



# Do European real estate stocks hedge inflation? evidence from developed and emerging markets.

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### Disclaimer

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## DO EUROPEAN REAL ESTATE STOCKS HEDGE INFLATION? EVIDENCE FROM DEVELOPED AND EMERGING MARKETS

### Executive summary

This report examines the long-run and short-run inflation-hedging properties of real estate stocks for five European markets. The total monthly returns of real estate stocks in the United Kingdom, France, Germany, Poland and Czech Republic over January 1990 to July 2011 were assessed. Three out of these five markets are categorised as developed markets, while another two are emerging markets.

Developed:

- United Kingdom
- France
- Germany

Emerging:

- Poland
- Czech Republic

A comparison of the inflation-hedging effectiveness of real estate stocks in developed and emerging markets allows us to further understand the dissimilarities between emerging and developed property markets, as well as serving as a natural laboratory for evaluating the role of institutional involvement proposition.

**There are three overall findings.**

**1) It is very difficult to hedge the short-run inflation risk.**

It appears that for real estate stock investors, it is very difficult to hedge the short-run inflation risk. The empirical results show little inflation-hedging ability of European real estate stocks over the short run. The results are consistent with the previous US REIT results. This also implies that real estate stocks are probably better hedge against longer-term inflation rather than short-term inflation risk.

**2) Real estate stocks in developed markets do provide a positive inflation hedge against expected inflation over the long run.**

Strong long-run inflation-hedging results of real estate stocks were evident in the UK, France and Germany, suggesting that real estate stocks in these developed markets do serve as a good hedge against expected inflation in the long run. This reflects that real estate stocks in these markets are effective investment vehicles that warrant consideration for inclusion in institutional portfolios.

**3) The degree of hedging against inflation over the long run is much stronger in developed markets. This can be attributed to a higher degree of participation by institutional investors in these markets.**

Our empirical results also show that the degree of hedging against inflation is much stronger in developed markets. Specifically, there is little evidence to support the notion of real estate stocks in Poland and Czech Republic (emerging markets) can provide a good long-term hedge against inflation, whereas real estate stocks in the UK, France and Germany reveal a strong positive relationship with expected inflation over the long run.

This can be attributed to a higher degree of participation by institutional investors in the developed markets in which a more sophisticated investor base improves inflation flow and facilitates information gathering (Bradripath et al., 1995, Ziering et al., 1997, Lee et al., 2008); thereby investors will be able to anticipate and incorporate inflation risk into investment returns in the long run effectively. In contrast, given the emerging markets are characterised with less informed and less sophisticated investors, it is not too surprisingly to find that investors in emerging markets fail to do so.

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Overall, the results clearly reinforce the role of European real estate stocks in an investment portfolio. The findings could have some profound implications to institutional investors and policy makers.

- Firstly, **investors and fund managers should distinguish the impacts of inflation on the short run and long run.** Real estate stocks in developed markets are effective risk management tools to hedge the inflation risk over the long run, although no similar evidence is found in the short run.
- Secondly, **investors**, particularly international property investors **should also be aware of** the fact that **real estate stocks in emerging markets** not only have different risk and return characteristics (Barry and Rodriguez, 2004), but also **have dissimilar inflation-hedging properties compared to developed markets.** The unique inflation-hedging characteristic in emerging markets should also be considered in their investment decision making.
- Thirdly, **policy makers should recognise the importance of institutional investors.** Importantly, institutional investors would strengthen the information-gathering process and improve the information flow; thereby the inflation-hedging effectiveness of real estate stocks can be enhanced.
- Lastly, **European investors in developed markets should consider including real estate stocks in their investment portfolios.** European real estate stocks in developed markets are effective investment vehicles in response to the effective inflation-hedging properties over the long run. Therefore, real estate stocks in these markets warrant consideration for inclusion in an investment portfolio.

See Table 15 for the summary of the European real estate stock inflation-hedging properties over the long run and short run.

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### Introduction

The European debt crisis and the Global Financial Crisis (GFC) have had a strong negative impact on the European economics. In response to the worsening economic climate, a loose monetary policy has been widely implemented by many European central banks. Loose monetary policy is adopted by cutting interest rate and providing massive injections of money into economics.

But a continuation of very loose monetary policy could heighten inflation expectation in the long run, particularly during the process of recovery from financial crisis (Kearns et al., 2010). In fact, inflationary pressures have been evident in many European countries in recent years. For instance, as of December 2011, the Eurozone inflation rate was 2.8%, which well above its 2% target (RREEF, 2012).

