get positive effects from diversification and the effects from diversification increase the more different the investments are.
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1 Introduction

This thesis has the intention to investigate the risk situation for small investors in the domestic residential property market in Sweden, and discuss some alternatives for reducing that risk. Focus will be on risk reduction by diversification.

Residential property is considered to be a rather safe investment for the long term investor. The return is determined by the change of value for the property (capital growth), and the direct return through net rental income. A more detailed description of the characteristics is in section 3. Most investors prefer a lower return for sure, than a higher return with a higher uncertainty. This can be in order to cover living expenses or buffersavings for retirement. There are different methods to reduce volatility in returns for investors. In the toolbox for investors with residential property we have cost regulating elements like a fixed interest rate, fixed electricity price and long term rent contracts on the income side. But volatility in returns and valuation can also be reduced by investing in different types of assets like other types of real estate or in equities and bonds. Diversification gains can be described in the frame of the Capital Assets Pricing Model (CAPM) which will be explained in section 2.

Large institutional investors can use the toolbox to its full extent, and in addition to that have a well diversified portfolio both within each class of asset, and diversified in combining different types of assets. Small investors do not always have those opportunities depending on which type of assets they are into.

The focus of this thesis is the risk situation for small investors who have invested in residential property. First by describing their risk situation in their residential property investment, and then, by looking at empirical data on returns for different types of assets, suggest how their investments best can be diversified.

The hypothesis that this thesis will prove for a portfolio based on residential property is:

- Risk can be reduced by diversification.
- The diversification effects increase the more different the investments are.

The dataset used in the empirical analysis is provided by SFI/IPD Svenskt Fastighetsindex (SFI/IPD), and is for the period from 1984 – 2004. The dataset is in two series with one from 1984-2003, and the other one from 1997-2004. Even though the series are overlapping in time space they are not compatible due to different methods used under estimation. Data on the Treasury bill rate is taken from Statistics Sweden. The empirical analysis focuses on the domestic real estate market in Sweden, and domestic hedging alternatives.
2 Portfolio Diversification

This section will explain the relationship between risk, return and correlation for investments in a portfolio. The theoretical base is the Capital Asset Pricing Model (CAPM), and general investment diversification theory. The section is based on the assumption that investors are risk-averse and are aiming towards stability both in income and wealth development. Diversification can be a tool to achieve that.

2.1 Risk

Risk can be divided into systematic and non-systematic. Non-systematic risk is the risk each investment item has. Single items have often large volatility, but the effect of this single item volatility can be reduced by putting different items into a portfolio. Each item has its own volatility, and differences in volatility are measured by estimating the correlation coefficient. The less correlated these volatilities are, the more reduction of the portfolio volatility. Typically equities from the same industry are much correlated, while equities from totally different industries are less correlated. The portfolio volatility is also a function of the number of different items in the portfolio (assuming that they are not perfectly correlated). The larger the number of different items in the portfolio the less portfolio volatility. Portfolio volatility is a measure of the systematic risk for a given portfolio. The normal use of the expression systematic risk is the risk for a market portfolio like at the Stockholm stock exchange. The market portfolio contains all equities at the Stockholm stock exchange, and it shows the development for the total wealth invested in that market. Market portfolios can also be combinations of different sub-markets and different types of investment items. The volatility for the market portfolio is not possible to diversify away and this is the systematic risk. The systematic risk for a given market can be looked upon like a benchmark level for portfolio risk. The wider the market is defined, the lower is the systematic risk.

2.2 Capital asset pricing model (CAPM)

The CAPM is one of the most used and widely known models in financial theory, and even though the CAPM is a pricing model it can be used to illustrate how investors can use diversification as a tool to reduce risk in their portfolio, without reducing expected returns. Its appropriateness will be explained further in this sub-section.

The theory used in this sub-section is basic knowledge in economics and can be found in most textbooks covering financial markets at the university level. Böhren & Michalsen (2001) and Haugen (2001) give both detailed and good descriptions of the CAPM, and are for those reasons chosen for this sub-section.

One of the most important foundations behind the CAPM is that there is a tradeoff between risk and return, which are the axis in figure 2.1.

