Residential Real Estate Investment
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Philippe Bertrand

Aix-Marseille Graduate School of Management - IAE

KEDGE BS, Marseille, France and

Aix-Marseille School of Economics

Jean-luc Prigent

THEMA, University of Cergy-Pontoise, and LabeX MME-DII

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Presentation schedule

- Motivation;
- Real estate investment;
- Financial Markets Data and Statistics for Fr, Ger, UK and Spain;
    - Quarterly;
    - Annual;
- Efficient Portfolios with four asset classes (Bills, Bonds, Stocks and Real Estate) for Fr, Ger, UK and Spain.

Motivation

- For portfolio investing purposes, real estate is usually considered as an alternative investment class;
- Standard results about mixed-asset portfolios suggest that the allocation to real estate should be **about 15-20%**;
- However, in most countries the share of real estate in portfolios of institutional investors is **significantly smaller** : about 7.3% for the US and about 8.5% for the UK;
- The difference between theoretical allocations and observed low allocations to real estate in portfolios of institutional investors is viewed as a **puzzle** in real estate research.
- In this paper, we study residential real estate investment for four major European markets: France, Germany, UK and Spain.
- More precisely, we address the question of the **composition of an investor's portfolio with money market instrument, bonds, stocks and real estate**.

Real estate investment

- Distinction between private and public investment in real estate:
    - Private market is concerned with direct interest in real estate properties.
    - Public real estate market through purchasing a share of a publicly traded real estate company, such as a (REIT).
- Distinction between equity and debt investment:
    - Equity investment means that an investor is essentially the owner of the property.
    - Debt investment corresponds to lending funds to an owner or purchaser of real estate : MBS.

Table: Real Estate Investment Typology

	Private	Public
Equity	Direct ownership Private REITs	Publicly traded real estate companies Standard equity REITs
Debt	Private mortgages	Mortgage-backed securities

Real estate investment

- Here, we rely on **private equity residential real estate returns**.
- Two main methodologies for index construction:
  - **Appraisal-based indices** use valuation of properties by appraisers. For income producing properties, the most common method used by appraisers is the **capitalization rate** (net income from a property divided by its price) approach. Another more technical approach relies on discounted cash flow methodology which is equivalent to the **DDM methodology** for stocks. The appraisal process introduces a bias due to appraisers seeking to smooth volatility in their price estimates.
  - On the other hand, **transaction-based indices** must accommodate the lack of comparability of transacted properties by either applying **repeat-sales measures**, a method which uses information on properties which have been sold more than once, or **hedonic index techniques** which regresses property prices on the properties characteristics and derives the price of a hypothetical standard property.
- INSEE index for sales of existing dwellings (all types of dwellings, whole country) is build on a **stratified hedonic regression method**.

Real estate investment

- In our study, we rely on OECD real estate data. Figure below displays historical returns of the INSEE raw and seasonally-adjusted as well the OECD residential real estate indexes.

Residential Real Estate Return: OECD and INSEE
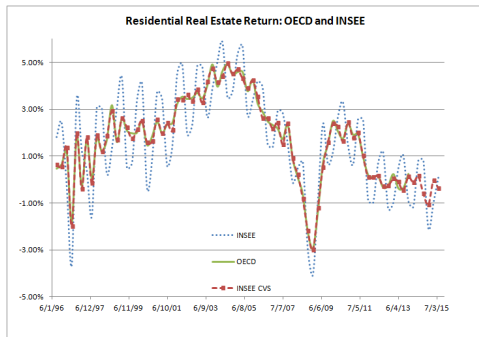
- **OECD index is the INSEE seasonally-adjusted index**. Important to consider the seasonally adjusted instead of raw one since **volatility** of the latter is **biased due to the cyclicality of quarterly returns.**

Real estate investment

- We build the Residential Real Estate nominal return series by adding the OECD index of sales of existing dwellings (all types, whole country and seasonally-adjusted) to the calculated rent index obtained from the OECD index series of price to rent ratio.
- More precisely regarding the rent component of the real estate return series, we rely on a study by Duajrdin *et al. (2016)*.
- The index series of price to rent ratio provided by OECD does not allow to obtain this nominal rent component by considering its inverse, *i.e.* ratio of rent to price.
- Indeed, the ratio of rent to price depends on the date chosen for the Index base 100. What is needed is data in $\text{€}/m^2$ for the price index and the rent index series to recover the whole series.
- This method is an approximation which seems to work well.
- Being interested in the net return, we must subtract the operational expenses from the rent. There exists no such series.
- Following Friggit (2007), we make the assumption than 37% of the rent perceived are paid as operational expenses for the 4 countries.