Therefore, the impact of inflation on asset values has regained the attention of institutional investors. Specifically, institutional investors would prefer investment vehicles that will provide protection against inflation. Theoretically, it is commonly argued in the academic literature that real estate stocks should act as a good hedge against inflation. But the empirical evidence on this is mixed (Hoesli et al., 1997, Liu et al., 1997, Chatrath and Liang, 1998, Ganesan and Chiang, 1998, Stevenson, 2001, Glascock et al., 2002, Maurer and Sebastian, 2002, Hoesli et al., 2008). The inconclusive findings suggested there are many issues surrounding the inflation-hedging characteristics of real estate stocks that have not been investigated.

The aim of this study is to explore the short-run and long-run inflation-hedging properties of European real estate stocks in three developed and two emerging markets over 1990-2011. Results are presented for:

- United Kingdom
- France
- Germany
- Poland
- Czech Republic

with particular attention given to:

- Do European real estate stocks hedge against inflation in the short run?
- Do European real estate stocks hedge against inflation in the long run?
- Do European real estate stocks in developed markets behave differently from those in emerging markets in terms of their inflation-hedging properties?

Our overall results suggest that European real estate stocks in developed markets are effective investment vehicles to an investment portfolio with reference to the effective long-run inflation-hedging characteristics of real estate stocks in the UK, France and Germany. This study also highlights the significant role of institutional investors in enhancing the inflation-hedging effectiveness of real estate stocks.

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### Prior research

The effectiveness of real estate securities to serve as inflation hedges has received considerable attention in the property literature. Numerous studies have documented the perverse inflation hedge phenomenon in the US REIT market. Gyourko and Linneman (1988) and Park et al. (1990) have offered empirical evidence of US REITs are significantly and negatively related to both expected and unexpected inflation. Yobaccio et al. (1995) showed that US REITs are perverse inflation hedges, even though the impact of stocks has been controlled.

Comparable international evidence was also illustrated by Liu et al. (1997) from 7 real estate security markets (i.e. Australia, France, Japan, South Africa, Switzerland, the UK and the US). Their results revealed either a negative or insignificant relationship between inflation and real estate stock returns. The similar inconclusive results for real estate stocks in the UK were also demonstrated by Hoesli et al. (1997). In Europe, Maurer and Sebastian (2002) evaluated the inflation-hedging properties of real estate stocks in Germany, France, Switzerland and the UK. Consistent with the previous studies, the results indicated that indirect properties in these countries provide either no inflation hedge or a perverse inflation hedge in the short run.

A number of studies have attempted to explain the observed negative relationship between inflation and property stock returns. One of the possible explanations is the proxy hypothesis. This hypothesis was first introduced by Fama (1981) and Geske and Roll (1983) in which the observed anomaly actually reflects the relationships between inflation and other fundamental real activities and monetary policy. Darret and Glascock (1989) examined the inflation-hedging effectiveness of US REITs, real estate investment and management firms. Their results provided some support for the proxy hypothesis in which a weak relationship between inflation and US real estate stock returns was evident. Nevertheless, the influences of monetary policy and the common stock market have significant lagged effects on current real estate returns. Glascock et al. (2002) further postulated that the perverse inflation puzzle for REITs is merely a manifestation of the effects of changes in monetary policies. Once monetary and other macro variables are controlled, the inverse relation between REIT returns and inflation goes away. Therefore, they argued that the perverse inflation hedge in the REIT market is spurious.

Distinctions are further made between short run and long run relationships. Chatrath and Liang (1998) found that REITs tend to be long-term inflation hedges. Although they did not find any evidence that REIT returns are positively associated with temporary or permanent components of inflation measures in the short run, they found REITs provided an inflation hedge to investors in the long run. Moreover, Ganesan and Chiang (1998) also documented real estate stocks in Hong Kong are cointegrated with inflation. In contrast, little cointegration between real estate stocks and inflation is demonstrated by Stevenson (2001) in 10 international real estate markets. Similar findings are also documented by Glascock et al. (2002). The inconsistent findings could be explained by the flaw of the cointegration test in which it does not guarantee positive relationships among the cointegrated series (Enders, 1995).

