GLOBAL RISK FACTORS

Mikhail A. Rogov

Department of Economics, The "Dubna" State International University,
University Str. 19, Dubna, Moscow Region 141980, Russia
E-mail: rogovm@hotmail.com

Abstract. The paper deals with a problem of solar and geomagnetic activity as global risk factors in financial risk management. The history of the idea of solar – earth relations is rather long (Hershel, 1804; Jevans, 1870 – Theory of Solar cycles, Chizhevsky, 1920 - Theory of Heliotaraxy; Collins, 1965 etc.), but financial risk management does not use these facts really and this paper may help to demonstrate some new risk management tools based on new results of the author's studies (Rogov 2003).

Keywords: global risk factors, financial risk management.

1. Global risk factors

"Global risk factors" is a name, given here for such risk factors, which have global character, and really it's possible to say that these factors include or correlate to solar and geomagnetic activity. Though most of business cycles theories may be incorporated into such global risk factors, there is no assumption of such and any other truthful but rather artificial factors. But it's enough to work with them for risk management.

It's possible to offer original main scheme for the problem:

Global natural factors, which correlate to solar activity and geomagnetic activity → Some kinds of operational risks → Some kinds of credit risks → Some kinds of market risks

1. Global natural factors correlate to solar activity. Geomagnetic activity depends on solar activity. It's especially interesting that astrophysics showed (Spiegel 1993) that solar and geomagnetic activities look like chaotic (in terms of the chaos theory) processes.

1. Some kinds of equipment is sensitive to solar and geomagnetic activity, magnetic storms may cause failures and crashes, e.g. in pipes, energy and communication systems, computer-based management systems. Modern business, production based on computer technologies, depend on such equipment and such failure problems very much. Geomagnetic storms and other deviations may cause heart attacks, mental problems and other health troubles, conflicts, incorrect management actions and decisions. Last problems were usual for all kinds of economics in past and present. All these problems cause financial and other losses and so they are some kinds of operational risks factors. Especially important to underlay that we cannot really watch incorrect management decisions and future losses in current data sometimes, so operation risks may have a latent form too.

2. Because of losses and incorrect management decisions, caused by above-mentioned operational risk factors, organizations may meet financial problems after some time lag. That is why some kinds of credit risks, e.g. business failures risk and bankruptcy risk depend on operational risk factors (maybe with a lag).

It's important to say that even hypothetic organization A is indifferent to operation risk factors, the ones may cause operation business process troubles in another organization B, and the organization A may have problems with it's negotiations with the organization B, so operation risk factors of the organization A depend on the organization B's sensitiveness to these kinds of risks. Global risk factors may cause credit risks for every firm or individual, it's not depend on operational risk sensitiveness of the same firm or individual to such factors.

3. Because of mass changes in operational and credit risks, caused the same global factors, market risk premium has to meet deviations. Movement of interest rates includes the global risk factors effect. These rates are used as discount rates for assets evaluation that is why asset global risk factors effect play important role for all economics. These two facts that the nature of most of kinds of risks (global risk factors) is related to solar and geomagnetic activity (1) and, the activities have chaotic character (2) may help us to find out the natural base for explanation of the chaos on financial markets which is discussed widely (Peters 1996). Additional reason is that during geomagnetic deviations periods people have more sensitive intuition, people and infrastructure for market trading have the above-mentioned troubles, and it may play it's role for market expectation too (Krivelyova and Robotti 2003, Rutkauskas 2005). So market risks may include global risks factors.

The discussed solar and geomagnetic activities correlation to operation risks is a well-known fact (for example, in (Jansen at al. 2000) we can see discussion about space weather factors as potential for insurance practice development) and we need not demonstrate it here (Fig 1–4). But it is important to demonstrate possibilities for predictions of some of key economical events and indicators values based on geomagnetic activity data. The correlation is rather high for large time periods and the estimated parameters look sufficient, but we do not present here any standard statistical analysis description because the offered following graphs look much more effective for predictions.
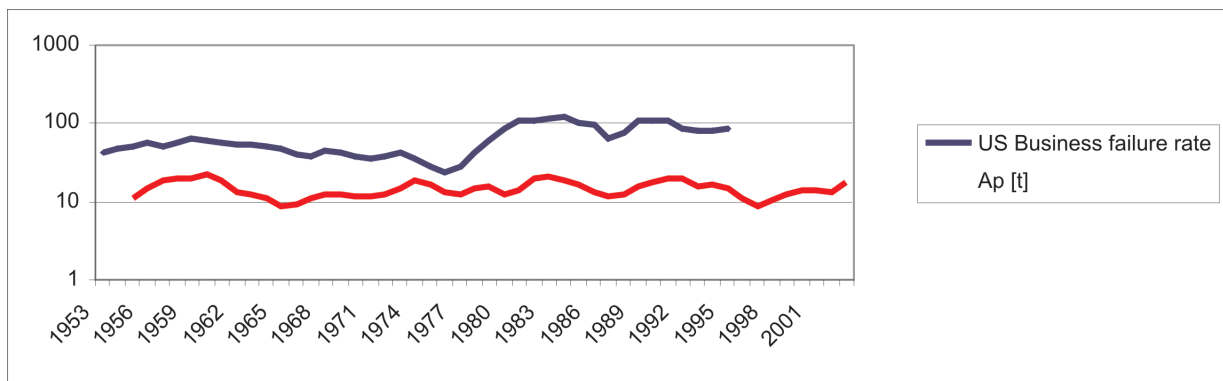
1.1. Credit risks