Financial Markets Data and Statistics

- For comparison purpose, we use the same source of data for the three type of financial assets considered in our study, namely: stocks (MSCI TR index), bonds (Datastream 10 year total return government indexes), 3-month T-bills.

- **Statistics for France : Quarterly data**

  Table: Descriptive Statistics, France - Quarterly Returns

	MSCI	Bond	Money Market	Real Estate
			1985:1 to 2015:1	
Mean	12.46%	8.81%	4.77%	9.67%
Volatility	22.46%	6.65%	1.67%	3.14%
Skewness	-0.367	0.013	0.418	-0.4614
Kurtosis	4.366	3.636	1.956	2.625

Financial Markets Data and Statistics
Statistics for France : Annual data

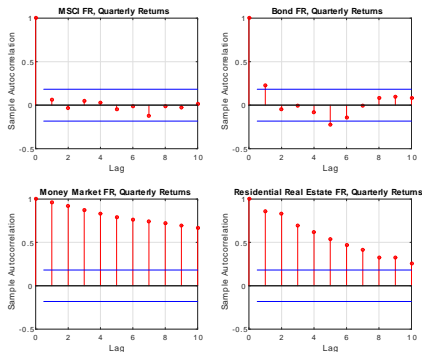Table: Descriptive Statistics, France - Annual Returns

	MSCI	Bond	Money Market	Real Estate
	1985 to 2014			
Mean	12.83%	9.13%	4.94%	10.22%
Volatility	25.53%	8.48%	**3.46%**	**6.29%**
Mean (Q)	12.46%	8.81%	4.77%	9.67%
Volatility (Q)	22.46%	6.65%	**1.67%**	**3.14%**
Skewness	-0.319	-0.325	0.393	-0.205
Kurtosis	2.404	2.766	1,841	2.058

- Volatility of Money market and Real Estate returns are approximately doubled. Here, the square root rule previously used to annualize the quarterly data is misleading because it relies on the assumption that changes in log price are independently and identically distributed. But here : High level of auto-correlation (see next slide).

Figure: ACF Quarterly Returns France (Q1:1985 to Q4:2014)

- Thus, we should have relied on the following rule, which leads to $\sigma(TC) = 3.25\%$ and $\sigma(RE) = 5.84\%$:

$$\sigma_n = \sigma_1 \sqrt{n + 2 \sum_{k=1}^{n-1} (n-k)\rho(k)}$$

Financial Markets Data and Statistics
Statistics for Germany and UK : Annual data

Table: Descriptive Statistics, Germany - Annual Returns

	1980 to 2014			
	MSCI	Bond	Money Market	Real Estate
Mean	13.05%	7.53%	4.70%	5.19%
Volatility	27.12%	7.41%	3.08%	2.97%
Skewness	-0.073	-0.108	0.665	0.490
Kurtosis	3.418	2.199	2.865	1.998

Table: Descriptive Statistics, UK - Annual Returns

	1980 to 2014			
	MSCI	Bond	Money Market	Real Estate
Mean	13.02%	10.86%	6.84%	11.65%
Volatility	15.60%	11.08%	4.46%	8.40%
Skewness	-0.890	1.338	0.262	0.245
Kurtosis	3.323	7.573	2.200	3.964

Table: Descriptive Statistics, Spain - Annual Returns

		1980 to 2014		
	MSCI	Bond	Money Market	Real Estate
Mean	14.28%	10.89%	4.79%	8.04%
Volatility	25.91%	12.93%	3.71%	9.31%
Skewness	-0.090	0.529	1.114	-0.227
Kurtosis	2.272	3.083	3.059	2.580

Efficient Portfolios with four asset classes

Correlation Matrix : France

Table: Correlations, France - Quarterly Returns, 1985-2014

	MSCI	Bond	Money Mkt	Real Estate
MSCI	1	0.0144	-0.004	0.172
Bond	0.0144	1	0.167	-0.111
Money Mkt	-0.004	0.167	1	0.086
Real Estate	0.172	-0.111	0.086	1
Average ρ	**0.06**	**0.02**	**0.08**	**0.05**

