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Real Estate Market Efficiency: A Survey of Literature

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Abstract

In this paper, we discuss the question whether or not the real estate market is efficient. We define market efficiency and the efficient market hypothesis as it had been developed in the literature on financial markets. Then, we discuss the empirical evidence that exists concerning the efficiency or inefficiency of financial markets, usually seen as the reference markets as far as market efficiency is concerned. In a separate section, we turn to the real estate market. There, we define the real estate market and discuss various aspects that are decisive for the efficiency of that market. As it turns out, the result found in the literature is inconclusive. Majority of studies provide evidence supporting inefficiency of the real estate market while several studies maintain the notion of real estate market efficiency.

1. Introduction

The Efficient Market Hypothesis (EMH) was defined and classified into its three versions in the mid 1970s, and the number of empirical efficiency tests of various financial markets grew since the early 1980s. First efficiency tests of the real estate market, using cross-sectional analysis, appeared in the mid 1980s. Subsequently, with the intensive use of time series data, market efficiency analyses employed time series techniques. We encountered two similar review papers that enumerate these developments in real estate market efficiency research, although they were published more than a decade ago (**Gatzlaff and Tirtiroglu, 1995**; **Cho, 1996**). Our paper accumulates some of the most

recent studies on real estate market efficiency, and we classify these papers by the type of investigation they have undertaken.

Real estate not only accounts for a considerable portion of an individual's wealth, but also a significant share of a national economy. For instance, real estate contributes to approximately ten percent of the total U.S. economy's output. If real estate decline in value, financial sector, construction sector, and many other related sectors would also decline and unemployment would potentially increase. Real estate assets are an integral part of an overall economy, therefore, changes in real estate value or transaction volume may have consequences in almost every sector of the economy. A reduction in real estate sales may eventually lead to a decline in real estate prices. The value of everyone's homes will decrease, whether they are actively selling it or not. The amount of home equity loans available for the homeowner will go down, and consumer spending will decline.

On the other hand, real estate is an essential element of a spatial economy. Most decisions by people and firms that we deal with in spatial economics involve rental or acquisition of real estate in some form. Location decisions are obvious examples. Whenever a household or a firm decides about a new location it has to find a house, apartment, office, industrial site, etc. to rent or buy, may have to adapt this real estate to its needs and so forth. But, also when we talk about more aggregate and more abstract concepts like interregional transfer of capital or labour, clustering of production, urban development dynamics or urban hierarchies, the underlying activities cannot come into effect without the respective real estate related decisions.

This close relationship between the spatial economy and the real estate market in itself justifies the question about the efficiency or inefficiency of the real estate market, since the potential inefficiency of such a closely related market may have strong implications for the spatial economy. Although it is hotly debated whether or not the current economic crisis is a "real estate crisis", it demonstrated quite clearly that negative developments in one of those areas send shock waves into large parts of the economy.

The question of the efficiency of the real estate market becomes important also in an environmental context. In an efficient real estate market the energy costs of buildings would be perfectly anticipated by the market and incorporated accordingly into the real estate price or rent. An efficient real estate market would ensure that other things equal a more energy efficient building would have a higher value and generate higher rents than a comparable one with a lower level of energy efficiency. In this case, increases in energy costs and financial policy incentives would stimulate investments to make buildings more energy efficient, consequently saving energy and reducing emissions.

In this paper we will review the literature dealing with efficiency or inefficiency of the real estate market. In section 2 we will discuss the conceptual framework for dealing with this issue, and in section 3 we will define the real estate market. In section 4 we will apply the conceptual framework discussed in section 2 to the real estate market and investigate the evidence that can be found in the respective literature. The paper will close with a summarizing section.

2. What is an efficient market?

The issue of what characterizes an efficient market was first systematically discussed by Fama and others in the late 1960s and early 1970s. In its original form their EMH stated that a market is efficient when it "adjusts rapidly to new information" (**Fama et al, 1969**). The market they originally had in mind was the financial market, particularly the stock market and the foreign exchange market. Over the following years these markets received the most attention in this context.

In general, the EMH emphasizes that financial markets are informationally efficient. The prices of traded assets already reveal all known information. Therefore, it is impossible to consistently outperform the market by using any information that the market already knows, except through fortune. Prices always fully reflect the fundamentals of the respective part of the economy. Information or news in the EMH is defined as anything

that may affect prices that is unknowable in the present and thus appears randomly in the future **(Fama, 1970)**. In the EMH price expectations are formed by rational expectations, and the expectations of future prices are therefore based on the same mechanisms as the current and past market prices. As a result no one can earn profits as far as the estimates are unbiased.

An implication of the EMH is the random walk hypothesis. It argues that the changes in the asset price are random and therefore follow a random walk and that future prices cannot be predicted based on past price information. Based on this argument neither excess investment profits nor incentive for speculation are available **(Fama, 1970)**.

The EMH emerged as a prominent theoretic position in the mid-1960s. **Samuelson (1965)** highlighted the significance of work of Louis Bachelier, who had documented about speculation and efficiency late back in 1900. **Fama (1965)** published arguing for the random walk hypothesis while **Samuelson (1965)** published a proof for a version of the EMH using wheat prices, but generalizing for prices of different goods. **Fama (1970)** documented a review of both the theory and the evidence for the hypothesis. The paper extended and refined the theory, and included the definitions of three forms of market efficiency: weak, semi-strong and strong. The weak form states that it is not possible to predict the future price schedules using information about the previous price movements. The semi-strong form argues that prices should reflect all publicly available information including past price information, all public financial information and other relevant information that might affect asset prices while the strong form states that even non-public information is included in the asset values.

A notable recent definition for an efficient market that has been quoted very frequently by a number of authors has been presented by **Malkiel (1996)**: "A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set (…) if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set (…) implies

that it is impossible to make economic profits by trading on the basis of (that information set)." The definition includes the concept of economic gains and therefore emphasizes the difference between 'the perfect market' and 'an efficient market'. In the latter, reality can be distorted as long as participants are collectively unaware of some additional information which would lead to a different valuation, and as long as no one possesses information beyond the defined information set that would allow for a trading strategy leading to economic gains.

Over the decades numerous studies have attempted to test the EMH. Before we turn to the question of the efficiency of the real estate market in section 4, let us briefly summarize the evidence that has been collected for the financial market. Two aspects are important to mention in this context: First, the EMH cannot be tested directly but only via its implications. Second, all tests require some reference model that links the information and fundamental market conditions to asset prices. Implicitly, every test of the EMH also tests the adequacy of the underlying model. Any rejection of the EMH can therefore either result from the inefficiency of the market or the inadequate selection of the underlying model. This is what is known as the "bad model problem" **(Fama 1991)**.

After the first decade of empirical test of the EMH in the financial markets the evidence collected was strongly in support of the hypothesis. "Within a decade, the EMH was so well established that **Jensen (1978)** was prompted to write that he believed there to be 'no other proposition in economics which has more solid empirical evidence supporting it'" **(Beechey et al., 2000, p. 21)**. This valuation was mainly supported by empirical evidence in favour of the random walk hypothesis and by analysis showing that by and large managed asset funds cannot systematically outperform the market.

After thirty more years of research in the context of financial markets, the EMH appears more controversial today. The relevant evidence is summarized nicely in the review by **Beechey et al. (2000)**. They raise a number of issues that cast doubt on the efficiency of financial markets:

1. At closer inspection there seem to be some systematic tendencies in the stock market:

    a. Portfolios constructed from stocks with high earnings, cash flows, or tangible assets relative to the share price tend to produce superior returns over long horizons (value effect).

    b. Portfolios with high returns in the recent past continue to produce above average returns over a 3-12 month horizon (momentum effect).

    c. Small stocks exhibit higher average returns **(Banz, 1981)**.

2. While the EMH implies that the price of a share in a closed-end fund should reflect the value of the underlying assets, empirical evidence shows a systematic deviation. As shown by **Lee et al. (1990)**, major US closed-end funds traded at an average discount of 10 per cent between 1965 and 1985.

3. There is empirical evidence both in the stock market and in the foreign exchange market that prices are significantly misaligned for extended periods of time. In the view of **Beechey et al. (2000)** this is a major challenge for the EMH since with such misalignments the markets would send the wrong price signals for an extended period of time thus creating distortions in the economy in general. **Beechey et al. (2000)** point out that the empirical evidence in favour of the EMH does not necessarily contradict the notion of misalignments. Prices may fluctuate randomly around a misaligned mean value and when the misalignments exist for an extended period, actors in the market may not be able to benefit from that distortion.

