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Ireland and the Global Financial Crisis: Growth, Volatility and Financial Development

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***Abstract*:** I examine the impact that a decline in financial development could have on Ireland's growth performance in light of the current credit crisis. A Markov-switching model with time-varying transition probabilities is applied to Irish data to examine the link between financial development and growth. In the model, the growth rate moves discretely between two regimes; one characterised by high average growth and low volatility, the other a more volatile low growth regime. Inferences are then made by estimating how long the country can be expected to remain in a slow growth regime, at given levels of financial development. The results show that higher levels of financial development correspond to spending more time in the higher growth regime. Furthermore, it is shown that the expected duration of remaining in the slow growth regime increases as financial development falls. This analysis takes into account the fact that the dynamics of output following a shock such as a financial crisis differs significantly from the dynamics of output during more stable time periods by taking a non-linear approach.

Keywords: financial development, econometrics, data modelling
JEL Classifications: E44, E47, G15

1. INTRODUCTION

The global credit crisis of 2007-2009 has been heralded as the worst financial crisis since the one related to the Great Depression. The aim of this paper is to assess the importance of financial development on economic growth in Ireland. In particular, I examine the impact that the decline in access to external financing could have on Ireland's growth performance in light of the current credit crisis. Employing Markov-switching methodology, two distinct regimes are identified. Inferences are made by estimating how long the country can be expected to remain in a slow growth regime, at given levels of financial development. The first is a regime characterised by high stable average annual growth, the second a regime represented by lower and more volatile average growth. The results show that higher levels of financial development correspond to spending more time in the higher growth regime. Furthermore, it is shown that the expected duration of remaining in the slow growth regime increases as financial development falls.

The breakdown in the financial systems of many industrialised nations has been caused by multiple factors. The exposure to US sub-prime mortgage backed assets, liquidity shortages that resulted from the slowdown of interbank lending, and the rapid decline in housing prices in other developed economies has led governments of wealthier nations to spend billions in adopting rescue packages in order to protect banks and institutions. Furthermore, private and investment banks invested in riskier assets during periods of economic stability but lacked the capital to support such risky investment. These factors coupled with some recent high profile fraud cases and the increasing complexity of some financial products and instruments has led to a rapid decline in many people's belief in the financial system.

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Following the unprecedented boom enjoyed by the Irish economy, the global financial meltdown coupled with a collapse in house prices and the domestic building industry has thrust Ireland into recession. Ireland's twin crisis in banking sector and public finances has intensified the impact of current global downturn. Honohan and Lane (2009) argue that Ireland is particularly exposed to the effects of the crisis for three reasons (1) the domestic banking crisis, (2) a loss in wage competitiveness, and (3) a tax structure that is too reliant on the boom periods.

An ESRI article entitled "Recovery Scenarios for Ireland" released in May 2009 indicates that, given a world recovery in 2010, the recession would lead to a permanent loss of GDP of 10%. Resolving the banking crisis is essential for even this level of recovery (Bergin et al, 2009). Kelly & Everett (2004) focus on the benefits that financial sector developments brought to the economy during the Celtic Tiger era. Rapid growth in credit resulted in the rapid increase in the private sector credit/GDP ratio. They note that the banks ability to respond to private sector demand for credit depends on the availability of funds. Currently, access to funds is limited due to falling confidence in the banking system and decreased interbank lending. In 2009, ratings agency Standard & Poor's downgraded both Bank of Ireland and Allied Irish Banks long-term credit ratings despite the governments €7 billion injection.

Since the beginning of the decade, in particular, 2005-2007, there was a property bubble due to the easy availability of credit and, because of this, bank exposure escalated. From 2003 onwards, Ireland's property boom was increasingly financed by foreign borrowing and banks continued to ease loan conditions (Honohan, 2009). The banks have been accused of contributing to the upward spiral of property prices by loose lending practices. House prices stabilised in 2007 and the bubble burst in 2008. By the first quarter of 2009, house prices had fallen by 23% compared with the second quarter of 2007, and the number of housing loans approved fell by 73%. Volatility in project returns and adverse selection increases during periods of macroeconomic instability, making banks more risk averse. The dramatic decline in property prices has added to the banking crisis.

During the boom, there was also an unprecedented expansion of construction driven growth (CBFSAI, 2009). Almost 13% of the Irish workforce is employed in the construction industry and over 9% of Irish GNP arises from construction (C.S.O. Quarterly National Accounts, 2008). The contraction of the construction industry has impacted heavily to Ireland's increasing unemployment rate.

In boom times, Ireland's international competitiveness fell as wages rapidly increased, leaving the country particularly vulnerable. During this period, soaring growth and revenue surpluses resulted in tax cuts and increasing public expenditure that could not be sustained. The IMF warned that "seemingly unstoppable growth masked serious imbalances". They also noted that, well before the crisis began, Irish public finances had developed serious structural weaknesses. Honohan and Leddin (2006) point out that the government has expanded spending in line with revenue during boom years and curtailed spending during downturns. They argue that "Ireland finds itself with less fiscal leeway than if it had held a tight belt in the overheating period 1999-2000".

According to the IMF annual report on Ireland (June 2009), Irish banks could face losses of €35 billion which corresponds to 20% of GDP. However, the real figure could turn out to be over double that. NAMA estimates impaired loans to be approximately €77 billion. The fall in the growth rate is expected to be the largest of all industrial nations, an expected drop of 13.5% between 2008-2010. After that, recovery is foreseen at only a modest rate of about 1% in 2011, increasing to 2.5% annually in 2012-2015. It is also noted in the report that maintaining lower wages is required to negate Ireland's cost disadvantage.

In the space of a few short years Ireland, has transformed from an economy that has been much admired for its growth performance to one that is at risk of collapse. This analysis shows that maintaining a high level of financial development is a key component of economic growth. The remainder of the paper proceeds as follows. Section 2 provides further motivation behind this study and reviews the related literature, section 3 examines the data while section 4 defines the model. The results are presented in section 5, policy implications are discussed in section 6 and section 7 concludes.

2. MOTIVATION AND RELATED LITERATURE

The relationship between financial sector development and economic growth is a widely researched area. Global financial markets are becoming increasingly integrated and changes in economic activity can have a strong impact on financial systems. Financial constraints that hamper firm and industrial expansion can be reduced through increased financial development. Financial development also influences several factors that drive growth such as technological innovations and savings and investment decisions. Several cross-country studies have found a positive correlation between financial development and growth (Goldsmith, 1969; King & Levine, 1993; Levine, Loyaza & Beck, 2000). Industry level data has also been used to examine the effect of financial development on growth and Wurgler (2000) finds that countries with higher levels of financial development increase investment more in growing economies. One of the issues when examining financial development and growth is that of directionality. One could argue that as countries improve their rate of economic growth, financial development is likely to take place. Joan Robinson (1952) remarked that 'where enterprise leads, finance follows'. Demetriades & Hussein (1996) find the relationship between growth and financial development to be bi-directional.

