



RUHR

ECONOMIC PAPERS

Michael Stein

German Real Estate Funds – Changes in Return Distributions and Portfolio Favourability

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, email: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
International Economics
Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Christoph M. Schmidt
RWI, Phone: +49 (0) 201/81 49-227, e-mail: christoph.schmidt@rwi-essen.de

Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

Ruhr Economic Papers #454

Responsible Editor: Volker Clausen

All rights reserved. Bochum, Dortmund, Duisburg, Essen, Germany, 2013

ISSN 1864-4872 (online) – ISBN 978-3-86788-512-6

The working papers published in the Series constitute work in progress circulated to stimulate discussion and critical comments. Views expressed represent exclusively the authors' own opinions and do not necessarily reflect those of the editors.

Ruhr Economic Papers #454

Michael Stein

**German Real Estate Funds –
Changes in Return Distributions and
Portfolio Favourability**

Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über:
<http://dnb.d-nb.de> abrufbar.

<http://dx.doi.org/10.4419/86788512>

ISSN 1864-4872 (online)

ISBN 978-3-86788-512-6

Michael Stein¹

German Real Estate Funds – Changes in Return Distributions and Portfolio Favourability

Abstract

Since 2008, the German open-ended real estate fund (GOEREF) industry has experienced a critical phase of suspensions of redemption of fund shares, announced fund terminations and, eventually, introduction of a new regulation. With assets under management of over EUR 80 billion, GOEREFs are the dominant indirect real estate investment vehicle in Germany. Thus, it is extremely important to study the effects of this crisis on the risk and return characteristics of the respective funds. Both net asset values (NAVs) and potential secondary market prices of the shares of funds with suspended redemptions are used. The resulting total return patterns are analysed on an index basis for fund groups that best represent the most important investor groups for GOEREFs. Groups that comprised a higher number of funds with suspended redemptions were considerably worse off and less attractive in an asset allocation context than the others given the often much lower secondary market prices. However, changes in return and risk must also be considered in terms of NAVs. The fund group comprising co-operative savings banks' funds was virtually unaffected by the liquidity crisis and continued to deliver stable and non-volatile returns, while the other fund groups exhibited a clear shift in their respective return profiles.

JEL Classification: G01, G10, G12

Keywords: German real estate funds; return distributions; portfolio building; secondary market

December 2013

¹ University of Duisburg-Essen – All correspondence to: Michael Stein, Faculty of Economics and Business Administration, University of Duisburg-Essen, Universitätsstr. 12, 45117 Essen, Germany. E-Mail: michael.stein@uni-due.de

1. Introduction

German open-ended real estate funds (GOEREFs) have displayed a highly favourable return-to-risk profile over decades. GOEREFs delivered between 3%–6% returns for most years with volatilities often below 1%. This changed for many funds with the onset of the industry’s liquidity crisis in 2008. Not only were investors and policymakers worried about the liquidity situation, but also the returns for many funds stood no comparison with those for the previous years. This study provides a comprehensive analysis of the risk and return profiles of GOEREFs over time and for different investor groups.

Since GOEREFs had a long-established role in many small investors’ portfolios and retirement investment schemes, the problems of this EUR 80+ billion industry had a significant impact on the German investment community and attracted the attention of both the policymakers and the public. Following a period of suspension of redemptions, failed re-openings, and announced fund terminations, a new law came into effect in April 2011. This regulation imposed a minimum holding period of two years, coupled with a one-year notice period. However, an exception was made for amounts below EUR 30.000 on a semi-annual basis. This exception was removed in accordance with the European Union’s (EU) Alternative Investment Fund Manager (AIFM) Directive in July 2013, thereby marking the latest change in the industry structure.

Prior to the crisis and the subsequent regulatory changes, GOEREFs provided daily liquidity and shares could be redeemed with the fund management companies on any trading day. When liquidity in the funds fell below critical levels, the fund management companies were allowed to suspend the redemption of fund shares for a maximum time span of two years, split into several sub-periods as pre-defined in the German investment law. In November 2012, the GOEREF industry still comprised assets under management of EUR 83billion, which represented a significant share of the German and European real estate investment and asset management space (see Maurer, 2004;

Focke, 2006; Bannier *et al.*, 2008; Sebastian and Strohsal, 2011 for general industry discussions). About a fourth of these assets are held by funds that are either closed for redemptions or in the process of termination.

To understand the performance of the once successful GOEREFs, the very nature of this special type of investment fund needs to be considered. Daily net asset values (NAVs) of the funds are determined based on rents received, yearly revaluations of properties (until the new regulation increased the valuation frequencies), sales and acquisitions of properties, and costs and fees. Thus, property management, consulting services, construction, and refurbishments are also determinants of the NAV. The price of a property as per German valuation and appraisal methods is based on the expected long-term rent to be received (long-term sustainable rental income method). This method resulted in very stable and non-volatile NAVs, although with some degree of appraisal smoothing. Real estate valuation principles in Germany are often seen in contrast to the more market-based valuation models and have been discussed in detail by Downie *et al.* (1996) and McParland *et al.* (2002). However, Schnaidt und Sebastian (2011) argue that it is not the legal framework but rather its application that is the reason for differencescausing differences. German real estate returns and their characteristics are discussed in detail by Maurer *et al.* (2004a, 2004b) and Richter *et al.* (2011); Maurer *et al.* (2004a) focus on GOEREF returns.

The suspension of redemptions of shares has led to increased trading of shares in the secondary market, primarily at local German exchanges specializing in fund trading. Although the market for fund shares is not long-established and large block trades may not be possible, volumes were substantial for several funds that were closed for redemptions. For example, the trading volume for CS Euroreal was around EUR 1.5 billion or around 25% of the fund's size for the four years that the fund was largely closed.

Since the fund exchange prices are determined by supply and demand, it is not surprising that they are more volatile than NAVs. While there is apparently no evidence regarding the composition of

market participants such as forced sellers, speculators, and traders, discounts apart from liquidity discount are expected to be applied as well. In Figure 1, it can be seen that some funds are traded at 40%–50% below NAV; thus, it is likely that market prices incorporate a valuation discount among others. The reason for this discount is the expectation that the termination or sale values of funds will be lower than their last valuation, since the NAVs of several funds, especially those that were closed for redemptions, fell significantly and/or numerous times following property de-valuations.

The GOEREF liquidity crisis has attracted considerable research attention in recent years, including studies by Fecht and Wedow (2010), Schweizer *et al.* (2013), and Stein (2013) that analysed the developments of the GOEREF industry since the onset of the crisis. Nevertheless, the inherent dangers of GOEREFs have already been discussed by Sebastian and Tyrell (2006) and Bannier *et al.* (2008); the former provided a theoretical framework for the GOEREF fund model, while the latter discussed issues arising from the funds' structures and the problem of liquidity transformation.

Haß *et al.* (2012), Schweizer *et al.* (2013), and Stein (2013) empirically consider secondary market prices. The former two studies use NAVs for index building and secondary market prices for the calculation of average discounts in event windows, whereas the latter employs secondary market prices for index calculations. By construction, event window discounts are much smaller than those for the entire period, since they reflect only those developments that occur within 30 days from the closing date and not thereafter, the entire development is depicted in Figure 1. Haß *et al.* (2012) and Schweizer *et al.* (2013) analyse the favourability of GOEREFs in mixed-asset portfolios and highlight the benefits of their inclusion. Apparently, this holds true even for the unsmoothed returns of the GOEREFs with the standard deviation increasing from 0.21% to 0.33%.

This is the first study that directly addresses how the return-to-risk profile and portfolio benefits of GOEREFs has changed in recent years based on secondary market prices. In Section 2, the index construction methodology based on Stein (2013) is discussed and the results are explained. In

Section 3, the changing return-to-risk characteristics of GOEREFs are discussed. Section 4 discusses the problems related to asset allocation and examines the effects of the liquidity crisis for different investor groups. Section 5 discusses the implications for both retail and institutional investors. Section 6 provides the conclusion and outlook.

2. GOEREF Groups and Index Building Methodology

2.1 GOEREF groups and classes

In order to assess how the return-to-risk pattern of GOEREFs has changed over time and how this affects their portfolio share, various investor groups and eligible funds need to be considered. The typical three groups or classes of GOEREFs are as follows.

Co-op funds. The first identifiable class of funds are retail funds that are exclusive to clients of the respective cooperative savings banks that manage these funds through their own asset management companies. These funds can be bought only by those investors who have a savings account with the cooperative savings bank that offers the fund. At times, shares of co-op funds can be bought in the secondary market as well, and therefore, may even be purchased by institutional investors. However, since only cooperative savings banks' clients can buy these shares and they may not necessarily sell them in the secondary market, trading is very limited and irregular. Notably, those shares sometimes even trade at a premium, as seen in Figure 1.

Retail ex co-op funds. These funds are generally targeted at small private investors and savers. However, many of these funds were open to institutional investors, who held a large fraction of assets in several funds. During and post the crisis, big investors were held responsible for the large fund outflows, although there was no evidence regarding the same.

Institutional funds. These funds include the so-called semi-institutional funds that are open to institutional investors and wealthy private investors. These funds typically impose a minimum investment amount that investors must exceed in order to be eligible for purchasing shares. Some institutional funds used holding period agreements as extensions to the general sales offer sheets; thus, investors were locked in for several years if they wanted their full investment back on the redemption of shares. Otherwise, they had to accept redemptions at a discount to the NAV. The holding period redemption fees were often coupled with notice periods.

