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Who has really paid for the Reconstruction of East Germany? Expected and Realized Returns on Real Estate Investments in East and West Germany in the 1990s

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Abstract
We evaluate the profitability of investments in residential property in Germany after unification with a focus on the comparison of East and West Germany. Calculations are carried out for (1) the after-tax return an investor might have expected at the beginning of the 1990s, and (2) the after-tax return that has been realized ten years after. We compare a set of statistical data for investments in fifty major cities by using complete financial budgeting. The results show that tax subsidies could not always protect investors from losing money, but they have boosted realized returns after tax considerably. Therefore, it was indeed the taxpayers, not the investors, who have borne the cost of reconstructing East Germany.

Keywords: real-estate investment, after-tax return on investment, tax subsidies, Assisted Area Law (Fördergebietsgesetz), empirical study, income tax reduction, loss offset, special depreciation, return on equity capital (ROE), property prices

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1 Introduction

At the time of German re-unification in 1990, after more than four decades of socialist maladministration, supply of flats and houses were short and the existing structure was generally in a very poor state of preservation. As a fast catch-up of the East German economy was expected, real property markets were characterized by a peak in the demand for housing and increasing property prices. Federal government promoted housebuilding and improvement with generous additional tax breaks and by the mid-1990s there was a real construction boom (Donner 2001, p. 60). When the transformation turned out to be slower than expected and the net-out migration from the new federal states could not be stopped (Burda 2006, p. 5), this massive construction resulted in an oversupply of dwellings. Vacancy rates were rising, and property prices and rents were in decline until the recent past (Vornholz 2001, p. 712-714).

According to a popular view, investment in residential property in East Germany after unification has turned out to be a financial disaster in most cases. Nota bene: we are not referring to scientific papers but to a view prevalent in the German media and, therefore, probably also in the general public.[1] This seems plausible, given the initial boom in the market for real property and its subsequent breakdown. But it does not take into account the generous tax benefits offered to investors in the new federal states. The media tend to argue based on the development of prices and rents or anecdotic evidence

[1] E.g., Handelsblatt No. 62, 28th March 2003, p. 44; Die Welt No. 190, 16th August 2003, p. IM 1 (two daily papers); Der Spiegel, 21st February 2004, p. 78; Welt am Sonntag, 11th July 2004, p. IM128 (two weekly news magazines); CAPITAL, 27th November 2003, p. 102; manager magazin, 1st April 2001, p. 252 (two monthly magazines).

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from spectacular misinvestments. The purpose of this paper is to challenge this wide-spread view by calculating (1) the after-tax return an investor in real property might have expected at the beginning of the 1990s, and (2) the after-tax return that has been realized ten years after, showing how profitable the investment has actually been. Only if realized returns after tax turn out to be substantially lower than those of similar investments in the old federal area would popular wisdom be confirmed. Otherwise we would have to conclude that the special tax subsidies have compensated for the unexpected downturn in the East German real estate market and that it has been the general public who has borne the cost of reconstructing the East.

To this end we compare investments in an average individually owned flat in seventeen major cities in East Germany including Berlin and thirty-three cities in West Germany. The term "individually owned flat" refers to a flat within a larger property, usually a multi-unit dwelling, where the ownership in the separate flat is typically connected with a share in the common property of the multi-unit dwelling. Expected rates of return are derived through complete financial budgeting for each investment based on expected rents, expected property prices in the year of divestment, expected lending and borrowing rates, and the tax law effective in the year of investment. Our approach is based on the assumption that this segment of the real estate market is not a perfect market. Realized returns are calculated using prices, rents, and interest rates which could actually be realized during the investment period. Changes in tax legislation are also taken into account. We use data for average property prices and rents for typified flats provided by BulwienGesa AG, a research and consulting firm that specialises in the analysis of real property markets.[2] Deutsche Bundesbank, the German central bank and the Bank for International Settlements use these data for calculating a nation-wide price indicator for real property. Although there may remain doubts about the quality, these standardized data are believed to be a more adequate indicator than a simple and raw average of transaction data which is provided by RDM, an association of real estate agents.[3]

Our contribution to the literature is twofold: Quite a number of publications measure the performance of investments in shares and bonds (Maier and Stehle 1999; Stehle 1999; Stehle 2004; Kachel, Kuhn, and Prugovecki 2004; Zeller 2005), and there is even some literature on investment funds and real estate investment funds (Maurer and Stephan 1995; Maurer, Reiner, and Rogalla 2004; Stark 2006; Darius and Schins 2006). But to our knowledge there is no study on the performance of direct real estate investments although they make up an import share of the portfolio of wealthy individuals in Germany. As the income from this type of investment is taxed quite differently to other forms of capital income, performance measurement must necessarily include tax consequences. Unlike shares, it is practically impossible to draw conclusions from price statistics, directly. Taxation of rental income is one of the last major loopholes in the German Income Tax Code. This issue has been discussed by tax researchers (Hundsdoerfer 2002, p. 375; Wissel 1999, p. 192) but has found astonishingly little attention in the political discussion. Therefore, our second contribution to the literature is to shed light on a politically disregarded tax subsidy by revealing the value of tax subsidies to a typical direct real estate investment.

The rest of the paper is organised as follows: in section 2 relevant aspects of tax legislation in Germany are presented. The data set and its interpretation for the purpose of this study is discussed in section 3. In section 4, computations of the expected and realized returns are described, some critical assumptions are discussed, and results are evaluated. Section 5 summarises and concludes. This article is supplemented with Excel spreadsheets that provide the relevant input data for all 50 German cities and allow the reader to reproduce our results, or to calculate expected and realized returns of a direct real estate investment based on own estimations of the relevant input data.[4]

[2] We gratefully acknowledge to the support from BulwienGesa AG for giving us access to their property price statistics.

[3] See Deutsche Bundesbank (2003a), Leifer (2004), p. 442, similar discussion of the quality of various indices for the British housing market see Bank of England (2003).

[4] These Excel files can be downloaded from www.business-research.org

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2 Taxation of Real Estate Investments

Tax consequences of an investment in residential property mainly result from the Income Tax Law (Einkommensteuergesetz, abbr.: EStG). Since it is assumed that the investor held the flat as privately owned (non-business) property, income from renting the flat is to be classified as income from rentals and royalties (EStG § 21 (1)). This is quite typical for direct real estate investments of high-income individuals in Germany. Investments in assets in the new federal states including Berlin acquired after 31 December 1990 and before 1 January 1997 were promoted by certain tax benefits stipulated under the *Assisted Area Law* (Fördergebietsgesetz, abbr.: FöGbG) of 24 June 1991 (BGBl 1991 I p.1322, 1331).

2.1 Income Tax on Rental Income

Net rental income is to be computed as the excess of total receipts from rents over income-related expenses (EStG § 2 (2) No. 2). Deductible income-related expenses are interest on loans, insofar as they relate to generating the rental income (EStG § 9 (1)), taxes on real property (EStG § 9 (1) No. 2), and depreciation (EStG § 9 (1) No. 7 and EStG § 7 (4, 5)).

The *Assisted Area Law* permitted, among other things, the claim of a *special depreciation amount* of 50 % of the acquisition cost (FöGbG § 4 (1)) for privately owned depreciable, immovable assets such as buildings and separately owned flats if they had been purchased in the year of completion (FöGbG § 3).[5] The remaining 50 % of the acquisition cost may be depreciated over 50 years according to EStG § 7 (4). In the case of a converted building only the conversion costs qualify for the accelerated depreciation and the acquisition cost for the old building must be depreciated according to regular schemes of the Income Tax Law.

Further income-related expenses are the disbursements for the maintenance or repair of the rented property as well as the premiums for insurances of the apartment, because these costs are also incurred by obtaining, maintaining or preserving the rental income. A loss from renting the flat would arise if the income-related expenses exceeded the receipts from rentals in a certain calendar year. Such a loss can be netted against positive income from the same income category or/and from the other categories (EStG § 2 (3)).[6] Losses, which are not offset in the period they occurred in, can be carried back to the previous period up to € 511,500 (EStG § 10d (1)) or alternatively carried forward to future periods without time limit (EStG § 10d (2) and (4)).

In the calculations, it is assumed for convenience that a loss which might have been sustained from renting the dwelling can be immediately and completely offset against positive income from other sources, so that the investor receives an immediate tax reduction and no losses needed to be carried back or forward. A loss reduces the total income tax liability and leads to a tax reimbursement, if income tax has been collected at source such as the wage tax. So-called "progressive benefits" would be obtained, if a loss reduced taxable income so much that a lower marginal tax rate would be applicable. We always apply the highest marginal tax rate, as it is assumed that the investor belongs to top income earners.

2.2 Income Tax on Capital Gains

A *capital gain* from the sale of a privately owned flat is to be classified as other income according to sec. 22 (EStG § 22 No. 2) and thus is liable to income tax if the time period between the acquisition and the sale of the apartment does not exceed 10 years (EStG § 23 (1) No. 1). The profit or loss from the sale of an individually owned flat is the difference between its price of sale and its acquisition cost reduced by regular, accelerated or/and special depreciation amounts which were claimed (EStG § 23 (3)). Losses from the sale of private assets may only be offset against profits from the sale of private property (EStG § 23 (3)). We assume that the sales of the privately owned flats occur after ten years, so that any capital gains earned are not liable to income tax.

2.3 Other Taxes

In addition to the income tax, a solidarity surcharge (Solidaritätszuschlag, abbr.: SolZ) is levied on the actual income tax amount (SolZG § 3 (2)) for the

[5] In the United States a comparable depreciation method has been introduced with the *Economic Stimulus Act of 2008*. This act allows a 50 % bonus first-year depreciation deduction, see Watts and Farewell (2008), p. 677.

[6] The German income tax system knows the concept of passive loss limitations. But it is not applicable to current rental income. See passive loss limitation on capital gains from the sale of a privately owned flat in section 2.2.

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purpose of supporting the economy of the new federal states.

Another tax that needs to be taken into account is the real property transfer tax. The Real Property Transfer Tax Law (Grunderwerbsteuergesetz, abbr.: GrEStG) relates to real property as understood by civil law, i.e. it refers to the land and any buildings on it. Flat ownership is also considered as real property (GrEStG § 2 (2), No. 3). The tax is imposed on transactions which imply a transfer of title to domestic real property and is usually measured by the purchase price (GrEStG §§ 8-9).

The effects of the real property tax were considered, too. The tax is annually imposed on farming and forestry establishments (called real property tax A) and on real estate (termed real property tax B) [GrStG § 2 No. 1, 2]. The tax liability of the real property tax B is calculated in two steps as stipulated in the law: First, the standardized value is multiplied by a factor of 0.0035 for general real estate (GrStG §§ 13 (1), 15 (1)). Then, a multiplier, which is determined by the municipality (GrStG § 25 (1)) and which varies between approximately 200 % and 600 %, is applied to this result (Rose (1993), p. 126-127). Real estate situated in the new federal states is subject to special rules. Partly, the standardized values of 1935 form the tax base (GrStG § 41). If the standardized value of 1935 does not exist or cannot be determined, a substitute assessment basis is applied to certain types of residential property such as rental housing capital (GrStG § 42).

