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POLICY PAPER

How Have Contracts for Difference Affected Irish Equity Market Volatility?

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Abstract: Contracts for Difference (CFDs) have existed for less than twenty years and the market has grown significantly up to the period before the recent international crises. This paper presents an analysis of how CFDs have affected equity market volatility in Ireland. EGARCH models are used to uncover volatility changes in the periods before and after the introduction of the new trading product in Ireland. We find that CFDs appear to have lowered asset-specific volatility across the majority of equities traded on the Irish Stock Exchange. These findings do not correspond to the expected volatility increase associated with leveraged products that are closely associated with high frequency trading. Our empirical analysis suggests that CFDs are having an alternative volatility reducing effect through the presence of bid and ask price "overhangs" that are generated through the hedging practices of CFD brokers. A fully worked example of the development of an "overhang" is provided.

I INTRODUCTION

The Contract for Difference (CFD) industry has grown significantly since the product's creation in the mid-1990s. A CFD can be described as a leveraged financial instrument whose value is based on the future price change ("the difference") of an asset. The global market for CFDs grew rapidly after their inception up to the recent international financial crisis. Investors

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can use CFDs to open either long or short positions with a standard rate of margin of 10 per cent. This paper analyses the effects of CFDs on Irish equity markets since their introduction in late 2002. We investigate whether the combined practices of CFD investors and providers affect individual equity volatility on the Irish stock exchange. In addition, we examine whether CFDs may have also had a beneficial impact on Irish stock markets through the provision of new liquidity.

We employ an Exponential Generalised Autoregressive Conditional Heteroskedasticity (EGARCH) methodology at both the index and equity-specific level to investigate volatility differences in the period before and after the introduction of CFDs. A total of 4,365 daily observations between 1998 and 2013 were used in the study. As CFDs are a leveraged, short-term investment product, they attract a large number of day-trading speculative investors. Markets with a significant proportion of such short-term traders have been associated with an increase in volatility in futures markets, beginning with Edwards (1988) and Baillie and Bollerslev (1991), together with more recent evidence uncovered by Chung, Choe and Kho (2009) and Schwert (2011). Alternatively, CFDs have also been associated with a market anomaly called an "overhang" on the bid and ask prices of the equities for which CFDs are available. These "overhangs" restrict market functionality and hinder trading, thus reducing volatility. This paper explores whether either scenario is present on Irish equity markets.

Although there is an extensive literature on volatility in derivatives markets, our research is the first to examine the influence of CFDs on equity market volatility. Previous research on CFDs is mainly limited to contract design (Brown *et al.*, 2009). We believe that a greater focus on CFDs is warranted in the context of their strong growth as a trading product.

There is also evidence of potential detrimental market consequences stemming from their presence on stock markets. For example, the *Report of the Irish Banking Commission* (2011) into the Irish banking crisis found evidence of an "overhang" from large CFD trades that may have led to market confusion and varying interpretations of what was driving the collapse in the Anglo Irish Bank[1] share price. "Overhangs" are created when large CFD

[1] The scenario the *Report of the Irish Banking Commission* (2011) refers to is based on a position allegedly accumulated by an Irish businessman in 2007. In January 2007, this individual purchased 5 per cent of the bank's value, and continued to accumulate positions until September 2007, where the position held was approximately 24 per cent of the company's value. It is widely reported that rather than selling the position and significantly reduce the bank's share price, a side-deal comprising of Anglo Irish Bank loans to purchase its own equity took place. The transfer of this position and the stop losses on a position worth 24 per cent of the bank at peak would have been significant and certainly strong enough to hinder market functionality at this sensitive time.

positions are set up and later hedged using standard stop losses and limit orders to protect the CFD provider. An "overhang" develops when significant volumes are placed within a few ticks of the currently traded bid and ask price. CFD brokers use stop losses and limit orders to protect themselves from losses stemming from clients running out of margin. The implementation of these large leveraged orders on an exchange with no other margin availability would have taken a significantly large amount of fully-margined investment to reduce, or alternatively, would have required opening an opposite CFD position. Without either of these events occurring, the average volumes traded would not have been large enough to dissolve the "overhang", therefore the price becomes trapped within a range. Leveraged products have been long associated with increased exchange volatility, but CFD-initiated "overhangs" may instead result in volatility decreases. Prior to the Australian Securities Exchange's decision in November 2007 to withdraw CFD investment and ring-fence the product to its own separate exchange, CFDs were found to have fuelled "overhangs" on the ASX exchange (Corbet and Twomey, 2014). The development of an "overhang" is discussed in detail through a fully worked example in Section III. This paper investigates whether such "overhangs" were pervasive in the Irish market; whether they caused additional systemic problems; and whether CFDs had an influence on equity market volatility.

From a policy perspective, it is vital to understand if CFDs have impacted on Irish stock market volatility. If CFDs have been associated with increased volatility, it might be necessary for the Irish Stock Exchange (ISE) and financial regulators within the Central Bank of Ireland to consider implementing rules or changing regulations to mitigate any potential effects. As discussed above, "overhangs" may hinder the efficient transfer of information across the exchange and reduce the probability of finding a trading counterparty at a fair price. If CFDs are found to have a negative impact on market functionality, then policymakers may need to consider tax changes to reduce the appeal of CFDs for short-term investors; margin limits to reduce position sizes; holding limits to reduce position accumulation through leverage; or by implementing a similar policy decision made by the Australian Securities Exchange and ring-fence CFDs outside the main exchange altogether.