So, after more than thirty years of empirical investigation of the EMH in the financial market the result is inconclusive. While some implications of the EMH seem to hold, others seemingly do not. With some of the technical problems involved with testing the EMH, particularly the bad model problem, the issue is far from being resolved.

Numerous contemporary researchers and academics agree that there are some other factors (than information) that can affect the market efficiency although early economists like Fama and Samuelson saw information as the prime concern when determining the

market efficiency. Existence of price cycles and the nature of the goods sold in the market are a few examples for the non-information factors. As we demonstrate later, price volatility, cycles, and bubbles could be inter-related in a specific market at a given point in time.

3. What is meant by the 'real estate market'?

The term 'real estate market' can mean different things to different people. When we talk about the efficiency of the real estate market, we have to be precise by what we mean by the real estate market. This is particularly important when reviewing empirical studies since their results may be contingent upon their definition and empirical selection of real estate market.

In economic terms it can be seen as the market where supply of and demand for real estate meet and where real estate is traded. This abstract definition leaves open a number of questions. The real estate market is typically segmented into various submarkets along different dimensions. The most important dimensions are type of real estate, space and time. An office building traded in Chicago in 1960 is clearly not in the same real estate submarket than an apartment building traded in the suburbs of Berlin in 2005. But, where are the boundaries delineating these sub-markets? How close in terms of type, location and time do transactions have to be, in order to be considered to belong to the same real estate market?

Various types of real estate exist, each of them posing specific challenges and issues for investors and analysts. Important types are: housing, office, shopping centres, industrial buildings and infrastructure real estate. A very special type that is quite different from all the others is undeveloped land. Each of these categories is quite heterogeneous in itself. "For example, the office building category includes both high-rise structures located in central business districts and one-story doctors' offices located in rural areas" (**Corgel et al., 1998, p. 173**).

When we look more closely into the housing category, for example, we find single unit and multi unit housing where in the latter case the real estate market can be viewed from the perspective of the individual units or the multi unit buildings as a whole. The results may be different whether we consider transactions of individual units or buying and selling of whole apartment buildings. At the level of the individual unit, transactions can be of different types. Transfer of ownership and rental agreements are probably the two most important ones. In the case of the rental market the question arises whether only new rental agreements represent the real estate market or also the much larger number of already existing rental agreements.

At the more aggregate level of the building, market transactions can again take place at different levels. It can be the single physical object that is traded or a portfolio of objects. In the latter case, the portfolio may consist of different types of real estate. Transactions of portfolios of real estate are often not done directly, but in some packaged form. Frequently, it is the company owning the portfolio of real estate that is traded so that other characteristics of the company may influence the deal as well. If the company is publicly listed, the trading of its shares, although obviously taking place on the financial market, can also be considered a real estate market transaction.

Since the respective submarkets are more or less related, all these differentiations by type, space, and time have potential implications for judging the efficiency of the real estate market. It can be argued that in an efficient market the prices at a more aggregate level should fully reflect the prices at the respective disaggregate level. So, the value of shares of real estate companies should reflect the value of their respective portfolios; the price of a portfolio should reflect the value of the buildings it contains; the price of a building should reflect the value of and the rent generated by its individual units. Similar arguments can be made for the relationship between types of real estate, between spatial submarkets and over time. Empirical tests of the efficiency of the real estate market typically focus on one of these aspects in one submarket. In order to judge the relevance of these empirical results, it is therefore necessary to clearly identify the focus of the respective studies. This will be done in section 4 of the paper.

4. Is the real estate market efficient?

In this section, we will review the empirical literature that deals with the question of whether the real estate market is an efficient market or not. We will focus the discussion on two major aspects related to real estate market efficiency and structure the section accordingly: information (section 4.1) and price volatility, cycles, bubbles and dispersion (section 4.2).

As has been already mentioned in section 2, market efficiency has classically been tested using either a market model or forecasting approach. In the context of real estate, for instance, **Linneman (1986)**; and **Guntermann and Smith (1987)** use the market model approach while **Gau (1984, 1985)**; **Rayburn, Devaney and Evans (1987)**; **McIntosh and Henderson (1989)**; and **Case and Shiller (1989)** utilize the forecasting approach **(Guntermann and Norrbin, 1991)**. The inability to foresee potential prices was interpreted as proof of market efficiency in the latter.

Our classification of different types of real estate property includes residential, business, commercial and land. Those researchers who examine the efficiency of the residential real estate market more often restrict themselves to the study of single family homes; nevertheless, we also came across other papers investigating efficiency of the other real estate markets such as multi-family residential, condominium, co-op housing, income generating residence, and residential construction market. The second main category of market efficiency research is based on commercial real estate properties. Most of the research undertaken on efficiency of the commercial real estate is concentrated on office, industrial or retail store markets. The central issue of efficiency of the business real estate is surrounding the REITs, builders and investments, and management firms. Only a few studies evaluate the efficiency of the land market.

Majority of the papers examine efficiency of the respective real estate markets at local or national level. In the case of US, if a particular study is based on a number of

Metropolitan Statistical Areas, i.e. MSAs (an earlier version of the MSA was the Standard Metropolitan Statistical Area (SMSA)), then we consider that to be a national level investigation since a considerable part of the country is covered. Our stock of literature has only a handful of studies that look at efficiency at the international level. The only paper on regional level was that of **Green et al. (1988)**, which compares efficiency of the inter-regional real estate markets in the US.

The focus of about two third of the real estate market efficiency tests reported here is based on different segments of the real estate market in the US. Other real estate markets tested for efficiency include several European countries (mainly UK and Sweden), and Asian countries (mainly Japan and Hong Kong). A few studies consider many countries together and look at global level efficiency or inefficiency.

Not surprisingly, most of the available literature on efficiency of the real estate market is surrounding the urban areas. We stick to the formal definition of Metropolitan Statistical areas and define them as both urban and rural (MSAs include suburban areas as well as outline counties, and some areas within the outlying counties of MSAs may be rural in nature). The only rural study we encountered was that of **Clapp and Giaccotto (1994)**, which examines the efficiency of the single family residential market in three small towns (Hartford, Manchester, West Hartford) in the US.

The studies on transaction level data (individual prices, rents, and returns etc.) and aggregate data (aggregate level prices, rents, returns, or average level prices, rents, returns) are evenly distributed. The rest of the articles investigate the efficiency phenomena at stock price level, or median price level (quite a few in number).

Our analysis covers literature on efficiency or inefficiency of the real estate market that attributes to information. These studies borrow from **Fama (1970)**, and investigate the weak form of Efficient Market Hypothesis (EMH), and the semi-strong form of EMH for various real estate markets around the world. This approach was initially used to analyse the financial market efficiency, but was used in real estate market research since the early

1980s. Some of these papers also look into the fact whether these markets reflect market fundamentals. The EMH is based on the rational expectations theory which states that if the asset price does not reflect all the information about it, then there exist profit opportunities to be exploited: someone can buy (or sell) the asset to make a profit, thus driving the price toward equilibrium. In the strongest versions of these theories, where all profit opportunities have been exploited, all prices in the markets are correct and reflect market fundamentals (such as future streams of profits and dividends).

The second category enumerates inefficiencies that originate from the cyclical behaviour (or cyclical effects) of the economy. Majority of the researchers in this category examine whether there exists price cycles in the real estate market. Real estate markets inherently are cyclical as any other market; therefore, we define real estate markets as inefficient if they have excessive cycles or volatility. In other words, the market fundamentals create natural cyclical effects, and excessive cycles or bubbles are generated when fundamental factors do not seem to justify the price of an asset. Not surprisingly, these studies use tests of market fundamentals and scrutinize price cycles, vacancy rate cycles, and supply cycles in the real estate market. In the case of the global price cycle, **Englund and Ioannides (1997)**, **Renaud (1997)**, and **Case et al. (1999)** test the phenomena of an international price cycle. We also encountered several studies that examine the existence of price bubbles.

Two additional studies report tests of real estate price dispersion. These papers usually subscribe to the Positive Feedback Hypothesis, which states that recent strengths (or weaknesses) in one submarket encourage positive (or negative) attitudes that lead to a greater than expected effect of the news on asset prices.

