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Discussion

On Granger's predictability of financial markets in theory and practice

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A B S T R A C T

I was kindly invited by the organizers to discuss the presentation by Professor Clive Granger at the 5th International Institute of Forecasters Workshop in Lisbon, which was, perhaps, the last one that he ever delivered in a regular meeting. The task would have not been easy in any case, given his deep knowledge of the field and his many contributions. My discussion, however, turned out to be more difficult than I anticipated, given that there was no formal paper to discuss, just some sparse notes that he had written at various different dates, but certainly before the spectacular gyrations that hit the speculative markets in mid to late October 2008 and early December 2008. During our brief encounters at the workshop, he mentioned the thought of expanding his notes and writing a full-length paper on the issue. However, his unexpected demise left this thought unrealized. The editors of this special issue thought that it would remain incomplete without his outstanding contribution, and invited me to write my reflections on his notes and his verbal presentation. If discussing the paper (in an informal setting) was already daring, writing a paper on such a wide and complicated topic was a daunting task. I had many reasons for refusing the assignment; however, in the end, I felt that I should take it, if only as a personal homage to a giant in our discipline.

1. Introduction

Throughout his contributions and public discussions, Granger has always adhered to the idea that it is not the absence of theory, but the lack of good quality data, which precludes greater advances in economic science. The most serious problems for empirical work in economics are typically related to data quality. Many empirical applications involve a lack of data at hand for testing theories, and the presence of measurement errors and data revisions. However, these issues are rarely of concern in finance, since the data recorded are the details from when trades actually took place or were quoted on the screen of information providers. Also, some sets of financial data are observed at much higher frequencies than macroeconomic data (daily, hourly or tick by tick frequencies), and thus the number of observations available for analysis can potentially be very large.

On the other hand, as was noted by Brooks (2008), financial data are often considered to be very noisy, which means that it is more difficult to separate *underlying trends* or *patterns* from random features. Also, on the negative side, financial data are rarely normally distributed, in spite of the fact that most econometric methodologies assume that they are. This is a well known result, dating back to the pioneering work of Fama (1970) regarding extreme points. Fama found that for all stocks, there were many more days of extreme behavior than would occur in a normal distribution. In contrast to the idealized markets considered in models, 'real life' financial markets are inherently more risky. As was noted by Campbell, Lo, and Mackinlay (1997), what distinguishes financial economics is the central role that uncertainty plays in both financial theory and its empirical applications.

In Granger's view, financial markets are large and complicated organizations which consist of many components that are somewhat interrelated, many of which are highly dynamic, and thus clearly in need of forecasting, if possible. This interrelatedness means that a trend in one market

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could spread to the next, and an isolated slump could lead to general chaos. For traders who are chained to electronic screens, the distinctions between markets of different countries, companies and commodities have almost ceased to exist. They are all points on a continuum of risk, stitched together by derivatives. In these circumstances, the very concept of safety through diversification – the basis of traditional finance – merits rethinking. As Lowenstein (2000) jokingly states, 'eggs in separate baskets can break simultaneously'. A good example of this situation is the current international financial crisis, which some consider to be part of a perennial pattern (Reinhart & Rogoff, 2009). The crisis started in the US with the collapse of the subprime mortgage market and the end of a major housing boom in early 2007. Mortgage defaults spread to investment and commercial banks both in the US and across the world via an elaborate network of derivatives. It subsequently spilled over into the real economy through a virulent credit crunch and a collapsing equities market, which probably produced a major economic recession. Although the present crisis has some important modern twists, Bordo (2008) has noted that it has many similarities to those of the past, including the crises of 1857, 1893, 1907 and 1929–33. The fact that most financial products are potentially linked in time and globally connected makes any forecasting exercise a daunting task. In these markets, the value of historical data for predicting future patterns is questionable at best. In spite of that, the belief that tomorrow's risks can be inferred from yesterday's prices and volatilities prevails at virtually every investment bank and trading desk.

In what follows, Section 2 briefly presents a partial list of predictable financial markets and introduces three general rules derived from results in empirical finance. Section 3 reviews various methodological issues relating to the forecasting process, and in particular, the recent shift from mean and variance forecasting to the analysis of the full return distribution for asset pricing, risk management and asset allocation purposes. Section 4 presents an overview of various economic and statistical measures of forecast accuracy, and argues in favor of a closer link between the decision and forecast evaluation problems, and Section 5 concludes.

2. A (partial) list of predictable financial markets

Granger's (2009) original notes included the following variables:

1. Stock prices and the associated returns, both individually and in groups such as portfolios and indices.
2. Volatility, measured in various ways and considered to be a basic measure of risk. The question is, how is the risk defined for a stock market crash? The usual definition implies that it is just the size of the lower tail of the return distribution, but how is this forecast?
3. Return risk, which has been found to be particularly important in recent market gyrations, but which is difficult to measure, and thus to forecast.
4. Earnings and dividends for individual companies.
5. The quantity or volume of trades, particularly over a given period such as a day.
6. Special events such as the formation of bubbles, or the formation of new exchanges or conglomerates leading to superexchanges. Many of these will be purely electronic, and thus will be cheaper to trade but less flexible. Many people do not have any experience of bubbles, and if they do have such experience, they may fail to acknowledge their similarities, considering different bubbles as unrelated events (Reinhart & Rogoff, 2009).
7. Many types of speculative markets, including the stock exchanges that can be found in most developed economies, as well as several commodity markets, such as those for gold, silver, oil, copper, scrap steel, and so forth. Furthermore, there are also all of the purely 'financial' and investment markets which are involved with interest rates, mortgages and such like. The number of speculative markets is growing according to demand, and a good example is provided by the enormous growth of hedge funds in some countries.

Although this list is incomplete and there are many special techniques which can be used to produce forecasts in these markets, it would be impossible to survey them all critically. Granger, however, proposed *three general rules* that would be expected to work in practice for most financial markets.

Rule 1

Any market where successful forecasts could make serious money, turns out to be very difficult to forecast.

This rule is basically just a restatement of the "efficient market theorem", and arises directly from the behavior of investors. Once they discover a potentially profitable situation, their investment behavior changes to remove this profitability. Studies based on the efficient market hypothesis have consistently found that the theory fits well, meaning that the returns continue to be very difficult to forecast. When using linear models based on predictor variables such as dividend yield, price-earning ratios, interest rates, default premia and other macroeconomic variables such as inflation, the empirical evidence on return predictability is very controversial. Papers published in the eighties and associated with *ex-post* or *in-sample* return predictabilities, such as those of Campbell (1987), Campbell and Shiller (1988), Fama and French (1988, 1989), among others, found positive evidence of return predictability. However, as Lettau and Ludvigson (2001) noted, many of the predictor variables proposed earlier did not produce good predictions during the bull market that characterized a large part of the 1990s. On the other hand, negative evidence based on *ex-ante* forecasts (or confined to particular sub-samples) was found by Bossaerts and Hillion (1999), Goyal and Welch (2003), and Pesaran and Timmerman (1995) among others. However, the debate is not yet settled, and Campbell and Thompson (2008) and Cochrane (2008) recently disputed previous negative findings.[1]

[1] Various other components of the market can sometimes be forecast, particularly those for which there is no speculative market due to a lack of interest on the part of investors. One example is the total number of shares that are traded in a given day on a major market, which is a quantity that is probably forecastable, but cannot be traded. Some of the volume figures fall into this category.