Speculation and Destabilisation

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Abstract: In the context of flexible exchange rates, Milton Friedman proposed that speculation must exert a stabilising influence upon prices to remain profitable. This generated a wealth of predominantly theoretical research into the behaviour of speculators, for which the results seem to depend critically upon the assumptions. Such theoretical models need to be tested against empirical evidence to determine whether speculators behave in a destabilising manner. Using recent theoretical developments in the literature on modelling financial volatility, this paper tests the significance of speculators and their contributions to describing weekly volatilities across a series of currency, metals and commodity markets. As the time-varying GARCH volatility model and its variants have been criticised for lacking economic content, incorporating speculators into such models contributes to an accommodation of this criticism. The economic implications from establishing the importance of speculators are far-reaching. Policymakers often discuss the imposition of a Tobin tax to curb speculation, so it must be established that speculators behave in economically destructive ways. The inclusion of speculators is also likely to yield superior forecasting models of volatility, and hence more efficient pricing of derivative instruments.

Keywords: *Volatility; speculation; destabilisation; Tobin tax; GARCH models.*

1. INTRODUCTION

Whether speculators cause financial markets to be more volatile than warranted by fundamentals has long been a topic of intense intellectual debate. The matter has important consequences for regulators of the international capital market framework. Capital can now travel great distances very rapidly, facilitated by advances in communications and the relaxation of capital account controls. However, whether such rapid redeployment of capital is in the best interests of world economic prosperity has been queried. For example, Tobin (1978) proposed taxing foreign exchange transactions, or 'sand in the wheels' to reduce the level of noise in currency markets. In his case for floating exchange rates, Friedman (1953) argued that speculators must exert a stabilising influence upon markets. This generated a wealth of counter-examples, most of which were viewed with scepticism (see Hart and Kreps (1986)). Since that time, major advancements in financial market and information theory have led to the development of models that show speculators need not act to stabilise prices, and indeed may even survive, contrary to Friedman's assertion.

An array of market models exists, deviating in different ways from the perfect competition, representative agent paradigm that has been the workhorse of economic analysis. For example, De Long *et al.* (1990) present a model whereby speculators may trade profitably by anticipating the direction in which a category of traders, referred to as noise traders, will trade. The actions of speculators will pre-empt noise trader demand and serves to push prices further away from their fundamental values. Other models, such as in Shalen (1993) and Harris and Raviv (1993), rely upon dispersion of beliefs among agents. These models lead to greater trading than is predicted by a simple model, and differences in beliefs cause prices to fluctuate more heavily before settling at the equilibrium price.

By comparison, the amount of empirical research into how speculation affects asset markets is relatively sparse. The major reason for such absence is that researchers are limited by data availability as traders typically do not have to disclose their motivations for trading. Moreover, it is not entirely clear as to what constitutes speculation. As observed by Hart and Kreps (1986, p. 928), a satisfactory definition is unlikely to become available. Thus, the concept of speculation used is that it is associated with traders who have no underlying business interest in the commodity and are simply trading to beat the market estimate of its future value. Such a definition is similar to that used by the

Commodity and Futures Trading Commission (CFTC), which is responsible for regulating the US futures and options markets, and which requires a large number of traders to register their purpose for trading futures and options. The number of outstanding speculative contracts is published weekly in the Commitment of Trader (COT) reports, and these data are used to measure speculation, albeit imperfectly.[1] Chang *et al.* (1997) and Wang (2002) use such speculative data, and conclude that speculation destabilises market prices.

This paper highlights the fact that the models used in the literature cannot capture the phenomenon of destabilising behaviour. The purpose of this paper is to correct for this oversight, employ different techniques to capture the volatility process, and contribute to the literature on volume and volatility (for a review, see Karpoff (1987)). Typically, researchers find a positive contemporaneous relationship between volume and volatility (see, for example, Lamoureux and Lastrapes (1990) and Bessembinder and Seguin (1993)). It is thought that volatility arises from information arriving on the market, and this information is impounded into prices via trades, as measured by volume. Hence, there appear to be strong theoretical reasons for supposing that such a relationship exists, as supported by the data. However, few papers have decomposed volume into speculative and non-speculative components, which the theoretical research outlined above indicates is an important consideration.

