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THE IMPACT OF RECENT CRISIS ON THE REAL ESTATE MARKET IN THE UAE: EVIDENCE FROM ASYMMETRIC METHODS

ABSTRACT

We explore empirically the impact of the world real estate crisis on the UAE real estate market. We consider the Global Financial Crisis (GFC) in our investigation. Besides the asymmetric causality test methods we also use recently developed asymmetric generalized impulse response functions and variance decompositions, which separate the effect of positive shocks from those of negative ones. The empirical results that this paper provides can be very informative and useful for both investors and policy makers.

Keywords: Asymmetric Impacts, Real Estate Markets, Crisis, UAE
JEL Classification: C32, F16, G15

RIASSUNTO

L'impatto della recente crisi sul mercato immobiliare degli Emirati Arabi Uniti: evidenze da metodi asimmetrici

Questo studio analizza empiricamente l'impatto della crisi del mercato immobiliare mondiale – nel contesto della crisi finanziaria globale – sul mercato immobiliare degli Emirati Arabi. Oltre ai test di causalità asimmetrici, abbiamo anche sviluppato funzioni asimmetriche con risposta generalizzata ad impulso e decomposizioni di varianza, le quali separano gli effetti degli shock positivi da quelli degli shock negativi. I risultati empirici di questo studio possono essere molto informativi ed utili sia agli investitori che ai *policy maker*.

1. INTRODUCTION

The UAE government has endorsed different policies in order to diversify the economy and reduce its dependence on the oil industry. Among the important selected sectors for this

purpose, two main ones are the tourism sector and the real estate sector. Both of these chosen sectors have increasingly become more important for the economic performance of the country. The impact of the tourism industry on the economic growth in the UAE has recently been investigated by Hatemi-J (2016). This article is devoted to the impact of the global financial crisis (GFC) on the UAE real estimate markets. These markets have indeed played an important role in the development of both Dubai and Abu Dhabi. Primarily, the UAE governments' distinctive policy of economic diversification has been the driving force for the development of the region. It is the oil sector which has been dominant in the economy of the UAE as it has in the whole region, in particular in the countries which have considerable reserves of this crucial resource. It is estimated, as far as is known at present, that the UAE has the world's ninth largest energy resources (British Petroleum, 2012), indicating the UAE may still rely on its energy resources for decades to come. Despite this assurance, the country's marked diversification policy indicates that the UAE does not count solely on its oil stocks for its future economic performance. This is due to the belief that it is not healthy for the economy to depend on a single product (Fernandes and Karnik, 2009). Therefore, the UAE has put forward strategies in an attempt to diversify its economy primarily in the area of real estate as well as various other areas.

The integration between the real estate markets and international markets is of great importance. When the significance of the global real estate market is considered, it is evident that this topic is theoretically and practically significant.

The integrated model of real estate markets shows the international market setting prices for real estate investments matched with the international asset pricing model. This allows the systematic risk of global market price penetrating into the local economy. This leads to the conclusion that the contagion risk which exists at the global level may on any global occurrence have a direct impact on a local real estate market. Investors and decision makers need to know about all these factors in detail because real estate markets are of prime importance to the national economy. In recent times, the impact on the real estate market of the global financial crises has given invaluable evidence about the way real estate markets can affect the national economy. Therefore, it is very important for investors to consider all these factors if they wish to price real estate accurately. Otherwise, improper pricing is more likely to affect the local as well as the international markets. When the markets interact with each other, several other effects also emerge as by-products of the interaction. These may include trade linkages, flow of capital,

and links between banks (Glick and Rose, 1999). These effects become stronger when the basic causes of coordination between markets change. However, the influence of such incidents can exceed expectations for certain basic reasons. When the markets behave in a way that provokes a reaction then herding behavior can be seen in factors which are not basic to the coordination of markets. In such cases, the contagion effects are the outcome of accompanying occurrences. It is of paramount importance to figure out if the spillover or co-movements between markets impacts by causing contagion since contagion, being the finding of non-fundamental factors, demonstrates the presence of market inefficiency. The effect of the globalization of stock markets has been to create more connections and stronger relationships between them, and when they undergo financial crises, there is a suspicion that the co-movements between markets comprise contagion impacts.

In this article, we explore the potential effect of the global real estate crisis on the UAE real estate market, and consider the recent global financial crisis (GFC) in our investigation. The influence of the world's real estate crisis on the worldwide market hazard for real estate markets is a key issue for financial investors, given the magnitude of the crisis and the overall effect it has made.

This article seeks to handle this issue with another methodology. Unlike previously published articles, the current study uses the recently developed asymmetric generalized impulse response functions and variance decompositions developed by Hatemi-J (2014a, 2014b). These methods distinguish explicitly between positive and negative permanent shocks and their effects. To our knowledge, none of the existing studies of the impact of the global real estate market crisis on the real estate sector in the UAE has used this methodology to estimate the impulse response functions and variance decompositions to the underlying shocks.

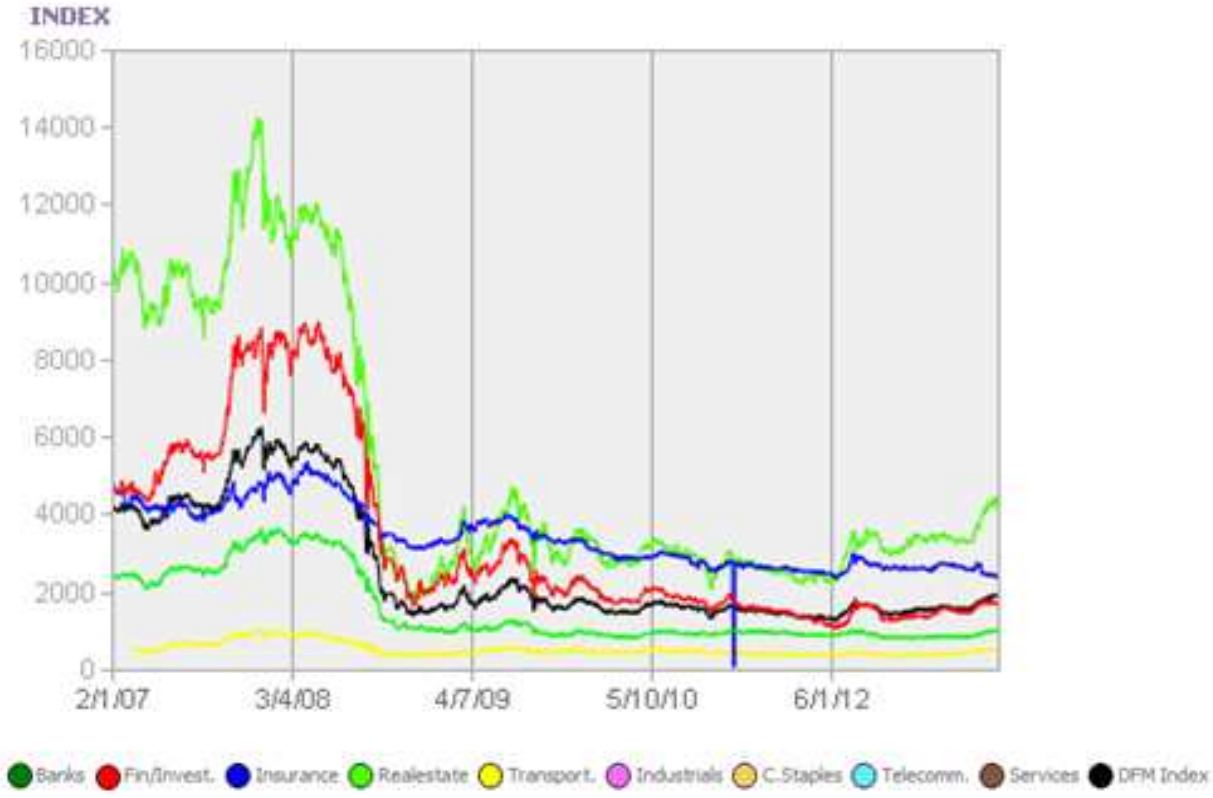
The rest of the article is organized as follows. The following section presents an overview of the UAE real estate market. The literature review is presented in Section 3. In Section 4, the methodology is discussed; while Section 5 exhibits the empirical results. Some conclusions are drawn in last section.

2. OVERVIEW OF THE UAE'S REAL ESTATE MARKET

The UAE authorities have been dynamically promoting the development of the country as a

global hub. One of the primary requirements of such a hub is that the destination should provide sufficient accommodation for the parties who need to stay there (Hepsen and Vatansever, 2011). Dubai and Abu Dhabi have recognized this as one of the major requirements that they need to meet in order to achieve the status of a global hub. It is well known that Dubai was the first to pursue this goal, and the first to see a boom in the real estate sector (Balakrishnan, 2008). Real estate has been one of the most important growth sectors in Dubai, and one which is currently larger than the hydrocarbon economy. The following chart shows the real estate sector compared with other sectors in Dubai over the last five years.

FIGURE 1 - *The Sector Indices of the Dubai Financial Market*



Notes: DFM Index = Dubai Financial Market (DFM) index. The source of the data is the Dubai Financial Market, 2013.

It is worth noting that before the global recession the UAE real estate sector was performing well above its current level. However, this changed drastically after the recession: due to the problems that the sector underwent, a steep decline in performance was observed during the

period 2008-2009. The result was that the sector's contribution to the economy reduced considerably. In fact, real estate contracted by 1.6% in 2009, the first contraction experienced up to this time. The growth rebound was also very slow, and in 2010 was almost flat (Global Research, 2011). The sector suffered most in Dubai precisely because it had become by then the most important part of Dubai's economy, and its decline created considerable impact on the economy (Hepsen and Vatansever, 2011). The sector underperformed due to the drying up of funding from foreign sources. There had been considerable foreign investment in the sector because of the various concessions offered to foreign investors. With this loss of funding, the sector found it very hard to recover from the difficulties that surrounded it. The declining performance of the sector is evident when the indices are examined. However, with the growth of the economy over time, the sector has returned to gradual growth (Global Research, 2011). It was expected that after the first half of 2012 the sector's demand and supply conditions would balance, and the real estate growth would be restored.

