

Sting in the Tail – Contagion and Liquidity Modelling

Risk Forum European User Group

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*Risk modelling will lose popularity. Because **most techniques** used to model risk in financial institutions **are backward looking** (in the sense that they rest on historical data), **they are essentially useless in times of fundamental structural change** - such as the markets are undergoing now. Elaborate modelling formulas for options and other complex financial derivatives, which are useful for dynamic hedging under normal circumstances, are of little use when transactions cannot be made without huge price concessions. Stated differently, **most models** rest on assumptions about normal, rational financial behaviour – and, therefore, **lose their predictive power during times of financial euphoria or panic.***

Grumpy Old Bankers
CSFI, 2009

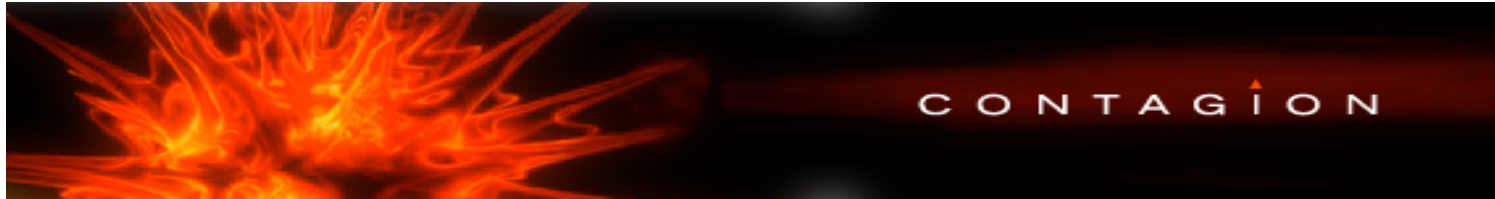
*When it comes to risk management **during market crises, the usual economic linkages and historical market relationships do not matter.** Rather, what matters is who owns what, and who is under pressure to liquidate. These dynamics are not part of institutions' risk management models. So, **the very time risk measurement is most critical, the models fail to deliver.***

Richard Bookstaber, *op. cit.*

- Pricing: Credit Derivatives & Measuring Concentration Risk
 - None of the market models adequately measures the full economic cost of exposure concentrations
 - The factor model approach (and especially the copula approach) do not capture the dynamic nature of the inter-relationships
 - ‘all correlations go to 1 in a downturn’
- Risk Management
 - VaR Models predict the future based on past data
 - *We are seeing things that were 25-standard deviation events, several days in a row*

David Viniar, Chief Financial Officer, Goldman Sachs
Limitations of Computer Models,
Financial Times, 14-Aug-07
- Liquidity
 - Capturing Herding Mentality
 - Liquidity black holes

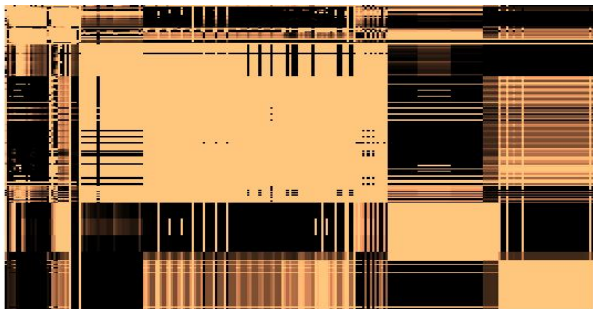




- Assumption of normality
- Multiple tail dependencies/fat tails
- Structural shifts in market parameters
- Identifying stress patterns
- Movements in market regime states

"...if one tortures a dataset long enough, it will confess to anything!"
- Andrew Lo

- Each of the 2^N components represents a possible combination of distress states
- We need to determine how often each state occurs in the market data
- **PROBLEM: THIS IS A VERY LARGE NUMBER even for moderate N!**
 - 5 risk factors $2^5 = 32$
 - 10 risk factors $2^{10} = 1024$
 - 30 risk factors $2^{30} = 1073741824$
 - 100 risk factors $2^{100} = 1267650600228229000000000000000000$
- There are too many parameters to determine! We need a smart approach.