In a study confined to the case of Ireland, Kelly & Everett (2004) focus on the benefits that financial sector developments brought during the Celtic Tiger era. Rapid growth in credit resulted in the rapid increase in the private credit sector/GDP ratio. Investment growth rates that averaged over fifteen per cent during the boom period have declined slightly during the 2001-2003 period.

Increasing trade and financial integration has increased the effect that a shock in one country has on another. There is an abundance of literature that finds evidence in support of increasing co-movements between the business cycles of different countries. Frankel & Rose (1998) find a higher correlation in the business cycle among countries with close trade links. They also find that small open economies are more sensitive to the transmission of shocks. Artis et al (1995) examine the international nature of the cyclical component of the classical business cycle and find evidence in support of business cycle regimes. They also endorse the notion of the presence of asymmetry in the cycles; there is a bigger drop in output during a period of recession than there is a rise in output in times of expansion. Increased co-movement among business cycles is supported by the empirical evidence. It is extremely rare for recessions to be confined to a single country. Being a small open economy coupled with the fact that a huge proportion of Ireland's GDP arises from exports, Ireland is markedly exposed to a global crisis. Furthermore, membership to the European Single Market increases the likelihood of co-movements in the business cycle due to the high nature of monetary policy correlation among member states. Coinciding with the global crisis, Ireland was dealing with the consequences of the end of the house price and construction industry bubbles. During peak times, the banks borrowed heavily from abroad to fund the demand for soaring house prices leading to heavy net debt.

Business cycle theory itself is based on the fluctuations of GDP around its mean. The importance of credit constraints in explaining the business cycle was initially explored by Bernanke (1983), Friedman (1986), and Eckstein & Sinai (1986). The intuition behind the hypothesis that financial development is important when examining the business cycle is that a binding credit constraint makes it harder to smooth consumption. Bernanke & Gertler (1995) develop an overlapping generations model where financial market imperfections lead to temporary shocks in net worth to be magnified and persistent. Kiyotaki & Moore (1997) examine the impact of credit constraints and find the constraint to be more binding when the economy faces a negative shock. Their model performs very well in times of crisis when the volatility of the growth rate is high. Mendoza (2001) develops a Small Open Economy model that predicts periods of stability and periods of high volatility in the presence of two credit constraints; one internal and one external, that are only periodically binding. Aghion et al (2003) show both theoretically and empirically that growth is reduced in credit-constrained economies.
Jacobsen et al (2002) examine the relationship between the financial sector, private saving and growth in the U.S. They find that the relationship is characterised by regime shifts and that the timing of the shifts coincide with changes in financial regulation and market structure.

The growth rate of a country evolves in a non-linear manner. When describing the features a useful model of the real world should incorporate, Stirzaker (2005) remarks 'they must be sufficiently complicated to describe complex systems, but they must also be sufficiently simple for us to analyse them'. Pritchett (2000) highlighted the limitations of the use of cross-sectional and panel data in the study of economic growth. The conventional framework of a single set of explanatory variables may not capture the growth process adequately and it is preferable to include the possibility of structural change in the analysis. Regime switching models, in which the parameters move discretely between a fixed number of regimes, with the switching controlled for by an unobserved state variable have

become popular in econometrics. In the Markov-switching model introduced by Goldfeld and Quandt (1973), the latent state variable controlling the regime shifts follows a Markov-chain.

The Markov-switching approach adopted by Hamilton (1989, 1990) assumes the existence of several states of an economy with growth rates and volatilities differing in each state. For simplicity, suppose there are favourable states; that is states with high growth rates, and unfavourable states, with low or negative growth rates. Then a nation's economic progress will depend on the amount of time spent in favourable states relative to the amount of time spent in unfavourable states. In this approach, the key parameters requiring estimation are the transition probabilities. That is, the likelihood of remaining in a particular state or moving to a different one.

Subsequent to Hamilton's (1989) article, numerous authors have employed the Markov-switching methodology to model regime change. Indeed, the regime switching approach has proved productive in many other fields of economic research. In applied economics, and especially in financial economics, it is often plausible to assume that parameters do not remain constant over the entire sample period. For example, a random variable observed over time and assumed normally distributed may change mean and variance from (μ_1, σ_1^2) to (μ_2, σ_2^2) at some point, or a relationship $y_t = a_1 + b_1 x_t + e_t$ may transform to $y_t = a_2 + b_2 x_t + e_t$. In fact, there may be several change points with corresponding parameter changes. If the change points are known estimates of the parameters, estimation by maximum likelihood, or other methods, is straightforward. Estimation is just conducted within each period. However, if the change points are unknown *a priori* the estimation problem is much more complex. Markov switching models were developed for this situation and are probably the most frequently applied of approaches. Some examples are the gilt-equity yield ratio (Brooks and Persand, 2001), labour market recruitment (Storer, 1996), the effects of oil prices on U.S. GDP growth (Raymond and Rich, 1997), risk-return tradeoffs in emerging markets (Chang and Ho, 2007) and business cycle fluctuations (Diebold et al (1994); Engel and Hakkio (1994); Moolman (2003)). The model's strength lies in its flexibility because it is capable of capturing changes in the variance between state processes, as well as changes in the mean. In order to examine the relationship between growth, volatility and financial development in Ireland, I apply a time-varying Markov-switching model to Irish data using the methods proposed by Hamilton(1989), and Diebold et al (1994). The model assumes that growth rates follow a non-linear stationary process. Non-linearities arise because the process is subject to a discrete shift in mean and possible variance. Each regime has its own dynamics. One of the main advantages of the model is its ability to model series that have irregular cycles. The model is characterised by a number of distinct and discrete regimes within which different model parameters apply. The model periodically switches from one regime to another and these switches represent structural changes occurring in the process that is being modelled.

3. DATA

Since 2008, Ireland's private sector credit/GDP ratio has been falling. Table 1 shows the Financial Development Report and Index for 2008. By 2008, Ireland was ranked 14th in the Financial Development Index. The results from my analysis show that maintaining financial development plays an important role in determining economic growth.