Unlike many other sectors, the real estate sector has been slow to recover. This is because the region has seen an oversupply of space while rents continue to decline, regardless of the fact that regional economies are seeing some growth (Global Research, 2011). It is evident that growth is only likely to return to this sector after the economies have accelerated to the level where demand for space exceeds the supply in the market. Zawya (2012) estimates that this is slowly ensuing and that the demand for real estate properties in the region is gradually growing. It is likely that rents will recover during the period, and that the eventual outcome in this regard will be renewed growth in the market, with the sector set to grow during 2013 followed by a considerable period of stagnation.

Amidst these hopes of growth, Dubai's real estate markets have shown clear signs of recovery (Global Research, 2011). From the second half of 2012 the sector recorded gradual growth, and into 2013, its performance has clearly outdone the performance of the other market sectors. This indicates that real estate is gradually recovering and will soon be the major growth sector of the region, attracting the required investments, and reflecting the changes taking place in the regional economy.

The growth of the real-estate sector is not limited to Dubai, for there are clear signs that growth

is also taking place in Abu Dhabi. However, unlike Dubai, Abu Dhabi did not experience so great an effect from the non-performance of real estate since it was not a main player there before the recession. This is because the region at this point was only gradually developing, and the real estate sector was just opening its doors to investment. The relevant indices of the Abu Dhabi Stock Exchange are as follows:

FIGURE 2 - *The Sector Performance of the Abu Dhabi Stock Exchange*

Notes: ADI = Abu Dhabi General Index, ADTL = Abu Dhabi Telecommunications Index, ADBF = Abu Dhabi Banking and Finance Index, ADCT = Abu Dhabi Consumer Staples Index, ADEG = Abu Dhabi Energy Index, and ADRE= Abu Dhabi Real Estate Index. The source of the data is *Source*: Abu Dhabi Financial Market (2013).

The above chart indicates clearly that before the recession the real estate sector was underperforming in Abu Dhabi. This was because the growth of this market was not seen as a necessary mechanism for the economic development of the region, which as a whole is entirely dependent on the hydrocarbon economy. Thus, the region functioned as a beacon leading the UAE out of recession, and maintained a better economic performance than all the other regions. However, the real estate sector in Abu Dhabi is currently growing fast, due to the government's

'Eichholtz Vision', which states that Abu Dhabi will develop to become an international hub. This implies that the growth of the region will continue, and that growth similar to Dubai's is likely to occur in Abu Dhabi (Jones Lang LaSalle, 2012). Naturally, these visions and aspirations are playing a major role in the growth and the performance of this sector.
It is clear, given the clear plan for the region's economic development that considerable foreign investments as well as local investment are flowing into the region. This indicates that the growth of the real estate sector will continue there and is likely to become one of the primary sectors of the Abu Dhabi region, just as it did in Dubai.

Another interesting aspect is that the sector is consolidating at the same time as growth is announced, which is a very unusual development for the region. However, the drive behind the consolidation is to create a company as powerful as Emaar to drive the real estate sector in the region. The recent upward trend in stock prices is driven by the approach of consolidation in the region. In view of the above facts, it is clear that Abu Dhabi will see a performance in the sector similar to Dubai's. However, the investors should identify the nature of the hike and make sure that the growth is in line with the needs of the region (Hepsen and Vatansever, 2011). If a bubble is created by growth, the eventual result will be detrimental for the sector as well as for the general performance credibility of the financial markets in the region (Lind, 2009). The markets must ensure that they have the necessary mechanisms in place to counter any kind of threat caused by the creation of bubbles.

It is evident that in the case of the Abu Dhabi Stock Exchange (ADX), as in that of the Dubai Financial Market (DFM), the real estate sector is the most prominent sector in the current context. The sector can probably be impacted considerably by considerations of a future global recession. However, the cautious development approach taken by both the regions means that even if such a problem persists, the companies are likely to be able to continue performing at the current level (Global Research, 2011). Currently, the Abu Dhabi and the Dubai markets are seeing growth at a time when the economy of the developed world is not doing well. This indicates that the growth of the sector could be sustainable in the future and that the region will continue to thrive, regardless of the changes taking place in other regions.

The real estate sector in the country will continue to grow and the UAE will become an

international hub for the real estate sector in the near future. This will allow the country to diversify its economy before long. This diversification will contribute to the growth of the financial markets, and is likely to be one of the driving forces behind them (Rao, 2008).
The role of real estate is growing in the UAE because all the real estate demand factors such as population, economy, and new investments are growing. It is surprising that the research finds considerable detachment between the UAE and the global real estate markets. However, many factors differentiate the UAE real estate markets from those of other countries, and these contribute to the increased level of detachment affecting the UAE real estate sector.

2.1 Is UAE Economic Growth always Driven by Global Growth Driver?

The UAE is a well-diversified nation, with stable economic policies, and has the ninth largest oil reserves in the world (BP, 2014). While global economic growth could affect the growth of the country, the strong fundamentals in place in the UAE keep the economy resilient and create minimal effect in the long term. This allows investors to see the UAE as a safe location for investment in times of slow growth in other parts of the world. Thus, investments are growing in the UAE driven by the timing of the recession in Europe and slow growth in the rest of the world. The UAE economy grew by 4% in 2013 compared with negligible growth in the developed markets (Gulf News, 2014).

2.2 Continuing High Stake of the Government Sector

With the increase of the global energy prices, the UAE government has seen a buildup of reserves and has invested funds in various projects, including real estate developments. As a result, the involvement and the degree of guidance of the state sector in the UAE real estate sector are high, and this has partially protected the sector from the changes in other nations' financial scenarios. This is acknowledged as another important differentiator for the industry.

2.3 Regulation of Demand and Supply Issues

The country in 1999 saw an oversupply scenario regarding real estate in 2009, and the global recession negatively affected the sector. However, while the supply is continuing to increase, the demand is increasing significantly faster; hence, the sector has been able to strengthen its

fundamentals. This is another reason why the real estate sector in the UAE has not suffered the global meltdown of other real estate sectors in recent years. While Abu Dhabi growth is still mild, Jones Lang Lasalle (2012, 2013) believes that the demand continues to grow in Dubai. The supply stock of real estate in Abu Dhabi and Dubai is illustrated in Figures 3-4.

FIGURE 3 – *Real Estate Growth in Dubai*

Source: Deutsche Bank (2014).

FIGURE (4) –*Real Estate Growth in Abu Dhabi*

Source: Deutsche Bank (2014).

2.4 The Major Role in Future Growth Played by Expo in Dubai

Expo 2020 is expected to attract a visitor base of over 25 million in 2020 compared with 10 million visitors in 2013. This indicates a massive growth and the investments are estimated to be around USD 43bn for the upgrading of the facilities in line with the requirements (Deutsche Bank, 2014). This further differentiates the real estate sector of UAE from the global sector and ensures that demand will continue to grow regardless of the global conditions.

2.5 The Contribution to High Growth of the Demand from the Expatriate Population

Out of the total residential population of the UAE, it is estimated that over 80% are expatriates (CIA Factbook, 2014). This indicates that the UAE locals are small in number. This very large expatriate community increases the demand for residential and commercial properties. It is important to note that in 2013 the growth of the population was 5%, and this may accelerate with the continuous growth of the economy (Deutsche Bank, 2014). This also differentiates the real estate demand trends from global real estate trends.

3. BRIEF LITERATURE REVIEW

3.1. Definition and Meaning of Contagion

It is common knowledge in investment literature that risk can be reduced by engaging in diversification. This is why investors regularly put resources into distinctive sorts of benefit in diverse nations in order to reduce risk. However, during financial crises, the financial markets of two countries often show the same characteristics, i.e. they either climb together or, even more frequently, move down together. It has been observed that even the relationship between various types of asset market may also intensify. This lessens the chance of diversification and makes it unable to give the perceived benefits to investors. In the financial literature this sequence is termed contagion.

The World Bank Group (2014) provides three meanings for the term contagion. In its general definition, contagion is a process of conveying the turbulence of one financial market into a whole country. Contagion also wields a spillover influence throughout a whole country.

According to the restrictive definition, contagion is the process when financial market turbulence is conveyed to other countries as well. Its effects may also create a cross-country

relationship. Such influences are recorded even when there is no other type of relationship between these sectors within a country or set of countries.

The very restrictive definition is the one that has been used in most of the previous studies. According to this definition, contagion is created when the cross-country relationships intensify during times of financial crisis, unlike other relationships in stable conditions.

Theoretically, contagion is understood as the spillover impacts or co-movements between markets that are brought about by non-fundamental factors. There are various distinctive descriptions with reference to why contagion happens throughout a crisis. These illustrations for the most part identify with information cascade and herd behavior.

Information about the crisis in one market may prompt a movement in desires or supposition with respect to the prospects in different markets. This may then lead investors in these different markets to auction holdings, which accelerate a domino effect.

Theoretical models, in this manner, point to the role of a third party, for example, investors or banks, in channeling contagion. The movements of these executors during a crisis bring about a critical connection between markets, which previously had been supposed discrete.

Investors and banks in a market hit by a crisis may encounter liquidity issues and may consequently decide to exchange their investments in different markets, keeping in mind the end goal of raising the required funds. Additionally, the decline in the worth of their speculations in the markets in a crisis may lead investors to sell off their possessions in different markets to re-adjust their portfolios. In this way, investors and banks transmit the crisis from one market to another.

