MARTIN E. HOESLI AND ANDRE R. BENDER

The Inflation-Hedging Effectiveness of Swiss Real Estate Mutual Funds

1. Introduction

1.1 Real Estate and Portfolio Optimization

Two arguments are generally given to motivate the decision of including real estate in portfolios of financial assets (e.g. stocks and bonds). These arguments are (1) the diversification benefits stemming from the less than perfect correlation of real estate with the other assets included in the portfolio, and (2) the better protection against inflation provided by real estate.

The diversification benefits of including real estate in mixed-asset portfolios make it possible to reduce a portfolio's systematic risk (for a given return) or to increase that portfolio's return (for a same risk level). FOGLER (1984), FIRSTENBERG/ROSS/ZISLER (1988) and BRUEGGEMAN/FISHER/STONE (1989), for instance, have shown the positive impact of including real estate in portfolios of U.S. stocks and bonds.

For Switzerland, ANDERSON/HOESLI (1991) reach similar conclusions. Using monthly data for the period from January 1978 to December 1989, they show that the introduction of Swiss real estate mutual fund units in portfolios of Swiss stocks and bonds can be very beneficial. The correlation of real estate with bonds is 0.62, and that with stocks 0.37. Real estate is well represented in the efficient combinations, e.g. 73% for an annual return of 6.60%, making it possible to reduce the portfolio's risk (as measured by the standard deviation) by as much as 18%.

Regarding the inflation-hedging argument, stocks have been found in most countries to be perverse hedges against inflation and its expected and unexpected components [1]. In contrast, it has been shown for the United States [2] that direct real estate investments (i.e. direct purchase of real property in contrast to purchase through real estate funds) provide an excellent protection against changes in the purchasing power. HARTZELL/HEKMAN/MILES (1987) also report significant positive coefficients for the expected and unexpected components of inflation. Other studies using a similar methodology have reached the same conclusion [3].

The investigation of securitized real estate (i.e. funds investing in equity real estate and the units of which are traded on a stock exchange) as hedges against inflation is of particular interest. Would they behave more like stocks (thus not providing a good hedge against inflation) or more like direct real estate investments (thus providing a good hedge against changes in the purchasing power)? For the U.S., GYOURKO/LINNEMAN (1988) and PARK/MULLINEAUX/CHEW (1990) have shown that real estate investment trusts [4] (REITs) do not provide a better hedge against inflation than U.S. common stocks. This is in accordance with MENGDEN/HARTZELL (1986) who conclude that REITs are more stocks than real estate.

More research needs to be undertaken before any clear conclusion regarding the inflation-hedging effectiveness of real estate can be reached. First, more knowledge has to be gained as to the validity of the results relying on appraisal-based return series [5]. There is a high probability that such studies lead to erroneous conclusions because the periodical (quarterly or annual) valuation of properties is often done by adjusting the previous value estimate with the inflation rate of the period. If this is the case, one would obviously expect real estate to be a good hedge against inflation. If REIT returns are used as a proxy for real estate, another major problem arises. Indeed, research has shown that the market value of REIT shares behaves quite similarly to the price of common stocks: the market beta of REITs is relatively high (0.55 for the period from 1973 to 1989); in October 1987, the REIT index declined by almost as much as the S&P 500 index. One can therefore understand why the studies which investigate the inflation-hedging capability of REITs reach the same conclusion as the studies examining stocks.

1.2 The Case of Switzerland

Some studies have been undertaken in Switzerland to examine the impact of including real estate in portfolios of financial assets [6]. However, no attempt has been made to analyze the inflation-hedging effectiveness of real property. This is very unfortunate given the important weight given to real estate in institutional portfolios, particularly in those of pension funds. The general belief is that real estate undoubtedly provides a good hedge against inflation due to price increases of both land and building. Whether this is true or not is empirically testable and constitutes the purpose of this paper. Using monthly and quarterly data for the period from January 1, 1973 to December 31, 1989, we follow the widespread methodology developed by FAMA/SCHWERT (1977).

