

#SPRING2020

ILB RESEARCH INSIGHT

Together we seek answers for a world in transition



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ILB accelerates

Welcome to our third IRIS (ILB Research InSight), the first of 2020. This issue marks the one-year celebration of a publication that offers an introduction to the broad variety of activities currently hosted by the ILB Group.

Looking back at 2019, I see an ILB that has accelerated and turning towards the horizon, the trend continues in 2020.

The number of public-private-academic research projects is rising, so that we now host more than 60 in the ILB Group. The Interdisciplinary Projects FaIR (Finance and Insurance Reloaded) and GSF (Green and Sustainable Finance) have taken shape and now include truly transversal partner groups. ReFinE (Real estate Finance and Economics network) was launch in the beginning of 2019 and ended the year with a call for projects that invites researchers and experts to propose projects to reinforce the research on seven prioritized real estate topics.

ILB continues to develop its daily operations services to the ILB Network among other with a DataLab that keeps growing as an applied research unit composed of engineers experienced in the issues of the financial industry. And this IRIS is just an example of how the ILB Communication & Engagement services have gone through a year of innovation and development too.

That 2019 had focus on going forward is also underlined by the fact that IEF renewed its donations for another five-year period through the partnerships with important and engaged partners such as: Autorité des Marchés Financiers (AMF), Caisse Des Dépôts et Consignations, CNP Assurances, Crédit Agricole, Euronext, HSBC, Société Générale and Lamarck Group.

With many interesting research projects going on it can be difficult to select the few that are “not to miss” reading about in this spring 2020 issue of IRIS.

However, I do recommend:

1 A look at the Focus 2 dedicated to the ILB Interdisciplinary Program FaIR (p. 12). The workshops hosted at the ACPR and following round table articles and publications offer valuable knowledge if you are interested in digitalization and finance.

2 If your focus is sustainable development from a green finance perspective, I recommend reading the synthesis of a new white paper “Blockchains and sustainable development” (p. 11) offered by ILB in collaboration with Coreum and Blockchain-X.

3 Finally, I wish to invite you to visit the new ILB Group and Network portail institutlouisbachelier.org (p. 20), where you will find links to the total amount of programs, events and media available.

I wish you an interesting reading and lots of new discoveries,

Didier Valet
Vice-Président Industry,
ILB Group.



The ILB Group research

The Louis Bachelier Group plays a leading role in the design of research programs and initiatives by creating links between experts from the academic sphere, economic actors and the public authorities. Together we seek answers for a world in transition.

RESEARCH AXES: FOUR MAJOR SOCIETAL TRANSITIONS

The ILB Group coordinates more than 60 research programs across four societal transitions: environmental, digital, demographic and financial. ILB provides administrative management and does deal-making. We offer an external R&D service to our partners through the Datalab and communicate the findings of chair research through diverse media and presentations. The ILB is also the driver of the "ILB Network" as well as organizer of numerous annual events for its public, private and academic partners. The two foundations: Fondation du Risque (FDR) and the Europlace Institute of Finance (EIF), function as incubators of fundamental and applied research programs. Two Interdisciplinary Research Programs (IRPs) as well as the Network ReFinE were launched during the past two years to increase the dissemination and impact of digital, environmental and real estate issues. The Interdisciplinary Research Programs bring together a large number of partners from the ILB Network.

DIGITAL TRANSITION



Research in this area is designed to meet the challenges of digital transformation. First of all, it provides new mathematical and statistical approaches capable of analyzing information in a context where the sheer volume of data to handle initially seemed daunting. More generally, this focus area addresses the various economic issues generated by the democratization of new technologies.

Research programs, publications and events have focused on topics such as: AI, blockchain, big data, cyber-risk, and robo-advisors.

ENVIRONMENTAL TRANSITION



The goal here is to advance and promote the analysis and evaluation of existing and future public policy and economic instruments in the area of climate change.

Research programs, publications and events have focused on topics such as: climate change, nonrenewable resources, climate risk for the agricultural, industrial and housing sectors, circular economy and CSR.

DEMOGRAPHIC TRANSITION



This focus area seeks to develop new public and private solutions for covering emerging risks pertaining to longevity, dependency, and health. It also aims to further our understanding of the impact these changes have on economic determinants: growth, productivity, financial markets, the accumulation strategy of human capital, etc. Programs contribute to defining new social insurance channels and products, both public and private, suited to the various geographic, cultural and temporal situations stemming from demographic transition.