The wealth tax was imposed on natural and legal persons until 1996, but has not been collected since 1997 because of the decision of the Federal Constitutional Court of 22 June 1995 (European Commission (ed) 2005, p. 12). The tax was regulated by the Wealth Tax Law (Vermögensteuergesetz, abbr.: VStG) and related to many stipulations of the Valuation Law (Bewertungsgesetz, abbr.: BewG). The wealth tax was levied on the net worth (assets minus liabilities) as defined according to sec. 114 to 120 of the Valuation Law (VStG § 4). Due to this fact no tax liability would arise in the first years after the acquisition of the flat if the investment was largely debt-financed. Since rental income is exempt from value added tax (VAT) according to Sec. 4 No. 12 of the Value Added Tax Law, VAT does not need to be considered. Likewise, church tax is not taken into account, because the investor is assumed not to belong to a public-law church body.

2.4 Changes in Tax Legislation between 1992 and 2002

During the investment period several relevant elements of German tax law have been subject to changes which have to be taken into account when calculating realized returns: The income tax tariff in Section 32a of the Income Tax Law has been changed substantially since 1999. The highest marginal tax rate in the upper proportional zone totalled to 53 % from 1991 until 1999. It was reduced to 51 % in 2000, to 48.5 % in 2001 and 2002. These reductions were the results of the Tax Relief Law 1999/2000/2002, the Tax Reduction Law of 23 October 2000, BGBl 2000 I p. 1433, the Extended Tax Reduction Law of 19 December 2000, BGBl 2000 I p. 1812. The tax rate of the solidarity surcharge has changed over time, as well. First, the solidarity surcharge was introduced only for the assessment periods 1991 and 1992 to be imposed at a regular rate of 7.5 % (Solidarity Surcharge Law of 24 June 1991, BGBl 1991 I p. 1318). Then, under the Solidarity Surcharge Law 1995 of 23 June 1993, BGBl 1993 I p. 975, the charge was levied at a rate of 7.5 % (§ 4) without time limit as from 1995. The tax rate of 7.5 % has been replaced by a rate of 5.5 % from the assessment period of 1998 under the Law of 21 November 1997, BGBl 1997 I p. 2743. A lump-sum deduction of DM 42 per m² of living space was deductible as an income-related expense in addition to interests on loans and depreciation from 1996 to 1998. This lump-sum deduction was introduced by Article 1, No. 15 of the Law of 11 October 1995, BGBl 1995 I p. 1250 and abolished by Article 1, No. 14 of the Tax Relief Law 1999/2000/2002 of 24 March 1999, BGBl 1999 I p. 402. The purchase of an individually owned flat has been subject to the real property transfer tax as from 24 June 1991 (Article 23 of the Law of 24 June 1991, BGBl 1991 I p. 1322). At that time, the tax was imposed at a rate of 2 % (section 11 of GrEStG 1983 of 17 December 1982, BGBl 1982 I p. 1777). The tax rate has been increased to 3.5 % as from 1 January 1997.

3 Data

Calculation of realized returns of typical or average real estate investments first of all requires information on the actual past development of property prices and rents. As our calculations should be of representative character we found it most appropriate to use existing statistical data. Nevertheless, this

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kind of data cannot be readily obtained for a number of reasons: First, a continuous measurement of price trends of identical objects is simply not possible, because there are usually long intervals between any two transactions, so that ongoing price measurements must relate to different objects. Second, residential property is very heterogeneous. No single building is completely identical to another. The most important single pricing determinant is the location of a property. Other relevant pricing determinants are, e.g., the living space, the characteristics and the configuration of the flat (Bank of England 2003, p. 38; Deutsche Bundesbank 2003a, p. 46).

It is due to these technical problems that for a long time there have not been any official statistics for residential property prices in Germany. It was not until 2003 that Deutsche Bundesbank presented a property price index (Monatsbericht Mai 2003; English version: Monthly Report September 2003). This index is based on raw data on rents and property prices provided by BulwienGesa AG. These statistics are available for terraced houses and flats of standardized characteristics in a number of German cities. There are prices for new and new reformed dwellings and for used property. BulwienGesa AG has provided us with data series of average prices of residential property and average rents for new and second-hand flats for fifty German cities.[7] Data go back to 1990 (see *Figures 1-4* below, exemplified in detail for Erfurt (Thuringia), Leipzig (Saxony), Magdeburg (Saxony-Anhalt), Munich (Bavaria) and Stuttgart (Baden-Württemberg), all data are given in Euro). According to BulwienGesa AG data series were derived from prices and rents of flats with approximately 70 m² of living space, three rooms, and in good locations. We find these characteristics appropriate for a typical direct investment in rental property.

These data are used in several ways: First, the *purchase price* for each of the five flats is directly taken from BulwienGesa's average property prices for new and new reformed dwellings in the respective city in the year of the investment. Second, the nominal amount of the rent in the first year is also taken from the data set of rents for first-time occupation.

Generating reasonable numbers for expected changes in property values and rents requires some additional assumptions. In principle, the prices of resold flats should form the basis of the property price movements over the investment period and the change in rents should be calculated from reoccupation data. But due to the special situation after unification, there seem to be quality-related differences in the data series for the new federal states. From 1990 to the mid-1990s the increase in the prices for resold flats in the three East German cities is substantially higher than for new dwellings (see *Figures 1 and 2*). Presumably, the share of well-preserved and well-equipped flats in the total stock of second-hand flats was very small in 1990. Over the years, this proportion has certainly risen substantially due to the massive construction of new dwellings and the renovation of older ones. The extraordinary increase in the prices of resold flats in the three Eastern German cities (see *Figure 2)* thus reflects a change in the quality of the average flat sold. Over the same period of time, we observe a strong increase in rents for reoccupation in the East German cities (see *Figure 4*). This effect should at least partially be due to the adjustment of the heavily subsidised rents in the former GDR to market levels. This interpretation is supported by the fact that these effects cannot be observed in the data of the cities in the old federal area. This is why we derive price movements for investments in Munich and Stuttgart from resale property prices and from rents for reoccupation without further modification. In order to eliminate the presumed data-quality-related effects from price trends in the new federal states, price movements as well as the changes in rents are computed by using a weighted average of the data for new dwellings (80 %) and second-hand flats (20 %) until 1995. We believe that the data for new dwellings are less polluted with quality-related differences and therefore better reflect the pure price movements over this period. As from 1996 the price trends were calculated by using only resale data, since the effect of quality differences should be rather small by then.

There are no comparable issues to be reported with respect to the remaining input data. Credit and debit interest rates are readily available through Bundesbank statistics (for details, see sec. 4.3 and 4.6). Tax data, including special municipal tax rates, have been collected from several sources (for details see sec. 4.6).

[7] We have picked the biggest German cities in proportion to the distribution of the population over the Federal States. In order to get a better picture of the Eastern States we had to overweight their share (33% instead of 20%).

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Figure 1: Prices of flats in different cities (New dwellings)

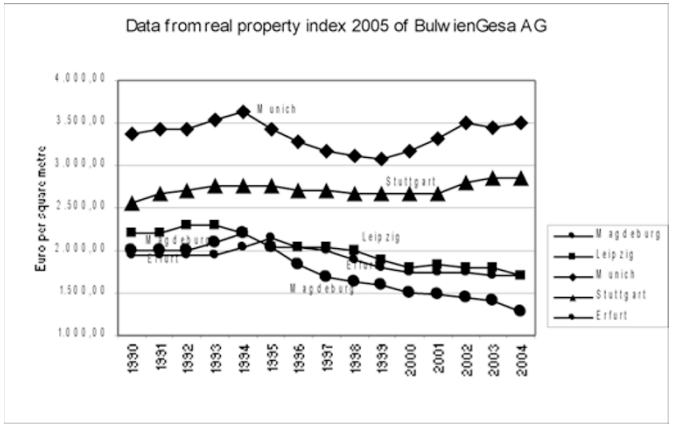


Figure 2: Prices of flats in different cities (Resales)

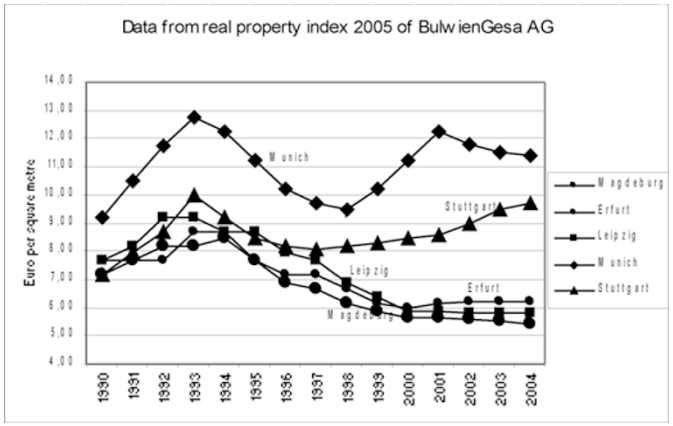


Figure 3: Rents of flats (First-time occupation)

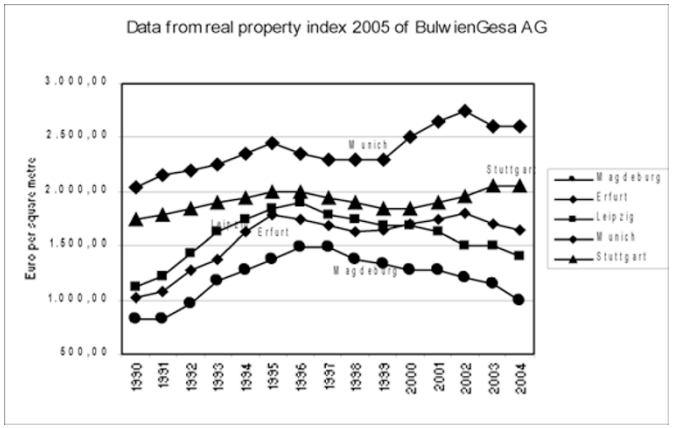
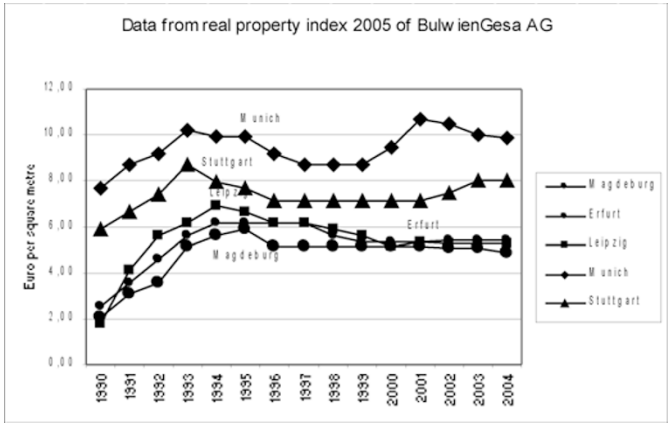


Figure 4: Rents of flats (Reoccupation)



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4 Computation of Returns

4.1 Assumptions on the Market Structure

The following analysis is based on the assumption of an imperfect real estate market. In the literature, there can be found more arguments in favor of this assumption than against it (Case and Shiller 1989; Guntermann and Norrbin 1991; Darrat and Glascock 1993). In detail, a real estate market is characterised by the heterogeneity of objects and by high transaction costs (Plewka 2003, p. 202; Maurer, Sebastian, and Stephan 2000, p. 2, 14). Furthermore, a lot of transaction data have not been publicly available in Germany (Plewka 2003, p. 201; Maurer, Sebastian, and Stephan 2000, p. 8, 17; Maurer and Stephan 1996, p. 1529). Up to now, a derivative market could not be established and arbitrage is practically impossible (Plewka 2003); Maurer, Sebastian, and Stephan 2000, p. 3). The assessment of an object's value for tax purposes or for reporting purposes of open-end real estate funds is problematic because it is difficult to find comparable transaction data. A market segmentation which would be necessary for a homogeneous classification of objects regularly fails due to a lack of representative transactions (Maurer and Stephan 1996, p. 1530).