The investigation of Swiss real estate mutual funds is also of particular interest from an academic standpoint. In contrast to the holders of American REIT shares, Swiss real estate mutual fund unitholders can ask for redemption of their shares at the intrinsic value. This value is computed on a yearly basis by experts and should reflect the market value of the underlying properties. In periods of euphoria in the real estate market, this value will however be lower than the most probable selling price because it is usually derived by computing an average of the value based on the cost approach and the value based on capitalization of rents. As unitholders can either sell their units on the market or ask for redemption, the intrinsic value constitutes the lower bound for the share prices. Aside from euphoric periods, both the intrinsic value and the market price should follow similar trends.

Swiss real estate mutual fund unit prices should therefore reflect quite accurately the prices of the underlying properties. In a bullish market, they can rise without any restriction and in a bearish market they will be stopped by the intrinsic value. As a result, they will be quite independent of stock market price fluctuations; for example, the October 1987 return on the BOPP real estate fund index was -2.84%, as compared to -23.21% for the stock market.

Studies which rely on real estate fund unit prices encounter, however, a minor problem created by the fact that the wealth of these funds is not fully invested in real property. First, the funds are legally required to hold significant amounts in cash or near-cash assets to be able to eventually redeem the units. Second, real estate mutual fund assets can also include mortgages, other long-term loans and stocks. The bias should nevertheless be small because the bulk of the wealth of real estate funds is invested in real estate assets (96.2% as of December 31, 1990).

The paper is organized as follows. In Section 2, we present the methodology. Section 3 contains a discussion of the data. We present our results in Section 4 and our conclusions in Section 5.

2. Methodology

The relationship between the return on an asset and the inflation rate is tested as follows:

$$R_{it} = \alpha_i + \beta_i \Pi_t + \mu_{it} \quad (1)$$

where

R_{it} = nominal return on the i-th asset during period t

Π_t = inflation rate during period t

μ_{it} = a disturbance term

If an asset is a perfect hedge against inflation, then the beta should be equal to one. When the beta is larger than one, the hedge is more than complete. Assets which provide an incomplete hedge will yield a beta between zero and one. A negative beta suggests that the asset acts as a perverse hedge against inflation.

The inflation rate in period t, Π_t, can be expressed as the sum of the expected inflation rate at the end of period t-1 for period t, $E(\Pi_t)$, and the unexpected inflation rate for period t, $\Pi_t - E(\Pi_t)$. If (1) nominal interest rates, I_t, are viewed as the sum of real interest rates, i_t, and inflation expectations and (2) real interest rates are assumed to be constant, then nominal rates will increase on a one-to-one basis with expected inflation. In other words, if real interest rates are constant, the nominal interest rate on a risk-free asset can be used as a proxy for anticipated inflation [7].

On the other hand, if real interest rates are hypothesized as being non-constant over time, a model for the behavior of these rates has to be selected. One common choice is the "interest rate model" of FAMA/GIBBONS (1984). According to this approach, real interest rates follow a random walk [8] and the difference between the real returns on a risk-free asset for months t and t-1 can be expressed as a first-order moving average process. More technically, real interest rates can be modelled by an ARIMA (0,1,1) procedure [9]. The steps involved when deriving inflation forecasts are as follows. First, the ex post real interest rate is computed:

$$i_t = I_t - \Pi_t$$

Expected real interest rates are then derived using the ARIMA model. Finally, the expected inflation rate for each period is derived as:

$$E(\Pi_t) = I_t - E(i_t)$$

where

$E(i_t)$ = expected real rate of interest on a risk-free asset

Whether real interest rates are assumed constant or are allowed to vary over time, the model tested for the effectiveness of real estate in hedging against expected and unexpected inflation is [10]:

$$R_{it} = \alpha_i + \Omega_i[E(\Pi_t)] + \gamma_i[\Pi t - E(\Pi_t)] + \eta_{it} \quad (2)$$

The coefficients Ω_i and γ_i can be interpreted in a similar fashion as the coefficient beta of equation (1).

3. Data

Equations (1) and (2) are tested for real estate mutual funds and stocks with monthly data from 1/1973 to 12/1989. The period is further divided in three subperiods (1973-1978, 1979-1984 and 1985-1989) to test whether the conclusions vary significantly over time. We also test these equations with quarterly data, because one-month time increments are probably too short to reflect the time period of a typical real estate investor [11]. With quarterly data, the period starts on July 1, 1977, because satisfactory data on three-month interest rates are only available since that time.

