

**BODY AND MIND: Weather maps to forecast market storms: Powerful new technology is being developed to provide an early warning system for the global economy.**

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By CLIVE COOKSON and RICHARD OLSEN

The terrorist attacks of September 11 and uncertainty about their economic repercussions highlight the complexity of today's economy. Its information processing capacity cannot handle such catastrophes. But help may be at hand, from a new field of research called high-frequency finance.

Modern computing power and data storage technology make it possible to collect every update of market prices. For liquid financial instruments, such as currencies, this "tick-by-tick" data can exceed 25,000 price quotes a day. High-frequency finance introduces a powerful new technology that could bring greater stability to the modern economy.

How is this possible?

The story starts in the late-18th century. Adam Smith and his friends observed then that regulated price schemes were a formidable obstacle to maximising the economic potential of "globalisation" via commerce with colonies and from "technology" via the first factories and their low production costs.

To overcome the vested interests they needed a convincing argument in support of freeing market prices from government control.

They came up with the concept of the "invisible hand", which sets prices fairly so as to balance supply and demand.

They claimed correctly that in an efficient market, every participant is small enough in relative size to have a negligible impact on the price.

But Smith went on to assume - incorrectly - that everyone shares the same psychology and reacts to events in the same way: that market reactions are uniform and instantaneous, without secondary effects. If external events are random and impossible to forecast, according to this erroneous argument, so too are market movements.

The new theory argues that there are groups whose trading decisions are based on different time horizons. The horizon is likely to be seconds and minutes for market-makers, hours and days for

speculators, months and years for treasurers and portfolio managers.

The trading horizons are of huge importance. They determine how individuals weight events.

The various groups react differently, thus giving rise to a potentially predictable pattern of secondary reactions, as the impact of the primary event feeds through the system. A market can return to apparent normality within a few hours of a 20-minute burst of extreme volatility. But it may take as long as a month for the underlying volatility to disappear.

Participants in today's financial markets have access to a flood of undigested price information and a huge supply of news distributed over television, internet sources, newspapers, intelligence briefs and so on.

But there is no systematic evaluation of the dynamic evolution of markets, comparable to a large-scale weather forecasting model. Participants have no access to more subtle information about relative price changes as perceived by the trading groups with the different time horizons.

To improve the information processing, we have to build a global early warning system that collects and analyses all relevant information. It would operate like a weather forecasting computer that processes millions of data points every day to provide a consistent overview.

We have to collect tick-by-tick market data systematically round the world. No one is doing so at the moment - not even the large data providers, central banks or other government institutions.

Then we have to process this data in an online information system that computes, among other things, a scale of market shocks for all the global markets and their sub-sectors, including the big companies.

The scale of market shock is best compared to the Richter scale for earthquakes. It measures the impact of fundamental and economic shocks and provides a consistent framework to evaluate the significance of events. The scale is computed by analysing the volatility observed by participants trading with different time horizons, from minutes to months.

For example, if participants had access to the scale of market shock, they would have been aware of the fragility of the yen-dollar rate prior to the dramatic events in November 1998 when foreign exchanges

came close to melt-down. If this information were assembled for every market and its financial instruments, it would provide a kind of X-ray of the health of the markets.

The proposed online global early warning system would generate a market "weather map". It would evaluate the probability of future market volatility and the expected direction of market moves.

Finance departments at universities around the world could be enlisted to develop a global early warning system. They have a large inflow of students eager to work in the exciting new field of high-frequency finance.

The institutes would set about preparing the market data and doing the groundwork necessary to implement the analytical tools required. A co-coordinating centre would operate the global early warning system, consolidate the information processed by the finance departments and offer it as a public service to news media, governments, companies and private individuals.

The first generation of the online global warning system would comprise financial market information on approximately 10,000 financial instruments traded around the world, from currency exchange rates to interest rates, stock indices and commodity prices. In a second generation, the coverage would be expanded to as many as 1m instruments traded worldwide.

In the longer term, a derivatives market could be created, based on the scale of market shock. Companies could then hedge their commercial risks of economic shock by trading the instrument.

We cannot prevent external blows to the financial system but we can make it easier for the world to weather their economic effects.

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