4.1. Information and real estate market (in-) efficiency

The relationship between information and the efficiency of the asset market has been highlighted by many scholars. **Grossman (1978)** and **Grossman and Stiglitz (1980)** articulated about the fundamental relationship between information and market efficiency

in general. They claim perfectly informationally efficient markets to be impossibility. If markets were perfectly efficient, the return to gathering information would be nil, in which case there would be little reason to trade and markets would eventually collapse. **Lo (1997)** commenting on the concept of "informational efficiency" claims that, the sequence of price changes generated by a more efficient market is more random, and the most efficient market of all is one in which price changes are completely random and unpredictable. He classifies this not as an accident, but as a direct result of many active participants in the market attempting to exploit profit from the information they have. Investors make use of even a very small piece of information, incorporate that information in to the market price, and quickly make that particular information public, eliminating the profit opportunities to other investors. For the real estate market the relationship between information and the efficiency was documented by **Kummerow and Lun (2005)**. They emphasized that the real estate industry has always been an 'information business', with high transaction costs and considerable inefficiency due to the difficulties of assessing what to do in markets where assets are heterogeneous and trading is infrequent. They further argued that better information can increase the magnitude of change of real estate cycles which will ultimately destabilise economies.

Evans (1995) demonstrates that the statistical methods or skilled assessors cannot predict property prices with reasonable accuracy. His search for the factors that lead to inefficiency seems to highlight explanations such as 'the properties are heterogeneous by nature', 'property transactions take place infrequently', and 'properties differ by location creating different markets with relatively few participants in different areas': the end result is market inefficiency due to limited information or unavailability of information. The conclusion of this analysis is the property market is not efficient and it is possible to make excess profits in the property market over the more efficient stock market.

Brown (1991) argues that the conventional arguments of market inefficiency such as property cannot easily be split up, is difficult to sell, and incurs high transaction costs only account for operational inefficiency but not allocational inefficiency. He argues that these operational imperfections could exist in other markets as well, and hence imply that

the property market can still be efficient with gross imperfections. Brown does not mean that the property market is perfectly efficient; it is rather weak form efficient. Moving in and out from the property market is difficult due to issues related with marketing and high transaction costs, nevertheless investors could divert funds to other more profitable investments without completely liquidating their property holdings.

The intrinsic structure of the real estate market itself causes inefficiencies within the real estate market (**Berrens and McKee, 2004**). They assert that the nondisclosure of real estate prices create inefficiency in the US market. If almost all the sales prices are available, and if those information is accessible by potential buyers and sellers, then the real estate market is close to informational efficiency. **Shilton and Tandy (1993)**, specifically looking at the quality of vacancy rate information, highlight another cause of inefficiency: an increased variance in the vacancy rates due to the fact that a national vendor and a local agent with national affiliations report on the same observations for the same market separately. Therefore, underlying volatility in the market, cost, and difficulty of acquiring information are highlighted as prime causes of information variance.

Tests of weak form efficiency

Two third of all the papers that test the weak form efficiency reported evidence supporting market inefficiency. Early studies of real estate market efficiency are those of **Gau (1984)** and **Hamilton and Schwab (1985)**. They test the weak form of efficiency hypothesis for the residential markets in Canada and the US respectively, and report contradicting results. Gau published that the Canadian (Vancouver) income generating residential market is efficient while Hamilton and Schwab found inefficiency in the residential market in the US. Hamilton and Schwab assert that the households failed to accurately incorporate past appreciation in their expectations as a result of the weak form efficiency of the housing market.

Research paper	Year	Type of property (Residential, business, commercial and land)	Scale (Local, regional, national or international)	Geography (US, Europe or Asia)	Urban and rural classification	Aggregation (Individual price/rent, aggregate level or stock prices)	Type of test/ investigation	Market efficiency
Gau (1984)	1984	Residential (Income generating)	Local	Canada-Vancouver	Urban	Individual level (prices)	Weak form of ME	Efficient
Hamilton and Schwab (1985)	1985	Residential	National	USA (49 MSAs)	Urban	Aggregate level (average price)	Weak form of ME	Inefficient
Guntermann and Smith (1987)	1987	Residential (Single family RE)	National	USA (57 MSAs)	Urban/ rural	Aggregate level (average price)	Weak form of ME	Efficient
Rayburn et al. (1987)	1987	Residential (Single family RE)	Local	USA- Memphis	Urban	Aggregate level (average returns)	Weak form of ME	Efficient (70-84) and inefficient (70-75)
Green et al. (1988)	1988	Residential (Single family houses)	Regional	USA (73 MSAs)	Urban/ rural	Individual level (prices)	Weak form of ME	Efficient
Case and Shiller (1989)	1989	Residential (Single family houses)	Local	USA (4 MSAs)	Urban/ rural	Individual level (repeat sales data)	Weak form of ME	Inefficient
McIntosh and Henderson (1989)	1989	Commercial (office)	Local	USA- Dallas	Urban	Individual level (prices)	Weak form of ME	Efficient
Brown (1991)	1991	Commercial	N/K	Europe- UK	N/K	Stock	Weak form of ME	Efficient
Guntermann and Norrbin (1991)	1991	Residential (Single family houses)	Local	USA- Lubbock	Urban	Aggregate level (average price)	Weak form of ME	Inefficient (Ex-post) Efficient (Ex ante)
Hosios and Pesando (1991)	1991	Residential	Local	Canada-Toronto	Urban	Individual level (repeat sales data)	Weak form of ME	Inefficient
Tirtiroglu (1992)	1992	Residential	Local	USA- Hartford	Urban/ rural	Individual level (prices)	Weak form of ME	Inefficient
Ito and Hirono (1993)	1993	Residential	Local	Asia- Japan (Tokyo)	Urban	Aggregate level (returns)	Weak form of ME	Inefficient
Gatzlaff (1994)	1994	Residential	Local	USA (4 MSAs)	Urban/ rural	Individual level (prices)	Weak form of ME	Inefficient
Barkham and Geltner (1995)	1995	Business (REITs)	National	USA/ UK	N/A	Stock	Weak form of ME	Inefficient
Capozza and Seguin (1996)	1996	Residential (Single family houses)	National	USA- 64 SMAs	Urban/ rural	Aggregate level (prices)	Weak form of ME Test of Market Fundamentals	Inefficient
Clayton (1998)	1998	Residential (Condominium)	Local	Canada-Vancouver	Urban	Aggregate level	Weak/ semi-strong forms of ME	Inefficient
Wang (2004)	2004	Residential (co-op housing)	Local	USA- Manhattan	Urban	Aggregate level	Weak form of ME Test of Market Fundamentals	Inefficient
Rosenthal (2006)	2006	Residential	National	Europe- UK	Urban/ rural	Individual level (prices)	Weak form of ME	Efficient
Larsen and Weum (2007)	2007	Residential	Local	Europe- Norway (Oslo)	Urban	Individual level (repeat sales data)	Weak form of ME	Inefficient

The results of the weak form efficiency test reported by **Guntermann and Norrbin (1991)** argue that the real estate market is inefficient, although infrequent trade in property, unique attributes of real property, the local orientation of the market requiring specialized knowledge of the factors that affect risk and return, transaction and financing costs and, tax considerations make exploiting profits a difficult task. They suggest that the real estate market may be efficient ex ante when an estimate of expected appreciation is included using a market model into the tests of market efficiency.

Wang (2004) states heterogeneous nature of the properties and lack of transaction information may not be the direct source of market inefficiency even though **Kummerow and Lun (2005)** and many others accept that the heterogeneous nature of the housing units makes the real estate market inefficient. An argument in support of house price cycles from the supply side was presented by Wang. He investigates the weak efficiency of the urban co-op residential market and the causes of weak efficiency. The formal weak form efficiency test is rejected, and Wang claims that the supply constraints bring about inefficiency.

Rosenthal (2006) argues that nominal house price inflation in the UK is difficult to predict in real time at a spatially disaggregated level. This particular investigation adjusts for the costs of housing purchase, housing transaction Stamp Duties and the lengthy delays involved, and empirically verifies weak efficiency in the owner–occupier sector of the UK.

