

Medium-Term Cycles: To What Extent do they Feature in the Booms and Busts in British and Irish Housing Markets?

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Abstract:

Using the Christiano-Fitzgerald filter to extract business and medium-term cycles, this paper considers house price and construction fluctuations in Eire, the UK and Northern Ireland. Taking the perspective of a multi-cyclical system, it is shown that the synchronisation of business and medium-term cycles is associated with the largest price events, generally. The UK is strongly associated with a financial cycle with smaller business fluctuations. Northern Ireland and Eire feature a strengthening medium-term cycle, consistent with global financial liberalisation. The business cycle amplitude, of comparable size, also escalates. What is shown is that there are construction cycles in the medium-term range complementing price cycles, adding credence to the claim that that stabilisation policy should look beyond the relatively short-term business cycle to avoid significant housing crises.

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INTRODUCTION

Medium-term cycles, beyond those associated with business cycles, have been neglected. Comin & Gertler (2006) posit that medium-term frequency oscillations may be intimately related to business cycles and that business cycles may be a more persistent phenomena than conventional measures suggest. Financial cycles are found among medium-term frequencies. Borio (2014) argues that financial cycles, through property, would affect business cycles. Alternatively, Leamer (2007; 2015) views housing cycles as business cycles. An implication of these two positions is that housing cycles could be found in both the business and medium-term ranges, reflecting both real and financial economies. Their interaction could provide some insight into house price dynamics, presenting the possibility that overlooking medium-term frequencies can mislead policy makers about potential housing bubbles.

A typical financial cycle has a lower frequency than a traditional business cycle (Drehmann *et al.*, 2012), possibly for the UK at around 13-years (Aikman, Haldane and Nelson, 2014) (here-on known as AHN). Borio (2014) argues that the cycle is not a constant of nature, dependent as it is on policy regimes. He claims an 11-year cycle before 1998 was extended to nearly 20 years after, with an average of 16 years. Drehmann *et al.* (2012) (here-on known as DBT) combine property and credit as a

proxy for financial cycles, concluding that the financial and business cycles are different phenomena, and that when they interact, it is more likely that there is a financial crisis.

Comin & Gertler, Borio, AHN and DBT define medium-term cycles as those of longer than 8 years. Recently, using spectral analysis, Gray (2017) finds UK nominal GDP has a cycle around 7½ years. However, he finds evidence of a 7½-year housing cycle, which the financial deregulated post-1985 era, is extended to 10 years, placing housing both sides of the 'wire' leading to questions over the division between medium-term and business cycle frequencies in housing.

To consider the role of medium-term cycles and the interplay with business cycles, three European house price series are explored. As Northern Ireland, Eire and the UK overlap historically, financially and are close, geographically, one could anticipate similar cycles. Each series is decomposed into three ranges using a Christiano and Fitzgerald filter. This filter is selected not only because one can specify the frequency range but also DBT and Borio use it.

The aim of the paper is to assess the relative contributions of business and medium-term cycles to associated housing 'booms and busts' in both price and quantity. De Groot and Franses (2008) argue that a small number of cycles may explain

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variations in an economic system. Leamer implies that the construction cycle periodicity is in the business cycle range, as is the price cycle. However, Barras (2005) finds longer periodicities. It is posited that there are at least two cycles in housing: the medium-term cycle reflects credit and the business cycle captures the influence of income. Can these be observed in price and quantity across various markets? Also, DBT/Borio are concerned about an unfinished recession. Cyclical alignment may be closely associated with crises. Can this be seen in this multi-cyclical framework?

The paper is structured as follows. First, there is a review of how booms and bubbles are considered in the literature. Next, there is a discussion of perspectives and estimates of financial and business cycles. This is followed by a discussion of data used and the method of trend extraction. The results are split into two: first, cyclical fluctuations with a maximum periodicity of 20-years for Eire, the UK and Northern Ireland (NI) are extracted. The 20-year cycle is decomposed into smoothed, business, medium-term and erratic ranges. Synchronicity and variance is assessed over the bi-cyclical decomposition.

2.1. Defining Bubbles or Booms

The starting point for many is the Stiglitz view that a bubble involves a price is not justified by fundamentals; it is high only because it is expected that price will be higher tomorrow. It is common to highlight the gap between price and fundamental value. Rather than price level being too high, a bubble can be defined by unusually rapid price changes. Lind (2009) and Zhou & Sornette (2006) emphasise growth rate, with the latter pair focusing on growth faster than exponential rate in the upswing. Their work, which covers 1993-2005, reveals a bubble in UK housing and ones in 22 US states.

Others focus on the collapse of a bubble. Covering 1970-2008, Kannan *et al.* (2011) identify a crash if the four-quarter trailing moving average of the annualised growth rates falls below -5%. They find that there were 47 busts across 17 advanced economies, lasting an average of 2½ years. Helbling & Terrones (2003) define a bust as a decline of 14% in real terms. They posit that housing busts are likely to follow housing booms, reflecting an unwinding of an imbalance, which could be of the same order of magnitude.

