ARE UNDERWRITING CYCLES FORECASTABLE? ARE THEY STATISTICAL ACCIDENTS?

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What do we mean by a cycle?

- It appears that the ratio of losses incurred over premiums earned (Loss ratio) cycles over many periods, even if we take into account operation expenses as a ratio of premium written (Combined Ratio).

Table 2

AUTOMOBILE INSURANCE LOSS RATIO REGRESSIONS FOR SIX MAJOR NATIONS

	a(0)	a(1)	a(2)	Time	R-SQ	Cycle Period
Canada*	1.297	0.851	-0.635	-0.014	0.78	6.24
		5.012	3.764	3.985		
France	0.696	0.946	-0.431	-0.007	0.90	8.20
		4.802	2.612	2.955		
Italy	0.741	1.261	-0.612	-0.014	0.87	9.92
		7.619	4.016	1.320		
Sweden	0.802	0.816	-0.397	-0.001	0.43	7.26
		3.781	2.087	0.150		
Switzerland	1.758	0.445	-0.409	-0.010	0.46	5.17
		2.219	2.242	2.522		
United States	1.347	0.735	-0.653	-0.007	0.73	5.72
		4.816	4.657	3.896		

NOTE: The estimation period is 1957–1979, unless otherwise indicated. The estimation equation is: $CR(t) = a(0) + a(1)CR(t-1) + a(2)CR(t-2) + u(t)$ where $CR(t)$ = the premiums to claims ratio in year t and $u(t)$ = a random error term. All equations were estimated by ordinary least squares. Absolute values of t-statistics appear below coefficients.

*Estimation period for Canada is 1958–1979.

Table 3

Cycle Periods by Country and Line of Insu

Country	Average Loss Ratio	Overall Underwriting Result	Automobile Liability	Fire Allie Los
United States	6.932	7.389	5.948	5.17
Canada	5.537	5.786	5.257	6.09
West Germany	6.448	5.128	5.472	7.81
France	6.700	10.194	5.386	Nor
Netherlands	6.149	12.031	N.A.	5.36
Switzerland	6.869	6.489	5.955	Nor
Spain	None	5.703	9.756	Nor
Austria	None	N.A.	8.596	Nor
Denmark	None	N.A.	4.961	6.21
Japan	18.352	7.066	7.574	Nor
Australia	5.044	5.180	5.298	4.39
Italy	None	4.840	7.529	Nor

Do Cycles Exist?

- Many questions and worries related to the robustness of the results. Indeed, we show that the test statistic used so far is not proper, in particular the impact of the time frame used.
- This is the purpose of this study.

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Historical Perspective

- Notion of an underwriting cycle is well-anchored in the minds of practitioners
  - a 2002 European Commission study affirms that "in the non-life insurance market one of the major market drivers is the insurance cycle";
  - One can even read on Wikipedia (http://en.wikipedia.org/wiki/Insurance_cycle, consulted last on 13 July 2012) that "the insurance cycle is a phenomenon that been recognized since at least the 1920s. Since then it has been considered an insurance fact of life".
  - In Lloyd's Annual Report 2006, one can read that "there is an increasingly complex underwriting cycle, where loss trends and market forces are driving cycles with characteristics that differ by line of business and territory".
  - In a McKinsey 2008 report, one can read that "reliance on the cycle and expectations of its implications for underwriting and profits are common across the P&C insurance industry" See also Clark (2010), as cited in Wang et al. (2010)
  - One can read in Lloyd's 2007 Survey of Underwriters that "for the third year running, underwriters in the Lloyd's market have identified managing the cycle as the most important challenge for the industry".

Historical Perspective

- Notion of an underwriting cycle is well-anchored in the minds of practitioners **and academics.**
  - Winter (1991, p.117): "the existence of cycles in insurance markets is a central topic of insurance literature".
  - Doherty and Garven (1995, p.383): "insurance markets are cyclical"
  - Derien (2008, p.1): "the presence of the underwriting cycle in non-life insurance is well established"
  - Wang *et al*. (2010, p.7): "the existence of the underwriting cycle is undeniable"
  - Lamm-Tennant *et al.* (1992, p.426) "the well-known cyclical pattern in loss ratios"
  - Chen et al. (1999, p.30): "existence of an underwriting cycle has been recognized by researchers"
  - Harrington and Niehaus (2001, p.658): "conventional wisdom … is that soft and hard markets occur in a regular cycle, commonly known as the underwriting cycle"
  - Meier (2006a, p.65): "there seems to be a wide consent in the insurance cycles literature ... that the American insurance industry can be characterized by cycles"
  - Fitzpatrick (2004, p.257) : "there are, in fact, as many underwriting cycles as there are products in the property and casualty insurance market"

Possible Interpretations and/or rationales

- Forecasting errors (Venezian, 1985)
- Insurer moral hazard (Harrington and Danzon, 1994)
- Arbitrage theory (Cummins and Outreville, 1987)
- Risky debt (Cummins and Danzon, 1997)
- Interest rate variation (Fields and Venezian, 1989)
- Capacity constraints (Gron, 1994, Niehaus and Terry, 1993, and Winter, 1994)
- Behavioural pricing by underwriters (Ligon and Thistle, 2006, and Boyer, 2006).