Based on these arguments the literature tends to see real estate markets as rather imperfect markets. The focus of this literature is not the market for small direct investments but rather large objects which are held by institutional investors including insurance companies and real estate funds. All of these arguments are also valid for small direct investments in the housing market. Besides, there is an even more important factor which impedes the assumption of market perfection: taxation. The treatment of income from rentals under the German Income Tax for individuals is very different from the taxation of any other income category (including real estate funds). Rates of return after tax are highly sensitive to even small changes in the investor's personal tax rate. Book losses from the investment can be used as a tax shield for income from other sources which otherwise would be subject to income tax. This is not possible with an investment in, e.g., real estate funds.

4.2 Capital Budgeting Method applied

In order to evaluate expected and realized profitability, *terminal wealth* is calculated using a *concept of capital budgeting* (Kruschwitz 2009, p. 45; Copeland and Weston 2005, p. 24; Ross, Westerfield, and Jaffe 1999, p. 161). All payments related to the project including a mortgage loan and the reinvestment of positive cash flows are accounted for and the terminal wealth is calculated for each object. This method of capital budgeting is consistent with the assumptions of imperfect capital markets with differing debit and credit interest rates as well as an imperfect real estate market.

As the average price of the standard flat differs between cities, terminal wealth is transformed into Baldwin-type rates of return in order to make the profitability of investments of different amounts comparable. The expected / realized return on the investor's equity ROE is (Baldwin 1959):

$$(1) \qquad ROE = \begin{cases} \sqrt[n]{\frac{E_n}{E_0}} - 1 & for\ E_n \geq 0 \\ -\sqrt[n]{1 - \frac{E_n}{E_0}} & for\ E_n < 0 \end{cases}$$

where E_o denotes the amount of equity capital invested at date $t=0$ and E_n denotes the terminal wealth of the investor's equity at the date of divestment $t=n=10$. An ROE higher than the opportunity cost of capital means that this investment is a favorable one. When comparing the profitability of different projects, a higher ROE stands for a more profitable project. This characteristic allows us to get a ranking of all investments analyzed.[8] Different expected ROE (before and after tax) are an implication of our assumption of imperfect housing markets.[9]

[8] Nevertheless, using ROE as a tool for capital budgeting may lead to wrong decisions when projects with different investment periods are compared (Hax 1993, p. 31; Pegels 1968, p. 219) or when an entire investment program has to be decided on.

[9] In contrast, the concept of "implicit taxes" would assume markets to be in equilibrium and ROE to be equal everywhere ex ante, see Scholes et al. (2008), p. 130.

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4.3 Expected Return: Calculation

Expected ROE are calculated using forecasted prices and interest rates as if they were certain. We do not account for uncertainty in any way because we think our approach is good enough to produce an indicator of ROE that could realistically be expected, given the market environment as it was in the year the investment was to be undertaken. Technically, this simplification could easily be overcome by including a sensitivity analysis or by accounting for probability-weighted scenarios.

It was assumed that all cash inflows and outflows always occur at the end of the period. The investor is assumed to maximize terminal wealth. There are no withdrawals for consumption during the investment period. Positive cash flows are reinvested at the relevant credit interest rate. Negative cash flows are assumed to reduce an existing capital market investment. Therefore, the investor loses other income at the credit interest rate. This foregone income is attributed to the project. Calculations are in Euro. Data prior to the introduction of the Euro in 1998 were converted at the official rate (1 € = 1.95583 DM). Furthermore, it should be noted that exact numbers were used for computation although numbers displayed are rounded to full Cents.

The input data and assumptions underlying the calculation of the ROE for an investment in Magdeburg (Saxony-Anhalt) are given in *Table 1*. Differences between these data for Magdeburg (Saxony-Anhalt) and the data for the other forty-nine cities are restricted to the purchase price of the flat, the rent, and data which derive from these amounts (e.g., amount of loan). It is assumed that the flat is purchased in the same fiscal year in which the (re-)construction of the building had been completed. The date of purchase is 30 December 1992. In addition to the purchase price, it was estimated that some fringe costs of 5 % of the purchase price (see *Table 1*) were incurred for extra expenses such as the real property transfer tax that amounted to 2 % at that time (section 11 of GrEStG 1983 as of 17 December 1982, BGBl 1982 I p. 1777), and costs for real estate agents and the like.

We assume that 75 % of the purchase cost is financed through a mortgage loan. Such a debt ratio can be regarded as conservative, since even ratios of up to 80 % are not unusual for direct real estate investments (see Laux 1993, p. 380). According to German practice, the loan is an annuity loan with a fixed interest rate. Typically, the interest rate is fixed for 5, 10, or sometimes 15 years and will then be renegotiated. On these dates, the mortgagee has the right to pay back the loan instead. In accordance with his planning horizon, we assume the investor to choose a fixed rate for 10 years. On divestment at date t=10, the investor pays back the outstanding loan. Using the average nominal interest rate for mortgage loans in December 1992 of p=9.3 % which was computed on the basis of the effective rate of 9.71 % (Statistisches Bundesamt 1995, p. 360) and assuming a contract term for the mortgage of n=30 years, the annuity payment to serve the loan is calculated as:

(2)
$$Ann_t = L_0 * \frac{p(1+p)^n}{(1+p)^n - 1}$$

Thus, the annuity payment for the investment in Magdeburg (Saxony-Anhalt), which requires a debt capital L0=109,921 €, totals to 10,985 € (see Table 1). The term structure of credit interest rates (e.g., 7.58 % in year 1) at which cash flows from the investment are reinvested until the end of the planning horizon are implicit forward rates derived on the basis of the term structure in the debt securities market published in the capital market statistics (Deutsche Bundesbank 2003c, p. 40). Forward rates (f) were computed from spot rates (r) on zero-coupon bonds without a default risk with a residual maturity (T) of 1 to 10 years by applying the formula:

(3)
$$f_T = \frac{(1+r_T)^T}{(1+r_{T-1})^{T-1}} - 1$$

It is estimated that property values, rents, and operating expenditures will all increase by an average 3 % p.a. These assumptions were adopted from Laux (1993, p. 382) and can be regarded as reasonable estimates at that date.

The complete *cash flow calculation* of the investment in the flat in Magdeburg (Saxony-Anhalt) is depicted in *Table 2*. Calculations for the other cities are built up likewise. Total cash inflow per year is calculated in lines 1-6; cash outflow in lines 7-14.

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Table 1: Data of calculation of expected return (Investment in flat in Magedburg)

Investment Cost		
Purchase price for flat	70 m²	1,994.04 €/m²
	100%	139,582.80 €
Share of building	60%	83,749.68 €
Share of land	40%	55,833.12€
Fringe costs	5%	6,979.14 €
Total investment	105%	146,561.94 €

Receipts (Annual rent received)			
70 m²	8.18 €/m²/month	12 months	6,871.20 €
Change in rents			3.00 % p.a.
		34.39 % over investment period	
Change in property value			3.00 % p.a.
		34.39 % over investment period	
Credit interest rate (year 1)			7.58 %

Results	
ROE before tax	0.97 %
ROE after tax	11.09 %
Gross return on capital invested	4.69 %

Financial Capital Structure		
Dept capital	75 %	109,921.46 €
Equity capital	25 %	36,640.49 €
Total	100 %	146,561.94 €

Debt capital – Annuity Loan	
Nominal amount	109,921.46 €
Amount of pay-out	100.0 %
Interest rate	9.3 %
Term of loan	30 years
Annuity payment	10,985.13 %

Operating Expenditures	
Rate of inflation	3 %
Maintenance and repairs (0,5 % of building value)	418.75 € p.a.
Insurance	76.00 € p.a.

The calculation of taxable rental income and interest income (from re-investing free cash flows) is calculated in lines 21-37, resulting in a net income tax payment (>0) or reduction (<0) from the investment (line 37 = line 16). This payment (reimbursement) reduces (increases) the cash flow before tax and results in the cash flow after tax of that year (line 17). All cash flows are reinvested at the assumed credit interest rate. The ROE after tax of 11.31 % is calculated by applying formula (1) to the cumulated cash flow at date t=10, € 106,986.67 (line 18). The ROE before tax (.97 %, line 19) is computed with the help of the calculation table at the bottom (line 38 to 40). In contrast to the calculation of ROE after tax the relevant reference value is the cumulated terminal wealth before income tax (line 39).

Payments for income tax and solidarity surcharge are computed separately for rental income (lines 21 to 34 in *Table 2*) and interest income (lines 35-36). Assuming that the investment takes place at the end of year 0, the investor can claim a special depreciation amount of 50 % of the building value including a share of 60 % of the fringe cost (line 25) in that same year. In the case of a newly converted building, special depreciation was restricted to the cost of conversion. In the following years, the building is depreciated in constant amounts of 2 % of this initial book value (line 26). Net income (line 32) multiplied with the marginal tax rate of the investor will give the income tax reduction or increase from rental income (line 34). In addition to the assumption that the investor has the highest marginal income tax rate, it was assumed that potential losses would not reduce the income so much that a lower marginal tax rate would become applicable. The highest marginal income tax rate was 53 % at that time and the solidarity surcharge amounted to 7.5 % (Solidarity Surcharge Law of 24 June 1991, BGBl 1991 I p. 1318). Since the solidarity surcharge is to be imposed on the income tax liability (SolZG § 3 (2)), a marginal tax rate of 56.975 % was applicable. Because the solidarity surcharge was restricted to the years 1991 and 1992 (Solidarity Surcharge Law of 24 June 1991, BGBl 1991 I p. 1318), from 1993 onwards the marginal tax rate of 53 % was used.