Ito and Hirono (1993) compare returns of the housing market in Tokyo and investments in financial instruments. They explain that housing investments generate higher yielding over the investments in financial instruments, therefore, reject the weak-form efficiency of excess returns on housing. This study does not rule out the possibility of not rejecting the weak-form efficient market hypothesis from one year to the next.

According to **Barkham and Geltner (1995)**, prices of the real estate stocks are determined first in the securitized markets in both England and the USA. It will take up to

one year or more to fully transmit the information into the unsecuritized markets. They conclude that the unsecuritized property markets appear not to be informationally efficient, having some degree of predictability by the securitized returns, and taking a long time to incorporate information available to the asset prices. Their findings also suggest that the public securitized commercial real estate markets are more informationaly efficient than the private unsecuritized markets given the recompense of information collection with regard to trading concentration, liquidity and micro-structure. Barkham and Geltner advocate an increase in buying and selling of houses for investment purposes and publication of all transactions prices would help improving the efficiency of the market. They further reiterate that development of housing "futures" contracts tradable in liquid public markets as suggested by **Shiller (1993)** would ease the issue for some extent.

In addition to testing the weak form efficiency of the housing market, **Gatzlaff (1994)** examines the possible effects of unexpected inflation on estimates of excess return using two different models of expected inflation: a rational expectations model and an adaptive expectations model. The results state that both estimates of unexpected inflation are positively correlated with excess returns to housing, nevertheless the serial correlation is greatly diminished when the unexpected inflation component of the return to housing market is eliminated assuming adaptive inflation.

Case and Shiller (1989), **Hosios and Pesando (1991)**, and **Larsen and Weum (2007)** utilize price indices based on the repeat sales of identical units (repeated-sales models), and report first order autocorrelation for the single-family housing market. This kind of studies usually extend to evaluate how the price history of returns that include capital gains, dividends, and interest payments can be exploited to predict future returns. These papers investigate efficiency of the residential markets in the US, Canada (Toronto), and Norway (Oslo) respectively, and reject the efficient market hypothesis.

A study of price appreciation of single-family houses was conducted by **Capozza and Seguin (1996)**. One of the arguments presented here is that observed equilibrium

component in rent-to-price ratios that varies across different metro areas could forecast subsequent appreciation rates for some extent. If cross-sectional differences in the quality of rental and owner-occupied housing are controlled for, then the expectations included in the rent-to-price ratio at the beginning of the decade successfully predict appreciation rates. The study provides evidence against real estate market efficiency due to high transaction costs, capital constrains and availability of a large volume of information in the real estate sector.

The spatial dimensions are considered along with the temporal dimensions in the efficiency test of **Tirtiroglu (1992)**. This study links the traditional weak form efficiency test with a test of price dispersion. The initial model of this study focuses on possible contemporary spatial interactions among the sample towns, and an extended model examines the temporal effects of this process of spatial influence on house values. This study uses the traditional time series asset pricing model, but also examines the correlation between percentage housing price changes for individual towns and average percentage housing price changes in neighbouring towns to capture spatial effects into the model. The correlation found supports a spatial diffusion pattern: a significant correlation between house prices in neighbouring towns (not between non-neighbouring towns).

Tests of semi-strong form efficiency

The results of the semi-strong form tests of real estate market efficiency are inconclusive. Approximately similar support is evident for both notions of efficiency and inefficiency while a few studies report mixed results.

An early study of real estate market efficiency based on the EMH was that of **Linneman (1986)** which uses cross sectional data to support the inefficiency argument. **Gau (1987)** argues that the real estate market is efficient. While ascertaining the fact that there are market imperfections in the real estate market, this study argues that the real estate market is still efficient given the "value-influencing" information is effectively capitalized into the prices.

Research paper	Year	Type of property (Residential, business, commercial and land)	Scale (Local, regional, national or international)	Geography (US, Europe or Asia)	Urban and rural classification	Aggregation (Individual price/rent, aggregate level or stock prices)	Type of test/ investigation	Market efficiency
Gau (1985)	1985	Residential (Income generating)	Local	Canada- Vancouver	Urban	Individual level (prices)	Semi-strong form of ME	Efficient
Linneman (1986)	1986	Residential	Local	USA- Philadelphia	Urban/ rural	Individual level (prices)	Semi-strong form of ME	Inefficient
Skantz and Strickland (1987)	1987	Residential	Local	USA- Houston	Urban	Individual level (repeat sales data)	Semi-strong form of ME	Efficient
Ford and Gilligan (1988)	1988	Residential	Local	USA- Baltimore	Urban	Individual level (prices)	Semi-strong form of ME	Efficient
Darrat and Glascock (1989)	1989	Business (REITs, builders and investments, and management firms)	National	USA	N/A	Stock	Semi-strong form of ME	Inefficient
Delaney and Smith (1989)	1989	Residential (Single family houses)	Local	USA- Dunedin	Urban	Individual level (prices)	Semi-strong form of ME	Efficient
Mankiw and Weil (1989)	1989	Residential	National	USA	Urban/ rural	Aggregate level (prices)	Semi-strong form of ME Test of Market Fundamentals	Inefficient
DiPasquale and Wheaton (1990)	1990	Residential (Single family houses)	National	USA	Urban/ rural	Aggregate level (prices)	Semi-strong form of ME	Efficient
Turnbull et al. (1990)	1990	Residential (co-op housing)	Local	USA- Baton Rouge	Urban	Individual level (prices)	Semi-strong form of ME	Efficient
Case and Shiller (1990)	1990	Residential (Single family houses)	Local	USA (4 MSAs)	Urban/ rural	Individual level (repeat sales data)	Semi-strong form of ME Test of Market Fundamentals	Inefficient
Evans and Rayburn (1991)	1991	Residential (Single family houses)	Local	USA- Memphis	Urban/ rural	Aggregate level (average price)	Semi-strong form of ME	Efficient
Voith (1991)	1991	Residential/ commercial/ mixed used	Regional	USA	Urban/ rural	Individual level (rent)	Semi-strong form of ME	Efficient
Poterba (1991)	1991	Residential	National	USA	Urban/ rural	Median prices	Semi-strong form of ME Test of Market Fundamentals	Inefficient
Gyourko and Keim (1992)	1992	Residential/ office/ industrial/ business	National	USA	Urban/ rural	Individual level (prices)	Semi-strong form of ME	Inefficient

Darrat and Glascock (1993)	1993	Business (REITs, builders and investments, and management firms)	National	USA	N/A	Stock	Semi-strong form of ME	Efficient
Clapp and Giaccotto (1994)	1994	Residential (Single family houses)	Local	USA- Hartford, Manchester, West Hartford	Rural	Individual level- repeat sales data	Semi-strong form of ME Test of Market Fundamentals	Inefficient
Meese and Wallace (1994)	1994	Residential	Local	USA- Northern California	Urban/ rural	Individual level (prices)	Semi-strong form of ME Test of Market Fundamentals	Efficient (Long run)/ Inefficient (Short run)
Ito and Iwaisako (1995)	1995	Land	National	Asia- Japan	Urban	Aggregate level (average price)	Semi-strong form of ME Existence of price bubbles	Efficient/ Inefficient
Barkham and Geltner (1996)	1996	Residential	National	Europe- UK	Urban/ rural	Aggregate level (average price)	Semi-strong form of ME	Inefficient
Abraham and Hendershott (1996)	1996	Residential	National	USA (30 MSAs)	Urban/ rural	Individual level (repeat sales data)	Semi-strong form of ME Existence of price bubbles	Inefficient
Clayton (1998)	1998	Residential (Condominium)	Local	Canada- Vancouver	Urban	Aggregate level	Weak/ semi-strong forms of ME	Inefficient

The results of the research conducted by **Darrat and Glascock (1993)** provide evidence that the real estate market is efficient. Darrat and Glascock uncover the relationship between current real estate prices and historical information on fiscal and monetary policy and other financial variables. Their conclusion was that the real estate market is efficient with respect to available information on the industrial production, the risk premium, the return structure of interest rates, and the monetary base. The study also reveals that movements in these variables are quickly and fully utilized by market agents, the major reason being that the relationship between real estate and their stock returns has been published in the media and the research literature.

