The Effects of Stock Index Futures Trading on Stock Index Volatility: An Analysis of the Asymmetric Response of Volatility to News

ANTONIOS ANTONIOU*
PHIL HOLMES
RICHARD PRIESTLEY

INTRODUCTION

The issue of the impact of futures trading on stock market volatility has received considerable and increasing attention in recent years, particularly following the stock market crash of October 1987. There is little agreement as to the effect futures contracts have on the underlying market [see, for example, Figlewski (1981), Moriarty and Tosini (1985), Ed-

The authors wish to thank the referees of this journal and the editor, Mark J. Powers, for helpful comments and suggestions on an earlier draft of this article. The usual disclaimer applies.
*Correspondence author, Department of Economics and Finance, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK.

- *Antonios Antoniou is a Professor in the Department of Economics and Finance, Brunel University.*
- *Phil Holmes is a Senior Lecturer in the Department of Economics, University of Durham.*
- *Richard Priestley is an Associate Professor in the Department of Business Economics, Norwegian School of Management.*

The Journal of Futures Markets, Vol. 18, No. 2, 151–166 (1998)

CCC 0270-7314/98/020151-16

wards (1988a, 1988b), Robinson (1994), and Antoniou and Holmes (1995)]. Traditionally, increased volatility, following the onset of futures trading, has been viewed as an undesirable consequence of destabilizing forces (for example, speculators). This view gained impetus following the stock market crash, which some commentators blamed on futures trading, in general, and program trading, in particular. The impact of destabilizing forces could lead to an increase in uncertainty in the spot market, which, in turn, could raise the required rate of return of investors in the market. If this is correct the cost of equity capital will be increased, perhaps unduly, leading to a misallocation of resources in the economy. On the other hand, some commentators argue that futures markets provide a means by which the mechanism for the transmission of news is improved, leading to a more rapid impounding of information in prices and, hence, more volatility. For example, Cox (1976) argues that futures markets can attract additional traders to the market and, hence, increase the possible channels of information flow. In addition, Cox argues that the lower costs of trading on the futures market means that information may be transmitted to the spot market more quickly.

However, even though futures trading can increase the routes through which information is transmitted into prices, the question of whether changes in volatility are desirable or undesirable depends on the nature of these changes and the underlying market dynamics before and after futures trading. For example, as Merton (1995) has argued, the introduction of futures trading and derivative markets, in general, can improve efficiency by reducing asymmetric responses to information. Therefore, to fully understand the impact of futures trading on stock market volatility and whether any such impact is undesirable, it is necessary to understand and take account of the causes of volatility. This, in turn, requires an understanding of the causes of the empirically observed phenomena of volatility clustering and the asymmetric response of volatility to news.

Volatility clustering is related to both the arrival and transmission of news. In relation to the former, it has been argued that items of news that have a large impact on prices have a tendency to be clustered together, as do items of news that have a small impact on prices [see Engle (1982)]. The role of the transmission of news in explaining volatility clustering relates to the market dynamics. For example, if traders have heterogenous expectations with some having inside information, then news may take more than one period to disseminate. In other words, differences in investors' expectations may take some time to be eradicated. The concept of the transmission of volatility and the role of market dynamics is an alternative to the traditional explanations of the asymmetric response of volatility to news. The traditional explanations argue that asymmetries arise because of the effect of price falls on operating and financial leverage [see, for example, Black (1976), Christie (1982), and Nelson (1989, 1991)]. However, the extent to which these traditional explanations can account fully for the observed asymmetric effect is questionable. In particular, see French, Schwert, and Stambaugh (1987) and especially Braun, Nelson, and Sunier (1991), who argue that these explanations are not sufficient to explain the extent of the observed asymmetries. Thus, the market dynamics argument may well explain, at least in part, the observed asymmetries in volatility.