Research programs, publications and events have focused on topics such as: longevity and health, human capital, and the labor market.

FINANCIAL TRANSITION



Research in this area aims to support transformation in the banking and financial industries from the standpoint of stability and sustainability.

Research programs, publications and events have focused on topics such as: responsible finance linked to sustainable development, financial regulation and stability, financial risk, finance and behavioral economics, and innovation-based growth.



People and programmes

ILB congratulates, on their award of excellence

- **Primavera de Filippi**, scientific co-director of the Research Initiative “Blockchain Perspectives Joint research Initiative” is the winner of an ERC Consolidator 2019 project. “BlockchainGov” is an interdisciplinary project to study the impact of blockchain technology on governance models.



- **Anna Creti**, Professor at Paris Dauphine University and Scientific Director of the Climate Economics Chair’s has received the special Prize of the AEE (Association of Energy Economists) for the book “Electricity Economics: Markets, Competition and Rules”, published in 2019 by Cambridge University Press.



Young researchers funded

- **Zeling Zhong**, Good In Tech Chair: Post-doctoral researcher in the chair at ITM-BS: “Impact of data protection and interpretable algorithms on the appropriation of connected objects and services”.



- **Louis Bertucci**, Research Fellow, notably on Blockchain, in collaboration with the Finance and Sustainable Development Chair.



- **Maximilien Baudry**, Research Fellow, DAMI Chair, presented his thesis “Statistical learning problems in the presence of incomplete data - Application of machine learning in actuarial science”, January 2020.



Publications

- **Digital Finance Chair:**
Marc Bourreau and Marianne Verdier, 2019, “Interchange Fees and Innovation in Payment Systems”, Review of Industrial Organization, Volume 54, Issue 1.

Natalia Ivanitska and Marianne Verdier, 2019, “The Global Cryptoasset Regulatory Landscape Study”, De Gaulle, Fleurance & Associés (in collaboration with Cambridge University).

Marianne Verdier, 2019, introduction in a special issue of “Concurrences” on the theme “Banking and Big Data”, N° 4.
- **Climate Economics Chair:**
Anna Creti and Duc Khuong Nguyen, 2020, “Energy, Climate and Environment: Policies and International Coordination” in the journal Energy Policy.

- **Finance and Sustainable Development Chair:**
Yves Achdou and Jean-Michel Lasry, 2019, "Mean field games for modeling crowd motion. In Contributions to partial differential equations and applications", pp. 17-42. Springer, Cham.
- **Prevent' Horizon Chair:**
Romain Gauchon, Stéphane Loisel and Jean-Louis Rullière, 2019, "Health-policyholder clustering using health consumption", (Under review in European/American Journals).
- **Research Initiative Advanced techniques for non-linear pricing and risk management of derivatives :**
"Understanding the dual formulation for the hedging of path-dependent options with price impact ", Bruno Bouchard & Xiaolu Tan.
- Research project of Jacques Pelletan "Allocation des ressources face aux risques de criminalité : fondements théoriques et empiriques ", financed by the Ministry of Interior and hosted by ILB.

Conférences funded by the ILB Labex

- "12th Annual Hedge Fund Research Conference ", 16-17 January 2020 à Paris.

Creation of programs

- **PEC chair (Managing the circular economy)** with PSCA, SIOM, CentraleSupélec and the Risk Foundation for 5 years (2019-2024).
- **DIALog chair (Digital Insurance And Long-term risks)** with CNP Assurances, Université Claude Bernard Lyon 1 and the Fondation du Risque for 5 years (2019-2024).
- **Quantamental Event Driven I** with CIAM and Europlace Institute of Finance for 1 year (2019-2020).
- **Research Initiative (Models and mathematical processing of very large-scale data)** with MEDIAMETRIE, the GENES and the Fondation du Risque for 3 years (2019-2022).

Renewed agreements

- Exploratory project "Machine Learning and Mean Field Games ", HUAWEI extension.
- "Data analytics in management consulting " with AT Kearney and Europlace Institute of Finance, 2020.
- **Energy and Prosperity Chair:**
Reconfiguration of partners: discontinuation of Air Liquide, MIROVA and Schneider; Renewal of SNCF, Caisse des Dépôts et Consignations and the Agence Française de Développement. Jean-Pierre Ponsard is this project lead.

The Fellows

The ILB Fellows is a forum of excellence for researchers and practitioners. It is a means of developing research and disseminating findings to stakeholders in France and internationally. ILB Fellows is also a platform for discussion, with the aim of identifying and conceiving new topics and areas of research.