The rest of this paper is structured as follows: In the next section we define Contracts for Difference and the previous literature on volatility relevant to this paper. In Section III, we discuss the development of bid and ask price "overhangs" recently uncovered in Irish equity markets. Section IV introduces the research methodology used. Section V follows with an overview of the results uncovered from the EGARCH models used. Finally, in Section VI, we conclude.

II CONTRACTS FOR DIFFERENCE AND PREVIOUS LITERATURE ON VOLATILITY

CFDs were originally developed by Smith New Court plc. in the early 1990s, who found purpose for their use as a method of shorting financial markets using a highly leveraged, low margin and tax-free investment. CFDs were limited to institutional trading until 1998 and were subsequently made publically available on the Irish Stock Exchange in 2002. In November 2002, CFDs were available worldwide on Irish equities. Estimates of CFD trading volumes have been estimated to range from 30 to 50 per cent of total exchange activity on the Irish Stock Exchange since 2002. Just prior to the global financial crisis, the Financial Services Authority (FSA) estimated that about 30 per cent of equity trades were in some way driven by CFD transactions in 2007 (FSA-CP07-20,2007). In Australia, CFDs were found to account between 8 and 14 per cent of total exchange activity between 2008 and 2010 (Corbet and Twomey, 2014). The most liquid equities on the Australian Securities Exchange (ASX) were found to have CFD trading levels above 60 per cent in some quarters during that particular time period. However, CFDs are not common across all financial markets. For example, the United States has not allowed CFDs to be traded as a result of restrictions on over-the-counter (OTC) financial instruments implemented by the Securities and Exchange Commission (SEC). As a consequence, CFDs on US equities are only available to non-US citizens.

CFDs are structured towards investors seeking additional levels of higher risk investments in their portfolios. Due to the leveraged nature of CFDs, market movements amplify the investor's gains and losses in multiples of the provided level of margin. In Ireland, CFDs are usually structured to allow an investor to obtain 10 per cent margin, while borrowing the remaining 90 per cent of the investment from their CFD broker. This enables the investor to enhance their buying power tenfold. When CFDs are used to invest, a price increase of 10 per cent results in 100 per cent profits, whereas a 10 per cent fall in price leaves the investor at a total loss.[2] When the investor is in this position, they must meet margin calls to maintain the position. Failure to do so results in the position being immediately closed. CFDs therefore act as an extremely cheap, non-selective source of investment finance due to the relative ease of setting up a trading account. CFDs thrive in periods of short-term heightened volatility, as investors increase their use of leverage to maximise

[2] When the investor has opened a "short" position, a price fall of 10 per cent (assuming 10 per cent margin) results in 100 per cent profits, whereas a price increase of 10 per cent leaves the investor at a total loss.

their exposure to a particular equity. Financial crises therefore generate a thriving environment for trading in CFDs. Longer-horizon investors typically refrain from using CFDs due to commissions and overnight interest charges that must be paid for the use of margin to create leverage.

In Ireland, CFD licences fall under betting and gambling legislation, therefore all profits are tax free. These tax exemptions stemmed from the mid-1980s when the Irish government attempted to grow the bloodstock industry. This tax-free characteristic is an attractive trait to investors who otherwise would have to pay capital gains tax (CGT) on fully-margined equity investments. In 2011, the Central Bank of Ireland raised concerns about the Irish CFD industry. They specifically cited a serious deficiency in transparency and a lack of information gathered by CFD brokers (Central Bank of Ireland, 2011). CFD brokers' clients were also found to have been accepted without "adequate assessment of appropriateness" under MiFID regulations.[3] Risk disclosures supplied by CFD brokers were found to have been inadequate and, in some cases, misleading.

Similar concerns led to the decision taken by the Australian Stock Exchange (ASX) on the 5 November 2007 to segregate CFDs from the main stock exchange. This decision was taken due to a lack of transparency stemming from CFD trading. Counterparty risk was also minimised as the settlements of all obligations were guaranteed by the SFECC.[4] After the segregation investors could for the first time observe a CFD exchange separated from the standard equity market, but still trade with the same leverage as before. In Germany, a 2009 report by the European Security Markets Expert Group (ESME), found that a large unwinding by Porsche of options related to CFDs in Volkswagen (VW), combined with takeover rumours, had triggered a 500 per cent price increase in less than seven days in late October 2008.

Brown *et al.* (2009) is the paper fully based on CFD markets, however, their focus is on regulatory restrictions imposed by the Australian Securities Exchange (ASX) to mitigate the potential effects of CFDs. However, there is a significant amount of non-CFD specific research based on market volatility and liquidity effects. Beginning with Figlewski (1981) and Stein (1987), there is a lot of evidence that derivatives trading as a whole increases market volatility in the underlying asset. Some authors believe that destabilising

[3] Market in Financial Instruments Directive (MiFID) applied to investment banks, portfolio managers, brokers, corporate finance firms and some derivative and commodity related firms. MiFID represents the next step into fully integrating the European Union's financial markets.