2. EMPIRICAL SPECIFICATIONS

Wang (2002) examined weekly Commitment of Traders (CoT) reports for six foreign currency markets, using both the Schwert estimator and the Garman-Klass extreme-value volatility estimator which accounts for intra-day price variations.[2] Wang reported that speculators have statistically significant and positive effects in currency futures, which suggests that speculators destabilise such markets. However, Wang (2002) followed a strategy of estimating volatility from a model of daily returns, followed by regressing these volatility estimates, or fitted values, against volume, open interest and speculator's data. Such data can then simply be inserted into the conditional volatility equation.

Chang *et al.* (1997) analyse daily data on the S&P 500 stock index, Treasury bonds, gold, corn and soy beans. They found that the coefficient on large speculators was positive and substantially larger than that of aggregate trading volume, although this was not tested statistically. Importantly, these regressions do not condition on other potentially relevant variables, which opens the results to omitted variable bias.

These studies have a severe limitation in that they do not accommodate the direction of speculative trades. For example, speculators may rush to sell against a trend, which would be stabilising behaviour, yet the model of Chang *et al.* (1997) would erroneously conclude that speculators act in a destabilising manner. Wang (2002) overlooks the fact that an increase in both net short and in net long positions is still an increase in speculation. However, Wang's model suggests that when speculators are net short, an increase in net short positions is an overall decrease in speculation, and when speculators are net long, an increase in net long positions is an overall increase in speculation.

In order to overcome these deficiencies, an ARMA(1,1)-GARCH(1,1) model with exogenous variables is used for the conditional volatility equation, in the spirit of Lamoureux and Lastrapes (1990) and Omran and McKenzie (2000). However, only information available at time t-1 is included because, as noted by Bollerslev *et al.* (1992, p.32), the inclusion of information at time t seriously biases the empirical results. The model used here is not structural as it is not prescribed by economic theory. However, as noted above, the existence of theories suggesting an inextricable link between volume and volatility, and the empirical work documenting such a relationship, justifies the specification used.

As some have argued that speculation destabilises markets, this may also be relevant in explaining volatility. Thus, the empirical specification used is given as follows:

[1] The distinction between hedging and speculation is not absolute. In assessing how much to hedge, hedgers will base their decisions upon forecasts of future prices, thereby effectively 'speculating' upon the future price. Such characteristics cannot be captured quantitatively. Moreover, models such as in Shalen (1993) use speculation solely to draw a distinction between the information available to traders. In this model, hedgers are assumed to be informed privately about the market conditions, whereas speculators are ill informed. In this instance, the speculator/hedger distinction seems appropriate.

[2] The two estimators yielded quantitatively similar results.

$$r_t = \mu_1 r_{t-1} + \mu_2 \varepsilon_{t-1} + \varepsilon_t,$$
$$\varepsilon_t \mid (X_{t-1}, \varepsilon_{t-1}, \varepsilon_{t-2}, \ldots) \sim D(0, h_t),$$
$$h_t = \alpha_0 + \alpha_1(L)\varepsilon_{t-1} + \alpha_2(L)h_{t-1} + \phi X_{t-1},$$

$$X_{t-1} = \begin{pmatrix} \text{EWEEKVOL, UEWEEKVOL, EOI,} \\ \text{UEOI, TOTALSPEC, D3} \end{pmatrix},$$

where EWEEKVOL (UEWEEKVOL) and EOI (UEOI) represent expected (unexpected) total volume traded for the week and open interest, respectively, TOTALSPEC is the sum of long and short speculator positions, and D3 is a dummy variable that takes the value 1 when speculators change their positions in the same direction as returns on the non-USD currency, and 0 otherwise. Such actions would add impetus to price movements, and thereby represent situations of destabilising speculation.