To proxy for real estate prices we use the Bopp ISB index. This index, computed by Bopp ISB AG, a research company in Zurich, is in fact an index of real estate mutual fund units. It is value-weighted and includes the 10 largest property funds, accounting for approximately 80% of the total worth of the

32 Swiss real estate mutual funds. As far as stocks are concerned, we use the index provided by Morgan Stanley Capital International. Similarly to the real estate mutual fund index, this index makes it possible to compute total returns (i.e. returns which include the income and appreciation components). Inflation rates are measured as the percentage change in the consumer's price index as reported in International Financial Statistics published by the International Monetary Fund.

The most difficult problem regarding the data relates to the selection of appropriate monthly interest rates. This constitutes a standard problem for empirical research in Switzerland and stems from the fact that there is no money market as such. We use the average day-to-day rates published by the International Monetary Fund to create a proxy for one-month interest rates. Regarding three-month rates, we use the three-month Euro-deposits which should represent a good proxy for Swiss short-term interest rates.

Table 1 provides summary statistics for monthly returns on real estate mutual fund units and stocks for the entire sample period (1973/1 to 1989/12) and for three subperiods (1973/1 to 1978/12, 1979/1 to 1984/12 and 1985/1 to 1989/12). These results confirm the findings of ANDERSON/HOESLI (1991) for the period from 1973 to 1989 in that the average return on the real estate mutual fund units is lower than that on stocks. However, this lower mean return is accompanied by a lower level of risk. Thus, an investor wishing to achieve a higher return has to accept simultaneously a greater degree of risk [12]. The entire sample period results are usually confirmed in the three examined subperiods. During the first subperiod (January 1973 to December 1978), however, stocks had a very poor performance as compared to that of real estate mutual funds. This is the consequence of the 1974-1975 Swiss stock market crash. However, the lowest monthly return on stocks (-23.21%) was experienced in October 1987, that is in the third subperiod. Despite

Table 1: Summary statistics for monthly returns of Swiss real estate mutual fund units and stocks (total sample period and subperiods).

	Market beta	Mean monthly return	Std. dev. (monthly)	Minimum	Maximum
Total period (73/1-89/12)					
Real estate	0.08	0.55	1.92	-8.38	14.75
Stocks		0.66	4.82	-23.21	22.57
1st subperiod (73/1-78/12)					
Real estate	0.07	0.71	2.42	-8.38	14.75
Stocks		-0.02	5.25	-11.61	22.57
2nd subperiod (79/1-84/12)					
Real estate	0.11	0.32	1.26	-3.81	3.11
Stocks		0.74	3.08	-8.05	10.72
3rd subperiod (85/1-89/12)					
Real estate	0.08	0.63	1.90	-5.52	4.99
Stocks		1.38	5.86	-23.21	11.60

the October 1987 crash, the return on stocks during the 1985 to 1989 subperiod was very good (1.38% on a monthly basis, i.e. approximately 18% on an annual basis).

Particularly interesting are the betas of real estate mutual funds relative to the market. These betas are very low (0.08 for the entire sample period) and quite identical across subperiods (0.07, 0.11 and 0.08, respectively). These low betas suggest that real estate mutual fund prices vary over time quite independently of the stock market [13]. This confirms that Swiss real estate mutual fund units should not be assimilated to shares and that they could reflect the evolution of the underlying assets.

4. Results

Table 2 contains the results of tests for the hedging ability of real estate mutual funds and stocks against inflation during the entire time period and three subperiods. The results for stocks are consistent with those reported by GÜLTEKIN (1983). In his empirical study on the inflation hedging capability of stocks in 25 countries, he finds for Switzerland the following results for the period from 1/1947 to 12/1979: beta = -0.818 and t(beta) = -2.03. For most other countries, the beta is negative but not significantly. For the UK and Israel, however, the beta is significantly positive. Whereas the coefficient reported by GÜLTEKIN (1983) is negative and statistically significant, the coefficient we obtain for the entire period is also negative but not significant at the 5% level. For the subperiods, the coefficient is negative in two cases (1973-1978 and 1979-1984) and positive in one case (1985-1989); however we cannot infer too much from these results because they are all non-significant. The use of quarterly data for the period 1977-1989 gives a similar result to that obtained on the basis of monthly data for the entire period (1973-1989): the beta coefficient is negative but not significant (Table 5, Panel A).