Unlike the other funds, co-op funds did not experience problems regarding fund flows and suspension of redemptions. Despite some outflows, none of the co-op funds had to suspend redemptions. These funds seemingly managed their investor base through their own distribution networks and asset management arms such that the liquidity levels never reached critical thresholds. On the other hand, several other institutional funds were unable to do so, resulting in suspension of redemptions even by those funds that had imposed safety measures like notice periods or holding period-related discounts. Announcement and notice periods merely shifted the problem of liquidity and drove funds to seek liquidity in the interim through sale of property. Often, redemptions at a discount did not prevent investors from redeeming their shares since the maximum discount was 5% in many cases. Retail ex co-op funds were affected the most by negative fund flows, suspensions, and terminations. However, there was a difference between funds that had their own integrated distribution networks (e.g. Commerzbank and Deutsche Bank) and others like AXA Immoselect, CS Euroreal, and SEB Immoinvest. While the former navigated through the crisis with open funds, the latter were unable to do so and are in the process of termination. These effects will be discussed further on.

2.2 Relevant price methodology

To understand the similarities and differences among GOEREFs' return characteristics, Stein's methodology (2013) of relevant price P_t^{rel} and relevant return R_t^{rel} is used, where the relevant price

at time t is a function of the net asset value NAV_t and the secondary market price P_t^{sec} , and $S_t = 1$ for days where redemptions of shares are suspended, and $S_t = 0$ otherwise.

$$(1) P_t^{rel} = NAV_t \cdot (1 - S_t) + P_t^{sec} \cdot (S_t)$$

$$(2) R_t^{rel} = \frac{P_t^{rel} - P_{t-1}^{rel}}{P_{t-1}^{rel}} = \frac{[NAV_t \cdot (1 - S_t) + P_t^{sec} \cdot (S_t)] - [NAV_{t-1} \cdot (1 - S_{t-1}) + P_{t-1}^{sec} \cdot (S_{t-1})]}{NAV_{t-1} \cdot (1 - S_{t-1}) + P_{t-1}^{sec} \cdot (S_{t-1})}$$

This methodology can incorporate jumps in performance; however, this phenomenon is actually observed in the relevant performance of funds that close for redemptions or re-open, and therefore is not just an assumption. It is important to understand that a separate analysis of secondary market prices is not required. When funds are open for redemptions, the secondary market prices are always very close to the NAVs since any difference between the two would provide arbitrage opportunities.

Dividends are added to the relevant price in order to calculate total return indices. For funds that are closed for redemptions and are not traded (mainly institutional funds), results using both NAVs and NAVs to which an average discount of closed funds is applied are reported. As market information suggests large discounts for over-the-counter trades of institutional funds (due to announcement and holding period restrictions), the discount assumption may be justified. Equal weighted indices are constructed if at least five constituents of a particular group are available. Both monthly rebalancing and buy-and-hold assumptions were used. In the buy-and-hold strategy, rebalancing occurs only when funds enter or exit their respective groups. Monthly rebalancing best mirrors calculations of common indices whereas buy-and-hold reflects a long-term view.

2.3 Data

Data for NAVs, secondary market prices, and dividends were obtained from Bloomberg and Thomson Reuters Datastream. Bloomberg data reflects only the last dividends paid. In order to identify funds that did not pay any dividend for a year or repeatedly paid the same amount, ex-dividend day information from Datastream was used. Datastream's dividend records for non-

American funds were available from the year 1990 onwards. At times, dividends were recorded on the following day after deduction from the NAV. Data adjustments were made for the same, otherwise the total return series would have been distorted.

Information regarding suspension of redemptions was obtained from the announcements of the respective fund management companies. These announcements are mandated by law whenever funds need to reject redemptions so that investors can identify the last day for acceptance of shares for redemption. The remaining uncertainties regarding ex-dividend dates and other data were resolved using information from the homepages of the fund management companies and through direct checks with the German funds association, BVI.

3. Indices Results and GOEREF Return-to-Risk Profiles Over Time

3.1 Indices Results

Data for indices using the monthly rebalancing assumption are presented in Figures 2 and 3 from October 2000 onwards since each of the three groups had at least five constituents from then on. It is obvious from the indices results that soon after the commencement of suspension of redemptions, all the groups except the co-op funds suffered from decreasing returns and higher volatility. Notably, this holds true whether secondary market prices or NAVs are considered. These effects are evident despite the fact that in both the retail ex co-op and the institutional funds groups, several funds remained open and their performances did not comparably worsen.

Interestingly, the drawdown period for NAVs begins with a little lag to that of the relevant price series. This raises the question about how property prices were set since funds' liquidity levels should generally not directly affect property prices. In addition, regulation prohibits fire sales with allowed sale price spans being referenced to last valuations. Consequently, the NAVs should also be unaffected, but the contrary was observed. Since a property's value is determined by the long-term sustainable rent, it should be unaffected by a fund's liquidity position. However, it is likely that property prices were set in line with market expectations since the long-term assumption does

not hold for closed funds that need to sell properties rather than hold them over their life cycle or at least until the next market upturn.

Descriptive statistics for all calculated indices are presented in Table 2. These results hold for the buy-and-hold strategy analysis as well. Based on these results, it is interesting how higher volatility and drawdowns reshape the return distributions of the various groups.

3.2 Return-to-Risk Profiles

Figure 4 shows the return distributions over time for both the NAV-based calculation (upper sub-plots) and the relevant price-based calculation (lower sub-plots) using monthly rebalancing. Clearly, the impact of secondary market prices on the relevant prices widens the return distributions from 2008 or at least 2009 onwards. Notably, this holds true for NAV-based calculations as well—the return distribution of the NAV index becomes wider from 2009 onwards. In addition, the average return is decreasing over time as can be seen in both Figure 4 and Table 2, where the descriptive statistics indicate in detail the extent to which the returns declined during the crisis. In particular, the differences among the three groups are important since the above index series analysis revealed that the returns vary considerably not only over time, but also among the groups as well. This is seen in the return distributions of the three fund classes presented in Figure 5 as well.

The differences between NAV-based distributions and relevant price-based distributions for the co-op funds are small. All co-op funds remained open except UniImmo Global that temporarily closed for redemption due to valuation uncertainty resulting from the Fukushima disaster. Using both these calculations, a very narrow distribution is maintained over time, thereby preserving the low volatility structure. This is evident from both the upper and lower middle sub-plots in Figure 5 and Table 2 as well.

There is a further variation in the returns of institutional funds when relevant prices are considered, as shown in the upper right and lower right sub-plots in Figure 5. However, the inception of several

new funds and the fact that numerous funds remained open cushioned the impact on returns performance.

The retail funds clearly show the strongest variation in returns when secondary market prices are considered for funds with suspended redemptions. The aforementioned variation among retail ex co-op funds with four retail ex co-op funds having their own integrated distribution networks does not mitigate the strong effects of the crisis. Reduced returns and higher volatility are observed even for the NAV-based analysis as illustrated in the upper left sub-plot in Figure 5, but this is more pronounced for the relevant price-based return distributions as depicted in the lower left sub-plot.

Thus, the return-to-risk ratio for the retail ex co-op and institutional funds composite worsens with decreasing returns and increasing volatility. It is of great interest then whether there is yet any favourability for GOEREFs and how it translates into allocations.

4. Asset Allocation

4.1 Data and Framework

A multi asset framework is employed to understand how changes in return characteristics influence investor decisions. This can be considered as a revisit to the studies of Haß *et al.* (2012) and Schweizer *et al.* (2013) since the asset selection is comparable.

In the portfolio, the stock markets are represented by the S&P 500 Composite, the Stoxx Europe 600, and the Nikkei 500. JP Morgan's government bond indices for the global composite, the European Monetary Union, and Japan, and the UK Interbank Overnight rate are also included as defensive assets. In order to derive a diversified portfolio, the S&P GSCI Commodity Index, the Barclays US Corporate High Yield Index, and the FTSE EPRA/NAREIT Developed Index for REITs are included. Thus, a diversified portfolio that is suitable for all investor types and aids the

analysis of asset allocation implications is obtained. Total return data for the indices were obtained from Datastream and are denominated in local currency.

GOEREF portfolio analyses are done both on an aggregate basis as well as group-wise. In general, two sets of portfolios can be considered—portfolios that comprise all the funds that retail/private investors can invest in (that is, retail ex co-op and co-op funds) and portfolios that comprise institutional and retail ex co-op funds. The former grouping represents funds that retail/private investors can invest in, while the latter reflects the fund choices available to institutional investors. By considering co-op and retail ex co-op as two separate index series and institutional and retail ex co-op as two separate index series, it is possible to determine the share of the respective groups within the respective GOEREF share.

In order to get the most meaningful and detailed overview of the time-varying asset allocation effects of the changing profiles of GOEREFs, a rolling window approach is applied to calculate optimal portfolios using the past year's weekly returns. Data of the relevant frequency were available from January 2001 onwards; consequently, over 600 optimal portfolios were calculated. The chosen time span of one year is rather short given that real estate investments are often considered as long-term investments. However, the recent past has clearly shown that investors do change their allocations quickly if possible; otherwise, the observed liquidity crisis would not have occurred at all.