[4] SFE Clearing Corporation (SFECC) is an Australian company operating all clearing and settlement facilities in Australian equity markets.

effects are evident in the market as this speculative investment style tends to originate from uninformed investors. In particular, Stein (1987) claimed that futures markets attracted uninformed traders because of their high degree of leverage, which can reduce the information content of prices and can accentuate market volatility. Similar findings are reported by, for example, Bessembinder and Seguin (1993), Antoniou and Holmes (1995) and Gulen and Mayhew (2000). Pok and Poshakwale (2004) found similar futures market related volatility increases on equity markets, but also noted greater sensitivity of spot market prices to new information and efficiency improvements through faster information transfer. However, there is another strand of research which argues that derivatives trading reduces spot market volatility and can, in fact, stabilise markets. In this context, derivatives are associated with an efficient medium of price discovery. Other benefits include improved market depth, a reduction in market asymmetries, and less cash market volatility as evidenced by Kumar *et al.* (1995) and Antoniou *et al.* (1998). Other research supporting volatility reductions after investigating derivative products include Bologna and Cavallo (2002), Chathrath *et al.* (1995) and Drimbetas *et al.* (2007).

In this paper, we implement an EGARCH methodology on the ISEQ Overall Index and twenty-one individual Irish equities between January 1998 and September 2013. The FTSE 100 and DAX are used in the EGARCH models to mitigate international effects at the index level, whereas the ISEQ, FTSE 100 and DAX are used at the equity-specific level. A dummy variable is used to denote the period where CFDs are present in Irish equity markets. We also explain the dynamics of the "overhang" and how the results in this paper indicate their presence.

III HOW HAS THE "OVERHANG" AFFECTED IRISH EQUITY MARKET VOLATILITY?

The *Report of the Irish Banking Commission* (2011) to investigate the collapse of Anglo Irish Bank found that "overhangs" specifically influenced the equity volatility of the bank, while misleading investor perceptions of future viability. The report found "overhangs" to be associated with a decrease in volatility due to "price trapping" effects. This paper attempts to investigate whether these effects can be found across all equities on the Irish stock exchange.

One major issue with CFDs is the decision making processes and associated investment horizons of traders using this investment product. If CFDs are used as a long-term investment vehicle, investors would seek additional returns to compensate for the commissions and interest charges associated with holding the position overnight. Short-term speculative investors are therefore most likely to use CFDs. However, the mechanism by which the introduction of CFDs may reduce volatility can best be explained using a simple example. This example uses level II trading data before and after the implementation of a standard market order. We will focus on a hypothetical ABCD plc. If the price of ABCD plc. shares is €0.12 at 1.00 pm, a trader would face the level II situation in Table 1.

Table 1: *Level II Trading Data Example With No CFD Transactions*

ABCD plc. 0.12 (–2.50%) 13.01 Vol: 2,400,575					
Buy Orders	*(Volume)*	*Price to Buy*	*Price to Sell*	*(Volume)*	*Sell Orders*
13.01 (1)	80,000	0.115	0.125	90,000	13.01 (3)
13.01 (3)	50,000	0.110	0.130	30,000	13.01 (5)
13.00 (4)	150,000	0.100	0.140	40,000	13.01 (1)
13.00 (2)	90,000	0.090	0.150	10,000	13.01 (2)
13.00 (4)	250,000	0.080	0.160	5,000	13.01 (4)
13.01 (1)	175,000	0.070	0.170	15,000	13.01 (4)

Note: The above table represents an example of the level II data that a trader would view for ABCD plc. in a situation without CFD hedging through stop-losses and limit orders present in the market. The left and right hand columns represent the time and trader number that implemented the order to buy or sell the stock.

If, for example, a CFD trader has bought €2 million of ABCD equity at €0.12 using 10 per cent margin, and we assume their net wealth is €5 million (€2 million invested in CFDs and €3 million held in a margin account with the CFD broker), this means a 25 per cent fall in share price results in a total loss for the CFD trader. The CFD broker inputs a limit-order to sell shares at 1.03 pm to protect against the price "gapping" their required minimum threshold. The scale of this position becomes evident in Table 2.

The €2 million CFD investment at €0.12 is the equivalent size of a €20 million fully-margined investment (166,666,667 shares at €0.09). If the price falls to €0.09, the trader has lost their entire available margin. Therefore, to protect the company, the broker will leave an order to sell the shares at €0.09. Other market agents, unaware of what is occurring in this brokerage, will see the level II data change (see Table 2).

