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The Inflation Hedging Properties of Real Estate: A Comparison between Direct Investments and Equity Returns

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Abstract: Using panel data augmented Fama-Schwert regressions this study analyses the inflation hedging properties of different types of real estate assets. The results reveal that real estate equities like other equities, too, do not provide any hedge against inflation. Moreover, the correlation is negative, indicating that increasing prices have a negative impact on real estate returns. One explanation for this finding is, that investors adjust their expectations when overall business activity weakens in response to increasing inflation. Direct investments in real estate show a more differentiated picture. While retail real estate does not provide a hedge against inflation, office as well as residential real estate returns rise with inflation. In particular, residential real estate is characterized by quite robust inflation hedging properties probably due to the low substitutability of dwellings.

Key words: *Inflation, Real Estate Returns, Fama-Schwert-Regression, Panel Data*

JEL Classification: *C33, E31, R33*

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1 Introduction

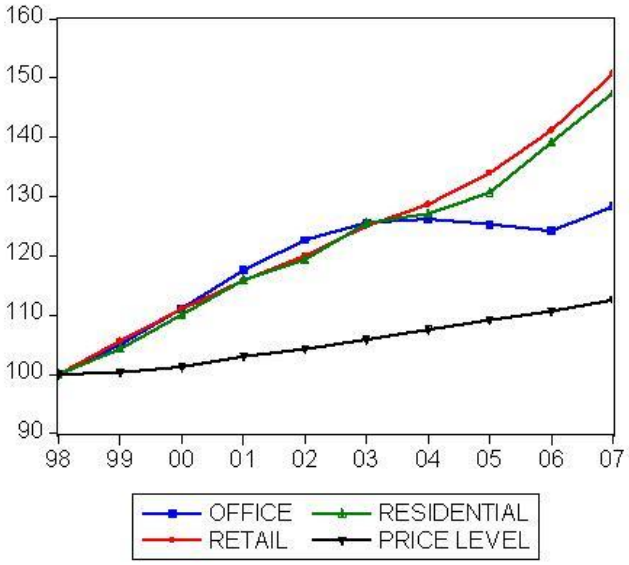
Real estate is known to public as an asset that might be usable for hedging inlfation risks. When one takes a look at public media, one frequently finds newspaper articles about the inflation hedging properties of real estate. Because inflation has negative effects on the future consumption of almost every economic agent, most agents try to protect their future consumption stream by investing into several kinds of assets that yield a nominal return, which should be higher compared to the inflation rate. Because asset returns as well as the inflation rate are fluctuating over time, it is not sufficient to compare the current return of an asset with the current inflation rate. For hedging inflation risks an asset should yield on average a higher return than the average inflation rate. In the first quarter of 2008 the German consumer price index increased due to increasing energy costs and some kind of easy monetary policy. German newspapers claimed this as a chance for real estate companies to make profits from the increased demand for real estate (Zittelmann 2008, Kunath 2008).

The price for real estate is an asset price an can therefore be interpreted as the discounted sum of future cash-flows (see Campbell and Shiller 1987), the inflation hedging property of real estate is evident if these cash-flows are connected to the growth rate of the general price level. In other words, if the cash-flows from renting real estate is inflation-indexed, the ownership of this asset should ensure against future inflation. Note, that the degree of insurance depends on a precise forecast of future inflation and a frequent renegotioation of the rental contract for adjustments to current and future inflation. Because in reality rental contracts are not re-optimized to future expected inflation but indexed to past inflation, the degree of inflation protection depends on the degree of price stability. If inflation is increasing at a high rate, re-optimization in rental contracts to past inflation might not be able to ensure the owners future consumption stream against future price increases. Figure 1 shows a snapshot of the IPD[2] total return indices on office buildings, residential real estate and retail buildings in Germany compared to the German consumer price index.

[2]The Investment Property Databank (IPD) collects data and constructs these total return indices.

What one can infer is, that during this time period the total return indices for all three segments rise at a higher rate compared to the German price level. But one can also inspect, that office returns seem to grow slower or are even declining. Especially in the period between 2003 and 2006 they were declinig whereas the consumer price index was increasing. Because this snapshot is no scientific evidence for the inflation hedging properties of real estate one has to apply econometric methods and statistical test on a larger emsemble of real estate returns. More concrete, one has to use a panel data set consisiting of real estate returns for several countries. Fama and Schwert (1977) provide us with a methodology for testing for the inflation hedging abilities of asset returns.

