“Panel discussion on modelling and pricing challenges”

- ***Simon Dejung***, *SCOR Global P&C, Engineering underwriter*
- ***Serge Droz***, *Opens Systems, Vice President OS-CERT*
- ***Jean Donio***, *University of Paris II, Professor Emeritus*
- ***Dr Roger Iles***, *Nanyang Business School, NTU, Insurance Risk and Finance Research Centre Senior Research Fellows*

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MODELING, COMPUTING AND INSURANCE

- CYBER ATTACKS IN INSURANCE-

Jean DONIO
Professor emeritus- U. of Paris 2

PLAN

1/ MODELING AND COMPUTING

2/ SAFETY TECHNIQUES IN CYBER ATTACKS

3/ INSURANCE COMPANIES

4/ CONCLUSION

1/ MODELING AND COMPUTING

1.1 EUROPE AND MODELING

1.2 USA AND COMPUTING

1.3 DATA COLLECTION, STORAGE, AND PROCESSING

1.1 EUROPE AND MODELING

- ✓ **Descartes**- the representation of data (17th and 18th century);
- ✓ **Newton** and life sciences (17th and 18th centuries);
- ✓ **Gauss**- **Laplace**/function of errors, and probability distribution (18th and 19 th centuries);
- ✓ **Babbage**- the models (19th century);

1.1 EUROPE AND MODELING

- ✓ **Tchebychev**- optimisation of parameters (19th century):
- ✓ **Levy- De Finetti** (change from mathematics to statistics: (20 th century). statistical approach and demonstrations.
- ✓ All together, it spanned four centuries (17th to 20th centuries), was due to brains in Europe, and was needed for modeling and studying industrial characteristics.

1.1/ EUROPE AND MODELING

- ✓ Initially, modeling was a function **Y= f(X,A**), representable on cartesian coordinates;
- ✓ **“X”** and **“Y”** were respectively the causal and resulting experimental **“variables**”, which are in fact **the “data”** that are collected, **“A”** was a **vector of “parameters”**, unknown to begin with, and **“estimable**”, through the variables;
- ✓ There are few parameters, much less **than “parameters**”, which come from **“variables”;**
- ✓ Today **“data”** are collected, stored and processed in great numbers, by millions, **whereas “parameters”** are few in numbers, only 3 or 4: Hence the difference between **“modeling**” and **“computing”.**

1/ EUROPE and MODELING

- A function of the **“committed errors”** was then added by **Gauss**;
- **Laplace** added to that a probability distribution, which transforms the function **“Y”** into: **Y= f(X)+E**;
- There is now in the function Y an error term due to Gauss (**S=Σe**2**), or a probability distribution of the errors, due to Laplace: both methods lead practically to the same extrema and optimizations, through computations.

1.1 EUROPE AND MODELING

- ✓ We can either **“optimize” the “sun of squares of the errors”** (Gauss) or get a regular **“distribution”** of the errors (Laplace), and optimize its variance;
- ✓ If we use **a ”linear”** model, things are greatly simplified, and there are as **many “coefficients”** as there are **“parameters”;**
- ✓ If we don’t, the function $Y = f(X;A)$ will provide the **data** that we collect, and the **parameters** that we estimate;
- ✓ The **“goodness of fit”** will then indicate whether or not the model that we use is good enough.

1.2 USA AND COMPUTING

- ✓ **“Computing”** is very recent, and dates back to the 20th century;
- ✓ In 1946, the U.S.A. had already the atom bombs which were used in Hiroshima and Nagasaki, but the President of the US had also discovered that his country did not have enough scientists to make the computations of the H Bomb: he had to revert to a machine to do it, and **“computers**” followed;
- ✓ **“computers**” are then very recent.

1.2 USA AND COMPUTING

- ✓ In 1946, the President of the U.S. decided to entrust the U. of HARVARD with the making of the first computer in the world, the ENIAC 1;
- ✓ All the american universities imitated HARVARD the year after, and computers became a **“must”** since 1947;
- ✓ Similarly, many developed countries started making their own computers: Russia, France, Great Britain, ecc.. followed in 1947, and computing became necessary everywhere;

1.2 USA AND COMPUTING

- ✓ In 1964, th U. of STANFORD finalized the protocol TCT/IP, which allowed the linkage of computers to one another;
- ✓ In 1994, Professor BERNERS-LEE, in GENEVA, announced what was to become later “INTERNET”.
- ✓ Conditions became then possible to induce the connection of computers through INTERNET;
- ✓ By the end of the 20th century, , both Europe and the USA have invented different ways to study and formalize industrial processes, including those covered by insurance companies.

1.3/ DATA COLLECTION, STORAGE, AND PROCESSING

- ✓ Today modeling and computing are used all over the planet;
- ✓ They both lead to collecting **“data**” everywhere;
- ✓ In fact, scientific contributions opened the way to collect, store and process data 40 years ago, successively in « **data warehouses »,« data mining »,** and **« big data »;**
- ✓ Words changed, but all these inventions were needed to model, or compute industrial characteristics all over.