If market dynamics are a cause of asymmetries, then innovations, such as the introduction of futures, may be expected to impact not only on the level of volatility in the underlying market, but also on the structure and characteristics of that volatility. Failure to take account of the market dynamics and the potential effects they can have on volatility clustering and asymmetries may lead to inappropriate policy conclusions regarding the role of futures markets. This article seeks to address the issue of the impact that the existence of futures trading has on stock market volatility.[1] This is important for a number of reasons. If futures markets cause a change in the level of volatility in the market (as in the arguments that speculators increase volatility) and this, in turn, is associated with greater uncertainty and higher required rates of return, then there may well be a case for increasing the regulation of these markets. However, if these markets lead to new channels of information being provided, more information due to more traders, and a reduction in uninformed investors, then futures markets provide a useful service and calls for their regulation are unwarranted. Examining the impact of futures trading on stock market volatility in a way that allows for consideration of volatility clustering and asymmetric responses to news not only provides important guidance on the appropriate regulatory regime for futures markets, but also will yield insights into the reasons why asymmetries exist. The rest of the article is organised as follows. The next section discusses some theoretical issues and develops the arguments as to the role of futures markets and their potential effects on stock price volatility. The third section presents the empirical design. The data and results are provided in the fourth section and the final section concludes.

[1]In the interests of brevity, in the remainder of the article the impact of the existence of futures trading is referred to simply as the impact of futures trading.

VOLATILITY CLUSTERING AND THE ARRIVAL AND PROCESSING OF NEWS

Following the seminal work of Engle (1982), researchers have employed many variants of the ARCH family of time-varying second moments in attempts to model volatility clustering.[2] Although the issue of volatility clustering predates the work of Engle (1982) and was recognized as far back as Mandelbrot (1963) and Fama (1965), it was not until Engle (1982) that researchers started to formally model second and higher moments of financial time series. The advantage of these models is that they capture the tendency of the volatility of financial data to cluster.

There are numerous extensions to the basic linear ARCH model of Engle (1982); for example, Bollerslev (1986) generalizes the ARCH model (GARCH), and Nelson (1991) provides a model of volatility clustering that captures the well-established empirical observation that price falls (bad news) have a greater impact on volatility than do price rises. The traditional explanations of this asymmetric response of volatility to news emphasize the role of financial and operating leverage and changes in the risk premium. Specifically, the leverage hypothesis states that as prices fall then the financial and operating leverage of firms rise and, hence, there is an increase in the required rates of return of equity holders. Consequently, prices fall by more than would be warranted in an unlevered firm.

Although the traditional explanations of the asymmetric response of volatility to news rest firmly within the efficient markets hypothesis (EMH) view, there is a growing body of literature that suggests that not all investors act in a rational manner when making their buy and sell decisions, and that their actions may lead to asymmetries. Black (1986) terms such investors *noise traders*—they trade not on information but on noise. Black claims that such investors must be a significant proportion of total market trading. An important element in the actions of noise traders is that of sentiment not fully justified in terms of the relevant information. Furthermore, Black (1986) shows that noise traders react to information in a way that would not be present in a fully rational model. Similarly, Shiller (1984) claims that investors chase trends based upon popular models that can be related to fundamentals, but there is an element of overreaction to news. Such actions have been the subject of a number of experimental studies [see references in Shleifer and Summers

[2]For a comprehensive review of ARCH-type models and their applications to financial time series, see Bollerslev Chou, and Kroner (1992).

(1990)], which show that investors may well overreact to news. Investors who chase trends or purchase on the back of price changes have been termed *positive feedback traders*. It is the actions of these investors that can have the greatest effect on the price of a security because it is not always the case that arbitrageurs will trade to counter their actions.

The role of noise traders and the potential effect of their actions on volatility is demonstrated in Kyle (1985), who shows that in a model with an insider, uninformed investors, and market makers, information held by the insider is transmitted into prices gradually, providing a possible explanation of volatility clustering. Although Kyle's model provides an explanation of volatility clustering, Sentana and Wadhwani (1992) provide an explanation of the asymmetric response of volatility to news. In particular, with a model of feedback traders who have access to less information than their informed counterparts, responses to bad news (price falls) lead to greater volatility than do responses to good news.

If the actions of noise traders are the cause of the observed phenomena regarding volatility in stock markets, then there are strong grounds for believing that the introduction of futures trading will impact on both the extent and nature of this volatility. In particular, futures markets are characterized by low transaction costs and low margin requirements, which may well attract traders away from the spot market to the futures market and may attract additional traders to the market. This may well determine the way information is transmitted into prices in both the futures and the spot market. The way in which such changes manifest themselves will depend upon the types of traders active in the two markets. For example, if noise traders are attracted away from the spot market to the futures market, then asymmetries that are observed in the spot market prior to the inception of futures trading will not be evident in the spot market postfutures trading, although they may, nonetheless, be present in the futures market.