Table 2: *Level II Trading Data Example With CFD Broker Hedging Implemented*

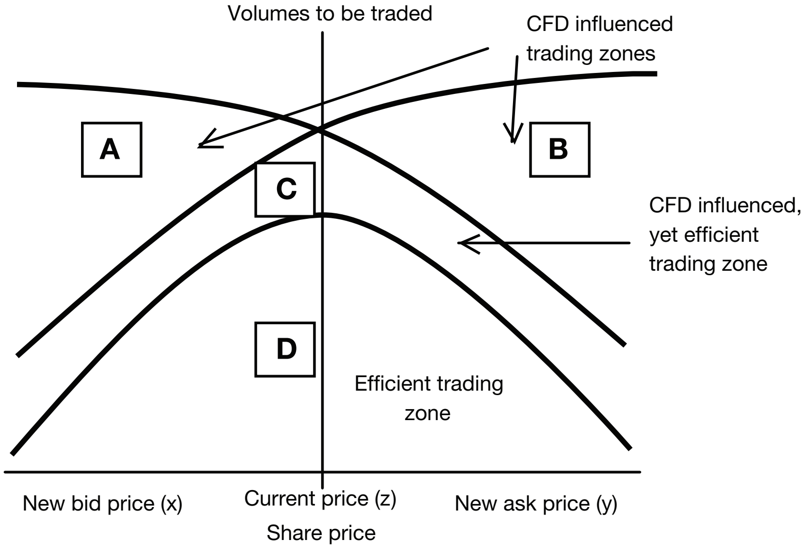
ABCD plc. 0.12 (–2.50%) 13.05 Vol: 2,400,575					
Buy Orders	*(Volume)*	*Price to Buy*	*Price to Sell*	*(Volume)*	*Sell Orders*
13.05 (1)	80,000	0.115	0.125	90,000	13.05 (3)
13.05 (3)	50,000	0.110	0.130	30,000	13.05 (5)
13.00 (4)	150,000	0.100	0.140	40,000	13.01 (1)
13.05 (2)	166,756,667	0.090	0.150	10,000	13.01 (2)
13.00 (4)	250,000	0.080	0.160	5,000	13.01 (4)
13.01 (1)	175,000	0.070	0.170	15,000	13.01 (4)

Note: The above table represents an example of the level II data that a trader would view for ABCD plc. after the implementation of a stop-loss order to hedge the CFD broker's counterparty risk of an investor's €2 million investment through CFDs. The order of 166,666,667 shares at €0.09 represents a full hedge against the €2 million position opened at €0.12 (the new value of 166.756,667 shares at €0.09 is the combination of the CFD position of 166,666,667 shares and the existing 90,000 shares present before the CFD order was implemented). This also creates a significant "overhang" on the bid-side of the market which is clearly evident from the scale of the position in comparison to other traders in the market on both the bid and ask side of the market. The left and right hand columns represent the time and trader number that implemented the order to buy or sell the stock.

The other traders in the market can now see the extremely large volumes at €0.09 and view this as a large "sell signal". But if the same scenario was to occur when a trader opened a short position, a similar limit order would be placed at €0.15. This would create an exceptionally large level of volume to be traded at €0.09 and €0.15, creating an "overhang" which effectively traps the volatility of the market within this trading range until an equally large trader enters the market with enough financial capital to remove these orders. Until this occurs, the volatility of the exchange would fall as the normal mechanics of daily trading are affected. If we assume that all investors maximise investible funds, if they invested using CFDs, their stop losses would be found at the point where they run out of trading margin. Therefore, every CFD trade would be accompanied by an associated stop loss or limit order that would exacerbate an "overhang". These effects would be more pronounced in markets with smaller average trading volumes.

If there is a high level of CFD trading within the exchange, there would be a reduced probability of an "overhang" present in the market. This is because CFD traders would hold sufficiently large positions to absorb large market orders. The alternative appears to have occurred in Irish equity markets,

Figure 1: *The Impact of CFD Volumes on the Bid and Ask Price*

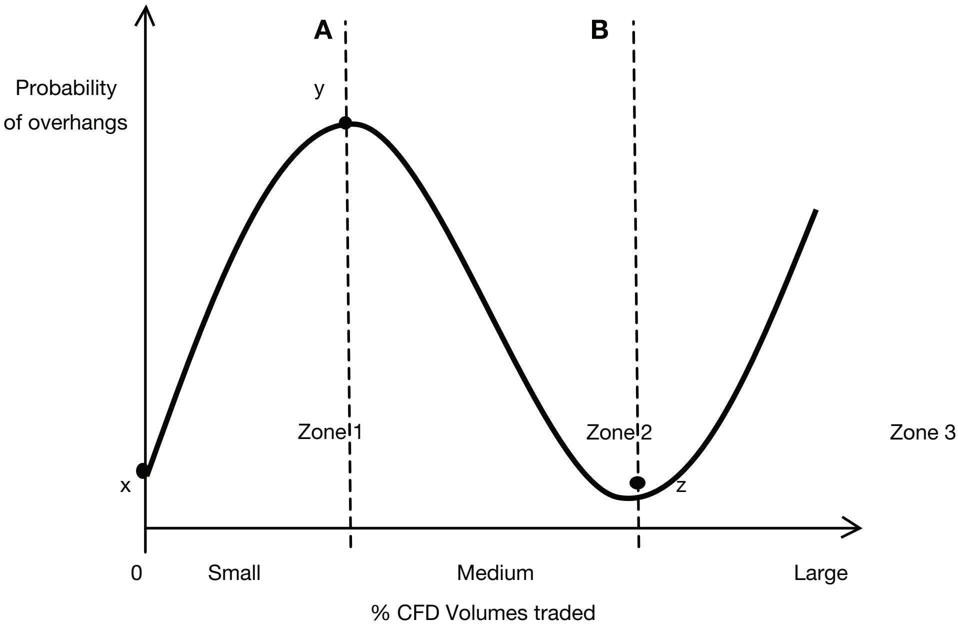


Note: Figure 1 above shows the theoretical situation when CFD volumes are placed in an exchange to be bought or sold by the market.