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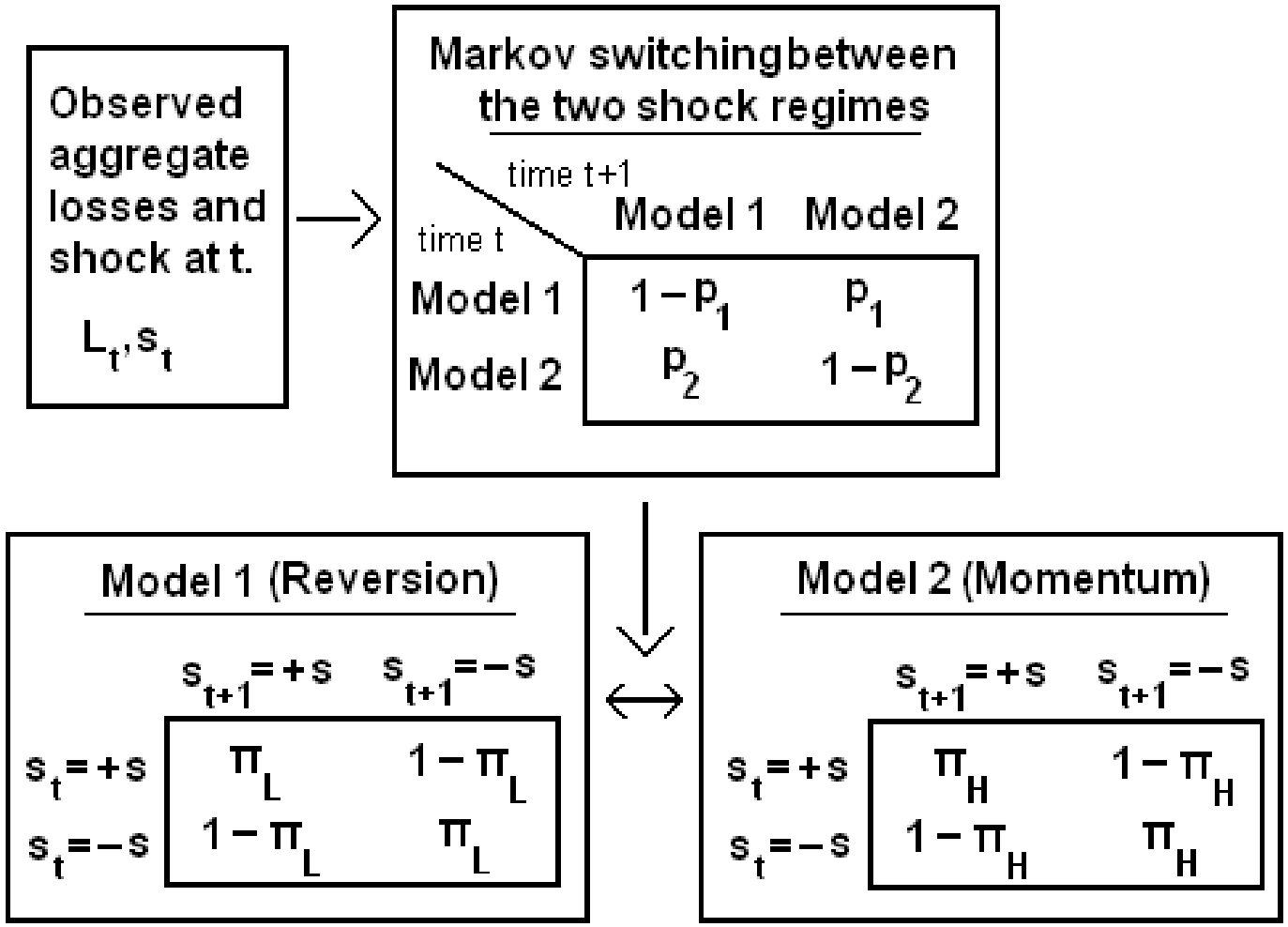
- A little on this paper of mine!