3. DATA

Five currency markets are analysed, namely the Australian dollar, Canadian dollar, British Pound, Japanese Yen and Swiss Franc *vis-à-vis* the US dollar. In order to determine whether speculators affect volatility, data on market prices are required. Thus, spot market data from Datastream Services were used. Spot rates were used for several reasons. First, futures require the construction of a continuous series. The most common method is to roll over contracts to the contract nearest the expiry when the current contract reaches the month of expiry because futures lose their liquidity as they approach expiry. Second, it is generally argued that futures become more volatile as they approach expiry, and the use of spot rates circumvents this complication. Finally, a popular view of futures markets is that they invite speculation, and may even make the underlying asset more volatile. Thus, it would be interesting to see whether the data support this assertion.

In order to gauge the extent of speculative activity, the CoT reports, which summarise the open interest in a particular commodity's contract series, are used. To facilitate its job as market regulator, the Commodity Futures Trading Commission (CFTC) requires all large traders to disclose the purpose for which they trade futures. Large traders may be classified as commercial or non-commercial traders, where commercial traders must 'use futures contracts in that particular commodity for hedging as defined in the CFTC's regulations'.[3]

A review of the volume-volatility literature shows that many researchers regard volume as an important input into the price formation process. In order to avoid possible omitted variable bias, we need to include a measure of aggregate volumes traded. For this purpose, we use the futures market volume and open interest data provided by DataStream. The literature has also documented a differential impact between expected and unexpected volumes (see Bessembinder and Seguin (1993)). For purposes of consistency, we decomposed the data into their expected and unexpected values. The method requires estimation of an ARIMA (d,p,q) model, with the fitted values representing expected values and the corresponding residuals representing unexpected values.

Summary statistics are presented in Table 1. No evidence of a constant risk premium exists, with mean returns statistically indistinguishable from zero. Leptokurtosis is a stylised fact in high-frequency empirical finance and is present in all currency returns, as indicated by a kurtosis coefficient greater than 3 and significant Lagrange Multiplier test statistics for normality, LM(N). Non-stationarity does not seem to be an issue, with the ADF rejecting the null hypothesis of a unit root for all data sets.

4. EMPIRICAL RESULTS

Table 2 provides estimates of an ARMA(1,1)-GARCH(1,1) model with exogenous variables in the conditional volatility equation for Australian and Canadian dollars, British pound, Japanese yen and Swiss franc. All estimates were obtained using EViews 4. When the likelihood function did not converge, different algorithms were implemented to obtain convergence, as follows: the preferred method of estimation was to use the BHHH algorithm with no backcasting (used for the Canadian dollar and British pound), while the Marquadt algorithm was used for the remaining currencies. The Bollerslev and Wooldridge (1992) robust standard errors are reported to provide consistency in the presence of non-normality in the standardised residuals.

EViews 4 is used to estimate the GARCH models under the assumption that the conditional error distribution is normal. Bollerslev *et al.* (1992,

[3] The 'CFTC Commitments of Traders Report Backgrounder' is available at www.cftc.gov

p.11) note that, if the distribution is not conditionally normal, then the asymptotic standard errors are typically biased downwards. Diagnostic tests for the standardised residuals were conducted but omitted due to space considerations. Consistent with most prior studies, there was no evidence of GARCH effects in the standardized residuals, as indicated by the insignificant test statistics for the LM(ARCH) test. However, the assumption of conditional normality was rejected for the pound, yen and franc, due mainly to the presence of excess kurtosis in the standardised residuals. This shows that the use of consistent standard errors is important. It should also be noted that non-normality in the standardised residuals causes the QMLE to be inefficient.

The conditional mean was assumed to follow an ARMA(1,1) process to accommodate any short term persistence effects. This provides a test of weak-form efficiency, which states that prices should not be predictable on the basis of previous prices. The estimates for the Canadian dollar, British pound and Japanese yen are inconsistent with weak-form efficiency, with both the AR and MA components being statistically significant at the one percent level.