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1 Wider in this context tells us how many sub-markets that is included in building a portfolio. Examples of sub-markets can be: The Swedish stockmarket, The Norwegian stockmarket, The Swedish Bondmarket,……

2 In this thesis risk is measured by the standard deviation, and both terms are used through the text.
Figure 2.1 The Capital Asset Pricing Model.

On the horizontal axis we have standard deviation, and on the vertical axis we have expected return. Both terms are expressed in percent.

The curve connecting the assets with the highest and the lowest return are the combinations of the available assets which give the lowest standard deviation, given the return. All points inside this curve are possible to achieve by combining the assets available, but it is not possible to get outside the curve.

The combinations of available investments make a curved area, and the boundary of this area is called the efficient set. Points below the efficient set give a larger than necessary risk for the expected return. The optimal portfolio is the point in the efficient set which is tangency point when rotating the line that goes through the risk free rate of return upwards. In this point we find the ideal combinations in the market i.e. the market portfolio (M). The market portfolio consists of all available assets weighted after their relative part of the total value. This is true when investors are risk-averse, well diversified and hold portfolios consisting of M and r_f. The line through r_f and M is called the capital market line (CML). On the line r_f – M the investor has invested in government bonds at the risk free rate of return, and money invested in the market portfolio. In the point M, the investor has invested all his wealth in the market portfolio. On the line to the right of M the investor has both his wealth and debt invested in the market portfolio. The funds are borrowed at the risk free rate of return. Within reasonable limits this is true, but as the investors debt ratio increase banks tend to raise the interest rate since the risk for negative investor wealth increase. In the real World r_f is different for savings and debt. Banks tend to pay less in interest rate for savings, than they demand in interest rate for debt. The position on the CML for the individual investor is determined by how risk averse he is. Individual risk situation is expressed through individual utility functions. The individual utility functions are optimised in their
tangency point with CML. The more risk averse the investor is, the more to the left is his tangency point between the utility curve and the CML.

In the market portfolio the non-systematic risk is diversified away, and only the systematic risk is left. This risk is equal to the standard deviation for the market portfolio. When considering new investments the risks for the investments are of less importance. The important risks are the risks they will add to the portfolio. This takes into account how the return for the new investment correlates with the return in the investor’s portfolio. Low correlation is more desirable for new investments than perfect correlation (for investments with similar levels of return). Assets that have negative correlation with the market portfolio are more valuable than assets that are highly correlated with the market portfolio, when it comes to reducing non-systematic risk. This characteristic is also being taken into account when investors trade these items. Investors are willing to pay more for them compared with other assets with similar risk and return features. They add less risk to the portfolio than more correlated assets, and assets that are negatively correlated are more worth!

The CAPM is being used, and is suitable to use, for investors to see the relationship between different assets when building a portfolio. But the use of the model can still vary. People look differently at risk, and knowledge about the different assets can also vary, so the CAPM is some kind of ideal situation that can be used as a benchmark for the reality. Deviations from the CAPM can be looked upon like arbitrage opportunities, and can be caused by either market imperfections or different interpretation (or even misinterpretation) of factors influencing the single asset. Only the first of these two possibilities is an arbitrage opportunity.

The CAPM is based on frictionless capital markets. The friction varies from market to market. Friction can be of different types but for property investments compared with equities we have higher transaction costs, and stickyness due to large item size. Both factors point in the direction of “thin-markets”. Typically this friction is smaller in equity markets than in markets for property investments. The larger the friction, the more costly it gets to rescale the portfolio. Thin markets also imply that business cycles have more impact on valuation of real estate. In the frame of the CAPM this will occur as increased risk for those investments with higher friction costs than their standard deviation tells. A quantification of this effect will not be done within this thesis other than stating that risk for property investments can be underestimated if only the standard deviation is considered.

When adding new investments:

- The reduction in the non-systematic risk is declining, as more stakes are included in the portfolio.

- The reduction in the non-systematic risk is dependent on the correlation between the new investment and the portfolio it is added to. The “perfect hedge” has perfect negative correlation with the portfolio it is added to.

Investors can get a good diversification performance even with a few stakes, or by investing in a fund.
3 Residential property

This section will describe the characteristics of investments in residential property, with focus on the risk situation. It is also based on the assumption that investors are risk-averse and are aiming towards stability both in income and wealth development.