Few existing studies have explicitly examined the relationship between real estate stock prices and inflation in the short-run and long run. Hoesli et al. (2008) was the first explicit investigation. They adopted an error correction method to investigate the linkages between inflation, monetary policy, real activity and real estate stocks in the US and UK over 1977-2003. Their empirical tests showed that longer time horizons will result in a positive relationship in accordance with the expected Fisher (1930) relationship. They also assert that real estate stocks do response to inflation changes through a gradual inflation adjustment process. Therefore, real estate stocks will only show inflation-hedging ability in the long run. More recently, Obereiner and Kurzrock (2012) presented comparable evidence in the German property market. They exhibited that German real estate stocks do provide a hedge against inflation in the long run, although real estate stocks are almost independent from inflation in the short run. The findings support the hypothesis of Lee et al. (1998) in which the Fisher effect only holds in the long run.

Hardin et al. (2012) provide an alternative explanation to why short-term REIT returns are often negatively related to expected inflation. They attributed this anomaly to inflation illusion. They found that REIT investors suffer with inflation illusion. Importantly, the effect is a short run phenomenon. Eventually, over a long term period, investors correct the stock prices. The findings echo the argument of Piazzesi

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and Schneider (2008) that stocks can provide a long-term hedge even though in the short-term, there is an inflation illusion effect.

In extending this line of research, Lee and Lee (2012) compared the inflation-hedging features of US REITs before and after the early 1990s. Interestingly, a positive relationship between US REITs and anticipated inflation is only evident in the long run after, though not before, the early 1990s. Importantly, the authors related the inflation hedging characteristics of REITs to the increased institutional involvement. Their size-based results further confirmed the argument of institutional involvement improves the inflation-hedging properties of REITs. Therefore, the authors suggested that institutional investors are informed and rational investors and they have improved information flow and assisted REIT prices more accurately reflect the performance of underlying real estate (Ziering et al., 1997, Lee et al., 2008). Lee et al. (2011) further tested the institutional involvement hypothesis with three emerging markets in East Asia (i.e. Malaysia, the Philippines and Taiwan). Consistent with the institutional involvement conjecture, they did not find strong evidence to support the notion of real estate stocks hedge against inflation in these markets over the long-term.

In summary, many studies have been sought to understand the inflation-hedging characteristics of real estate stocks in the short run and long run, whereas specific studies in emerging markets, particularly emerging markets in Europe are relatively limited. More importantly, few studies examined the institutional involvement hypothesis with real estate stocks in the US and some emerging markets in Asia. Therefore, it is critically important to examine the linkages between inflation-hedging ability and institutional involvement in order to enhance the investment decision making process of institutional investors.

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### Data and methodology

#### Data

The inflation-hedging properties of property securities were carried out for the following five European countries:

Three developed markets:

- UK
- France
- Germany

Two emerging markets:

- Poland
- Czech Republic

Total monthly returns of property stocks were assessed over January 1990 to July 2011, using the following data:

- The FTSE EPRA/NAREIT indices
- Industrial production
- M2 money supply
- Consumer price indices (CPI)

The FTSE EPRA/NAREIT indices for the UK, France, Germany and Poland were utilised to present the performance of British, French, German and Polish property stocks respectively. However, the Czech property stock prices were based on the Czech Republic Real Estate Index. It should be noted that the data for Polish and Czech real estate stocks spanned from December 2005-July 2011 and January 1996- July 2011 respectively due to the limitations of data.

Similar to Spyrou (2004) and Lee et al. (2011), industrial production and M2 money supply are proxies of real activities and monetary policies. Therefore, the industrial production and M2 figures of these five markets were also obtained. Consumer price indices (CPI) were also obtained to measure the inflation rates in these markets. All data were downloaded from DataStream. Following Hoesli et al. (2008), an ARIMA model was utilised to estimate the expected and unexpected inflation indices. To eliminate potential scaling effects, all indices were set at one for the first month of 1990. The series were also logged for long run/levels analyses and differenced as appropriate (Hoesli et al., 2008).

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**Table 1: Descriptive summary**

Market	Real estate stocks	Inflation rate	Money supply	Industrial production
<b>Panel A: United Kingdom</b>				
Mean	0.414	0.192	0.383	0.008
SD	4.545	0.422	4.751	0.805
Maximum	29.275	3.300	7.557	2.266
Minimum	-18.962	-1.000	-71.276	-4.302
<b>Panel B: France</b>				
Mean	0.890	0.143	0.390	-0.017
SD	4.917	0.182	1.677	3.170
Maximum	14.427	0.800	6.887	10.997
Minimum	-23.079	-0.500	-4.322	-9.312
<b>Panel C: Germany</b>				
Mean	0.281	0.156	0.441	0.089
SD	7.395	0.271	0.749	3.337
Maximum	34.518	1.800	4.237	11.867
Minimum	-34.509	-1.600	-4.906	-12.017
<b>Panel D: Poland</b>				
Mean	0.714	0.230	0.975	0.513
SD	10.892	0.348	1.032	7.075
Maximum	22.220	1.000	3.200	17.505
Minimum	-36.398	-0.400	-1.761	-13.987
<b>Panel E: Czech Republic</b>				
Mean	-1.353	0.296	0.575	0.315
SD	15.248	0.620	0.668	2.689
Maximum	65.316	3.979	2.741	8.092
Minimum	-45.024	-0.784	-2.074	-7.838

Notes: The first two moments (mean and standard deviations) are expressed in percentage form.