3.2. Previous Studies

The internationalization of the real estate markets has been a primary phenomenon in the context of the real estate market over the past decade. This was chiefly driven by the development of real estate related securities that would allow the participation of investors in a global area for real estate development (Bardhan and Kroll, 2007; Eichholtz and Nils, 2009; Hobbs *et al.,* 2007). This suggests that real estate markets are well enough integrated with each other to form a global real estate market. While this seems the case, the fact remains that real estate is not a commodity that can be treated in an international context and this affects the

prospect of achieving global integration on the part of the real estate markets (Bond and Patel, 2003; Liow, 2007; Liow and Webb, 2005). However, the securitization of real estate allows the international trading of real estate related instruments to take place, eliminating the hurdles to internationalization: the last decade saw this model being established. It has been observed that the correlation of prices between the real estate markets is low, or in other words that the prices in one market move independently of those in other markets (Bardhan *et al.*, 2007).

According to Eichholtz *et al.* (2011), apart from investment globalization factors, there are other factors that contribute to the globalization of real estate markets. These include the development of transparent international standards or benchmarks in the area of real estate: internationalization in the area of providers of real estate services; capital market liberalization; reduction in the number of political barriers; and the appearance of new financial instruments, which adjust to equalize conditions for both local and foreign real estate investors.

Further, investors might have a tendency to concentrate on their local market as opposed to a global market. But real estate markets may be tempted to open up additional incentives to welcome foreign financial investors who are retreating from other global markets.

Many studies have been conducted on real estate, and a significant number of articles has been written about international diversification in this area, which has proven advantageous because of the low correlation mentioned above. Comparisons between global real estate returns and stock exchange returns in the USA were made in various studies, including Gordon and Canter (1999), Conover *et al.* (1998), Gordon *et al.* (1998) and Eichholtz (1996, 1997). The results of the studies show that investment in foreign equity is less useful than investment in the international real estate market.

A study conducted by Eichholtz *et al.* (1998) claims that investors in Europe and North America can attain in other countries the benefits of global property market diversification. The findings for the investors of Asia Pacific implied the opposite, because the investors were found to maximize the benefit from worldwide real estate diversification in their home countries. The basic purpose of the study conducted by Eichholtz *et al.* (1998) was to investigate how real estate returns vary in different continents.

Barry and Rodriguez (2004) found that it would be beneficial if investors invested concurrently

in foreign countries and their home country. The focus of the above research was on the developing and emerging real estate markets. In a similar study, Idzorek *et al.* (2006) showed that investing in a diverse portfolio of real estate mitigates risk for investors. These findings were for the period from 1990 to 2005 and for North American real estate in the US. In Europe and Asia, a diverse portfolio did not seem to reduce risks.

Kasa (1992), Masih and Masih (2002), Yang *et al.* (2003), Fraser and Oyefeso (2005) have investigated the way in which major equity markets in the world are inter-related. The studies, which focused primarily on international stock markets, discovered a single common stochastic trend, which was responsible for changes in stock prices. The studies conclude that stock markets are strongly co-related in the long term and that this result dilutes the benefits that might be attained from diversification.

McCue and Kling (1994), Ling and Naranjo (1997), Myer *et al.* (1997), Case *et al.* (2000), and Liow and Yang (2005) have conducted detailed studies to determine certain macroeconomic indicators that affect the prices of public properties. After this development, researchers are now trying to study possible linkages that real estate markets may have with one another in the global framework. For this purpose, a multivariate co-integration technique is being used to determine the integration of global real estate markets in different parts of the world.

Wilson and Okunev (1996) find that property markets in developed countries such as the USA, the UK, and Australia are segmented. Their study suggests that investors from these countries can make beneficial investments in foreign countries. Myer *et al.* (1997) examine the stochastic properties of the real estate wealth indices of the USA, the UK, and Canada. They find that among the real estate indices of the USA, the UK, and Canada a strong co-integrating relationship exists, and there are common factors that establish a linkage between all the indices.

Wilson and Zurbruegg (2001), however, contradict the findings of the above study. Their study, taking in Australia and Japan along with the UK and the USA, concludes that global real estate markets are related only if the structural changes are taken into account.

Liow and Yang (2005) study the real estate markets in Asia-Pacific economies and discover a fractional co-integration between macroeconomic factors, stock market prices, and securitized

real estate prices.

Yang *et al.* (2005) consider the effect of the European Monetary Union (EMU) on relationships in Europe's public real estate markets. The study reveals that real estate markets in large EMU economies can integrate better with their European counterparts than smaller EMU economies.

The long-run and short-run relationships between real estate markets in Australia, Singapore, Hong Kong and Japan have been investigated by Yunus and Swanson (2007). The findings of their study show that investors of the USA can attain the benefits of real estate diversification on a global scale if they invest in the countries on the above list.

Since several real estate markets are still not integrated with the international stock market, global investors find it helpful, according to Hatemi-J *et al.* (2014), to use the benchmark of international real estate in place of the world stock market benchmark when they want to decide about allocating their international assets and other practices of performance measurement.

Real estate is a sector which offers important opportunities to investors who wish to diversify their portfolio, because it has shown persistent growth in value over the years. In several countries real estate is not as highly correlated with conventional assets, for example, stocks and bonds, as other investment instruments are. Real estate is also favored because of its capacity to perform as a hedge against inflation, as documented by Hudson-Wilson *et al.* (2005), Yunus (2009) and Bond *et al.* (2006), among others. One of the disadvantages of physical real estate, however, is that it is often considered "lumpy" and increasingly "illiquid".

The processes involved in finalizing transactions to do with physical properties may linger protractedly, perhaps six months to a year (Hwang, 2004). To avoid the disadvantages of investing in physical real estate, an alternative is to invest in real estate securities. Yunus (2009) points out that ever since the securitization of real estate took place in the early 1960s, receiving higher emphasis during the last decade, Real Estate Investment Trusts (REITs), Real Estate Operating Companies (RECOs) and several private vehicles have appeared which provide feasible alternatives to domestic real estate ownership, which is done on a commercial basis. These have enabled more investors to invest in the real estate sector.

The advent of REITs and similar securities has been the result of demand from the institutional investors for these securities. This has in turn given rise to the securitized real estate markets.

The National Association of Real Estate Investment Trusts (NAREIT) reports that there has been an increase of 170% in global market capitalization among the publicly listed property securities. The growth is from $350 billion to approximately $945 billion, covering a period of seven years, from January 2000 to March 2007. The value of real estate securities market had touched the $1 trillion mark by 2010.

In addition, there are a very few papers which have analyzed the issue of the worldwide integration of real estate markets. For example, Liow (2007) researched the relevance of the international capital asset pricing model (ICAPM) in connection with the securitized real estate markets of Australia, Japan, the UK, and Europe. This study used the world stock exchange and world real estate market advertisers as proxies for the world market. It assessed contingent and time varying betas and discovered the average betas of the markets to be less than one. The consequences of the study indicate that the world real estate market has a positive impact on the real estate markets of the Asia-Pacific countries: Hong Kong, Singapore and Malaysia, and a negative impact on the real estate markets of Europe and the UK. It additionally inferred that the world real estate market, as contrasted with the world stock exchange, was a superior proxy for the world market.

Ling and Naranjo (2002) likewise examined the securitized real estate markets while Goetzmann and Wachter (2001) scrutinized the direct real estate markets. The discoveries of their examinations additionally demonstrate that the world market fundamentally influences individual real estate markets.

However, Hatemi-J *et al.* (2014) examined which real estate markets were integrated with the international market; they covered five international real estate markets, namely, the US, the UK, Japan, Australia and the UAE, using a case-wise bootstrap analysis, which was robust to non-normality, and to the high volatility that characterizes financial data. Their discoveries indicate that each of the five markets is integrated with the world market, the US and the UK markets being the most universally integrated real estate markets and the UAE being the least. Their results likewise show that the US sub-prime crisis had a different impact on individual real estate market: the US real estate market crisis made the US, Australia, and the UAE real estate markets more universally integrated, while the Japanese market moved in the reverse direction. Further, the crisis did not influence the degree to which the UK market was integrated with the global market, whether with the world securities exchange or the world real estate market.

These results imply that, in real estate calculations, worldwide market risk should be estimated, and that universal turbulences, for example, the US sub-prime crisis, have a differential effect on diverse real estate markets. This was the first study to take into consideration the impact that the recent world financial crisis had on the markets concerned.

At the same time, in regard to contagion effects, the few studies that have been conducted to investigate the impact of contagion between real estate markets across the globe, in particular in the case of the real estate crisis in the US, have demonstrated different findings. For instance, a study conducted by Hatemi-J and Roca (2011) set out to identify the global implications for the crisis in the area of real estate in the UK, the USA, and Australia. They applied the contagion test suggested by Hatemi-J and Hacker (2005), regarding real estate market contagion. The main conclusion of the study was that the contagion effect was not revealed in the relationships between the US real estate market and those of other countries.

Fry *et al.* (2008) conducted an investigation of contagion in the real estate markets of Australia, Germany, Japan, Hong Kong, the US, and the UK through the application of a contagion test, which was supposed to determine the changes at the most critical moments; however, the study failed to identify the evidence of such contagion. Bond *et al.* (2006) investigated the contagion in the real estate markets of Hong Kong, Singapore, Australia, Japan and the US with the use of a multivariate latent factor model. In contrast with the study of Fry *et al.* (2008), contagion between the markets in question was found. The evidence of contagion effects in the real estate markets was found by Mun (2005), who based his investigation on the countries of the Pacific Rim in the period of financial crisis in Mexico, Asia, Russia and Brazil.

Yunus (2009) emphasized the importance of investigating the level of interdependence among real estate markets. He selected the USA and six developing countries to apply a co-integration test for the period January 1990 to August 2007. The results of his investigation showed an interconnection between the US markets and the markets of the selected countries. Moreover, he determined that the leaders and lawmakers in the area of common trends are Japan and the US, and that the two larger real estate markets have a positive effect on developing countries.