Case and Shiller (1990) utilize a residential price index calculated using weighted repeat sales methodology for Atlanta, Dallas, Chicago, and San Francisco, and find strong serial correlation in house prices. They use a sample of micro-level transaction data for the years 1970-1986 to demonstrate that the housing market is inefficient, and that inefficiency arises from the possibility to predict future prices based on the currently available information on economic fundamentals including past price, ratio of construction costs to prices, real per capita income growth, and changes in the adult population.

Barkham and Geltner (1996) state that the real estate market is inefficient if returns are predictable compared to returns in another market. They compare monthly data on the housing market and stock market returns. The results of their investigation demonstrate that the returns in the UK housing market could be anticipated for a certain degree by returns to certain securities on the UK stock market.

Gyourko and Keim (1992) evaluate the relationship between returns on traded real estate shares (REITs) and returns in the private real estate markets. They state that the lagged values of traded real estate investment trusts (shares) can be used to forecast returns on a standard appraisal-based index making the real estate market inefficient. The relationship is possibly caused by the fact that the stock market information on real estate markets is later imbedded in infrequent property appraisals. They also highlight the fact

that the firms in a securitized real estate market are heterogeneous by nature creating further inefficiencies in the market.

Voith (1991) tests efficiency by looking at whether the rent market is responsive to the new information. The significance of this study is that local and regional attributes and distinction between residential, commercial, and mixed-use communities are taken into consideration. The study finds evidence that rents vary both inter-regionally and intra-regionally. The investigation finds proof that in locations with both residences and firms, wages and rents are jointly determined as opposed to residential locations. In exclusively residential locations the rents are conditionally determined by the equilibrium regional wage. The conclusion emphasizes that the regional attributes and the local attributes significantly affect rents, and higher wages can result in higher rents in both residential and mixed-use localities.

Evans and Rayburn (1991) have shown that the effects school desegregation decisions possibly are incorporated into the single-family house prices. The methodology used in this study involves computing monthly mean prices per square foot for residences in Memphis and Tennessee over 15 years. The ratio of the mean prices follows a stochastic process, but is interrupted by four decisions related to school desegregation with different racial characteristics. This signifies that the ratio of the mean prices reflects the time patterns of differential impacts of school desegregation events on the neighbourhoods of the two respective cities.

The test of market efficiency conducted by **Delaney and Smith (1989)** evaluates whether the publicly available information about government impact fees are capitalized into the house prices. The study tests possible consequences of the impact fee charged by the city of Dunedin in 1974 on new single-family home sale prices in Dunedin and three other cities in Pinellas County from 1971 to 1982. They evaluate the nature of the fee structure in Dunedin, adjustments in factor costs, increases in the price of housing in competing cities, and unrealized expectations regarding the benefits to be provided by impact fee collections. The paper concludes reporting that the builders pass on the total cost of

government fees to new home buyers throughout the proceeding six years in the city of Dunedin.

Ford and Gilligan (1988) report that the information on lead paint abatement laws has been incorporated into the rental property values in Baltimore. The homeowners have two available options if the forced abatement is in place: either comply or sell their properties. The cost of abatement would need to be greater than the discounted value of future rent streams for the property to be removed from the rental market. This paper shows that these costs have already been discounted into property values, and this value in most cases is less than the value of the rental property, thus, the forced abatement did not result in property abandonment.

The purpose of the investigation by **Skantz and Strickland (1987)** is to examine whether a flood on a previously un-flooded subdivision can cause an impact on the house prices in that respective area. The study reported that there was no decline in house prices immediately following the floods, but house prices started to decline after one year. The possible reason for this is that the flood insurance rates were substantially increased approximately in one year, and this information was absorbed into the home prices. Therefore, consistent with the efficient market hypothesis, the real estate market is sensitive to the publicly available information.

The only available semi-strong form efficiency test on the urban co-op market is that of **Turnbull et al. (1990)**, which tests the efficiency of the Baton Rouge area co-op market. Consistent with the efficient market hypothesis, the empirical results of the homogeneity test demonstrate that corporate houses are not sold for less than the price charged by individuals despite the popular perception that these corporations sell the houses at a discount as a part of the employee relocation process. Based on the argument that identical houses might have the same expected sales price, they arrive at two possible explanations: 1. any available discounts could leave opportunity for arbitrage, hence contradicting to the concept of market efficiency; 2. it is unlikely that the corporations would be willing to accept lower prices compared to the individuals.

Gau (1985) and **Clayton (1998)** agree that the Vancouver real estate market is inefficient based on a perceived set of market imperfections including capital constraints faced by investors due to expensive and heterogeneous nature of real estate assets. These imperfections may limit incorporation of information into asset values. Clayton further argues that many local housing markets in North America have undergone boom and bust cycles in recent years due to excess speculation during real estate market up-swings caused by intangible expectations leading prices to be placed ahead of built-in or fundamental value. Therefore, based on Clayton, irrational house price expectations and investor psychology lead the market in to inefficiency. Clayton's study of condominium apartment prices suggests that the future returns can for some extent be predicted observing lagged annual returns, and a measure of the divergence of price from fundamental value of an asset.

Poterba (1991) and **Mankiw and Weil (1989)** argue that the entry of baby boomers into the housing market affected house prices. Three alternative explanations for price movements have been presented by Poterba: possible systematic changes in construction costs, favourable and unexpected demand shocks resulting from the interaction of unanticipated inflation and the tax system, and the entry of a large cohort of baby boomers into the housing market (demographic view). The results indicate that changes in construction costs and income have a significant impact on real house price changes than the demographic factor. Poterba's findings support the view that house price movements are predictable using past information on fundamentals including house price appreciation and changes in real per capita income. The study completed by Mankiw and Weil states entry of the baby boom generation into the housing market increased real house prices while entry of the baby bust generation in the 1990s slowed the rate of increase in demand. To the Efficient Market Hypothesis to hold, the demographic changes should not affect the asset prices, because they are forecastable. Therefore, Mankiw and Weil argue, naive expectations better determine house prices than the predictable fundamentals.

Clapp and Giaccotto (1994) explore the relationship between different methods used in measuring house price indices and economic determinants of house prices. Changes in house prices are measured using the repeat sales method as well as the assessed value method, and both price indices are related to economic variables including expected inflation and unemployment related factors. They ascertain that these variables have the ability to considerably forecast house price changes, and oppose to the Efficient Market Hypothesis.

Ito and Iwaisako (1995) demonstrate that the land market in urban Japan has efficiencies as well as inefficiencies while **Meese and Wallace (1994)** argue the residential market in Nothern California may be efficient in the long run, but is inefficient in the short run. In addition to testing the semi strong form version of the EMH, **Ito and Iwaisako (1995)** and **Meese and Wallace (1994)** acknowledge the presence of a price bubble.

An examination of whether the booms in the asset prices are explained by changes in the fundamentals such as growth of the real economy or interest rates was conducted by **Ito and Iwaisako (1995)**. They evaluate stock and land price behaviour during the bubble economy period (the second half of the 1980s) in Japan. One of their findings is that the asset price increases from mid-1987 to mid-1989 cannot be fully explained by the changes in the fundamental values alone despite the fact that the real economy was doing well and the interest rates were still low. Findings that favour the EMH include; sharp increase in bank lending caused the initial increases of asset prices, and there is a relationship between the stock and land prices (there is a relationship between the collateral value of land and cash flow for constrained firms).

Meese and Wallace (1994) examine the efficiency of residential housing market by evaluating price, rent, and cost of capital indices. Using transaction level data for Alameda and San Francisco counties, the investigation arrives at two conclusions on the short run and the long run scenarios: reject the housing price present value relation in the short run owing to large transaction costs, and accept that in the long run (after adjustment in the discount factor for changes in the tax rates and borrowing costs).

Nonetheless, they do not leave out the possible distortions resulting from irrational expectations and asset market bubbles.

4.2. Tests of efficiency using market fundamentals

Efficiency tests dealing with market fundamentals without direct reference to three versions of the EMH are examined in this section. There are numerous studies addressing the issues of price volatility, bubbles, cycles, and price dispersion in the real estate market. If the prices are determined by the movements of economic fundamentals, then these studies define that as evidence supporting market efficiency. For instance, even a simple lagged supply response to price changes is sufficient to generate real estate cycles, but such pricing is not assumed to be inefficient, because, it is excess volatility which creates bubbles that lead to market inefficiency. Shiller (1990a) argues that speculative asset prices tend to show excess volatility relative to models of market efficiency using the simple present value approach, and the speculative prices are partly predictable due to the tendency to return to the mean values. He further notes that most of the evidence confirms substantial excess volatility in the asset markets. If stock prices are strongly correlated with dividends, then it could be concluded that the movements in stock prices are driven by fundamentals irrespective of whether the speculative prices are too volatile or not. Therefore, presence of excessively volatile prices, bubbles or cycles created as a result of speculation, or price dispersion would imply there are inefficiencies in a market. The readers should bear in mind that price volatility, bubbles, and cycles could be interrelated and could co-exist in a specific real estate market.