4.4 Alternative Assumption: Equal Expected Return on all local markets

A critical reader might argue that real estate markets are nearly perfect markets and that expected after tax returns should be the same for every local market. An alternative approach consistent with this view would be to start from the assumption that risk is more or less the same all over Germany, and that therefore expected rates of return must be the same everywhere. In the structure of our model this

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Table 2: Financial Plan of Calculation of Expected Return (Investment in flat for first-time occupation in Magdeburg)

		1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
	Cash Inflows												
1.	Income from rentals (3.00 %)		6,871.20	7,077.34	7,289.66	7,508.35	7,733.60	7,965.60	8,204,57	8,450.71	8,704.23	8,965.36	78,770.61
2.	Interest earnings		1,898.87	1,635.71	1,563.49	1,543.19	1,514.48	1,486.41	1,442.76	1,400.32	1,358.99	1,318.65	15,162.88
3.	Pay-out loan	109,921.46											109,921.46
4.	Pay-out equity capital	36,640.49											36,640.49
5.	Liquidation value of property											187,587.61	187,587.61
6.	**Total Cash Inflow**	**146,561.94**	**8,770.07**	**8,713.04**	**8,853.15**	**9,051.54**	**9,248.08**	**9,452.02**	**9,647.33**	**9,851.03**	**10,063.22**	**197,871.62**	**428,083.04**
	Cash Outflows												
7.	Maintenance / re pairs (3.00 %)		-418.75	-431.31	-444.25	-457.58	-471.31	-485.44	-500.01	-515.01	-530.46	-546.37	-4,800.48
8.	Insurance		-76.00	-78.28	-80.63	-83.05	-85.54	-88.10	-90.75	-93.47	-96.27	-99.16	-871.25
9l	Interest expense (loan) (9.30 %)		-10,222.70	-10,151.79	-10,074.29	-9,989.58	-9,897.00	-9,795.80	-9,685.19	-9,564.30	-9,432.16	-9,287.74	-98,100.54
10.	Redemption of loan		-762.43	-833.34	-910.84	-995.54	-1,088.13	-1,189.33	-1,299.93	-1,420.83	-1,552.96	-99,868.13	-109,921.46
11.	Initial investment	-146,561.94											-146,561.94
12.	Real property tax		-91.00	-91.00	-91.00	-91.00	-91.00	-91.00	-91.00	-91.00	-91.00	-91.00	-910.00
13.	Wealth tax		0	0	0	0	0	0	0	0	0	0	0.00
14.	**Total Cash Outflow**	**-146,561.94**	**-11,570.87**	**-11,585.72**	**-11,601.00**	**-11,616.75**	**-11,632.97**	**-11,649.67**	**-11,666.88**	**-11,684.60**	**-11,702.86**	**-109,892.40**	**-361,165.67**

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Table 2 continued: Financial Plan of Calculation of Expected Return (Investment in flat for first-time occupation in Magdeburg)

		1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
15.	**Cash Flow**	**0.00**	**-2,800.80**	**-2,872.67**	**-2,747.85**	**-2,565.21**	**-2,384.89**	**-2,197.66**	**-2,019.55**	**-1,833.58**	**-1,639.64**	**87,979.22**	**66,917.37**
16.	Income tax increase (+) or reduction (-)	-25,051.10	-2,012.47	-2,012.98	-1,905.75	-1,764.06	-1,619.42	-1,466.55	-1,313.53	-1,150.89	-978.07	-794.47	-40,069.30
17.	**Cash Flow after Tax**	**25,051.10**	**-788.33**	**-859.69**	**-842.10**	**-801.16**	**-765.47**	**-731.11**	**-706.02**	**-682.69**	**-661.57**	**88,773.70**	**106,986.67**
18.	**Cumulated CF after tax (terminal wealth)**	**25,051.10**	**24,262.77**	**23,403.08**	**22,560.98**	**21,759.82**	**20,994.35**	**20,263.24**	**19,557.22**	**18,874.54**	**18,212.97**	**106,986.67**	
19.	ROE before tax	0.97%											
20.	**ROE after tax**	**11.31%**											

Calculation of Income Tax Increase or Reduction

	Rental Income											
21.	**Receipts**											
22.	Income from rentals	0.00	6,871.20	7,077.34	7,289.66	7,508.35	7,733.60	7,965.60	8,204.57	8,450.71	8,704.23	8,965.36
23.	**Total receipts from rental income**	0.00	6,871.20	7,077.34	7,289.66	7,508.35	7,733.60	7,965.60	8,204.57	8,450.71	8,704.23	8,965.36

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Table 2 continued: Financial Plan of Calculation of Expected Return (Investment in flat for first-time occupation in Magdeburg)

	1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
Income-related Expenses												
24. Book value of flat (share of building)	87,937.16	43,968.58	42,209.84	40,451.10	38,692.35	36,933.61	35,174.87	33,416.12	31,657.38	29,898.64	28,139.89	
25. Special depreciation (50 %)	43,968.58											
26. Linear depreciation (2 %)		1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	
27. Maintenance / repairs	0.00	418.75	431.31	444.25	457.58	471.31	485.44	500.01	515.01	530.46	546.37	
28. Insurance	0.00	76.00	78.28	80.63	83.05	85.54	88.10	90.75	93.47	96.27	99.16	
29. Interest expense	0	10,222.70	10,151.79	10,074.29	9,989.58	9,897.00	9,795.80	9,685.19	9,564.30	9,432.16	9,287.74	
30. Real property tax	0.00	91.00	91.00	91.00	91.00	91.00	91.00	91.00	91.00	91.00	91.00	
31. **Total income-related expenses**	43,968.58	12,567.19	12,511.12	12,448.91	12,379.95	12,303.58	12,219.09	12,125.69	12,022.52	11,908.64	11,783.01	
32. Net income from rentals	-43,968.58	-5,695.99	-5,433.79	-5,159.25	-4,871.60	-4,569.99	-4,253.49	-3,921.12	-3,571.81	-3,204.41	-2,817.66	
33. Marginal tax rates (income tax, solidarity surcharge)	56.98%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	
34. **Income tax reduction (-) / increase (+) from rental income**	-25,051.10	-3,018.87	-2,879.91	-2,734.41	-2,581.95	-2,422.09	-2,254.35	-2,078.19	-1,893.06	-1,698.34	-1,493.36	**-48,105.62**

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Table 2 continued: Financial Plan of Calculation of Expected Return (Investment in flat for first-time occupation in Magdeburg)

		1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
	Interest Income												
35.	Marginal tax rates (income tax, solidarity surcharge)	56.98%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	53.00%	
36.	Income Tax on interest income		1,006.40	866.93	828.65	817.89	802.68	787.80	764.66	742.17	720.27	698.88	8,036.33
37.	**Total Income Tax reduction (-)/ increase (+)**	**-25,051.10**	**-2,012.47**	**-2,012.98**	**-1,905.75**	**-1,764.06**	**-1,619.42**	**-1,466.55**	**-1,313.53**	**-1,150.89**	**-978.07**	**-794.47**	**-40,069.30**
38.	Cash flow minus interest earnings	0.00	-4,699.67	-4,508.38	-4,311.35	-4,108.40	-3,899.37	-3,684.07	-3,462.31	-3,233.89	-2,998.63	86,660.57	
39.	Terminal wealth before income tax		-7,442.10	-6,783.71	-6,164.23	-5,581.59	-5,033.84	-4,519.09	-4,035.60	-3,581.69	-3,155.76	86,660.57	40,362.97
40.	Terminal wealth of tax benefits	-41,747.95	-3,186.82	-3,028.91	-2,724.79	-2,396.61	-2,090.56	-1,798.96	-1,531.03	-1,274.66	-1,029.32	-794.47	**-61,604.08**

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would imply to assume a uniform rate of return and to adjust local growth rates p.a. for rents and property prices. For reasons of simplicity, we set both growth rates equal. The expected return is assumed to be 10 % which is approximately the average return of our sample. Rates of return for Leipzig and Wiesbaden were equal to the average in East and West Germany, respectively. Table 3 shows endogenously determined growth rates for Leipzig and Wiesbaden assuming different debt ratios.

Table 3: Endogenous growth rates ($g_{Rent}=g_{Value}$) for Leipzig and Wiesbaden

Leipzig				
	Debt ratio_50	Debt ratio_70	Debt ratio_75	Debt ratio_90
r_S=10 %	4.35 %	2.85 %	2.43 %	1.11 %
Wiesbaden				
	Debt ratio_50	Debt ratio_70	Debt ratio_75	Debt ratio_90
r_S=10 %	5.13 %	3.75 %	3.39 %	2.22 %

These growth rates of 2.4 % and 3.4 % p.a. (debt ratio 75 %) are not too different from our initial assumption of 3 %. But this is a rather counter-intuitive result, given that at that date the East was generally expected to catch up with the West rather quickly. Table 3 shows that endogenous growth rates are very sensitive to little changes in the assumptions on the investor's characteristics, like the debt ratio or marginal tax rate. Furthermore, this method implies that the tax subsidies in East Germany are completely pocketed by sellers and developers. Obviously, these are rather problematic implications. Therefore, we prefer the approach presented above. Under our assumptions, the rather small differences in expected rates of return may be explained by some amount of market imperfection, besides differing risk or growth expectations for the various local markets.

4.5 Expected Return: Results

In order to evaluate the expected return on equity capital after tax of 11.31 % for an investment in a flat in Magdeburg (Saxony-Anhalt) (see line 20 in *Table 2*), this ROE needs to be compared with the opportunity cost of capital to the investor. The opportunity cost of capital depends on the individual investment opportunities of a person or firm and is difficult to estimate. There are several possible indicators like credit interest rates, real estate investment funds, or property indices.

As real estate investments carry substantial investment risk it would be preferable to use a risky benchmark. Unfortunately, German property indices have substantial constructional defects. On the one hand, the composition of indices does not sufficiently reflect residential property investments. For instance, the DIX (German Property Index for institutional investors) consists of 47.4 % office and only 11.3 % residential property.[10] We could not use DIX data because it wasn't published before 1996. On the other hand DIMAX, an index composed of German listed corporations whose revenues mainly stem from real estate investment, is correlated with the stock market in general rather than real estate markets (Rohmert 2008, p. 13). Real estate funds are typically invested in a small number of projects and they also have some leverage (Maurer, Reiner and Sebastian 2004, p. 61). Historically, funds have performed poorly, with returns to investors often below the return on public debt.[11] Therefore, we feel most comfortable with public debt securities as benchmark investments.