Figure 1: Consumer Price Inflation and Total Return Indices



This figure shows the time evolution of the German consumer price index (1998 = 100) and the IPD total return indices for offices, retail and residential property (1998 = 100) from 1998 to 2007. For comparison, all data series were scaled such that they take the value 100 in 1998.

If we have a look at the literature on the inflation hedging properties of asset returns we will find mixed results. Fama and Schwert (1977) were the first who applied econometric methods for finding evidence of effects of inflation onto equity returns. Their results did not reveal evidence for a positive relationship

between inflation and returns, however, the correlation between both variables seem to be negative. The Fama-Schwert methodology to test for inflation protection was also applied to real estate returns. Most studies apply their test on Real Estate Investment Trust (REIT) returns and real estate company returns because one can find rich dataset for them compared to data on direct investments. For the inflation hedging properties of real estate there is mixed evidence. Adrangi et al. (2004) find evidence for the Fama-Schwert results, while Glascock et al. (2002) do not find any statistically significant correlation betwenn inflation and real estate returns. Hoesli et al. (2006) conclude from their results that there is some inflation protection in investing in direct as well as indirect real estate assets for the USA as well as for the UK. Maurer and Sebastian (2002) is a study which uses a German dataset on open real estate investment funds. They come to the result, that open investment funds perform better in inflation hedging compared to equities and bonds. Note, that most studies do not differentiate between different segments like office, residential property and retail. Rubens et al. (1989) is one study that differentiates between land, offices and homes. From their results they conclude that an investment in homes has inflation protection properties, where land and offices are not closely tied to the inflation rate.

This gap in the literature on inflation hedging is due to the fact that most studies do not differentiate between segments like retail, housing and office property. Moreover, they cannot draw a uniform picture of the inflation hedging properties of real estate because they basically concentrate on single country comparisons. In order to overcome these difficulties this study wants to find cross-country evidence for the inflation hedging properties of real estate and wants to differentiate between different kinds of assets. For this reason we apply the Fama-Schwert methodology to a panel data set consisting of real estate returns for different object classes. The panel data approach is in favor of a single country comparison because we are able to employ a richer dataset. Because we only have year-to-year observations for direct investments, a single country approach may suffer from the small sample bias.

Within this study the following results emerge. We find evidence that the

Fama-Schwert results can be verified for equities and real estate equity returns. Here, we also find negative correlations between inflation and returns. Our results indicate that direct investments perform better in inflation hedging. But we find that the different object classes perform differently. We find that an investment in residential property results in the best inflation protection, while investments in offices and retail properties are inferior compared to housing.

The remainder of this paper is organized as follows. Section two presents the empirical model, while section three contains the empirical results. Section four concludes.

2 The Panel Data Augmented Fama-Schwert Regression

We apply the Fama-Schwert regression to a panel dataset. The Fama and Schwert (1977) approach to test for inflation hedging has emerged as a standard model in the literature. Its application to panel data is straightforward. The panel data augmented Fama-Schwert regression has the following form

$$r_{it} = \alpha_i + \beta_1 \pi_{it}^{exp} + \beta_2(\pi_{it} - \pi_{it}^{exp}) + u_{it}, \tag{1}$$

where r_{it} is the nominal real estate return of country i in year t, where π_{it} is the corresponding rate of inflation. The expected inflation π_{it}^{exp} is the only unobservable variable in this model and can either be approximated by official inflation forecasts or it can be approximated by a time series model forecast applied to the inflation rate π_{it}. The time-constant term α_i controls for individual heterogeneity, which can be dealt with by applying either a fixed effects model or a random effects model. The error term u_{it} satisfies the usual assumption to be a identically and independently distributed mean zero constant variance random disturbance. If the inflation forecast π_{it}^{exp} is priced correctedly into the asset return r_{it}, then the asset is a perfect hedge against inflation indicated by a coefficient $\beta_1 = 1$. The second term $\pi_{it} - \pi_{it}^{exp}$ is the inflation forecast error representing an unexpected high or low inflation rate. If the asset is also

a hedge against unexpected inflation this should translate into $\beta_2 = 1$. The economic foundation of this regression model is the Fisher-hypothesis going back to Fisher (1930). It claims that the real rate of return is not affected by monetary factors and can therefore be treated as a constant under the assumption of long-run monetary neutrality. Thus, a monetary expansion is not able to shift production and therefore will translate 1:1 into prices. This indicates that the inflation rate (as well as the expected inflation rate) will be equal to the money growth rate. Thus, in order to prevent real losses from holding funds, the return of assets should rise 1:1 with the inflation rate holding the real return constant.