Investors differ not only based on their classification as private/retail or institutional investors, but also with respect to their risk appetite. These differences are incorporated by calculating portfolios with different degrees of risk. Government bonds, the overnight rate, and GOEREFs are classified as conservative assets, whereas stock indices, the commodity index, the REIT index, and high yield bonds are classified as risky investments. Apart from the restriction on short sales and the application of full investment constraints, the following restrictions are applied as well—single asset class allocation is capped at 50% and portfolios are calculated comprising 25%, 50%, and

75% risky assets, thereby reflecting the different degrees of risk tolerance among investors. The relative implications for GOEREFs when calculating optimal portfolios with 25% or 75% limits on risky assets are comparable with those with the 50% limit; hence, only results for the latter are reported. The 50% limit reflects the classical “balanced 50/50” approach to asset allocation with 0%–50% risky investments and 50%–100% non-risky investments.

As per Treynor (2011), the mean-variance approach is vital and continues to be a commonly used benchmark method in asset allocation. It is used as a standard technique in this study and the results are compared to the mean-expected tail loss optimizations. Mean-variance optimization involves determining the weights w^T that maximize a portfolio’s Sharpe ratio (Sharpe, 1964), which is the ratio of expected portfolio return $w^T r$ to portfolio volatility $\sigma(w^T r)$, whereby in mean-expected tail loss optimization the expected portfolio return is set in relation to the expected tail loss $E(\max(-w^T r, 0) \mid -w^T r > VaR_{1-\alpha}(w^T r))$:

$$(3) \max_w SR(r_p) = \frac{w^T r}{\sigma(w^T r)}$$

$$(4) \max_w Mean/ETL_{1-\alpha} = \frac{w^T r}{E(\max(-w^T r, 0) \mid -w^T r > VaR_{1-\alpha}(w^T r))}$$

The expected tail loss indicates the losses incurred when the value at risk $VaR_{1-\alpha}(w^T r)$ is exceeded at a certain significance level α and, thus, presents the expected loss when tail events occur. For continuous distributions, the expected tail loss is the conditional value at risk (CVaR), which is extensively discussed by Rockafellar and Uryasev (2002). Mean-expected tail loss or mean-conditional value at risk methods were increasingly used in comparable studies and became a prominent complementary benchmark to mean-variance analyses as the assumptions involved are less restrictive. Related discussions regarding performance ratios in an asset allocation context are presented by Farinelli *et al.* (2009), among others.

As discussed, GOEREF returns are subject to appraisal smoothing (Geltner, 1991; Clayton *et al.*, 2001; Geltner *et al.*, 2003; Edelstein and Quan, 2006, among others). Haß *et al.* (2012) adjust for

appraisal smoothing and illiquidity by using the serial correlation model for hedge fund returns proposed by Getmansky *et al.* (2004). In their study, they highlight that while the relative increase in the standard deviation is considerable, the absolute value of 0.33% is still very low.

In this study, there is no correction made for appraisal smoothing for the following reasons. First, the author believes that a correction is applicable only for the NAV series and, therefore, one would compare an unsmoothed series (relevant price) with one that is corrected for smoothing effects (NAV). On theoretical grounds, even if an unsmoothing procedure is applicable for the relevant price series, the changes due to the switch between NAV and secondary market prices would severely distort the parameters derived using an autocorrelation function. Second, while the total return series used in this study is based on actual prices and dividends, the raw or “true” real estate return is difficult to determine because fund liquidity and other factors like costs, rents received, and operating expenses cannot be observed and, thus, will have to be unsmoothed as well. The fact that liquidity in the funds changes drastically over time and several large funds almost reached the regulatory limit of 50% before the crisis further intensifies this problem.

4.2 Results

Results obtained using the Sharpe ratio and mean-expected tail loss optimizations are in line with each other, although allocations based on the latter change somewhat more dynamically over different time periods.

For both the analyses based on NAVs and the relevant price method, the portfolio share of GOEREFs in all the funds in the composite index decreases after the onset of the crisis, as seen in the upper left and lower left sub-plots in Figures 6 and 7. Naturally, this effect is more pronounced for the analysis based on relevant prices, in line with the results of the distribution analysis where increased volatility and lower average returns were observed late 2008 onwards.

However, the composite index comprises all the classes of GOEREFs and may only be a broad indicator. It is evident from the analysis of the indices and the resulting return distributions that the groups are extremely different from each other and depending on their type may not be accessed by all investors. Accordingly, the analysis must take into account different investor and fund groups and the results must clearly indicate how the favourability of GOEREFs in an asset allocation context changed over time.

Based on the assumption that retail investors have a choice between co-op funds and other retail funds (that is, the upper middle and lower middle sub-plots in Figures 6 and 7), it would be advisable that they continue to allocate a considerably large portion of their portfolio to GOEREFs. However, this holds true only when they seek access to co-operative savings banks' funds. This result holds true depending on the choice of price used—only one fund in the co-op funds group temporarily closed for redemption and the relevant price series of this class is close to the NAV series.

Institutional investors may include shares of retail ex co-op funds in their respective portfolios of institutional funds. One can see the optimal allocation in the upper right and lower right sub-plots in Figures 6 and 7. Again, a considerable shift away from retail ex co-op funds along with a reduction in the total allocation to GOEREFs is observed, as institutional investors cannot access co-op funds. At the end of the estimation period, only small amounts (NAV-based analysis), or even nothing (relevant price-based analysis) are allocated to GOEREFs. Admittedly, the analysis with relevant prices for institutional funds is more assumptive than that for the other fund classes since the average discounts that are applied to all the traded closed funds are applied to some of the non-traded institutional funds as well. Given that a corresponding impact is seen in the NAV-based analysis as well, the relevant price analysis appears to be highly reliable though.

The results of the portfolio optimizations indicate that the crisis has re-shaped the industry and the return-to-risk profiles in a way that suggests exiting GOEREFs when co-op funds are not

accessible. This implies that GOEREFs must be substituted with other conservative asset classes in the optimal allocations. The attractiveness of GOEREFs was at the lowest around the end of 2012 which was the end of the sample period.

A comparison of these results with those of Haß *et al.* (2012) and Schweizer *et al.* (2013) yields interesting similarities and differences. Haß *et al.* (2012) conclude that besides the aforementioned liquidity risks, GOEREFs are still beneficial in an asset allocation context. However, their sample period ends in December 2008. This is close to the turning point in terms of performance even at the NAV level (see Figure 2 and Table 3). At that time, the optimal allocation to GOEREFs in both the NAV-based and relevant price-based analyses in this study was still close to the maximum of 50%. This is evident from the index calculations and the return distribution analyses that show that the effects had just begun to manifest around that time. It follows that at the end of the Haß *et al.* (2012) sample the characteristics of GOEREFs were such that the optimizations continued to imply large portfolio allocations and that the reductions were made only later.

Notably, the results regarding the attractiveness of GOEREFs are still different from those of Schweizer *et al.* (2013). While their sample period (until the end of June 2010) is closer to that used in this study, they analyse the long-term effects for asset allocators and assume buy-and-hold strategies and funds re-opening for redemptions in the future. They conclude that the long-term performance of GOEREFs will be beneficial to investors. While this may indeed be true when funds re-open and secondary market prices revert to NAV levels, almost no fund has successfully re-opened hitherto. The number of funds that announced liquidation was two in 2010, six in 2011, and five until October 2012 (see Tables 1 and 2). Further, the NAVs of several funds that had suspended redemptions declined as well, thereby reducing the upward potential.

For the later stages of the sample, it is relevant that funds in termination may not issue new shares. While no assumptions were made regarding the holding periods, it must be noted that the funds could no longer be purchased from the respective management companies at NAV. However, funds

in liquidation are still traded in the secondary market, and their shares can therefore be purchased at discounted prices. This is incorporated in the analysis at the time of rebalancing, thereby yielding realistic results in terms of the relevant purchase price.

Purchasing shares on the secondary market in turn largely depends upon the regulatory and auditing structures. BVI distributed a note by the regulator BaFin in 2011 that gave investors a legal choice between the NAV and the secondary market price as the relevant price when accounting for funds that were closed for redemptions. Interested readers may obtain this note from the author.

5. Implications for investors

Given that the findings of both the NAV-based analysis and the relevant price-based analysis indicate that the return distributions of GOEREFs have changed significantly in recent years, the expectation that this should reflect in the optimal asset allocations was met. While the overall share of GOEREFs in the optimal portfolios appears to be smaller than that in the pre-crisis period, there is no clear answer as to whether this holds true for all investors or in the future for the following reasons.

The results imply that large portfolio allocations are currently only in the co-operative savings banks' funds. However, this would be a short-sighted interpretation given the expected differences among the groups and the drivers of differences:

Based on both NAV and relevant price analyses, it can be seen that the allocations implied by the optimized portfolios were best suited for the group that has the least problem of suspension of redemptions—the co-op funds group. A comparison of the descriptive statistics, index results, return distributions, and portfolio allocations indicates that investors of co-op funds were best off. In the context of the dispersion among the fund classes mentioned above, it must be noted that funds with characteristics similar to those of the co-op funds can constitute other groups as well, although they represent a minority. Accordingly, the results hold for a class or group even though

several funds, particularly those with their own integrated distribution networks, remained open for redemptions. Yet, this analysis provides the most realistic view with respect to a hindsight-free evaluation. In retrospect, it is evident which funds followed the new law and which remained closed and/or went into termination, but in 2008 it was not. Therefore, dividing the groups further or re-assigning funds based on past liquidity would have led to biased results.