The average yield of public debt securities with a residual maturity of 10 years was 7.9 % in 1992 (Deutsche Bundesbank 2003b, 61), i.e. 3.4 % p.a. (3.71 %) after tax at a marginal tax rate of 56.975 % (53 %). Compared to this, the expected ROE after tax (see *Table 4*) of 7.65 % (Würzburg, Bavaria) up to 11.72 % (Erfurt, Thuringia) offered a considerable premium to compensate for the risks from leverage and from the development of real property and rental markets. *Figure 5* shows expected returns after tax for all fifty cities. The fact that East German cities head the list is mostly due to the special depreciation scheme in that area which increases ROE after tax by 2-3 %, approximately. The remaining difference in ROE between the fifty cities may be due to the heterogeneity of the German real estate market. It may also reflect a lack of specific information on the expectations of regional markets. E.g.,

[10] The remainder are retail and industrial property. The index uses the valuation and management records for individual buildings held as property investments within regularly valued portfolios. See IPD Deutscher Immobilien Index (2008).

[11] Stark (2006), p. 599 f., Darius and Schins (2006), p. 112 f.

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we have assumed a uniform rate of appreciation of market prices for the whole country.

The highest return could be expected for an investment in Erfurt (Thuringia) with a ROE before tax of 3.06 % and a ROE after tax of 11.72 %. After Erfurt (Thuringia) follow nearly all considered cities of the new federal states except Dessau (see *Table 4*). We calculate a higher ROE than Dessau (Saxony-Anhalt) with an estimated ROE after tax of 10.02 % for Oldenburg (Lower Saxony), Frankfurt (Hesse) and Saarbrücken (Saarland). The least profitable investment is in Würzburg (Bavaria), with an expected ROE after tax of 7.65 %. The ranking is the same for ROE before and after tax within the groups of East and West German cities. There are a number of interesting observations to be made in Table 4: First, ROE after tax is considerably higher than ROE before tax, in each of the fifty locations. Corresponding to this, the investor's wealth after divesting the flat E_{10} is higher after tax than before tax. Terminal wealth and ROE after tax are boosted by tax benefits which on average amount to 60 % of terminal wealth, ranging from 36 % to 82 %. This is due to the well-known fact that, under German income tax, the profit from selling the flat remains untaxed although depreciation allowances are deductible in the calculation of net income from rentals (see Chapter 2.2 for details). In East Germany (labelled grey in *Table 4*), this tax subsidy is only somewhat higher than in West Germany. The special depreciation of 50 % plus the regular depreciation of 2 % p.a. of the building value add up to a deduction of 70 % of the acquisition and conversion cost of the building (not the ground). For West German investments, the investor could opt for declining balance depreciation with 7 % in the year of acquisition and three more years (1992-1995), 5 % in the following 6 years (1996-2001), and 2 % for 6 more years (EStG § 7 (5) No. 3). For a holding period of ten years (plus one day) this adds up to only 60 % of the cost of the building.[12]

It is interesting to note that the spread of returns after tax is much lower than before tax. In other words: taxation has levelled expected returns considerably. The remaining difference in returns could be interpreted as a premium for higher risks for investments in the respective cities (besides some margin of error in our assumptions). Indeed, we have calculated the highest expected returns for East Germany, where the economic perspective was most insecure. On the other hand, we get the lowest returns for cities in the economically most stable and dynamic South.

Figure 5: Regional expected returns for cities in Germany[13]

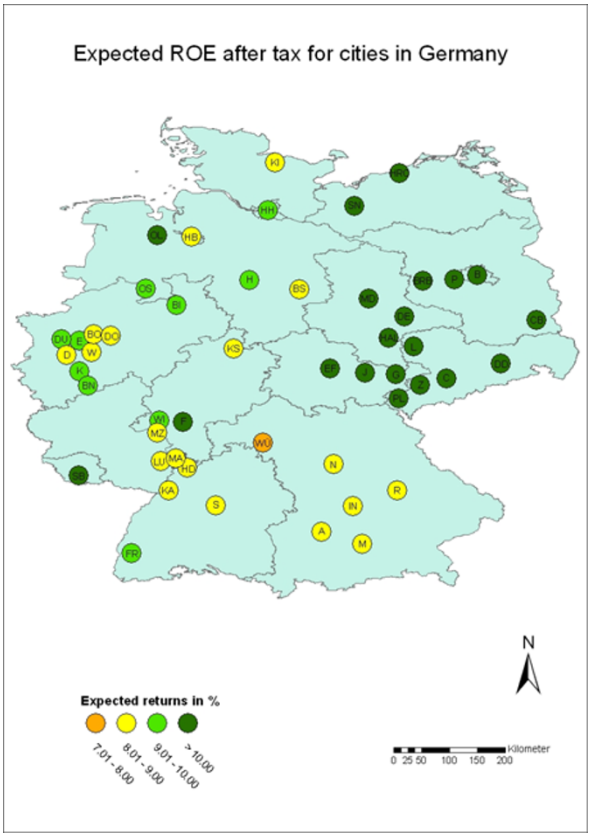

Table 4: Expected returns for cities in Germany

Cities	Investment cost	Tax benefits in % of terminal wealth after tax	ROE before tax	ROE after tax
Erfurt (T)	142,804	50.52%	3.06%	11.72%
Rostock (MWP)	135,288	51.29%	2.85%	11.67%
Brandenburg (BB)	112,740	53.34%	2.26%	11.55%
Berlin (Berlin)	179,634	54.03%	2.05%	11.51%
Magdeburg (SA)	146,562	57.58%	0.97%	11.31%
Dresden (S)	184,142	57.78%	0.91%	11.30%
Halle a.d.S. (SA)	139,046	61.03%	-0.15%	11.12%
Leipzig (S)	169,110	63.34%	0.40%	11.00%

[12] Linear depreciation of 2 % p.a. (EStG § 7 (4)) would only allow to write down 20 % of the building value. As this obviously offers a lower tax shield, we assume the declining balance scheme in all calculations.

[13] Abbreviations of the cities are explaines in Appendix 3.

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Table 4 continued: Expected returns for cities in Germany

Cities	Investment cost	Tax benefits in % of terminal wealth after tax	ROE before tax	ROE after tax
Gera (T)	157,836	63.11%	-0.86%	11.00%
Potsdam (BB)	180,384	68.23%	-1.26%	10.73%
Chemnitz (S)	150,320	64.35%	-1.29%	10.94%
Schwerin (MWP)	142,804	64.51%	0.02%	10.93%
Plauen (S)	139,046	69.51%	-3.27%	10.66%
Jena (T)	154,078	71.46%	-4.10%	10.56%
Cottbus (BB)	169,110	73.21%	-4.88%	10.47%
Zwickau (S)	146,562	73.29%	-4.92%	10.46%
Oldenburg (LS)	112,740	36.21%	5.21%	10.33%
Frankfurt a.M. (H)	180,384	36.53%	5.14%	10.30%
Saarbrücken (SL)	108,982	39.84%	4.38%	10.09%
Dessau (SA)	139,046	81.99%	-9.75%	10.02%
Essen (NRW)	131,530	44.89%	3.18%	9.77%
Cologne (NRW)	157,836	45.78%	2.97%	9.71%
Bonn (NRW)	150,320	45.88%	2.94%	9.70%
Freiburg (BW)	150,320	45.94%	2.93%	9.70%
Osnabrück (LS)	108,982	53.45%	1.01%	9.24%
Hannover (LS)	135,288	53.82%	0.91%	9.22%
Duisburg (NRW)	120,256	55.41%	0.48%	9.13%
Bielefeld (NRW)	131,530	56.67%	0.13%	9.05%
Wiesbaden (H)	187,900	56.84%	0.08%	9.04%
Hamburg (HH)	187,900	56.94%	0.05%	9.04%
Düsseldorf (NRW)	176,626	58.33%	-0.34%	8.95%
Kiel (SH)	154,078	59.40%	-0.65%	8.89%
Ludwigshafen (RP)	127,772	60.69%	-1.03%	8.82%
Brunswick (LS)	139,046	61.92%	-1.40%	8.75%
Nuremberg (B)	157,836	62.92%	-1.70%	8.69%
Munich (B)	251,786	63.27%	-1.70%	8.65%
Wuppertal (NRW)	131,530	63.70%	-1.94%	8.65%
Stuttgart (BW)	199,174	64.36%	-2.15%	8.61%
Heidelberg (BW)	187,900	66.36%	-2.80%	8.50%
Bremen (HB)	135,288	66.53%	-2.85%	8.49%
Bochum (NRW)	139,046	68.87%	-3.65%	8.36%
Dortmund (NRW)	139,046	68.92%	-3.67%	8.36%
Regensburg (B)	161,594	69.30%	-3.80%	8.34%
Mainz (RP)	161,594	69.46%	-3.85%	8.33%
Ingolstadt (B)	146,562	69.94%	-4.03%	8.31%
Kassel (H)	131,530	71.23%	-4.49%	8.24%
Karlsruhe (BW)	157,836	73.09%	-5.19%	8.14%
Augsburg (B)	169,110	73.47%	-5.34%	8.12%
Mannheim (BW)	169,110	73.67%	-5.42%	8.10%
Würzburg (B)	161,594	82.44%	-9.38%	7.65%

4.6 Realized Return: Calculation

The computations of realized returns are structured in the same way as those of expected returns. But now, realized changes in rents, maintenance costs, and property prices replace the forecasts used in *section 4.3* and changes in interest rates and tax rates are accounted for. *Table 5* shows some non-tax key data for Magdeburg (Saxony-Anhalt).

Table 5: Data excerpt of calculation of realized return (Investment in flat in Magdeburg)

Receipts (Annual rent received)

70 m²	8.18 €/ m²/ month	12 months	6,871.20 €
Average change in rents			1.62 % p.a.
Change in rents over investment period			-15.11 %
Average change in property value			-0.46 % p.a.
Change in property value over investment period			-4.50 %
Credit interest rate (year 1)			7.06 %

Results

ROE before tax	-105.14 %
ROE after tax	1.54 %
Average gross return on capital invested	4.21 %

Debt Capital – Annuity Loan

Nominal amount	109,921.46 €
Amount of pay-out	100.0 %
Interest rate 1	9.3 %
For	10 years
Term of loan	30 years
Annuity payment	10,985.13 €

Operating Expenditures

Rate of inflation (year 2)	2.67 %
Maintenance and repairs (0.5 % of building value)	418.75 € p.a.
Insurance	76.00 € p.a.

Note that the average price changes in *Table 5* are merely given for information purposes. Computations are based on year-per-year price. The one-year change in the rent per year R_t is computed on the basis of the time-series data of BulwienGesa AG (see *section 3*) as

$$\Delta R_t = \frac{R_t - R_{t-1}}{R_t} .$$

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The change in the property value is calculated in the same way. Costs of maintenance and repair are assumed to grow with the consumer price index as reported in the Statistical Yearbook (Statistisches Bundesamt 2005, p. 512).

The term structure of credit interest rates[14] is given by the current yields published in the capital market statistics (Deutsche Bundesbank 2003c, p. 40).

