

Conférence-débat inaugurale :

*De Pygmalion à Frankenstein ?  
Modélisation des risques financiers, pertinence et résilience*

Nassim Nicholas Taleb

*Distinguished professor* en ingénierie du risque, *New York University*

&

Jean-Philippe Bouchaud

Professeur de physique statistique et systèmes complexes, Ecole polytechnique

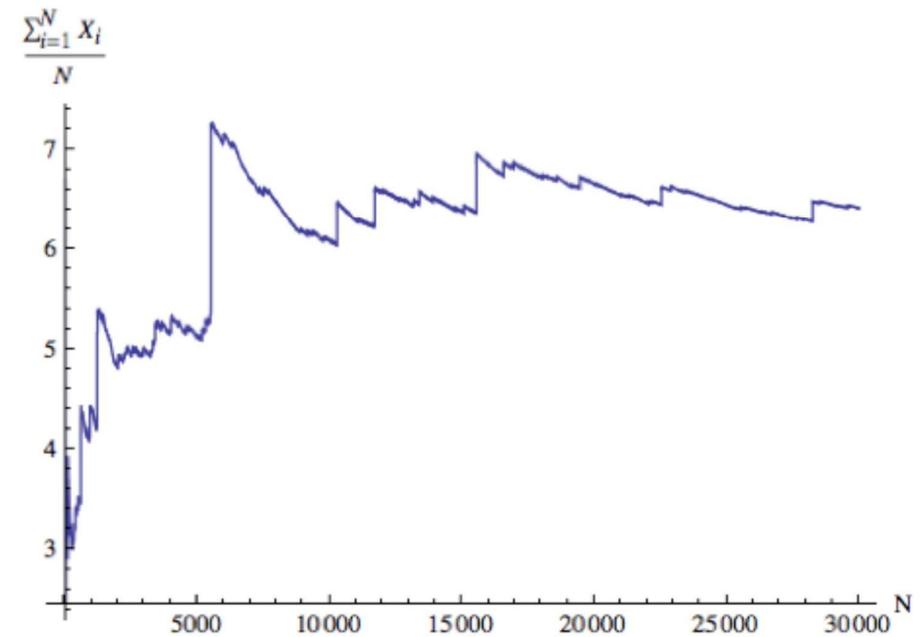
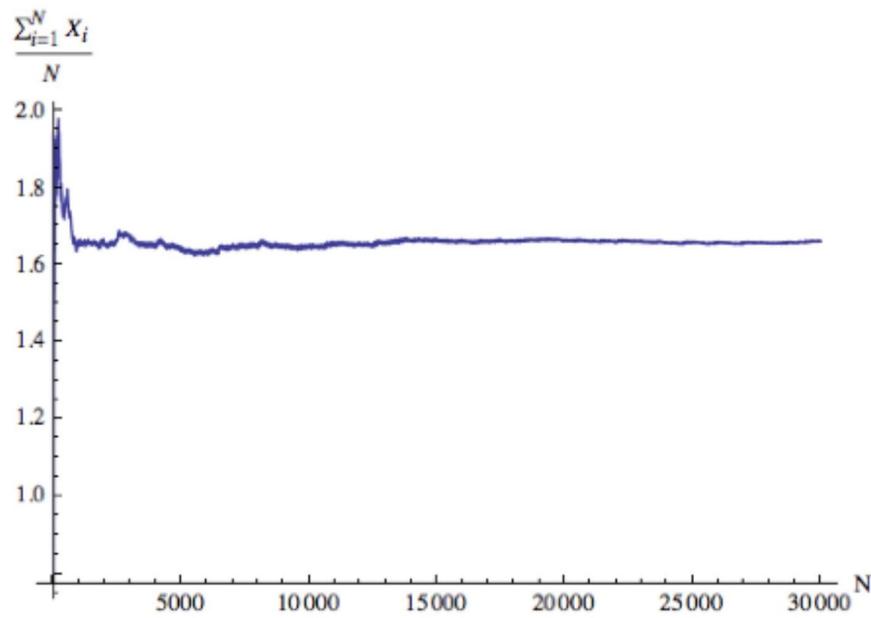
Animée par Sylvestre Frezal, co-porteur de PARI

