

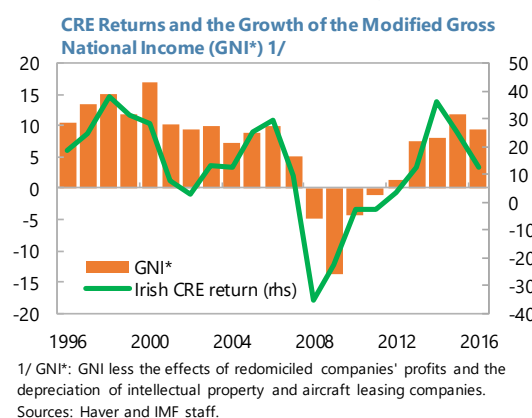
# THE IRISH COMMERCIAL REAL ESTATE MARKET: SYNCHRONIZATION AND THE ROLE OF EXTERNAL FACTORS<sup>1</sup>

*This chapter examines the synchronization of the Irish returns on commercial real estate (CRE) properties with those in peers to better understand the importance of external factors in explaining the high volatility of CRE returns in recent years. The analysis finds that the cyclical pattern of Irish CRE returns is highly correlated with that in other advanced economies, yet with much higher volatility. Moreover, a vector auto-regression (VAR) analysis points to a high impact of international CRE prices on Irish CRE prices, and to strong feedback effects between the latter and domestic economic activity. These findings underline the importance of continued close monitoring of this market to ensure that the financial system is resilient to possible drops in collateral values and investment flows.*

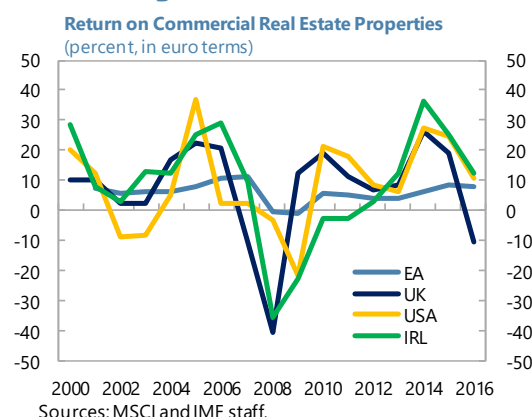
## A. Introduction

1. **Irish CRE prices and rents have bounced back strongly in recent years after experiencing a highly volatile boom-bust episode (Figure 1).** The Irish CRE market has been on a recovery path since 2012, after a prolonged and substantial adjustment in which a highly-leveraged commercial property boom was abruptly unwound and returns on CRE properties dropped by more than 50 percent cumulatively in 2008–11.<sup>2</sup> The massive adjustment, which negatively affected construction activity, had far-reaching adverse effects on the financial system and the economy as a whole. Since then, Ireland's growth prospects have improved substantially, and the rapid expansion of economic activity as well as domestic and foreign investors' search for yield have prompted a renewed demand for CRE properties and pushed prices and rents upwards in the face of limited supply. While CRE prices remain significantly below their pre-crisis highs and the price-to-rent ratio continues to be well

**Figure 1. CRE Return and Domestic Economic Activity**



**Figure 2. CRE Returns**

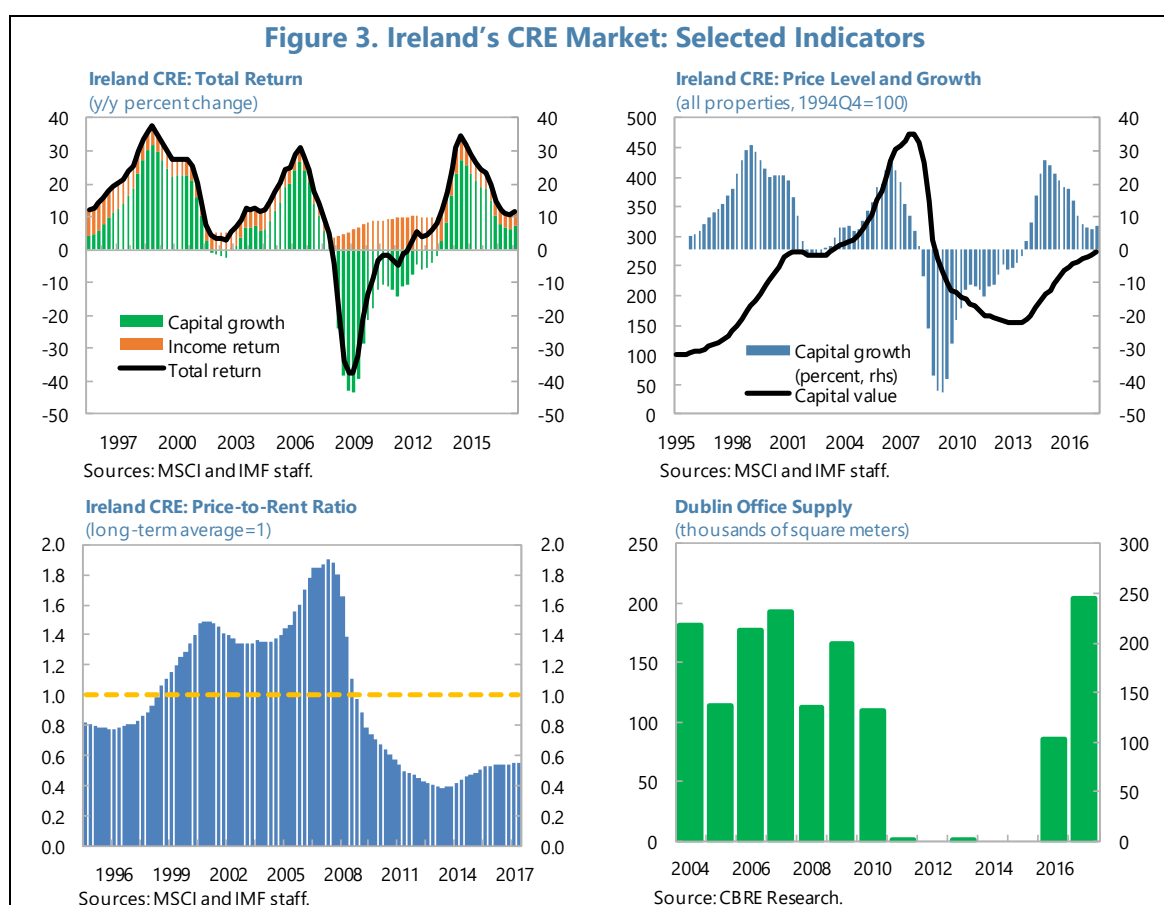


<sup>1</sup> Prepared by Nir Klein. The paper benefited from useful comments and suggestions by Gerard Kennedy and the participants of the workshop at the Central Bank of Ireland.