Agnello and Schuknecht (2011) define a boom as a notable current price deviation from long term trend. Notable is defined as a 10% deviation. Goodhart and Hoffman (2008) define notable as a 5% deviation from the trend for three years. These definitions are related to cyclical extractions using filters similar to the approach adopted here.

2.2 Perspectives on Cycles

De Groot and Franses (2008) lament mainstream economics' conceptualisation of markets as essentially stable in nature with any impact from shock that causes a deviation (in the short-run) from the long-run steady state is temporary. New Classical and New Keynesian business cycle theories do not recognise the notion of a periodicity. De Groot and Franses argue that long term economic stability comes from the persistence of multiple, robust cycles. Property could be one such case. Pyhrr

et al. (1999: 23) review a large body of literature on real estate markets, and conclude that "the real estate literature supports the theory that real estate markets are cyclical". A cycle [in property] is a recurrent but irregular fluctuation in a price or return.

DBT consider the cyclical characteristics of credit, credit/GDP, house prices, equity prices, and GDP, across seven OECD countries, including the UK. They find a well-defined financial cycle that is best characterised by the co-movement of medium-term cycles in credit and property prices. AHN identify a 13½-year periodicity in credit within a 130 year series of UK data. This financial cycle is pro-cyclical, with an amplitude four to five times that of the general business cycle, as proxied by real GDP, but a periodicity that is twice as long as the one for GDP.

Business cycles are taken to reflect income. Calderon and Fuentes (2014) identify a 7½-year cycle in UK GDP. Using spectral analysis, Levy and Dezhbakhsh (2003) show single peak at around 6 to 8 years. Gray (2017) finds similar periodicities for both GDP and house prices in the UK suggesting that that housing is income-driven with a corresponding periodicity in the business cycle range. The Royal Institute of Chartered Surveyors find cycles in UK property of around 8 years, with possibly two periodicities of five and nine years (RICS, 1999). Using spectral analysis, Alexander and Barrow (1994) and Rosenthal (1986) find a five to ten and six to eight year periodicity respectively. Gray (2013) identifies a 6.4-year cycle in Eire's property.

Agnello and Schuknecht (2011) and Bracke (2013) use a different 'lens'. The former reveal an upward and a downward UK house price trend of an average seven years each (1983-1989, 1989-1996, 1996-2005, 2005+). The latter identifies 1980Q3, 1989Q2 and 2007Q4 as peaks and 1982Q2 and 1996Q2 as troughs in UK house prices. For Eire, Agnello and Schuknecht highlight a 6-year boom (1995-2000) and a bust over eight (1980-1987). Bracke identifies troughs in 1987Q2 and 1994Q4 whereas peaks arise in 1979Q2, 1990Q2 and 2006Q3.

Price and quantity supplied should be linked. Also using spectral analysis, Barras and Ferguson (1985) find a major and a minor cycle for almost all the UK property construction series they examine. They find a short cycles of 3¾ years, and a major one twice that in private housing orders, and 5¼ one in completions. Jadevicius and Huston (2017) reveal one of eight whilst Barras (2005) also mentions 20 and 50 years in commercial property. From this review depending on the 'lens' there are medium-term cycles in housing of circa 14 years and 5 to 10 years that one could associate with a business cycle range.

2.3. Housing, Finance and the Real Economy

Housing links the real and financial economies through a number of conduits. To address the agency problem that lending institutions face, the issuance of mortgages is rationed via lending metrics. A standard one, loan to borrower's income, is one of two key credit constraints. As general income

levels rise, more generous loans are forthcoming, boosting property demand.

Stein (1995) analyses a housing market comprising only owner-occupiers wanting to buy. When price rises they receive a windfall; the equity in their current dwelling is enhanced, so their credit-constraint is loosened. Thus, a second standard rationing metric, the loan to dwelling value, with a rise in price, is more of a constraint on first time buyers. Rising price affects the lender. The collateral posted to gain approval for secured borrowing rises in value, resulting in a pro-price-cyclical credit provision. The greater provision of funds will impact on prices favourably, reinforcing creditworthiness, setting the conditions for a financial multiplier effect and the conditions for volatile asset prices (Aoki *et al.*, 2004).

A balanced portfolio approach predicts an increase in the money stock would lead to a drop in interest rates. Lowering the discount factor increases asset price an investor is willing to pay (Goodhart & Hofmann, 2008). Looser credit conditions raise future expectations of economic activity, affecting buyers projected future price levels. Financial liberalisation increases the demand for property from those whose access to credit is constrained (Goodhart & Hofmann, 2008), allowing some of those excluded to join the housing market. The loosening of lending criteria has notable consequences. For many developed countries financial deregulation over 1980-2007 strongly magnified the impact of the financial sector on the occurrence of booms, which was fortified by international liquidity (Agnello and Schuknecht, 2011).