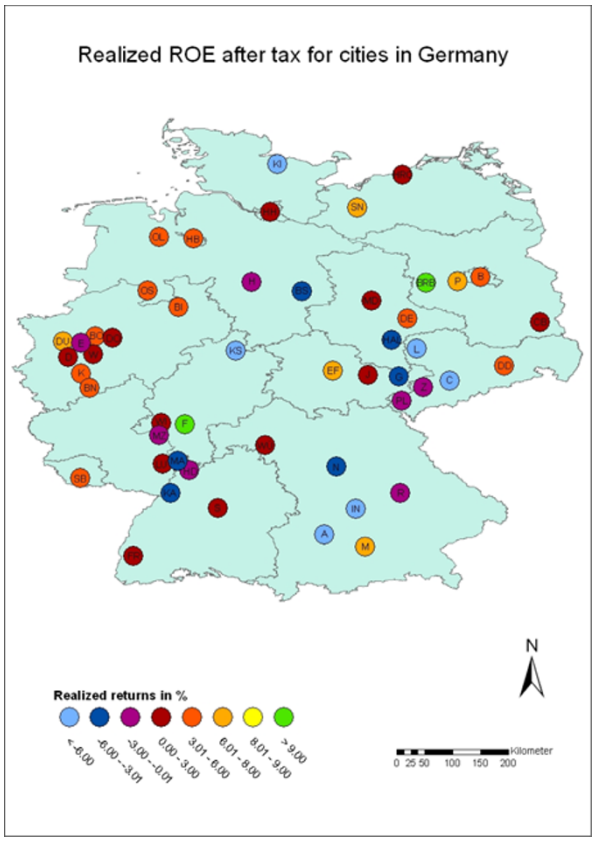
There have also been a number of changes in the relevant tax rules during the project's life (see *section 2.4*). First, the combined marginal tax rates reflect the changes in the top marginal income tax rate and the re-introduction of the solidarity surcharge had to be adapted to the valid rate each year.[15] Second, between 1996 and 1998, a lump-sum allowance for expenses could be deducted instead of actual maintenance costs. The allowance was € 21.47 / m² (DM 42 / m²) or € 1,503.2 per year for a 70-m² flat.[16] Finally, there are location-specific differences with respect to the real property tax. Magdeburg (Saxony-Anhalt), e.g., has increased its municipal multiplier twice.[17]

Adapting the annual rent received to the market level every year as we do is a somewhat problematic assumption. Under German tenancy law, there are rather tight limits of increasing the rent for an existing tenancy. On the other hand, the landlord is not obliged to reduce the rent within an existing contract. Only if the tenants changed every year, would the rent necessarily have to be adapted to the current price level. Therefore, in times of sinking rents (see *Tables 5*), our assumption is rather pessimistic. On the other hand, due to a lack of reliable data, we do not assume any vacancy periods. This somewhat exaggerates revenues and should compensate for the first effect.

4.7 Realized Return: Results

None of the investments has met with investors' expectations but realized returns differ a lot between locations (see Figure 6 *and Table 6*). Surprisingly, the profitability gap is not between East and West Germany. There are more and less prosperous real estate markets in the new as well as in the old federal area (see light-green and orange spots in *Figure 6*).

Figure 6: Regional realized returns for cities in Germany[18]



Generally speaking, regions with high prices and high expected potential at the date of investment have produced the lowest ROE. This is the case in the region of Leipzig/Chemnitz, most of Bavaria (except Munich) and the Rhine-Main region (except Frankfurt). There, only some booming cities like Dresden and Erfurt in the East or Frankfurt and Munich in the West that have given good returns. The new German capital, Berlin, and the area around it, have also performed rather well. No generalisation can be made for low-price, low-expectation areas. Some, like the Saar or the German North-West, show medium ROEs. Others, like the Center North, don't. The picture in the Ruhr area is mixed.

The most successful investments could be realized in Brandenburg (Brandenburg) with an ROE after tax of 9.66 % (see *Table 6*). The second best investment was in Frankfurt (Hesse), here the expected ROE was only missed by approximately one percentage point (9.36 % instead of 10.30 %). Frankfurt is followed by Erfurt (Thuringia) and Duisburg

[14] See Appendix 1, line 4.

[15] See Appendix 1, lines 40 and 42.

[16] See Appendix 1, lines 33-35.

[17] See Appendix 1, line 18.

[18] Abbreviations of the cities are explained in Appendix 3.

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(North Rhine Westphalia). The worst-performing locations were Kiel (Schleswig-Holstein, -8.26 %) and Augsburg (Bavaria, -11.38 %). In thirty-one cities a positive return after tax could be realized, but only in one location (Frankfurt, Hesse) ROE was also positive before tax (see *Table 6*).

Table 6: Realized returns for cities in Germany

Cities in Germany	Average change in rents	Liquidation value in % of investment	Tax benefits in % of terminal wealth a.t.	Realized ROE before tax	Realized ROE after tax
Brandenburg (BB)	1.25%	117.80%	78.50%	-4.62%	9.66%
Frankfurt a.M. (H)	0.70%	125.07%	50.18%	2.27%	9.36%
Erfurt (T)	-2.07%	111.20%	99.01%	-20.64%	7.76%
Schwerin (MWP)	5.51%	101.66%	77.32%	-5.51%	7.70%
Duisburg (NRW)	0.74%	119.75%	72.36%	-5.04%	7.64%
Munich (B)	0.26%	119.13%	89.52%	-14.94%	6.43%
Potsdam (BB)	2.93%	100.70%	106.96%	-100.48%	6.07%
Saarbrücken (SL)	0.84%	105.28%	63.59%	-3.57%	5.97%
Dresden (S)	-2.18%	104.31%	129.81%	-103.75%	5.54%
Bochum (NRW)	0.84%	112.54%	96.48%	-23.44%	5.39%
Cologne (NRW)	0.86%	105.39%	82.48%	-11.08%	4.84%
Bielefeld (NRW)	0.55%	108.38%	98.19%	-26.86%	4.72%
Bonn (NRW)	-0.91%	106.44%	94.37%	-19.86%	4.48%
Bremen (HB)	-0.97%	110.07%	110.62%	-101.46%	4.41%
Oldenburg (LS)	0.74%	96.86%	75.93%	-8.78%	3.85%
Dessau (SA)	2.87%	95.63%	151.99%	-105.35%	3.71%
Berlin (Berlin)	-0.96%	94.15%	157.32%	-105.54%	3.19%
Osnabrück (LS)	-0.97%	103.26%	118.93%	-102.18%	3.14%
Rostock (MWP)	4.80%	101.66%	119.49%	-101.57%	3.00%
Würzburg (B)	0.24%	108.66%	139.78%	-104.42%	2.99%
Freiburg (BW)	-0.29%	99.43%	103.81%	-100.24%	2.88%
Cottbus (BB)	5.04%	88.96%	148.79%	-104.66%	2.85%
Magdeburg (SA)	-1.62%	90.96%	167.33%	-105.97%	2.12%
Dortmund (NRW)	0.37%	100.30%	133.34%	-103.38%	1.93%
Jena (T)	1.84%	90.19%	181.79%	-106.74%	1.88%
Wiesbaden (H)	0.17%	99.63%	130.82%	-103.08%	1.75%
Ludwigshafen (RP)	-0.77%	98.65%	149.05%	-104.39%	1.11%
Stuttgart (BW)	-1.46%	100.90%	165.08%	-105.45%	0.73%
Düsseldorf (NRW)	-0.63%	98.04%	153.24%	-104.57%	0.69%
Hamburg (HH)	-0.22%	95.59%	150.26%	-104.17%	0.30%
Wuppertal (NRW)	0.84%	93.13%	149.85%	-104.04%	0.08%
Plauen (S)	-2.69%	88.59%	245.48%	-109.03%	-0.16%
Essen (NRW)	1.27%	87.31%	129.35%	-102.24%	-0.38%
Regensburg (B)	1.31%	95.80%	181.34%	-105.86%	-0.56%
Hannover (LS)	-2.23%	93.13%	178.67%	-105.46%	-0.93%
Mainz (RP)	0.02%	95.31%	195.25%	-106.36%	-1.08%
Heidelberg (BW)	1.12%	93.13%	193.40%	-106.03%	-1.51%
Zwickau (S)	-3.20%	84.57%	321.65%	-110.26%	-2.57%
Mannheim (BW)	0.14%	90.31%	251.49%	-107.45%	-3.59%
Halle a.d.S. (SA)	0.19%	73.28%	297.78%	-108.45%	-3.89%
Brunswick (LS)	-0.97%	87.76%	251.30%	-107.16%	-4.00%
Karlsruhe (BW)	-1.02%	90.31%	317.77%	-108.71%	-5.04%
Gera (T)	2.17%	70.09%	336.03%	-108.64%	-5.31%
Nuremberg (B)	-0.22%	87.13%	320.80%	-108.31%	-5.74%
Ingolstadt (B)	1.32%	87.31%	345.51%	-108.75%	-6.09%
Leipzig (S)	-2.51%	74.55%	423.47%	-110.17%	-6.22%
Chemnitz (S)	0.03%	70.91%	472.89%	-110.18%	-7.53%
Kassel (H)	2.70%	78.81%	346.84%	-107.51%	-7.95%
Kiel (SH)	-0.92%	80.72%	377.54%	-108.00%	-8.26%
Augsburg (B)	-0.57%	83.16%	636.21%	-110.07%	-11.38%

Lower-than-expected rents and liquidation values both are responsible for the low-realized ROE. Ex ante, rents were expected to increase by 3 % per year. The actual development was heterogeneous. The average annual change of rents over the investment period ranges between an increase of 5.51 % percentage points (Schwerin; Mecklenburg Western Pomerania) and a decrease of -3.20 % percentage points (Zwickau; Saxony). In total, thirteen cities register an increase (labelled green in *Table 6*), whereas in sixteen cities, rents have stagnated (labelled yellow in *Table 6*). There is no obvious disparity in the development of rents between East and West Germany. In any case, changes in rents have little influence on ROE.

Liquidation value has a much bigger effect on results. In none of the cities could be realized a liquidation value of 127.99 % of investment costs which we had assumed ex ante (see *Table 6*). The highest liquidation value was documented in Frankfurt (Hesse) with 125.07 %. The sharpest decline in liquidation value was registered in Gera (Thuringia, 70.09 %). During the investment period, real estate prices have risen in thirteen cities (labelled green in *Table 6*), they have stagnated in nine cities (labelled yellow in *Table 6*), and they have fallen in twenty-eight cities. In fact, the ranking of locations with respect to realized ROE is mostly driven by the change in property prices. This influence on profitability would be smaller for longer investment periods as the current cash flow extracted from rents would become more important.