<sup>2</sup> The total return incorporates both capital and income elements.

below its long-run average, demand pressures, including from foreign investors, are likely to persist in the period ahead, keeping the returns in this market elevated.

**2. The high volatility of the CRE market was also featured in other economies, including in Ireland's key trading partners.** The CRE returns in countries that were at the epicenter of the global financial crisis, such as the U.S. and the U.K., also exhibited high volatility in recent years with trends that are closely correlated with those in Ireland. The average return on CRE properties in the euro area showed a similar trend, though its volatility has been more limited. The apparent co-movement in the CRE returns between Ireland and other countries may suggest that the developments in the Irish CRE markets are also influenced by external factors, which could work through both direct and indirect channels.



**3. Recent empirical evidence corroborates the strong co-movement in the real estate markets across countries.** While housing is considered a non-tradable heterogeneous asset, there is growing empirical evidence that shows that the degree of synchronization of real house price returns has been surprisingly high across countries. For example, Case et al. (2000), who examined the synchronization of commercial property returns, show that the co-movement between property prices and GDP growth decrease noticeably after controlling for global GDP, suggesting that real estate markets are largely correlated through common movements of real GDP. Other studies, which focused more on the synchronization of the residential property

prices, found that real house price returns can be highly correlated across countries, partly due to global and regional housing factors (Cesa-Bianchi, 2012), and that they have become more synchronized over time (Hirata et al., 2012), with increases in the short-run co-movements around global recessions (IMF, 2018)

**4. The strong real estate price co-movement across countries points to the existence of underlying common driving factors.** These include the synchronization of the property market fundamentals such as income and interest rates, as well as enhanced financial integration, which results in synchronized borrowing conditions. These effects may have played a prominent role in currency unions where countries share the same monetary policy, and trade and financial markets are strongly integrated. Expectations about global economic and financial conditions are likely to result in synchronized business cycles and CRE returns. The presence of international lenders and investors (e.g. equity firms, real estate investment funds (REITs), and institutional investors) that operate in various markets simultaneously may have also contributed to strong synchronization across countries. Finally, global confidence effects and the degree of investors' risk aversion can also increase the co-movement in property price dynamics.

**5. The drivers and degree of property price synchronization may have policy implications.** Coordinated movements in CRE prices across countries suggest that country-specific or global shocks can be transmitted from one country to another rather quickly through both direct and indirect channels and could potentially inflict widespread bouts of economic and financial instability. Indeed, large house price swings in the past were associated with periods of financial instability across many countries, especially if they were accompanied with a pullback of global investors and capital flight (Claessens et al. 2008, 2011). Therefore, understanding the drivers of the synchronization in the CRE markets is important to enhance the resilience of the financial sector and the economy against shocks.

**6. Against this background, the analysis takes a closer look at the drivers of Irish CRE returns and the impact of the latter on the Irish economy.** Specifically, this chapter aims to:

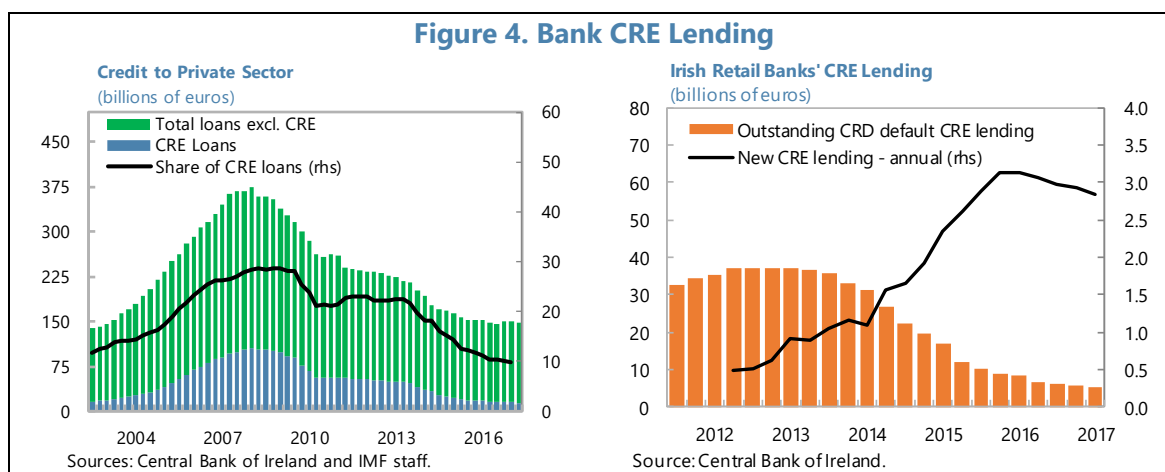
- Examine to what extent the returns on Irish CRE properties co-move with those in peers, and whether this synchronization has changed over time;
- Investigate the role of global factors and Ireland's bilateral linkages with peers in driving the synchronization of Irish CRE returns with those in other countries; and
- Assess the sensitivity of Irish CRE prices to international CRE prices, and the linkage between the CRE market and the broader domestic economy through a VAR analysis.

**7. The chapter is organized as follows:** Section B provides a short description of the recent developments in the Irish CRE market with a focus on CRE investment and financing. Section C assesses the co-movement of the CRE's total return in Ireland with that in peers, and section D examines the drivers of the synchronization using panel estimates. Section E explores the sensitivity of Irish CRE prices to changes in international CRE prices and their effect on the

domestic economy through a VAR analysis. Section F summarizes the key takeaways and offers some policy implications.