Hay (2009) compares the UK and Irish experiences of house price inflation. He argues that for different institutional reasons, from the early 1990s, both pursued consumer-led growth strategies that fed on raised private debt levels. However, it was the incentives around allocating mortgage debt in both countries that inflated prices, propitiously. Addison-Smyth *et al.* (2009) posit that in both the UK and Eire, the ability of credit institutions to access funding from abroad, post-2000, appears to have increased average mortgage levels. Prices in 2008, on average, were 30% greater than what they would have been if this alternative source of funding had not been available.

Leamer (2007; 2015) argues that housing cycles are business cycles [in the US]. Building dwellings generates employment in construction, with consequent Keynesian income and supply chain expenditure growth. Through stable lending metrics, growing income would underwrite price growth. Thus, the interaction that Leamer implies is that house prices would influence, and be influenced by, this income.

Mian & Sufi (2018) suggest that house prices are more likely to be a response to credit supply expansion rather than a cause. Exogenous changes in credit supply have quantitatively large effects on house prices. An expansion in credit supply could affect aggregate demand by enabling households to increase consumption. A further channel is by boosting firm investment. Beitel (2000) argues that building cycles are also a function of finance. In the US, the cycles of over-supply are driven by the provision of credit and its profitability. When low

risk returns are scarce, developers are encouraged to engage in a bout of reckless but potentially high-return speculative construction. Indicative of this is falling appraisal standards as loan officers attempt to hit lending targets. Office space construction between 1969 and 1989 shifted from normal to hyper-extended cycles with heightened volatility, particularly towards the end. A bubble is caused, in part, by the agency problem. Given targets where there is a dwindling pool of secure options, lending officers attenuate underwriting standards, increasing the demand for property from those whose access to credit is currently constrained (Leamer 2007) and speculative construction (Beitel, 2000). Thus, lowering standards increases the number of buyers and builders.

Wheaton's (1999) simulates cyclic price responses based on an income shock. Varying expectations, economic growth and rental demand and construction supply elasticities, he simulates a range of responses. A cyclic response can be characterised a slow but steady absorption process that overshoots, and then undershoots in decreasing swings. A greater delay between shock and dwelling completion raises the price volatility (amplitude) but the cycle lengthens.

Other simulations show lower supply elasticity and greater demand side shocks generating longer and more volatile cyclic price responses (Dieci & Westerhoff, 2016; Malpezzi & Wachter, 2005). Following a global liquidity shock, Cesa-Bianchi *et al.* (2015) find a cyclic response in house price inflation and in nominal short-term interest rates, with a lag between the two, consistent with a monetary authority reacting to house price inflation counter-cyclically, with the latter shaping the former.

3. METHOD

A frequency domain filter, using a Fourier transform, would separate out components within a range of periodicities. Christiano and Fitzgerald (2003) propose a time-domain approximation to the frequency domain filter, using weights drawn from the power spectrum of the unfiltered series. To extract up to a 20-year cycle from a time series, 80 quarters is used as the upper and two quarters for the lower settings. The Smoothed 20-year series entails a range of 20 to 80 quarters. AHN define medium-term cycles as periodicities between 8 and 20 years. Ten years is set as the lower, as this falls in between the two sets of housing cycle estimates better than 8. Business cycles are presumed to fall in the range 5 to 10 years (20 to 40 periods). Erratics and one-off shocks are captured by a 2 to 20 quarter setting. From here-on the data from the 10-20-year filtered data will be referred to as the medium-term cycle, and from the 5-10, the business cycle. The business and the medium-term cycles are combined in the 5-20 year cycle, referred to as the Smoothed 20-year cycle. By implication, AHN/ DBT etc.'s definition could apportion fluctuations in the business cycle range to the medium-term cycle, inflating one relative to the other.

A multi-cyclical perspective envisages a price series as characterised by a range of cycles. At any given periodicity, the more important of these, the greater the deviation from trend (or amplitude). This is volatility can be assessed by standard

deviation. The trend is taken to be anything with a periodicity of over twenty years.

An examination of synchronicity between the smoothed 5-20-year cycle and the business and medium-term cycles entails Cohen's Kappa. Mink *et al.* (2012) proposed a measure of synchronisation. It generates values are very similar to Kappa and Meller and Metiu (2017) index. These transform the cyclical component into values above 0 as +1 and those below, -1. On a pairwise basis, the average number of coincidences of these 'phases' gives synchronicity measure between 1 and -1. One implies perfectly in phase; -1 perfectly out of phase; and 0 they are orthogonal. Miles (2015) finds divergence in US regional house price cycles until the peak of the 2001-2005 bubble, which he argues, is a lot of local bubbles that coalesce into one large one. Using this idea but relating it to the alignment of business and medium-term cycles the data is split into two: first, the tranquil or non-bubble period; second, where area prices deviate more than 10% from the trend line (bubble period).