Price volatility, price cycles, and price bubbles

Malpezzi and Wachter (2005) describes if prices are apparent, participants have good information about at least present prices. In illiquid markets like real estate markets, the costs of ascertaining prices can be costly, and therefore, these prices can be volatile. Moreover, activities of the short-term investors who do 'short selling' contribute to price volatility. When the prices are volatile, it becomes difficult to be informed about all the

Research paper	Year	Type of property (Residential, business, commercial and land)	Scale (Local, regional, national or international)	Geography (US, Europe or Asia)	Urban and rural classification	Aggregation (Individual price/rent, aggregate level or stock prices)	Type of test/ investigation	Market efficiency
Rosen (1984)	1984	Commercial (office)	Local	USA- San Francisco	Urban	Aggregate level (average rent)	Existence of price cycles	Inefficient
Fogler, Granito and Smith (1985)	1985	Residential/ commercial	National	USA	Urban/ rural	Individual level	Existence of price cycles	Inefficient
Hekman (1985)	1985	Office (construction)	Local	USA- 14 cities	Urban	Aggregate level (average rent)	Existence of price cycles	Efficient
Park, Mullineaux, and Chew (1990)	1990	Business (REITs)	National	USA	N/A	Stock	Existence of price cycles	Inefficient
Pollakowski and Wachter (1990)	1990	Residential/ land	Local	USA- Montgomery	Urban/ rural	Individual level (prices)	Existence of price cycles	Inefficient
Borio, Kennedy, and Prowse (1994)	1994	Residential/ commercial/ business	International	Major industrialised countries	Urban/ rural	Aggregate level	Existence of price cycles	Inefficient
Born and Pyhrr (1994)	1994	Residential (construction)	Local	USA- Houston	Urban	Aggregate level (prices)	Existence of price cycles	Inefficient
Jaffee (1994)	1994	Residential/ commercial	National	Europe- Sweden	Urban/ rural	Aggregate level	Existence of price cycles	Efficient
Atterhog (1995)	1995	Land	International	Asia- South Asia/ South East Asia	Urban	City case study approach	Existence of price cycles	Inefficient
Clayton (1996)	1996	Commercial	National	Canada	Urban/ rural	Individual level (returns)	Existence of price cycles	Inefficient
Björklund and Söderberg (1999)	1999	Commercial (office)	National	Europe- Sweden	Urban/ rural	Aggregate level (rents)	Existence of price cycles	Inefficient
Malpezzi (1999)	1999	Residential	National	USA	Urban/ rural	Individual level (prices)	Existence of price cycles	Inefficient
Wheaton (1999)	1999	Commercial	National	USA (54 MSAs)	Urban/ rural	Aggregate level	Existence of price cycles	Inefficient
Case (2000)	2000	Residential/ commercial	National	USA	Urban/ rural	Aggregate level	Existence of price cycles	Inefficient
Fu and Ng (2001)	2001	Residential/ commercial	Local	Asia (Hong Kong)	Urban	Individual level (prices)	Existence of price cycles	Inefficient
Capozza et al (2002)	2002	Residential	National	USA (62 MSAs)	Urban/ rural	Median prices	Existence of price cycles	Inefficient
Salama et al (2002)	2002	Residential	Local	USA- New York	Urban	Aggregate level	Existence of price cycles	Inefficient
Salins (2002)	2002	Residential	Local	USA- New York	Urban	Aggregate level	Existence of price cycles	Inefficient
Ball (2006)	2006	Residential	International	Europe	Urban/ rural	Aggregate level	Existence of price cycles	Inefficient
Scott (1990)	1990	Business (REITs)/ commercial (land)	National	USA	N/A, Urban/ rural	Stock/ Individual level (prices)	Existence of price cycles Test of market fundamentals	Inefficient

Study	Year	Property type	Scope	Location	Area	Level	Test	Result
Meese and Wallace (2003)	2003	Residential	Local	Europe- France (Paris)	Urban	Individual level (prices)	Existence of price cycles Test of Market Fundamentals	Efficient/ Inefficient
Malpezzi and Wachter (2005)	2005	Land	N/A	N/A	N/A	Aggregate level	Existence of price cycles Test of Market Fundamentals	Inefficient
Kummerow (1999)	1999	Commercial (office)	N/A	N/A	N/A	Individual level	Existence of supply cycles	Inefficient
Wheaton (1987)	1987	Commercial (office)	National	USA (10 MSAs)	Urban/ rural	Average vacancy rates	Existence of vacancy rate cycles	Inefficient
Gordon et al. (1996)	1996	Commercial (office)	National	USA (31 MSAs)	Urban/ rural	Average vacancy rates	Existence of vacancy rate cycles	Inefficient
Wheaton and Rossoff (1998)	1998	Commercial (industry)	National	USA	Urban/ rural	Aggregate level	Existence of vacancy rate cycles	Efficient (demand side)/ Inefficient (supply side)
Shiller (1990b)	1990	Residential	Local	USA- Anaheim, San Francisco, Boston, and Milwaukee	Urban	Aggregate level (average price)	Existence of price bubbles	Efficient/ Inefficient
Case and Shiller (2003)	2003	Residential	National	USA	Urban/ rural	Median prices	Existence of price bubbles	Efficient (1995-) Inefficient (1988,2003)
Englund and Ioannides (1997)	1997	Residential (Single family houses)	International	15 OECD countries	Urban/ rural	Aggregate level (prices)	Existence of international price cycle	Efficient
Renaud (1997)	1997	Residential/ office/ industrial/ business	International	USA, Europe, Asia and Latin America	Urban/ rural	Aggregate level (prices)	Existence of international price cycle	Inefficient
Case et al. (1999)	1999	Commercial	International	21 countries	Urban	Aggregate level (returns)	Existence of international price cycle	Efficient

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prices unless there is a continuous flow of accurate information. The erroneous expectations of the investors who are based on adaptive expectations or extrapolations also cause price volatility. If the past price increases were extrapolated in formulating expectations (speculation), then this is likely to lead to classic speculative bubbles, because optimistic investors are speculating on a continuation of price appreciation without cyclic effect from the demand or supply fundamentals. They also argue that the speculation strongly related to supply conditions contributes to boom and bust cycles in housing and real estate markets.

Malpezzi and Wachter (2005) have empirically argued that real estate speculation is linked to volatility in land prices, and in turn to the elasticity of supply. The effects of speculation appear to be dominated by the effect of the price elasticity of supply, and the largest effects of speculation are only observed when supply is inelastic.

Malpezzi and Wachter (2005) also explain how the weak form efficiency contributes to price cycles. They draw from the "Random walk" hypothesis, and maintain that the weak definition of EMH dominates in the contemporary literature. Accordingly, the changes in the asset price follow a random pattern and the future prices cannot be predicted based on past price information, and as a result, neither excess investment profits nor incentive for speculation be available. Nevertheless, there is enough evidence that the real estate markets are far from perfectly efficiency. Malpezzi and Wachter further argue that when there is perfect or near perfect information, there is a room for speculation, because excess profits could be earned by the investors who know how the other investors value real estate based on prevailing market conditions.

In addition to **Malpezzi and Wachter (2005)**, **Borio et al (1994)**, **Case et al (1997)**, and **Wheaton (1999)** published that the real estate prices are by their nature prone to cycles. **Atterhog (1995)** suggests that real estate prices and rent growth expectations are central to the pricing of real estate, and the primary factor causing these cycles is the speculation. However, there are many other determinants of cycles available. Demographic and economic fundamentals, financial conditions and banking policies, and supply conditions,

such as natural geography and the regulatory environment for development are a few among them (**Pollakowski and Wachter, 1990**; **Malpezzi, 1999**; and **Case, 2000**).