8 juin 2015

Centre de conférences Pierre Mendès France, Ministère de l'Économie et des Finances



# Lois des grands nombres



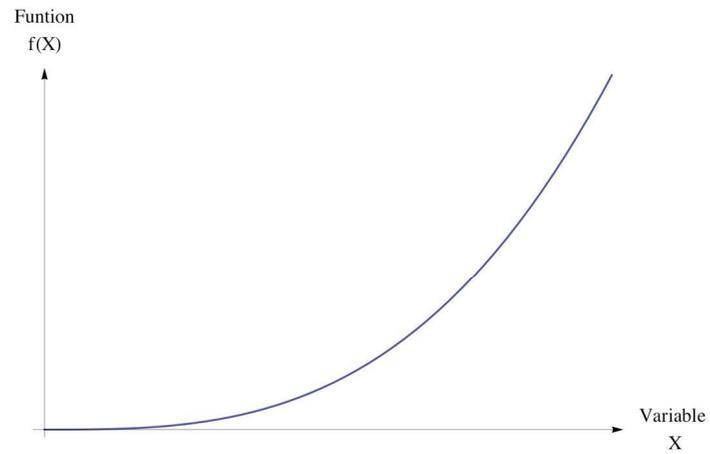
PIERRE DE JEAN  
OLIVI

TRAITÉ  
DES CONTRATS

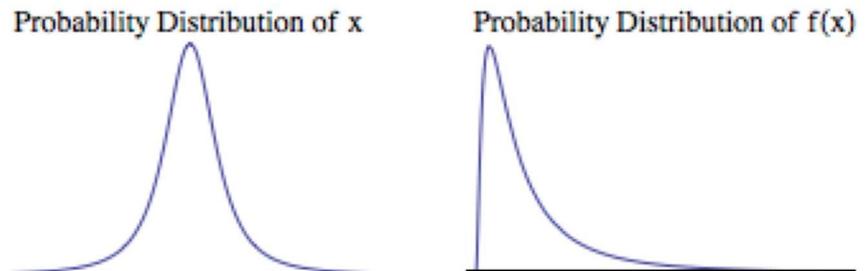


LES BELLES LETTRES

# Conflation Problem

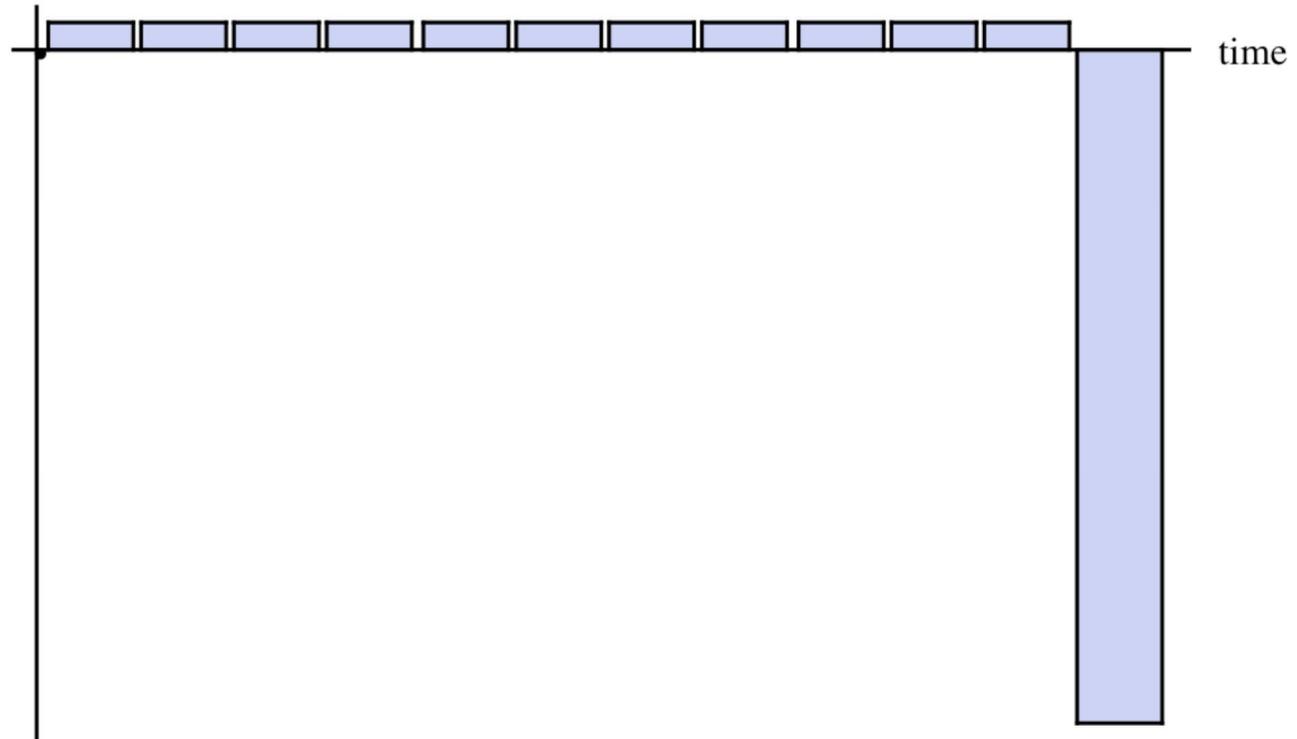


*Figure 1- The conflation problem: mistaking the variable  $X$ , on the horizontal, for  $f(X)$ , on the vertical. The difference becomes significant under nonlinearities (here, convexity).*





Changes in Value



# DISORDER BROTHERS

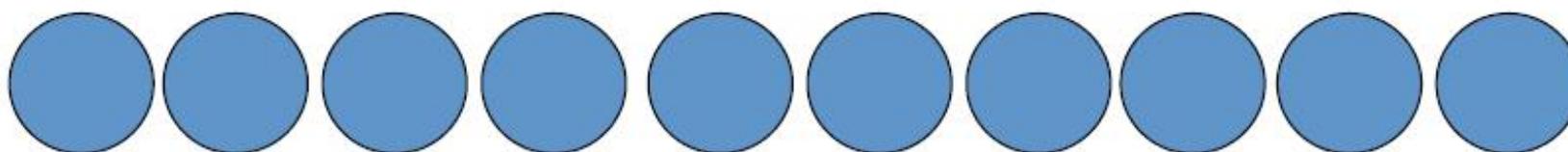
i) l'incertitude, ii) la variabilité, iii) la connaissance incomplète, imparfaite, iv) l'aléatoire, v) le chaos, vi) la volatilité, vii) le désordre, viii) l'entropie, ix) le temps, x) l'inconnu, xi) le chaos, xii) l'erreur