What kind of irrationality?



The **real world** is defined as a random walk (+s, -s, ½).

Premium equal to expected future loss; what is that expectation (reality: $E_t(L_{t+1})=L_t$)?

Underwriters believe losses follow a reversion process or a momentum process.

Markov switching process in three matrices.

Macroeconomists have no problem with this when looking at interest rates… should we?

Research strategy: Simulation

- For now, only the only variable in the model is the shock to losses in a DCF insurance pricing model.
- The "empirical model" is relatively simple, but it allows for a lot of insight as to what induces underwriting cycles in the economy. For now, only the only variable in the model is the shock to losses.
- The Excel simulation results show that cycles are more likely when underwriters behave « irrationally » than when they accept the random walk of losses.
  - Basic simulations with this model allows to find « artificial cycles » in 2/3 of cases, and the period of the average cycle is about six years.
  - Both statistics « fit » with previous research on the topic.

- Search costs and search probability.
  - If consumers do not shop around, why would an underwriter not behave « irrationally » if this irrationality pays off?
  - Could it be rational to be irrational?

Coming back to the current paper

- Speculative efficiency requires that future changes in a series cannot be forecast.
- In contrast, series with a cyclical component would seem to be forecastable, with decreases (perhaps relative to a trend) during the upper part of the cycle and increases during the lower part.
- It is therefore crucial to determine the robustness of the evidence of cyclicality and predictability.
- The method of estimation (basic OLS in most studies) is consistent with that of a Bayesian who has diffuse priors on the coefficients estimated. While this may sound reasonable at first, it can be shown to result in an overstatement of the existence of a cycle.
- So the classical econometrician inadvertently starts the analysis with strong prior in favor of the existence of a cycle. To remedy this, especially on the short samples available, one needs to compare the posterior density of the period with the prior density implied by the priors on the parameters.

Theory of Cycles

- **What needs explaining?**
  - Shocks are triggering mechanisms and are not inherently "causes" of cycles so that a rational expectations market could exist with shocks but no cycles
  - Boyer et al. (2012a) find that any evidence of underwriting cycles in the property and casualty insurance market could simply be spurious because the naive prior is that cycles exist.

$$y_t = \beta_0 X_t + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \varepsilon_t$$

$$\left.\begin{array}{l} \beta_1^2 + 4\beta_2 < 0 \\ \\ \beta_2 > -1 \end{array}\right\} T = \frac{2\pi}{\arccos\left(\frac{\beta_1}{2\sqrt{-\beta_2}}\right)}$$

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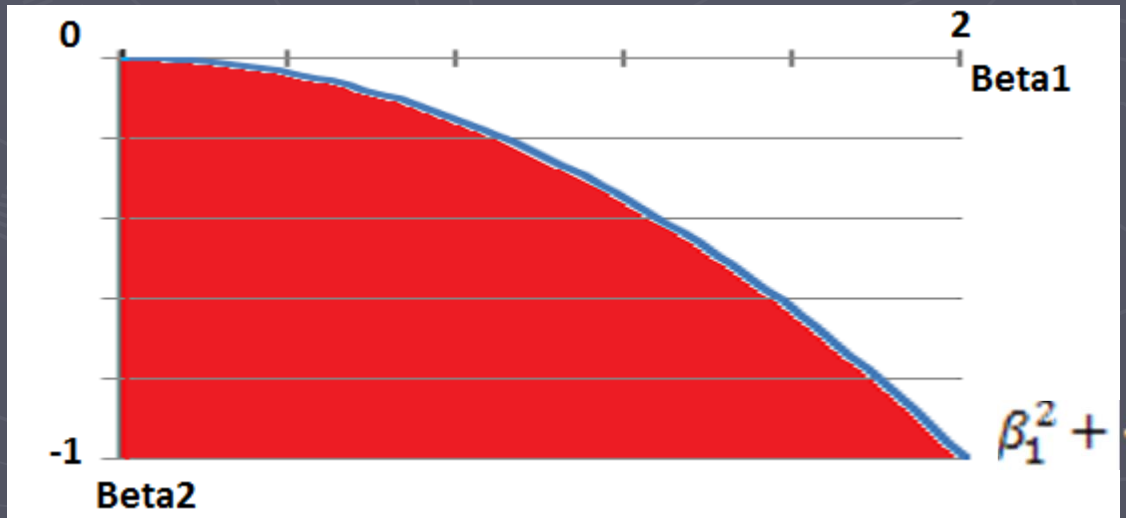