Following the findings that real estate assets may be a hedge against unanticipated inflation (**Park et al., 1990**), and real estate assets may not reflect market fundamentals (**Scott, 1990**), **Fogler et al. (1985)** advocate that the real estate may have exhibited high returns due to unexpectedly high inflation and that investors' perception plays an important role in causing possible anomalies. These anomalies could create volatility or dispersion in house prices which in turn lead the real estate market in to inefficiency.

In his recent book, **Ball (2006)** has offered an empirical explanation about house price cycles. He acknowledges that several European countries have seen significant hikes in real house prices over the past two decades, particularly Spain, Ireland, the Netherlands, the United Kingdom and Belgium. The irregularity of house price cycles shows through in house price volatility. Price volatility for the countries varies considerably over time, which suggests that these housing markets are inefficient. He further ascertains several factors including increasing shortage of land, rising costs of house-building (slower relative productivity growth or mounting skill shortages), and failure to take account of housing quality changes affect the long-run house prices those causing the house price cycles.

Fu and Ng (2001) noted that several features of the real estate market typically prevent rapid price adjustment. Momentous search time and cost required to match buyers and sellers and nonexistence of short selling make it hard for the investors to act on market news immediately. On the other hand, the transactions in the real estate market are decentralized making it costly to gather information. Moreover, using Hong Kong real estate and stock market data, they found that the quarterly real estate price incorporates only about half the effect of market news, whereas the quarterly stock price incorporates the news fully. Hong Kong has one of the most efficient real estate markets in the world, yet real estate returns in Hong Kong exhibit very similar features documented in other

countries such as high serial autocorrelation, relatively low volatility and low correlation with stock market returns.

The conclusion of the investigation by **Clayton (1996)** states that the risk premium on unsecuritized commercial real estate varies over time and is strongly related to general economic conditions. The author finds evidence that the time variation in real estate risk is partly predictable, and thus can be of help in forecasting future movements in commercial property values. The analysis supports the argument that changes in commercial property prices are driven more by changes in expected returns over the changes in current and expected future property income in periods surrounding major market movements.

Kummerow and Lun (2005) add that endogenous real estate cycles are caused mostly by information problems- asymmetric information, forecasting difficulties, and strategic uncertainty. They demonstrate that the property oversupply cycles in the mid-1970s, late-1980s and late-1990s, in the US were associated with recessions. The price collapses caused by real estate oversupply cycles have a multiple effect when it comes to writing down the real estate loans by the banks. The total loan amount in the economy is cut down by the banks by ten times the written off value to restore capital adequacy ratios. As a result, money circulation in the economy goes down and the tendency to make high-risk loans goes up.

In the approach for property valuation introduced by **Born and Pyhrr (1994)**, the authors acknowledge there exist property cycles, and they are integrated into the traditional income approach to real estate valuation. This particular approach what they termed a 'cycle valuation model' investigates linkages between real estate supply and demand cycles, equilibrium price cycles, inflation cycles, rent rate catch-up cycles, and property life cycles. The study further explains the effects of cash flow variables on these cycles, and shows the significant impact these cycles have on asset value. They compare the cycle model with the traditional valuation model, and state that appraisers should

incorporate cycle impacts into the valuation models to produce realistic present value estimates.

A study by **Hekman (1985)** argues otherwise. This study of property cycles in the office construction market examines rental price adjustments and investment response. The author records that both local as well as national economic conditions have an impact on the market rents. The study measures investment by building permits, and conclude investment responds strongly to determine rent. Surprisingly, this study does not reveal any cyclical characteristics of the market: the author justifies the fact that the effects of random demand shocks are not felt beyond the normal construction period.

The study of movements in the office market by **Rosen (1984)** provides additional evidence to support the cyclical behaviour of the real estate market. He states that the traditional methodology available for analyzing future commercial real estate market conditions relies on concepts such as vacancy rates and market absorption rates. These concepts usually rely on accounting type and trend analysis to provide forecasts of space demand. Rosen maintains that the variables in the office building sector are cyclical, and introduces a methodology which involves developing a statistical model of supply and demand to forecast the key variables in the office market.

Capozza et al. (2002) has tested two hypotheses for serial correlation of prices; information explanation and supply-based explanation. The initial investigation involves directly modelling the roles of information dissemination, supply constraints, and backward looking expectation formation about market dynamics. Population and real income are used as proxies of information cost. The results do not favour the information explanation but support the supply based argument. Supply constraints create a cyclical movement, which indicates that the real estate market is inefficient.

The studies completed by **Salins (2002)** and **Salama et al. (2002)** demonstrate the role of supply constraints in creating market inefficiencies. Both these studies report that the Manhattan real estate market is highly regulated and the infamous zoning policy and

approval procedure make it very costly for developers to supply additional apartments in response to the increase in demand. The home seekers are required to buy a certain amount of shares of the cooperation holding the houses before the right to live in the co-ops is being granted, so the approval procedure and the strict review process to evaluate the qualification of the potential buyer takes a long time. The market microstructure and the implicit transaction cost play a major role in the course of market inefficiency.

The Swedish real estate crisis during the 1980s and 1990s has been analyzed by **Jaffee (1994)**. The study covers the duration from the early 1980s up to the 1990s. This analysis takes in to account changes in numerous macroeconomic factors including real income growth, real interest rates, financial deregulation (loan availability), tax rates applicable for mortgage interest deductions, and housing subsidies. Jaffee agrees that there exists price cycles, although maintain that they were purely driven by changes in fundamental factors. He further argues that there was no speculative bubble due to the investors' expectations that the asset prices would keep rising.

A subsequent study by **Björklund and Söderberg (1999)** raises concerns regarding the results reported by **Jaffee (1994)**. Björklund and Söderberg show that significant price increases occurring during the up-phase of the property cycle can be explained by a speculative bubble. They propose to use the Gross Income Multiplier (GIM) as a simple and informative measure of the stages of the property cycles. The GIM is able to track disparities in the relation between real estate prices and fundamentals that would lead to a speculative bubble. The findings provide evidence supporting market inefficiency. They indicate that the Swedish market for income real estate may have been partly driven by a speculative bubble during the 1980s.

The paper by **Meese and Wallace (2003)** compares two methods of price modelling to explore possible relationship between market fundamentals and house prices. First method involves estimating a house price index and then using it in subsequent structural modelling to evaluate the effect of market fundamentals on housing price dynamics. The second method is a filter strategy that allows for the simultaneous estimation of the

parameters of a dynamic hedonic price model, the price index and the parameters of a structural model for housing prices. They confirm that both methodologies produce similar results suggesting that economic fundamentals restrain movements in Parisian dwelling prices over longer-term horizons.

There are several studies that examine efficiency arising from vacancy rate cycles. **Gordon et al (1996)** measure the volatility in office vacancy rate, and identify those economic factors that underlie the risk of persistent vacancy rates in the metropolitan markets. The investigation reveals that volatility of office vacancy rates are likely to be affected by availability of capital in the long run even though the capital flows may not be spread evenly among different cities. The results emphasize that the market-specific demand-side factors including expected and unexpected employment growth, the economic base of the area, the cost of doing business, and the development restrictiveness of the area appear to have a dominant influence during the periods that follow excess construction.

There was a recurrent ten to twelve year cycle in the U.S. office building construction market for the period after the Second World War (**Wheaton, 1987**). This study of commercial real estate market arrives at several conclusions including; 1. Long run expectations play a crucial role in market behaviour resulting in slow clearing of the office market; and 2. Market conditions depend mainly on supply than on demand. The author further suggests, based on a six-year forecast, that the over-supply prevailed in the late 1980s would take a longer time to quit than similar excess supply situations in the past.

The paper completed by **Wheaton and Rossoff (1998)** examines the relation between the macroeconomy and the movements of demand and supply in the hotel market. The authors define a longer run cyclical component if the hotel market does not move closely with the overall economy. This study acknowledges that the hotel industry in the U.S. experienced two large building booms from 1969 to 1994, nevertheless argues that the demand for hotel night moves closely with the macroeconomic conditions specially with

the U.S. GDP. On the other hand, room rental rates and new hotel investments show little or no connection to macroeconomic fluctuations. The structural model utilized in this study demonstrates long lags between occupancy and room rental rates and, room rental rates and supply, creating instability in the hotel market.