Table 1: Financial Development Index, 2008

Rank	Country	Score (1-7)	Rank	Country	Score (1-7)
1	U.S.	5.85	11	Australia	4.98
2	U.K.	5.83	12	Spain	4.90
3	Germany	5.28	13	Switzerland	4.75
4	Japan	5.28	**14**	**Ireland**	**4.72**
5	Canada	5.26	15	Norway	4.66
6	France	5.25	16	U.A.E.	4.61
7	Sweden	5.23	17	Belgium	4.56
8	Hong Kong	5.23	18	Austria	4.55
9	Netherlands	5.22	19	Korea (Rep)	4.55
10	Singapore	5.15	20	Malaysia	4.48

Source: World Economic Forum

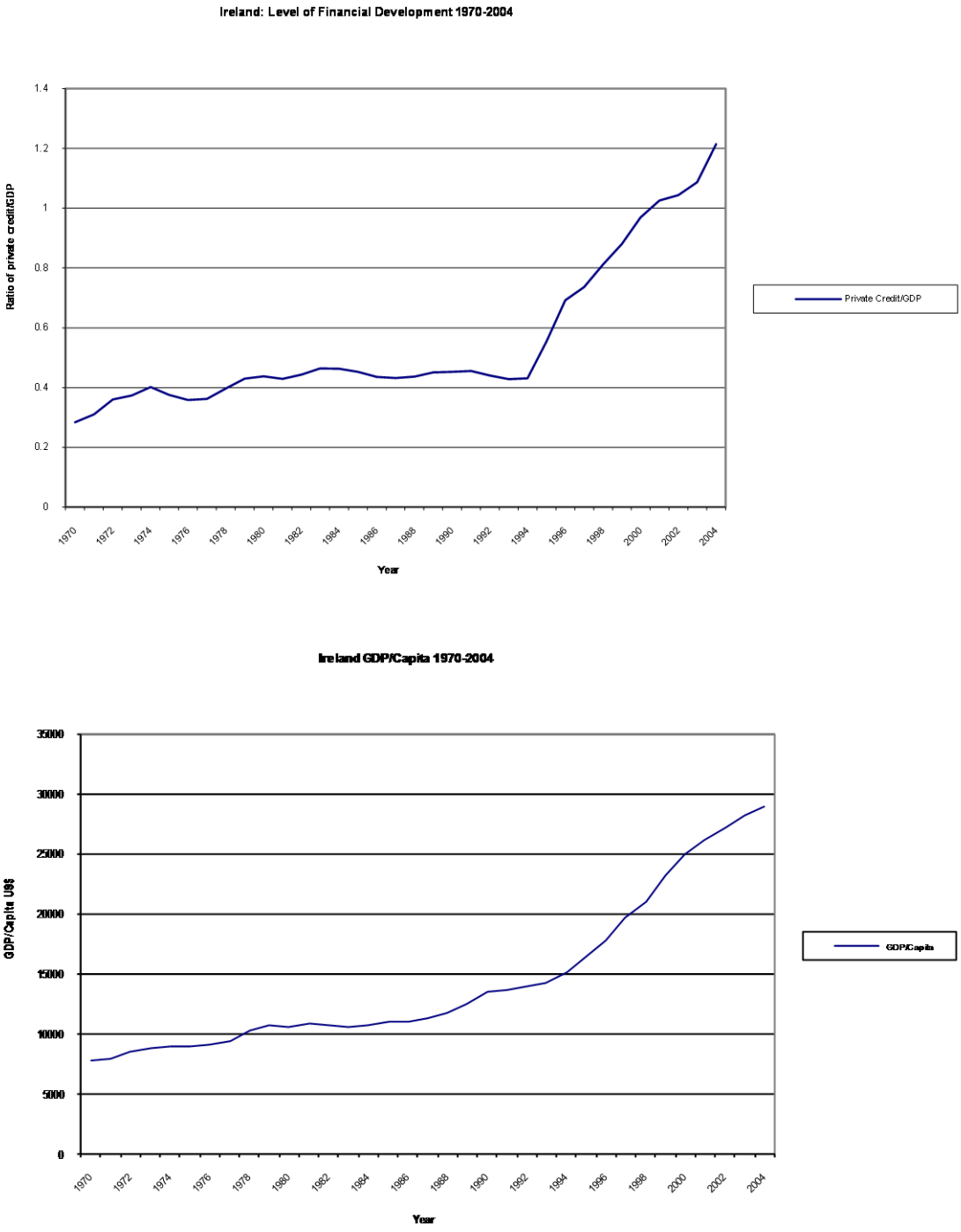
The first issue to address is how to measure financial development. Because there are no concrete definitions as to what financial development is, measuring financial development is a difficult procedure. Although financial development has generally been found to promote growth, the indicators used as a proxy require some interpretation. Beck and Levine (2004) found that both financial markets and banks have a positive and significant impact on growth, even when control variables were added to their model. Loayza and Ranciere (2006) use a panel error-correction model to estimate both the short-run and long-run effects of financial development on growth. They use domestic credit by banks and other financial institutions as a percentage of GDP as their financial development variable, and show that the relationship between financial variables and growth is positive and significant in the long-run. Favara (2003) uses domestic credit by banks and other financial institutions as a percentage of GDP and finds a strong positive relationship between growth and financial development.

Although many different variables have been used to investigate the relationship between financial development and growth, there are some limitations to all of them. Beck et al (2000) have used liquid liabilities, the ratio of commercial to central bank assets, and private credit in their analysis. However, because liquid liabilities include deposits by one financial intermediary to another, the possibility of double counting arises. The ratio of commercial to central bank assets used by King and Levine (1993) does not account for the effectiveness of banks in researching firms, easing transactions, providing risk management and mobilising savings. Kelly and Mavrotas (2003) used three different types of financial sector development indicators to examine the impact of financial development on private savings in India. The measures used were

1. The ratio of deposit money assets to central bank assets, which gives an indication of the relative size of the financial sector.
2. The ratio of liquid liabilities to GDP, which gives an idea of the absolute size of the financial sector.
3. The ratio of private credit by deposit money banks and other financial institutions to GDP, which gives an indication of the activity of financial intermediaries.

Private credit as a ratio of GDP is the preferred measure of financial development in recent literature (for example, Aghion et al (2003); Arellano et al (2008)). It has been argued that companies are more productive and grow faster when there is more long-term finance available to them (Caprio and Demirguc-Kunt, 1997). Lie et al (1998) found that financial development, measured by the ratio of private credit to GDP, contributed to falling inequality and increases the average income of 80% of the population. The ratio of private credit/GDP is a measure of financial depth and concentrates on credit issued by financial intermediaries other than the central bank. It includes the value of all credit that financial intermediaries issue to the private sector as a share of GDP. The measure can be interpreted as a way of channelling savings from financial institutions to investors. Figure 1 compares the levels of GDP/capita in Ireland since 1970 with corresponding levels of private credit/GDP. The graphs show that the two series move together. The correlation coefficient is 0.978 which is indicative of a positive relationship between financial development and growth.