When we break down the inflation rate into its expected and unexpected components, we obtain results which are consistent with those of U.S. studies: with one exception, all the coefficients are negative (Tables 3 and 4, and Table 5, Panels B and C). Thus, Swiss stocks appear to provide a perverse hedge against inflation and its expected and unexpected components. Whereas studies based on American data give significant results, our Ω and γ coefficients are not significant however.

As far as real estate is concerned and contrary to the general belief, we find a negative relationship between the return on the mutual funds and the inflation rate for the overall period when we use monthly and quarterly data (Table 2 and Table 5, Panel A). For the subperiods, however, the beta coefficient is positive in two cases (1973-1978 and 1979-1984) and negative in one case (1985-1989). Surprisingly, the beta estimates for the overall period have the same sign as those reported in U.S. studies which make use of REIT returns to proxy for real estate [14]. As mentioned previously, REITs behave quite similarly to stocks; therefore their inflation hedging capability should be more or less the same than that of stocks, which is precisely what is reported in U.S. studies. We could have obtained different results for Switzerland because the real estate proxy behaves quite independently from stock indices. Though the beta coefficients we report for the entire time period are not significant, they have the same sign as those for stocks. Based on a methodology which is widely accepted to test the inflation-hedging effectiveness of assets, Swiss real estate does not appear to provide a significantly better hedge against inflation than stocks.

The decomposition of the inflation rate into its two components does not alter the above conclusions substantially. When real interest rates are constant (Table 3), one can however point out that the omega coefficients on expected inflation are all negative, whereas the gamma coefficients on unexpected inflation are all positive. At first glance, these results seem to give more insight as to the hedging ability of real estate. However, one has to be very cautious before drawing any inferences from these results because most of the Ω and γ coefficients are not significant and because the R-squares are very small. When real interest rates are assumed to

Table 2: Tests for a hedge against actual inflation [15] for real estate and stocks for the 1973-1989 period and three subperiods, based on the following regression: $R_{it} = \alpha_i + \beta_i \Pi_t + \mu_{it}$ (monthly data).

	Real estate		Stocks	
	Coefficient (t-ratio)	R-square	Coefficient (t-ratio)	R-square
1973-1989	-0.013	0.000	-1.185	0.012
	(-0.042)		(-1.548)	
1973-1978	0.458	0.000	-1.423	0.022
	(0.774)		(-1.248)	
1979-1984	0.296	0.009	-1.199	0.023
	(0.776)		(-1.291)	
1985-1989	-0.420	0.007	0.453	0.001
	(-0.513)		(0.194)	

Table 3: Tests for a hedge against expected and unexpected inflation for real estate and stocks for the 1973-1989 period and three subperiods assuming constant real interest rates, based on the following regression: $R_{it} = \alpha_i + \Omega_i[E(\Pi_t)] + \gamma_i[\Pi_t - E(\Pi_t)] + \eta_{it}$ (monthly data).

	Real estate			Stocks		
	Expected	Unexpected	R-square	Expected	Unexpected	R-square
1973-1989	-2.851	0.219	0.058	-1.015	-1.199	0.012
	(-3.312)	(0.716)		(-0.458)	(-1.525)	
1973-1978	-2.808	0.740	0.052	-3.919	-1.145	0.030
	(-1.288)	(1.193)		(-1.077)	(-0.908)	
1979-1984	-1.311	0.272	0.032	-0.948	-1.128	0.024
	(-1.006)	(0.710)		(-0.320)	(-1.297)	
1985-1989	-4.078	0.095	0.121	3.764	-0.804	0.015
	(-2.671)	(0.121)		(0.759)	(-0.315)	

Table 4: Tests for a hedge against expected and unexpected inflation for real estate and stocks for the 1973-1989 period and three subperiods assuming that real interest rates follow a random walk, based on the following regression: $R_{it} = \alpha_i + \Omega_i[E(\Pi_t)] + \gamma_i[\Pi_t - E(\Pi_t)] + \eta_{it}$ (monthly data).