4 DATA

Second-hand house prices data and house completions for Eire are taken from the Department of Environment, Heritage and Local Government. The quarterly data covers the period 1978Q1 to 2015Q2. The UK and Northern Ireland price data are drawn from the Nationwide Building Society's web site. This data is for Modern housing. Average house prices are mix adjusted and based on loan approval data supplied by the mortgage lending agencies. Second-hand (Eire) and Modern (UK/NI) dwellings are chosen specifically as their owners are far more likely to experience the financial accelerator effect. Completions are taken from the Ministry of Housing, Communities & Local Government for Great Britain and Northern Ireland. Private sector completions, rather than starts are used as there is a more complete data set.

The house prices are deflated by inflation indices. For the UK and Northern Ireland, Retail Price Index is taken from the Office for National Statistics. Eire's Consumer Prices Index values are taken from the Central Statistical Office. Exchange rate data is also taken from the CSO. The data is analysed in natural logarithm form. Prices are standardised by converting them into Sterling in real terms.

5. RESULTS

In Table 1, the extreme values in the Eire house prices series of €19,320 and €389,871 give a ratio of 20.18. In other words, house prices grew in nominal terms just under twenty one times. Assessing the price trend only, in real terms, with adjustments due to the exchange rate the annualised, growth across the 38-year study is 2.4%. This is similar to the UK's with an annual real growth rate of 2.21%. Northern Ireland's (hereafter NI) 0.8% is modest by comparison. That said, over the same period the annual growth in housing completions was positive for the province but negative for Britain and Eire.

Table 1 also reports the deviations from trend, or the cycle components. To establish the importance of medium-term cycles, AHN separate out the financial from the business cycles

and compare the standard deviations. Here we proffer variance-covariance. Eire's price spread are greater at longer cycles, with the 10-year [Var = 0.46], four times that of the 5-year, but smaller than the 0.89 of the 20-year. Omitting the erratics, the 10-20 year medium-term cycle has a larger deviation than the 5-10 year business but it is below the 20-year cycles. This is broadly the same pattern found with the UK and NI.

Completions are much more volatile, particularly in Eire. Analysing volatility beyond the business cycle range doubles the price variation but triples the volume. This could be interpreted much like price elasticity, which should be greater over a longer horizon. By contrast, the UK has a relatively price insensitive completions ratio at the medium-term cycle. The completions to price volatility ratio is 0.77. This is consistent with a shock being absorbed more in price than quantity. Northern Ireland is more similar to Eire in completions and to the UK in price.

Table 1. Nominal Price and Growth, Completions and Volatility.

	Price			Completions		
	NI	UK	EIRE	NI	GB	EIRE
Price Low	£15,294	£13,573	€19,320			
Price High	£218,261	£179,358	€389,871			
Growth ¹	0.81	2.21	2.40	0.69	-0.35	-2.22
Variance						
20 years	1.69	1.69	0.89	7.10	2.34	9.98
Medium ²	0.76	1.34	0.39	4.02	1.03	5.60
10 years	0.69	0.31	0.46	2.66	1.01	3.37
Business ³	0.43	0.17	0.34	0.53	0.31	1.64
Med-Bus Covariance	0.12	0.02	0.02	0.20	0.15	0.49
Erratics	0.26	0.11	0.11	2.11	0.69	1.71

1 Growth is the ratio of the end value to the start value on trend converted to annualised growth rate
 2 10-20 year cycle range
 3 5-10 year cycle range

5.1. Smoothed Cycles

The Smoothed 20-year cycles (capturing 5 to 20 year cycles), displayed in Fig. (1), highlights two peaks (1989Q2, 2004Q3) and three troughs (1982Q2, 1996Q1, 2009Q1) for price and (1988Q3, 2006Q2) (1981Q3, 1993Q1, 2011Q3) for completions. Taking the definition of a boom or bust as a deviation from the price trend at >10%, the UK has a large event on a regular basis. If a bubble or crash is defined as a deviation of 14% from trend or even a 5% deviation from trend for three years, it isolates the same events and does not alter conclusions.

Completions appear to move with price but perhaps with a more dramatic downswing. Both have a strong similarity with Agnello and Schuknecht's (2011) dates. This suggests that the

issues about ignoring the medium-term cycle are also applicable to completions, but perhaps for the reverse reason. Additional housing supply should put downward pressure on price inflation, but whether it does is not clear. Rather than the former affecting the latter, both might be jointly determined by the finance cycle (Beitel, 2000).