where there is not enough CFD trading in the exchange to absorb large market orders. In Figure 1, when a CFD provider implements a stop loss or limit order to hedge a CFD provider against the counterparty risk of holding client positions, areas A and B represent the large volumes now in the market, creating situations where "overhangs" develop. These areas are zones where market volatility fall due to restrictive trading conditions. Zone C is the intersection of both "overhang" influenced trading regions, where there is an appropriate amount of CFD trading on both the buy and sell side of the market, therefore the probability of CFD-induced volatility effects are reduced. We can see that area D is the trading zone with no CFDs present, therefore the reduction of leverage reduces the average trade size in the market, reducing the probability of an "overhang".

In Figure 2, there is a trading zone (area 2) where the fully margined market is unable to absorb the amount of CFD trading within the market. When there is a small amount of CFD trading in the market (left of line A), the percentage of CFD trading is too small to have any effect. In this case, fully-margined investors dominate, whereas to the right of line B, there are a sufficient number of CFD traders to absorb the volumes traded. With sufficiently granular data on the exact percentages of CFD traders per day, it would be possible to calculate these areas and input thresholds of CFD trading to counteract any market hindering effects that CFDs possess.

Figure 2: *CFD Trading and Probability of Overhangs in the Irish Stock Exchange*



Note: Figure 2 represents the relationship between the percentage of volumes on the Irish Stock Exchange that are CFD traded and the probability of the presence of an overhang. At point x, there is no CFD trading available in the market, thus volumes traded are fully margined. Therefore in zone 1, there are a small number of CFD traders in the market, but as this number grows larger in proportion to fully margined traders, the potential for overhangs to be present increases. This also occurs in zone 3 where extremely large CFD traders can dominate the market similar to the Anglo Irish Bank scenario of 2007 and 2008. In zone 2, there are a sufficient number of CFD traders to trade with each other, therefore, the probability of an overhang falls.

IV RESEARCH METHODOLOGY

The paper analyses daily returns for the ISEQ Overall Index and the twenty-two largest equities on the Irish Stock Exchange from January 1998 to September 2013. The remaining equities on the exchange are omitted for a number of reasons, including insufficient liquidity, nationalisation, bankruptcy and takeover within the time period. To investigate volatility changes in the period before and after the introduction and withdrawal of CFDs, we apply Exponential GARCH (EGARCH) techniques. To calculate volatility changes before and after the introduction of CFDs, we first calculate daily return as $R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$. Dividends in this model are ignored for simplicity. The EGARCH model uses a dummy variable to signal the inclusion of CFDs as a trading product (November 2002), denoted as zero in the period without CFDs and one otherwise.

The EGARCH model was developed by Nelson (1991). The ARCH (p) and GARCH (p,q) models impose symmetry on the conditional variance structure and the logarithmic construction of the conditional variance equation ensures that the estimated variance is strictly positive, thus the non-negativity constraints used in the estimation of the ARCH and GARCH models are not necessary. To mitigate international effects such as shocks and crises, other exchanges can be added to the mean equation, resulting in the γ coefficient of the dummy variable D_{CFD}, being explicitly related to the exchange being investigated. In this study, the FTSE 100 and DAX 30 were found to offer the most significant explanatory power in the Irish EGARCH analysis. Both are statistically significant at the one per cent level. Therefore, both international and European-specific crises are diluted in the model through their inclusion. The EGARCH model used is:

$$R_t = b_0 + b_1 R_{t-1} + b_2 R_{DAX_t} + b_3 R_{FTSE_t} + \varepsilon_t$$

$$\text{where } \varepsilon_t \mid \omega_{t-1} \sim N(0, h_t)$$

$$\log (h_t) = \omega + \alpha \left[\left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right| \right] + \beta \log (h_{t-1}) + \delta \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \gamma D_{CFD_t}$$

At the equity-specific level, the ISEQ Overall Index is included to dilute Irish-specific crises. The mean equation changes to:

$$R_t = b_0 + b_1 R_{t-1} + b_2 R_{ISEQ_t} + b_3 R_{DAX_t} + b_4 R_{FTSE_t} + \varepsilon_t$$

but the variance equation remains the same. In both models, h_t is known at the beginning of time t. Ω_{t-1} is the information set at the end of time period $t-1$. This makes the leverage effect exponential instead of quadratic and therefore, estimates of the conditional variance are guaranteed to be non-negative. The EGARCH model allows for the testing of asymmetries, which is picked up in the β term. D_{CFD_t} is included in the variance equation as a representation of the dummy variable included in the EGARCH model denoting the introduction of CFDs. When $\beta = 0$, the model is symmetric, but when $\beta < 0$, then positive shocks generate less volatility than negative shocks.

The model captures the asymmetric features of the dataset, which occurs when an unexpected drop in price due to bad news increases volatility more than an unexpected increase in price because of good news of a similar magnitude. At the equity-specific level, the models are repeated to obtain volatility estimates based on the individual equity at the time of CFD segregation. The EGARCH model is found to be the most optimal methodology to investigate volatility changes between periods. The inclusion of the exchanges to adapt the model for international effects is also found to be beneficial when attempting to segregate financial crisis from that of normal equity market behaviour.