It is to be noted that funds that remain open for redemptions offer different benefits to investors than funds with suspended redemptions. In this context, regulation helps to understand the implications of the analyses above. Currently, all the funds that are open to investors are operating under the new rules; thus, a more homogenous industry could emerge again. However, this depends on how the industry fares under the new regime and whether investors continue to have a taste for GOEREFs with the introduction of new regulations following the implementation of the EU's AIFM Directive in effect.

While retail investors and savers can choose among different retail GOEREFs that do not have to suspend redemptions as they are now structured by law, institutional investors continue to have the same choices as before though they may find alternatives in the closed-end fund space. It remains to be seen whether the new regulation will indeed prevent suspensions and terminations in the future and deliver long-term safety or only serves as a temporary shift for otherwise short-term problems. In any case, it is best that investors carefully monitor the industry developments and avoid funds that may face liquidity troubles and, consequently, deliver relatively worse performance.

While the above discussion is in the context of the problems observed, there are other important aspects as well. As mentioned earlier, the secondary market prices were heading largely downwards. There were definitely some discrepancies—when funds temporarily opened for redemptions and the secondary market prices immediately reverted to the respective NAV levels, but the trend was and is clearly negative. This is clearly seen in the results of the analysis where the

relevant price was used. However, it remains to be seen whether the applied discounts are justified and at what level the NAVs and secondary market prices converge over time.

Although asset management companies are allowed several years to wind up their funds, there are (still?) regulatory lower bounds on the selling price of a property based on its last valuation. Upside price potentials on the other hand are discussed by Schweizer *et al.* (2013). They base their argument on possible gains when funds re-open for redemptions, although this obviously does not hold for most funds with suspended redemptions and for all funds in termination. However, secondary prices will revert to the NAV levels eventually. Investors are paid in tranches when funds sell a property and the secondary market price and NAV for each fund ultimately converge.

Improving real estate market conditions coupled with a low interest rate environment may lead to favourable deals. Consequently, the secondary market prices of funds with suspended redemptions or those that have announced liquidations may move closer to their respective NAV levels. This would reshape the return-to-risk profiles and alter the attractiveness of the funds again.

6. Conclusions and Outlook

The analysis of GOEREFs on an aggregate as well as group index basis provided valuable insights into the changing structure of funds' return profiles. Significant changes on NAV basis as well as relevant price basis are observed over time. The three identified groups of GOEREF funds are extremely different from each other in both the NAV and relevant price analysis. As is evident from the asset allocation results, retail funds of co-operative savings banks contribute most favourably to optimal portfolios, while the other retail funds are seemingly the least favourable.

A study of the return distributions and asset allocation results indicates that funds that can navigate through liquidity drains and remain open for redemptions should be favoured by investors. It is evident that this was best achieved by the co-operative savings banks' funds.

A possible future consequence of the new regulation that aims at preventing further suspensions in redemptions is the emergence of a more homogenous industry, as was the case prior to the liquidity crisis. However, it is also known that the similarity among the funds was an illusion clouded by a then functioning market and that the structural problems emerged only later on. It remains to be seen whether the industry transition leads to a scenario where a fund is considered beneficial for a portfolio not because it belongs to a particular group of funds, but because it is open for redemptions – given the new regulation with holding periods and notice periods however.

Further research should be conducted on the aforementioned determinants of favourability once the effects of the current phase of transition are observed. Another potential research area concerns how funds in liquidation manage their disinvestments and the resulting effect on their NAVs and secondary market prices. Further, in the context of appraisals and valuations, it will be interesting to study valuations that appear to be more market-based post the liquidity crisis, particularly in relation to funds' liquidity status.

References

- Bannier, C., Fecht, F. and Tyrell, M. (2008), „Open-End Real Estate Funds in Germany – Genesis and Crisis“, *Kredit und Kapital*, Vol. 41 No. 1, pp. 9-36.
- Clayton, J., Geltner, D. and Hamilton, S. (2001), „Smoothing in Commercial Property Valuations – Evidence from Individual Appraisals“, *Real Estate Economics*, Vol. 29 No. 2, pp. 337-360.
- Downie, M., Schulte, K. and Thomas, M. (1996), „Germany“, Adair, A., M.L. Downie, S. McGreal and G.Vos, *European Valuation Practice*, EIFN Spon, London.
- Edelstein, R. and Quan, D. (2006), „How Does Appraisal Smoothing Bias Real Estate Returns Measurement?“ , *Journal of Real Estate Finance and Economics*, Vol. 32 No. 1, pp. 41-60.
- Farinelli, S., Ferreira, M., Rossello, D., Thoeny, M. and Tibiletti, L. (2009), „Optimal Asset Allocation Aid System: From One-Size vs Tailor-Made Performance Ratio“, *European Journal of Operational Research*, Vol. 192 No. 1, pp. 209-215.
- Fecht, F. and Wedow, M. (2010), „The Dark and the Bright Side of Liquidity Risks: Evidence from Open-End Real Estate Funds in Germany“, available at <http://ssrn.com/abstract=1487085> (accessed 11 October 2013).
- Focke, C. (2006), „Development of German Open-Ended Real Estate Funds“, *Journal of Real Estate Literature*, Vol. 14 No. 1, pp. 39-55.
- Geltner, D. (1991), „Smoothing in Appraisal-Based Returns“, *Journal of Real Estate Finance and Economics*, Vol. 4 No. 3, pp. 327-345.
- Geltner, D., MacGregor, B. and Schwann, G. (2003), „Appraisal Smoothing and Price Discovery in Real Estate Markets“, *Urban Studies*, Vol. 40 No. 5-6, pp. 1047-1064.
- Getmansky, M., Lo, A. and Makarov, I. (2004), „An Econometric Model of Serial Correlation and Illiquidity in Hedge Fund Returns“, *Journal of Financial Economics*, Vol. 74 No. 3, pp. 529-609.
- Haß, L., Johanning, L., Rudolph, B. and Schweizer, D. (2012), „Open-Ended Property Funds: Risk and Return Profile – Diversification Benefits and Liquidity Risks“, *International Review of Financial Analysis*, Vol 21, pp. 90-107.
- Markowitz, H. (1952), „Portfolio Selection“, *Journal of Finance*, Vol. 7 No. 1, pp. 77-91.
- Maurer, R. (2004), „Institutional Investors in Germany: Insurance Companies and Investment Funds“, Krahen, J.P. and R.H. Schmidt, *The German Financial System*, Oxford University Press, London.
- Maurer, R., Reiner, F. and Rogalla, R. (2004a), „Return and Risk of German Open-End Real Estate Funds“, *Journal of Property Research*, Vol. 21 No. 3, pp. 209-233.
- Maurer, R., Reiner, F. and Sebastian, S. (2004b), „Characteristics of German Real Estate Return Distributions: Evidence from Germany and Comparison to the U.S. and U.K“, *Journal of Real Estate Portfolio Management*, Vol. 16 No. 1, pp. 59-76.
- McParland, C., Adair, A. and McGreal, S. (2002), „Valuation Standard – A Comparison of Four

European Countries“, *Journal of Property Valuation and Investment*, Vol. 20 No. 2, pp. 127-141.

Richter, J., Thomas, M. and Füss, R. (2011), „German Real Estate Return Distributions: Is there anything Normal?“, *Journal of Real Estate Portfolio Management*, Vol. 17 No. 2, pp. 161-179.

Rockafellar, R. and Uryasev, S. (2002), „Conditional Value-at-Risk for General Loss Distributions“, *Journal of Banking and Finance*, Vol. 26 No. 7, pp. 1443-1471.

Schnaidt, T. and Sebastian, S. (2011), „German Valuation: Review of Methods and Legal Framework“, *Journal of Property Investment & Finance*, Vol. 30 No. 2, pp. 145-158.

Schweizer, D., Haß, L., Johanning, L. and Rudolph, B. (2013), „Do Alternative Real Estate Investment Vehicles Add Value to REITs? Evidence from German Open-ended Property Funds“, *Journal of Real Estate Finance and Economics*, Vol. 47 No. 1, pp. 65-82.

Sebastian, S. and Strohsal, T. (2011), „German Open-Ended Real Estate Funds“, Maennig, W. and T. Just, *Understanding German Real Estate Markets*, Springer, München.

Sebastian, S. and Tyrell, M. (2006), „Open-End Real Estate Funds – Diamond or Danger?“, working paper, University of Frankfurt, *Working Paper Series Finance and Accounting*, No. 168.

Sharpe, W. (1964), „Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk“, *Journal of Finance*, Vol. 19 No. 3, pp. 425-442.

Sortino, F. and Satchell, S. (2001), *Managing Downside Risk in Financial Markets: Theory, Practice and Implementation*, Butterworth Heinemann, Oxford.

Stein, M. (2013), „German Open Ended Real Estate Fund Performance - The Impact of Liquidity“, *Kredit und Kapital*, Vol. 46 No. 1, pp. 119-151.

Stein, M. (2011), „The True Cost of Liquidity“, *IPE Real Estate*, November/December 2012.

Stein, M. and Rachev, S. (2011), „Flow-Induced Redemption Costs in Funds of Funds“, *Journal of Derivatives & Hedge Funds*, Vol. 17 No. 3, pp. 253-265.