Figure 1: Comparing Irelands levels of GDP/Capita and Level of Financial Development from 1970 to 2004



As previously mentioned, one of the reasons put forward for Ireland's current financial crisis is the easy availability of credit during the boom. Therefore, when analysing the impact of financial development on the Irish growth rate, using the private credit/GDP ratio alone is not sufficient. Therefore I follow Kelly and Mavrotas (2003) and use three measure of financial development: the ratio of liquid liabilities to GDP, the ratio of deposit money assets to central bank assets, and the ratio of private sector credit to GDP. The data is obtained from the Financial Structure Dataset (updated 2009). Table 2 shows the measures of financial development used in this analysis. I give each of the three measures an equal weighting in the model in order to obtain a more complete measurement of financial development.

Table 2 Indicators of Financial Development

Year	Liquid Liabilities/GDP	Private Credit/GDP	Deposit Money Assets to Central Bank Assets
1960	0.49	0.32	0.97
1961	0.49	0.31	0.97
1962	0.49	0.31	0.97
1963	0.49	0.31	0.97
1964	0.49	0.31	0.97
1965	0.49	0.32	0.94
1966	0.49	0.32	0.93
1967	0.49	0.31	0.93
1968	0.49	0.31	0.95
1969	0.49	0.30	0.96
1970	0.49	0.28	0.93
1971	0.49	0.31	0.97
1972	0.49	0.36	0.97
1973	0.49	0.37	0.96
1974	0.49	0.40	0.97
1975	0.49	0.38	0.95
1976	0.49	0.36	0.93
1977	0.49	0.36	0.96
1978	0.49	0.40	0.96
1979	0.49	0.43	0.94
1980	0.49	0.44	0.94
1981	0.49	0.43	0.95
1982	0.49	0.44	0.95
1983	0.50	0.46	0.96
1984	0.49	0.46	0.95
1985	0.49	0.45	0.96
1986	0.45	0.44	0.96
1987	0.44	0.43	0.97
1988	0.44	0.44	0.96
1989	0.42	0.45	0.97
1990	0.41	0.45	0.97
1991	0.44	0.46	0.98
1992	0.44	0.44	0.98
1993	0.47	0.43	0.98
1994	0.51	0.43	0.99
1995	0.59	0.55	0.99
1996	0.70	0.69	1
1997	0.71	0.74	1
1998	0.73	0.81	1
1999	0.76	0.88	1
2000	0.79	0.97	1
2001	0.78	1.03	1
2002	0.77	1.04	1
2003	0.79	1.09	1
2004	0.83	1.21	1
2005	0.88	1.42	1
2006	0.94	1.65	1
2007	0.98	1.84	1

The data for the growth rate is taken from the Penn World Tables 6.3 and is the growth rate of GDP/Capita from 1960-2007.

4. THE MODEL

In using Markov-switching models, the first challenge is to determine the true number of regimes. Looking for the number of regimes is equivalent to looking for the number of regression lines that will best fit the data. The idea behind regime switching models is that the parameters of the underlying data generating process of the observed time series vector ψ_t depends on an unobservable regime variable s_t, the probability of being in a certain state. If there is insufficient information in the series, the regime classification will be weak. Badly parameterised switching models may not be an improvement over models that do not allow for switching. I apply a regime classification measure (RCM) introduced by Ang and Bekaert (2002). The RCM provides a measure of the information of regime switches available in the data. The measure relies on the estimated filtered probabilities of the states from the model that indicate the likelihood of a particular regime. The RCM is given by the following:

$$RCM = 400X \frac{1}{T} \sum_{t=1}^{T} ps_{1,t}(1 - ps_{1,t}), \quad (1)$$

where $ps_{1,t}$ is the smoothed probability of being in regime 1 at time t, and the constant normalises the statistic to between 0 and 100. The same method can be applied to $ps_{2,t}$. In the case of a perfect regime classification, the inferred state probability for a particular data point would be 0. A statistic of 100 indicates no regime classification. Here, the RCM for state 1 is 7.03 and for state 2 is 29 indicating that both regimes are well defined.

An AR(1) model of growth is chosen using the S.I.C. and A.I.C. criterion. Therefore, I assume there are two possible states of nature and that in each state, growth follows an AR(1) process.

$$\begin{aligned} y_{it} &= \alpha_{st} + \beta_{1st} y_{it-1} + \varepsilon_{it}^{st}, \\ \varepsilon_{it}^{st} &\sim i.i.d.N(o, \sigma_{st}^2) \end{aligned} \quad (2)$$

y_{it} is the growth rate of country i in period t.

s_t is the state that is in effect at time t.

To allow the transition probabilities to depend on financial development in order to explain the probability of switching from one regime to another, we follow the method of Diebold et al (1994). Then, the first order Markov chain is:

$$\begin{aligned} p[s_t = 1 \mid s_{t-1} = 1] &= p_{11}(\psi_t) \\ p[s_t = 2 \mid s_{t-1} = 2] &= p_{22}(\psi_t) \\ p[s_t = 2 \mid s_{t-1} = 1] &= p_{12}(\psi_t) \\ p[s_t = 1 \mid s_{t-1} = 2] &= p_{21}(\psi_t) \end{aligned} \quad (3)$$

where ψ_t is the vector containing the level of financial development at time t.

Under the two-state model, the universe of possible occurrences is split into two states of the world, $s_i, i = 1,2$, corresponding to two regimes. It is assumed that y_t switches regime according to some unobserved variable, s_t.

The Markov processes are thus not path dependent as the probability distribution of the state at any time t depends only on the state at time t-1. If a variable follows a Markov process, all that is required to forecast the probability that it will be in a given regime during the next period is the current period's probability and a set of transition probabilities.