V RESULTS

The first EGARCH model is based on the total ISEQ Overall Index, indicative of changes in exchange volatility as a whole in the period between 1998 and 2013. The results are found in Table 3. In the overall period, volatility decreased by 0.65 per cent in the period after the arrival of CFDs. The results hold even after the mitigation of international effects through the use of the DAX 30 and FTSE 100 in the mean equation. The results are statistically significant at the 5 per cent level.

Table 3: *EGARCH (1,1) Results for the ISEQ Overall Index*

Equity	b_0	b_1	b_2 *DAX*	b_3 *FTSE*	γ	*DF Test Z(t)*
ISEQ	0.0033	0.1126	0.1259	0.6506	–0.0065	–61.244
	(1.20)	(3.27)*	(8.74)*	(41.85)*	(–1.97)**	(0.000)*

Note: The above table shows the associated EGARCH coefficients in the period before and after the introduction of CFDs in the Irish Stock Exchange. T-statistics are in parentheses where *<0.01, **<0.05 and ***<0.10. The Dickey-Fuller test statistics for a unit root are also found in the above table. The significance of the associated MacKinnon approximate p-value for Z(t) is also included. Phillip-Perron test results are also available on request.

The Irish Stock Exchange consists of over fifty equities, but only twenty-one are included due to insufficient liquidity to provide accurate EGARCH analysis and differing periods of registration on the Irish Stock Exchange. As Anglo Irish Bank, was nationalised in 2009, the estimates related to the period from 1998 to 2009. Again, the inclusion of the ISEQ, DAX 30 and FTSE 100 appear to segregate international effects, therefore, ensuring the EGARCH analysis remains focused on the equity investigated. In Table 4, we report the

Table 4: *EGARCH (1,1) Results for the Equities on the Irish Stock Exchange*

Equity	b_0	b_1	b_2 *ISEQ*	b_3 *DAX*	b_4 *FTSE*	γ	*DF Test Z(t)*
Allied Irish Bank	–0.0005	0.1092*	1.3406*	–0.0926*	0.2179*	–0.0013***	–59.104*
Anglo Irish Bank†	–0.0007	0.1172*	1.1178*	0.0124*	0.5911*	–0.0035*	–68.225*
Aryzta	0.0010***	–0.2221*	0.5005*	0.1042*	–0.1594*	–0.0018*	–75.445*
Bank of Ireland	–0.0008	0.0921*	–	0.0066	1.1526*	–0.0008***	–67.612*
CRH	–0.0002	0.0341*	0.9629*	–	0.0734*	–0.0002	–69.227*
C&C	0.0008	0.0933*	–	–	–	–0.0025*	–61.928*
DCC	0.0005	0.0668*	0.3883*	–0.0059	0.1135*	–0.0005	–63.220*
Dragon Oil	0.0011	–0.0149	0.4112*	0.0387	0.3355*	–0.0002**	–71.991*
Elan	0.0011	–0.0827*	1.7215*	0.0488	–0.3664*	–0.0064***	–73.738*
Greencore	0.0005**	–0.0004	0.3540*	–0.0329	0.1422*	–0.0003**	–65.443*
Icon	0.0018	0.1242*	0.1339	–0.0238	–0.1045	–0.0055**	–72.149*
Irish Continental	–0.0001	–0.0326*	0.0942***	0.0059*	–0.0501	+0.0010**	–66.919*
Irish Life & Perm.	–0.0019***	0.1953*	0.9743*	–	0.0467***	+0.0056*	–76.481*
Kenmare	0.0046*	0.0149**	0.0701	–0.2053**	0.3828*	–0.0069*	–77.440*
Kerry	0.0004	–	0.2933*	0.0114	–	–0.0021**	–72.616*
Kingspan	0.0004***	0.0175***	0.6017*	0.1872*	0.2421*	–0.0002***	–69.999*
Paddy Power	–0.0034*	0.0049	0.3227*	0.0701*	–	–0.0003	–62.382*
Ryanair	–0.0011	0.0059	0.7849*	0.0915	0.2128**	–0.0005*	–70.551*
United Drug	–0.0032*	–0.0003	0.2816	0.3800	–0.2874	–0.0029*	–75.377*

Note: The above table represents the estimated coefficients for each investigated Irish equity using the discussed EGARCH(1,1) methodology to investigate changes in volatility dynamics after CFD introduction. The robust standard errors for each of the coefficients are marked in parentheses, where *p<0.01, **p<0.05 and ***p<0.10. The Dickey-Fuller test statistics for a unit root are also found in the above table. The significance of the associated MacKinnon approximate p-value for Z(t) is also included. Differing specification test results are also available by contacting the authors.

†Anglo Irish Bank's EGARCH estimate is based on data available until January 2009. Therefore, the volatility estimates are based on the period after CFD introduction in Ireland until the date that Anglo Irish Bank was nationalised.