TABLE 1 – SUMMARY STATISTICS

Statistics	RET	EVOL	UEVOL	EOI	UEOI	TOTAL SPEC
AUD						
Mean	0.000533	11193.20	19.66106	7824.82	-0.09423	4668.998
SD	0.012975	5246361	7915.482	9314.678	3283.181	4049.477
Skew	-0.02363	0.572878	2.03891	0.424157	-0.45665	1.706019
Kurtosis	3.661516	3.030941	10.15173	2.860096	7.709530	7.376001
LM(N)	9.5115**	28.409**	1463**	15.98**	497.7**	665.9**
ADF	-15.831**	-7.2795**	-15.985**	-3.2710*	-15.658**	-5.3712**
CAD						
Mean	0.000464	42968.45	37.20956	55209.76	-3.74735	18576.69
SD	.007353	12825.18	18257.16	15401.68	6677.360	9465.870
Skew	0.04762	0.46190	1.00683	-0.10131	-1.0058	0.508868
Kurtosis	4.05615	2.89084	4.53424	2.13746	6.33945	2.575162
LM(N)	24.365**	18.749**	138.86**	17.01**	329.31**	26.353**
ADF	-15.95**	-9.0162**	-16.082**	-4.353**	-15.500**	-6.2662**
GBP						
Mean	-0.00017	52842.8	-13.2396	42627.1	9.96575	14986.8
SD	0.01166	11668.3	21972.2	9752.6	7478.46	7951.68
Skew	-0.38428	0.21789	1.28418	0.48977	-0.62658	1.16260
Kurtosis	5.13051	2.17561	5.72934	2.61575	5.93335	4.77323
LM(N)	111.15**	18.84**	304.3**	23.988**	20.456**	185.29**
ADF	-17.078**	-5.4172**	-16.235**	-5.7881**	-15.899**	-5.7667**
JPY						
Mean	2.0E-05	105964.9	-18.6288	84774.9	8.7500	35132.88
SD	0.01609	25835.4	42156.2	19113.2	12317.5	15177.3
Skew	-0.66763	0.36498	1.18754	0.81676	-1.06682	1.05228
Kurtosis	6.02082	2.82699	5.23682	3.79038	7.52216	3.738495
LM(N)	236.35**	12.193**	230.63**	71.350**	541.72**	107.78**
ADF	-15.499**	-7.7615**	-16.404**	-6.2756**	-16.548**	-5.8647**
SFR						
Mean	0.00016	78298.2	-3.0016	49285.3	20.2677	18852.52
SD	0.01526	19145	25343.2	10392.8	7673.58	8313.194
Skew	-0.26221	0.11356	0.87913	0.82358	-0.65161	1.027691
Kurtosis	4.41791	2.12847	4.17629	4.19916	6.97199	4.44171
LM(N)	49.423**	17.541**	96.775**	89.769**	377.90**	136.3045**
ADF	-16.804**	-6.1359**	-15.950**	-5.597**	-16.327**	-6.0402**

* (**) denotes significance at the 5% (1%) level.

TABLE 2 – CURRENCIES: ARMA(1,1)-GARCH(1,1) PLUS EXOGENOUS VARIABLES

The top row reports coefficient estimates and Bollerslev-Wooldridge adjusted standard errors are reported below. Estimates based upon 520 weekly observations over the period 6 October 1992 to 15 October 2002.