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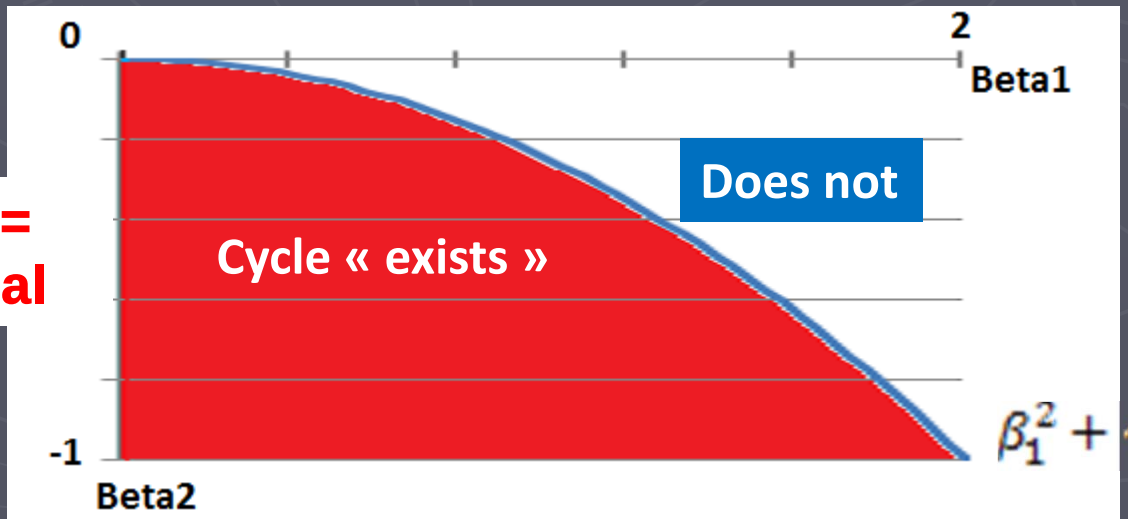
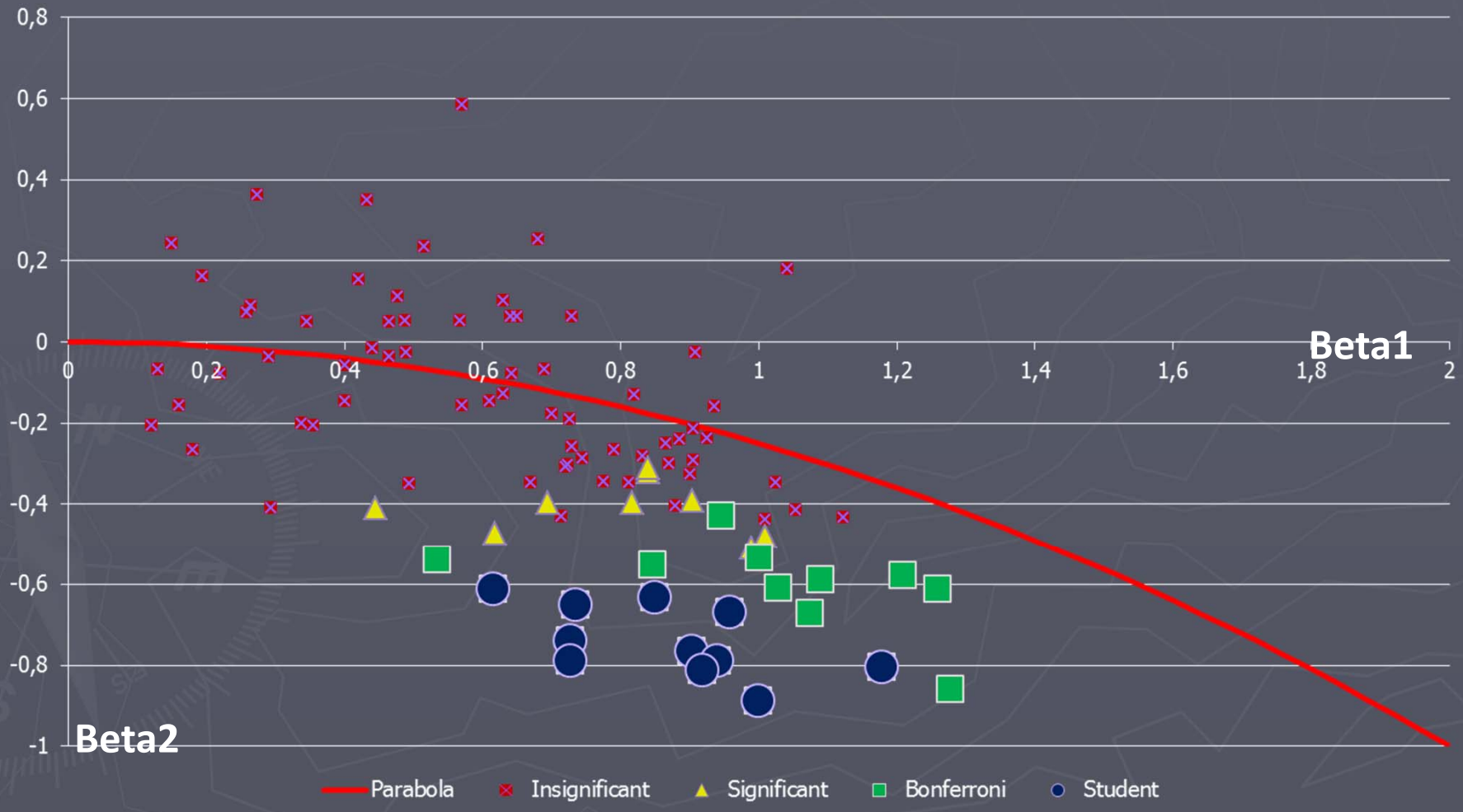