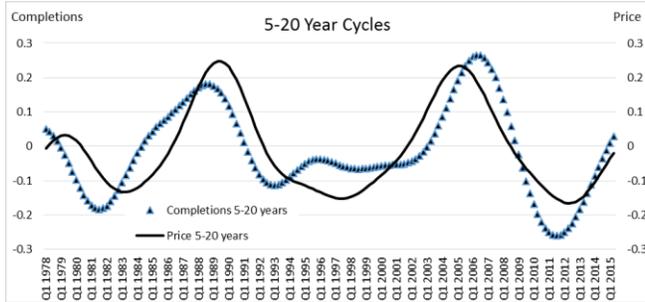


Fig. (1). UK/GB 5-20 Year Cycles.

Fig. (2) shows Eire’s smoothed 20-year cycles. Eire has a more irregular sequence. Prices show four peaks, with an additional one in 2000 compared with the UK. In general, values are lower than in the UK, with only 2006Q2 above 14% with the Smoothed cycle. The 5%-3 year measure highlights two peaks (1990, 2006) and two troughs (1996, 2011). Two short deviations would not constitute booms. Key dates in the 20-year cycle of 1979Q2, 1990Q2, 1995Q4 and 2009Q4 entail large erratic components. Again, the cycles echo Agnello and Schuknecht (2011) and Bracke (2013).

Completions are as volatile as prices but with a very unusual period, post-2002 which affects some inferences. Key peaks occur in 1983Q3 and 2006Q4; troughs in 2000Q3 and 2011Q4. Here again, volume is not performing its theoretical role in suppressing price.



Fig. (2). Eire 5-20 Year Cycles.

Fig. (3) shows the smoothed cycles for Northern Ireland. Despite being part of the UK, its price profile is very different. For price, scaling is $2\frac{1}{2} \times$ the others; for completions NI is more similar to Eire. Dates of note are 1982Q2, 2013Q3, and 2007Q3. The first of these entailed a deviation of 14% linked to 3 year dip in price. There is another prolonged dip around 2003. The peak in 2007 illustrates a bubble in the Lind sense of assets with an unusually high price, a rapid rise, and fall over a long period.

By contrast, the peaks in completions are reminiscent of GB’s, occurring in 1987Q1 and 2004Q4 whereas troughs emerge in

1982Q3, 1994Q1 and 2012Q2. Of particular importance is the first peak. When examining Gregoriou *et al.*’s (2014) price-earnings ratios, NI is unique among UK regions in not having such a spike in the late 1980s. A spike in housing supply could suppress prices, explaining the missing price peak in NI’s price profile.

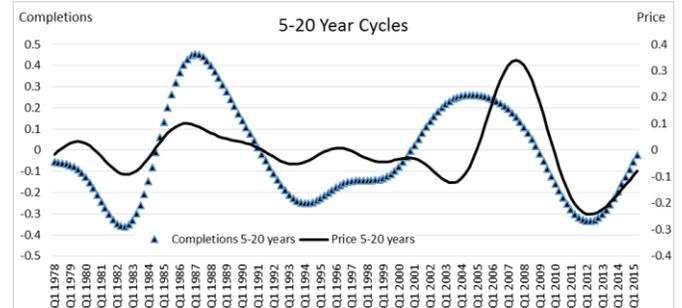


Fig. (3). Northern Ireland 5-20 Year Cycles.

5.2. Anatomy of Cycles

To examine DBT’s claim that it is interaction between business and medium-term cycles that heralds a crisis, the 5 to 20 year smoothed cycles are subdivided into business and medium-term cycle ranges. Fig. (4) displays the UK medium-term price cycle (10-20 years) of around 15 years and the business cycle (5-10 years) of around 9 years. This supports the two cycle thesis with the medium-term cycle consistent with Agnello and Schuknecht’s (2011) work and AHN’s financial periodicity. Importantly, the business periodicity is of the same order as the more conventional estimates for housing and income periodicities reviewed earlier, but beyond the 8-year threshold. The UK business and medium-term completion cycles in Fig. (5) appear similar to the price cycles. In keeping with Borio, the medium-term is more prominent than the business cycle for both.

To highlight where the UK medium-term and the business cycles interact a further series is plotted in Fig. (4) (Business-Medium), which is the product of the values of both series. A high positive value indicates the two are in phase, reinforcing each other strongly. The peak in 1989 entails of the synchronisation of three cycles, including erratics. Jordà *et al.* (2016: 147-148) report 1979, 1990 and 2007 as turning points for a business cycle. Importantly, they identify the latter two as linked with financial crises. These dates are strongly reflected in Fig. (4).

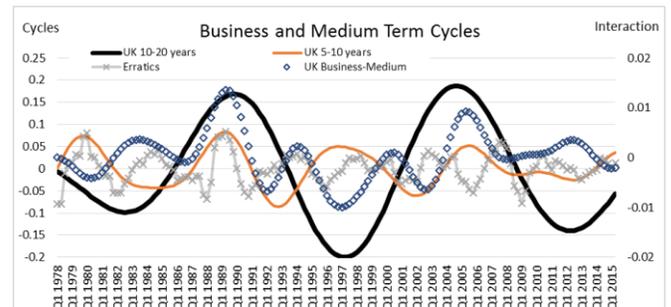


Fig. (4). Business and Medium-Term Price Cycles: UK.