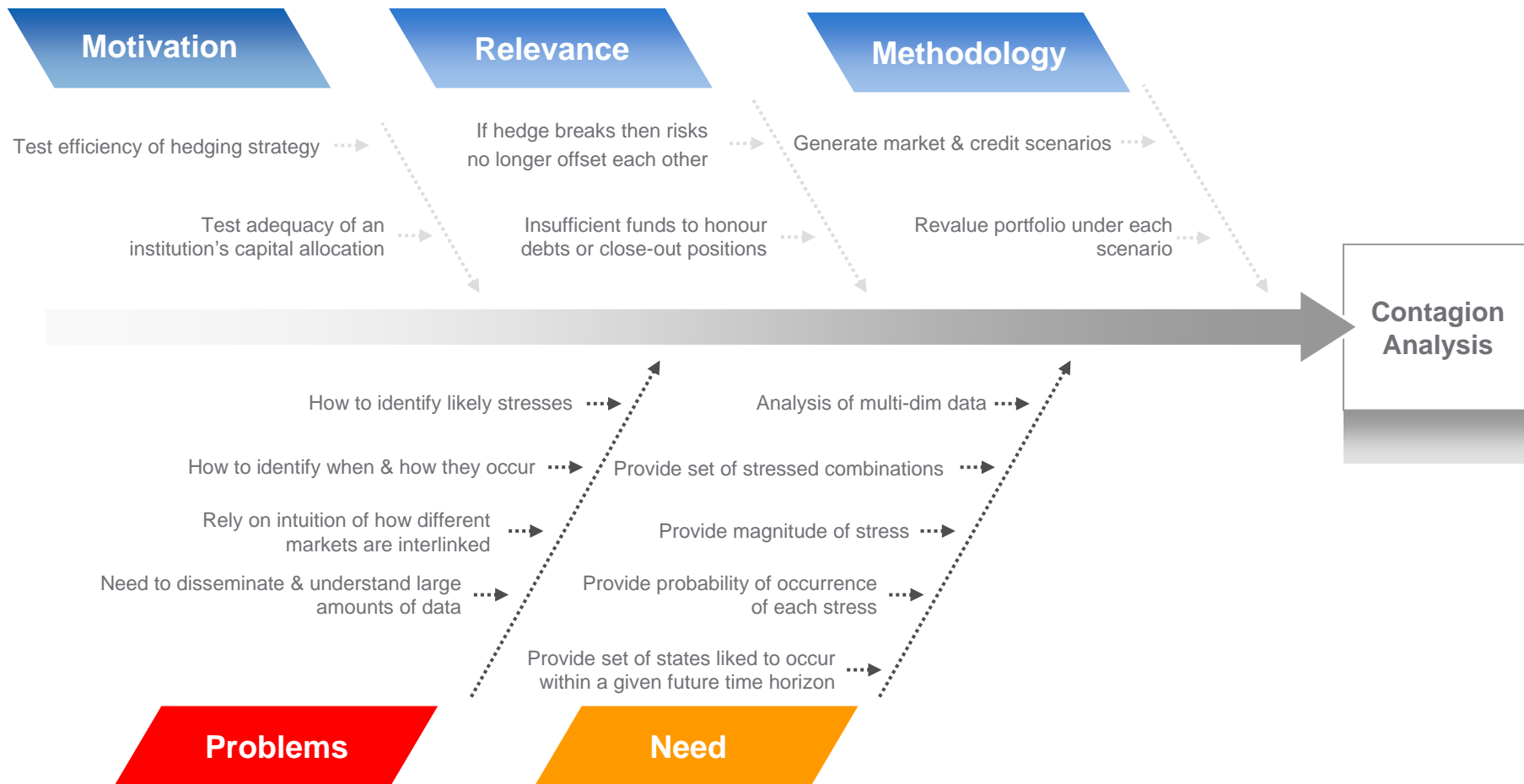


We have designed a proprietary pattern analysis routine that determines the multivariate probabilities consistent with