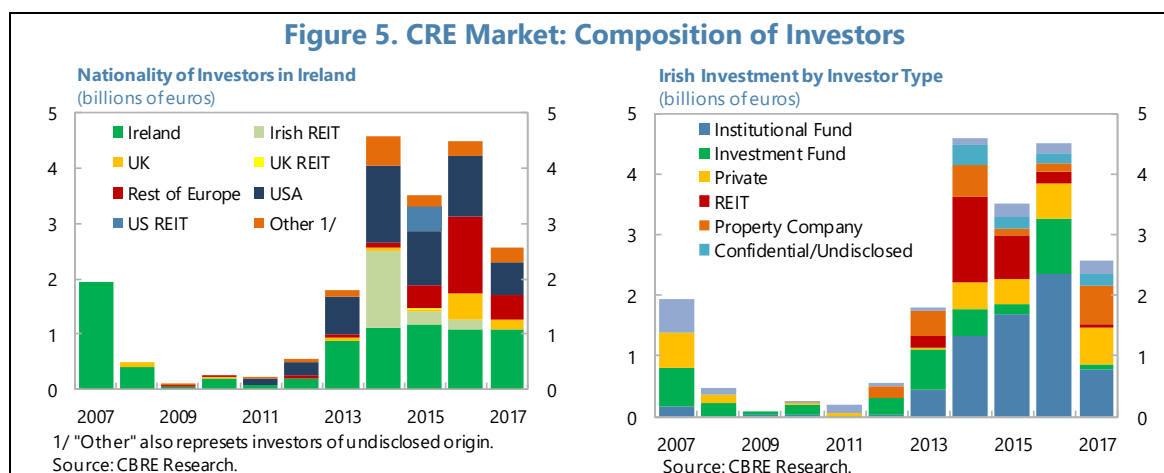
## B. CRE Investment and Financing: Some Stylized Facts

**8. Domestic banks' deleveraging in the post-crisis period was accompanied with a significant decline in their CRE exposure.** Domestic banks have deleveraged considerably since the onset of the financial crisis, registering a contraction in all loan categories. Nevertheless, the decline in the CRE portfolio was substantial, largely reflecting the transfer of large CRE loans from bank balance sheets to the National Asset Management Agency (NAMA). Overall, domestic banks' exposure to the CRE market declined to about 10 percent of total loans in 2017q4 from nearly 30 percent in 2009 (Figure 4). In recent years, however, new bank lending—although still falling short of the large redemptions—has picked up after a prolonged period of subdued activity. The level of impaired loans on bank balance sheets also dropped significantly, yet, at about a quarter of total CRE loans, they remain elevated.



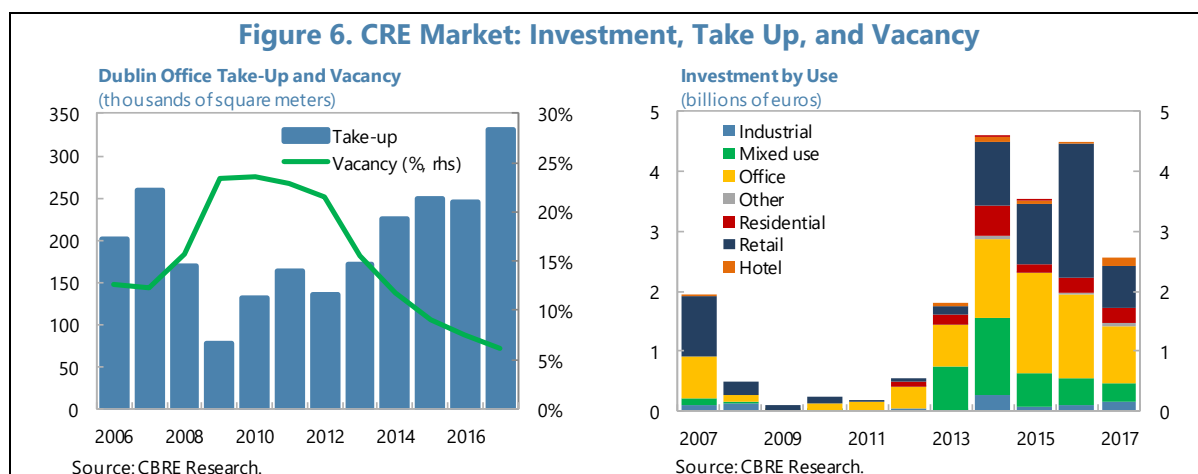
**9. Foreign investors' activity has increased significantly in recent years (Figure 5).** The CRE market prior to the crisis was largely dominated by Irish investors that funded their activity by bank financing. However, in recent years the role of foreign investors increased and, apart from 2014, they accounted for most of investment in the Irish CRE market. The total foreign investment in CRE in 2011–17 amounted to about €10 billion, of which €5.5 billion is related to direct investment by U.S.-based investors. Investment by U.K. investors and investors from other European countries represented 8 percent and 23 percent, respectively, of foreign investment over this period, while direct investment from other regions such as Asia, Africa, and Canada, remained rather small. Investment by Irish investors has shown signs of recovery from 2013, yet at an annual average of €1.6 billion in 2013–17, it remained well below the pre-crisis levels.

**10. CRE investment was driven by a diversified group of investors.** Irish REITS, which used bank and nonbank funding sources (including equity), acquired a sizeable portfolio of assets after their entry in the market in 2013, but more recently they have been less involved in new investments. The role of institutional investors also increased as pension and insurance



funds from the U.S., the U.K., and Germany sought to match long-term liabilities with long-term assets. Other private investors such as investment funds and property companies were also active.

**11. The value of CRE investment moderated in 2017 as commercial properties available for sale declined.** Following very strong investment activity in 2014–16 of about €3.5–4 billion a year, investment fell to about €2.5 billion in 2017, reflecting in part the shrinking supply of offices. Dublin's office vacancy rate has fallen to a record-low of 6 percent at end-2017 from about 24 percent in 2010, while the take up has reached the highest level in last 15 years. Although declining, investment in offices and retail assets continued to make up the bulk of investment in the CRE market (Figure 6).