Figure 3.1 shows different returns\(^3\) for residential property. Capital Growth for residential property (CG) and Total Return for residential property (TR) have an almost parallel development, while the Direct Return for residential property (DR) have a downward trend, with less fluctuations than CG and TR. The average TR during the period is 12.95 %, of which CG contributes with 6.96 % and DR with 5.63 %.

![Figure 3.1 Returns residential property 1997-2004.](image)

Source: SFI/IPD Svensk Fastighetsindex

In the table 3.1 data for the last 20 years is used to estimate average annual return, standard deviation and the correlation coefficient with residential property.

<table>
<thead>
<tr>
<th>Period</th>
<th>Return</th>
<th>Stddev</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Total return</td>
<td>17.1</td>
<td>12.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Residential Direct return</td>
<td>6.0</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Residential Capital growth</td>
<td>11.1</td>
<td>6.1</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Table 3.1 Return and standard deviation on residential property 1984-2003.

Source: SFI/IPD Svensk Fastighetsindex

The pattern from figure 3.1 is confirmed in table 3.1 through estimating the correlation coefficient between TR and DR for residential property, which is estimated to be 0.282. In combination with the estimated values for standard deviation one can say that the variation in returns for residential property is mainly caused by fluctuation in CG. DR varies much

\(^3\) Total return = capital growth + direct return. Capital growth is the change in valuation for the property item. Direct return is the income after expenses from having property investments when sales of property items and capital growth is excluded.
less than TR and CG through both sub-periods and in sum. The relative importance of the DR as part of TR has increased during the period (from 35% to 50%). The average annual return DR has remained constant during the period, while the average annual return CG has fallen. This can be due to two reasons: Removal of rent controls has lifted the DR, and the after tax cost of having debt has increased substantially in Sweden if we compare the 80’s with the present situation.

Unless the property item is sold, or the debt ratio is very high, the CG is of less importance for the cash-flow and annual income. DR is the main input for estimation of taxes. The fact that DR fluctuates very little creates short run stability in income. But in the long run CG is also important and has to be taken into account. Residential property investments are considered to have a long horizon. This makes TR the correct input to use when comparing residential property with other types of assets.

### 3.1 The risk situation for residential property

The overall risk situation for residential property is more or less similar to all other investments. But there are some special features for property and residential property that needs to be discussed.

Rent controls put a maximum price the investor can charge in rents for his property. If this level is too low it can lead to market imperfections since there are more people that want rental contracts than there are contracts at that price. It can result in a black market for rental contracts. The investor gets a lower direct return than in a free market situation and residential property is valued lower due to reduced income potential. The smaller DR gives the investor less money in return, and to use for maintenance of the buildings. The Swedish domestic market for residential property has been heavily regulated through rent controls. During the last decades there has been a development towards market pricing and deregulation of the market. This has resulted in that rent income per unit has increased more than the effect of inflation. This effect has been stronger in the large cities like Stockholm, Gothenburg and Malmö, than in the rest of the country. This has most likely had a positive effect on the valuation of residential property the last two decades in Sweden compared with other classes of real estate. This should imply that returns for residential property during this period have been above the long term level. The rents are still below market pricing for many residential units in the large cities, but the further development and the speed of deregulation of rent controls is a political issue which is hard to model and calculate. It can be assumed that this uncertainty is calculated into the prices for residential property. But as risk is removed, prices for residential property will increase.

Real estate is not mobile. This makes property items vulnerable to changes in local legislation. Items that are not possible to move are ideal for the government and municipalities to use when further tax income is needed.

The occupancy rate is also a significant risk factor. Vacancies and falling prices do often occur together. This gives a double negative impact on property returns. Even though va-

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4 Data is taken from table 3.1, and DR is divided with TR for both subperiods.

5 The mismatch between market pricing and contract prices has been higher in these areas than in the rest of Sweden.
cancies lead to some reduced variable costs, other costs\(^6\) are increased in order to increase the occupancy rate again.

There are relatively few buyers and sellers in the market for residential property, and the number of trades per period is lower, if we compare with securities like equities and bonds the market for residential property can be called a thin market. The market is cyclical in the way that in recessions the demand shifts inwards, and prices are low, while in booms demand shifts outwards and prices are higher. This implies that market thickness is a function of the cyclical situation, and that the market for residential property acts procyclical. The procyclical variations in the market for residential property make prices more volatile than would have been the case in a thicker market. The size per item in residential property is large compared with other types of assets. This implies fewer items for the same money and reduced diversification effect. It gives large investors advantages compared with small investors, since diversification effect in this case is proportional with invested money. Thin markets, higher transaction costs and large size per item increase the cost of rescaling the portfolio, and thereby reduce the flexibility in the portfolio. In the frame of the CAPM this should imply a higher risk premium than for other items with similar return features without rescaling costs.