Our study diverges in a few ways from the previous study conducted by Hatemi-J *et al.* (2014) on the integration of real estate markets with the world market. First, we make use of an alternative estimation methodology. We use asymmetric generalized impulse response functions. It is

important to consider asymmetry because it is widely agreed that people in finance respond differently to good news and bad news for legal, moral or other applicable reasons. We will also apply asymmetric causality tests.

4. DATA AND ECONOMETRIC METHODOLOGY

In this section, we report on applying two econometric methods and confirm that we obtained the same results, thus establishing the credibility and reliability of our empirical results.

4.1. Asymmetric Generalized Impulse Response Background

The impulse response functions and variance decompositions are normally used within the empirical literature, following the pioneer contributions of Sims (1980). But, again, this unique strategy is prone to the way that the variables are ordered in the VAR model. Koop *et al.* (1996) and Pesaran and Shin (1998) recommend using the generalized impulse response in order to cure this ordering limit. As Hatemi-J (2014a) indicates, a paramount issue that has not been considered in past approaches to the estimation of impulses and variance decompositions is that account asymmetry should also be considered. Hatemi-J argues that it is important to not disregard the potential for asymmetry and he has developed an asymmetric approach that differentiates the effect of a positive turbulence from that of a negative one on the proliferation system of the impulse response functions and variance decompositions.

We apply the asymmetric generalized impulse response functions and asymmetric variance decompositions to assess the potential effect of turbulence in the world real estate market price index on the UAE real estate market price index. We also take into account the effect of the global financial crisis (GFC) on the two markets concerned.

In the following we describe how integrated variables can be expressed in partial cumulative positive and negative parts in order to produce the asymmetric generalized impulse response (AGIR) functions as suggested by Hatemi-J (2014a).

Consider the following integrated components variable with trend parts, denoted by W_{1t} , which

represents the world market index:

$$_{1t} = \mathrm{a} + \mathrm{bt} + \mathrm{W}_{1t-1} + \varepsilon_{1t} \quad (1)$$

In this equation, a and b are constants to be estimated and t denotes the time index. This equation has the following solution:

$$W_{1t} = at + \frac{t(t+1)}{2}b + W_{01} + \sum_{i=1}^{t}\varepsilon_{1i} \quad (2)$$

For t =1, 2, ...T. The constant W_{01} indicates the starting value and ε_{1t} denotes a white noise disturbance term. Negative and positive turbulences are presented as ε_{1t}^{+} := max (ε_{1t} , 0) , and ε_{1t}^{-} := min (ε_{1t} , 0) ,respectively. Thus, we have

$$W_{1t} = a + bt + W_{1t-1} + \varepsilon_t = at + \frac{t(t+1)}{2}b + W_{01} + \sum_{i=1}^{t}\varepsilon_{1i} \quad (3)$$

In this way, the positive and negative shocks can be defined as shown below:

$$W_{1t}^{+} = \frac{at + \left[\frac{t(t+1)}{2}\right]b + W_{01}}{2} + \sum_{i=1}^{t}\varepsilon_{1i}^{+} \quad (4)$$

and

$$W_{1t}^{-} = \frac{at + \left[\frac{t(t+1)}{2}\right]b + W_{01}}{2} + \sum_{i=1}^{t}\varepsilon_{1i}^{-} \quad (5)$$

Accordingly, $W_{1t} = W_{1t}^{+} + W_{1t}^{-}$.

The other variable in our model, which is the weekly closing stock price index of the UAE real estate market, signified by W_{2t}, could be decomposed in a comparative manner. These decomposed qualities could be used to gauge the asymmetric impulses and variance decompositions between the weekly closing stock price index of the world real estate market and the real estate market in the UAE. It is assumed that we seek to catch the dynamic relationship of all the positive turbulences between these two variables; that is, the vector of interest, $W_t^{+} = (W_{1t}^{+}, W_{2t}^{+})$. Next, the following VAR(k) model can be estimated:

$$W_t^+ = \Gamma_0 + \Gamma_1 W_{t-1}^+ + ... + \Gamma_k W_{t-k}^+ + u_t^+ \tag{6}$$

where Γ_0 is a 2 x 1 vector, Γ_s (s = 1, ..., k.) is a 2×2 matrix, and u_t^+ is a 2 x 1 vector of error terms. The optimal lag order k is selected by minimizing an information criterion suggested by Hatemi-J (2003, 2008). In order to calculate the asymmetric impulses, we have to represent the VAR model in the moving average format as shown below:

$$W_t^+ = \sum_{i=0}^{\infty} C_i + \sum_{i=0}^{\infty} A_i u_{t-1}^+, \qquad \text{for} \quad t = 1,...,T. \tag{7}$$

where the 2×2 coefficient matrixes A_i are acquired recursively, as follows:

$$A_i = \Gamma_1 A_{i-1} + \Gamma_2 A_{i-2} + ... + \Gamma_k A_{1-k}, \qquad \text{for} \quad i = 1,2,..., \tag{8}$$

with $A_0 \simeq I_2$ and $A_i = 0, \forall i < 0$ and $C_i = A_i \Gamma_0$. The asymmetric generalized impulse response of the impact of one SE turbulence in the jth equation at time *t* on W_{t+f}^+ is derived through the following equation:

$$AGIR(f) = \sigma_{jj}^{-0,5} A_f X e_j, \text{ for } f = 0,1,2,..., \tag{9}$$

where X is the calculated variance-covariance matrix of the error terms in the VAR model (i.e., X = { $\sigma_{ij,}$, i, j = 1,2.}) , and e_j is a 2 x 1 indicator variable denoted in such a manner that its jth element is 1 and all other elements are 0. The symmetric forecast error variance decomposition can also be calculated, denoted by $AVD_{ij}(f)$, via the following equation:

$$AVD_{ij}(f) = \frac{\sigma_{ii}^{-1} \sum_{l=0}^{f} \left(e_i' A_l X_{ej} \right)^2}{\sum_{l=0}^{f} \left(e_i' A_l X A_l' e_j \right)^2}, \qquad \text{for } i, j = 1,2. \tag{10}$$

We apply this methodology of the asymmetry generalized impulse response to check the possibly asymmetric relationship between the UAE real estate market price index (indicated by UAER) and the world real estate market price index (signified by WR) on a week after week premise. The sample period is from 01/14/2005 to 06/14/2013. The Morgan Stanley Capital International (MSCI) price index is used as a part of the instanced world real estate market price index while the Securities Commodities Authority price index is used within the instance of the

UAE real estate market price index.

Cumulative positive and negative aspects of the data are separated by the use of the statistical software of Hatemi-J (2014b) and the asymmetric generalized impulses and variance decompositions are estimated by using EViews 8.

The date of the structural break was decided to be August 1, 2008 in view of the fact that this was the point at which the condition of the US real estate issue became critical (Frank and Hesse, 2009; Kiff and Mills, 2008).

5. Empirical Results

5.1 Empirical Findings for the Asymmetric Impulse Relationship between the World Real Estate Market and the UAE Real Estate Market

The results for asymmetric impulses joined with relating the 95% confidence intervals that are produced by means of the Monte Carlo simulations before and after the crisis period are exhibited in Figures 5-10. Figures 5 and 8 introduce the standard impulses for the original data joined with the 95% confidence intervals. These demonstrate that the reaction of the UAE real estate market to a symmetric turbulence on the world real estate market is not statistically noteworthy before or after the crisis period for a time horizon of ten periods. Next, we present the asymmetric impulses. Figures 6 and 10 exhibit the reaction for the variables given in the total of positive changes together with the 95% confidence interval. It is evident that, before and after the crisis period, the combined positive variations on the world real estate market do not have any considerable effect on the UAE real estate market. We also estimated the asymmetric variance decomposition in this situation and can reveal the following results. The real estate industry of the UAE is responsible for 99% of the variations in the forecast error and the remaining 1% of variations in the forecast error is due to the cumulative positive shocks of the global real estate market. In contrast, the cumulative positive shocks in the global real estate market and the real estate market in UAE are 97.6% and 2.3% respectively.

Figures 7 and 10 mutually outline the reaction for the variables in the combined negative configuration with the 95% confidence interval. From these estimations it is obvious to an

observer that, before and after the crisis period, the total negative progressions of the UAE real estate are not statistically significant to any negative impulse in the world real estate market index. On the same lines, the real estate market in the UAE was not influenced by the crisis in the real estate market on a global scale. Next, we estimated the variance decomposition and came up with the following results. The cumulative negative changes in the UAE's real estate market are responsible for 99.5% of the forecast error in the analysis. The remainder of the 1% change in the forecast error is attributable to cumulative negative innovation in the overall global real estate market. The corresponding values of the cumulative negative shocks in the global real estate market are 94% and 5.5% for the real estate market in the UAE.

The impact of the world real estate market on the UAE real estate market before the crisis are estimated for the period between 01/14/2005 and 08/01/2008. The following figures illustrate the responses.