**12. New development is underway in the face of sustained demand pressures.** Demand for CRE properties is likely to be sustained in the period ahead, in line with the favorable outlook for the Irish economy. Nevertheless, price pressures are likely to be mitigated by the extent of new development commencing and planning applications that are being lodged. According to CBRE Research, office supply in Dublin is projected to increase by an annual average of 220,000 square meters in 2018–20, exceeding the average annual take up of about 200,000 square meters

in 2010–16. The post-Brexit arrangement—while expected to have a negative impact on the Irish economy as a whole—may exacerbate demand pressure in prime locations in Dublin due to relocation decisions.

## C. The Co-movement of Ireland’s CRE Return with Peers

**13. Recent studies applied a range of measures to assess co-movements among economic variables, including property prices.** There is no single way to measure synchronization as each method has its pros and cons. Some methods are simple and intuitive yet sensitive to filtering methods, while other more sophisticated ones, may be subject to prior assumptions and estimations errors. Methodologies that were applied in the context of the housing market include a simple rolling correlation, a dynamic factor model (Kose et al. 2012 and IMF, 2018), an inverse of the absolute difference of house prices, instantaneous quasi-correlation, and concordance statistics. Some studies such as Hirata et al. (2012) also used a variance decomposition into global and country-specific components to assess the common factor in house price movements across countries.

**14. This study employs two alternative indicators for synchronization that are commonly used in empirical studies.** The two indicators complement each other as one measures the synchronization in the level of the CRE returns (*Synch1*), while the second indicator measures the synchronization of CRE returns’ cycles (*Synch2*). The construction of these two indicators is as follows:

**Synch1:** We follow Morgan, Rime, and Strahan (2004) and Kalemli-Ozcan et al (2013), and construct the synchronization measure as the negative of the absolute difference between Ireland’s and country *j*’s total returns (*TR*):

$$Synch1_{irl,j,t} = -|TR_{irl,t} - TR_{j,t}|$$

By construction, this measure obtains non-positive values. Less negative values would suggest higher correlation.

**Synch2:** We follow Duval et al. (2016) and IMF (2018), and calculate the instantaneous quasi-correlation that can be computed at any point in time:

$$Synch2_{irl,j,t} = \frac{(TR_{irl,t} - \overline{TR}_{irl})(TR_{j,t} - \overline{TR}_j)}{\sigma_{irl}^{TR} \sigma_j^{TR}}$$

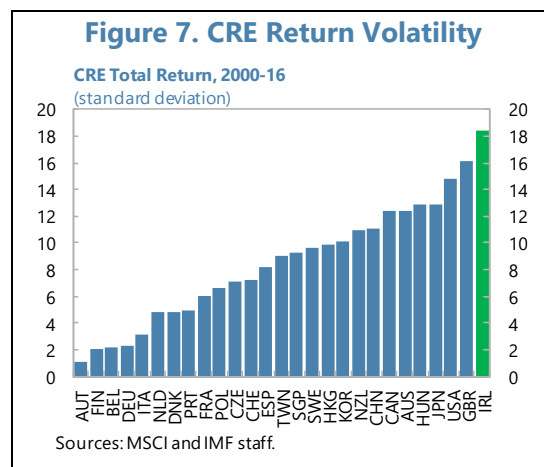
where  $TR_{j,t}$  denotes the total return of CRE property of country *j* in year *t*, and  $\overline{TR}_j$  and  $\sigma_j^{TR}$  represent the mean and standard deviation of the total return over the sample period, respectively. A negative value would suggest that synchronization is low as the total return in one country is above its long-term average while the total return in the counterpart country is below its long-term average. Positive values, which suggest higher synchronization, would result if both countries simultaneously experience returns above or below their long-term averages. Other things the same, higher volatility would suggest less synchronization.

We use annual data for 2000–16 from Morgan Stanley Capital International (MSCI). The data covers all properties types (office, industrial, retail, residential, and hotels) across 27 countries (including Ireland) for which data is available.<sup>3</sup> To ensure comparability across countries, the CRE total return is measured in euro terms.

**15. Table 1 presents the summary statistics of the total return and the synchronization by both measures.**

We divide the sample into three sub-periods: the pre-crisis period 2000–07, the crisis period (2008–2011) when Ireland experienced a prolonged period of negative returns on CRE properties, and the recovery in 2012–16. Over these three periods the total return exhibited high volatility. It ranged from 40 percent (Canada) in the run up to the crisis to about -40 percent (Great Britain) during the financial crisis. The volatility in Ireland has been the highest in the sample owing to the boom-bust episode in 2005–11 as well as the strong recovery in recent years (Figure 7). The two synchronization measures show that, on average, Ireland's degree of synchronization declined slightly in 2012–16 compared to the pre-crisis period. Moreover, during the crisis

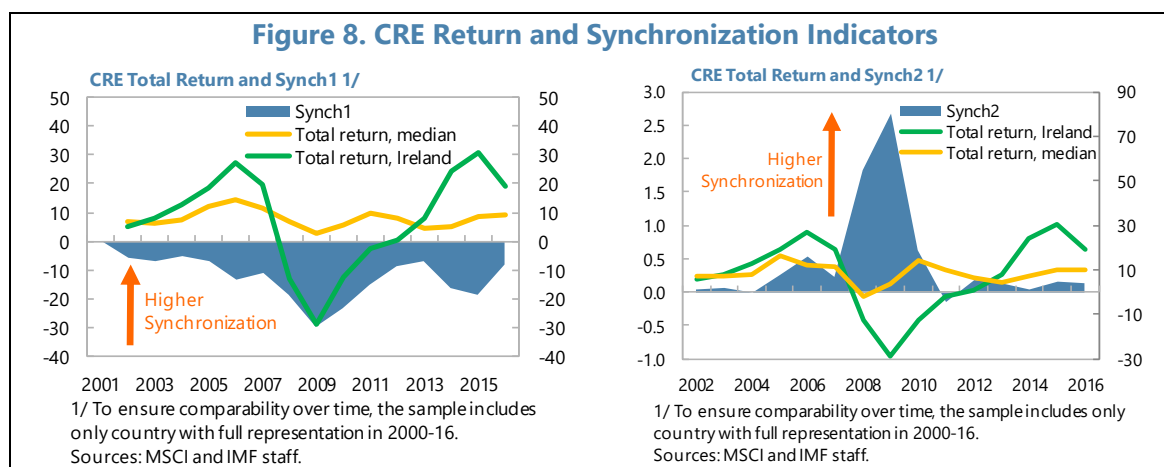
(2008–11), the measures moved in opposite directions: *Synch1* indicates a decline in the synchronization, while *Synch2* shows an increase in synchronization (Figure 8). This suggests that, while the downturn in the Irish CRE return largely coincided with that in peers, it was much more severe than in other countries.<sup>4</sup>