Treynor, J. (2011), „What can Taleb learn from Markowitz“, *Journal of Investment Management*, Vol. 9 No. 4, pp. 5-9.

Appendix

Table 1. Descriptive statistics for GOEREFs over time

Fund	Return according to NAV (1990-2007)	Return according to NAV (2008-2012)	Volatility according to NAV (1990-2007)	Volatility according to NAV (2008-2012)	Return according to Relevant Price (2008-2012)	Volatility according to Relevant Price (2008-2012)	Volume Traded	Group	Status
Aachener Grundfonds 1	3,27%	3,88%	1,14%	0,56%	3,88%	0,56%	0	co-operative savings bank fund	open
Aachener Spar- und Stiftungsfonds	N/A	1,53%	N/A	0,98%	1,53%	0,98%	0	co-operative savings bank fund	open
Axa Immoresidential	N/A	1,69%	N/A	0,97%	1,69%	0,97%	0	institutional	transferred to "Specialisations", liquidation, October 2012
Axa Immoselect	1,51%	-0,52%	0,61%	1,81%	-12,24%	16,39%	815	retail	announced liquidation, October 2011
Axa ImmoSolutions	0,28%	0,04%	0,36%	2,81%	-4,69%	11,54%	0	institutional	announced liquidation, October 2011
Bouwfonds European Residential	N/A	4,18%	N/A	1,08%	4,18%	1,08%	0	institutional	open
Catella Focus Health Care	N/A	1,50%	N/A	1,15%	1,50%	1,15%	0	institutional	open
Catella Focus Nordic Cities	N/A	3,64%	N/A	0,89%	3,64%	0,89%	0	institutional	open
Commerzreal Hausinvest Europa	5,61%	3,48%	1,15%	0,51%	3,48%	0,51%	368	retail, own distribution	open
Commerzreal Hausinvest Global	0,87%	1,79%	0,52%	1,00%	1,79%	1,00%	7	retail, own distribution	merged with Hausinvest Europa, September 2010
Credit Suisse Euroreal	4,73%	1,53%	1,44%	1,63%	-5,59%	15,94%	1535	retail	announced liquidation, May 2012
Credit Suisse Property Dynamic	0,43%	3,92%	0,21%	0,49%	-2,11%	9,35%	0	institutional	closed, since March 2012
Degi Europa	4,95%	-14,26%	1,12%	11,40%	-23,85%	24,24%	724	retail	announced liquidation, October 2010
Degi German Business	0,27%	-1,25%	0,10%	2,85%	-6,98%	11,15%	0	institutional	announced liquidation, since November 2011
Degi Global Business	0,83%	-10,16%	0,99%	11,28%	-15,39%	14,15%	0	institutional	announced liquidation, August 2011
Degi International	1,06%	-3,07%	0,33%	2,31%	-10,00%	19,75%	238	retail	announced liquidation, October 2011
Deka Immobilien Europa	2,87%	3,05%	1,02%	0,52%	3,05%	0,52%	179	co-operative banks fund	open
Deka Immobilien Global	1,31%	3,48%	0,52%	0,65%	3,48%	0,65%	120	co-operative banks fund	open
DWS Grundbesitz Europa	5,82%	3,46%	2,00%	0,77%	3,46%	0,77%	328	retail, own distribution	open
DWS Grundbesitz Global	1,98%	2,79%	0,72%	0,90%	2,79%	0,90%	140	retail, own distribution	open
Hansa Immobilien	3,37%	0,22%	1,02%	1,86%	-5,01%	15,33%	66	retail	announced liquidation, October 2012
iii Euro Immoprofil	4,31%	-1,48%	1,24%	1,92%	-1,48%	1,92%	58	retail	announced liquidation with iii Inter Immo, L. October 2010
iii Inter Immoprofil	2,36%	2,39%	0,90%	1,81%	2,39%	1,81%	62	retail	open

Table 1. Descriptive statistics for GOEREFs over time (cont.)

Fund	Return according to NAV (1990-2007)	Return according to NAV (2008-2012)	Volatility according to NAV (1990-2007)	Volatility according to NAV (2008-2012)	Return according to Relevant Price (2008-2012)	Volatility according to Relevant Price (2008-2012)	Volume Traded	Group	Status, since
Morgan Stanley P2 Value	0.64%	-13,24%	0,35%	12,52%	-15,79%	23,94%	513	retail	announced liquidation, October 2010
Pradera Open European Retail	N/A	3,97%	N/A	2,31%	3,97%	2,31%	0	institutional	open
SEB Global Property	0,37%	0,39%	0,23%	2,64%	-5,47%	10,10%	0	institutional	closed, December 2011
SEB Immo Portfolio Target Return	2,95%	5,06%	2,07%	0,90%	-1,26%	12,10%	0	institutional	closed, June 2012
SEB Immoinvest	6,04%	1,39%	1,23%	2,77%	-5,11%	16,25%	1080	retail	announced liquidation, May 2012
TMW Weltfonds	0,74%	-2,24%	0,39%	2,23%	-16,97%	56,89%	180	retail	announced liquidation, May 2012
UBS 3 Sector Real Estate	1,03%	0,54%	0,96%	1,79%	-12,08%	39,52%	53	retail	announced liquidation, September 2012
UBS Euroinvest	4,11%	3,48%	3,93%	0,74%	3,49%	6,03%	170	institutional	open
Uni Immo Deutschland	5,33%	2,86%	1,38%	0,39%	2,86%	0,39%	97	co-operative savings banks fund	open
Uni Immo Europa	5,38%	2,86%	1,57%	0,41%	2,96%	0,41%	85	co-operative savings banks fund	open
Uni Immo Global	0,84%	2,33%	0,32%	2,17%	2,33%	6,93%	37	co-operative savings banks fund	open
Uni Institutional European Real Estate	1,00%	3,53%	0,25%	0,56%	3,53%	0,56%	0	institutional	open
Warburg Henderson Deutschland	1,69%	1,53%	0,83%	2,60%	1,53%	2,60%	0	institutional	open
Warburg Henderson Deutschland Plus	N/A	4,38%	N/A	8,74%	4,38%	8,74%	0	institutional	open
Warburg Henderson Multinational Plus	N/A	-2,11%	N/A	3,29%	-2,11%	3,29%	0	institutional	open
Wertgrund Wohnselect	N/A	1,72%	N/A	0,71%	1,72%	0,71%	0	co-operative savings banks fund	open
West Invest Interest	2,16%	2,40%	1,14%	0,56%	2,40%	0,56%	153	co-operative savings banks fund	open
Kan Am Grundinvest	2,14%	0,54%	0,91%	2,26%	-4,97%	13,51%	0	retail	announced liquidation, February 2012
Kan Am Spezial Grundinvest	1,00%	0,40%	0,57%	4,67%	-20,73%	29,48%	1858	institutional	announced liquidation, September 2011
Kan Am US Grundinvest	1,62%	2,28%	0,43%	11,36%	9,47%	37,98%	114	retail	open

Notes: Aachener normally church-associated, included in co-op. Returns and volatility annualized, volume traded in mm €.

Table 2. Descriptive Statistics for calculated indexes

Class or Group	Price Used	Rebalancing	Return (2000-2007)	Return (2008-2012)	Volatility (2000-2007)	Volatility (2008-2012)	Maximum Drawdown	Maximum Drawdown Period
All	NAV	monthly	4.87%	1.04%	0.46%	0.71%	2.04%	June-10 to October-12
Retail	NAV	monthly	4.49%	0.53%	0.44%	0.93%	4.44%	March-10 to April-11
Retail ex Coop	NAV	monthly	4.51%	-0.81%	0.50%	1.41%	10.16%	March-10 to October-12
Coop	NAV	monthly	4.40%	3.14%	0.58%	0.38%	0.53%	February-11 to February-11
Retail and Institutional	NAV	monthly	5.02%	0.50%	0.56%	0.88%	4.30%	February-10 to October-12
Institutional	NAV	monthly	7.54%	1.81%	2.18%	1.05%	8.15%	April-12 to October-12
All	RP, AD	monthly	4.91%	-0.35%	0.60%	3.14%	8.15%	September-09 to July-12
All	RP, NAV	monthly	4.91%	0.41%	0.60%	2.70%	5.28%	January-10 to August-10
Retail	RP	monthly	4.54%	-0.56%	0.64%	4.52%	10.46%	July-09 to December-10
Retail ex Coop	RP	monthly	4.58%	-2.43%	0.82%	6.81%	18.20%	October-08 to June-12
Coop	RP	monthly	4.40%	3.17%	0.58%	0.86%	1.86%	February-11 to April-11
Retail and Institutional	RP, AD	monthly	5.08%	-1.24%	0.74%	3.92%	12.14%	July-09 to July-12
Retail and Institutional	RP, NAV	monthly	5.08%	-0.29%	0.74%	3.35%	6.99%	July-09 to December-10
Institutional	RP, AD	monthly	7.54%	0.00%	2.18%	1.92%	7.74%	September-10 to October-12
Institutional	RP, NAV	monthly	7.54%	1.83%	2.18%	1.14%	1.80%	April-12 to October-12
All	NAV	buy and hold	4.88%	1.11%	0.47%	0.89%	1.77%	June-10 to February-11
Retail	NAV	buy and hold	4.49%	0.61%	0.44%	0.90%	4.16%	March-10 to April-11
Retail ex Coop	NAV	buy and hold	4.51%	-0.71%	0.50%	1.38%	9.67%	March-10 to October-12
Coop	NAV	buy and hold	4.39%	3.14%	0.58%	0.38%	0.53%	February-11 to February-11
Retail and Institutional	NAV	buy and hold	5.03%	0.58%	0.58%	0.86%	3.95%	February-10 to October-12
Institutional	NAV	buy and hold	7.60%	1.84%	2.18%	1.03%	1.74%	April-12 to October-12
All	RP, AD	buy and hold	4.90%	-0.24%	0.58%	3.12%	7.67%	September-09 to July-12
All	RP, NAV	buy and hold	4.90%	0.50%	0.58%	2.70%	5.14%	January-10 to December-10
Retail	RP	buy and hold	4.51%	-0.38%	0.61%	4.53%	10.33%	July-09 to December-10
Retail ex Coop	RP	buy and hold	4.54%	-2.10%	0.78%	6.90%	16.85%	October-08 to December-10
Coop	RP	buy and hold	4.39%	3.17%	0.58%	0.84%	1.82%	February-11 to April-11
Retail and Institutional	RP, AD	buy and hold	5.05%	-1.11%	0.71%	3.91%	11.59%	July-09 to July-12
Retail and Institutional	RP, NAV	buy and hold	5.05%	-0.17%	0.71%	3.86%	6.94%	July-09 to December-10
Institutional	RP, AD	buy and hold	7.60%	0.01%	2.18%	1.89%	7.67%	September-10 to October-12
Institutional	RP, NAV	buy and hold	7.60%	1.88%	2.18%	1.12%	1.74%	April-12 to October-12