Fig 1. Yearly time series: US Business Failures Rate (source: Dun & Bradstreet, D&B) and moving average geomagnetic activity index Ap [t]
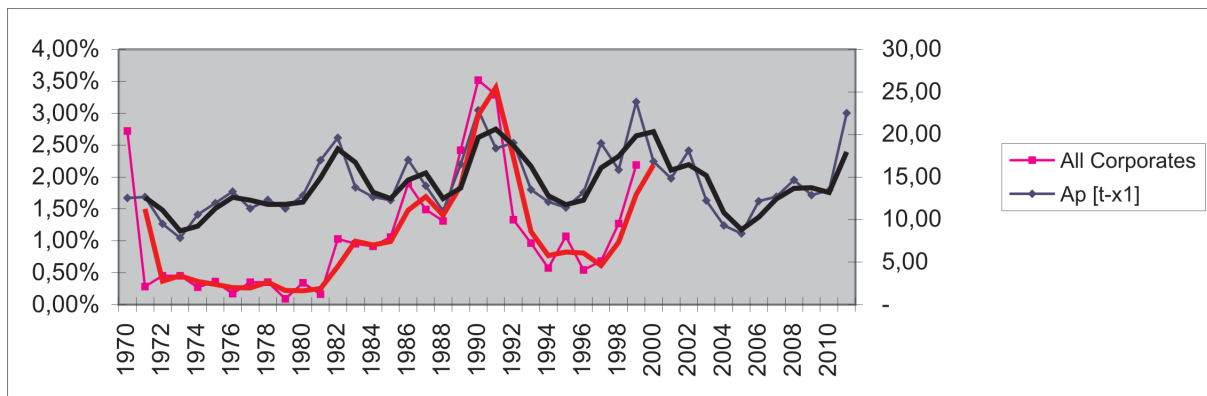

Fig 2. Yearly time series: Moody's Year Default Rate (for all corporates, source: Moody's) and geomagnetic activity index Ap [t-x1] – with time lag x1 and their moving averages
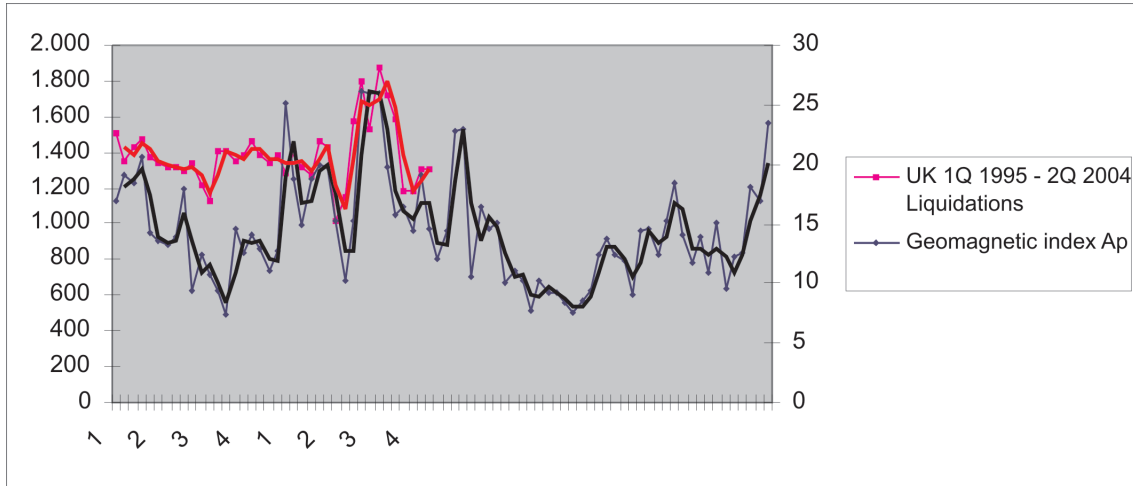
Figure 3. Quarterly time series: Number of liquidations of UK companies for period of 1Q 1995 - 2Q 2004 and geomagnetic activity index Ap [t-x2] – with time lag x2 and their moving averages