Red area = 2/3 of total

Where are the cycles?



Parameter stability or the importance of an out-of-sample validation

- Predictability is only economically significant if it can be verified out-of-sample.
  - The key is the characterization of the last observations in our sample, and the ensuing out-of-sample forecasts made with the model at hand.
- If the parameter estimates are unstable, this can be very different from the future characterization of this very same day after we have collected subsequent observations.
- In the context of the insurance industry where cycles have always been found in sample, this means that **even statistical evidence of cycles in loss ratios is not sufficient to conclude that the industry is not speculatively efficient**.
- A contrario, we need to demonstrate that contemporary estimates of cycles are sufficiently accurate to enable underwriters to forecast changes in the loss ratios. Absent this, we would not know if prices are going to increase or drop in the future!

Alternative Detrending Methods

- The estimation of the cycle involves a detrending method which decomposes the underwriting ratio, $q_t = \mu_t + z_t$, into a trend component, μ_t, and a cycle component z_t.
- Obviously, the method used to detrend the data has a strong influence on the estimated deviation from the trend. Even though it is simple (and was used in Cummins and Outreville, 1987 and Lamm-Tennant and Weiss), a simple linear time trend is not the ideal way to stationarize data. Alternative methods are often preferred. A simple AR(3) allowing for a unit root might be a preferable alternative, as shown in Geweke (1988).
- We will compare the following eight detrending methods to see which fits worse according to the Diebold-Mariano Tests for Equal mean-squared forcasting error.
  1. Linear Trend
  2. Quadratic Trend
  3. Hodrick-Prescott Filter
  4. Band-Pass Filter (2-8 Years)
  5. Beveridge-Nelson Decomposition
  6. Watson (Local Level & AR(2))
  7. Harvey-Clark (Local Linear Trend & AR(2))
  8. Harvey-Jaeger (Local Linear Trend & Sine)

Results

- Three figures and one table.
- Figure 1: Forecasting error.
- Figure 2: Real-time cycles.
- Figure 3: Rolling cycle estimates.
- Table: Diebold-Mariano Test.

Apophenia and Pareidolia

- "There is a universal tendency among mankind to conceive all beings like themselves, and to transfer to every object those qualities with which they are familiarly acquainted, and of which they are intimately conscious. We find human faces in the moon, armies in the clouds; and by a natural propensity, if not corrected by experience and reflection, ascribe malice and good will to everything that hurts or pleases us."
  - David Hume (Section 3, 1757)
- We observe cycles because we try to find pattern in randomness. In essence, we find cycles because we are looking to find them.
  - Apophenia is the experience of seeing meaningful patterns or connections in random or meaningless data; a human tendency to seek patterns in random information

Conclusion

- Macroeconomists have developped many statistical techniques to assess and predict the economic and/or business cycle. When we apply the most basic of these techniques to test and measure for the presence of cycles in insurance, we come to the conclusion that the loss ratio is not predictable (in finance-speak, the loss ratio is a martingale).
- This does not mean (YET) that cycles do not exist; it does say, however, that we should not care.
- Forthermore, the fact that some researchers have found evidence of underwriting cycles in many different countries (but not all) and in many different lines of business (but not all) may only be a nice example of the man-on-the-moon fallacy. In other words, we are looking for a recognizable pattern where there is nothing but randomness.