Large May Harm

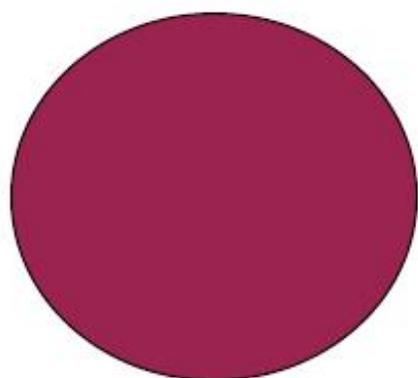


# SIZE EFFECTS -Taleb & Tapiero 2009

€5 bn hidden risk



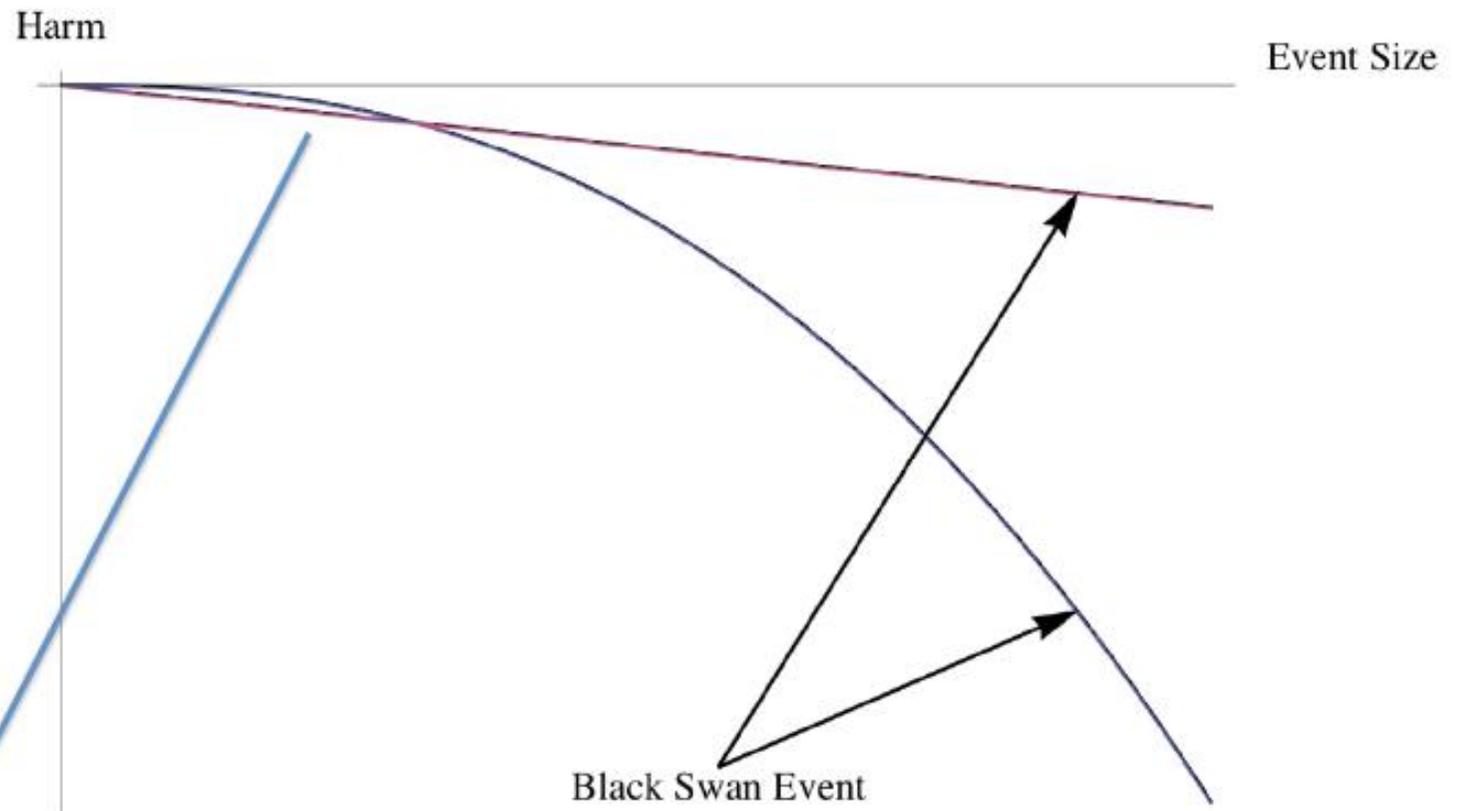
€50 bn



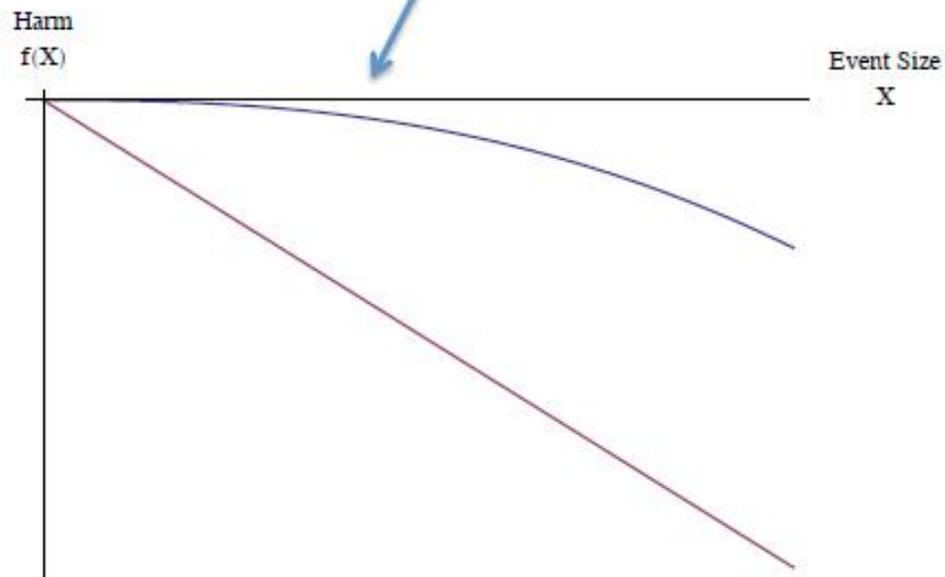
Price Impact



Liquidation Costs  
~ €4 bn



Zoom



A matching linear exposure would be very volatile for small variations.



# A New Heuristic Measure of Fragility and Tail Risks: Application to Stress Testing

*Nassim N. Taleb, Elie Canetti, Tidiane Kinda,  
Elena Loukoianova, and Christian Schmieder*

# Convexity Effects

- *For the fragile, shocks bring higher and higher harm as their intensity increases (up to the point of breaking).*