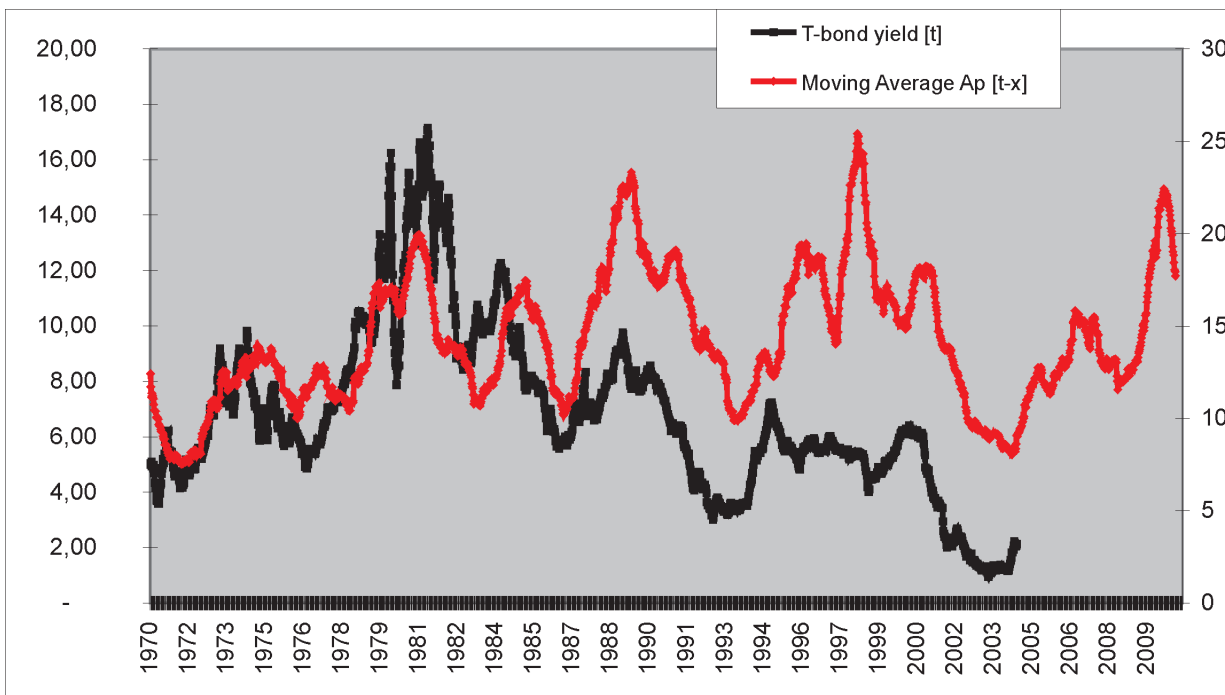## 1.2. Market risks: e.g. Interest rate risk

Fig 4. Weekly time series: US T-bond average year yield and moving average geomagnetic activity index Ap [t-x] - with lag x

2. Risk management based on global risk factors

1. First of all, it's possible to take into account these factors for predictions and risk analysis. This information should be used both in portfolio management and in actuarial calculations too. There are two moments:

1) Sometimes rather great time lag allow make rather long forecasts.

2) Factor of geomagnetic coordinates (magnetic latitude, declination etc.) may be studied as parameter during regional risks analysis.

The strength of correlations between events and solar and geomagnetic activity depends on geomagnetic

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coordinates, which are changing with time. Factor of geomagnetic coordinates (magnetic latitude, declination etc.) may be studied as parameters during regional risks analysis.

For example, countries with high absolute values of magnetic latitude (e.g. Finland, Canada etc.) usually show higher correlation between bankruptcies numbers and geomagnetic index than states of low absolute values of magnetic latitude (e.g. Austria, Switzerland etc.).

2. We can more effective diversify credit, market and operation risks caused by the same global factors. Fore example, if we know about road accident correlation to geomagnetic activity and about credit risk correlation to the same factor, we may test correlation between these operational and credit risks. In some cases the correlation is rather great. If we make a portfolio of car insurance and credit banking, we may find the optimal structure for risk diversification etc.

3. We can manage both credit and market risks and some kinds of operation risks by means of market derivatives or other hedge instruments. It's an absolutely new result for operation risks. It's common opinion, that operation risks cannot be hedged. Recently in (Hyman 2001) perspectives for hedging energetic failures by derivatives on magnetic indexes discussed. But, firstly, if we use other risks correlation, we may build some hedging strategies with existing market instruments, for example, we may try to hedge operation risks by interest rate derivatives. And secondly, we may really use new derivatives (index futures, options etc.), such as "solar" derivatives or others, based on solar sun spot numbers (Wolf numbers) or geomagnetic indexes or other indicators for hedging both operational (not in energy business as offered in (Hyman 2001) only) and credit and market risks too, as described in author's of the paper invention, successfully patented since November, 2002 (Rogov 2004). The world weather derivatives market (based on air temperature index) turnover was of 4,6 billions US dollars nominal value for 2003/2004 year. So perspectives of the solar derivatives look rather great too.

4. It's possible to apply financial mathematical apparatus of beta and alpha analysis of financial assets (CAPM etc.) with another manner: as a factor of systematic risk may be used geomagnetic index etc.

Finally it's possible to suppose that the offered tools based on global risk factors may be effective direction for new modern econophysics-based risk management.

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