	Real estate			Stocks		
	Expected inflation	Unexpected inflation	R-square	Expected inflation	Unexpected inflation	R-square
1973-1989	0.472	0.184	0.030	-1.325	-1.248	0.012
	(1.308)	(0.583)		(-1.447)	(-1.562)	
1973-1978	0.103	0.869	0.049	-1.586	-1.156	0.028
	(0.166)	(1.356)		(-1.338)	(-0.891)	
1979-1984	-0.249	0.365	0.033	-1.359	-1.100	0.025
	(-0.443)	(0.945)		(-1.066)	(-1.255)	
1985-1989	-1.928	-0.319	0.079	2.030	-0.428	0.018
	(-1.872)	(-0.411)		(0.623)	(-0.174)	

Table 5: Inflation hedge results for real estate and stocks for the period from 1977-3 to 1989-4. Panel A is based on the following regression: $R_{it} = \alpha_i + \beta_i \pi_t + \mu_{it}$. Panels B and C are based on the following regression: $R_{it} = \alpha_i + \Omega_i[E(\Pi_t)] + \gamma_i[\Pi_t - E(\Pi_t)] + \eta_{it}$ (quarterly data).

A. Tests for a hedge against actual inflation.

Real estate		Stocks	
Coefficient (t-ratio)	R-square	Coefficient (t-ratio)	R-square
-0.468 (-0.654)	0.009	-1.413 (-0.872)	0.016

B. Tests for a hedge against expected and unexpected inflation: real rates constant.

Real estate			Stocks		
Expected inflation	Unexpected inflation	R-square	Expected inflation	Unexpected inflation	R-square
-1.895 (-1.734)	-0.145 (-0.199)	0.066	-1.344 (-0.527)	-1.429 (-0.842)	0.016

C. Tests for a hedge against expected and unexpected inflation: random walk real rates.

Real estate			Stocks		
Expected inflation	Unexpected inflation	R-square	Expected inflation	Unexpected inflation	R-square
-1.108 (-1.182)	-0.309 (-0.422)	0.032	-1.203 (-0.560)	-1.466 (-0.875)	0.016

follow a random walk (Table 4), both the coefficient estimates for expected and unexpected inflation are positive. These results are not confirmed, however, when quarterly data are used (Table 5, Panels B and C).

5. Conclusion

As mentioned previously, two arguments are often given to motivate the decision of including real estate in portfolios of financial assets (e.g. stocks and bonds), i.e. the diversification benefits stemming from the less than perfect correlation of real estate with the other assets included in the portfolio and the better protection against inflation provided by real estate. In this study, we test the inflation-hedging ability of Swiss real estate and, for comparison purposes, that of stocks. Following a well-accepted method, we use monthly and quarterly data for the period from January 1973 to December 1989.

Our results do not allow us to reach definitive answers with respect to the important question of

the inflation-hedging effectiveness of Swiss real estate. The regression coefficients are in several instances negative as is the case in U.S. studies which have examined the inflation-hedging effectiveness of REITs. These coefficients are generally non-significant in our study, whereas they are significant in the U.S. Our results also yield that coefficient estimates are more often positive for real estate funds than for stocks. These results, however, do not make it possible to infer that real estate funds provide a significantly better hedge against inflation than stocks.

Whether real estate does or does not provide a good protection against inflation in the long-run is still a question which needs to be investigated. When one considers the long-term evolution of the real estate index, there appears to be a strong argument for the inflation-hedging ability of this asset. Further research should be conducted in order to investigate this important topic, possibly by making use of another methodology.