Jumping 10 times 1 meter harms less than 1 time 10 meter

Times	meters
1	10.00
2	5.00
10	1.00
100	0.10
1,000	0.01
10,000	0.001
100,000	0.0001

# Equivalence

Convexit   $\Leftrightarrow$  B n fici  de la volatilit 

&

Concavit   $\Leftrightarrow$  B n fici  de la stabilit 

**The**  
Economist

The World in 2036

Nassim Taleb looks at what will break, and what won't

Nov 22nd 2010 | from PRINT EDITION [O uke](#)



# Economic & Financial Crises

## The Need for Agent Based, "Third Generation" Models

J.P. Bouchaud, Capital Fund Management

# First generation models

- *A la Bachelier*: Randomness + Central Limit Theorem
  - => Brownian motion, Gaussian statistics
  - => Black-Scholes and the absurdity of “perfect replication” (that understates risk and corrupts intuition)
- **Note**: In parallel, DSGE macro-economic models are linear, and describe stable economies subject to small exogenous shocks
  - => *In the face of the crisis, we felt abandoned by conventional tools* (JC Trichet)

# Second generation models

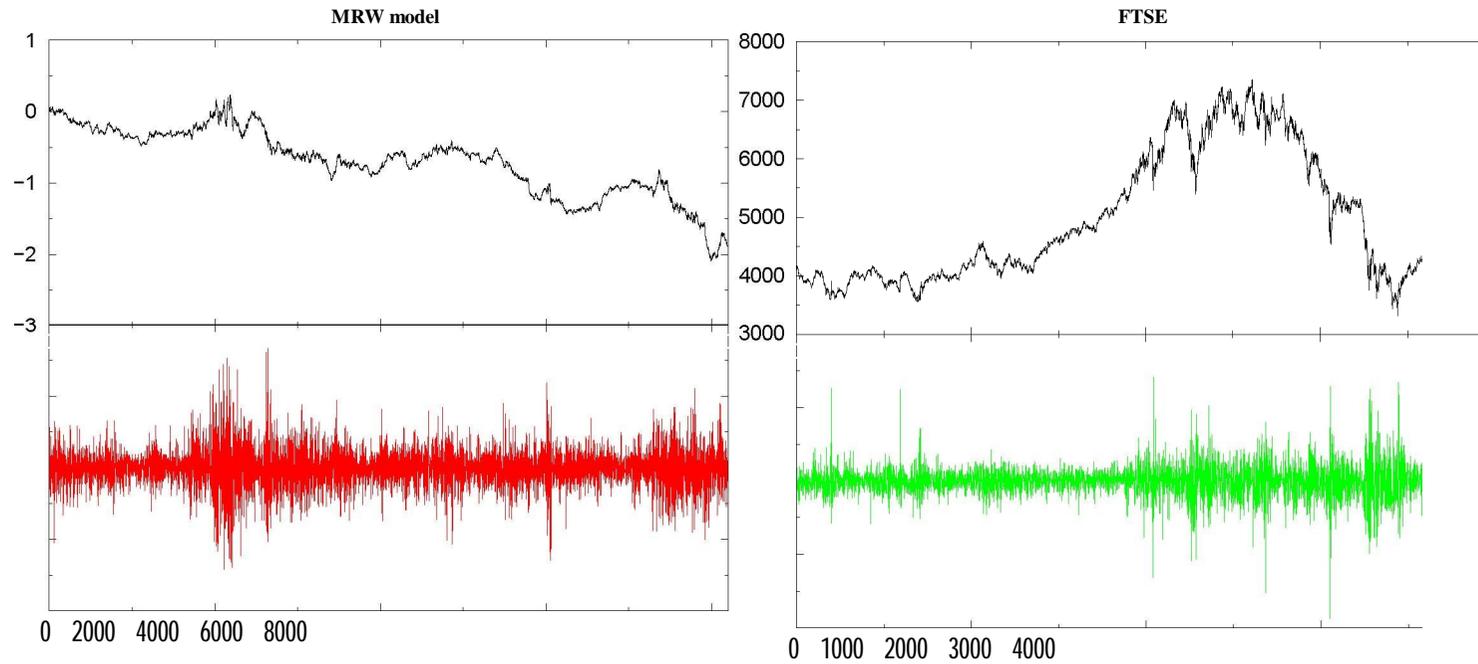
In view of the blatant inadequacies of the Brownian motion, research (after 1987) has moved to “second” generation models:

- (1) **postulate** any process that is mathematically tractable and looks vaguely similar to real data
- (2) **brute force calibrate**, often on so-called “liquid” markets

Examples: GARCH, Heston, Local vol., Levy, Multifractal, etc. , etc. - Same story for correlation models

- **To calibrate does not mean to understand and a perfect fit is not a theory - often a red-herring - cf N. Taleb**

# Multifractal fluctuations



Mandelbrot-Calvet-Fisher 1997; Bacry-Muzy 2000...

# BUT

- None of these models are justified by deeper underlying mechanisms, as e.g. Navier-Stokes is justified by molecular collisions, and parameters can be *computed* from first principles
- Uncontrolled brute force calibration can lead to **absurd results** and **be extremely dangerous**:
  - Errors are amplified in a non-linear way
  - “Liquid” markets are not liquid and are impacted by small trades (see below)
  - “Liquid” markets are not efficient - very little trustable “forward looking” information
  - Black Swans
  - The “local volatility model” is an **extreme example of a “non-model”** - the demise of Theory and blind faith in Market Prices

# The 2013 Nobel Prize in Economics

- **E. Fama**: The word “bubble” drives me nuts, frankly. I don't even know what a bubble means. [...] Prices (in 2008) started to decline in advance of when people recognized that it was a recession... That's exactly what you would expect if markets were efficient. (!)
- **R. Shiller**: Market prices are esteemed as if they were oracles. This view grew to dominate much professional thinking in economics, and its implications are dangerous. It is a substantial reason for the economic crisis we have been stuck in for the past five years, for it led authorities in the United States and elsewhere to be complacent about [...] the instability of the global system.

# We need Third Generation models

- “Third generation” models should identify *mechanisms*:
  - agent based models (what do agents do?)
  - impact (how do trades impact prices)
  - unstable feedback loops (models, calibration, risk/leverage control, regulation, etc.)
- and work **upscale** to
  - *derive* a coarse-grained process with correct fat tails, etc
  - *qualitatively understand* the value of the parameters
  - **capture some Black-Swans** (and account for others using simple rules of thumb - for example analogies)