To fully understand the impact of futures trading on the volatility of the underlying market and whether such an impact is desirable or undesirable, it is necessary to model volatility pre- and postfutures by using a technique that takes account of possible asymmetric responses to news. Even if it is found that spot market volatility has increased postfutures, this is not necessarily an undesirable consequence of derivative trading, because there may, simultaneously, be a change in the spot market dynamics that removes asymmetries and improves the transmission mechanism for news. Consideration of the impact of futures trading in a way that does not account for asymmetries may lead to inappropriate policy advice. Adopting an approach that allows for consideration of this issue has the additional advantage that it may provide insights into the causes of volatility asymmetries. If it is found that asymmetries exist in the spot market prefutures, but are either eliminated or transferred to the futures market once derivative trading commences, then the traditional explanations of asymmetries would appear to be inappropriate. In contrast, if the asymmetries are due to leverage and changes in the risk premium, then the introduction of futures trading should have little impact on the extent of any asymmetries.

EMPIRICAL DESIGN

To analyze the impact of news on stock market volatility, a variant of the now-familiar ARCH type models is employed, which allows for asymmetric responses of volatility to news. In evaluating the performance of alternative models of conditional, variance, Engle and Ng (1993) find that the model proposed in Glosten, Jagannathan, and Runkle (1989) (GJR) captures the asymmetries of the Japanese stock index most accurately.[3] To see how this model arises consider the simple GARCH (1,1) specification

$$h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} \tag{1}$$

where h_t is the conditional volatility at time, t, α_0 is a constant, α_1 is a coefficient that relates the past value of the squared residuals, (u_{t-1}^2), to current volatility, and β_1 is a coefficient that relates current volatility to the past period of volatility. It is apparent from this model that the impact of news on volatility is symmetric. As such, news is assumed to have an equal effect irrespective of sign. If news has an asymmetric effect on volatility, then the GARCH model will be misspecified and subsequent inferences based on this model may be misleading. However, this model is easily extended to allow for asymmetric effects. In the GJR model the asymmetric response of conditional volatility to information is captured by including, along with the standard GARCH variables, squared values of u_{t-1} when the sign on u_{t-1} is negative:

$$h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \gamma_1 S_{t-1}^- u_{t-1}^2 \tag{2}$$

where $S_{t-1}^- = 1$ if $u_{t-1} < 0$, $S_{t-1}^- = 0$ otherwise. It is this model that is employed in the empirical analysis.

[3]Given that in general the likelihood function for the GJR model is higher than for the E-GARCH model, the former is preferred.

There are three stages to the analysis undertaken in this article. First, the question of whether futures trading has increased or decreased the level of volatility is analyzed by augmenting eq. (2) with a dummy variable that takes on the value, 0, prefutures and 1, postfutures. The augmented equation is then estimated for the spot market for the whole period. A significant positive coefficient suggests futures trading has increased spot price volatility, whereas a negative value suggests the opposite. Second, to determine whether the existence of futures has led to changes in the asymmetric response of volatility, the data set is partitioned into two subperiods (pre- and postfutures), eq. (2) is estimated for both subperiods, and comparisons of the estimates are made. Third, futures data are used in estimating eq. (2) to assess the extent to which the asymmetric response of volatility in the futures market is different from that in the spot market.

Before any empirical analysis can be undertaken it is necessary to generate a news component of returns. Let r_t be the return on a stock from $t - 1$ to t and Φ_{t-1} be the information set containing all relevant information up to time, $t - 1$. Given that Φ_{t-1} is known, expected returns and volatility are the values of r_t conditional on Φ_{t-1} and the variance of r_t, which is also conditional on Φ_{t-1}. The conditional expected return, ρ_t, is defined as