The Fisher-hypothesis can also be applied to real estate returns. As a measure for the performance of an investment in real estate we take the nominal (logarithmic) total return

$$r_t = \frac{s_t - s_{t-1} + d_t}{s_{t-1}}, \tag{2}$$

where s_t is the price of the building and d_t is the cash-flow the owner receives for renting the building. Thus, this total return consists of two components, the percentage change in the value of the bulding and the cash-flow return. Under the assumption of long-run neutrality the monetary expansion has no effect on the real value of the building but only on the cash-flow the owner receives because it is a flow of monetary units. In order to ensure his or her consumption level, the owner has to adjust the cash-flow from renting the building to the new and higher inflation rate. Thus, the increase in inflation will translate 1:1 into the nominal return of the building holding its real return constant. The reason why this 1:1 relationship does not hold empirically is that the assumption of long-run monetary neutrality does not hold. One reason for this is, that most of the used datasets to test this hypothesis empirically are too short to represent the long run. Another reason is, that in the short-run monetary policy has impacts onto the real economy because of nominal and real frictions in the goods and labor markets. Fama (1981) suggests that higher expected inflation has negative effects on real activity. One reason is that monetary policy will tighten in order to fight this future inflation (Svensson

1997). Another reason is that inflation has real costs. Moreover, inflation uncertainty has negative effects on credit supply and investment. Because the development of the real sector is positively correlated with asset returns, there will by a negative correlation between inflation and returns although there is no direct connection between both. Increasing interest rates on mortgages increase the cost of financing real estate projects and will thereby have a negative effect on the demand for real estate (Jäger and Voigtländer 2006, Demary 2009). In order to control for these two effects we augment the Fama-Schwert regression by the growth rate of industrial production and the short-term interest rate with three month maturity. The reason why we use industrial prodution as a measure of economic activity is that it is highly correlated with the business cycle and it is the only measure of economic activity that is available on a monthly basis. We use the short-term interest rate as a measure of financing cost, because it is the interest rate that is not directly connected to inflation (to avoid multicollinearity) and it is the interest rate which closely represents the monetary policy stance.

3 Empirical Results

This section contains the empirical results. First of all we apply the Fama-Schwert regression to equity returns. After that we compare these regression results, with results for real estate investment trusts and direct investments.

3.1 Inflation and Real Estate Equity Returns

We apply the regression model to total returns on monthly equity returns and real estate equity returns. We employ a dataset consisting of indices of the European Public Real Estate Association (EPRA) for the countries Canada, USA, Finland, France, Germany, Ireland, the Netherlands, Sweden and the UK. The indices contain companies which have their main business in renting buildings and have a certain market impact and a certain degree of diversification. The constructed country panel consists of these countries and

monthly observations from February 1994 to June 2008 consisting of around 1000 data points. For explaining these returns we follow the methodology suggested by Fama and Schwert (1988) using the realized monthly rate of consumer price inflation, the growth rate of industrial production and a money market rate with three months maturity. These data are taken from the OECD database (www.sourceoecd.org). The market expectation of future inflation is approximated by fitting an autoregressive model to the inflation rate and using these forecasts as a proxy for the market expectation. The advantage of using the Box-Jenkins methodology (see Box et al. 2008) for generating inflation forecasts is that these models yield unbiased forecasts. Note that this was also done by Yobaccio et al. 1995. We approximated the unexpected inflation rate by the forecast errors generated by the Box-Jenkins forecasts.

Because our dataset consists of monthly observations for numerous countries, we apply a panel data regression model. In order to control for country-specific heterogeneity we employ the fixed effect model. Because the fixed effects model assumes country specific intercepts α_i but common coefficients β_1 and β_2 these can be interpreted as country wide averages. The main advantage of using panel data methods is that the estimated coeficients are more precise in comparison to single equation methods because we are able to exploit a larger dataset for estimation and testing.