Table 1 presents the summary statistics of the indices. As it can be seen from Table 1, real estate stocks in emerging markets are very volatile in which the standard deviation statistics of Czech Republic (15%) and Poland (10.9%) are considerably higher than the UK (4.5%), France (4.9%) and Germany (7.4%). The results provide some support for the finding of Barry and Rodriguez (2004) that property indices in emerging markets are more volatile than developed markets.

Another important observation is the average monthly inflation rates in emerging markets are also relatively higher than developed markets. The figures suggest that inflation risk is more noticeable in emerging markets compared to developed markets.

A preliminary picture of the inflation-hedging properties of each market, obtained by comparing inflation rates with average returns for each market, is also shown in Table 1. Results here reveal that the real estate stock returns do not move in line with inflation, particularly in emerging markets. Despite higher inflation rates are observed in emerging markets, little evidence of higher returns is evident in these markets. This implies that emerging markets offer little inflation-hedging benefits. Nonetheless, the preliminary results should be formally investigated by rigorous tests.

### Methodology

The analysis of this study involves two stages. The first stage is to test the short-run inflation-hedging characteristics of European property stocks. The Fama and Schwert (1977) model was employed to examine the inflation-hedging effectiveness of European real estate stocks over the short run. Subsequently, the linkages between inflation and real estate stock returns in the long run were investigated in the second stage. To assess the linkages, a dynamic ordinary least squares model was carried out.



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### Results and discussion

#### UK

This section examines on the inflation-hedging ability of British real estate stocks in the short run and long run. The results in Table 3 show that real estate stocks in the UK do not appear to act as a good hedge against expected inflation over a short run. The insignificant coefficient for the expected inflation ( $\beta_i$ ) is evident, suggesting that real estate stocks in the UK offer little hedging benefit against expected inflation. Comparable results are also documented for the unexpected inflation ( $\gamma_i$ ) in which insignificant unexpected coefficient is observed.

In the long run, the coefficient of  $\ln(\text{EINF})$ , the logarithm of the expected inflation index, in the UK is positive and statistically significant at 1% level, reflecting that the British property stocks are positively link to the expected inflation index in the long run. Similar evidence is also found for the unexpected inflation index (UEINF).

Overall, British real estate stocks do provide a good hedge against inflation over the long run, although little inflation-hedging ability is found in the short run.

**Table 2: UK: Key findings**

	Short-run	Long-run
Expected inflation	✘	✓
Unexpected inflation	✘	✓

Notes: ✓ indicates strong inflation-hedging ability; ✘ indicates no inflation-hedging ability

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**Table 3: The United Kingdom**

**Panel A: Short-run inflation-hedging effectiveness**

Market	$\alpha$	$\beta$	$\gamma$
UK	0.003 (0.453)	1.301 (1.109)	1.104 (0.647)

Notes: This table reports estimated coefficients for the Fama and Schwert test. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation. \*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

**Panel B: Long-run inflation-hedging ability of real estate stocks**

Market	UK
Constant	-0.055 (-0.767)
$\ln(EINF)$	1.282 (3.450)***
$\ln(UEINF)$	4.555 (3.540)***
$\ln(MS)$	0.155 (3.645)***
$\ln(IPR)$	4.148 (6.428)***
SIC	-4.026

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation. \*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

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### France

Table 5 presents the inflation-hedging ability of real estate stocks in France. Results show that French real estate stocks offer little hedging benefit against expected inflation and unexpected inflation in the short run in light of the insignificant coefficients.

On the other hand, strong evidence is found to support the notion of real estate stocks in France hedge against inflation (both expected and unexpected components) over the long-term.

In brief, French investors would receive inflation protection by investing in real estate stocks over a long run.