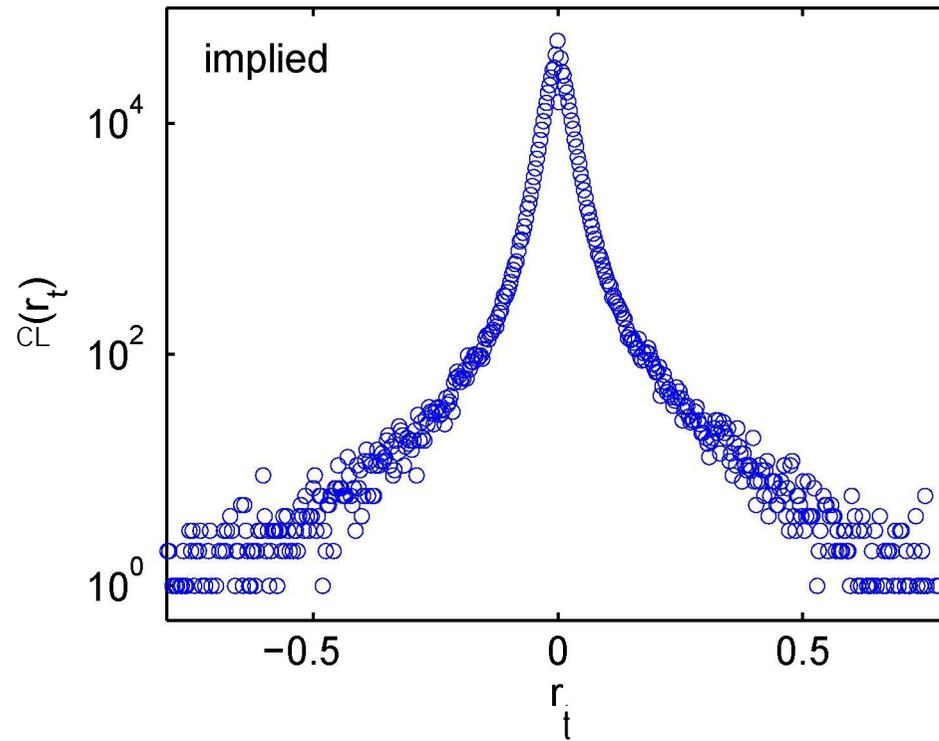
# Impact

- There is nothing like a God given price reflecting “true” value that we merely “observe”
- Markets should be stable in theory, but the volatility of financial markets/large economies is far too large to be explained by “fundamentals” - most jumps come from nowhere
- Impact is crucial to understand what happens in real markets
- Trading, even with relatively small volumes, strongly influences prices and leads to noticeable effects (excess volatility, impact costs) or even unstable feedback loops (Portfolio Insurance & 1987, Flash Crash, etc.)

# Third generation models manifesto

- Interactions, non-linearities and heterogeneities lead to complexity and surprising results
- Coarse-graining lead to the emergence of some **universality**
- Mathematics are often too hard and simulations are needed: *Done properly, computer simulation represents a kind of telescope for the mind, multiplying human powers of analysis and insight just as a telescope does our powers of vision. With simulations, we can discover phenomena that the unaided human mind, or even the human mind aided with the best mathematical analysis, would never grasp.* (M. Buchanan)

# Universal distributions



**Universal distributions** (here daily volatility moves on option markets) -> there is something deep to be understood

# Third generation models manifesto

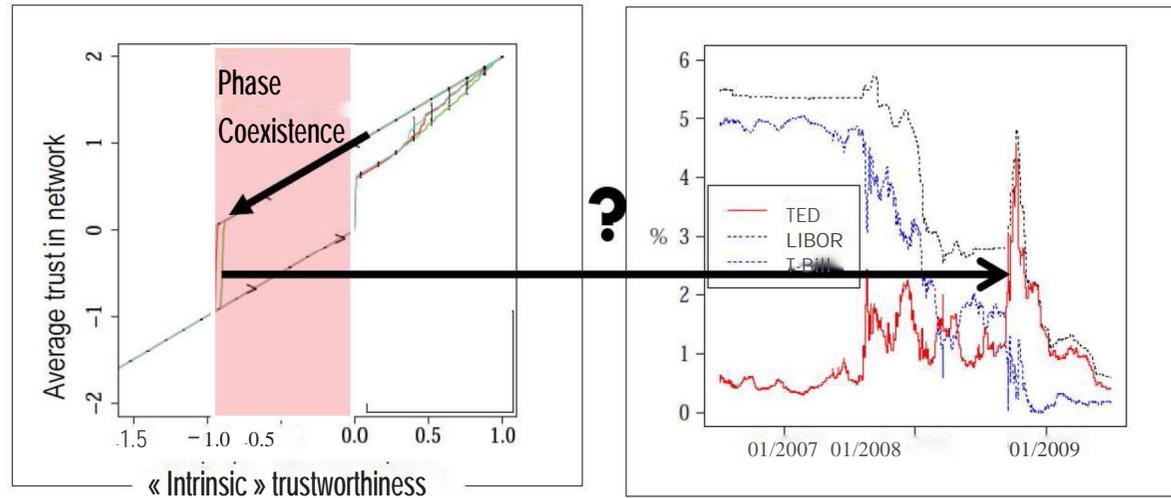
Some examples:

- Microscopic models help understand *correlations* in a broad sense: not God given either but result from identifiable mechanisms (interactions, networks, firesales - cf. Rama Cont)

=> In particular **extreme tail correlations** for which there is *no data* and for which brute force calibration of silly "copulas" have played a part in the demise of credit markets (again, no insight about underlying mechanisms)

=> An interesting example: phase transitions and sudden collapse of trust in networked communities (w. J. Batista)

# So, what happened?



Our workers are no less productive than when this crisis began. Our minds are no less inventive, our goods and services no less needed than they were last week.. Pr. Barack Obama (2009)

# Third generation models manifesto

- Focus on data and mechanisms, not on ad-hoc mathematical models
- A true scientific endeavour - Can *some* Black Swans *just* result of our lack of imagination and be tamed??
- Like in physics, some discoveries cannot be anticipated, while others are in fact predicted by a *true* theory, mostly absent at this stage in economics and finance



L'édition de Pierre François et Sylvestre Frezal

**PARI est lancé**  
Notre vision "c'est dans la maîtrise du champ de pertinence des outils plutôt que dans leur raffinement que résident les gisements de progrès".

De Pygmalion à Frankenstein  
Conférence-débat inaugurale  
le 11 juin 2015 à 18h  
Centre de conférences Pierre Mendès France, Ministère de l'Économie et des Finances

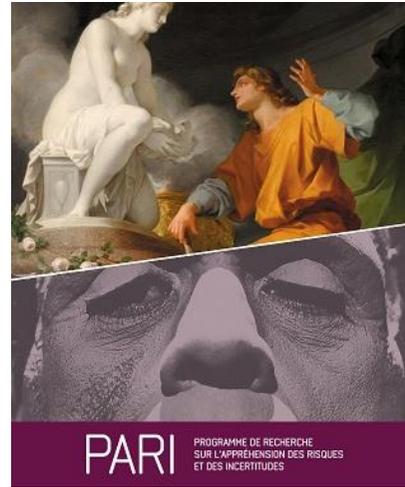
« Le courage, c'est le doute dans l'ordre théorique et l'action dans l'ordre pratique. »  
Jean Lacrotte

Projet de recherche

**Au delà du formalisme mathématique**  
par Sylvestre Frezal  
Les fonctions de distributions décrivent partiellement l'aléa et l'hétérogénéité. Mais peut-on les appliquer indistinctement pour appréhender le risque vécu par l'assuré (aléa de réalisation) et celui vu par l'assureur (hétérogénéité de la population assurée) ?

**L'émergence de Solvabilité 2**  
par Pierre François  
Depuis le début des années 2000, les calibrages de Solvabilité 2 font l'objet de discussions. Mais avant ? Comment ont émergé, comment se sont imposés, une vision "valeur de marché" ou le principe de la "VARS" ? Même les modes ne résultent pas de l'air du temps. Analysons-les !

**Créateurs de mondes. Nos possibles, nos impossibles**  
Nous vous faisons également découvrir la recherche extérieure à PARI.  
Aujourd'hui, un ouvrage d'Andreu Solé sur la prise de décision et ses conséquences en matière de risk management et d'allocation d'actifs



[www.chaire-pari.fr](http://www.chaire-pari.fr)  
[contact@chaire-pari.fr](mailto:contact@chaire-pari.fr)