The transition matrix is

$$\mathbf{P}(t) = \begin{bmatrix} p_{11}(t) & p_{12}(t) \\ p_{21}(t) & p_{22}(t) \end{bmatrix} \quad (4)$$

The transition probabilities are modelled as a logistical functional form such as:

$$\begin{aligned} p_{11} &= \frac{\exp(\beta_{11}(1) + \beta_{11}(2) * \mu_t)}{(1 + \exp \beta_{11}(1) + \beta_{11}(2)\mu + \exp(\beta_{12}(1) + \beta_{12}(2) * \mu_t)} \\ p_{12} &= 1 - \frac{\exp(\beta_{12}(1) + \beta_{12}(2) * \mu_t)}{(1 + \exp \beta_{11}(1) + \beta_{11}(2)\mu + \exp(\beta_{12}(1) + \beta_{12}(2) * \mu_t)} \\ p_{21} &= 1 - \frac{\exp(\beta_{21}(1) + \beta_{21}(2) * \mu_t)}{(1 + \exp \beta_{21}(1) + \beta_{22}(2)\mu + \exp(\beta_{22}(1) + \beta_{22}(2) * \mu_t)} \\ p_{22} &= \frac{\exp(\beta_{21}(1) + \beta_{21}(2) * \mu_t)}{(1 + \exp \beta_{21}(1) + \beta_{22}(2)\mu + \exp(\beta_{22}(1) + \beta_{22}(2) * \mu_t)} \end{aligned} \quad (5)$$

Maximisation of the likelihood function is not straightforward and employs the iterative E-M algorithm. The EM algorithm calculates the expectations of the smoothed transition probabilities conditional upon the parameters. The parameters are then amended conditional upon the smoothed transition probabilities. This process continues until maximisation is achieved. Full details are given in Hamilton (2004: 685-696).

5. RESULTS

I find that there are two unobserved states of growth; low growth and high growth, and that the economy periodically switches between these two states. The results are presented in Table 3.

Table 3 Results of two-state Markov Switching Model with Time-varying Transition Probabilities

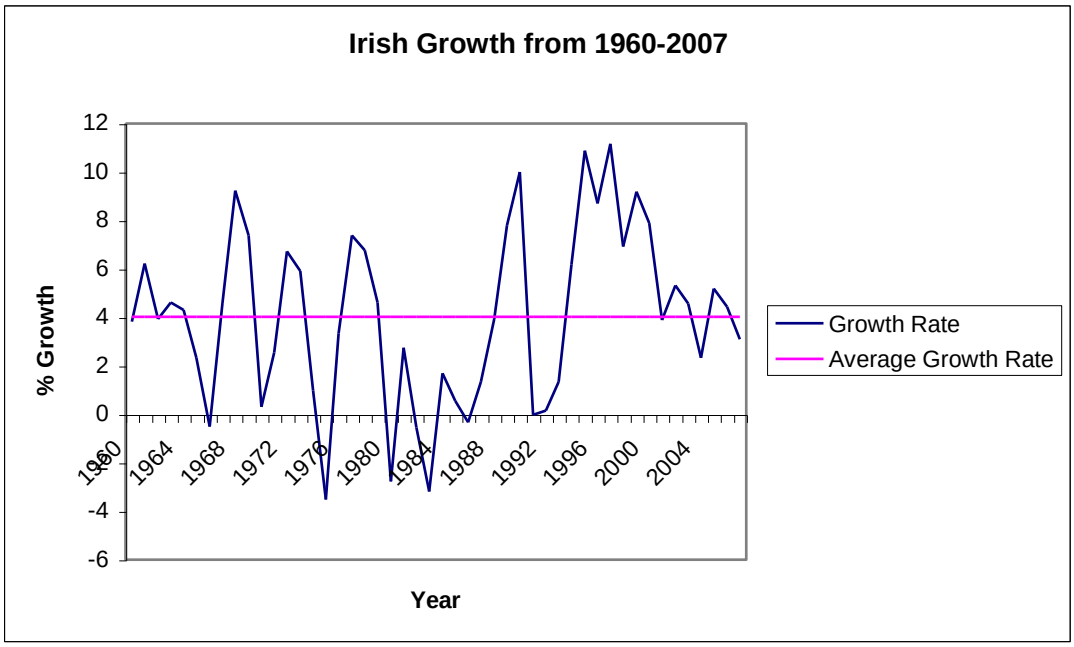
	State 1 (High Growth)	State 2 (Low Growth)
Average Growth Rate	4.56***	-0.35*
Volatility	1.74*	3.93*
Probabilities	p_{11} =0.95	p_{22} =0.64
	Log Likelihood = -131.81	

***Denotes significance at 1% level, ** Denotes significance at 5% level, * Denotes significance at 10% level

In regime 1, the average growth rate is 4.5%, with a low level of volatility. In regime 2, the growth rate is –0.35% and is more volatile. The probability of remaining in regime 1 at time t, given that it was in regime 1 at time t-1 is 0.95. The regime is very persistent, indicating that once Ireland is in the high growth regime, it is highly likely to remain there. The probability of remaining in the low growth regime is lower but still persistent at 0.64. Figure 2 shows how the growth rate in Ireland has evolved over the sample time period. Ireland enjoyed an annual average growth rate of 4.03%, well above the average for industrialised countries (2.1%). The Celtic Tiger Era is clearly picked up and is characterised by sustained levels of high growth. The graph shows that for most of the sample period, Ireland enjoyed positive growth rates and that periods of lower growth were of relatively short duration. The series is characterised by episodes of sharp fluctuations, usually corresponding to external worldwide shocks. The model therefore appears to explain the Irish growth experience quite well. Easy access to credit has been argued to be one of the causes of the recession. Therefore, it is possible that, if the current growth rates were included in the analysis, an additional "collapse" type

regime would be identified. This would indicate that, for a developed economy like Ireland, there may be an optimal level of financial development.[2]

Figure 2: Average Growth and Annual Growth in Ireland from 1960-2007



One question I would like to address is what will happen should financial development in Ireland fall. By calculating the expected duration of remaining in each regime, it is possible to estimate this. First, I calculate the expected duration of remaining in each regime when financial development is as given in the model. I then re-estimate the model and calculate the expected duration of remaining in each state when financial development falls by 5%, by 10% and by 20%.

If the transition probabilities differ across states, then the expected duration will also differ across states. The expected duration of remaining in a particular state, *j*, can be calculated from the transition probabilities. Let D_j denote the number of periods the system is in state *j*. Then the probability of remaining k periods in state j is:

$$P(D_j = k) = P_{jj}^{k-1}(1 - P_{jj}),$$

which implies for the expected duration of that state:

$$E(D_j) = \sum_{k=0}^{\infty} kP(D_j = k) = \frac{1}{1 - P_{jj}} \qquad (6)$$

From (6), we can calculate the expected duration of remaining in each regime.

[2] Financial Development as measured here.