FIGURE 5 - *The Standard Generalized Responses from the Original Data*

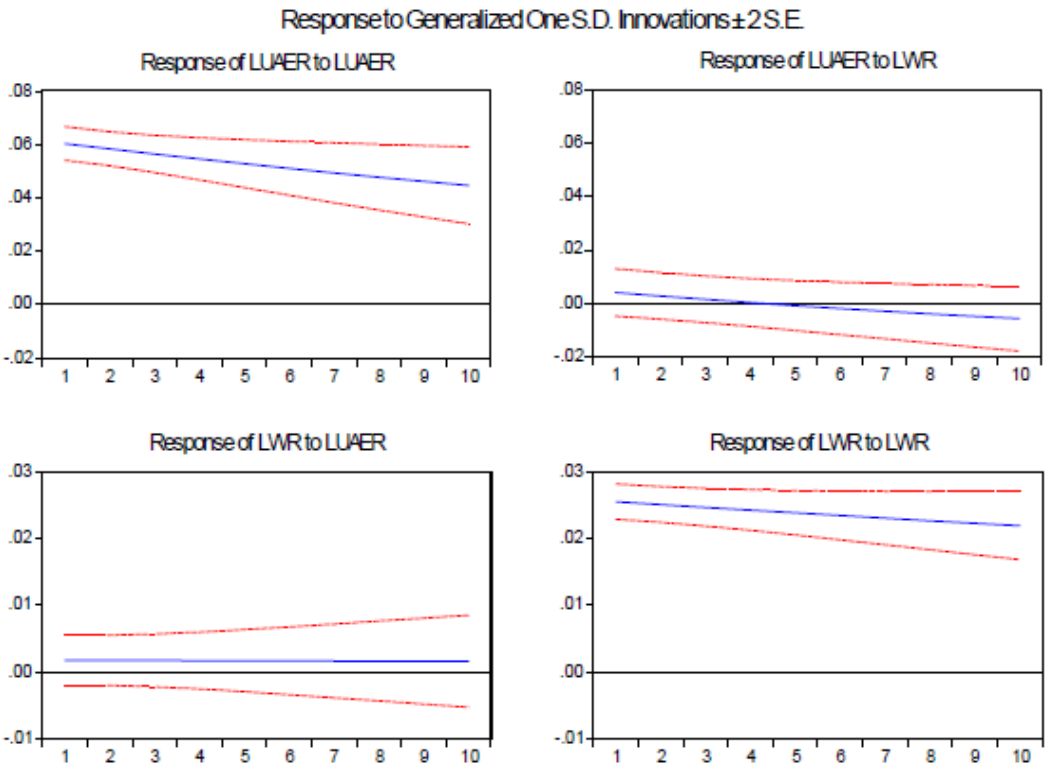


FIGURE 6 - *The Asymmetric Generalized Responses to the Cumulative Positive Shocks*

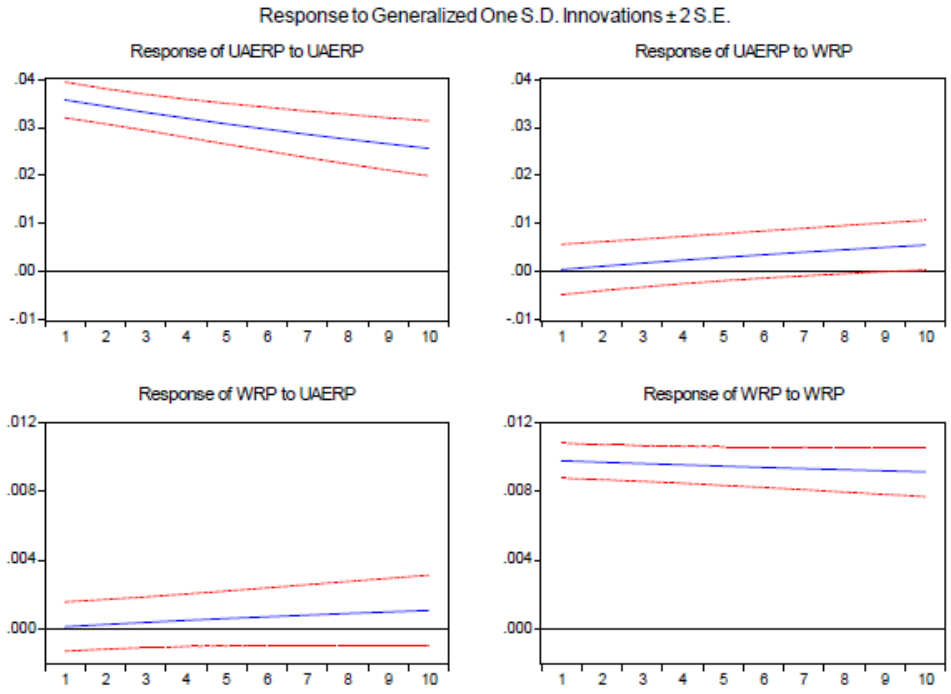
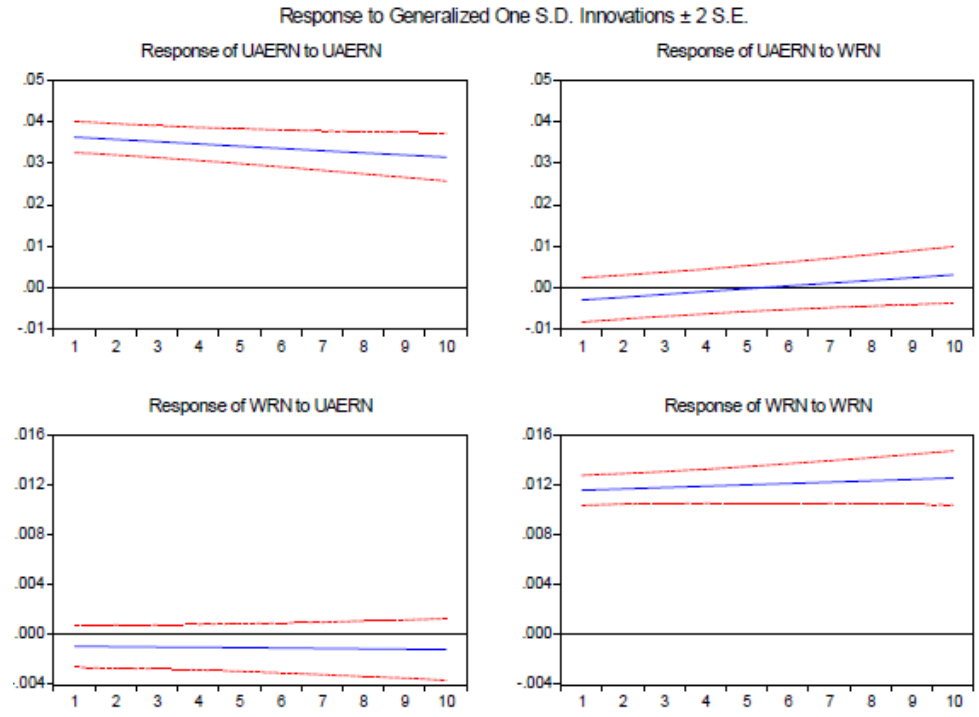


FIGURE 7 - *The Asymmetric Generalized Responses to the Cumulative Negative Shocks*



After the crisis period during 08/08/2008 to 06/14/2013, the responses were as illustrated in the figures below.

FIGURE 8 - *The Standard Generalized Responses for the Original Data*

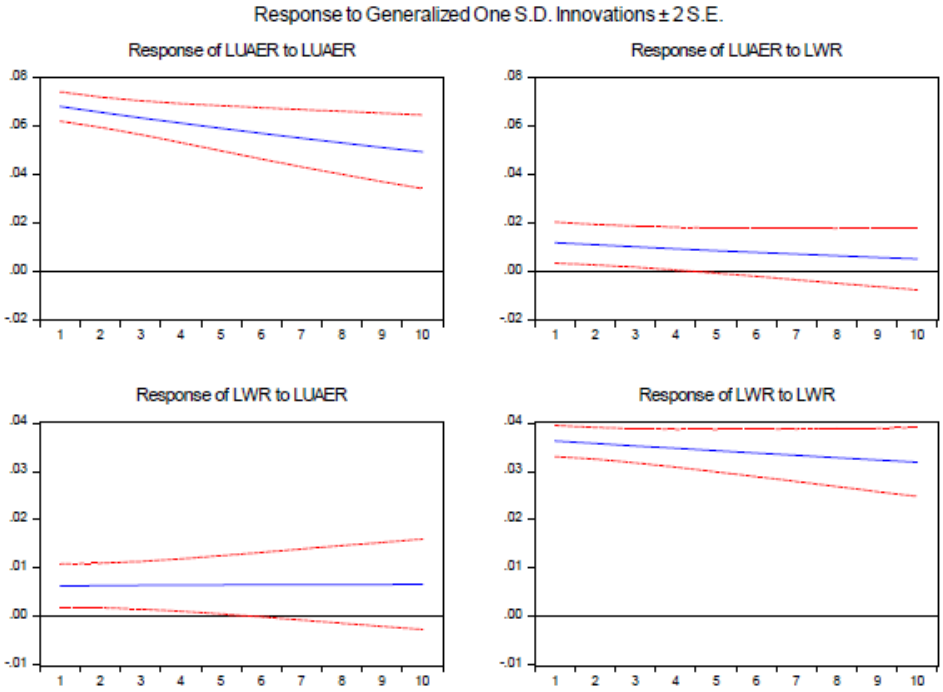


FIGURE 9 - *The Asymmetric Generalized Responses to the Cumulative Positive Shocks*