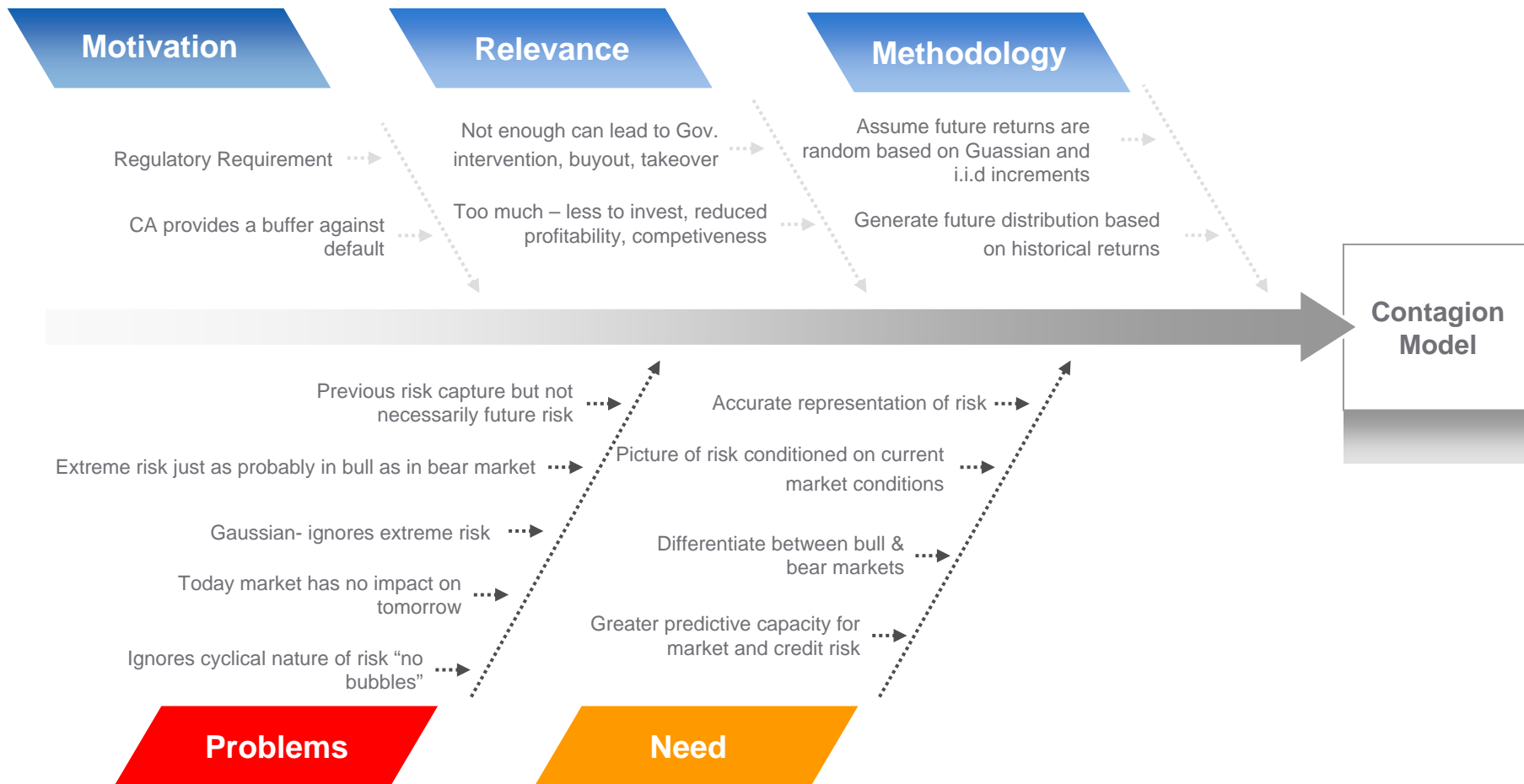
- A matrix of bivariate tail-dependencies (for each unique risk factor pair) as implied by
- empirical correlations

Need information before the crisis!

Risk Manager – Stress testing (worst case scenario analysis)



Risk Manager – Determining Capital Allocation (CA)