1.3/ DATA COLLECTION, STORAGE, AND PROCESSING

- Data were collected, stored during many years, and finally processed when people felt like it;

- Besides statistics , a technique to analyze the data may be **“cubes”** and **“hypercubes”**, if we dispose of many processors in the computer that we utilize. This is another way in which statistics and computers join together

2.1/CYBER ATTACKS

- ✓ As soon as data began being assembled 40 years ego, governments and ill-intentioned people began to collect data on connected computers, whether we like it or not;
- ✓ Cyber crimes were born, and **invoked "illegal activities undertaken by criminals for financial gain";**
- ✓ they are vehicled and tempered by insurance companies through data, modeling and computing;
- ✓ The vulnerabilities of internet to illicitly attack information and services are determinant for insurance companies, which have to follow anyway;
- ✓ internet and connection of computers made that irreversible.

2.1/CYBER ATTACKS

- ✓ IP theft, espionage and extortion of businesses may affect everybody though insurance, but it does not affect governments and ill-intentioned people;
- ✓ As a consequence of these new problems, LLOYD'S have issued a nomenclature of 19 computer crimes, which needs revising;
- ✓ The full economic impact of cyber attacks goes far beyond direct costs;
- ✓ Indirect costs, such as administrative costs, now become greater: they include **"exhaustion through repetition", "businesses interruptions"**, ecc., and they threaten entire states;

2.1/CYBER ATTACKS

- ✓ Cyber attacks are necessary to analyze risks, fees insurance costs, and many other results (like GNP, benefits, human work stops, ecc…) ;
- ✓ In fact, insurance companies may have more detailed data than they think they have, but they exploit them with enormous difficulty;

2.2/ SOME SAFETY FEATURES

- ✓ Security followed Cyber Crimes, and different techniques of security were designed because of it: They include among others different techniques such as what follows;

- ✓ **Passwords, encryptions** (including end to end encryption scheme) **, hardware thefts, systems thefts, applications thefts** (contacts, banking codes, and telephone numbers) , **public and private keys/ RSA, scripts/SSH**, ecc…

- ✓ We are going to analyze rapidly hereafter some of these techniques.

2.1/ SOME SAFETY FEATURES

- ✓ **Passwords** : initially, cyber security was limited to key-words, called **“passwords**”, which were used then to accept or refuse the use of connected elements, like **“programs**”;
- ✓ nobody thought that these « passwords » would later become elements of the cyber security, which was yet to be defined;

- ✓ **Encryptions**: they may be **“total”** (like for disks), or **“partial”** (encryption of given programs which are necessary to accept or refuse specific actions).

2.2/ SOME SAFETY FEATURES

- ✓ Encryption even covers **“end to end encryption schemes”**, where companies wait for the last moment to deliver their coding schemes;
- ✓ A security signal is necessary to encode contents, but this is not enough to provoke security;
- ✓ It can only annoy the people who use it, and the fact that such a signal will be used only once, is not enough to deter whoever will attack;
- ✓ Other safety techniques exist, or are developed.

3/ Insurance and reinsurance companies

- ✓ Insurance companies compute **“risks”**, to see if they can include them in their portfolio, and insure then;
- ✓ They utilize models, actuaries, and computers, to make their analyses;
- ✓ but they always need a set of estimates which converges and is stable, if they want to finalize;
- ✓ Computers are easier to use, but they have results which need further analysis, and besides, they need statistics or mathematics to verify **“extrema”;**

3/ Insurance and reinsurance companies

- ✓ Modeling is different, but more difficult to use;
- ✓ Insurance companies face the same problems as any other company in the world (i.e. data and security), but there are possible solutions (modeling or computing);
- ✓ Insurance companies may insure companies, which in turn insure individuals;

3/ Insurance and reinsurance companies

- ✓ Besides, it takes away the responsibility of the people, and nations : banking codes, contacts, addresses and telephones, are now among the prized elements of cyber crimes;
- ✓ Terrorist's information is fast becoming also welcome :
- ✓ Today, no intelligence can result directly from data, because there are too many of them: we need selection;
- ✓ It has become essential to know the info that you want to keep, otherwise you are flooded by too many data.

4/ CONCLUSION

- ✓ Insurance companies use **“actuarial work and computers” a**nyway, and scarcely **“modeling”**, to **estimate « risks »,** and **« fees »**; they may also analyze and compute other characteristics of industry (GNP, absences of personnel, benefits, ecc…);

- ✓ But insurance companies utilize scarcely modeling, and they will have to develop it;

- ✓ As a result, insurance companies will have to understand better cyber attacks, if they want to provide a better service to other firms, and perhaps public entities as well.