Table: Correlations, France - Annual Returns, 1985-2014

	MSCI	Bond	Money Mkt	Real Estate
MSCI	1	0.1754	0.0595	0.2267
Bond	0.1754	1	0.2760	-0.1636
Money Mkt	0.0595	0.2760	1	0.0618
Real Estate	0.2267	-0.1636	0.0618	1
Average ρ	**0.15**	**0.10**	**0.13**	**0.04**

Efficient Portfolios with four asset classes
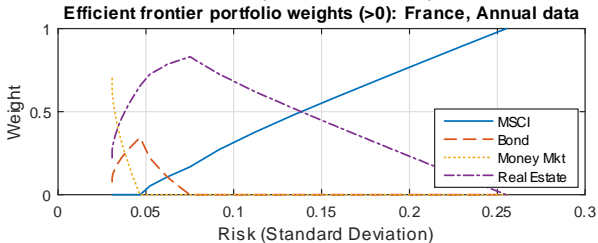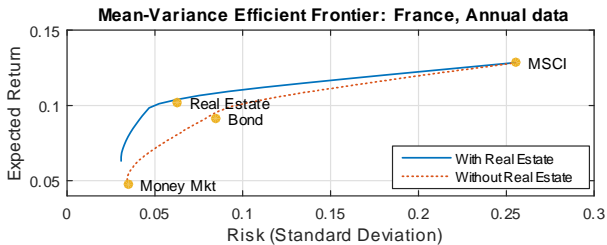## France - Quarterly data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, France (quarterly data,1985-2014)
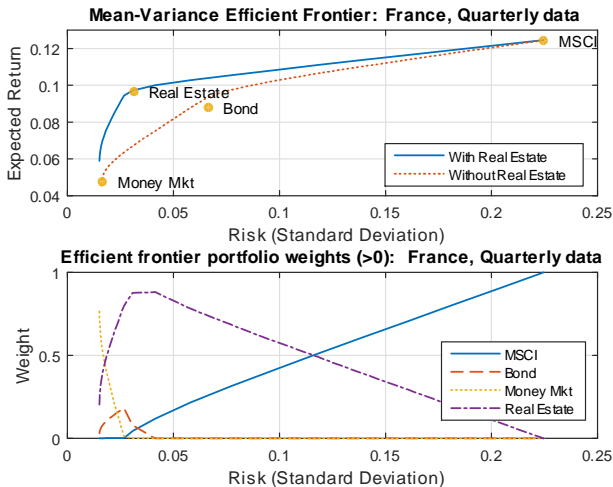
Efficient Portfolios with four asset classes
France - Annual data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, France (annual data,1985-2014)

Efficient Portfolios with four asset classes
Correlation Matrix : Germany

Table: Correlations, Germany - Quarterly Returns, 1980-2014

	MSCI	**Bond**	**Money Mkt**	**Real Estate**
MSCI	1	-0.196	-0.066	0.018
Bond	-0.196	1	0.069	-0.142
Money Mkt	-0.066	0.069	1	0.044
Real Estate	0.018	-0.142	0.044	1
Average ρ	**-0.08**	**-0.09**	**0.02**	**-0.03**

Table: Correlations, Germany - Annual Returns, 1980-2014

	MSCI	**Bond**	**Money Mkt**	**Real Estate**
MSCI	1	-0.071	-0.087	-0.072
Bond	-0.071	1	0.110	-0.166
Money Mkt	-0.087	0.110	1	0.051
Real Estate	-0.072	-0.166	0.051	1
Average ρ	**-0.08**	**-0.04**	**0.02**	**-0.06**

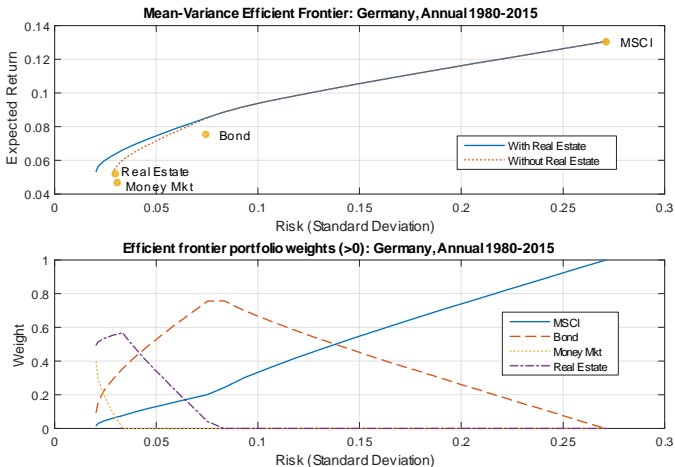# Efficient Portfolios with four asset classes