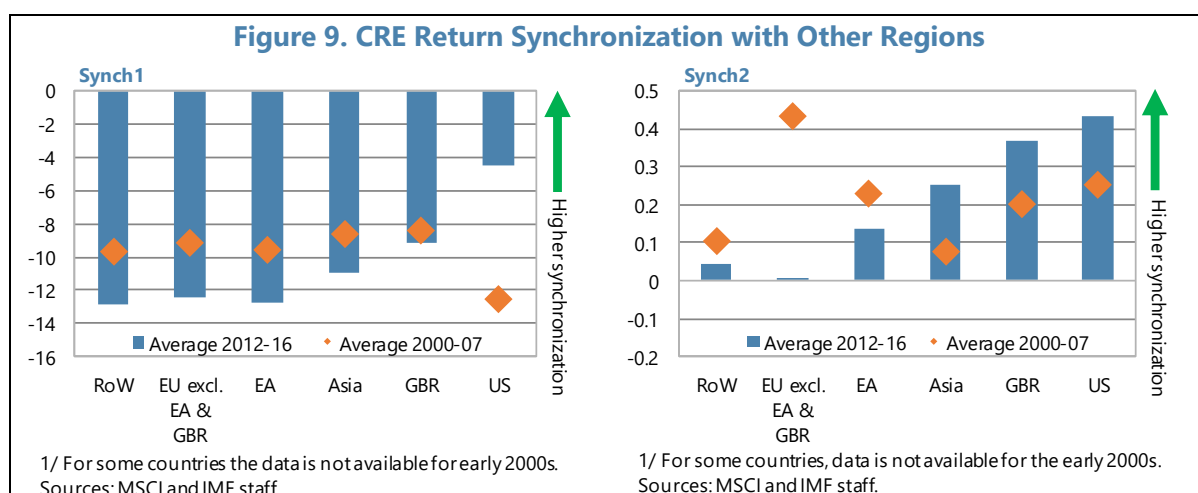
<b>Table 1. Summary Statistics 1/</b>									
	<b>2000–07</b>			<b>2008–11</b>			<b>2012–16</b>		
	<b>Total Return</b>	<b>Synch1</b>	<b>Synch2</b>	<b>Total Return</b>	<b>Synch1</b>	<b>Synch2</b>	<b>Total Return</b>	<b>Synch1</b>	<b>Synch2</b>
Average	10.5	-9.2	0.2	4.1	-18.2	1.1	8.8	-11.5	0.1
Min	-10.5	-31.3	-1.3	-40.6	-54.2	-3.8	-10.3	-34.9	-1.2
Max	39.8	-0.2	2.2	33.3	-0.3	8.4	36.1	-0.3	1.4
Std.	8.4	7.5	0.6	14.2	13.2	2.3	7.2	9.6	0.5
1/ Figures are calculated only for countries that have full representation over the sample period.									

<sup>3</sup> The sample includes Australia, Austria, Belgium, Canada, Switzerland, China, Czech Republic, Germany, Denmark, Spain, Finland, France, Great Britain, Hong Kong, Hungary, Ireland, Italy, Japan, Korea, the Netherlands, New Zealand, Poland, Portugal, Singapore, Sweden, Taiwan, and the USA. For some countries, data is only available for a shorter period.

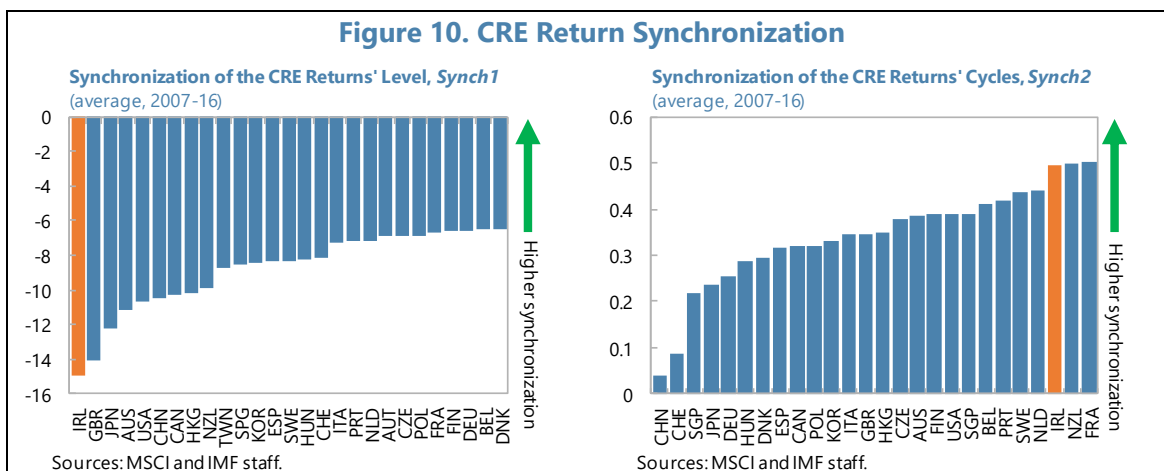
<sup>4</sup> While synchronization of CRE returns is measured across countries, one would expect it to be more likely between cities, including in Ireland where some regions are more insulated from external shocks.



**16. The co-movement of Ireland's CRE returns varied significantly across countries and over time.** The calculation shows that, for both measures, Ireland's synchronization with the U.S., Great Britain, and Asian countries is high compared to that with other countries in the sample (Figure 9). In addition, while *Synch1* shows that, apart from the U.S., the degree of synchronization has declined in recent years compared to its pre-crisis level, *Synch2* shows that the synchronization with the U.S., Great Britain, and Asian countries has increased overtime.