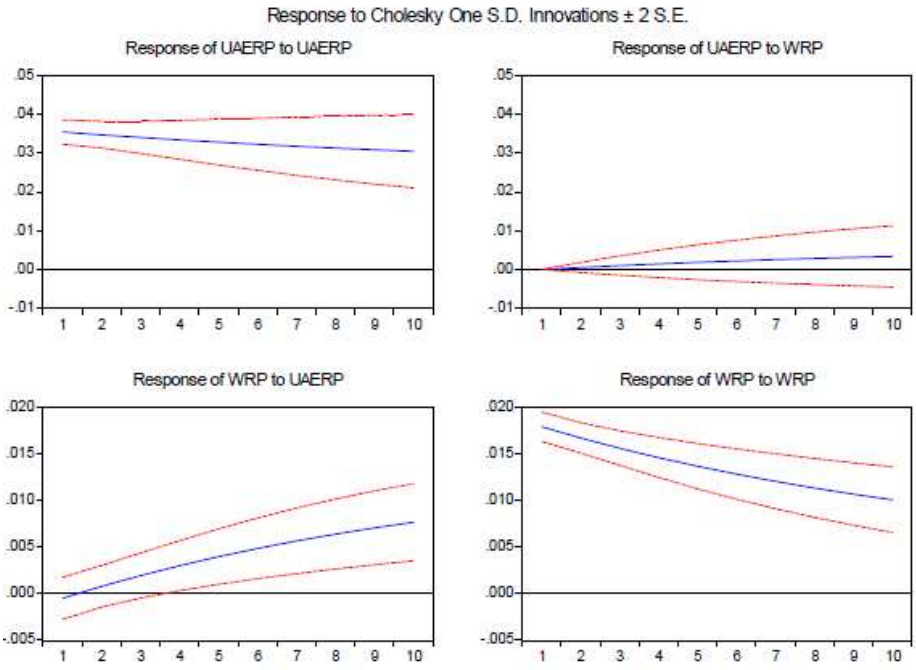
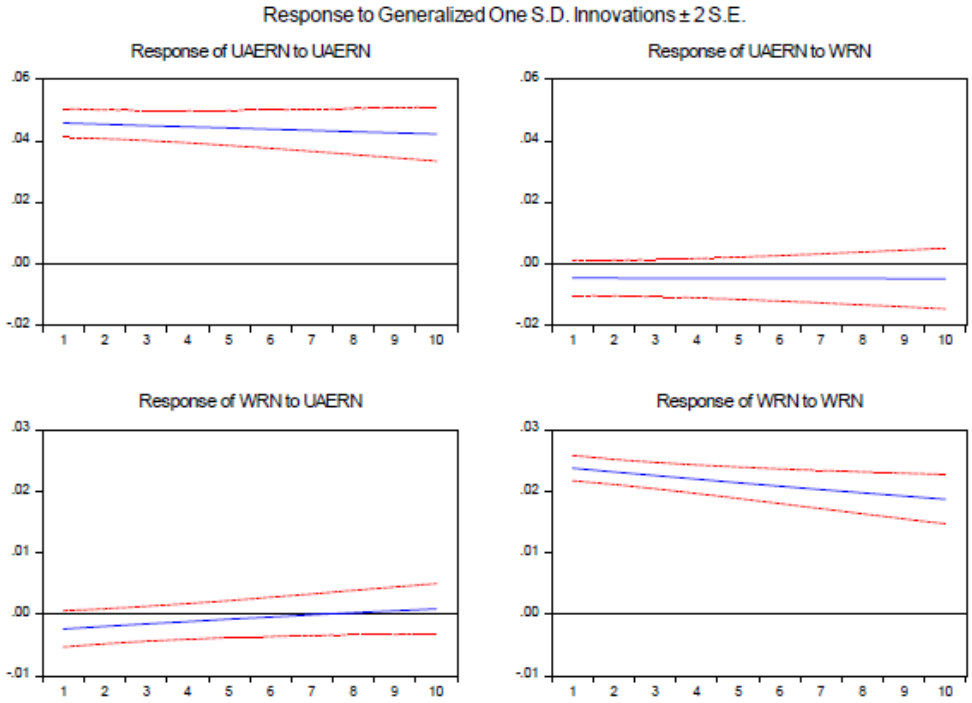


FIGURE 10 - *The Asymmetric Generalized Responses for the Cumulative Negative Shocks*



5.1.1 Empirical Results for the Asymmetric Impulse Relationship between the World Stock Market and the UAE Real Estate Market

In this sub-section, we investigate the interaction between the world stock market and the UAE real estate market. The results for the asymmetric impulses joined with the related 95% confidence intervals, which are produced by means of Monte Carlo simulations before and after the crisis period, together with the interaction between the world stock market and the UAE real estate market are shown diagrammatically in Figures 11-16.

Figures 11 to 14 present the standard impulses for the original data joined with the 95% confidence intervals. As is demonstrated, the reaction of the UAE real estate market to symmetric shocks on the world stock market is not statistically significant before and after crisis period for a time horizon of ten periods. Next, we will investigate the asymmetric impulses to see whether or not there are asymmetric effects.

Figures 12 to 15 exhibit the reaction for the variables given in total positive changes together with the 95% confidence interval. As is evident, before and after crisis period the combined

positive variations on the world stock market do not have any significant impact on the UAE real estate market. The estimated variance decomposition for this case reveals the following. Among the changes in the forecast error in the real estate market of the UAE, 2% is attributable to the UAE market and the remaining 98% is accounted for by the forecast error in the cumulative positive innovation of the global stock market. The corresponding value of cumulative positive shocks in the UAE real estate market is 97% and that for the world equity market is 3%.

Figures 13 to 16 exhibit the mutual reaction of the variables in the combined negative configuration with the 95% confidence interval. We can plainly observe that, before and after the crisis period, the total negative progressions of the UAE real estate after a positive shock in the world stock market index are not statistically significant. Following this line of thought, the real estate market in the UAE was not impacted by the global financial market. Next, we estimated the asymmetric variance decomposition and found the following. Cumulative positive changes were responsible for less than 1% of the changes in the forecast error of the UAE real estate market and the overall cumulative negative shocks in the global stock market were responsible for 99.9% of the changes in the forecast error. 90% and 9.6% are the corresponding values for the cumulative negative innovation overall in the UAE's real estate market and global stock market respectively. It should be noted that in no case does the UAE real estate market price index react to shocks in the world stock market.

5.2 World Stock Market and the UAE Real Estate Market between 01/14/2005 and 08/01/2008

FIGURE 11 - *The Standard Generalized Responses from the Original Data*

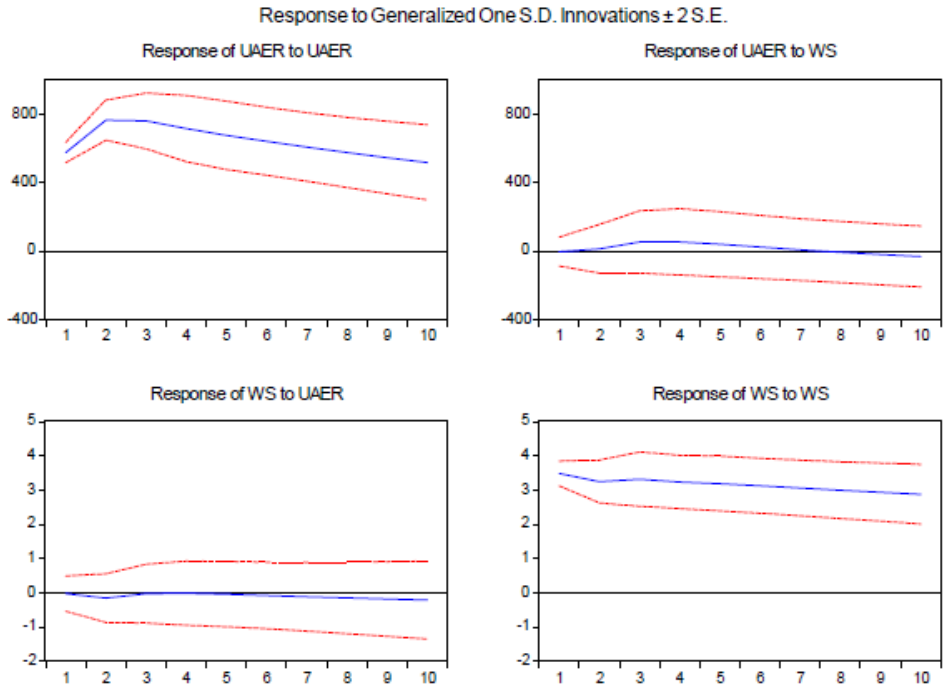


FIGURE 12 - *The Asymmetric Generalized Responses to the Cumulative Positive Shocks*