COEFFICIENT	AUD	CAD	GBP	JPY	SFR
Conditional Mean					
C	0.000482	0.000523	0.000316	0.000314	0.00054
	0.0005	0.000268	0.00036	0.000728	0.000603
AR(1)	-0.00881	-0.6611**	0.588136**	0.779799**	-0.14857
	0.571689	0.204557	0.068235	0.261939	6.617999
MA(1)	-0.04031	0.561701*	-0.68019**	-0.74946**	0.142504
	0.568102	0.228164	0.073532	0.276947	6.62258
Conditional Variance					
C	7.32E-06**	-1.3E-06**	5.99E-06	-9.8E-05**	-9.7E-06**
	2.46E-06	1.79E-07	7.20E-06	2.91E-05	2.90E-07
ARCH	0.013992	0.049822*	0.038438	0.094574*	-0.01743
	0.011916	0.020813	0.021651	0.044496	0.011439
GARCH	0.948527**	0.910786**	0.884277**	0.703289**	0.998788**
	0.023114	0.029964	0.037646	0.114516	0.015459
EVOL	-2.29E-09	-1.67E-10	1.89E-10	7.17E-10	8.93E-11
	1.42E-09	9.35E-11	2.16E-10	6.60E-10	7.20E-11
UEVOL(-1)	-1.72E-09*	-1.79E-10	-6.06E-10	-8.04E-10	-1.97E-10
	8.02E-10	1.39E-10	3.72E-10	6.43E-10	1.80E-10
EOI	1.37E-09	1.11E-10	-4.64E-10	9.70E-10	-1.50E-10
	1.04E-09	9.22E-11	4.27E-10	1.14E-09	2.52E-10
UEOI(-1)	1.01E-09	-4.51E-10	5.82E-11	3.50E-10	4.00E-10
	2.11E-09	3.28E-10	8.26E-10	2.26E-09	7.81E-10
TOTALSPEC(-1)	-1.02E-09	3.17E-10	8.86E-10	2.34E-10	1.29E-09
	1.25E-09	2.04E-10	5.26E-10	1.45E-09	6.93E-10
DUM3(-1)	3.35E-09	-1.96E-10	6.19E-11	-1.25E-09	-1.34E-09*
	2.34E-09	2.15E-10	9.15E-10	1.45E-09	5.51E-10

* (**) denotes significance at the 5% (1%) level.

For the conditional volatility equation, the lagged conditional variance, h_{t-1}, was significant in all cases. This is consistent with studies such as Baillie and Bollerslev (1989) that find significant GARCH effects at weekly frequencies. Of the five currencies, the results for Swiss francs showed the GARCH coefficient to be too close to unity, in which case the ARCH coefficient was negative, though insignificant. The ARCH coefficients were significant in only two of five cases, whereas the GARCH coefficients were significant in all five cases. It seems that the Japanese yen displayed the least persistence, whereas the Swiss franc displayed the greatest persistence, with a coefficient near unity. None of the exogenous factors hypothesised to affect volatility appeared to be significant. Contrary to previous research in the literature, the empirical results in this paper did not find significant volume effects. Thus, there was no empirical evidence to suggest that GARCH was related to volume or the rate of information flow to the market. Reasons for this discrepancy could be that weekly data were used in this paper, as well as currency markets and a different time period. Lagged volume and open interest data rather than their contemporaneous counterparts also show that the bias in the latter does not affect the results appreciably. The use of futures market volume, together with spot prices, is not considered to be a major concern because futures and spot markets are inextricably linked by arbitrage.

No apparent evidence can be gleaned from the GARCH specification that speculators contribute to more volatile markets. Thus, the absence of significant total speculative trades and the dummy variable shows that there is no impact on future volatility, regardless of whether speculators behave in a manner consistent with stabilisation or destabilisation. Economically, there is no evidence to suggest that speculation destabilises markets, so that it does not support a policy to curb speculation. It may be that prices, volume and volatility are contemporaneously related, in which case the GARCH model may not be suitable to analyse this issue. In order to overcome this problem, an alternative method that analyses contemporaneous correlations, or infers the impact of traders indirectly, may be required.

5. CONCLUSIONS

A wide range of views exists as to how speculators affect volatility. The existing empirical evidence supports the notion that speculators destabilise prices. However, when the deficiencies of existing research are addressed, the empirical evidence supports the hypothesis that speculators have no impact on volatility. Thus, policymakers and politicians who blame the plight of their currency upon speculation are not in accord with existing empirical evidence.

6. ACKNOWLEDGEMENTS

The first author would like to acknowledge the financial assistance of the Hackett Postgraduate Scholarship. The second author wishes to acknowledge the financial support of the Australian Research Council and the Center for International Research on the Japanese Economy, Faculty of Economics, University of Tokyo.

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