$$\rho_t = E(r_t|\Phi_{t-1}) \tag{3}$$

and the conditional volatility, h_t, is

$$h_t = \mathrm{var}(r_t|\Phi_{t-1}) \tag{4}$$

It is typical to define news as the unexpected component of returns, u_t,

$$u_t = r_t - \rho_t \tag{5}$$

and to treat a positive u_t as good news and a negative u_t as bad news. This unexpected component should be a mean-zero white noise process. Because the article is interested in the effect of news on conditional volatility, it is necessary to construct a measure of news. The analysis carried out in this article uses daily data. Day-of-the-week effects are taken into account in the construction of the unexpected component. To this end the procedure adopted in Engle and Ng (1993) is followed [see also Pagan and Schwert (1990)], which involves regressing returns on a constant and day-of-the-week dummy variables and subsequently ensuring the residuals from this model are serially uncorrelated. When such residuals

TABLE I

Data Description

Country	*Stock Index Futures*	*Introduction of Futures*
Germany	DAX 100	23/11/1990
Japan	NIKKEI 225	05/09/1988
Spain	IBEX 35	20/04/1992
Switzerland	SWISS MI	09/11/1990
U.K.*	FTSE-100	03/05/1984
U.S.	S&P 500	01/06/1982

*For the U.K. the stock index used is the FTALL Share index, because the FTSE-100 index was only introduced in 1984 to support the futures contract. For all other markets the stock index corresponds to the futures contract.

are serially correlated an autoregressive model of the residuals from the first step is formed and any linear temporal predictability is subsequently removed. Having obtained the unexpected components it is then possible to analyze the impact of the introduction of futures on the nature and characteristics of volatility.

DATA AND EMPIRICAL RESULTS

A. Data

In this article, daily closing prices on stock market indexes and their associated futures contracts are used for the countries shown in Table I. Logarithmic returns are constructed from these price series.

The countries of Table I are chosen for analysis to allow comparisons to be made of markets with different characteristics. The futures series are constructed by splicing together contracts near maturity. The month immediately prior to maturity is excluded to avoid problems relating to expiration effects. For example, stock index futures contracts on the Standard and Poors composite index expire in March, June, September, and December. Returns series are calculated with the use of data relating to the 1st of December to the 28th of February for the March contract, the 1st of March to the 31st of May for the June contract, et cetera. Analysis is undertaken with the use of data for the period 3 years prior to through 3 years after the introduction of futures trading. All data are from Datastream International.

B. Results

Table II reports Ljung and Box (1976) portmanteau statistics for the first, fourth, eighth, and twelfth autocorrelations of the returns series adjusted

TABLE II

Ljung and Box Portmanteau Statistics for Linear Temporal Dependence

Stock Index	*Lag 1*	*Lag 4*	*Lag 8*	*Lag 12*
Germany	0.0228	0.3117	6.4663	7.354
	[0.88]	[0.98]	[0.59]	[0.76]
Japan	0.0003	0.0173	0.2167	6.025
	[0.99]	[1.00]	[1.00]	[0.86]
Spain	0.0111	0.0244	6.3721	7.6431
	[0.91]	[1.00]	[0.60]	[0.74]
Switzerland	0.0003	0.0040	1.2838	4.4189
	[0.98]	[1.00]	[0.99]	[0.97]
U.K.	0.0001	0.0161	0.3304	6.202
	[0.99]	[1.00]	[1.00]	[0.85]
U.S.	0.0003	0.0011	1.4941	7.0122
	[0.98]	[1.00]	[0.99]	[0.87]

Note: Probability values are in brackets.

TABLE III

Ljung and Box Portmanteau Statistics for Nonlinear Temporal Dependence

Stock Index	*Lag 1*	*Lag 4*	*Lag 8*	*Lag 12*
Germany	95.333	157.52	235.37	302.51
	[0.00]	[0.00]	[0.00]	[0.00]
Japan	134.49	186.47	209.18	222.29
	[0.00]	[0.00]	[0.00]	[0.00]
Spain	101.36	167.01	234.28	302.62
	[0.00]	[0.00]	[0.00]	[0.00]
Switzerland	64.486	74.224	76.740	77.670
	[0.00]	[0.00]	[0.00]	[0.00]
U.K.	763.57	1001.1	1245.2	1300.1
	[0.00]	[0.00]	[0.00]	[0.00]
U.S.	30.062	30.606	84.111	126.23
	[0.00]	[0.00]	[0.00]	[0.00]