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Our calculations show the huge impact of taxation on ROE. The lower realized ROE the higher is the tax benefit ratio, the contribution of tax benefits to terminal wealth (compare light blue cells in *Table 6*). In four locations (Plauen (Saxony), Mannheim, (Baden Württemberg), Brunswick (Lower Saxony), Halle (Saxony-Anhalt)) the tax advantage exceeds twice the amount of the investment. An even higher proportion of over 300 % was realized in the following seven cities: Zwickau (Saxony), Ingolstadt, Nuremberg (both Bavaria), Karlsruhe (Baden Württemberg), Gera (Thuringia), Kassel (Hesse) and Kiel (Schleswig-Holstein). In Leipzig and Chemnitz (both Saxony) the tax benefit ratio is over 400 %, in Augsburg (Bavaria) even 636.21 %. Even this enormous tax advantage could not avoid a negative realized ROE after tax of 11.38 % in Augsburg (Bavaria). Here, it must be emphasized that calculated tax advantages could be realized only by investors in the top tax bracket. The lower an investor's marginal income tax rate, the smaller is the tax shield he could reap from the investment and the smaller is his ROE after tax. An investor with a marginal income tax rate of zero would not benefit from tax reductions and therefore would have realized the ROE before tax.

Table 7: ROE with different debt ratio

	Branden-burg_0	Branden-burg_50	Branden-burg_75	Branden-burg_90
ROE after tax	5.48 %	7.09 %	9.66 %	15.16 %
	Frank-furt_0	Frank-furt_50	Frank-furt_75	Frank-furt_90
ROE after tax	5.36 %	6.90 %	9.36 %	14.68 %
	Magde-burg_0	Magde-burg_50	Magde-burg_75	Magde-burg_90
ROE after tax	3.31 %	3.00 %	2.12 %	-1.03 %
	Chem-nitz_0	Chem-nitz_50	Chem-nitz_75	Chem-nitz_90
ROE after tax	3.31 %	3.00 %	2.12 %	-1.03 %
	Augs-burg_0	Augs-burg_50	Augs-burg_75	Augs-burg_90
ROE after tax	3.31 %	3.00 %	2.12 %	-1.03 %

So far calculations are based on the assumption that investment costs are financed by 25 % equity and 75 % debt. As leverage is critical for the results a sensitivity analysis has been performed for debt ratios of 0 %, 50 %, 75 %, and 90 %. Table 7 shows five examples: Brandenburg (Brandenburg), Frankfurt (Hesse), Magdeburg (Saxony-Anhalt), Chemnitz (Saxony) and Augsburg (Bavaria).

The ranking of locations with respect to ROE after tax remains mostly unchanged when leverage is varied.[19] We observe the standard effect of leverage on ROE. When the return on investment is high enough to serve interest payments there is a positive effect on ROE from increasing leverage. This is the case in Frankfurt and Brandenburg. In the opposite case of too-low returns on investment leverage reduces ROE and increases losses.

5 Conclusion

To our knowledge, we have conducted the first scientific study calculating expected and realized returns on an average direct investment in residential property. We have used price and rent statistics for 50 major cities and have modelled the tax characteristics of a representative high-income investor. Based on our analyses, the popular hypothesis can be rejected that investments in residential property in East Germany after unification on average has turned out to be a financial disaster. This misperception is due to the fact that the media typically use price and rent statistics but do not take into account tax effects. Nevertheless, the tax shield from privately held property boosts returns considerably. Data from tax statistics show that taxation of rental income in Germany is a subsidy as the aggregate rental income declared per year is negative. Our analysis allows the amount of this subsidy to be quantified per average object.

An investor who, in 1992, bought public debt securities with a residual maturity of 10 years yielding 7.9 % p.a. on average, has earned a net return of 3.58 % after income tax and solidarity surcharge (average marginal tax rate of 54.715 %). In retrospect, public debt securities with a term of 10 years have delivered a better return than a real estate investment in thirty-four cities of our sample, but have performed worse than investments in Frankfurt (Hesse), Duisburg, Bochum, Cologne, Bielefeld, Bonn (all North Rhine-Westfalia), Brandenburg (Brandenburg), Erfurt (Thuringia), Schwerin (Mecklenburg-Western Pomerania), Munich (Bava-

[19] Unlike in a single-period model, ROE is not a strictly linear function of leverage. In some cases, this may result in changes in the ranking of locations. E.g., Chemnitz performs worse than Augsburg with a leverage of 90 % (see Table 7).

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ria), Saarbrücken (Saarland), Potsdam (Brandenburg), Dresden (Saxony), Bremen (Bremen), Oldenburg (Lower Saxony) and Dessau (Saxony-Anhalt).
Whereas German public debt securities can be regarded as riskless investments, the average real estate investor had to bear the risks from the development of property prices and from leverage of his investment (which we have assumed to be 75 %). Property-related indices which could serve as risky benchmarks either are not available for the investment period or do not represent residential investments. Still we can conclude that investors on average have not been compensated for risk. Back in 1992, assuming a further although low increase of property prices and rents and counting on a healthy development of the East German economy, investors had good reasons to expect attractive returns on real estate investments. Due to additional tax incentives, investments in East Germany promised an extra 2.5 % to 3 % of return after tax which can be understood as a premium for investing in a riskier environment.

Table 8: Expected and realized returns for selected cities in Germany[20]

Expected Returns	Brandenburg	Frankfurt	Magdeburg	Chemnitz	Augsburg
ROE before tax	2.26 %	5.14 %	0.97 %	-1.29 %	-5.34 %
ROE after tax	11.55 %	10.30 %	11.31 %	10.94 %	8.12 %
Realized Returns					
ROE before tax	-4.62 %	2.27 %	-105.97 %	-110.18 %	-110.07 %
ROE after tax	9.66 %	9.36 %	2.12 %	-7.53 %	-11.38 %

Our calculations show clearly that tax subsidies are an important contribution to the profitability of direct real estate investments all over Germany. The subsidy is based on the rules of income calculation which allow expensing 60 % of the building's value during a holding period of 10 years. For East Germany this subsidy was only somewhat higher than the *Assisted Area Law* (see section 2.1) increased the amount of depreciation to up to 70 % instead of 60 % of the building's value. In any case, this leads to negative rental income which is allowed to be subtracted from positive income from other sources, e.g.. labor income. Therefore, rental income in Germany is systematically negative, also on an aggregate level (see Müller 2004, p. 76). On the other hand, profits from selling the property are not taxable after a holding period of at least ten years. Note that in all locations investors have realized a book profit (liquidation value minus net book value) although prices have decreased in most locations. If either this book profit were taxable or if there were no depreciation allowance the tax subsidy to direct real estate investment could be abolished and ROE after tax would come very near ROE before tax.
In the period we have analysed, tax subsidies alone protected a high-income investor from losing his money in a real estate investment, whether it was undertaken in the East or in the West. Only in markets which were most overheated in 1992, like Leipzig (Saxony), Kassel (Hesse), Kiel (Schleswig-Holstein), Chemnitz (Saxony) or Augsburg (Bavaria), tax subsidies did not prevent a complete loss of the money invested.
To a low-income investor the tax subsidy is worth much less, as our calculation of ROE before tax show for a marginal tax rate of zero.
We must point out that these results are based on a typified investment at an average price with an average performance. The performance of actual investments may differ significantly from these average results, of course. We also want to emphasize that our results cannot be transferred to other types of real estate investments like office buildings or to investors with other tax characteristics like non-residents. Nevertheless, our research offers valuable insight into the question who has really paid for the reconstruction of East Germany. Whereas raw data on property prices and rents suggest that investors have lost a lot of the money they have invested in East Germany, our calculations show that on average tax subsidies should have compensated for most of the losses. Therefore, it was the taxpayers not the investors who have carried the extra burden from reconstructing East Germany. But taxpayers have probably spent a lot more on subsidising the much bigger West German housing market where property prices and tax subsidies per average investment were much higher.

[20] For expected and realized returns of all considered cities in Germany see Appendix 2.

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Appendix 1: Financial Plan of Calculation of Realized Return (Investment in flat for first-time occupation in Magdeburg)

		1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 8	2002 10	Total
	Cash Inflows												
1.	Income from rentals		6,871.20	7,183.08	6,725.28	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,833.15	61,680.20
2.	Weighted average changes in annual rental			4.54%	-6.37%	-13.10%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.20%	
3.	Interest earnings		1,768.61	1,386.75	1,799.18	1,305.90	1,136.05	1,000.30	647.32	789.41	679.55	420.61	10,933.67
4.	Credit interest rates		7.06%	5.73%	7.73%	5.82%	5.28%	4.89%	3.37%	4.59%	4.51%	3.32%	
5.	Pay-out loan	109,921.46											109,921.46
6.	Pay-out equity capital	36,640.49											36,640.49
7.	Weighted average changes in property pieces		8.31%	5.64%	-3.98%	7.41%	0.00%	-6.90%	-3.70%	-3.85%	0.00%	-6.12%	
8.	Market value of property	139,582.80	151,186.65	159,716.08	153,357.07	164,717.02	164,717.02	153,357.07	147,677.10	141,997.12	141,997.12	133,306.64	
9.	Liquidat9ion value of property											133,306.64	133,306.64
10.	Total Cash Inflow	**146,561.94**	**8,639.81**	**8,569.82**	**8,524.46**	**7,150.49**	**6,980.63**	**6,844.89**	**6,491.90**	**6,633.99**	**6,524.13**	**139,560.40**	**352,482.46**

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Appendix 1 continued: Financial Plan of Calculation of Realized Return (Investment in flat for first-time occupation in Magdeburg)

	1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
Cash Outflows												
11. Changes in consumer price index			2.67%	1.73%	1.49%	1.89%	0.93%	0.61%	1.42%	2.00%	1.37%	
12. Maintenance / repairs		-418.75	-429.93	-437.38	-443.90	-452.29	-456.48	-459.27	-465.79	-475.11	-481.63	-4,520.53
13. Insurance		-76.00	-78.03	-79.38	-80.57	-82.09	-82.85	-83.35	-84.54	-86.23	-87.41	-820.44
14. Interest expense (loan)		-10,222.70	-10,151.79	-10,074.29	-9,989.58	-9,897.00	-9,795.80	-9,685.19	-9,564.30	-9,432.16	-9,287.74	-98,100.54
15. Redemption of loan		-762.43	-833.34	-910.84	-995.54	-1,088.13	-1,189.33	-1,299.93	-1,420.83	-1,552.96	-99,868.13	-109,921.46
16. Initial investment	-146,561.94											-146,561.94
17. Real property tax		-91.00	-91.00	-91.00	-91.00	-95.67	-95.67	-105.00	-105.00	-105.00	-105.00	-975.33
18. Municipal factors in %		390	390	390	390	410	410	450	450	450	450	
19. Wealth tax		0	0	0	0							0
20. Total Cash Outflow	**-146,561.94**	**-11,570.87**	**-11,584.08**	**-11,592.89**	**-11,600.59**	**-11,615.16**	**-11,620.12**	**-11,632.75**	**-11,640.46**	**-11,651.46**	**-109,829.90**	**-360,900.24**
21. Cash Flow	**0.00**	**-2,931.07**	**-3,014.26**	**-3,068.43**	**-4,450.10**	**-4,634.53**	**-4,775.23**	**-5,140.85**	**-5,006.46**	**-5,127.33**	**29,730.49**	**-8,417.78**
22. Income tax increase (+) or reduction (-)	-25,051.10	-2,081.51	-2,088.02	-2,231.33	-3,527.91	-3,574.60	-3,527.41	-3,131.05	-2,875.54	-2,728.82	-2,797.21	-53,614.50
23. Cash Flow after Tax	**25,051.10**	**-849.56**	**-926.24**	**-837.10**	**-922.19**	**-1,059.94**	**-1,247.82**	**-2,009.80**	**-2,130.92**	**-2,398.51**	**32,527.70**	**45,196.73**
24. Cumulated CF after tax (terminal wealth)	**25,051.10**	**24,201.54**	**23,275.31**	**22,438.21**	**21,516.02**	**20,456.08**	**19,208.26**	**17,198.46**	**15,067.54**	**12,669.03**	**45,196.73**	
25. ROE before tax	-105.97%											
26. ROE after tax	**2.12%**											