### 3.2 Tax differences between small and large investors.

Large diversified investors have lower expectations on their returns from residential property than undiversified small investors because they have less unsystematic risk. This gives them a comparative advantage. This advantage is partly compensated through the Swedish system of taxation\(^7\).

- Large investors must pay wages to their workers and additional tax on 32.82% to the government, small investors can have a substantial part of their own work on the property item taxed as capital income\(^8\) which is preferable.

- The effect of the untaxed capital growth does also go in the same direction since small investors often have a longer horizon for their investments. Large investors typically have an investment horizon on 10-15 years, and capitalize items each year which implies taxation of the capital growth.

- The specific tax for sales of real estate is also different. For companies the buyer has to pay a specific tax on 3% of the sales value, while the same item has a specific tax on 1.5% if the buyer is an individual.

- Depreciation reduces the annual tax burden, and increases the wealth accumulation until realization. This is because inflation often increases the value of the item more than it is depreciated. When comparing small and large investors, this effect is assumed to be neutral. This effect also occurs in securities, but since the time horizon

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\(^6\) Advertising costs for filling up vacancies, and even extra maintenance costs because of people moving in and out of buildings.

\(^7\) Taxation facts in this sub-section are from Rabe (2003).

\(^8\) “Arbetsgivaravgift” is avoided and the marginal tax is 30%, which is lower than for work income “55%”.
is much shorter for those types of investments, the effect is more positive for property investments.

Taxation differences can make it possible for small investors to get a higher after tax return on the same item. This can reduce some of the negative effects caused by less diversification.

### 3.3 Risk handling methods for residential property

In the risk management toolbox for residential property there are both the general tools which are similar for all types of investments and some specific tools for property investments.

There can be fluctuations both in the item value and in the capital cost. The item value is important in combination with the debt ratio. If debt ratio is high, negative changes in the item value can have strong negative effects. A critical value is if the debt exceeds the item value, and in those cases capital costs often increase heavily. Investors on the limit can also be forced to sell off assets at suboptimal conditions to finance debt or interest rate payments. The higher the debt ratio, the harder it is to increase debt further if need be, and the vulnerability for negative changes in the interest rate also increases as the debt ratio increase. A high debt ratio implies that the investor is taking a higher risk than a low debt ratio which is more robust, and that the vulnerability for changes in the economy increase there is also less money available for diversification.

Fixed interest rates can be an important cost controlling method since interest rates are often one of the largest costs for property investments. But to fix the interest rate implies that risk shifts from the investor to the bank, and the bank wants compensation for it. In the long run fixed interest rates are higher than floating interest rates due to changes in the risk situation. There is a possibility to fix the interest rate before it increases, and to take a floating interest rate when recession comes again. But to do this profitably the investor must have market knowledge and be lucky with the timing. The higher debt ratio the investor has, the more he should consider fixed interest rates for parts of, or the whole debt. In border cases banks often have it as one of the conditions for loan. Alternatively a high debt ratio can be a deliberate choice to increase risk in order to also increase the return.9

In addition to fixing the interest rates, other costs can also be fixed like the electricity price or the oil price. The heating expences are often one of the largest variable costs for property. Climate can vary from year to year which makes the consumption fluctuate, but with fixed prices the volatility is reduced to only one factor namely the consumption. The seller charges extra for a fixed price compared with a floating price, in this case too.

Long term rental contracts can be used to reduce the risk of vacancies for the investor. But the rental guest increases his risk, and wants compensation through reduced rental costs. Because of the risk transfer, the investor will most likely in the long run receive lower rental income and lower volatility in income.

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9 To do this the expected total return for the investment should be higher than the interest rates paid for the debt. Otherwise capital costs will decrease the return on the equity. Capital cost is also a function of the debt ratio. The higher the debt ratio, the higher the capital cost.
The way investments are organised is also a way to either take or reduce risk. If the investments are organised in a limited company, the risk is limited to the invested capital. The alternative is private investments. In this case the investor is responsible with his total wealth, for the total risk in his investments. The choice of organising investments influence terms for debt, interest rates and other possibilities for credit. As in the other examples it is costly to reduce risk.