Note: Probability values are in brackets.

for day-of-the-week effects and serial correlation. There is no evidence of linear temporal dependence in the adjusted returns series, so these series are treated as news. Table III reports Ljung and Box (1976) portmanteau statistics for the first, fourth, eighth, and twelfth autocorrelations of the squared adjusted returns. It is clear that there is significant, nonlinear temporal dependence in the squared adjusted returns series, suggesting

TABLE IV

Estimates of the Effect of Futures Trading on Stock Market Volatility

Stock Index	*Coefficient on Dummy Variable*	*T Ratio*
Germany	−0.051	−5.209
Japan	−0.011	−0.785
Spain	−0.015	−1.069
Switzerland	−0.049	−3.356
U.K.	−0.003	−0.125
U.S.	0.000	0.010

that the volatility of adjusted returns follows an ARCH-type model. However, from these results it is not possible to infer whether there has been an increase in volatility following the inception of futures trading, and/or whether there are any asymmetries present in the volatility series.

To assess whether there has been an increase in volatility after the inception of futures trading the methodology outlined in the empirical design section is followed by estimating GJR GARCH (1,1)[4] models of conditional volatility. A dummy variable that takes on the value of 0 prefutures and 1 postfutures is included. Table IV reports the results from this part of the analysis.[5] It is clear that in all but the U.S. market, futures trading has had a negative impact on the level of price volatility of the underlying stock market. However, it is only for Germany and Switzerland that the negative effect is statistically significant. Furthermore, although the sign on the dummy variable in the U.S. is positive, it is insignificantly different from zero. Thus, with the exception of Germany and Switzerland, the introduction of futures trading has not had an impact on the level of volatility in the underlying stock market.

Although the introduction of futures trading has had a limited effect on the level of stock market volatility, the really interesting issue is whether the introduction of futures trading has had an effect on the way news impacts on volatility; that is, has futures trading altered the market dynamics? To address this issue the GJR model of volatility is estimated for the adjusted returns series for each subperiod (pre- and postfutures). Table V reports the results for the 3 years before the introduction of futures. All the countries' stock indexes, except for the U.K. and the U.S., exhibit statistically significant asymmetric effects at the 5% level. The

[4]The finance literature has demonstrated that the GARCH(1, 1) specification is the most appropriate for a wide variety of markets. See, for example, Bollerslev et al. (1992), among many others.

[5]Only the coefficient on the dummy variable is reported; the rest of the results are available on request.

TABLE V

Asymmetric Volatility Model (GJR) of Stock Index—3 Years before Futures $h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \gamma_1 S_{t-1}^- u_{t-1}^2$ where $S_t^- = 1$ if $u_t < 0$, $S_t^- = 0$ Otherwise

Stock Index	α_0	α_1	β_1	γ_1
Germany	0.3338	0.0182	0.6697	0.0939
	(6.552)	(1.078)	(12.89)	(5.068)
Japan	0.6019	0.0101	0.2726	0.2002
	(10.92)	(0.331)	(4.438)	(6.863)
Spain	0.0826	0.0112	0.8741	0.0439
	(3.417)	(0.915)	(25.13)	(3.472)
Switzerland	0.2846	0.0217	0.7068	0.0820
	(3.403)	(1.362)	(8.304)	(4.314)
U.K.	0.1619	0.0084	0.7623	0.0854
	(1.315)	(0.257)	(4.609)	(1.749)
U.S.	0.0375	0.0037	0.9495	0.0270
	(0.935)	(0.276)	(18.31)	(1.532)

Note: Figures in parentheses are T statistics.

results suggest that asymmetries are strongest in Japan,[6] Germany, and Switzerland. Interestingly, the latter markets in which asymmetries are statistically strongest are characterized by different trading conditions compared to the U.S. and U.K. markets. In addition, the percentage of transactions in domestic equity markets accounted for by foreign investors is significantly lower in Japan, Germany, and Switzerland than in the U.S. and the U.K. [see, for example, Pavel and McElravey (1990)], also, Japanese authorities are reluctant to allow foreign investors to freely participate in their equity markets, which reduces their competitiveness. Furthermore, the Anglo-Saxon countries are characterized by different shareholding structures.