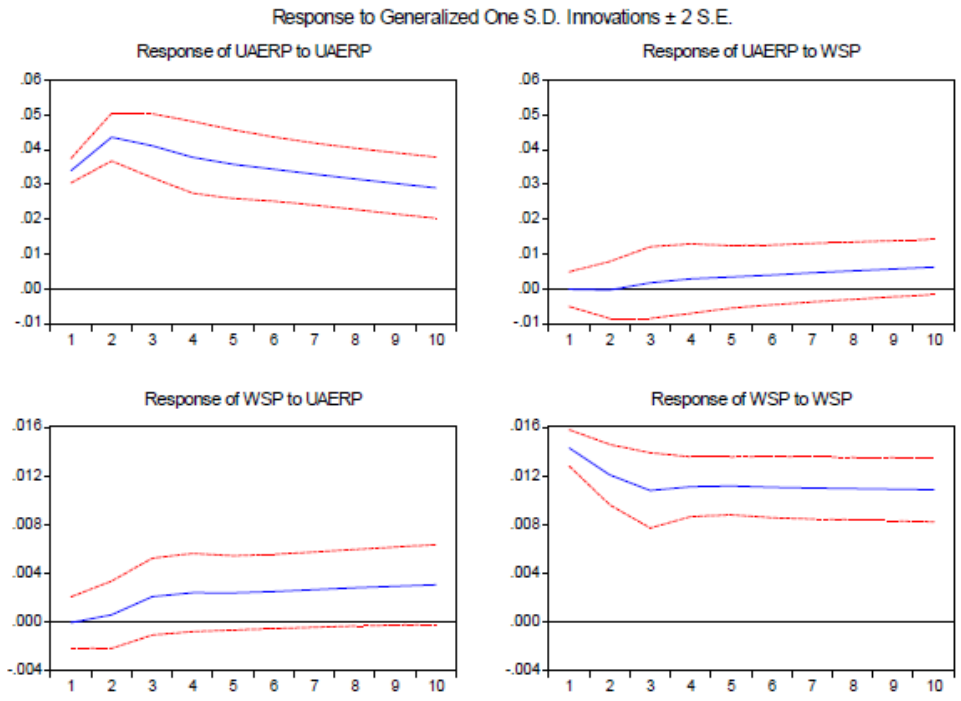
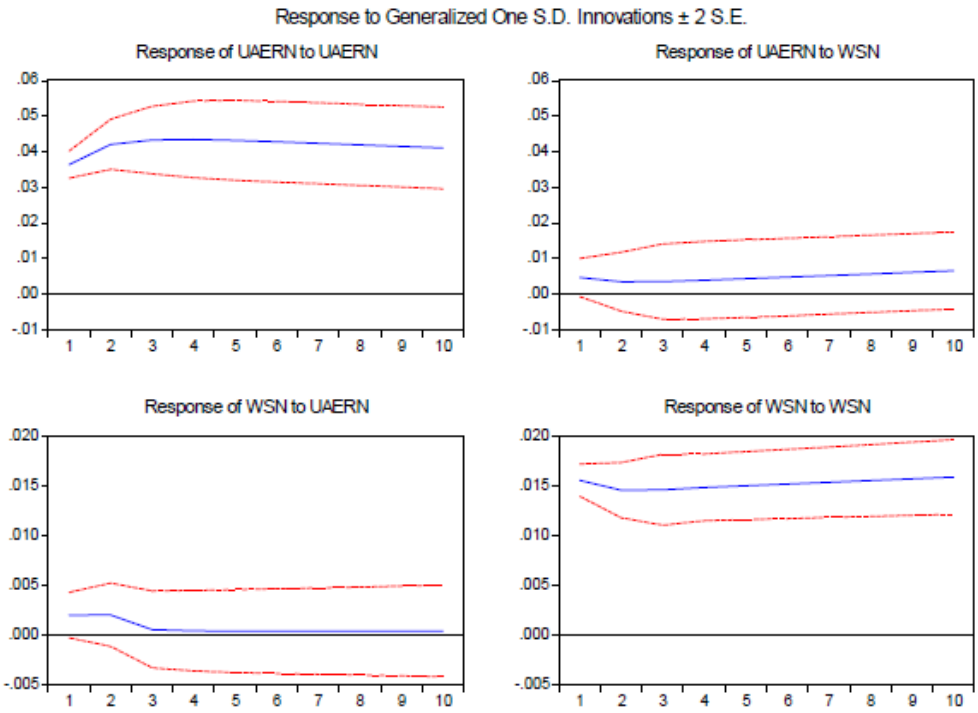


FIGURE 13 - *The Asymmetric Generalized Responses to the Cumulative Negative Shock*



After crisis period during 08/08/2008 to 06/14/2013

FIGURE 14 - *The Standard Generalized Responses from the Original Data*

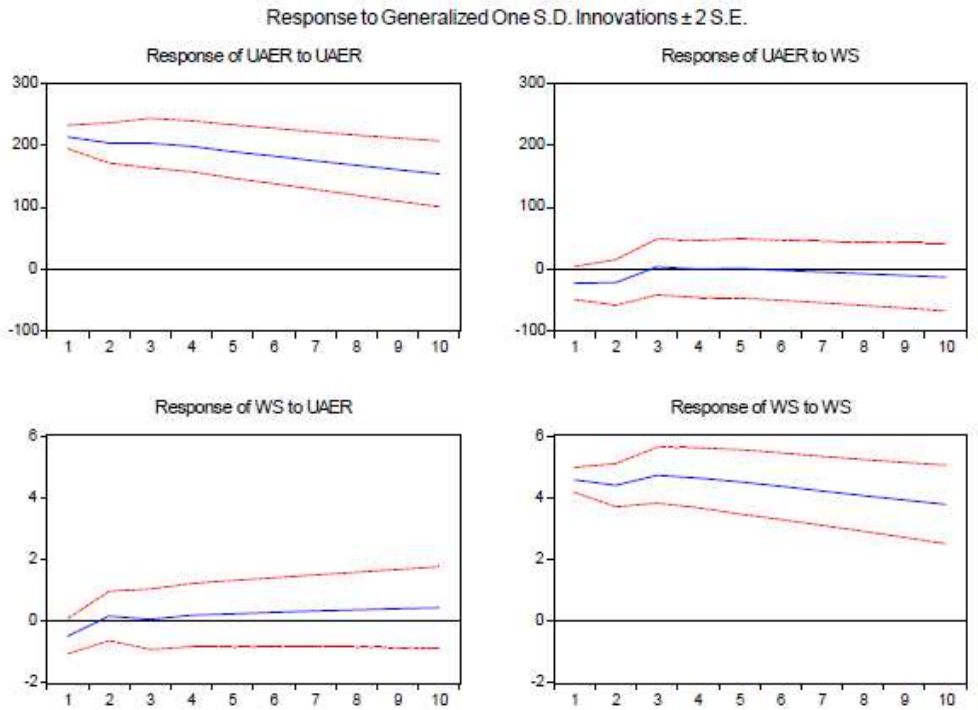


FIGURE 15 - *The Asymmetric Generalized Responses to the Cumulative Positive Shocks*

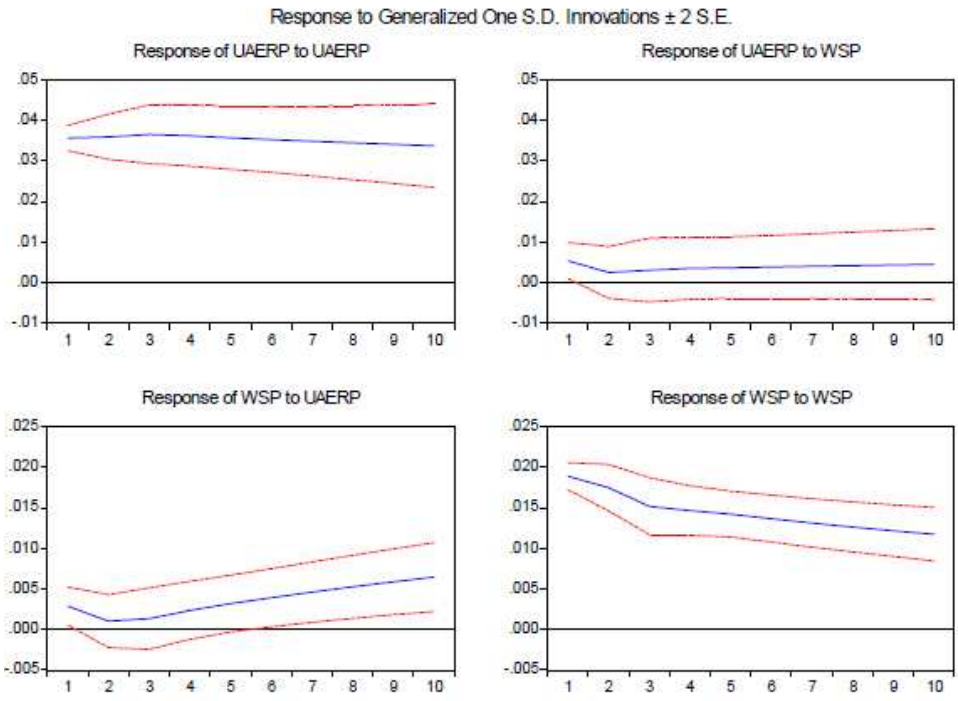
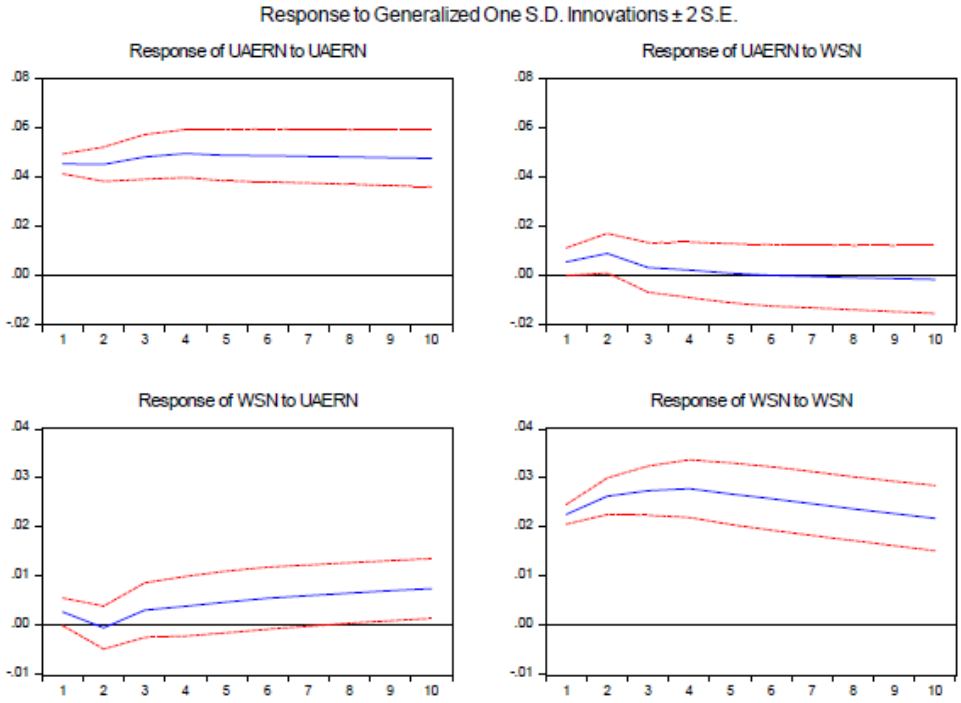


FIGURE 16 - *The Asymmetric Generalized Responses to the Cumulative Negative Shocks*



5.3 Asymmetric Causality Tests

In order to check the robustness of the results we also conducted symmetric and asymmetric causality tests, as developed by Hatemi-J (2012)[1]. The results are presented in Tables 1 and 2. These causal results support the results obtained by the impulse response functions. The null hypothesis of no causality cannot be rejected in any of the three cases.