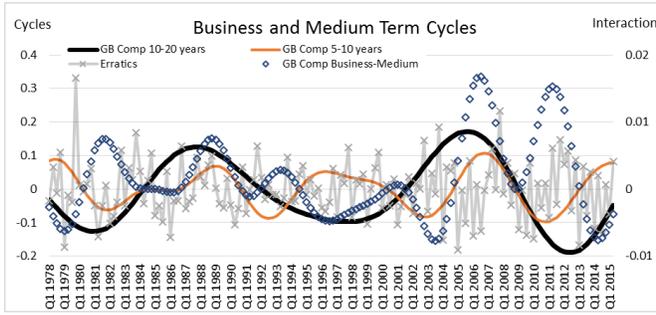


Fig. (5). Business and Medium-Term Completion Cycles: GB.

Turning to completions, what is remarkable is how similar Fig. (5) is compared with Fig. (4). When exploring synchronisation of cycles found in price and volume in the business cycle range the Kappa values in Table 2 of 0.667 [0.000] suggest relatively high level. Indeed, 0.765 suggests even greater alignment among medium-term cycles. For both, the period between 1991 and 2003 entails a large medium-term cycle bust that is moderated or off-set by the business cycle in a boom phase.

Table 2. Kappa Values.

Price-Quantity	GB	p	Eire	p	NI	p
5-20 years	0.579**	0.000	0.358**	0.000	0.488**	0.000
Bubble	0.948**	0.000	0.777**	0.000	0.835**	0.000
Tranquil	0.126	0.285	0.173	0.078	0.375**	0.000
10-20 years	0.765**	0.000	0.306**	0.000	0.482**	0.000
Bubble	1**	0.000	0.495**	0.001	0.776**	0.000
Tranquil	0.484**	0.000	0.185	0.059	0.388**	0.000
5-10 years	0.667**	0.000	0.613**	0.000	0.35**	0.000
Bubble	0.758**	0.000	0.653**	0.000	0.836**	0.000
Tranquil	0.52**	0.000	0.595**	0.000	0.192*	0.038
10-20 year - 5-10 year Cycle Alignment						
Price	0.019	0.811	0.244**	0.003	0.027	0.73
Bubble	0.324**	0.002	0.869**	0.000	0.682**	0.000
Tranquil	-0.408**	0.001	-0.026	0.784	-0.191*	0.032
Quantity	0.107	0.182	-0.12	0.142	0.17**	0.000
Bubble	0.196	0.069	0.228	0.1	0.628**	0.000
Tranquil	-0.043	0.714	-0.262**	0.007	0.018	0.845

Bubble 20 yr price cycle deviates over $\pm 10\%$ from trend
 Tranquil 20 yr price cycle deviates less than $\pm 10\%$ from trend
 * sig. at the 5% level
 ** sig. at the 1% level

Consistent with Agnello and Schuknecht (2011), Eire’s medium-term cycle, in Fig. (6), is around 12 years. The business cycle is around 8 years, which is longer than assessed by Gray (2013) but in the business cycle zone of Borio etc.

In Fig. (7) again the parallels between price and volume are evident. The cycles are similar but not well aligned. The business cycles have a relatively high Kappa value (0.613), which is not much affected by volatility, and the lower one for the medium-term cycles (0.306) perhaps reflects a delay between price and completions of between two and four years, which seems to be declining.

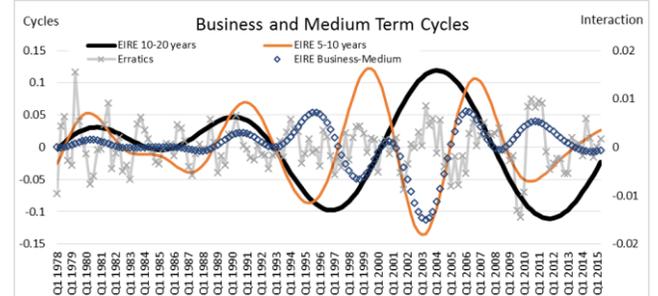


Fig. (6). Business and Medium-term Price Cycles: Eire.

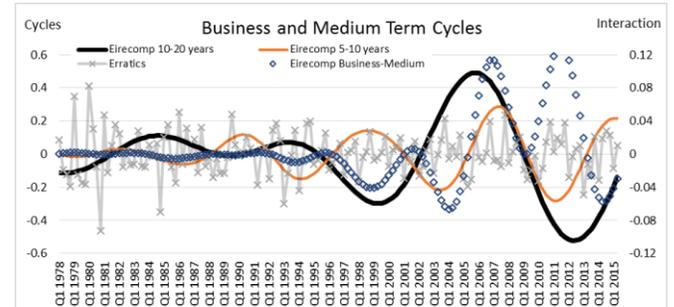


Fig. (7). Business and Medium-Term Completion Cycles: Eire.