**Table 4: France: Key findings**

	Short-run	Long-run
Expected inflation	*	✓
Unexpected inflation	*	✓

Notes: ✓ indicates strong inflation-hedging ability; \* indicates no inflation-hedging ability

**Table 5: France**

**Panel A: Short-run inflation-hedging effectiveness**

Market	$\alpha$	$\beta$	$\gamma$
France	0.074 (1.456)	-29.671 (-1.126)	-4.750 (-0.511)

Notes: This table reports estimated coefficients for the Fama and Schwert test.

The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

**Panel B: Long-run inflation-hedging ability of real estate stocks**

Market	France
Constant	-0.151 (-1.269)
$\ln(EINF)$	2.528 (1.735)*
$\ln(UEINF)$	8.487 (2.286)**
$\ln(MS)$	1.494 (3.275)***
$\ln(IPR)$	0.580 (2.124)**
SIC	-2.998

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

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### Germany

The results on the inflation-hedging effectiveness of real estate stocks in Germany are reported in Table 7. Insignificant coefficients that are documented in Panel A of Table 7 suggest that German real estate stocks do not offer strong hedging benefit against expected inflation and unexpected inflation in the short run.

Panel B of Table 7 shows the inflation hedging ability of German real estate stocks in the long run. Results show that German real estate stocks offer some protection against expected inflation. However, an insignificant coefficient is illustrated for the unexpected inflation index, signifying that little hedging ability of German real estate stocks against unexpected inflation.

In summary, German real estate stocks only provide some long-term hedge against expected inflation.

**Table 6: Germany: Key findings**

	Short-run	Long-run
Expected inflation	*	✓
Unexpected inflation	*	*

Notes: ✓ indicates strong inflation-hedging ability; \* indicates no inflation-hedging ability

**Table 7: Germany**

**Panel A: Short-run inflation-hedging effectiveness**

Market	$\alpha$	$\beta$	$\gamma$
Germany	-0.019 (-1.304)	10.318 (1.615)	-4.079 (-1.549)

Notes: This table reports estimated coefficients for the Fama and Schwert test.

The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

**Panel B: Long-run inflation-hedging ability of real estate stocks**

Market	Germany
Constant	1.166 (4.572)
$\ln(EINF)$	5.905 (1.750)*
$\ln(UEINF)$	2.867 (0.937)
$\ln(MS)$	-2.864 (-2.188)***
$\ln(IPR)$	1.220 (5.929)***
SIC	-2.199

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

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### Poland

Table 9 reports the inflation-hedging characteristics of Polish real estate stocks in the short-run and long run. Results from Panel A of Table 9 clearly show that real estate stocks in Poland do not exhibit any short-run inflation-hedging characteristics.

Comparable evidence is also illustrated in Panel B of Table 9 over the long run. Specifically, estimates on the expected and unexpected inflation indices are either positive or negative. Importantly, both coefficients are not statistically significant, suggesting that Polish real estate stocks offer little long-run inflation-hedging ability.

Overall, Polish real estate stocks do not appear as a good hedge against inflation in the short run and long run.

**Table 8: Poland: Key findings**

	Short-run	Long-run
Expected inflation	*	*
Unexpected inflation	*	*

Notes: ✓ indicates strong inflation-hedging ability; \* indicates no inflation-hedging ability

**Table 9: Poland**

**Panel A: Short-run inflation-hedging effectiveness**

Market	$\alpha$	$\beta$	$\gamma$
Poland	-0.010 (-0.281)	0.113 (0.386)	1.616 (0.504)

Notes: This table reports estimated coefficients for the Fama and Schwert test. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation. \*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

**Panel B: Long-run inflation-hedging ability of real estate stocks**

Market	Poland
Constant	-11412.59 (-1.009)
$\ln(EINF)$	3574.766 (1.006)
$\ln(UEINF)$	-1107.696 (-0.968)
$\ln(MS)$	-6.705 (-2.367)**
$\ln(IPR)$	1.780 (0.781)
SIC	-3.291

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation. \*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

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### Czech Republic

Table 11 presents the inflation-hedging properties of Polish real estate stocks. Little short-run inflation-hedging evidence is available from real estate stocks in Czech Republic in light of the documented insignificant coefficients in Panel A.

Panel B of Table 11 also demonstrates similar evidence over a long run. Therefore, Czech real estate stocks offer little long-run inflation-hedging ability.

To sum up, no evidence is found to support the notion of Czech real estate stocks provide good inflation protection in the short run and long run.