Table 1 contains the results of the estimation of the panel data augmented Fama-Schwert regression applied to real estate equity returns (panel (a)) and equity returns (panel (b)). This table contains three model variations. Model 1 has the realized inflation rate as the only explanatory variable, model 2 the expected as well as the unexpected inflation rate, where we control for realized inflation, industrial production and interest rate effects im model 3. For model 1 we find a negative effect of inflation on real estate equity returns which is statistically significant. Thus, an inflationary hike of 1 percentage point leads to a 0.02 percentage point decrease in returns. Enriching the model by including interest rates and industrial production does not change the value and the sign of this coefficient. Moreover, it remains significantly different from zero. Industrial production is not significantly different, whereas the money

Table 1: The Fama-Schwert-Regression for Equity Returns

	(I)	(II)	(III)
	(a) Real Estate Equity Returns		
Constant	0.01**	0.01	0.03**
Inflation			
Realized	-0.02*	—	-0.02*
Expected	—	0.05	—
Unexpected	—	-0.03*	—
Ind. Prod.	—	—	-0.25
Interest Rate	—	—	-0.62**
R-Squared	0.01	0.01	0.03
	(b) Equity Returns		
Constant	0.00**	-0.00	0.01*
Inflation			
Realized	-0.01**	—	-0.01*
Expected	—	0.06	—
Unexpected	—	-0.02*	—
Ind. Prod.	—	—	-0.10
Interest Rate	—	—	-0.05
R-Squared	0.01	0.01	0.01

The dataset for real estate equity returns (panel (a)) includes nine countries spanning the time from February 1994 to June 2008 including a total of 1192 observations. The dataset for equity returns (panel (b)) includes only eight countries from February 1994 to June 2008 making a total of 1096 observations. Two asterics denote significance of the estimated coefficient on a 1 percent level, while one asterics denotes significance of the coefficient of a 5 percent level.

market rate has a negative and siginficant impact on the real estate return. That makes sense because the interest rate is nothing else as the opportunity costs of holding equities. The value of the coeffcient (-0.62) is larger than the inflation coefficient (-0.02) in absolute value. When we have a look at the model with expected inflation and unexpected inflation we can infer that expected inflation has no significant impact on the returns, where unexpected inflation has a negative and statistically significant effect. From these results we have to conclude that we have to reject the Fisher-hypothesis for real estate equity returns. If we compare these results to the results in panel (b) we come to more or less the same results. If we have a look at the goodness of fit coefficients we see that they are in a range near zero. This finding can often be

found for financial market returns[3]. At the frequency of monthly data market microstructure effects dominate the effects of macroeconomic fundamentals. The reason for this is that private information (e.g. company news) arive more frequently compared to macro news (e.g. business cycle or inflation projections).

3.2 Inflation and REIT Returns

We ran the same regressions for REIT returns. The advantage of using REITs instead of real estate equity returns is that they are provided for different object classes like office, retail and residential property. The disadvantage of using REIT returns is that they measure the performance of the company and not the performance of the object class. The European Real Estate Association (EPRA) does not provide us up to now with these kind of indices. Therefore we use US data, which is available for these object classes. The difference between REITs and equities is that they are restricted to hold their wealth to a large degree in real estate. Moreover, their profits sould also be gained to a large degree from administering real estate. Furthermore, they have to distribute a large fraction of their earnings to their shareholder and they are only taxed on the shareholder level (compare Voigtländer 2006). The used dataset for running the Fama-Schwert regressions is provided by the National Association of Real Estate Investment Trusts (NAREIT) spanning the period from February 1994 to June 2008. Thus, we have a dataset consisting of 173 monthly observations. Table 2 contains the estimates of the Fama-Schwert regressions for office returns, residential property returns and retail property returns. What can be inferred is, that the regressions for office as well as residential property returns do not exhibit any significant coefficient. Only for retail returns we find significant estimates of the inflation as well as the interest rate coefficient. The interesting finding is that US-REITs do not yield any hedge against inflation and moreover are not connected to macroeconomic

[3]Meese and Rogoff (1983) is a prominent study for the low explanatory power of macroeconomic variables for asset prices. The authors found that monetary exchange rate models are not able to beat a random walk forecast.

variables. This is in contrast to our findings in table 1, where we found that equity returns can be explained by a small part by interest rate movements. Thus, we conclude, that REITs might be an independent asset class. This might have implications for portfolio managers.