TABLE 1 - *Results of the Symmetric and Asymmetric Causality Tests for the Pre-Crisis Period between 01/14/2005 and 08/01/2008 on a Weekly Basis (186 Observations)*

Null Hypothesis H_0	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%	Wald Test Value	Conclusion on H_0
$WR \neq> UAER$	9.255	5.762	4.529	0.561	Not rejected
$WR^{+} \neq> UAER^{+}$	10.112	5.635	4.193	0.682	Not rejected
$WR^{-} \neq> UAER^{-}$	7.499	4.008	2.684	0.649	Not rejected

Notes: The denotation WR ≠> UAER means that the WR does not cause the UAER. The denotation CV is an abbreviation for 'critical value'. The statistical software component produced by Hatemi-J (2011) is used in order to implement the asymmetric causality tests.

TABLE 2 - *Results of the Symmetric and Asymmetric Causality Tests after the Crisis Period between 08/08/2008 and 06/14/2013 on a Weekly Basis (254 Observations)*

Null Hypothesis H_0	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%	Wald Test Value	Conclusion on H_0
$WR \neq> UAER$	7.327	4.047	2.681	0.082	Not rejected
$WR+ \neq> UAER+$	9.065	3.704	2.747	2.164	Not rejected
$WR^{-} \neq> UAER^{-}$	9.954	6.533	4.487	6.51	Not rejected

Notes: The denotation WR ≠> UAER means that the WR does not cause the UAER. The denotation CV is an abbreviation for 'critical value'.

The empirical results of the null hypothesis indicate that the changes in the real estate sector of the UAE were not caused by the world's real estate crisis either in the pre-crisis period or the

[1] For details on bootstrap simulations when causality tests are implemented see Hacker and Hatemi-J (2006).

post-crisis period but can be attributed to some positive factors which contributed to insulating the UAE from negative international spill-over effects. The reason that the UAE market was not negatively affected by the world market may be as follows. The UAE Federal Cabinet's decision on October 13, 2008 to take major steps to tackle this crisis entailed the promise that the UAE's Central Bank would guarantee bank deposits in both local and foreign banks (so long as they had shown significant operations in the UAE for at least 3 years).

On 14th December 2009 the Abu Dhabi government played a key role by providing funds for Dubai World, the owner of Nakheel, the giant real estate arm of the Dubai government, in order to avoid a default in paying back the debt due to its creditors, which strengthened the investors' trust and restored their confidence. The confidence grew further with the considerable increase in earnings and the enormous monetary reserve that the UAE had been amassing from the dramatic increase in oil prices since the year 2000.

The UAE Government's realistic and timely planning of expenditure in the infrastructure sector significantly strengthened the demand of the real estate market in the UAE. In addition, the high influx of tourists, and the presence of expatriate investors for newly finished residential units intensified the demand during this period, contrasting with the lukewarm ness of the pre-crisis and post- crisis period. After the crisis, a boom in the real estate sector in Abu Dhabi started. The estimated supply of residential units available during the year 2010 was 31,000, while the demand was estimated to be about 160,000 units, which led real estate prices to climb and also led to more construction, as firms tried to plug the shortage in the market. There had been a prevailing recession and decline in the properties market in Dubai in 2008 and 2009, when prices dropped by around 30% to 40%, but the UAE Government managed to overcome this by imposing a strategic control on monetary policy on the part of the UAE Central Bank, thus minimizing the impact of the crisis. Within the Middle East region it is the United Arab Emirates whose real estate market enjoys the highest rank as far as stability, security, and transparency are concerned (Jones Lang LaSalle, 2012 and 2013).

We further explored the influence of the Global Financial Crisis (GFC) on the real estate sector of the UAE. For this purpose, the MSCI world stock price index was used along with the Emirates Securities and Commodities Authority index for the UAE real estate sector on a weekly

basis, covering the period from 2005 to 2013. The sample period for this purpose ran from 01/14/2005 to 06/14/2013, based on weekly data. The structural break period was selected at 1st August, 2008.

TABLE 3 - *Results of the Symmetric and Asymmetric Causality Tests for the Pre-Crisis Period between 01/14/2005 and 08/01/2008 on a Weekly Basis (186 Observations)*

Null Hypothesis H_0	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%	Wald Test Value	Conclusion on H_0
$WM \neq> UAER$	9.471	6.023	4.635	1.538	Not rejected
$WM^+ \neq> UAER^+$	9.010	4.436	3.010	0.661	Not rejected
$WM^- \neq> UAER^-$	11.456	8.440	6.426	0.792	Not rejected

Notes: The denotation WM ≠> UAER means that the WM does not cause the UAER. The denotation CV is an abbreviation for 'critical value'.

TABLE 4 - *Results of the Symmetric and Asymmetric Causality Tests after the Crisis Period between 08/08/2008 and 06/14/2013 on a Weekly Basis (254 Observations)*

Null Hypothesis H_0	Bootstrap CV at 1%	Bootstrap CV at 5%	Bootstrap CV at 10%	Wald Test Value	Conclusion on H_0
$WM \neq> UAER$	6.719	3.527	2.526	0.220	Not rejected
$WM^+ \neq> UAER^+$	10.555	3.824	2.512	0.033	Not rejected
$WM^- \neq> UAER^-$	7.609	4.285	2.860	1.083	Not rejected

Notes: The denotation WM ≠> UAER means that the WM does not cause the UAER. The denotation CV is an abbreviation for 'critical value'.

Tables 3 and 4 illustrate the results of the estimation of parameters, which were used separately for the pre-crisis and post-crisis periods. The estimated value of the causal relationship between the UAE real estate price index and the stock price index of the global stock market is evident in both tables. It shows in both cases that the stock price index of the global stock market does not have any significant influence on the UAE real estate price index, either before or after the crisis. However, we also find that the real estate market of the UAE is more sensitive to the world stock

market then is the world's real estate markets, since these markets registered higher critical values with the former than the latter during the pre-crisis period. Nevertheless, the real estate market of the UAE seems to be more sensitive to the world's real estate market than to the world stock market after the crisis period.

6. Concluding remarks

This paper explores the possible relationship between the UAE real estate market and the world real estate market. It also investigates the interaction between the world's stock market and the real estate market in the UAE by applying generalized asymmetry impulse responses. The use of this approach improves performance more than the other standard methods do. We also used asymmetric causality tests which can separate the effects of adverse changes from those of favorable ones. The technique of bootstrap simulation was used to ensure the reliability of critical values since the data are not normally distributed. Both methods confirm the same empirical results. The estimated results make it statistically evident that the real estate market of the UAE received no impact from the global real estate market before or after the crisis period. Taking into account the asymmetry in these assessments may be essential for evaluating whether positive turbulences have the same total effect as negative turbulences. This is attained by evaluating the impulses and reactions to turbulences focusing on the total segments of the positive and negative progressions of the world's real estate market and the UAE's real estate market.

Furthermore, we investigate the movement of the world stock market price index with regard to the real estate price index in the UAE for the period between 1/14/2005 and 14/6/2013, considering the impact of the global financial crisis. This paper is fundamentally different from other studies in its use of asymmetric causality tests for differentiating between positive and negative changes. In order to establish authentic critical values, bootstrap simulation methodologies were used. The results make it clear that the null hypothesis that the world stock price indexes do not cause a negative impact on the UAE real estate stock price index, under any conventional level of significance, is valid for both positive and negative changes. Thus, there seems to be no linkage between the world stock price index and the real estate stock prices in the UAE.

The outcome of the analysis indicates that the developments in the world's real estate market price did not prompt any critical reaction in the UAE real estate market price index. This was due to the bailout effort of the Abu Dhabi government in creating the required cash flow in the Dubai market from bulk purchases of property stocks valued in the range of 10 million Euros, which allowed Dubai to settle its debts and loans.

Further, Abu Dhabi's commitment to the Eichholtz Vision is shown by an investment plan of US$180 billion in various sectors such as property and infrastructure facilities, in particular the development of the Saadyat and Al Reem Islands which compose about 18% of Abu Dhabi. However, during the financial crisis a number of real-estate projects in the UAE were abandoned or shelved, due not only to the drop in the oil and gas prices but also the 25%-40% decline in property prices brought about by the world financial crisis. During this period, many of the bankrupt real estate companies survived only by outsourced loans.

The conventional banking system in the UAE is controlled by the Central Bank under strict regulations for securing lending facilities. The collateral that exists in the banking sector serves to protect lenders against borrowers. Thus, the banks in the UAE managed to sustain the world financial crisis and its negative effects. Sustainability in this sector was maintained simply by the strict policies covering loan facilities to minimize credit risk. In addition, the growth in the Islamic banking sector, which contributed to its power to resist the world's financial crisis can be traced to the fact that Islamic banking products are based not on interest but on strict Shari'ah law using the Murabaha system.

The real-estate crisis in the USA and the world market was led by the failure in other banking systems to select reliable mortgagors, which was not the case in the UAE.
The real estate investors, consumers, and bankers were not sure what to decide during the world financial crisis, which created suspicion and uncertain conditions, resulting in an unpredictable period while the crisis continued. The situation led consumers to postpone any decision to buy a new residential unit, real-estate investors to cancel projects, and banks to pretend to be stricter on their financing policies than they had been, as a precaution against negative consequences encouraged by the crisis.

The UAE has the richest possible sovereign funds, which contributed to the rescue of the UAE economy and the real-estate sector from the turmoil of the financial crisis. This appears to be the situation when the impulses are estimated, taking account of the concept of asymmetric property.

Another implication of our empirical findings is that the UAE real estate market can be considered as informationally efficient with regard to movements in both the world real estate market and the world stock market.

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