The issue of the impact of futures trading on stock market volatility is now investigated by estimating the GJR model for stock returns for the period postfutures. The results should provide insights into the causes of asymmetries. For the traditional explanation of the asymmetric effect to be satisfactory, the introduction of futures contracts on the stock index should have no discernible effect on the asymmetry. Table VI reports the estimates of the GJR volatility models for all the stock indexes for the 3

[6]The prefutures sample for Japan includes the period of the stock market crash of 1987. Estimations with and without a dummy variable relating to the period surrounding the crash are made as well. The inclusion of the dummy does not materially affect the results. Results are available from the authors on request.

TABLE VI

Asymmetric Volatility Model (GJR) of Stock Index—3 Years after Futures $h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \gamma_1 S_{t-1}^- u_{t-1}^2$ where $S_t^- = 1$ if $u_t < 0$, $S_t^- = 0$ Otherwise

Stock Index	α_0	α_I	β_I	γ_I	χ^2
Germany	0.1542 (1.353)	0.0078 (0.038)	0.8819 (6.176)	0.0194 (0.936)	12.76 [0.00]
Japan	0.0532 (4.362)	0.0069 (1.554)	0.9109 (54.65)	0.0638 (9.243)	388.9 [0.00]
Spain	0.1348 (1.976)	0.0029 (0.192)	0.8452 (11.17)	0.0613 (2.475)	0.496 [0.048]
Switzerland	0.3324 (3.248)	0.0015 (0.046)	0.5902 (4.511)	0.0791 (1.897)	0.01 [0.94]
U.K.	0.0706 (1.039)	0.0191 (0.406)	0.8643 (7.349)	0.0540 (0.964)	0.31 [0.58]
U.S.	0.0393 (1.705)	0.0216 (1.925)	0.9338 (26.95)	0.0062 (0.295)	4.53 [0.03]

Note: Figures in parentheses are *T* statistics. Figures in square brackets are probability values.
*The test is for the equality of the asymmetric coefficient for the pre- and postfutures periods. The test statistic is distributed, χ^2 (1).

years after the introduction of futures. Interestingly, the results postfutures present a picture different from those for prefutures. In particular, there has been a reduction in the asymmetric response of volatility to news in all markets, except Spain. A chi-squared test reveals that the reduction in the value of the asymmetry coefficient is statistically significant for three of the countries. From this evidence it is clear that the introduction of futures contracts on the underlying stock indexes has had a substantial effect on the way information impacts on volatility. The results for the postfutures sample provide support for the view that market dynamics are a major cause of asymmetric responses of volatility to news. Given the absence of well-established financial markets in Spain, it is not surprising to find that this market has responded differently to the introduction of futures trading.

Summarizing the results this far, it is apparent that although the introduction of futures trading has had limited impact on the level of volatility, it has had a substantial impact on the nature of stock market volatility. Importantly, it appears that, in general, asymmetric effects have been reduced in the stock market, with the reduction being statistically significant in three markets. This result is inconsistent with leverage being the sole explanation of the asymmetries present in volatility. It seems more appropriate to argue that market dynamics have been changed by

TABLE VII

Asymmetric Volatility Model (GJR) of Futures Contract—First 3 Years after Introduction $h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 h_{t-1} + \gamma_1 S_{t-1}^- u_{t-1}^2$ where $S_t^- = 1$ if $u_t < 0$, $S_t^- = 0$, Otherwise.

Stock Index	α_0	α_l	β_l	γ_l
Germany	0.2181 (2.037)	0.0043 (0.432)	0.7961 (7.980)	0.0281 (1.777)
Japan	0.0305 (3.458)	0.0102 (2.253)	0.9369 (63.55)	0.0655 (7.664)
Spain	0.0792 (3.209)	0.0100 (1.424)	0.8411 (21.01)	0.1184 (5.857)
Switzerland	0.3563 (4.563)	0.0068 (0.415)	0.5659 (5.712)	0.0888 (3.275)
U.K.	0.0722 (1.206)	0.0402 (0.957)	0.8795 (10.20)	0.0039 (0.091)
U.S.	0.0216 (1.247)	0.0085 (0.801)	0.9616 (36.81)	0.0141 (0.899)