Table 2: The Fama-Schwert-Regression for REITs

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
	(a) Office Returns						
Constant	0.02**	0.02	0.01**	0.02	0.01	0.01	0.01
Inflation							
Realized	-0.02	—	—	—	—	—	-0.02
Expected	—	-0.03	—	-0.03	—	—	—
Unexpected	—	—	-0.01	-0.01	—	—	—
Ind. Prod.	—	—	—	—	—	-0.43	-0.53
Interest Rate	—	—	—	—	0.08	0.08	0.09
R-Squared	0.01	0.00	0.00	0.01	0.00	0.00	0.01
	(b) Retail Returns						
Constant	0.02**	0.02**	0.01**	0.03**	0.03**	0.03**	0.03*
Inflation							
Realized	-0.03	—	—	—	—	—	-0.03*
Expected	—	-0.08	—	-0.08	—	—	—
Unexpected	—	—	-0.02	-0.02	—	—	—
Ind. Prod.	—	—	—	—	—	-1.32	-1.50
Interest Rate	—	—	—	—	-0.37*	-0.35	-0.34
R-Squared	0.02	0.02	0.01	0.03	0.02	0.03	0.05
	(c) Residential Returns						
Constant	0.01**	0.02*	0.01**	0.02*	0.01	0.01	0.02
Inflation							
Realized	-0.02	—	—	—	—	—	-0.02
Expected	—	-0.05	—	-0.05	—	—	—
Unexpected	—	—	-0.02	-0.02	—	—	—
Ind. Prod.	—	—	—	—	—	-0.96	-1.10
Interest Rate	—	—	—	—	-0.03	-0.01	-0.01
R-Squared	0.01	0.01	0.01	0.02	0.00	0.00	0.02

The dataset on US-REIT returns spans the period from February 1994 to June 2008 including 173 observations. Two asterics denote significance of the estimated coefficient on a 1 percent level, while one asterics denotes significance of the coefficient of a 5 percent level.

3.3 Inflation and Direct Investment Returns

By investing in real estate equities investors earn profits which are indirectly connected to the performance of the building but which are also connected to the performance of the company which manages these buildings. By doing indirect investments other factors despite the performance of the building determine the returns, like the leverage of the company. Moreover, equity returns may be more volatile compared to the returns of a direct investment. Thus, these additional factors might superimpose the pure inflation hedge of an investment in real estate. Larsen and McQueen (1995) show for example, that an investment in gold can be used as a hedge against inflation, while assets connected to gold are not able to protect against inflation. For this reason, we will test for the inflation hedging properties of the buildings itself in these section. Furthermore, we divide the class of direct real estate investments into different subunits consisting of homes, offices and retail. Because an investor wants to protect his or her expected future income stream from rising prices, we should use total return indices, which contain the change in the price of the building and the cash-flow return from renting the building. These so called total return indices are supplied by the Investment Property Databank (IPD). IPD gets the input data directly from institutional investors for constructing these indices. These total returns do not measure the performance of these companies, but the performance of the buildings. Our panel consists of these total return indices for residential property, offices and retail for Canada, the USA, Australia, Finland, France, Germany, Ireland, the Netherlands, Sweden and the UK spanning the period 1998 to 2007. Thus, our panel consists of 100 yearly observations for offices, 90 observations for retail and 60 observations for homes. Macroeconomic data are taken from the OECD's database (www.sourceoecd.org). In contrast to the regressions we ran in the section before we do not approximate expected inflation by fitting autoregressive models, but we take the OECD's official inflation forecasts instead. We also tried forecasts supplied by the Consensus Forecast but got qualitatively similar results. Table 3 contains the regression results.