**17. The two indicators suggest that while Ireland's synchronization with regard to the returns' cycle is high, the synchronization of the returns' level is low.** To assess how Ireland's synchronization in CRE returns compares to other countries, we calculate for each country in the sample the average synchronization with its counterparts. The calculation shows that Ireland's cyclical synchronization, as measured by *Synch2*, has been one of the highest in the sample, reflecting the economy's high openness and the large presence of foreign-owned companies that are affected by external macroeconomic conditions. The fact that Ireland is part of a currency union and shares monetary policy with other members may also have contributed to the high co-movement of the CRE returns' cycle. Nevertheless, the synchronization of the returns' level, as measured by *Synch1*, indicates low synchronicity reflecting the high volatility of Irish CRE returns over the sample period (Figure 10).



## D. The Determinants of Synchronization in the CRE Markets

**18. We estimate the following specification to study the relationship between the degree of synchronicity and various global and bilateral factors:**

$$Sync_{irl,j,t} = \alpha_{irl,j} + \beta BILATERAL_{irl,j,t} + \gamma GLOBAL_t + \varepsilon_t$$

where  $Synch_{irl,j,t}$  reflects the co-movement between Irish CRE returns and those in country  $j$  as measured by the two measures (*Synch1*, *Synch2*);  $BILATERAL_{irl,j,t}$  is a vector of bilateral variables of Ireland and country  $j$ . These include financial linkages, proxied by country's  $j$  portfolio investment in Ireland as a share of Ireland's GDP (*FINANCIAL*), bilateral trade (*TRADE*, imports plus exports as a share of Ireland's GDP), government long-term yield differentials in absolute value (*ABS\_SPREAD*), and synchronization of business cycles, measured by the co-movements of output gaps (*OUTPUTGAP\_SYNCH*).  $GLOBAL_t$  represents a vector of global variables that may affect CRE market synchronicity such as risk aversion (*VIX*), and the global liquidity gap, which is measured as the deviation of bank credit to the nonfinancial private sector (as a share of global GDP) from its trend. The specifications include several dummy variables such as *Crisis* for the global financial crisis in 2008–09 and *EA* for Euro area members, which share a common currency and thus may experience a higher level of synchronization. The regressions are estimated using an instrumental variable method to address a possible endogeneity bias (two-stage least square), with country and time fixed effects.

**Table 2. CRE's Total Return: Determinants of Synchronization**

Instrumental variable estimation, two-stage least square (GLS2LS), Random Effects 1995-2016					
<b>Dependent Variable: SYNCH1</b>					
	(1)	(2)	(3)	(4)	(5)
VIX	-2.431***	-2.538***	-2.675***	-2.488***	-2.439**
GLOBAL LIQUIDITY GAP	4.575***	4.470***	2.533**	4.602***	4.332***
CRISIS	-17.955***	-16.092***	-8.481	-17.876***	-16.178**
EURO AREA	1.284*	-0.011	1.302	6.462**	-8.607
ABS_GOV YIELD SPREAD		-1.809**			
OUTPUTGAP_SYNCH			2.805***		
TRADE				-0.839	
FINANCIAL					2.921***
Constant	28.015***	32.151***	36.545***	27.529***	20.146***
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup> (overall)	0.625	0.642	0.557	0.571	0.363
# obs.	364	363	364	324	319
Hausman test p-value					
H <sub>0</sub> : RE H <sub>1</sub> : FE	0.122	0.985	0.945	0.163	0.998
# countries	26	26	26	25	25
*** Indicate significance level of 1 percent; ** indicates significant level of 5 percent, and * indicates significance level of 10 percent.					

**19. The estimation results for *Synch1* are presented in Table 2.** We present only the random effects specifications as Hausman tests validate the consistency of the estimated coefficients. The estimations show that global factors play an important role in the co-movement of CRE returns: higher global liquidity, which is associated with low interest rates and search for yield, tend to increase the degree of synchronization while higher risk aversion, as measured by the VIX, tends to reduce it. Moreover, the estimations show that during the global financial crisis the synchronicity of CRE returns declined significantly on average. The analysis also indicates that co-movement of Irish CRE returns is affected by the country's bilateral linkages. Higher business cycles synchronization (as measured by the co-movement of output gaps), and higher financial interconnectedness (proxied by portfolio investment in Ireland as a share of GDP) contribute to higher CRE return synchronicity.<sup>5</sup> Higher correlation of long-term yields, which may capture the cost of capital, contribute to higher synchronization. Relatedly, Ireland seems to exhibit higher synchronicity with countries within the monetary union, reflecting perhaps the absence of exchange rate risks for investors in the euro area. Bilateral trade was not found to have a significant impact on the synchronicity of the CRE returns.

**20. The estimation results for the cyclical synchronization measure (*Synch2*), which are presented in the Annex (Table A1), have lower explanatory power.** Nevertheless, the results confirm the impact of bilateral linkages such as business cycle synchronization, correlation of

<sup>5</sup> FDI flows were not found to have a significant impact on the synchronization of the CRE returns. Also, the interaction of EA with other variables was not found to have a significant impact.

long-term yields, and financial links. The crisis period was associated with higher synchronization, and some specifications also indicate that the synchronization of Irish CRE returns are, on average, higher with EA countries. Global variables, however, were not found to have a significant impact on Ireland's synchronization of the returns' cycle.

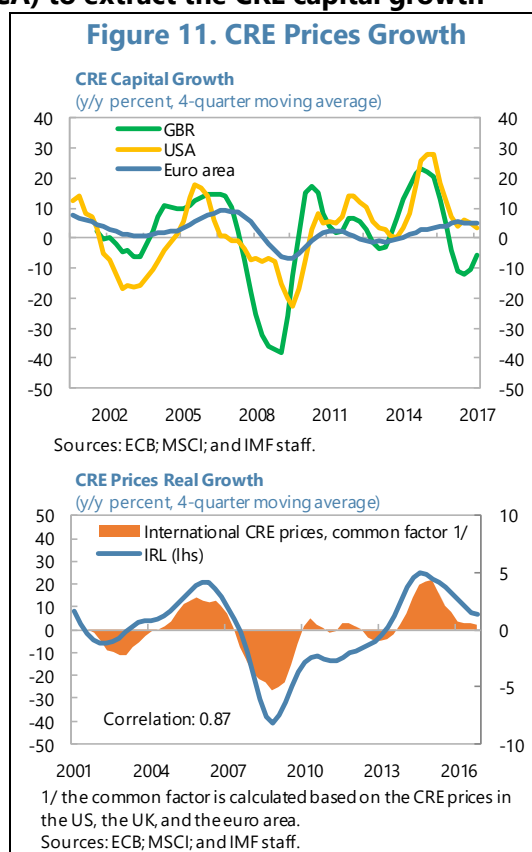
## E. The Sensitivity of Irish CRE Prices to Changes in International CRE Prices