Note: Figures in parentheses are *T* statistics

the introduction of futures trading. For example, if noise traders/feedback traders are present in the market and they overreact to news, especially bad news, then the introduction of futures trading seems to have reduced this overreaction. This could come about either because futures markets provide more reliable information and, thus, traders become better informed, or because noise traders have less of an impact as a result of more reliable information in the public domain. An alternative explanation is that noise traders have moved to the futures market because of the relatively lower cost of trading in futures contracts compared to the spot market. As such, asymmetries may be present in the futures rather than the spot market.[7] To investigate this possibility the same procedure is followed as for the stock indexes, but with futures prices for 3 years after the inception of trading used. Table VII reports the GJR models for the futures markets. As was the case with the prefutures stock market samples there are significant asymmetric effects in the futures series for all countries with the exception of the U.S. and the U.K.[8]

The results suggest that for those countries characterized by asymmetries prefutures, the introduction of futures trading has, in part, led to a transfer of the asymmetries to the futures market. Although the find-

[7]Koutmos and Tucker (1996) provide evidence that the volatility of futures returns is more asymmetric than that for spot returns.
[8]The asymmetric coefficient in Germany is statistically significant at the 10% level.

ings are inconsistent with leverage being the sole explanation of asymmetries, they are supportive of the view that asymmetric responses to information are largely the result of market dynamics. Thus, far from having had a detrimental impact on the underlying market, it appears that the introduction of futures trading has attracted noise and feedback traders away from the stock market and has led to an improvement in the dynamics of the underlying market.

CONCLUSION

This article examines the impact of futures trading on stock market volatility. In doing so it extends the traditional analysis of examining whether futures trading has increased stock market volatility by considering the issue of volatility, asymmetries, and market dynamics.

The results suggest that although the onset of futures trading has had limited impact on the level of stock market volatility over a 3-year period, it has had a major effect on the dynamics of the stock market. In particular, the way that news impacts volatility has changed with the introduction of futures trading: prefutures the stock markets of all but the U.S. and the U.K. exhibit significant asymmetric responses of volatility to the arrival of news; postfutures asymmetries are significantly lower. This evidence is inconsistent with the so-called leverage effect being the sole explanation of asymmetries and suggests that the explanation based on market dynamics has validity. This view is given additional support by the finding that the futures markets themselves are characterized by asymmetric responses of volatility to news. It therefore appears that there has been a transference of asymmetries from the spot market to the futures market.

Overall, contrary to the traditional view of futures trading, the results suggest that the introduction of futures has not had a detrimental effect on the underlying market. Indeed, it appears that there has been an improvement in the way that news is transmitted into prices following the onset of futures trading. Thus, the view that market turbulence results from the introduction of derivative trading generally appears unfounded; consequently, calls for further regulation of futures markets based on this view are misguided. However, the results for Spain suggest that this is not true for all markets. In particular, if futures are to have a beneficial impact on the underlying market it is important that they are introduced at the appropriate stage of the development of the financial system. As Merton (1995) has argued, there is a learning curve associated with financial innovations. In addition to conclusions relating to the impact of futures trading, the evidence presented here suggests that the empirically observed asymmetries in volatility, far from being the result solely of leverage effects, are a consequence, at least in part, of noise and feedback trading.

BIBLIOGRAPHY

Antoniou, A., and Holmes, P. (1995): "Futures Trading, Information and Spot Price Volatility: Evidence for the FTSE-100 Stock Index Futures Contract Using GARCH," *Journal of Banking and Finance,* 19:117–129.

Black, F. (1976): "Studies in Stock Price Volatility Changes," *Proceedings of the 1976 Business Meeting of the Business and Economic Statistics Section,* American Statistical Association, pp. 117–181.

Black, F. (1986): "Noise," *Journal of Finance,* 41:529–543.

Bollerslev, T. (1986): "Generalised Autoregressive Conditional Heteroscedasticity," *Journal of Econometrics,* 33:307–327.

Bollerslev, T., Chou, R. Y., and Kroner, K. F. (1992): "ARCH Modeling in Finance: A Review of the Theory and Empirical Evidence," *Journal of Econometrics,* 52:5–59.