**Table 10: Czech Republic: Key findings**

	Short-run	Long-run
Expected inflation	✗	✗
Unexpected inflation	✗	✗

Notes: ✓ indicates strong inflation-hedging ability; ✗ indicates no inflation-hedging ability

**Table 11: Czech Republic**

**Panel A: Short-run inflation-hedging effectiveness**

Market	$\alpha$	$\beta$	$\gamma$
Czech Republic	0.004 (0.582)	-2.219 (-1.025)	-0.592 (-1.369)

Notes: This table reports estimated coefficients for the Fama and Schwert test.

The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

**Panel B: Long-run inflation-hedging ability of real estate stocks**

Market	Czech Republic
Constant	-1.136 (-2.359)**
$\ln(EINF)$	2.390 (0.901)
$\ln(UEINF)$	-8.500 (-2.130)**
$\ln(MS)$	-4.205 (-3.218)***
$\ln(IPR)$	1.448 (1.134)
SIC	-1.219

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively

## DO EUROPEAN REAL ESTATE STOCKS HEDGE INFLATION? EVIDENCE FROM DEVELOPED AND EMERGING MARKETS

### Long-run inflation-hedging properties in developed and emerging markets

The above results indicate the differing degree of inflation hedging by different countries, particularly **the degree of hedging against inflation is stronger in advanced markets** compared to emerging markets. The differences can be attributed to the involvement level of institutional investors in these markets.

It should be noted that property markets in the UK, France and Germany are developed markets. In reality, these are one of the largest and most active property markets in Europe. As a developed property market, the market has a higher degree of institutional investors' participation. Recently, Devos et al. (2012) have also found that institutional investors prefer mature REITs with lower risk and larger size. Therefore, it appears that real estate stocks in developed markets are much appealing to institutional investors.

Furthermore, institutional investors are well informed and more rational investors. Importantly, a more sophisticated investor base improves inflation flow and facilitates information gathering (Zeiring et al., 1997); thereby investors will be able to adjust and respond to inflation stocks in the long run.

On the other hand, the Polish and Czech property markets are emerging markets. Given the markets are characterised by less informed and less rational investors, it is not surprising to find that investors in emerging markets are unable to react to inflation changes correctly.

Overall, the differences between developed and emerging markets can be attributed to the level of institutional investors involvement in these markets. Whilst this is a possible cause, the results may just be specific to our sample. In particular, there is still a critical remaining question of whether the abovementioned results in developed and emerging markets could be generalised to all developed and emerging markets in Europe or the findings are attributed to the sample selection. This is a key issue for investors and one that will enable more informed investment decision making.

To address this issue, the **FTSE EPRA/NAREIT Developed Europe index** and the **FTSE EPRA/NAREIT Emerging Europe index** were introduced for developed and emerging markets respectively. The use of two aggregate indices would also overcome the limitation of small sample size for each individual index's computation, particularly in the emerging markets.

The initial results from this analysis are reported in Table 12 and the findings for the developed markets, as shown in Panel A, demonstrate that the FTSE EPRA/ NAREIT Developed Europe index is positively related to expected inflation in the UK, France and Germany, with a significant and positive coefficient of expected inflation is evident in these markets.

**Table 12A: Long-run inflation-hedging of developed real estate stocks**

Market	UK	France	Germany
Constant	-0.509 (-2.925)***	-0.516 (-1.977)**	0.077 (0.815)
$\ln(EINF)$	1.676 (1.991)**	4.149 (1.777)*	13.121 (11.777)***
$\ln(UEINF)$	17.358 (5.800)***	12.724 (3.118)***	0.379 (0.384)
$\ln(MS)$	-0.061 (0.601)	0.363 (0.531)	-3.274 (-7.632)***
$\ln(IPR)$	6.818 (5.233)***	1.166 (3.485)***	0.614 (7.123)***
SIC	-2.501	-2.614	-2.972

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

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The results indicate that the baseline results are robust. In other words, the inflation-hedging effectiveness is more likely documented in a developed market. As discussed earlier, advanced markets are characterised with more institutional investors who are more informed investors. Importantly, the participation of institutional investors would enhance the information flow and assist real estate stocks more accurately to reflect the performance of underlying real estate (Zeiring et al., 1997). In other words, investors in this market can have a faster inflation adjustment process. Therefore it is intuitively appealing to find strong inflation hedging results in these developed markets.

The results reported in Table 12B reveal that little link is found between the FTSE EPRA/NAREIT Emerging Europe index and anticipated and unexpected inflations in Poland and Czech Republic. Specifically the coefficients of expected and unexpected inflation rates for Poland and Czech Republic are not statistically significant.