Table 5:The Expected Duration of Remaining in Each Regime $E(D_j) = \frac{1}{1-P_{jj}}$

	State 1	State 2
Expected duration (from the model)	14.49 years	2.98 years
Expected duration when F.D. is reduced by 5%	12.5 years	3.31 years
Expected duration when F.D. is reduced by 10%	10.1 years	3.93 years
Expected duration when F.D. is reduced by 20%	8.26 years	4.97 years

It is clear that the expected duration of remaining in the high growth state is far higher than the expected duration of remaining in the low growth state for all levels of financial development. That is, the Irish economy will experience higher growth more often than lower growth, irrespective of financial development levels. This is to be expected as industrial countries tend to have relatively stable, positive growth rates. The expected duration of the low growth regime is relatively short. The models tell us that once Ireland enters a period of slow growth, the economy is likely to remain there for approximately three years. However, as the level of financial development falls, it is clear that the expected duration of remaining in the low growth state increases. The implication is that if financial development in Ireland falls by 20%, then the economy will remain in the low growth state for an additional two years. Conversely, the expected duration of remaining in the high growth regime falls as the level of financial development falls. Therefore, I conclude that financial development not only mitigates volatility but also leads to higher long-term growth because a higher level of financial development leads to spending more time in the high-growth regime.

6. POLICY IMPLICATIONS

The results can have important implications for the current predicament of the economy. It would be imprudent to claim that financial development is the only important factor in determining the Irish growth rate. Indeed, there are many factors not within the scope of this paper that play a crucial role in determining the economic performance of any economy and these will need to be considered when implementing new policies. However, what is clear from the results is that maintaining financial development is a key factor for growth. A well functioning financial system is crucial, and confidence in the Irish financial system is currently at an all time low. Bernanke and Gertler (1990, 1995) argue that a reduction in the supply of bank credit is likely to increase the external finance premium which, in turn, decreases real economic activity. Faced with a financial crisis, the first reaction is to minimise short-term effects. The intervention by the government (for example through NAMA and bank bailouts) is intended to contain the current financial crisis and restore access to credit for private firms, prevent capital flight and restore faith in the banking system. The aim now should be to overhaul the financial system in order to reduce risk to investors and taxpayers, and to limit the possibility of future crises.

7. CONCLUDING REMARKS

In this paper I examine the role of financial development on the Irish growth rate while allowing growth to follow a non-linear process. The Irish economy has been particularly badly affected by the current global financial crisis, leaving the Celtic Tiger Era a somewhat distant memory. As a small-open economy, Ireland was especially vulnerable to a worldwide downturn. Confidence in the Irish financial system has been greatly reduced and lending rates are falling rapidly.

The idea that increasing financial development spurs growth is discussed. In order to examine the impact of falling levels of financial development on Irish growth I apply a two-state time-varying Markov-switching model to Irish data from 1960-2007. I allow the transition probabilities to be governed by the levels of financial development. As easy access to credit has been argued to be a contributory factor to the current financial crisis in Ireland, there are issues to using the preferred measure of the ratio of private credit/GDP alone as a proxy for financial development. Instead, I combine three measures of financial development - the ratio of liquid liabilities to GDP, the ratio of deposit money assets to central bank assets, and the ratio of private sector credit to GDP. However, it is yet not feasible to capture the current crisis period in the analysis due to the lack of available data.

Including the crisis period could identify a third "collapse" type regime, pointing to the possibility of there being an optimal level of financial development for developed countries.

I find that the model explains the Irish growth experience quite well. My results show that as the levels of financial development in Ireland increase, so does the growth rate. Higher levels of financial development correspond to more time spent in a high growth, low volatility regime. After calculating the expected duration of remaining in each regime at given levels of financial development, I find that a 20% decrease in the level of financial development will result in remaining in the low growth regime, with a growth rate of approximately -0.35%, for an additional two years.

I conclude that financial development is a driving factor in determining Irish growth. The financial system should help allocate resources efficiently and provide mechanisms to manage risk. However, the financial system can also increase volatility by providing easy access to credit in the presence of inadequate monitoring of the risks. Periods of rapid financial development are often observed immediately before a financial crisis. Although eliminating financial crises is almost impossible, it may be possible to lower the risk by focusing on fundamentals such as creditor rights, adequate regulations etc. as the ability of an economy to accommodate a shock will be crucial in determining the long-run growth performance of a country. The question also remains as to how to accurately measure financial development and whether an optimal level of financial development exists after which point, loosening credit constraints further can ultimately harm growth.

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FIRST VOTE OF THANKS PROPOSED BY FRANK BROWNE,
CENTRAL BANK OF IRELAND

I would like to thank the Society for inviting me to second Julie's paper. It is indeed a privilege and a pleasure to do so. Julie, in her presentation, has to some extend stolen my thunder by discussing in a candid way the shortcomings in the methodology she is employing. Although this is an excellent paper there is scope for future work.

I am very sympathetic to the idea of looking to financial variables in trying to come to grips with at least some of the underlying forces behind economic growth. It is clear from experience that financial deepening is favourable for economic growth. It is also clear from the current crisis that the financial sector of an economy can over-expand and be inimical to growth. There must therefore be some optimal size of the financial system that promotes growth. Growth would be adversely affected by a level of development that is either less than, or greater than, this optimal level. Although not an expert in this area of economics, it seems to me that the growth/financial depth literature does not seem to have this idea embedded in it. It seems to suggest that whatever measures of financial depth are identified then the bigger these measures the better for growth.

The following consideration is also relevant. I do not think that the financial depth-growth literature on the one hand and the financial crisis – growth literature on the other are one and the same thing. I think that in the financial depth – growth framework, we would not expect to see abrupt transitions between regimes. Rather one regime would tend to emerge from the legacy regime gradually over time rather than abruptly. However, in the financial crisis literature abrupt regime transitions are likely. Indeed, it is very likely that we are experiencing one in Ireland right now.

So what is the optimal size of the financial sector? The benefits in theory of having an efficient financial system are fairly well known: they can lower the cost of financial intermediation and promote growth by conducting the following functions:

- Producing information about participants in banking and financial markets;
- Providing secure and efficient payments media and, in most cases, an efficient payments infrastructure;
- Pooling savings and allocating capital (i.e., financial intermediation);
- Managing and allocating risks;
- Monitoring businesses and borrowers generally;
- Easing external financing constraints facing some firms; and,
- Allowing households and firms alike to smooth expenditures over time and thus attenuate the higher fluctuations in output and income growth that would otherwise occur.

These are the benefits and these have to outweigh opportunity costs of the capital employed to produce these services, i.e., the costs of diverting resources away from other sectors of the economy. When the financial sector becomes bloated (as it did globally in the run up to the current global financial crisis) these costs can be considerable. The growth/financial depth literature does not seem to recognise that there can be a problem of "over-financialisation" of the economy. I think the crisis demonstrates amply that rapid financial sector growth can reflect an unsustainable asset boom rather than improved intermediation and increasing financial depth. To the extent that this misallocates resources which it almost invariably does, then beyond a certain threshold, further financial market development is inimical to growth.