Notes: The early sub-sample starts in October 2000 when all indexes had at least 5 constituents. RP, AD and RP, NAV indicate whether a average discounts or NAV were used for gated funds with no trading. Aachenor normally church-associated, included in co-op. Returns and volatility annualized.

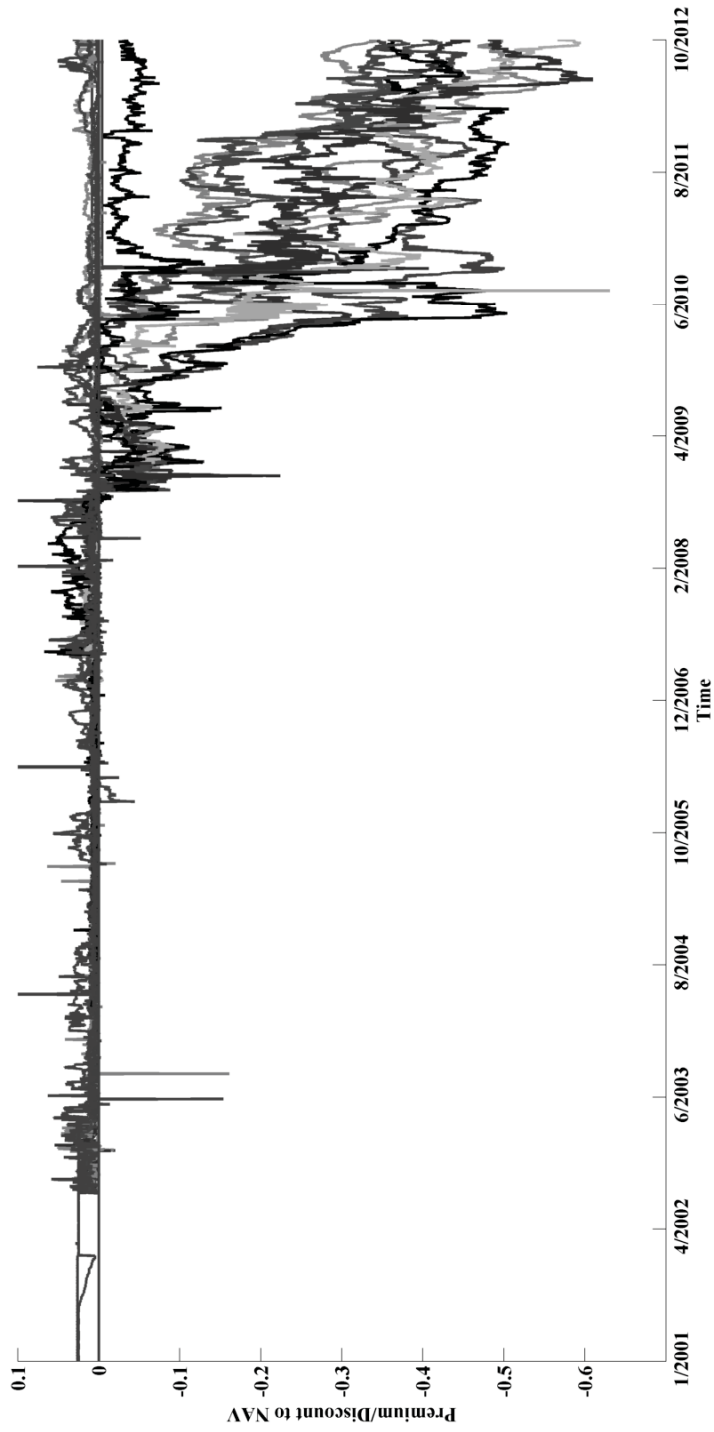


Figure 1. Premiums/Discounts of GOEREFs on the Secondary Market

Notes: The plot shows the daily premiums/discounts of secondary market prices versus NAV, corrected for dividends. The few observations of premiums relate to trading of funds with access restrictions or front-load fee exceptions.

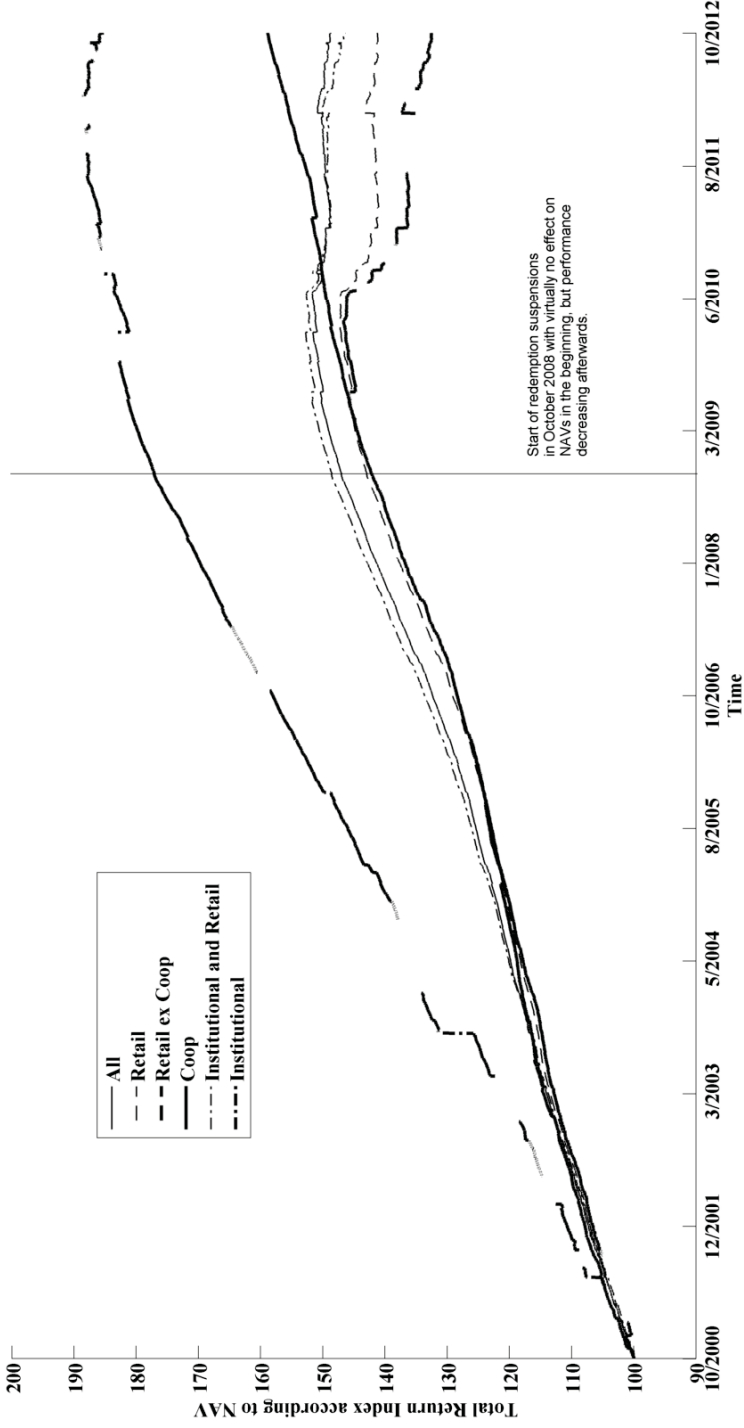


Figure 2. Index of GOEREF Groups when using NAV

Notes: The plot shows the calculated total return indexes for all 6 groups. Here the monthly rebalanced indexes are shown, calculations using NAV. Bold lines used for the three separate classes retail ex coop, coop and institutional, thin lines for composites of the classes.