Northern Ireland has a medium-term price cycle of around 13 years and a business cycle half that. Fig. (8) shows rising business and medium-term cycle amplitudes. As with Eire, the business and medium-term price cycles become more active at the same time and for much of the era have the same amplitudes that decline to around 1998 and then they tend to rise.

The completion cycles are slightly longer than the price and far from a good representation. The medium-term cycle has two peaks and is not reinforced by the business cycle at the time of the 2007 price bubble. This contrasts with the price cycle where the 2007 price spike entails synchronised, large, medium-term and business cycle deviations.

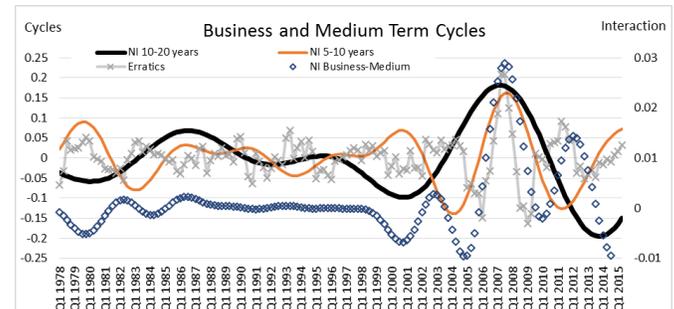


Fig. (8). Business and Medium-Term Price Cycles: Northern Ireland.

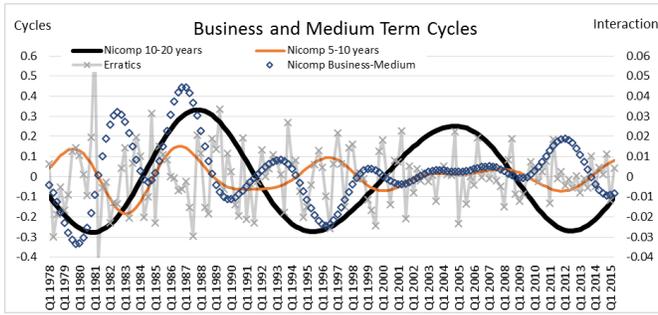


Fig. (9). Business and Medium-Term Completion Cycles: Northern Ireland.

5.3. Medium-Term Cycles and the Local Context

Medium-term cycles, which have been linked to the liberalisation of finance, are shown to be growing in importance. Minsky considers structures and institutions that moderate lending practices, calling them thwarting institutions (Palley, 2011). These are eroded before a boom and reinforced after a bust: Minsky predicts a super-cycle in asset prices based on regulatory tightening and loosening. The UK’s medium-term cycles corresponds with the history of mortgage regulation: the pattern resembles Gregoriou *et al.*’s (2014) house price-earnings ratio profile; Borio’s (2014) UK financial cycle; and Mellor and Metiu’s (2017) credit cycle.

Despite being subject to the same regulatory regime and having banks in common with the mainland, McCord *et al.* (2011) show that the house price-earnings ratio in NI only began drifting from long term norms in 1999. Authors have projected that the Province’s local issues adversely affected its prices (Besley and Mueller, 2012), Indeed, it appears to miss the UK 1989 boom entirely (Gregoriou *et al.*, 2014). However, completions suggest that before the Good Friday Agreement (1998) there was a boom in housing. Indeed, completions indicate that Northern Ireland resembles a British region.

In Fig. (6), Ireland’s 1999 housing boom is business cycle-dominated. This is consistent with Kitchin *et al.* (2012) who link this first Celtic Tiger phase to American foreign direct investment; European Single Market membership and the Common Agricultural Policy; and a favourable tax climate for businesses. During the 1994-2000 period the outstanding mortgage debt ratio increased from 23 to 32%, considerably below the UK general level of 54%. With annual property construction rising from 27,000 to 50,000 and income growing rapidly, this phase is in keeping with Leamer and housing as a business cycle driver.

The second phase of the Irish Celtic Tiger period of 2002-2006 is strongly linked to property finance and speculative construction (Kitchin *et al.*, 2012), suggesting that, as with Britain, the finance cycle is a key driver (Beitel, 2000). In this light, Leamer’s analysis could be extended to the medium-term range, whereby the building industry, also a function of finance, generates a dwelling construction cycle.

Using the definition of bubble above, the UK is prone to bubbles, with a 10% from trend 52% of the time, for Eire, 30% and NI, 25%. When subdividing the series into bubble and non-bubble periods, the alignment between price and

quantity rises. Table 2 shows that, for the bubble periods Kappa increases from 0.667 to 0.758 in the business range and from 0.765 to 1 for the UK in the medium-term. Increases in the other two areal units confirm that, with notable deviations from trend, price and completions are closely tied when there are large deviations from trend.