Footnotes

[1] See GÜLTEKIN (1983) and SOLNIK (1983).
[2] HARTZELL/HEKMAN/MILES (1987).
[3] See, for instance, GYOURKO/LINNEMAN (1988).
[4] A REIT is essentially a closed end investment company whose assets consist of equity and/or debt interests in real estate. Shares in REITs are publicly traded on the major exchanges. The trusts do not pay tax at the corporate level as long as 75% of the net assets of the trust are invested in "real estate related" assets (e.g. equity investments in real estate, commercial and residential mortgages, and mortgage-backed securities), and as long as 95% of the net income is distributed to the shareholders.
[5] Such as those contained in HARTZELL/HEKMAN/MILES (1987).
[6] ANDERSON/HOESLI (1991) and HOESLI/ANDERSON (1991).
[7] See FAMA (1975).
[8] FAMA/GIBBONS (1982).
[9] For a discussion of ARIMA modelling, see for example HARVEY (1990).
[10] FAMA/SCHWERT (1977).
[11] Longer time increments could not be considered because the number of periods would become too small.
[12] ANDERSON/HOESLI (1991) also show, for the 1978-1989 period, that bonds are less risky than real estate mutual fund units but accordingly experience a lower mean return.
[13] For comparison purposes, we computed the betas of U.S. REITs relative to the U.S. stock market. The results are 0.55 for the entire period, 0.63 for the first subperiod, 0.61 for the second subperiod, and 0.43 for the last subperiod. For an investigation of the declining betas on U.S. REITs, see HARTZELL/HOESLI/KHOO (1992).
[14] See, for instance, PARK, MULLINEAUX and CHEW (1990).
[15] The Durbin-Watson statistics showed that, in most instances, the null hypothesis of no autocorrelation could not be rejected. When autocorrelation appeared to be a matter of concern, we used the Cochrane-Orcutt procedure to correct for first order autocorrelation.

References

ANDERSON, M. and M. E. HOESLI (1991): "The Performance of the Major Swiss Real Estate Mutual Funds, 1978-1989", Finanzmarkt und Portfolio Management 5, pp. 39-52.

BRUEGGEMAN, W. B., J. D. FISHER and L. D. STONE (1989): "Real Estate Finance", 8th Edition, Irwin, Homewood.

FAMA, E. F. (1975): "Short-Term Interest Rates as Predictors of Inflation", The American Economic Review 65, pp. 269-282.
FAMA, E.F. and M.R. GIBBONS (1982): "Inflation, Real Returns and Capital Investment", Journal of Monetary Economics 9, pp. 297-323.
FAMA, E.F. and M.R. GIBBONS (1984): "A Comparison of Inflation Forecasts", Journal of Monetary Economics 13, pp. 327-348.
FAMA, E.F. and G.W. SCHWERT (1977): "Asset Returns and Inflation", Journal of Financial Economics 5, 115-146.
FIRSTENBERG, P.M., S.A. ROSS and R.C. ZISLER, 1988, "Real Estate: The Whole Story", Journal of Portfolio Management, Spring, pp. 22-34.
FOGLER, H. R. (1984): "20% in Real Estate: Can Theory Justify it?", Journal of Portfolio Management, Winter, pp. 6-13.
GÜLTEKIN, N.B. (1983): "Stock Market Returns and Inflation: Evidence from other Countries", Journal of Finance 38, pp. 49-65.
GYOURKO, J. and P. LINNEMAN (1988): "Owner-Occupied Homes, Income-Producing Properties, and REITs as Inflation Hedges: Empirical Findings", Journal of Real Estate Finance and Economics 1, pp. 347-372.
HARTZELL, D., J. HEKMAN and M. MILES (1987): "Real Estate Returns and Inflation", AREUEA Journal 15, pp. 617-637.
HARTZELL, D.J., M.E. HOESLI and T.B.K. KHOO (1992): "An Investigation of the Structural Change in REIT Betas", Working paper, The University of North Carolina at Chapel Hill.
HARVEY, A.C. (1990): "The Econometric Analysis of Time Series", 2nd Ed., Philip Allan, London.
HOESLI, M.E. and M.S. ANDERSON (1991): "Swiss Real Estate: Return, Risk, and Diversification Opportunities", Journal of Property Research 8, pp. 133-145.
MENGDEN, A. and D. J. HARTZELL (1986): "Real Estate Investment Trusts - Are they Stocks or Real Estate?", Stock Research - Real Estate, Salomon Brothers, Inc.
PARK, J., D. J. MULLINEAUX and I.-K. CHEW (1990): "Are REITs Inflation Hedges?", Journal of Real Estate Finance and Economics 3, pp. 91-103.
SOLNIK, B. (1983): "The Relation Between Stock Prices and Inflationary Expectations: The International Evidence", Journal of Finance 38, pp. 35-48.