**21. This section evaluates the extent to which the Irish CRE prices are sensitive to global CRE prices and international developments.** To study the sensitivity and the potential impact of external conditions on the Irish CRE market and domestic economy, we employ a reduced-form Vector Auto Regression (VAR) model, which includes four variables: GDP growth in advanced economies, the real growth of CRE prices in advanced economies with strong financial linkages to Ireland, the real growth of Ireland's CRE prices, and a measure of Ireland's domestic economic activity (modified final domestic demand).<sup>6</sup> The latter is used given the significant impact of multinationals' activity on Ireland's headline GDP figures.

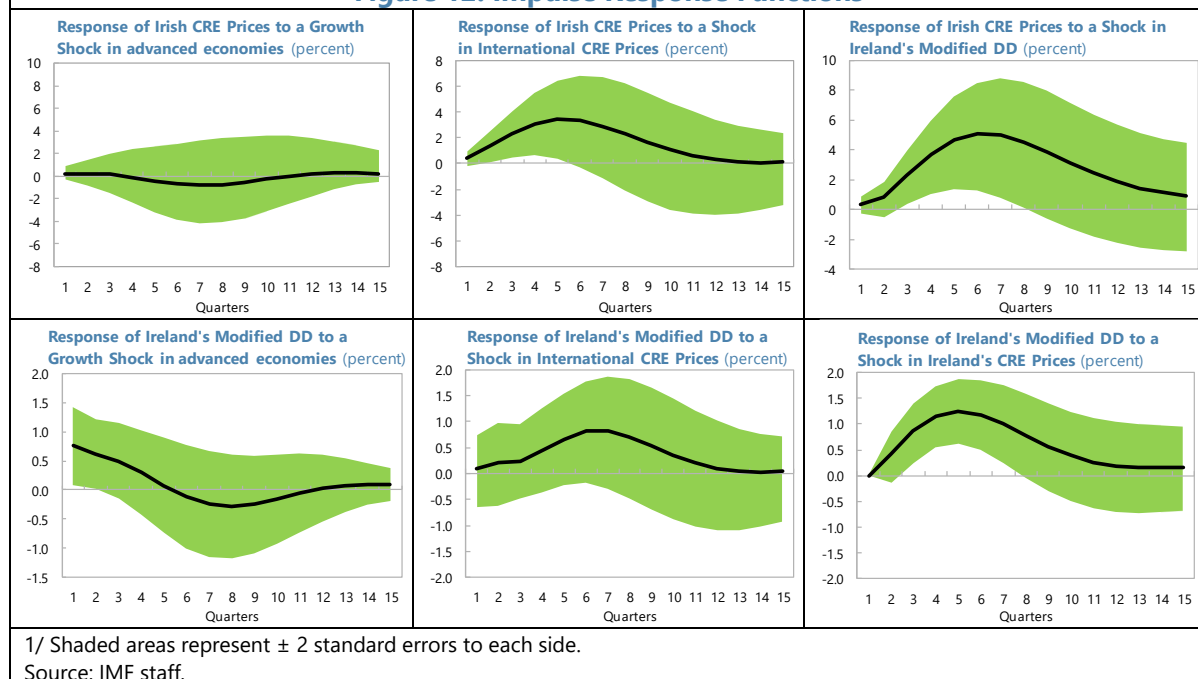
**22. We use a Principal Component Analysis (PCA) to extract the CRE capital growth among selected advanced economies.** The

calculated factor is based on quarterly data for the CRE capital growth for the period 2002Q1–2017Q3. Due to limited availability of quarterly data, the calculation relies on CRE prices of Great Britain (GBR), the U.S., and the euro area (EA). The trajectory of CRE capital growth in these three economies is largely correlated, though the volatility of CRE prices in the EA was significantly more limited than that in the U.S. and Great Britain (Figure 11). Moreover, EA price increases have remained subdued in recent years, while those in the U.S. have registered strong gains. In the U.K., CRE prices recovered strongly following the financial crisis; however, prices (in euro terms) have changed course from 2016q3 onwards, following the U. K's decision to exit the EU.

**23. The calculated common factor is highly correlated with Irish CRE capital growth, though it exhibits a lower volatility (Figure 12).** The common factor's loadings, which reveal the



<sup>6</sup> Total Domestic Demand less the effects of trade in aircraft by aircraft leasing companies and imports of intellectual property.

**Figure 12. Impulse Response Functions**

magnitudes of the variables included in the factor, suggest that it allocates higher weights to the CRE capital growth in the U.S. and GBR compared to that in the EA. The volatility of the common factor is significantly lower than that of the Irish CRE capital growth, reflecting in part the Irish boom-bust period, yet the correlation between the two is high (0.87), implying that the two series have moved together over time.

**24. The dynamic behavior of the model is assessed using impulse response functions (IRFs).** The shocks in the VAR were orthogonalized using Cholesky decomposition, which implies that variables appearing earlier in the ordering are considered as more exogenous, while those appearing later in the ordering are considered as more endogenous. Since the objective is to assess the impact of international economic developments on the Irish economy through the CRE channel, advanced economies' GDP growth is placed first in the ordering, followed by advanced economies' CRE capital growth, and Irish modified final domestic demand. Ireland's CRE prices are placed last, allowing them to be subject to a contemporaneous effect of all other variables. The VAR is estimated over 2002q1–2017q3, using two lags of endogenous variables.<sup>7</sup> Unit root tests reject the null hypothesis that the endogenous variables have a unit root.