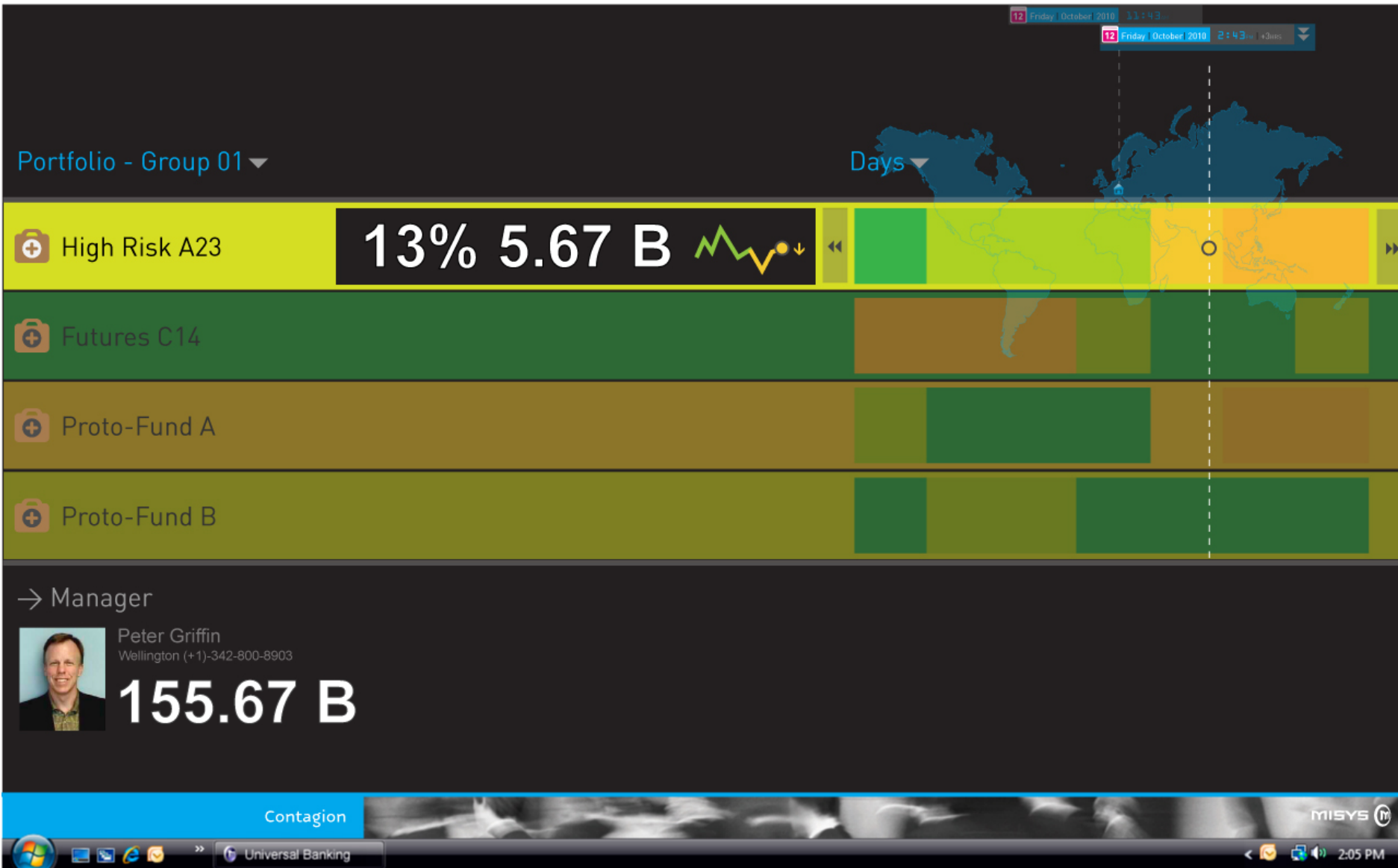
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- New guidelines recommend a 3 month liquidity horizon
 - Impacted by the calculation of PDs – Through-the-cycle-defaults
 - State-based view of the market
 - Conditional probabilities infer set of modified mean default probabilities conditioned upon and immediately responsive to market factors.

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- Captures extreme value risk
 - Hidden Markov-Chain tail switching model
 - Better predictive power