Germany - Quarterly data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, Germany (quarterly data,1980:1-2014:4)
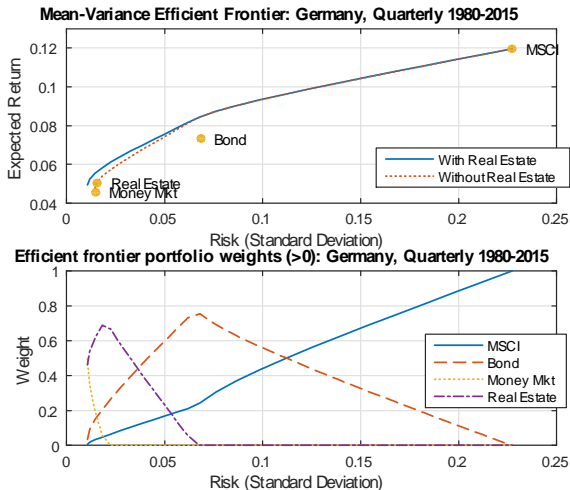
Efficient Portfolios with four asset classes
Germany - Annual data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, Germany (Annual data,1980-2014)

Efficient Portfolios with four asset classes
Correlation Matrix : UK

Table: Correlations, UK - Quarterly Returns, 1980-2014

	MSCI	Bond	Money Mkt	Real Estate
MSCI	1	0.149	0.148	0.154
Bond	0.149	1	0.232	-0.007
Money Mkt	0.148	0.232	1	0.090
Real Estate	0.154	-0.007	0.090	1
Average ρ	**0.15**	**0.12**	**0.16**	**0.08**

Table: Correlations, UK - Annual Returns, 1980-2014

	MSCI	Bond	Money Mkt	Real Estate
MSCI	1.000	0.187	0.331	0.142
Bond	0.187	1.000	0.365	-0.007
Money Mkt	0.331	0.365	1.000	0.137
Real Estate	0.142	-0.007	0.137	1.000
Average ρ	**0.22**	**0.18**	**0.28**	**0.09**

Efficient Portfolios with four asset classes
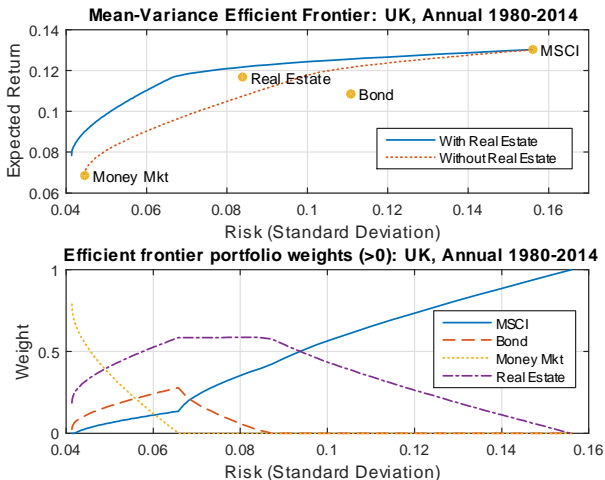
UK - Quarterly data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, UK (Quarterly data,1980:1-2014:4)
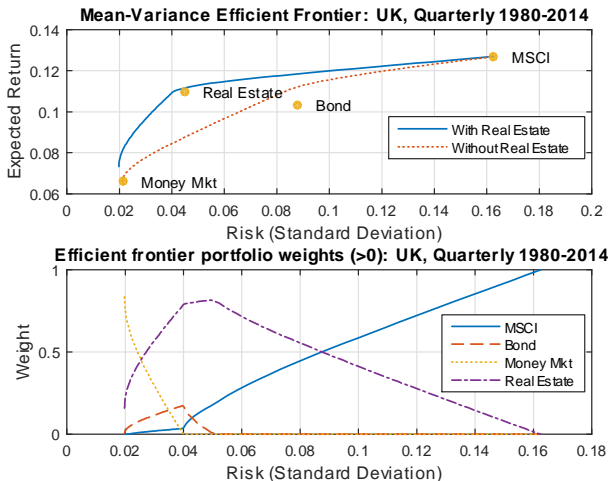
Efficient Portfolios with four asset classes