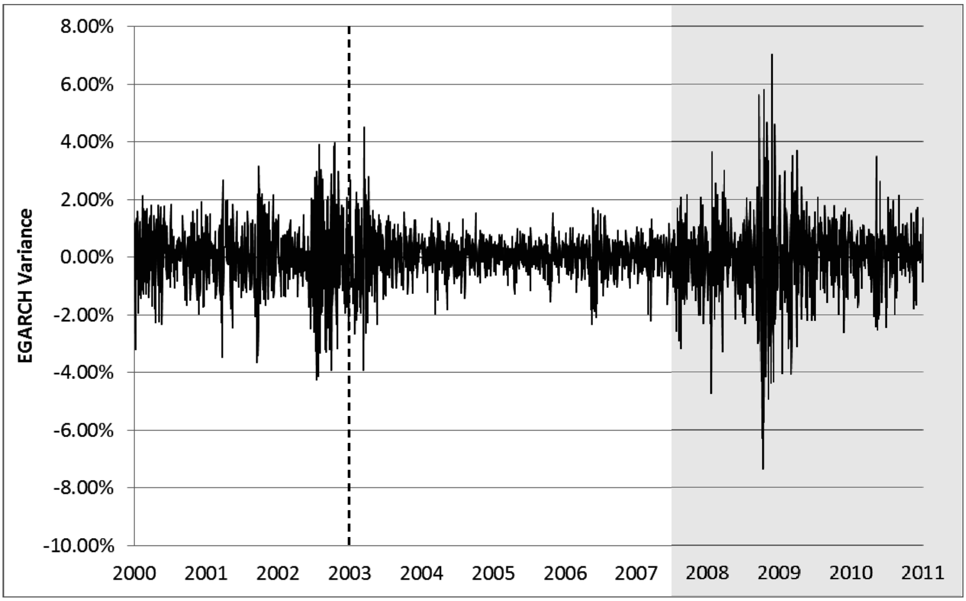
results for the individual equities. Again, the dummy variable signals volatility changes after the inclusion of CFDs.

Of the twenty-one equities investigated, eighteen show reduced EGARCH volatility after the arrival of CFDs. Only four results prove to be insignificant. Irish Life and Permanent showed a 0.56 per cent increases in volatility, while Glanbia and Irish Continental had a 0.13 per cent and 0.10 per cent increase respectively. Elan and Kenmare possessed the largest decreases in CFD-specific volatility at 0.64 per cent and 0.69 per cent respectively. CRH, Greencore, Kingspan and Paddy Power all possess volatility reductions in the period after CFD introduction, but as the results are so small (0.002 per cent, 0.003 per cent, 0.002 per cent and 0.003 per cent respectively) they cannot be interpreted as clear reductions in volatility. Nevertheless, the results offer significant evidence that the majority of Irish equities experienced a reduction of volatility in the period after the arrival of CFDs. CFDs by their very nature are leveraged, high-frequency trading product. Derivatives with these characteristics are typically associated with increased volatility, therefore, the results may be considered unexpected. However, one hypothesis is that volatility has fallen due to improved flows of information transfer created by increased liquidity. Analysis of the volumes traded on the Irish Stock Exchange present no dramatic increases apart from the period prior to the European financial crisis, with financials showing the most dramatic changes. More explanatory power would be added through the addition of specific CFD trading volumes, but to date this is not possible.

However, a plausible alternative explanation for these results can be provided. There have been several instances of trading irregularities associated with CFD investment. As discussed in Section III, the *Report of the Irish Banking Commission* on the systemic banking crisis found that an “overhang” existed from large CFD trades that was capable of leading to confusion and different interpretations of what was driving the share price collapse of Anglo Irish Bank. This may be a key factor in understanding how CFDs reduced volatility. It is also important to note that “overhangs” would only be recognised in level II data, as market orders (stop losses and limit orders) used by CFD providers to hedge their risk against clients trades and available margin. Therefore, the size of these positions could have detrimental effects on the market, even though there may indeed be no additional volume traded on the associated equity.

Further analysis of the EGARCH volatility uncovered on the Irish Stock Exchange in Figure 3 offer some interesting results. EGARCH volatility oscillated to plus and minus 4 per cent in the period initially before the arrival of the largest CFD providers in Ireland. Within one year, EGARCH volatility reduced by more than 50 per cent. This continued until mid-to-late 2007, when the full effects of the international subprime crisis took hold. We can see that the peak changes in EGARCH volatility occurred in late 2008 when the international crises were taking full effect. Even though the EGARCH methodology is adapted to mitigate international effects, this result shows the significant strain that Irish financial markets were under during this period.