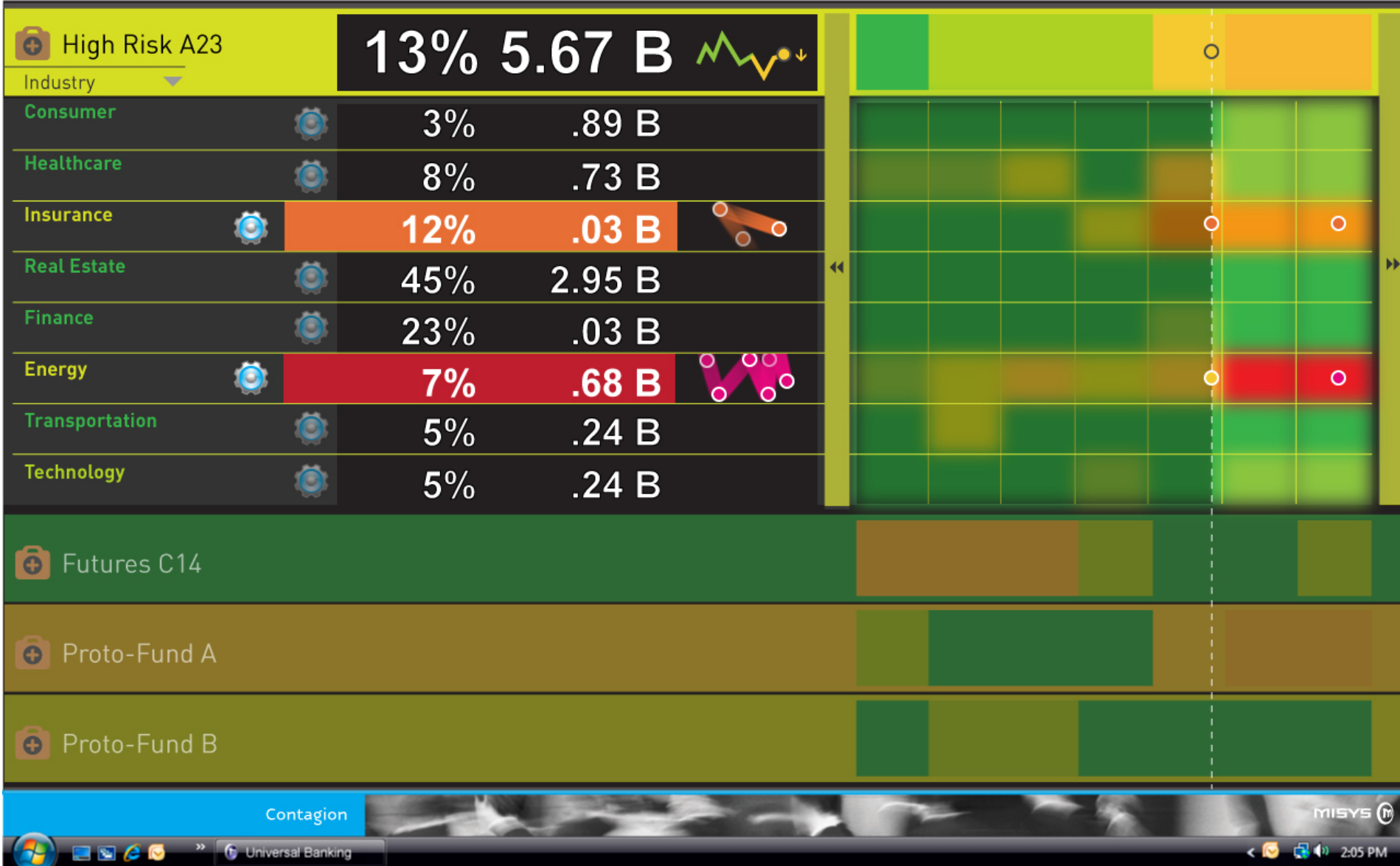
Contagion Screen Shot Regime States (Past & Future)