Decomposing the smoothed cycles into variance attributable to the medium-term, the business cycle and the covariance between the two, in Table 3 the values are consistent with Table 1. There is a further decomposition into bubble and tranquil periods. As by definition bubble periods have greater volatility. Eire’s price volatility is doubled (0.77 to 1.65) but this is not reflected in the medium-term and business ranges. Rather, reinforcement is important in the bubble period but there is off-setting (negative covariance) in the tranquil periods. There is a similar narrative for quantity.

The completions ratio in Eire in the medium range jumps from 11 across the full period to 18 in the bubble eras. The price insensitivity UK appears to worsen in the bubble period in the same cycle range, dropping from 0.77 to 0.4. The former is likely to reflect Kitchin *et al.*’s second-period analysis. The latter’s reinforced the price insensitivity of supply in the private sector (Barker, 2003)

In general, price volatility across the three markets in the tranquil period is about the same. With quantity, the island of Ireland appears as one whilst the UK’s weakness is evident.

Table 3. Variance Across Cycle Ranges and Eras.

	Price			Quantity			
	Eire	All	Bubble	Tranquil	All	Bubble	Tranquil
5-20 years	0.772	1.647	0.398	8.216	16.629	4.620	
Medium	0.391	0.484	0.354	5.595	8.831	4.236	
Business	0.339	0.442	0.297	1.637	2.024	1.483	
Med-Bus Covariance	0.021	0.360	-0.126	0.492	2.887	-0.550	
	UK			GB			
5-20 years	1.556	4.460	0.303	1.636	2.388	0.844	
Medium	1.338	3.718	0.311	1.027	1.496	0.532	
Business	0.172	0.209	0.158	0.307	0.319	0.299	
Med-Bus Covariance	0.023	0.267	-0.083	0.151	0.286	0.007	
	NI						
5-20 years	1.426	3.804	0.400	4.956	6.917	4.370	
Medium	0.758	1.629	0.385	4.015	4.464	3.907	
Business	0.430	0.729	0.304	0.529	0.406	0.573	
Med-Bus Covariance	0.118	0.722	-0.145	0.205	1.022	-0.055	

It is asserted that alignment of business and the medium-term cycles is a characteristic of bubbles. Overall, for price and

completion cycles the two are independent ($\alpha = 0.019$ [0.811], 0.107 [0.182]). However, for price the value jumps to 0.324, but remains not significant for completions 0.196 [0.069]. These changes are reflected in covariances. Extending this to Eire and NI, there is alignment in the bubble and the misalignment in the tranquil periods, which the covariances also echo. This reflects that there is some off-setting, reducing the likelihood of a large housing event.

6. CONCLUSIONS

The Christiano-Fitzgerald filter reveals two notable cycles for each market. A number of important implications emerge from the work. First, the dual-cycle empirics match the narrative distinguishing between first and second Celtic Tiger eras in Eire where the medium-term and business cycles combine in the second and the non-financial dynamics are central in the first. Nevertheless, large events do not necessarily coincide with financial swings; they can be business cycle driven alone.

Second, a multi-cyclical framework highlights what DBT/Borio project that, based on cycle-interaction, large events occur. Unacknowledged though is the corollary; business and medium-term cycles should off-set as well as reinforce. Asynchronised cycles in UK housing in 1991-2003 and in 1990-2006 in Ireland suppressed deviations from trend. Although all three markets experienced a boom, alignments of the business and medium-term cycles in Eire and the UK were imperfect, leading to dual peaks around 2004-2006.

Third, Northern Ireland's 20-year price cycle has two unusual elements. Unlike other regional profiles, it does not have a large spike in the 1980s, whilst it saw a quadrupling of volatility over a one year period in the 2007 period. The dwelling completion cycle in the former era possibly suppresses any price spike. In the latter era, in the business cycle range, it is on trend, failing to provide supplementary downward pressure on price. Thus, the atypical regional price profile is as much to do with cycle alignment as business and medium-term cycle amplitudes.

Fourth, it is shown that there is a medium-term cycle in completions as well as prices. It is suggested that although market theory suggests one affects the other, finance drives both price and completions, likely to generate comovement, particularly in bubble eras. Construction cycles should also be monitored in the medium-term range for policy purposes. As noted above, this might be a key issue for inferences drawn about Northern Ireland. Combining Leamer's claim that building cycles are business cycles, and Comin & Gertler (2006) assertion that medium-term frequency oscillations may be intimately related to business cycles and that business cycles may be a more persistent phenomena than conventional measures suggest, Borio's assertion about the importance of medium-term cycle for stabilisation policy is supported. Extending Borio, credit cycles for building as well as buying should monitored by policy makers. Depending on supply elasticity credit could seep in to construction and excess property supply or excess demand; both could have significant inflationary consequences.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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