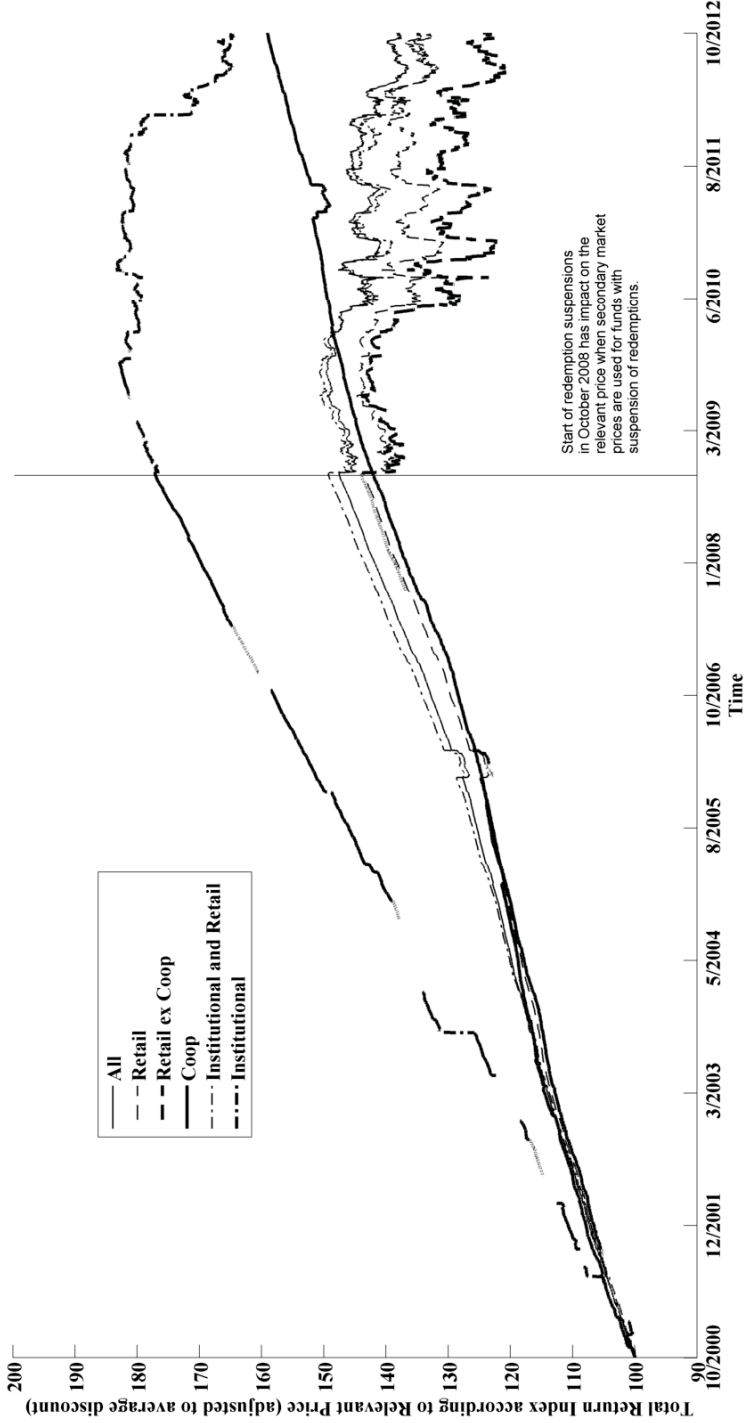


Figure 3. Index of GOEREF Groups when using relevant price, adjusted to average discount

Notes: The plot shows the calculated total return indexes for all 6 groups. Here the monthly rebalanced indexes are shown, calculations using relevant price. When no trading is done but funds are gated, average discount is used. Bold lines used for the three separate classes retail ex coop, coop and institutional, thin lines for composites of the classes.

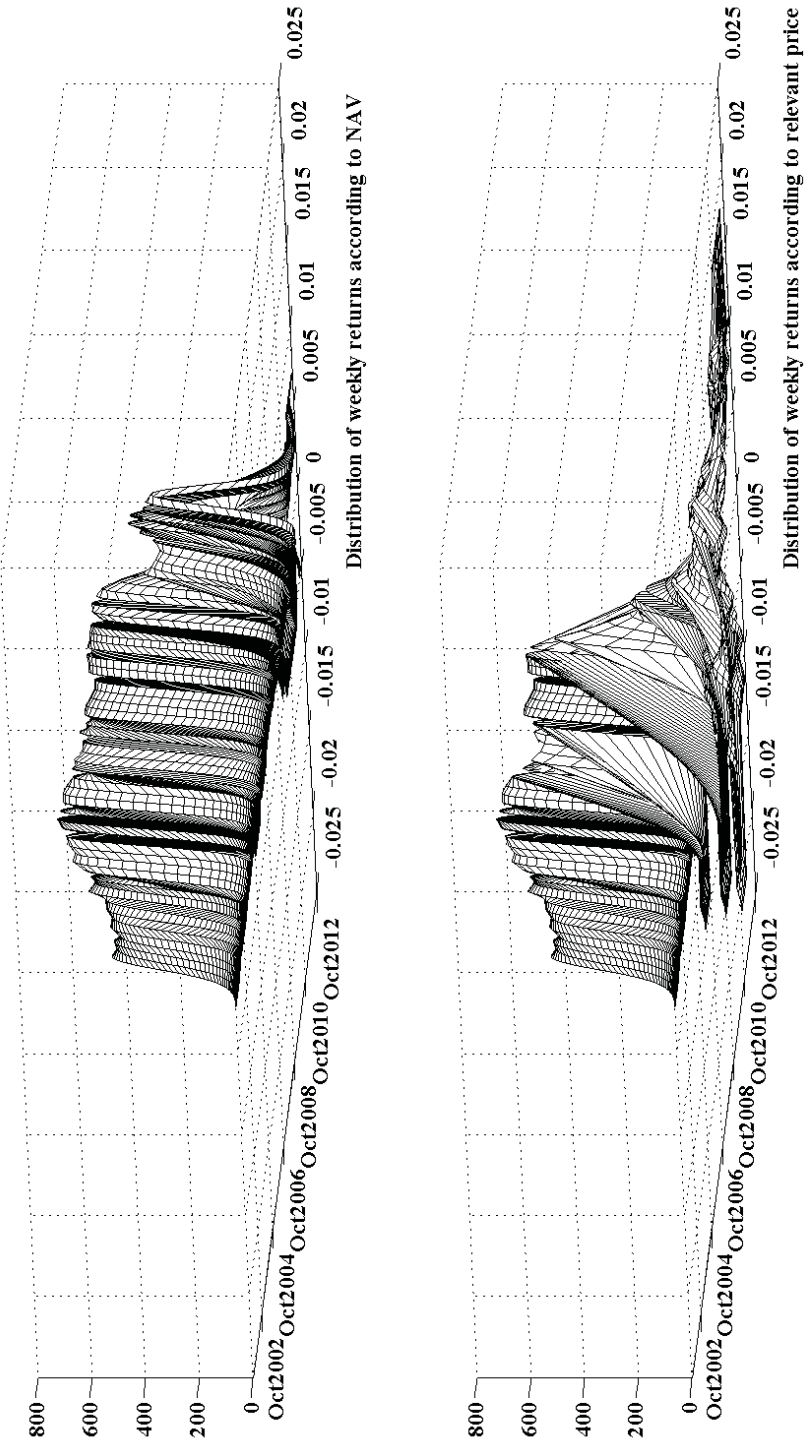


Figure 4. Return distributions over time for whole GOEREF industry

Notes: The upper sub-plot shows the return distributions over time for the NAV case. The lower sub-plot depict the return distribution over time using the relevant price. When no trading is done but funds are gated, average discount is used. Monthly rebalanced indexes used.