UK - Annual data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, UK (Annual data,1980-2014)

Efficient Portfolios with four asset classes
Correlation Matrix : Spain

Table: Correlations, Spain - Quarterly Returns, 1991-2014

|	MSCI	Bond	Money Mkt	Real Estate
MSCI	1	0.310	0.054	0.164
Bond	0.310	1	0.236	0.006
Money Mkt	0.054	0.236	1	0.032
Real Estate	0.164	0.006	0.032	1
Average ρ	**0.176**	**0.184**	**0.107**	**0.067**

Table: Correlations, Spain - Annual Returns, 1991-2014

	MSCI	Bond	Money Mkt	Real Estate
MSCI	1	0.187	0.331	0.142
Bond	0.187	1	0.365	-0.007
Money Mkt	0.331	0.365	1	0.137
Real Estate	0.142	-0.007	0.137	1
Average ρ	**0.22**	**0.18**	**0.28**	**0.09**

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, ESP (Quarterly data,1991:1-2014:4)
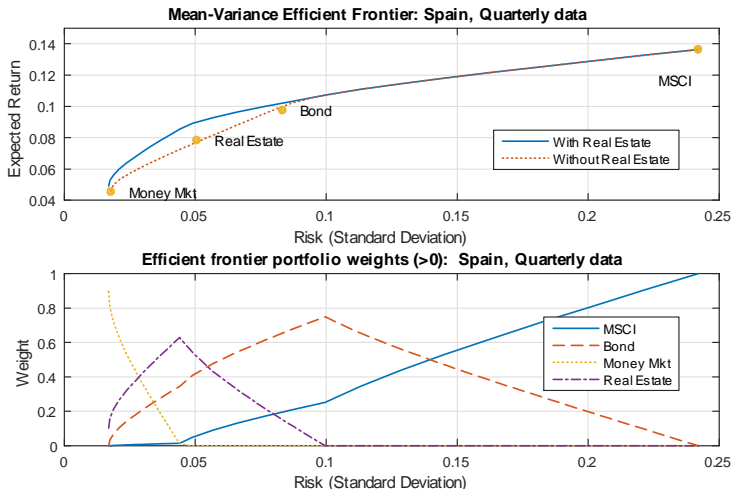
Mean-Variance Efficient Frontier: Spain, Quarterly data

Efficient frontier portfolio weights (>0): Spain, Quarterly data

Figure: Efficient Frontier with and without Real Estate and Portfolio Weights, Spain (Annual data,1991-2014)
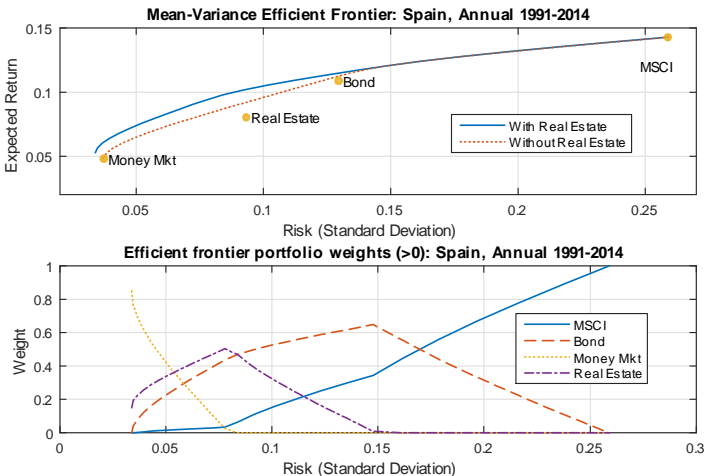
Concluding Remark

- Analysis of diversified portfolio investment in stocks, bonds, cash and real estate over the period 1980 to 2014 for Germany and UK, 1985 to 2015 for France and 1991 to 2014 for Spain with both quarterly and annual data.

- Our study shows that Residential Private Real Estate enhances significantly the mean-variance trade-off for three of the four markets considered: France, UK and Spain.

- This is not true for the German market where real estate experiments poor performance and is not really interesting in terms of correlation.

- Note also that the optimal weight on the real asset is always first increasing then decreasing with respect to the volatility level of the portfolio (for example, for France, UK and Spain, the real asset weight reaches its maximum when the portfolio volatility lies between 5% and 7%).