**Table 12B: Long-run inflation-hedging of emerging real estate stocks**

Market	Poland	Czech Republic
Constant	-154.778 (-0.096)	-22.322 (-0.281)
$\ln(EINF)$	44.155 (0.088)	-2.052 (-0.016)
$\ln(UEINF)$	0.796 (0.005)	40.441 (1.009)
$\ln(MS)$	-5.733 (-6.311)***	15.831 (2.759)***
$\ln(IPR)$	4.013 (2.971)***	5.083 (4.265)***
SIC	-2.491	-1.583

Notes: This table reports estimated coefficients for the DOLS test. T-values are presented in parentheses. The Newey-West procedure is used to correct the standard errors for heteroskedasticity and autocorrelation.

\*, \*\*, \*\*\* denotes significance at the 10%, 5% and 1% level respectively.

The results are expected in light of the weak inflation-hedging features of Polish and Czech real estate stocks that are found in Tables 9 and 11, confirming that emerging property markets offer little inflation-hedging benefits. The fact that little hedging benefits in emerging markets would also support the explanation is to why institutional investors prefers developed markets that characterised as lower risk, more mature and larger market capitalisation in comparison to emerging markets.

Collectively, the inflation-hedging results for the FTSE EPRA/NAREIT Developed and Emerging Europe indices support the view of an enhanced long-run inflation-hedging result is only presented in developed markets, suggesting that our preceding results are not due to our sample selection. The results are summarised in Table 13.

**Table 13: Summary of the long-run inflation-hedging of the FTSE EPRA/NAREIT Developed and Emerging Europe indices**

	UK	France	Germany	Poland	Czech Republic
Expected inflation	✓	✓	✓	✗	✗
Unexpected inflation	✓	✓	✗	✗	✗

Notes: ✓ indicates strong inflation hedging ability; ✗ indicates no inflation hedging ability

**To sum up, strong long-run inflation-hedging evidence of real estate stocks is only documented in developed markets. This can be attributed to higher institutional investor involvement in these markets. This suggests that the participation of institutional investors is crucial to enhance the inflation-hedging ability of real estate stocks.**



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### Conclusion and investment implications

#### Conclusion

European real estate stocks have received increasing attention from investors in recent years. Numerous studies have examined the inflation-hedging efficiency of European real estate stocks. But mixed findings have been found in previous studies. This study aims to examine the inflation-hedging properties of real estate stocks in the UK, France, Germany, Poland and Czech Republic in the short run and long run.

The current study provides a number of important insights. A summary of the inflation-hedging characteristics of real estate stocks is also exhibited in Table 15.

**Table 15: Summary of the inflation-hedging properties of real estate stocks**

Market	Expected inflation	Unexpected inflation
<b>Panel A: Long-run inflation-hedging</b>		
UK	Yes	Yes
France	Yes	Yes
Germany	Yes	No
Poland	No	No
Czech Republic	No	No
<b>Panel B: Short-run inflation-hedging</b>		
UK	No	No
France	No	No
Germany	No	No
Poland	No	No
Czech Republic	No	No

Notes: This table summarises the inflation-hedging properties of real estate stocks in the short run and long run. The short-run inflation-hedging properties of real estate stocks were examined by the Fama-Schwartz (1977) model. On contrary, the long-run inflation-hedging characteristics of real estate stocks were investigated by the DOLS model.

**Three key findings have been found in this study.**

**1) It is very difficult to hedge the short-run inflation risk.**

It appears that for real estate stock investors, it is very difficult to hedge the short-run inflation risk. The empirical results show little inflation-hedging ability of European real estate stocks over the short run. The results are consistent with the previous US REIT results. This also implies that real estate stocks are probably better hedge against longer-term inflation rather than short-term inflation risk.

**2) Real estate stocks in developed markets do provide a positive inflation hedge against expected inflation over the long run.**

Strong long-run inflation hedging results of real estate stocks were evident in the UK, France and Germany, suggesting that real estate stocks in these developed markets do serve as a good hedge against expected inflation in the long run. This reflects that real estate stocks in these markets are effective investment vehicles that warrant consideration for inclusion in institutional portfolios.

**3) The degree of hedging against inflation over the long run is much stronger in developed markets. This can be attributed to a higher degree of participation by institutional investors in these markets.**

Our empirical results also show that the degree of hedging against inflation is much stronger in developed markets. Specifically, there is little evidence to support the notion of real estate stocks in Poland and Czech Republic (emerging markets) can provide a good long-term hedge against inflation,

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whereas real estate stocks in the UK, France and Germany reveal a strong positive relationship with expected inflation over the long run.