For offices (panel (a)) we found that neither the realized inflation rate, nor any

Table 3: The Fama-Schwert-Regression for Direct Investments

	(I)	(II)	(III)	(IV)	(V)	(VI)
	(a) Office Returns					
Constant	0.09***	0.08***	0.10***	0.07**	0.05*	0.06**
Inflation						
Realized	0.29	—	—	—	—	-0.08
Expected	—	1.16	—	1.36	—	—
Unexpected	—	—	-0.04	0.24	—	—
Ind. Prod.	—	—	—	—	1.93***	2.03***
Interest Rate	—	—	—	—	-0.78	-0.93
R-Squared	0.37	0.38	0.37	0.38	0.48	0.49
	(b) Retail Returns					
Constant	0.14**	0.20**	0.13**	0.20***	0.17***	0.17***
Inflation						
Realized	0.54	—	—	—	—	-0.57
Expected	—	-3.37***	—	-3.41***	—	—
Unexpected	—	—	0.30	-0.09	—	—
Ind. Prod.	—	—	—	—	1.00***	1.07**
Interest Rate	—	—	—	—	-1.26***	-1.10*
R-Squared	0.48	0.52	0.47	0.53	0.51	0.52
	(c) Residential Returns					
Constant	0.08***	0.11**	0.10***	0.10***	0.08***	0.07***
Inflation						
Realized	1.06*	—	—	—	—	0.86
Expected	—	-0.45	—	0.20	—	—
Unexpected	—	—	1.18*	1.22*	—	—
Ind. Prod.	—	—	—	—	0.54	0.52
Interest Rate	—	—	—	—	0.53	0.28
R-Squared	0.42	0.39	0.43	0.42	0.42	0.44

The dataset consists of yearly returns spanning the period from 1998 to 2007, making a total of 100 observations for office returns (panel (a)), 90 observations for retail (panel (b)) and 60 observations for residential returns (panel (c)). Three asterics denote significance of the estimated coefficient on a 1 percent level, two asterics denotes significance of the coefficient of a 5 percent level, while one asteric denotes significante of the coefficient on a 10 percent level.

other variable like the inflation forecast, the unexpected inflation rate, or the money market rate yield any statistically significant coefficients. In contrast to the regressions for real estate equity returns these estimated coefficients lie more in the range around one as predicted by theory (see models 1 to 3). The growth rate of industrial production is positively and significantly

connected to office returns yielding a strong comovement between both. The estimate is approximately two, which means that an increase in the growth rate of industrial production by 1 percentage point leads to an increase in office returns of two percents which is quite large. This result is in line with the results found in Jäger and Voigtländer (2007), who found a similar relationship between office returns and output growth. In contrast to this, we cannot find a statistically significant estimate for realized and unexpected inflation for retail property returns (panel (b)). The coefficient of expected inflation is highly significant but negative implying a deviation from the value predicted by the Fisher hypothesis. Thus, if agents expect an increase in future inflation of one percentage point, this will result in a drop of retail returns of three percentage points. Because rents on retail buildings are often connected to retail sales, this estimate indicates, that retailers face the problem of passing higher prices to their customers. This problem will carry over to new rental rates. By having a look at the results for residential property returns we can infer that the estimate is in the range of one implying a perfect hedge against inflation. Moreover, this finding is robust to the inclusion of the growth rate of industrial production and the money market rate into the regression.

In contrast the regressions we ran for equity returns, we find higher values for the coefficient of determination here. Although they are not directly compareble, because the imput samples have different frequencies, these results make sence. Equity returns are affected to a larger degree to market microstructure effects and news about the company and their future earnings compared to the returns on direct investments, whose future earnings vary on a small scale. This is the reason, why equity returns cannot be explained by macroeconomic factors alone, whereby a large fraction of the variation of the returns of direct investments can be explained by macroeconomic factors. Another reason is that the trading volume of equities is higher compared to the trading volume of property, whereby the frequency of the trades is higher for equities. In the regressions we run for retail returns we found goodness-of-fit values around 50 percent, while we found values in the range of 40 percent for residential property returns. Thus, the returns on direct property can be explained by a large fraction with macroeconomic factors on a yearly time scale.

3.4 Which Asset Class Performs Best?

When running regression one is usually interested if a variable contributes to the explaination of the dependent variable or not. This is usually done by testing the null hypothesis that the value of this coefficient is zero. But the Fisher hypothesis places one additional restriction onto the coefficient. The Fisher relation implies a perfect hedge against inflation predicting that the value of the coefficient is one. Thus, the null hypothesis of a perfect inflation hedge can simply be beformed by running a t-test of the null hypothesis that the coefficient of inflation takes the value one. This kind of test is also applied in Yobaccio et al. (1995), Rubens et al. (1998) and Maurer and Sebastian (2002).