Work carried out at the IMF and elsewhere suggests that persistently high rates of credit growth have been an important leading indicator of future fragility in the banking system, and in many of the countries examined by the IMF, an important leading indicator of systemic collapse. It is also notable that these periods of high growth tend to be preceded by official programmes of financial market liberalisation (in the Irish case we had the reduction in banks' reserve ratios, the ending of credit guidelines, the ending of the interest rate matrix and full liberalisation of forex and capital controls). Again, this analysis does not seem to tackle the issue of a threshold level of financial development.

Up to this threshold, increases in indebtedness represent genuine financial deepening and are positive for growth. Beyond this threshold, increases in indebtedness reduces growth or may, as we have seen in the Irish case over the last couple of years, causes negative growth. So the threshold is the dividing

line between good and bad lending. The problem is that these adverse consequences are only produced with a lag which could be fairly long. This makes it difficult to identify the threshold in real time. To the extent that loan standards and conditions might be a useful leading indicator of this, then the Irish results of the ECB's Bank Lending Survey might give us a handle on this.

It would clearly be of great benefit to policymakers to know at what level of indebtedness this threshold is passed. In Julie's measure of financial depth, indebtedness is still contributing positively to growth well past this threshold. In reality, it was contributing to the worst recession experienced by the Irish state.

To improve on this approach we would need much more data - i.e., the kind of extensive international databanks the IMF has available to it. We could then search for the breakpoint (threshold) in the indebtedness variable. This would be assumed to occur at the point where the explanatory power of "good indebtedness" (low indebtedness growth rates before the breakpoint) on economic growth is maximised and the explanatory power of "bad indebtedness" (high indebtedness growth rates after the breakpoint) on low or negative growth rates is also maximised.

There is another, longer term effect, as to why future economic development might not be so closely associated with further bank loan growth. This argument starts from the proposition that the return to the lending bank is asymmetric in the outcome from the project being funded by the loan. If the project being funded is spectacularly successful, the lending bank still only obtains interest and principal in return while if the project is a total failure, it receives nothing. This asymmetry between upside and downside risks facing the bank can be overcome by the bank requiring suitable collateral for the loan. Collateral is an asset which is the property of the borrower but which must be forfeited to the lender in the event of default on the loan.

But the economic landscape is changing rapidly. The rapidly developing services-based intangible economy, unlike heavy industry and manufacturing, is generally not in a position to offer the kind of collateral a bank would find suitable as security for the loan. Banks may therefore find that the asymmetry in return from supplying loans to this increasingly important part of the economy renders such loans no longer attractive. This type of funding, i.e., the plain vanilla bank loan, may be in the process of becoming an inferior funding instrument as economies develop. Banks have to operate in a world in which corporate borrowers enjoy the privilege of limited liability but cannot offer collateral for loans. The bank does not therefore have an incentive to lend.

I suspect that real financial deepening involves not just the levels of certain financial variables but also how these variables interrelate. In other words, the composition of finance may also be of key importance in understanding the driving forces of growth. An advanced industrial country may not progress if it only has access to the type of funding provided by banks. Beyond a certain level of development, when the services sector of the economy becomes dominant (as it already has in advanced industrial economies), equity-type funding would seem to be essential ingredient to further economic development. This would seem to be bad news for further (good) financial deepening in Ireland since the equity market makes only a minimal contribution to corporate funding of indigenous firms.

In examining financial deepening, we must acknowledge that there is a long-term trend affecting banking, and that trend is one of long-term disintermediation of the banking industry. If this bank disintermediation is asymmetric (as it has been in Ireland leading up to the crisis, with retail deposit growing more slowly than loans) then this is further bad news for financial deepening in Ireland and for the funding possibilities for Irish SMEs without access to international financial markets.

Funding deficits (the shortfall of retail deposits to loans) for most banking systems have increased substantially since the 1990s, although the extent of the increases varied across countries. As I see it, this is the result of banks being increasingly disintermediated on the liabilities side of their balance sheets due to more active portfolio management by households (and probably non-financial firms as well) in the form of increased international portfolio diversification in order to reduce the home country bias in their portfolios. However, neither households nor non-financial firms can easily disintermediate banks on the assets side of banks' balance sheets since they are unable to borrow overseas. This leaves banks increasingly dependent on wholesale funding to fill the gap in their balance sheets. If this

interpretation is correct, then the funding deficit is a structural problem for banks, which is set to remain, if not increase further, in the future and for which there is no easy solution.

If banks wean themselves off wholesale funding to get rid of this vulnerability, and they cannot fill the funding gap in their balance sheets, then they will be obliged to cut back on loan supply. Another possibility would be to securitise part of their loan books. This would free up resources for additional lending. However, this does not look like an imminent possibility given the fact that the originate and distribute (OAD) model, of which securitisation is an integral part, is not exactly popular in the wake of the financial crisis.

If, in the future, wholesale funding remains important for the banks, then loan supply may also become more erratic and therefore contribute less to financial deepening and economic growth since wholesale tends to be more erratic than retail funding. The outcome could be even less favourable than this. As just noted, financial markets are under-developed in Ireland. So, financial deepening is little more than bank loan growth (in Julie's paper it is only loan growth). So, if banks cannot tackle their funding problems and cannot (or do not) have recourse to loan securitisation, then financial "shallowing", rather than deepening, is the prospect – not a good one for indigenous Irish industry.

This brings us to the tricky and controversial area of what actually triggered the crisis. My view is that it was it was an external shock that came in two phases:

1. The collapse in the prices of sub-prime funded houses – to which many banks had an exposure since this risk had been spread around the world via credit risk transfer (CRT) techniques (August 2007)
2. The collapse of Lehmans Brothers (September 2008)

But these shocks occurred in the context of substantial pre-existing vulnerabilities in the Irish financial system, which were highlighted in the Central Bank and Financial Services Authority of Ireland's Financial Stability Reports:

1. The rate of credit growth and the level of indebtedness which were exacerbating the vulnerabilities to a variety of shocks;
2. The share of the loan book in the property related sectors which had reached dangerous levels of concentration;
3. Declining net interest margins, a vulnerability camouflaged somewhat by very rapid rates of volume growth in bank assets and liabilities;
4. A high and growing funding gap, i.e., the gap between assets and the portion of liabilities accounted for by retail deposits rendering the banks' funding very sensitive to an Irish country specific shock; and
5. A level of bank provisioning that was already low by international standards were lowered further by the adoption of International Financial Reporting Standards (IFRS).