Diversification is in the general toolbox for investors, but still it deserves special attention for property investors since the impact of not being diversified can be larger for them. They have large investments, and are often undiversified. Even though residential property has rather high direct returns and small fluctuations in the total return, markets can collapse and unforeseen things can happen. Diversification can create both a buffer against such happenings, and it can reduce the risk for a given level of expected return.

Undiversified small investors, in the residential property business, will in the long-run always have a portfolio which is below the efficient set. This is due to the non-systematic risk in their investments. It implies that they will have a higher standard deviation in their returns than if they were diversified, for a given level of return. The CAPM can be useful for these investors as a tool to see how they can create more stability in wealth and income through adding investments to their portfolio, and in the choice between different assets. Alternatives for how to diversify will be discussed further in section 4 with historical data from the Swedish markets.

Local market knowledge and local network/contacts can vary between locations and segments. Many small investors are superior to large investors in this area, and this can give them an advantage. The more investment specific knowledge the investor has, the less risk in his investment. In small segments the scale economies are not as important as in large segments. The combination of superior local market knowledge, small segment and small item size can be an ideal combination for many small investors, and under those conditions they can compete under competitive conditions.

All the discussed tools are consistent with the logic from the CAPM. Those who increase their risk get compensation for it, from those who decrease their risk. It is possible for undiversified small investors to be in the real estate business. This can be due to taxation rules and local market knowledge, which compensate for some of the lacking scale economies and disadvantages of not being diversified. Small and large investors are also competing in different segments of the markets. Large investors are often not interested in small items, which create opportunities for smaller investors to enter the market. But the overall development in the real estate business is increased market share for large investors on behalf of the small investors.
4 Hedging alternatives for residential property

This section will be used to look at historical data from the Swedish markets in order to determine different asset qualities as hedging alternatives for residential property.

Annual data is chosen due to availability, and also because the purpose behind these investments are defensive. For investments in residential property it is costly to rescale the portfolio too often. To include assets from other countries would undoubtfully be positive from a diversification point of view, and even within a similar class of assets large differences could occur between countries both in return, risk and correlation. But the topic for this thesis is not the positive effects from international diversification, and an important input for property investments is also local market knowledge. This market knowledge is in most cases best for the area people live in. Due to convenience, and also supported by the empirical research about “home market effects” like in Coval & Moskowitz (1999), this section will use data only from Sweden. The data from SFI/IPD is solely equity based with no debt.

Most financial time series are random walk processes in their level form (they are non-stationary) which makes it difficult to work with them. But in first difference form they are in general stationary\(^{10}\) which makes them easier to work with (Gujarati (2003)). All series used in this section are in first differences.

Empirical results on risk, return and correlation will be discussed for the different types of assets. Risk reduction will be discussed at three different levels of diversification. The levels in this section are made by looking at how different the assets are compared with residential property. The first level is other residential property in Sweden. The second level is other real estate, and the third level is equities and bonds.

Individual tax situation can be of importance for the solutions, but is not taken into account.

The risk and return dimensions for 7 different types of assets in the Swedish market are shown in table 4.1 and plotted in figure 4.1. Correlation is estimated with residential property as a benchmark.

<table>
<thead>
<tr>
<th></th>
<th>Stddev</th>
<th>Return</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential property TR</td>
<td>11.58</td>
<td>14.7</td>
<td>1.000</td>
</tr>
<tr>
<td>All property TR</td>
<td>15.00</td>
<td>11.5</td>
<td>0.956</td>
</tr>
<tr>
<td>Office TR</td>
<td>16.62</td>
<td>11.3</td>
<td>0.935</td>
</tr>
<tr>
<td>Retail TR</td>
<td>12.20</td>
<td>10.9</td>
<td>0.965</td>
</tr>
<tr>
<td>Industrial TR</td>
<td>14.67</td>
<td>9.8</td>
<td>0.951</td>
</tr>
<tr>
<td>Equities TR</td>
<td>29.87</td>
<td>17.0</td>
<td>0.198</td>
</tr>
<tr>
<td>Bonds TR</td>
<td>8.13</td>
<td>11.1</td>
<td>-0.170</td>
</tr>
</tbody>
</table>

Table 4.1 Risk, return and correlation for chosen assets 1984-2003.