Contagion Screen Shot – Portfolio Drilldown



Contagion Screen Shot – Drilldown into High Risk Portfolio



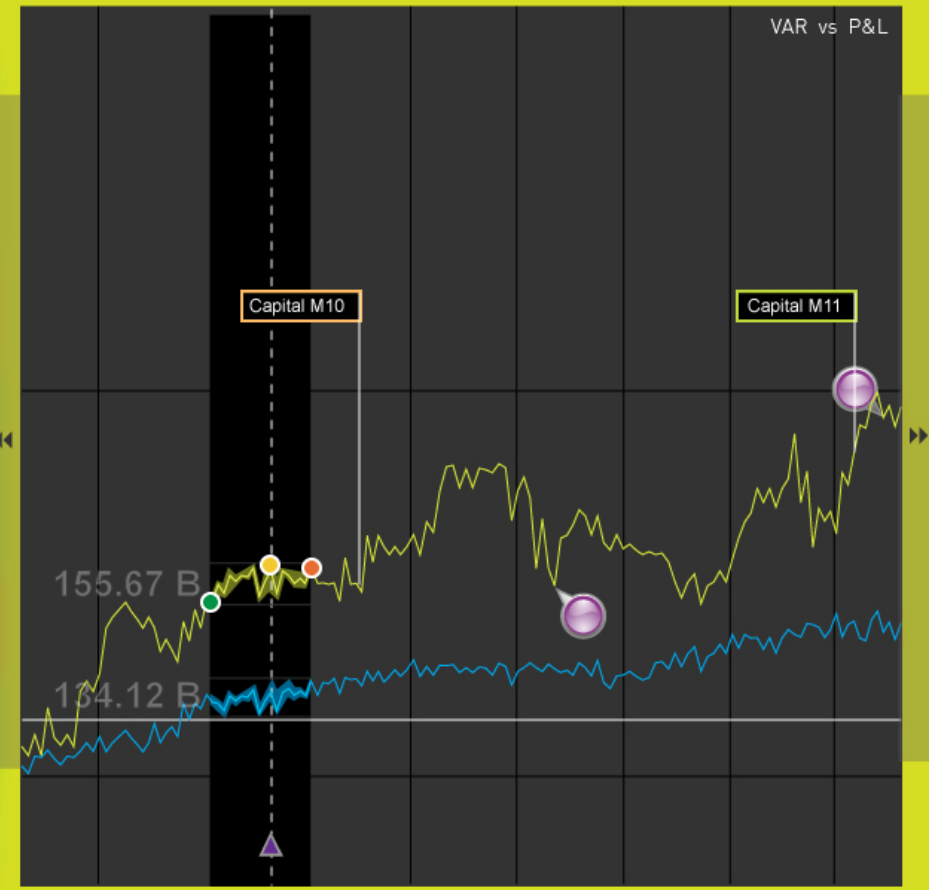
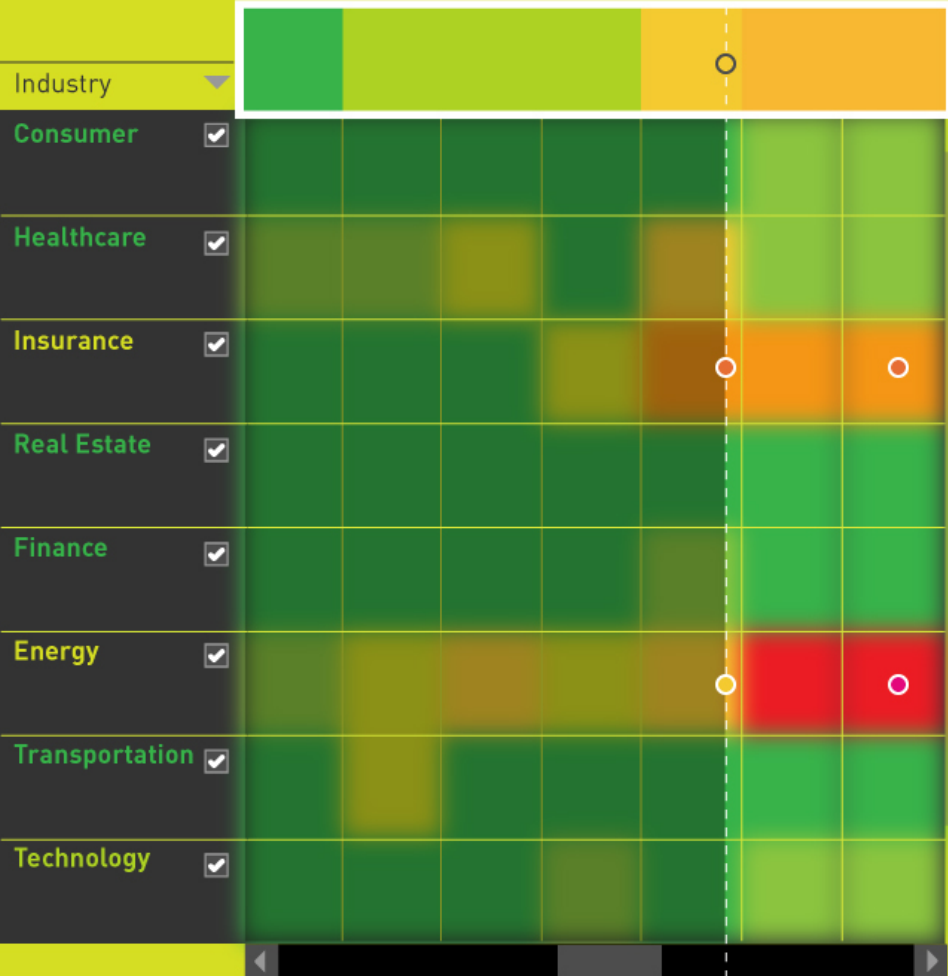
Contagion Screen Shot – Var & P&L drilldown

High Risk A23

Forecast 1

Save As...