**25. The summary statistics and correlation matrix are presented in the Annex.** They show that Ireland's CRE prices and domestic demand growth exhibited significantly higher volatility compared to that in advanced economies, reflecting sharp movements in both boom and bust periods. The correlation matrix (Table A2) indicates that Ireland's modified domestic

<sup>7</sup> The VAR lag structure was chosen by the Akaike Information Criterion (AIC).

demand and CRE prices are strongly correlated with each other and with the global GDP growth and international CRE prices.

**26. The VAR analysis indicates that the CRE market has been an important channel through which international developments affect the Irish economy (Figure 13).** Specifically, the IRFs indicate that:

- A shock of one standard deviation to international CRE prices, equivalent to 0.8 percentage points, results in an increase of up to 3.5 percent y/y in Irish CRE prices by the fifth quarter (in real terms).
- A shock of one standard deviation to Irish CRE prices, equivalent to about 2 percent in real terms, leads to an increase of 0.7 percent y/y in Ireland's modified domestic demand by the sixth and seventh quarters. A shock of one standard deviation to modified domestic demand, equivalent to 2.6 percent, results in an increase in Irish CRE prices of up to 5 percent y/y in the fifth quarter.
- A shock of one standard deviation to advanced economies' GDP growth, equivalent to 0.4 percent, results in an average increase of 0.5 percent y/y in Ireland's modified domestic demand in the first year, possibly reflecting various channels such as consumer and business confidence, higher government revenues, or more favorable credit conditions.

## F. Key Takeaways and Policy Implications

**27. Irish CRE prices and rents have bounced back sharply in recent years following a massive adjustment in 2008–11.** This recovery was supported by strong investment by nonbank Irish institutions, including REITs and institutional funds, as well as by a variety of foreign investors, largely from the U.S. and Europe. At the same time, the domestic banking system continued to reduce significantly its exposure to the CRE market. Despite banks' deleveraging, their exposure to CRE market remains non-negligible, at about 10 percent of total loans, and new lending to this sector is picking up.

**28. The analysis uses two alternative measures to assess the degree of CRE returns' co-movement between Ireland and its peers.** These measures point to a high degree of synchronization with regard to peers' CRE return cycles, but with much higher volatility, possibly reflecting the economy's small size and high openness. The large presence of multinational companies may have also contributed to a strong transmission of external conditions into the economy. Indeed, the VAR analysis suggests that international CRE prices have a significant and robust impact on Irish CRE prices, and that there are strong feedback effects between the latter and modified domestic demand. The analysis also shows that the degree of synchronization of Irish CRE returns with that of the U.S. and the U.K. is higher than with other countries, and that the synchronization of Ireland's CRE returns with that of other countries is affected by both global and bilateral factors.

**29. Turning to policy implications, the high sensitivity of CRE prices to international developments implies that the movements of the latter can serve as an early warning indicator to possible movements in the domestic CRE market.** Moreover, the strong feedback effects between CRE prices and domestic demand stress the importance of close monitoring of the CRE market and the need to close data gaps, including on transactions, leases, and financing, as part of the efforts to safeguard financial stability.

**30. New bank lending to the CRE sector, including to REITs, and existing property exposure should be managed prudently to enhance the resiliency of Irish banks and the broader financial system to a possible decline in CRE prices and the potential need for an increase in provisions.** An increase in banks' risk appetite and a possible change in banks' business models should be monitored closely. Funding from nonbank financial institutions and their exposure to the banking system also requires careful attention.

**31. Lastly, in the absence of independent monetary policy and given that CRE activity has been largely externally-financed, there is scope to continue using tax measures (i.e. stamp duty, property tax, capital gains tax) to effectively manage demand and dampen the strong sensitivity of the Irish CRE prices to external CRE price movements.**

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## Annex I. Determinants of Synchronization

<b>Table A1. CRE's Total Return: Determinants of Synchronization</b>					
Instrumental variable estimation, two-stage least square (GLS2LS), Random Effects 1995–2016					
<i>Dependent Variable: SYNCH2</i>					
	(1)	(2)	(3)	(4)	(5)
<i>VIX</i>	0.021	0.041	0.019	0.056	0.056
<i>GLOBAL LIQUIDITY GAP</i>	0.119	0.052	-0.253	0.095	0.097
<i>CRISIS</i>	1.309*	1.506*	2.716**	1.089	1.134
<i>EURO AREA</i>	0.208*	-0.008	0.184	1.095*	
<i>ABS_GOV YIELD SPREAD</i>		-0.275*			
<i>OUTPUTGAP_SYNCH</i>			0.442***		
<i>TRADE</i>				0.616	
<i>FINANCIAL</i>					0.137*
<i>Constant</i>	0.384	0.269	0.447	-0.947	-1.349
<i>Time Fixed Effects</i>	Yes	Yes	Yes	Yes	Yes
<i>R<sup>2</sup> (overall)</i>	0.341	0.342	0.258	0.280	0.321
<i># obs.</i>	377	363	365	325	320
<i>Hausman test p-value</i> <i>H<sub>0</sub>: RE H<sub>1</sub>: FE</i>	0.177	0.378	0.990	0.999	0.999
<i># countries</i>	26	26	26	25	25
*** Indicate significance level of 1 percent; ** indicates significant level of 5 percent, and * indicates significance level of 10 percent.					

## Annex II. Summary Statistics: VAR Endogenous Variables

Table A2. Summary Statistics: VAR Endogenous Variables				
	<i>ADVANCED_GDP</i>	<i>INT_CRE</i>	<i>IRL_CRE</i>	<i>IRL_MFDD</i>
Mean	2.153	0.000	0.529	3.949
Median	2.485	0.227	3.390	5.010
Maximum	4.830	5.484	27.263	13.650
Minimum	-4.730	-6.243	-42.943	-11.380
Std. Dev.	1.574	2.421	16.513	5.454

Table A3. Correlations: VAR Endogenous Variables				
	<i>ADVANCED_GDP</i>	<i>INT_CRE</i>	<i>IRL_CRE</i>	<i>IRL_MFDD</i>
<i>ADVANCED_GDP</i>	1.000	0.688	0.732	0.671
<i>INT_CRE</i>	0.688	1.000	0.832	0.657
<i>IRL_CRE</i>	0.732	0.832	1.000	0.824
<i>IRL_MFDD</i>	0.671	0.657	0.824	1.000