Source: SFI/IPD Svenskt Fastighetsindex.

\(^{10}\) It is a strong statement to make. But whether it is 100 % correct or not is of less importance for the results in this thesis, since data are only used to illustrate and give the directions of the conclusions. If the context was real investment valuation more econometric testing would have been appropriate to make sure whether the data are stationary or not.
Figure 4.1 Comparing assets 1984-2003.

Source: SFI/IPD Svenskt Fastighetsindex.

Other real estate is the area with retail/industrial/office and all property. Simply by looking at this two dimensional figure it is clear that equities have high risk and high return, bonds have low risk and medium return and residential property has both high return and low risk. The other types of real estate have all relatively low returns compared to the risk connected with investing in them. The CAPM suggests that investments are distributed after a linear relationship between risk and return. This linear relationship is not obvious in figure 4.1. But it is too early to conclude by looking at this figure.

4.1 Other residential property

Data for estimating hedging performance for residential property at different locations in Sweden is shown in table 4.2. Correlation coefficient is estimated with “all residential” as benchmark.

<table>
<thead>
<tr>
<th>Total return 1984-2003</th>
<th>Return</th>
<th>Stddev</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Stockholm Central Area</td>
<td>16.2</td>
<td>14.49</td>
<td>0.969</td>
</tr>
<tr>
<td>Residential Rest of Greater Stockholm</td>
<td>14.5</td>
<td>11.76</td>
<td>0.939</td>
</tr>
<tr>
<td>Residential Greater Göteborg</td>
<td>14.3</td>
<td>12.01</td>
<td>0.909</td>
</tr>
<tr>
<td>Residential Greater Malmö</td>
<td>15.4</td>
<td>12.33</td>
<td>0.930</td>
</tr>
<tr>
<td>Residential Other Major Cities</td>
<td>13.1</td>
<td>9.31</td>
<td>0.866</td>
</tr>
<tr>
<td>All Residential</td>
<td>14.7</td>
<td>11.58</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Table 4.2 Comparing residential property in different Swedish areas.

Source: SFI/IPD Svenskt Fastighetsindex.

Variations in both returns and risks for residential property are small. It seems though as both risk and return increase with the size of the city. The estimated correlation coefficients are high for all the regions, and tell that fluctuations are similar in the regions. Diversification through investing in residential property in different Swedish regions gives only a limited positive effect. Scale economies are expected to be larger for investments in one re-
region, than the same investment split up in different regions. This effect has to be considered when residential property investments in other regions are being discussed.

### 4.2 Other real estate

Data for estimating hedging performance for different types of property is shown in table 4.3. Residential property is used as a benchmark for estimating correlation coefficient.

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<td>20.5</td>
<td>14.4</td>
<td>0.956</td>
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</tbody>
</table>

Table 4.3 Comparing different types of property investments 1984 - 2003.

Source: SFI/IPD Svenskt Fastighetsindex.

Both returns and standard deviation has decreased during the period, but the relationship between residential property and the other types of property remains rather constant. Residential property has the lowest standard deviation and highest total return in both sub-periods.

The fact that residential property both has lowest standard deviation, and highest average return, combined with almost perfect correlation between the different types of property makes other types of property poorly suited as hedges for residential property.

Diversification with other real estate compared with other residential property give similar effects. The lack of positive hedging performance can in both cases be compensated by scale economies. It is believed that some of the costs connected with property investments have the nature of scale economies. This effect points in the same direction as diversification within residential property or other property investments, since an increased number of investments within real estate is expected to give positive scale effects.

### 4.3 Equities and Bonds

Data for estimating hedging performance for Swedish equities and bonds is in table 4.4. Correlation coefficient is estimated with residential property as benchmark.

<table>
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<tr>
<th>Source</th>
<th>Return</th>
<th>Stddev</th>
<th>Correlation</th>
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<tr>
<td>Bonds</td>
<td>11.1</td>
<td>8.13</td>
<td>-0.170</td>
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<tr>
<td>Equities</td>
<td>17.0</td>
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<td>Residential</td>
<td>14.7</td>
<td>11.58</td>
<td>1.000</td>
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</table>

Table 4.4 Comparing residential property with equities and bonds.