Save



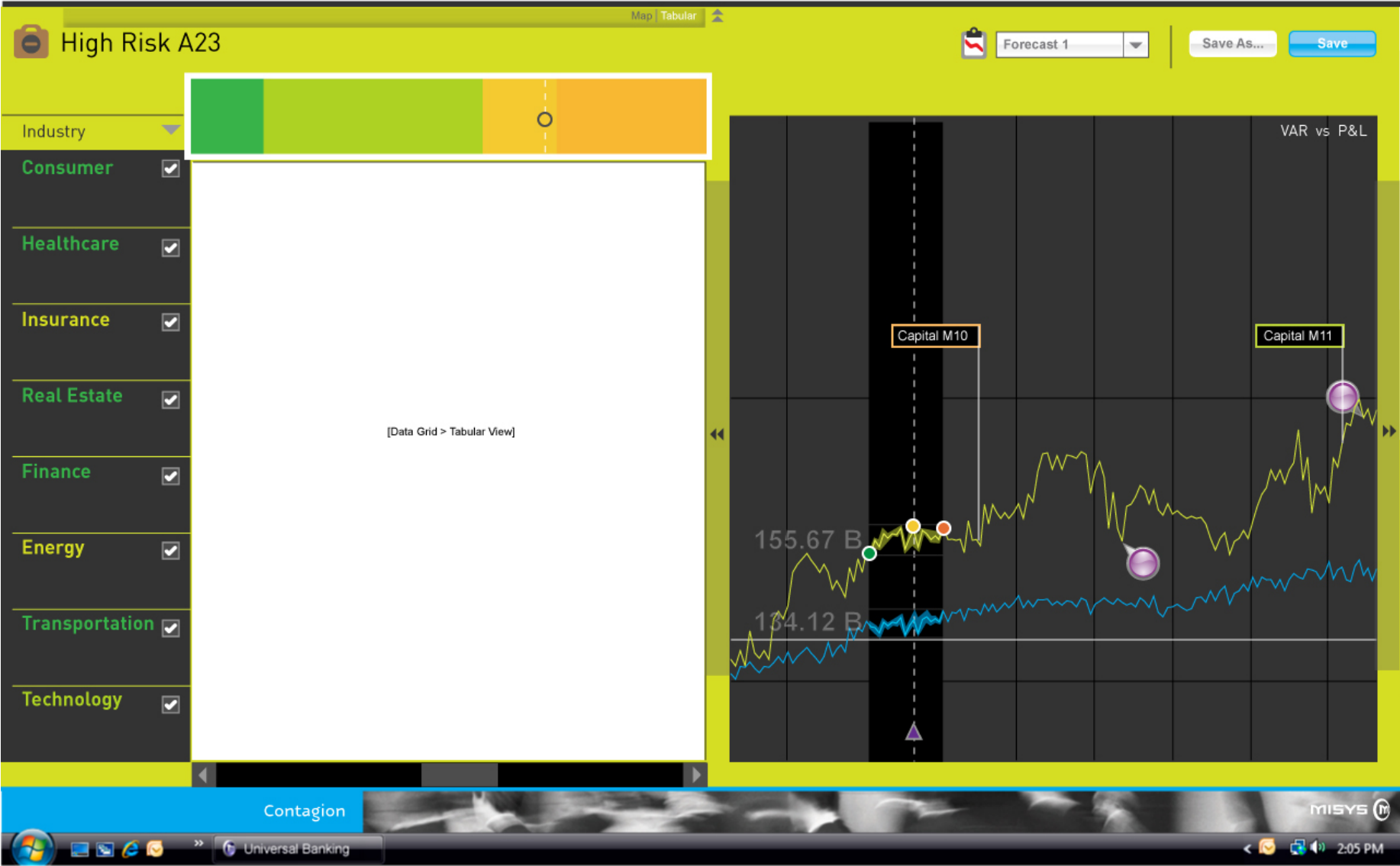
Contagion

MISYS

Universal Banking

2:05 PM

Contagion Screen work in progress tabular & graphical display **MISYS**





experience, solutions, results