Braun, P. A., Nelson, D. B., and Sunier, A. M. (1991): "Good News, Bad News, Volatility and Betas," *CRSP Working Paper* No. 297.

Christie, A. (1982) "The Stochastic Behavior of Common Stock Variance: Value, Leverage and Interest Rate Effects," *Journal of Financial Economics,* 10:407–432.

Cox, C. C. (1976): "Futures Trading and Market Information," *Journal of Political Economy,* 84:1215–1237.

De Long, J. B., Shleifer, A., Summers, L. H., and Waldman, R. J. (1990): "Noise Trader Risk in Financial Markets," *Journal of Political Economy,* 98:703–738.

Edwards, F. R. (1988a): "Does Futures Trading Increase Stock Market Volatility?," *Financial Analysts Journal,* 44:63–69.

Edwards, F. R. (1988b): "Futures Trading and Cash Market Volatility: Stock Index and Interest Rate Futures," *Journal of Futures Markets,* 8:421–439.

Engle, R. F. (1982): "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica,* 50:987–1008.

Engle, R. F., and Ng, V. K. (1993): "Measuring and Testing the Impact of News on Volatility," *Journal of Finance,* 48:1749–1778.

Fama, E. F. (1965): "The Behavior of Stock Market Prices," *Journal of Business,* 38:34–105.

Figlewski, S. (1981): "Futures Trading and Volatility in the GNMA Market," *Journal of Finance,* 36:445–456.

French, K., Schwert, G. W., and Stambaugh, R. (1987): "Expected Stock Returns and Volatility," *Journal of Financial Economics,* 19:3–29.

Glosten, L., Jagannathan, R., and Runkle, D. (1989) "Relationship between the Expected Value and the Volatility of the Nominal Excess Return on Stocks," *Working Paper,* Department of Finance, Columbia University.

Koutmos, G., and Tucker M. (1996): "Temporal Relationships and Dynamic Interactions between Spot and Futures Stock Markets," *Journal of Futures Markets,* 16:55–69.

Kyle, A. S. (1985): "Continuous Auctions and Insider Trading," *Econometrica,* 53:1315–1335.

Ljung, G. M., and Box, G. E. P. (1978): "On a Measure of Lack of Fit in Time Series Models," *Biometrica,* 65:297–303.

Mandelbrot, B. (1963): "The Variation of Certain Speculative Prices," *Journal of Business,* 36:394–419.

Merton, R. C. (1995): "Financial Innovation and the Management and Regulation of Financial Institutions," *Journal of Banking and Finance,* 19:461–481.

Moriarty, E. J., and Tosini, P. A. (1985): "Futures Trading and the Price Volatility of GNMA Certificates—Further Evidence," *Journal of Futures Markets,* 5:633–641.

Nelson, D. B. (1989): "Modeling Stock Market Volatility Changes," *Proceedings of the 1986 Business Meeting of the Business and Economic Statistics Section,* American Statistical Association, pp. 93–98.

Nelson, D. B. (1991): "Conditional Heteroskedasticity in Asset Returns: A New Approach," *Econometrica,* 59:347–370.

Pagan, A. R., and Schwert, G. W. (1990): "Alternative Models for Conditional Stock Volatility," *Journal of Econometrics,* 45:267–290.

Pavel, C., and McElravey, J. N. (1990): "Globalization in the Financial Services Industry," *Federal Reserve Bank of Chicago Economic Perspectives,* 14:3–18.

Porterba, T. M., and Summers, L. H. (1986): "The Persistence of Volatility and Stock Market Fluctuations," *American Economic Review,* 76:1142–1151.

Robinson, G. (1994): "The Effects of Futures Trading on Cash Market Volatility: Evidence from the London Stock Exchange," *Review of Futures Markets,* 13:429–452.

Sentana, E., and Wadhwani, S. (1992): "Feedback Traders and Stock Return Autocorrelations: Evidence from a Century of Daily Data," *Economic Journal,* 102:415–425.

Shiller, R. J. (1984): "Stock Prices and Social Dynamics," *Brookings Papers on Economic Activity,* 457–498.

Shleifer, A., and Summers, L. H. (1990): "The Noise Trader Approach to Finance," *Journal of Economic Perspectives,* 4:19–33.