This can be attributed to a higher degree of participation by institutional investors in the developed markets in which a more sophisticated investor base improves inflation flow and facilitates information gathering (Bradripath et al., 1995, Ziering et al., 1997, Lee et al., 2008); thereby investors will be able to anticipate and incorporate inflation risk into investment returns in the long run effectively. In contrast, given the emerging markets are characterised with less informed and less sophisticated investors, it is not too surprisingly to find that investors in emerging markets fail to do so.

### Property investment implications

The findings would have some far-reaching practical investment implications to real estate investors, fund managers and policy makers:

**(1) Investors and fund managers should distinguish the impacts of inflation on the short run and long run.**

The results confirm that real estate stock investors may experience lower returns as a result of inflation over the short run, although real estate stocks in developed markets are effective risk management tools to hedge the inflation risk over the long run.

**(2) Investors should recognise the fact that real estate stocks in emerging markets have different inflation-hedging properties compared to developed markets.**

Investors, particularly international property investors should also be aware of the fact that real estate stocks in emerging markets not only have different risk and return characteristics (Barry and Rodriguez, 2004), but also have dissimilar inflation-hedging properties compared to developed markets. The unique inflation-hedging characteristic in emerging markets should also be considered in their investment decision making.

**(3) Policy makers should recognise the importance of institutional investors.**

Importantly, institutional investors would strengthen the information-gathering process and improve the information flow; thereby the inflation hedging effectiveness of real estate stocks can be enhanced.

**(4) European real estate stocks in developed markets should be included in an investment portfolio.**

European real estate stocks in developed markets are effective investment vehicles in response to the effective inflation-hedging properties over the long run. Therefore, real estate stocks in these markets warrant consideration for inclusion in an investment portfolio.

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### Appendix

#### Stationary Test

To avoid spurious estimation by non-stationary variables, the Augmented Dickey-Fuller (ADF) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationary tests were undertaken to assess the stationary of the series. The results are shown in Table I.

**Table I: Unit-Root Tests**

Markets	Level Series		Differenced Series	
	ADF	KPSS	ADF	KPSS
<b>Panel A: United Kingdom</b>				
Real estate stock return index	-1.963	1.490***	-6.092***	0.072
Expected inflation index	0.545	1.872***	-3.950***	0.448
Unexpected inflation index	1.184	1.347***	-9.674***	0.028
Money supply	-1.646	0.321**	-15.613***	0.107
Industrial production	-1.237	0.581**	-18.897***	0.057
<b>Panel B: France</b>				
Real estate stock return index	-0.115	1.974***	-12.621***	0.138
Expected inflation index	-2.642*	2.009***	-13.972***	0.145
Unexpected inflation index	-0.984	0.355**	-13.979***	0.201
Money supply	0.857	2.040***	-18.218***	0.124
Industrial production	-1.212	0.423***	-16.120***	0.189
<b>Panel C: Germany</b>				
Real estate stock return index	-1.654	0.181	-14.430***	0.120
Expected inflation index	1.790	2.024***	-8.168***	0.368
Unexpected inflation index	-1.736	0.531**	-14.571***	0.299
Money supply	-1.920	2.017***	-5.862***	0.358
Industrial production	-1.901	0.469**	-16.542***	0.076
<b>Panel D: Poland</b>				
Real estate stock return index	-1.911	0.609**	-6.438***	0.300
Expected inflation index	1.178	1.164***	-5.958***	0.653**
Unexpected inflation index	0.794	1.947***	-3.127**	0.278
Money supply	-2.216	1.224***	-4.109***	0.399
Industrial production	-1.735	0.479**	-2.476	0.215
<b>Panel E: Czech Republic</b>				
Real estate stock return index	0.705	0.985***	-4.233***	0.255
Expected inflation index	-2.980	1.602***	-4.467***	0.391***
Unexpected inflation index	-2.079	1.125***	-2.543**	0.185
Money supply	-1.173	1.654***	-13.146***	0.166
Industrial production	-0.460	1.553***	-18.921***	0.069

Notes:

\* Rejection of the unit root null hypothesis in the ADF test and the no unit root null hypothesis in the KPSS tests at the 10% level of significance.

\*\* Rejection of the unit root null hypothesis in the ADF test and the no unit root null hypothesis in the KPSS tests at the 5% level of significance.

\*\*\* Rejection of the unit root null hypothesis in the ADF test and the no unit root null hypothesis in the KPSS tests at the 1% level of significance.