Source: SFI/IPD Svenskt Fastighetsindex.

In this case variations in standard deviation have increased substantially, and assets are less correlated than within the property area. To show what this implies combinations of the different assets have been calculated, and put in figure 4.2 with risk and return on the axis. All 66 combinations dividable with 10 % have been made, and the three combinations with
100% of one asset are large and red in figure 4.2. The blue and smaller squares are combinations of at least two types of the available assets. This is a simplification of the estimation of the efficient set/possible outcomes, but for this purpose which is to illustrate the positive effects of diversification for residential property it is believed to be sufficient. 66 points are sufficient to illustrate the curved pattern combinations of different assets give.

**Figure 4.2** Combinations of residential property, equities and bonds 1984 - 2003.

Source: SFI/IPD Svenskt Fastighetsindex.

The lines in figure 4.2 connecting the three large points show the area, for the combinations of the available investments, if they had been perfectly correlated (“correlation not included”). Combinations with correlation included are better with respect to their risk return performance than the combinations limited by the triangle. Figure 4.2 also illustrates the fact that it is possible for combinations of investments to have lower risk, than the investment with the lowest risk, for a given level of return.

Figure 4.2 shows that the expected risk can be reduced from 11.58 down to 10.2 for residential property by diversifying with bonds and equities (a portfolio with 80 % residential property, 10 % bonds and 10 % equities). This is with similar expected return. The portfolio with lowest risk has standard deviation 6.1 and expected return 12.5 % (a portfolio with 60 % bonds and 40 % residential property). An important feature in figure 4.2 is that residential property is not on the efficient set, which implies that a portfolio consisting solely by residential property is not optimal from a risk return perspective. Equities and bonds are border cases simply because they are the extreme cases with the highest and the lowest return of the available assets. Figure 4.2 shows how assets that are less correlated can reduce portfolio risk, for a given return.
4.4 Creating an optimal portfolio

A market portfolio is described in section 2, and is determined by $r_f$ and the available investments. The available investments in this case are taken from subsection 4.3 namely residential property, Swedish equities and Swedish Bonds.

The risk free rate of return is chosen to be Swedish Treasury Bills (T-bills) with 3 months maturity. Monthly data from Statistics Sweden is calculated into yearly returns, and shown in figure 4.3.

![figure 4.3](image)

**Figure 4.3** Yearly returns for Swedish 3 months T-bill rates 1984 – 2003.

Source: Statistics Sweden

During the period there is a clear downward trend in the T-bill rate. A linear regression based on data from figure 4.3 suggests a decline in the T-bill rate with 0.56 % a year. This makes it difficult to choose one value for the risk free rate of return. In stead of that boundaries are made. The bottom level is around 3 %, the top level is 14 % and there is a declining trend. According to the logic in the CAPM the risk free rate of return has to be lower than the return for a risky alternative. Bonds have average return on 11.1 %. Then it is likely that $r_f$ is between 3 – 11 %. The average in the T-Bill series is 8.1 %.

The combinations of equities, bonds and residential property are also based on declining trends for those assets. But since the standard deviation have been much larger for those investments the trend is less clear.

As a next step $r_f$ is introduced in figure 4.4 to find the point M. This creates an optimal portfolio that is based on residential property, bonds and some equities. The weights for the different types of assets vary with the chosen risk free rate of return.
The lowest risk portfolio consists of 60% bonds and 40% residential property. This is the ideal portfolio for $r_f$ at 3%. As the risk free rate increases to 11% the share in the ideal portfolio of residential property and equities increases (since tangency point moves upwards on the curve). The tangency point is then at 13.8% return and standard deviation 8.25. The portfolio is then 30% bonds, 10% equities and 60% residential property.

The optimal solution is then:

- 40 - 60% residential property.
- 30 – 60% bonds.
- 0 – 10% equities.

This is a broad solution based on a risk free rate in the region 3 – 11%. Since the risk free rate today is in the area of the lowest border, it is reasonable to expect it to be in the lower part of the boundaries during the coming years. A risk free rate below 3% will automatically make the lowest risk portfolio the optimal. Only if the risk free rate goes above the upper boundary at 11% changes in the bands for the optimal portfolio has to be made. Within the estimated boundaries the investor is expected to be optimally diversified and to have the optimal relationship between risk and return. Based on the present situation the solution is expected to be rather robust for short-term forecasts.