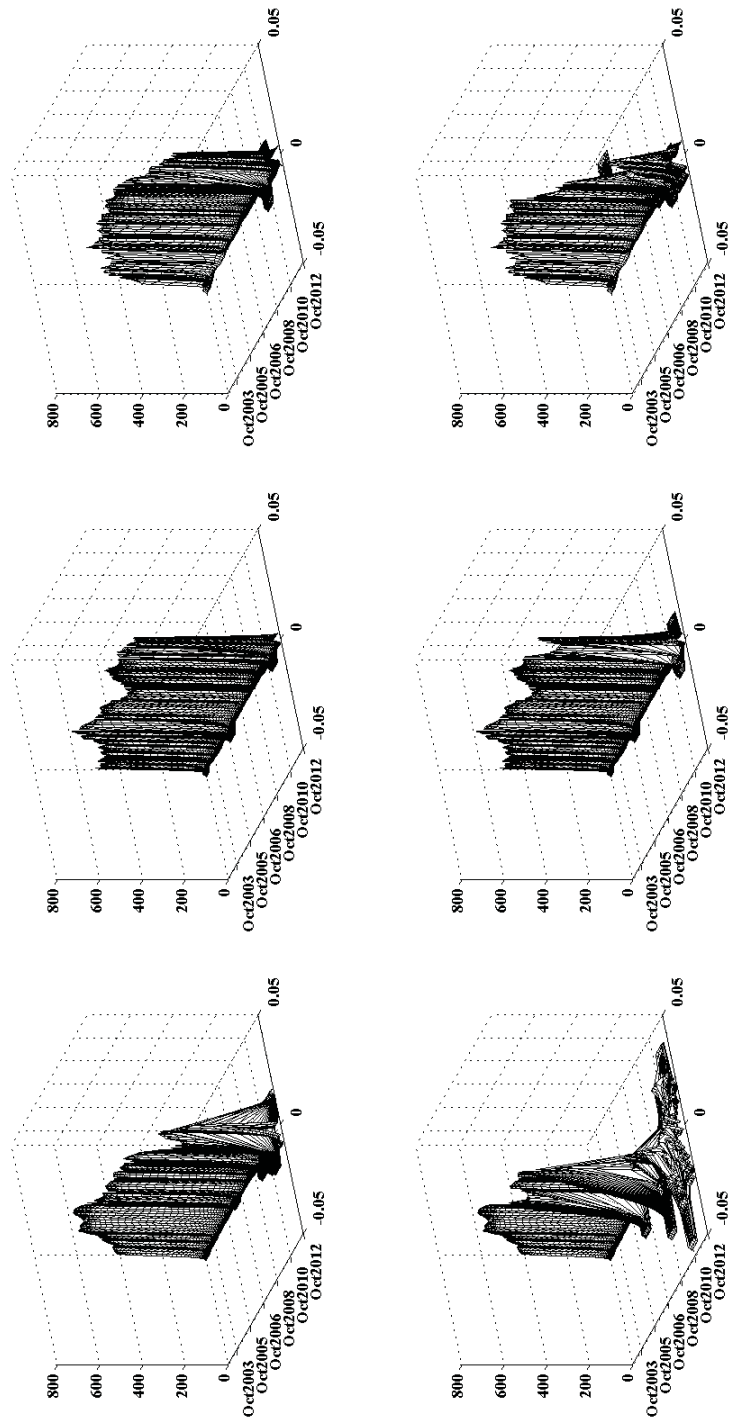


Figure 5. Return distributions over time for groups

Notes: The upper sub-plots show the return distributions over time for the NAV case. The lower sub-plots depict the return distribution over time using the relevant price. Left is retail ex co-op group, middle is co-op group and right is institutional group. When no trading is done but funds are gated, average discount is used. Monthly rebalanced indexes used.

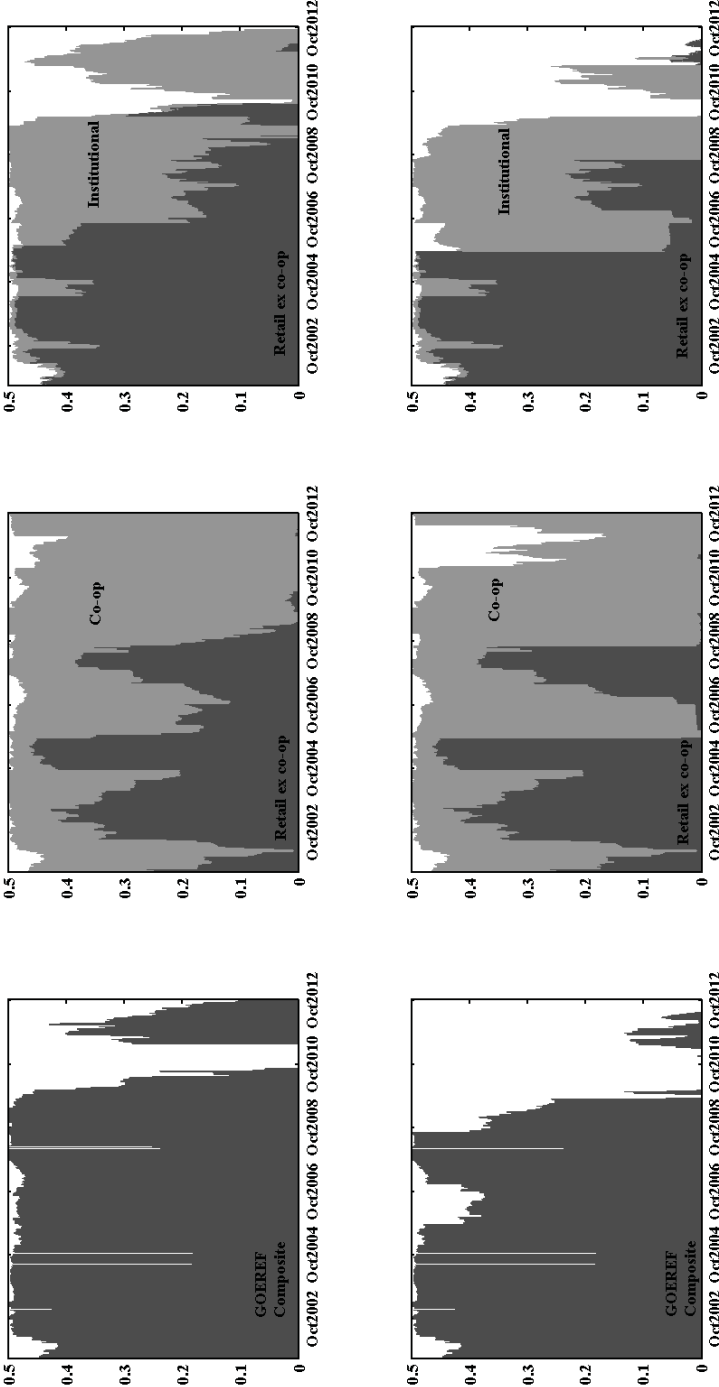


Figure 6. Sharpe ratio optimization results for GOEREFs

Notes: The upper subplots show the allocations to GOEREFs over time using NAVs in the optimization, lower plots show results using the relevant price. Composite on the left, funds accessible for retail investors in general in the middle, funds accessible for institutional investors in general on the right. When no trading is done but funds are gated, average discount is used. Restriction of maximum 50% to risky assets and 50% for each asset, GOEREFs treated as one asset in 50% restrictions. Monthly rebalanced indexes used.

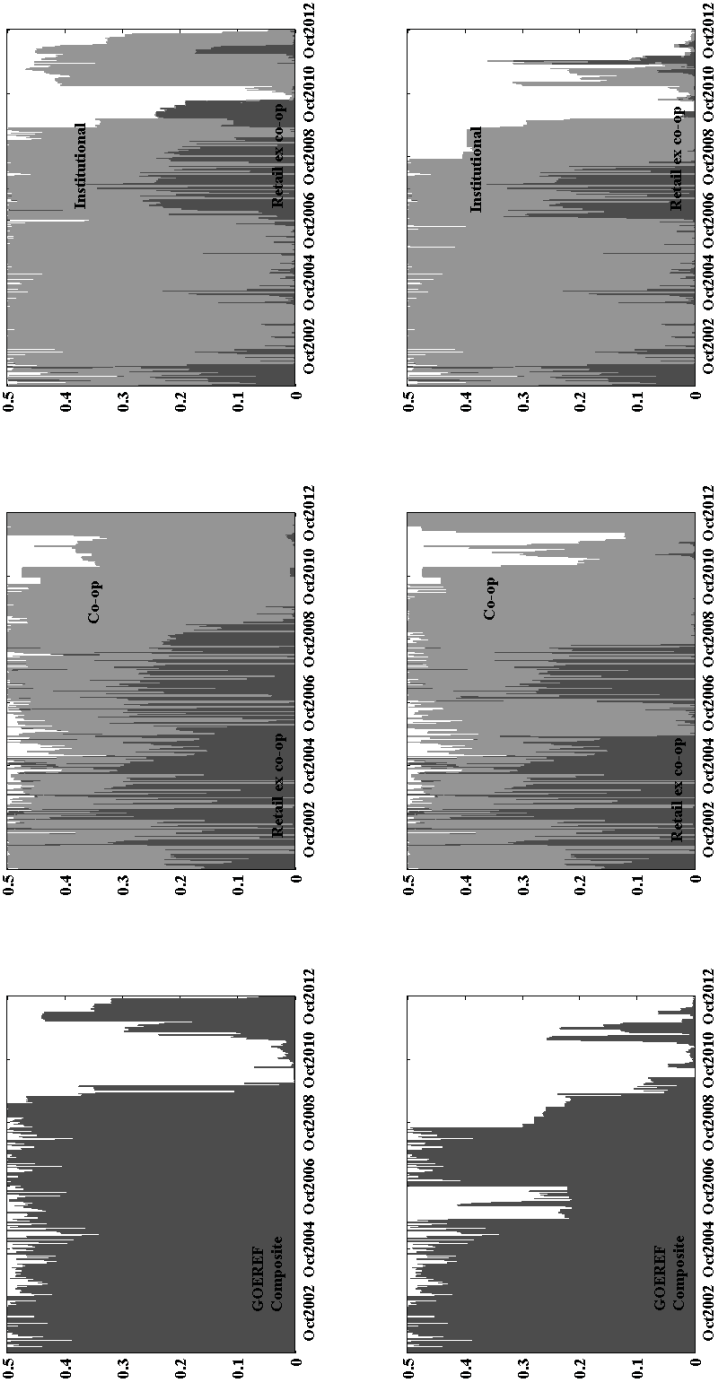


Figure 7. Mean-expected tail loss optimization results for GOEREFs

Notes: The upper subplots show the allocations to GOEREFs over time using NAVs in the optimization, lower plots show results using the relevant price. Composite on the left, funds accessible for retail investors in general in the middle, funds accessible for institutional investors in general on the right. When no trading is done but funds are gated, average discount is used. Restriction of maximum 50% to risky assets and 50% for each asset, GOEREFs treated as one asset in 50% restrictions. Monthly rebalanced indexes used.