Table 4: Test on Perfect Inflation Hedging

	Expected Inflation	Unexpected Inflation	Realized Inflation	Augmented Model
	(a) Direct Investments			
Residential	1.33	-0.30	-0.10	0.22
Retail	3.82	1.16	2.58	2.49
Office	-0.11	1.41	0.88	2.30
	(b) Real Estate Investment Trusts			
Residential	23.02	70.15	73.65	—
Retail	23.49	70.16	74.34	—
Office	20.64	63.74	67.31	—
	(c) Equities			
Equities	20.98	180.47	181.91	—
Real Estate Equities	16.93	96.59	98.95	—

The test on perfect inflation hedging of an asset is performed as a t-test of the null hypothesis that the coefficient is equal to one. The null hypiothesis of perfect inflation hedging properties can be rejected at the 5 percent level if the reported test statistic lies outside the interval [-1.96,1.96].

Table 4 contains the results of the test of the null hypothesis of a perfect hedge against inflation. If the value of the test statistic lies in the interval [-1.96,1.96] we cannot reject this null hypothesis, while we have to reject perfect inflation hedging properties, when the value of this statistic lies outside this interval. We

perform this test for the coefficients of expected inflation, unexpected inflation and realized inflation. Moreover, we applied this test on the inflation coefficient in the augmented inflation model with industrial production and the money market rate. The results imply that an investment into equities do not serve as a hedge against inflation. If we have a look at direct investments we can infer that offices as well as homes can serve the purpose of a hedge against inflation. Moreover, they yield a hedge for both, expected and unexpected inflation. In the augmented model we have to reject the null hypothesis for offices, whereas we still cannot reject it for residential property. Retail has inflation hedging properties against unexpected inflation. Together with the negative coefficient on expected inflation this gives us the indication that retailers may decrease the rents but are not able to react to surprice inflation.

All in all, these results imply that direct investments yield better inflation hedging properties compared to equities. Moreover we find that office returns and residential property returns yield the best hedge against inflation. A reason might be that the suppliers of residential property might have market power so that renters have to accept higher rents in response to higher inflation. In contrast to this, Demary (2009) finds that real estate prices fall in response to an unexpected hike in the price level. He wants to study the link between house prices, inflation, output fluctuations and monetary policy and therefore uses the OECD price indices which contain the prices at which residential property is sold. He explains his findings by the fact that the central bank tightens monetary policy in response to inflationary pressures. This increases the costs of financing real estate projects, which will result in a declining demand for real estate. Thus, selling prices will deline. But declining selling prices is not sufficient to conclude that housing is no hedge against inflation. It does nothing say about declining cash flows from renting the house. Thus, for studying inflation hedging properties one has to use total return indices, because these are the ones which reflect the investors' income from investing in real estate.

4 Conclusion and Outlook

This study uses the panel data augmented Fama-Schwert regression to test for the inflation hedging properties of real estate. For giving a detailed picture, we run regressions for equity returns and for returns on direct investments. Our dataset includes the total return indices for homes, offices and retail property and covers several OECD countries. We found that investments in equities and real estate equities do not protect the investor against inflation. Moreover, correlations between returns and several measures of inflation are negative and statistically significant. The reason for this finding might be that investors expect declining future earnings due to inflation which translates into a negative return. We find that direct investments perform better in protecting against inflation. But we also find different degrees of inflation protection for homes, offices and retail real estate. Retail property did worse in inflation protection. We conclude that this is due to the fact that owners have problems in increasing profits, when the price level is rising. Offices yield the highest estimate, but we cannot generalize their inflation hedging properties because we found no statistically significant effect. Reasons might be the strong link to bisiness cycle conditions and the perhaps low degree of re-optimizing rents due to increases in inflation. For homes we found robust evidence for inflation protection. The reason might be that home owners have market power and therefore can easily re-optimize rent payments. Further research should elaborate on the inflation hedging properties of homes. Results can give important information for institutional investors like insurance companies and real estate investment funds. Maybe residential property might be an asset to decrease macroeconomic risks in portfolios.

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