Supply cycles in the real estate market are a major source of inefficiency **(Kummerow, 1999)**. He believes that the Australian office oversupply in the 1990s contributed to the recession. Supply mistakes create the real estate market inefficient which ultimately leads to instability and inefficiency of the overall economy.

The well known phenomenon of price cycles in the housing market is examined at international level by **Englund and Ioannides (1997)**. They compare dynamics of single-family housing prices in 15 OECD countries based on the observation that data reveals a remarkable degree of similarity across countries. The results suggest; 1. A significant negative autocorrelation for the real house prices up to the fifth lag with movements around the trend, and 2. A very significant correlation between the house prices along with the first-order lag and the GDP growth rate and the rate of change in real rate of interest. Even though the house price dynamics in different countries seem to be inter-dependent, the study concludes with weak support for the existence of an international property cycle.

Case et al (1999) use global property returns from 1987-1997 to explore the factors influencing the simultaneous movement of global real estate markets. They observe that country-specific GDP changes help explain substantial amount of the variation in real estate returns, and suggest that the international property returns could be attributed, to some extent, to changes in GDPs in respective countries. This will result in a cross-border correlation of real estate due in part to common exposure to fluctuations in the global economy. In other words, this study explains that fundamental economic variables which are correlated across countries can determine real estate prices for a substantial extent. In some countries, local factors explain considerably more variation of real estate returns

than do global factors confirming the common knowledge that real estate is fundamentally local.

The phenomenon of global real estate crash is explained by **Renaud (1997)**. He maintains that the global real estate crisis is a consequence of the internationalization of the financial system. The article discusses the factors that may have generated a global real estate cycle and their possible consequences. The author presents a strong case for the presence of a global real estate cycle from 1985 to 1994. According to the study, a real estate boom was evident after 1985, the boom peaked around 1989, and the asset prices depressed and output tapered subsequently in many countries.

Case and Shiller (2003) present empirical evidence related to price bubbles in the housing market. They establish that elements of a speculative bubble including the strong motive for investment, high expectations of future price increases, and the strong influence of word-of-mouth discussion were present in the single-family residential market at least in some cities in the US. The study states, market fundamentals drove the home price increments from 1995 in many cities in the US, and the income growth and falling interest rates in a number of states explained the entire increase in the house prices. Nevertheless, findings prove existence of bubble elements as well. The study utilizes U.S. state-level data to analyze the relationship between home prices and market fundamentals, followed by a questionnaire survey of people who bought homes in 2002 to identify any available bubble indicators. The comparison of fundamental measures of bubble activity in 1988 and 2003 demonstrates that the indicators of bubble for the year 2003 are, in general, strong as those indicators in the 1988 house price bubble.

A study by **Shiller (1990b)** not only attempts to understand speculative markets, but also explains the idea brought about by rational expectation models. The dominant qualitative methodology used here is the questionnaire survey. The respondents were asked what explained recent changes in home prices in their respective cities, and for any events that they thought might have changed the trends in housing prices: not a single person from among the respondents cited any changes in fundamentals. The quantitative evidence

about future trends in supply or demand, or professional forecasts of future supply or demand were not of interest. The main reason cited as the prime motive for buying homes in boom cities was the speculative considerations at local level.

Price dispersion and Positive-feedback hypothesis

There are several studies that resort to Positive-feedback Hypothesis in explaining the efficiency of the real estate market. **Pollakowski and Ray (1997)** justify applying the 'Positive-feedback hypothesis' to the housing market. Positive-feedback hypothesis states that the recent strengths (or weaknesses) in one submarket persuade positive (or negative) attitudes that lead to a greater than expected effect of the news on asset prices. Accordingly, the news of a negative shock to a given real estate market would impact potential home buyers by making them aware of the risk of owning them. Based on this argument, this paper evaluates the interrelationship among housing price changes in different US census divisions and in different primary MSAs within a consolidated MSA. The results of the census division analysis exhibit different diffusion patters while the MSA analysis confirms diffusion between neighbouring areas.

Evidence indicates that not all movements in asset prices can be accounted for by news about fundamental values. Accordingly, **Cutler et al (1990)** agree that demand from the traders is based on the history of past returns rather than the expectation of future fundamentals, therefore, incorporate the positive-feedback hypothesis into their analysis. The study sheds some light on the fact that repeated analysis of the single time-series on US stock returns could create subsequent patterns. The discussion is then extended to evaluate an alternative framework to capture fluctuations in speculative prices. The authors seek to determine whether the regularities that appear in the US equity returns are common in the other asset markets as well. Considering the speculative process, the paper tries to identify common patterns across different markets given the risk factors operate differently in are similar across markets. **Shiller (1990a)** supports the Positive-feedback hypothesis, and suggests a simple feedback model of observed volatility of speculative prices and the pattern of feedback of price to dividends or earnings.

Leung et al (2006) have empirically argued that the efficiency of a market is challenged when price dispersion occurs. Using a sample of urban residential property in Hong Kong, they found a relationship between skewness of the housing prices and the movement of the macroeconomic variables. The statistical tests confirmed an interaction between the standard deviation of the housing prices and macroeconomic variables including the budget ratio, the trade ratio and the economic growth rate. They concluded that house price dispersion exists, and the degree of dispersion changes systematically with some macroeconomic factors.

Another contribution to the Positive-feedback hypothesis is found in **De Long et al. (1990)**. This paper criticizes the previous papers that claim rational investors resist or oppose obstinately the irrational speculation, to bring prices closer to fundamental values. Rather, Positive-feedback investors are present in the market and, it might be rational for the speculators to follow the footsteps of those investors. Additionally, some rational speculators would buy assets today expecting that 'noise traders' will buy at a higher price in the future. The authors demonstrate that purchases by rational speculators would encourage other positive feedback traders to buy assets, moving prices further away from fundamental values (destabilizing speculation).

Additional evidence supporting the Positive-feedback hypothesis is presented by **Clapp and Tirtiroglu (1994)**. They perform a test of Positive-feedback hypothesis using data for the housing submarkets in Hartford, CT. The authors relate to the general tendency to overemphasis the most recent evidence, and suggest that the changes in housing prices in a given submarket not only depend on their lagged values, but also on the lagged values of the house price changes in the neighbouring submarkets. Their conclusion states that the housing prices tend to disperse throughout a metropolitan area and the decision-makers use information on recent rates of change in asset prices to determine their purchasing decisions.

Research paper	Year	Type of property (Residential, business, commercial and land)	Scale (Local, regional, national or international)	Geography (US, Europe or Asia)	Urban and rural classification	Aggregation (Individual price/rent, aggregate level or stock prices)	Type of test/ investigation	Market efficiency
Clapp and Tirtiroglu (1994)	1994	Residential (Single family houses)	Local	USA- Hartford	Urban/ rural	Individual level (prices)	Test of price dispersion Positive Feedback Hypothesis	Inefficient
Pollakowski and Ray (1997)	1997	Residential	National	USA	Urban/ rural	Aggregate level (prices)- (repeat sales)	Test of price dispersion Positive Feedback Hypothesis	Inefficient (Census divisions), Efficient (NY)
Leung, Leong and Wong (2006)	2006	Residential	Local	Asia (Hong Kong)	Urban	Individual level (prices)	Test of price dispersion Positive Feedback Hypothesis	Inefficient

5. Summary

In this paper, we discussed the question whether or not the real estate market is efficient. This question is of eminent importance for all policies that either attempt to influence the spatial structure of an area or the design of buildings. Efficiency of the real estate market is necessary for an adequate response of the economy to such policy measures.

After discussing the Efficient Market Hypothesis (EMH), the conceptual reference point for the analysis of market efficiency, we discuss the empirical evidence on efficiency of financial markets, the markets usually considered to be more efficient. The evidence that we find in the literature is mixed. While some implications of the EMH are generally supported by the empirical evidence, others are not.

In sections 3 and 4 of the paper, we turn to the real estate market. We look at three aspects in particular: the availability of information, price volatility- cycles- bubbles, and price dispersion. As it turns out, the results regarding the real estate market are inconclusive. Although there is strong evidence of inefficiencies arising from imperfect information, transaction costs, production time lags, price volatility, and cyclical factors etc., there are also claims that the real estate market is generally efficient. To what extent this is the result of aggregation, where the effects of the well known sources of distortion at the micro level are levelled out by aggregation, seems to be an interesting topic for further research.

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