Arguably, it is these types of vulnerabilities that would foreshadow a regime shift. So one could contend that there were at least 5 or 6 variables pertaining to the banking sector which reflected key vulnerabilities and which were crucial in determining the transition to a new regime. Only one of these is included in Julie's proxy for financial wealth and this, without any adjustment, would have told a wrong story.

Nevertheless, the regime transition according to Julie's methodology is a probabilistic event – not an inevitability! The only way one could have ascertained how probable the event might have been would have been to refer to a combination of similar vulnerabilities elsewhere (i.e., in other countries) in the past since we have never had a financial crash in Ireland. This would again mean looking at international experience, which is something I would recommend to Julie in developing her work further.

Recalling Julie's paper title: "Ireland and the Global Financial Crisis: Growth, Volatility and Financial Development", there is not much discussion in her paper of volatility which I take to mean volatility in output or more likely volatility in output growth. Maybe this has less to do with financial deepening than with monetary policy. The evidence is fairly clear-cut on this: the correlation between output growth volatility and inflation volatility is quite remarkable especially for so-called Anglo-Saxon

countries. The benign effect of many independent central banks being committed statutorily to price stability, or at least giving price stability a top priority, and the favourable effect of this on stability of output growth, is evident in the data.

Probably one of the most telling criticisms levelled against the economic growth and development literature is that it has seemed unable to come up with a fundamental explanation of economic growth. The case is summarised neatly by North and Thomas (1973): "..the factors we have listed (innovation, economies of scale, education, capital accumulation, etc.,) are not causes of growth; they are growth". In their view, the fundamental explanation of comparative growth is differences in institutions. This line of argument maintains that economic institutions matter for economic growth because they shape the incentives of key economic actors in the economy by influencing investment in physical and human capital and technology and the organisation of production.

This means that quantitative variables may not be enough to account for the complexity of financial deepening and its effects on growth. It may be necessary to adjust these quantitative variables for quality. This is very pertinent to the main variable used by Julie to proxy for financial depth – private sector credit. This is because beyond a certain threshold level of loan supply, banks can only supply more by going down the list of creditworthy borrowers. To do this, banks tend to relax lending terms and conditions. The ECB's Bank Lending Survey for Ireland (but not just Ireland) bears testimony to this. According to Julie's own theory and measure of financial deepening, the Irish economy should not only not have gone into a deep recession starting in 2007 but should have thrived further in the light of the increasing depth of Irish financial markets as proxied by loan growth. However, corrected for quality (deteriorating loan underwriting), the probability of a regime shift would have increased significantly. This raises a more general point about the need to adjust indicators of financial depth for quality effects.

Again I would like to thank the Society for the opportunity to discuss Julie's paper and I would like to encourage her in exploring this very important area of research (which I think has become even more important in the wake of the financial crisis) and I would like to wish her the best of luck in doing so.

SECOND VOTE OF THANKS PROPOSED BY ROBERT KELLY, CENTRAL BANK OF IRELAND

The paper presented by Dr. Julie Byrne is most welcome and presents an interesting analysis of the growth implications of financial deepening for Ireland. It is timely for a number of reasons, not least as research focuses on the part played by financial development in the current Irish recession. Ultimately, work of this nature will contribute at the international level, as bodies such as the Basel Committee on Capital Requirements develop measures such as counter-cyclical capital requirements based on similar financial development variables (ratio of private sector credit to GDP) to avoid credit outpacing economic growth. It gives me great pleasure to second the vote of thanks.

The Great Moderation is not discussed in the paper – a trend of reduced output growth volatility is an undeniable stylised fact of all advanced industrial countries since the 1960s. These reductions in volatility have been both very significant and substantial. This poses two natural questions; why did the Great Moderation occur and whether financial deepening has played any part in the moderation of the business cycle?

The paper makes the point that increasing trade and financial integration facilitates the international transmission of shocks. However, a key distinction needs to be made between the transitional period when integration is in the process of being achieved and the effects on financial deepening and the real economy in the steady state when integration is complete. The starting conditions are crucially important. Take the commencement in the 1990s – the standard of living and price level was well below that of our main trading partners. Then 'catch-up' growth caused high growth rates relative to our trading partners and converging price levels yielded higher inflation. The creation of the single monetary union introduced very low short term interest rates, when coupled with high inflation resulted in very low or possible negative real interest rates. At the same time, our high growth rates ensured that the return on capital invested in Ireland remained unprecedentedly high while the cost of capital remained low. The more the economy invested, the more inflation accelerated and further lowered the

real interest rate – further reducing the cost of investment. This was financial integration and deepening but, as we now know and regret, not all deepening is positive for the real economy.

The paper clearly states the number of defined regimes is based on the regime classification measure (RCM) introduced by Ang and Bekaert (2002) and defines two; a high growth, low volatility state and a low growth, high volatility state. This is puzzling since Ireland in the 1980s would have been characterised by low growth and low volatility. This raises a question about the suitability of a Markov switching framework in the financial depth and growth framework. Abrupt switching is required for Markov switching such as the modelling crisis dynamics but abrupt transitions is not a feature in the financial depth and growth literature. Could there be gains to using learning processes such as those employed in Baynesian techniques or a Kalman filter which would allow for a more gradual change?

An interesting avenue to explore further is the interbank affects on financial development. Kelly & Everett (2004) outline the growth due to financial sector developments over the last decade. Aggressive credit growth yielded a credit/GDP ratio of 2.5 by 2007. They note that a bank's ability to respond to private sector demand for credit depends on the availability of funds in the interbank market. Interbank markets provide a mechanism to distribute liquidity across banks. But in the recent crisis, this market locked up even as central banks increased the monetary base. Can this Markov framework integrate this wholesale level information?

DISCUSSION

Noel O'Gorman echoed the concern about finding a satisfactory measure of financial development. He drew attention to two features of the data in Table 3: (i) their relative 'stationarity' for long periods, until the surge from the middle of the 1990s, and (ii) the shifts in the Private Credit/GDP series, which broadly coincided with phases of Ireland's integration with the EU. On the issue of the direction of causality, he asked the author to comment on the channel(s) of transmission from financial development to economic growth. Was the linkage mainly through availability of or ease of access to credit? Was this via the demand side of the economy, or were there wider aspects?

Thomas Conefrey said liquid liabilities are one component of the measure of financial development used in the paper. In the paper, does this figure include the liabilities of foreign institutyions located in the IFSC? On the question o developing a reliable measure of financial development/financial sector expansion, the suggestion was made to examine the numbers on the ney foreign liabilities of the banking system. The expansion in lending by banks in Ireland to fund the rise in domestic housing investment after 2003 is in part captured by this series and it could be useful to examine it in the context of this paper.