Figure 3: *EGARCH Volatility of ISEQ Overall Index from 2000 to 2011*

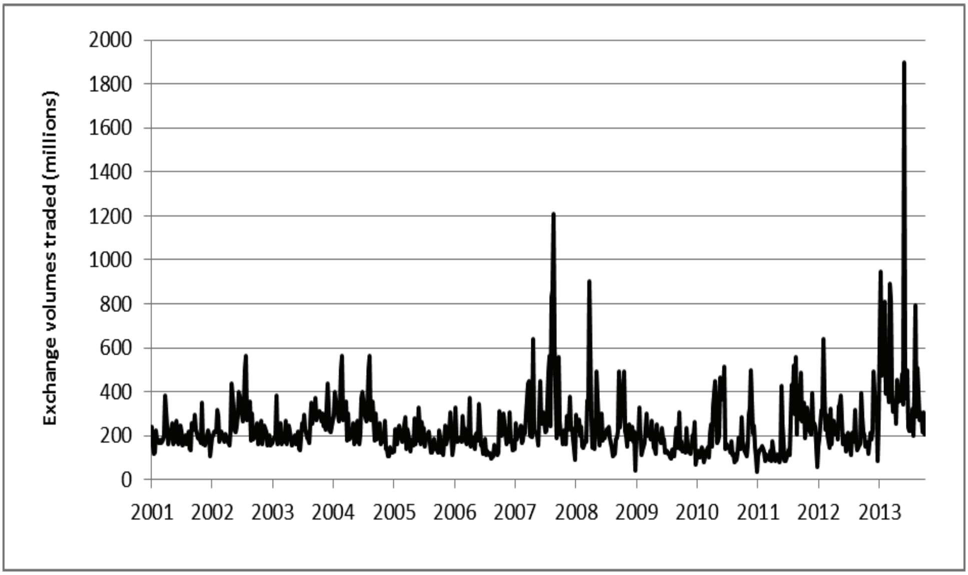


Note: The above figure represents the plotted EGARCH volatility of the Irish Stock Exchange between 2000 and 2011. The dashed line represents the inclusion of CFDs as a traded product on Irish equities in November 2002. The grey shaded area represents the onset of the international subprime crisis in 2007 while including the European sovereign debt crisis thereon.

It appears that the arrival of CFDs in Ireland was associated with a significant and prolonged reduction in equity market volatility. Again, there are no dramatic changes to be found in terms of volumes traded at this time as evidenced in Figure 4.

In fact, between 2005 and 2007, volumes traded on the Irish Stock Exchange were dramatically below the market average between 2001 and 2013 (at times more than 70 per cent). Combining these results with those found by the *Report of the Irish Banking Commission* into the banking collapse in Ireland raises significant questions on the role that CFDs have had in the functionality of the Irish Stock Exchange over the last ten years.

Figure 4: *Total Irish Stock Exchange Volumes Traded (2001-2013)*



Note: The above figure represents the volume of shares traded on the Irish Stock Exchange between 2001 and 2013. CFDs began to trade on Irish equities in November 2002 and from the data we can see an initial spike in trading levels, but no dramatic difference in the period after. In fact from 2005 to 2007, there is an evident decrease in volumes traded. From 2007 to 2013, volumes trade are dramatically higher than normal as Ireland was gripped by financial crises.

VI CONCLUSIONS

This paper presents an analysis of the effects of CFDs on Irish equity markets since their introduction in late 2002. An EGARCH analysis is used to uncover volatility changes in the periods before and after the introduction of CFDs in Ireland. The EGARCH analysis provided in this paper indicates that CFDs were not associated with increased volatility, therefore, the presence of market "overhangs" cannot be rejected. The analysis indicates that the Irish Stock Exchange was subjected to a significant decrease in long-term volatility after the introduction of CFDs at both the index and equity-specific levels. There are no obvious differences in volumes traded at the point of CFD inception, ruling out volatility reduction based on liquidity improvements. Therefore, the results appear to be associated with the presence of market order anomalies known as "overhangs", stemming from extremely large hedging positions taken by CFD providers, a result consistent with the Report of the Irish Banking Commission (2011). These positions can "trap" the market between the bid and ask price, artificially reducing volatility as little or no price movement occurs until the orders have deteriorated or are removed altogether. Trading volumes remain in line with market norms, as all activity occurs within the level II data as many of these positions may never be traded or even partially filled. This offers significant explanation to how CFDs have reduced Irish equity market volatility.

In terms of policymaking, it must be noted that anomalies found in the Australian stock market resulted in CFDs being ring-fenced to their own separate exchange in 2007. With the provision of CFD trading volumes, more detailed analysis could be presented such as that found on Australian equities before and after their "ring-fencing" (Corbet and Twomey, 2014). It would also be of interest to investigate specific equity volatility based on the proportion of CFD investment available. The large positions built in Anglo Irish Bank resulting in an artificially inflated price were also caused by CFDs. The trading anomaly associated with VW in 2008 was also attributed to options associated with CFDs. Therefore, it may be necessary to take a step similar to that taken in Australia, and separate the trading book of CFDs, offering total transparency. At a minimum, position limits should be implemented to reduce the potential for another "Anglo Irish Bank" CFD scenario to occur.

Alternative methods of restricting CFD affects would be to simply increase the minimum margin level. For example, an increase from 10 per cent to 20 per cent would move stop losses and limit orders based on margin illiquidity away from the current traded price, thus reducing any "overhang" influence. Alternatively, implementing taxation on CFD trading would reduce the levels traded.

To gain a role as a conventional investment product, CFDs have to become more transparent. This is vital to their long-term success. Providers of market data should be encouraged to segregate leveraged positions on Irish equities, along with all CFD stop losses and limit orders. This would allow traders to identify positions that may change direction rapidly should a sharp market movement occur, thus identifying potential "overhangs" in the market. Options and futures products have separate exchanges, even though their products are fundamentally established on the cash market, which provides full transparency so all effects can be viewed by informed traders. Why should CFDs be different?

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