### 4.5 Portfolio effects and implications for investor

The analysis in this section is based on historical data. By using historical data we can make predictions about the future, but historical data is not always a good proxy for future events. The longer the time horizon gets, the larger is the uncertainty in estimates about the future. According to the CAPM the price for each asset is decided by the expected return,
the correlation with the market portfolio and $r_f$. The expected return is $r_f$ plus the risk premium for each asset. The risk free rate has dropped substantially the last decade. This implies that if we use the estimated returns they will probably overshoot the real returns in the near future, but the relationship between the different classes of assets is expected to remain similar to the estimated results, and it is this relationship which is important in diversification. This decaying trend is confirmed through comparing properties for the series from the first and second half of the period like in table 4.3. Both returns and standard deviations are higher in the first half of the period. To conclude this we can say that there are problems with both heteroscedasticity (decaying standard deviation) and non-stationary time series (decaying trend in returns and variance) in the data used in this section. Despite this the results are believed to describe and illustrate the markets in a reliable and robust way.

Hedging with bonds and equities are more valuable than hedging with other types of property due to high correlation between the different types of property. This is logic and expected. It was also expected that different types of property should be strongly correlated and have small variations in risk. But it was not expected that the returns in residential property were so much higher than for other property.

The economic intuition behind these results can be explained through looking at the business cycle. Both residential property and equities seem to follow the business cycle, while bonds act more counter cyclical.
5 Conclusion

The purpose of this thesis was to discuss the overall risk situation for small investors who have invested in residential property. There are both advantages and disadvantages by being a small investor in residential property. The main disadvantage is that they are often poorly diversified. This makes their income and wealth fluctuate more than investors that are properly diversified. Some Swedish tax rules give small investors a preferable treatment compared to larger investors. On the other hand small and large investors are often competing in different segments, which make comparison rather irrelevant. Local market knowledge is also important as a method to reduce risk.

When investments in residential property are compared with other types of investments, they have high returns compared to their standard deviation. This is most evident for other real estate, of which all the other categories had lower returns and higher standard deviations. The good performance for residential property can be caused by low valuation at the beginning of the period due to rent controls. Rent controls have less market impact now than 20 years ago. The friction costs in residential property investments are not accounted for in the CAPM since they are “constant”. If they should be included it implies that the risk premium for residential property should increase compared with submarkets that have less friction. Compared with other real estate it would have no effect since all real estate has comparable friction.

The CAPM shows that portfolios based on residential property can reduce their risk and maintain the same level of returns through diversification. To get the best effect out of this diversification this should be done with assets that are least correlated with residential property. This thesis has tested with other residential property, other real estate and equities/bonds. Of which equities/bonds gave the best results. An optimal portfolio based on historical data from 1984 – 2003 suggests a portfolio with 40 – 60 % residential property, 30 – 60 % bonds and 0 – 10 % equities. This is with a risk free rate between 3 – 11 %. The debt ratio for this portfolio is determined by the investor’s risk-aversity and utility function.

The positive effects from diversification have to be compared to the increased scale effect from investing in more residential property when choosing new investment items. Investors can get a good diversification performance even with a few stakes. The main point in this thesis is that investors with residential property can get positive effects from diversification and the effect of diversification increase as the investments becomes more different.

5.1 Suggested future research

This is a vast area, and only each person’s imagination, interest for the area and knowledge limits further research. Still I have some suggestions for further research:

- The market situation with large state owned property companies and their impact on local rental markets for residential property.
- Rent controls for residential property in Sweden and their impact on residential property investments.
References


Internet references

Statistics Sweden, www.scb.se

SFI/IPD Svensk Fastighetsindex, www.fastighetsindex.se
## Appendix 1: Data from SFI/IPD Svensk Fastighetsindex 1997-2004.

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Appendix 1: Data from SFI/IPD Svensk Fastighetsindex 1997-2004.

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In the different tables the best value for each column is in **bold**.

Average, standard deviation and correlation coefficients are estimated in excel.

This appendix is included to show the quality of the data used. This serie is available on internet, while the 1984-2003 is only available through contacting SF/IPD Svensk Fastighetsindex.