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Appendix 1 continued: Financial Plan of Calculation of Realized Return (Investment in flat for first-time occupation in Magdeburg)

		1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
	Calculation of Income Tax Increase or Reduction												
	Rental Inome												
27.	**Receipts**												
28.	Income from rentals	0.00	6,871.20	7,183.08	6,725.28	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,833.15	
29.	**Total receipts from rental income**	0.00	6,871.20	7,183.08	6,725.28	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,844.58	5,833.15	
	Income-related expenses												
30	Book value of flat (share of building)	87,937.16	43,968.58	42,209.84	40,451.10	38,692.35	36,933.61	35,174.87	33,416.12	31,657.38	29,898.64	28,139.89	
31.	Special depreciation (50 %)	43,968.58											
32.	Linear depreciation (2 %)		1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	1,758.74	
33.	Maintenance / repairs	0.00	418.75	429.93	437.38	443.90	452.29	456.48	459.27	465.79	475.11	481.63	
34.	Insurance	0.00	76.00	78.03	79.38	80.57	82.09	82.85	83.35	84.54	86.23	87.41	
35.	Share of lump sum deduction exceeding m/r + i					978.73	968.83	963.87					
36.	Interest expense	0	10,222.70	10,151.79	10,074.29	9,989.58	9,897.00	9,795.80	9,685.19	9,564.30	9,432.16	9,287.74	
37.	Real property tax	0.00	91.00	91.00	91.00	91.00	95.67	95.67	105.00	105.00	105.00	105.00	
38.	**Total income-connected expenses**	43,968.58	12,567.19	12,509.49	12,440.79	13,342.52	13,254.60	13,153.41	12,091.56	11,978.37	11,857.24	11,720.52	

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Appendix 1 continued: Financial Plan of Calculation of Realized Return (Investment in flat for first-time occupation in Magdeburg)

	1992 0	1993 1	1994 2	1995 3	1996 4	1997 5	1998 6	1999 7	2000 8	2001 9	2002 10	Total
39. Net income from rentals	-43,968.58	-5,695.99	-5,326.41	-5,715.52	-7,497.94	-7,410.02	-7,308.82	-6,246.98	-6,133.79	-6,012.66	-5,887.38	
40. Marginal tax rates (income tax, solidarity surcharge)	56.98%	53.00%	53.00%	56.98%	56.98%	56.98%	55.92%	55.92%	53.81%	51.17%	51.17%	
41. Income tax reduction (-) / increase (+) from rental income	-25,051.10	-3,018.87	-2,823.00	-3,256.42	-4,271.95	-4,221.86	-4,086.73	-3,493.00	-3,300.29	-3,076.53	-3,012.42	**-59,612.16**
Interest Income												
42. Marginal tax rates (income tax, solidarity surcharge)	56.98%	53.00%	53.00%	56.98%	56.98%	56.98%	55.92%	55.92%	53.81%	51.17%	51.17%	
43. Income Tax on interest income		937.36	734.98	1,025.08	744.04	647.26	559.32	361.95	424.74	347.71	215.22	5,997.66
44. Total Income Tax reduction (-) / increase (+)	**-25,051.10**	**-2,081.51**	**-2,088.02**	**-2,231.33**	**-3,527.91**	**-3,574.60**	**-3,527.41**	**-3,131.05**	**-2,875.54**	**-2,728.82**	**-2,797.21**	**-53,614.50**
45. Cash flow minus interest earnings	0.00	-4,699.67	-4,401.01	-4,867.61	-5,756.01	-5,770.58	-5,775.53	-5,788.17	-5,795.87	-5,806.88	29,309.88	
46. Cumulated Cash flow before income tax	0.00	-4,699.67	-9,100.68	-14,237.58	-20,697.07	-27,296.28	-34,164.62	-41,287.58	-48,234.80	-55,936.78	-28,802.28	
47. Interest earnings		0.00	-269.29	-703.48	-828.63	-1,092.81	-1,334.79	-1,151.35	-1,895.10	-2,175.39		

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Appendix 2: Expected and realized returns for cities in Germany (index by realized ROE after tax)

Cities in Germany	Realized ROE before tax	Realized ROE after tax	Expected ROE before tax	Expected ROE after tax
Brandenburg (BB)	-4.62%	9.66%	2.26%	11.55%
Frankfurt a.M. (H)	2.27%	9.36%	5.14%	10.30%
Erfurt (T)	-20.64%	7.76%	3.06%	11.72%
Duisburg (NRW)	-5.04%	7.64%	0.48%	9.13%
Schwerin (MWP)	-5.51%	7.70%	0.02%	10.93%
Munich (B)	-14.94%	6.43%	-1.70%	8.65%
Potsdam (BB)	-100.48%	6.07%	-1.26%	10.73%
Saarbrücken (SL)	-3.57%	5.97%	4.38%	10.09%
Dresden (S)	-103.75%	5.54%	0.91%	11.30%
Bochum (NRW)	-23.44%	5.39%	-3.65%	8.36%
Cologne (NRW)	-11.08%	4.84%	2.97%	9.71%
Bielefeld (NRW)	-26.86%	4.72%	0.13%	9.05%
Bonn (NRW)	-19.86%	4.48%	2.94%	9.70%
Bremen (HB)	-101.46%	4.41%	-2.85%	8.49%
Oldenburg (LS)	-8.78%	3.85%	5.21%	10.33%
Dessau (SA)	-105.35%	3.71%	-9.75%	10.02%
Osnabrück (LS)	-102.18%	3.14%	1.01%	9.24%
Berlin (Berlin)	-105.54%	3.19%	2.05%	11.51%
Würzburg (B)	-104.42%	2.99%	-9.38%	7.65%
Freiburg (BW)	-100.24%	2.88%	2.93%	9.70%
Rostock (MWP)	-101.57%	3.00%	2.85%	11.67%
Cottbus (BB)	-104.66%	2.85%	-4.88%	10.47%
Magdeburg (SA)	-105.97%	2.12%	0.97%	11.31%
Dortmund (NRW)	-103.38%	1.93%	-3.67%	8.36%
Jena (T)	-106.74%	1.88%	-4.10%	10.56%
Wiesbaden (H)	-103.08%	1.75%	0.08%	9.04%
Ludwigshafen (RP)	-104.39%	1.11%	-1.03%	8.82%
Stuttgart (BW)	-105.45%	0.73%	-2.15%	8.61%
Düsseldorf (NRW)	-104.57%	0.69%	-0.34%	8.95%
Hamburg (HH)	-104.17%	0.30%	0.05%	9.04%
Wuppertal (NRW)	-104.04%	0.08%	-1.94%	8.65%
Plauen (S)	-109.03%	-0.16%	-3.27%	10.66%
Essen (NRW)	-102.24%	-0.38%	3.18%	9.77%
Regensburg (B)	-105.86%	-0.56%	-3.80%	8.34%
Hannover (LS)	-105.46%	-0.93%	0.91%	9.22%
Mainz (RP)	-106.36%	-1.08%	-3.85%	8.33%
Heidelberg (BW)	-106.03%	-1.51%	-2.80%	8.50%
Zwickau (S)	-110.26%	-2.57%	-4.92%	10.46%
Mannheim (BW)	-107.45%	-3.59%	-5.42%	8.10%
Brunswick (LS)	-107.16%	-4.00%	-1.40%	8.75%
Halle a.d.S. (SA)	-108.45%	-3.89%	-0.15%	11.12%
Karlsruhe (BW)	-108.71%	-5.04%	-5.19%	8.14%
Gera (T)	-108.64%	-5.31%	-0.86%	11.00%
Nuremberg (B)	-108.31%	-5.74%	-4.24%	8.69%
Ingolstadt (B)	-108.75%	-6.09%	-4.03%	8.31%
Leipzig (S)	-110.17%	-6.22%	0.40%	11.00%
Chemnitz (S)	-110.18%	-7.53%	-1.29%	10.94%
Kassel (H)	-107.51%	-7.95%	-4.49%	8.24%
Kiel (SH)	-108.00%	-8.26%	-0.65%	8.89%
Augsburg (B)	-110.07%	-11.38%	-5.34%	8.12%

Appendix 3: Abbreviations used for cities in Germany

City	Abbr.	City	Abbr.
Augsburg (B)	A	Jena (T)	J
Berlin (Berlin)	B	Karlsruhe (BW)	KA
Bielefeld (NRW)	BI	Kassel (H)	KS
Bochum (NRW)	BO	Kiel (SH)	KI
Bonn (NRW)	BN	Köln (NRW)	K
Brandenburg (BB)	BRB	Leipzig (S)	L
Bremen (HB)	HB	Ludwigshafen (RP)	LU
Brunswick (LS)	BS	Magdeburg (SA)	MD
Chemnitz (S)	C	Mainz (RP)	MZ
Cottbus (BB)	CB	Mannheim (BW)	MA
Dessau (SA)	DE	Munich (B)	M
Dortmund (NRW)	DO	Nuremberg (B)	N
Dresden (S)	DD	Oldenburg (LS)	OL
Duisburg (NRW)	DU	Osnabrueck (LS)	OS
Düsseldorf (NRW)	D	Plauen (S)	PL
Erfurt (T)	EF	Potsdam (BB)	P
Essen (NRW)	E	Regensburg (B)	R
Frankfurt a.M. (H)	F	Rostock	HRO
Freiburg (BW)	FR	Saarbrücken (SL)	SB
Gera (T)	G	Schwerin (MWP)	SN
Halle a.d.S. (SA)	Hal	Stuttgart (BW)	S
Hamburg (HH)	HH	Wiesbaden (H)	WI
Hannover (LS)	H	Wuppertal (NRW)	W
Heidelberg (BW)	HD	Würzburg (B)	WÜ
Ingolstadt (B)	IN	Zwickau (S)	Z

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