Scientific Director of the Europlace Institute of Finance

Elyès Jouini

“The vocation of the Fellows is to carry the spirit of the ILB”

Director of the House of Finance, Paris Dauphine-PSL University, member of the University Institute of France, Elyès Jouini is Scientific Director of the Europlace Institute of Finance, Vice-Chairman and member of the Board of Directors of the Institut Louis Bachelier and member of the Executive Board of the Fondation du Risque. He is also Professor of Economics at Paris-Dauphine University where he directs the Master's degree in Asset Management, having previously been Professor of Mathematics and Professor of Finance at Ensaë and NYU. From 2004 to 2019, he was Vice President of Paris-Dauphine University.

As Scientific Director of the Europlace Institute of Finance and an active member of the ILB, what was your motivation in wanting to create the ILB Fellows?

“The ILB has a rich endowment of foundations, chairs, teams working in this framework, the research projects it finances, publications, and so on. However, it lacked a vibrant community that would embody and reflect its essence. This community now exists: the community of ILB Fellows. Initially made up of the inner circle, i.e. holders of chairs, members of the ILB's scientific boards and its group of professionals, this community is now growing by co-opting new members.”

As Director of ILB Fellows, what are your expectations of this community, which is distinctive in bringing together academics and professionals?

“The vocation of the ILB Fellows is to carry the spirit of the ILB and thereby to be a force for the creation of new Chairs, launching new programmes, defining new scientific objectives, exploring in relation to the scientific positioning of the ILB, and so on. Because this community brings together scientists and professionals in the field with in-depth knowledge and

practical experience of applied research, it forms a bridge between the scientific work being conducted and the needs of professional communities. In this respect it is particularly suited to be the force for the proposal of projects as described above and thereby embodies the specificity and strength of the ILB.”

Since its creation in 2016, the ILB Fellows has grown through annual elections. What long-term plans do you have for the group?

“In order for ILB Fellows to be best able to exercise its role as a force for proposals, we plan to put in place tools that will further mobilize the group and facilitate relations between its members. An annual residential seminar would thus allow exchanges and debates on current topics to be organized with a view to gathering insights from the scientific community and the viewpoints of and questions from professionals. The role of this community also includes making scientists, especially the most promising among them, better known to a wider public. Encounters around these “Rising Stars” will be a way of showcasing these young talents, as well as a means of regenerating the community and the themes of the ILB.”

TO KNOW MORE

About the Fellows and their activities please visit institutlouisbachelier.org.

Risk Forum 2020

The expansion of Fintechs is shaking up Finance

The Risk Forum, organized by the ILB Group, takes place every year at the Paris Chamber of Commerce and Industry. Marie Brière, Scientific Director of this international event, discusses this 13th edition, on the topic of Fintechs.

Why did you choose year's theme: "The Rise of Fintechs: How Networks and Platforms can disrupt traditional financial intermediation?"

Marie Brière : "The digitalization of our economies is profoundly changing the financial sector. Start-ups and large technology companies are disrupting traditional banks and insurance companies by introducing new services using innovative technologies: new methods of payment (mobile, peer-to-peer), new currencies (digital and crypto), new forms of participatory financing (peer-to-peer, crowdfunding), digital advice (robo advice), etc.

In addition, advances in information technology have made possible the use of new datasets, such as online consumer transactions, information from social networks and satellite images, along with new forecasting techniques, with a wide use of machine/deep learning techniques and more advanced use of text analysis techniques. These technological changes can improve financial services, but they can also change the competitive landscape, create new risks for borrowers, consumers and investors, and potentially undermine financial stability."

What are the issues arising, for both researchers and professionals?

"It is essential today to understand the potential of these new technologies, but also to measure their impact on the economic environment. For example, does the use of new data improve the informational coverage and

potentially the efficiency of markets? Some recent work tends to show the weaker role of governments' statistical announcements, which can be easily anticipated using leading indicators built on the basis of alternative data (e.g. from satellites). What is the impact of the introduction of robo-advisors on people's investment behaviour? Do robo-advisors help correct certain behavioural biases and improve people's investment performance? To what extent can the digitization of payment services and the introduction of new digital currencies disrupt the traditional model of monetary exchange, thereby intensifying competition between currencies or leading to the emergence of cross-border digital currency zones? Can competition mechanisms between platforms hamper their interoperability? Will the payments revolution lead to greater financial inclusion?

We will examine all these questions through presentations by the best researchers in the field and debates with specialists from the professional community."

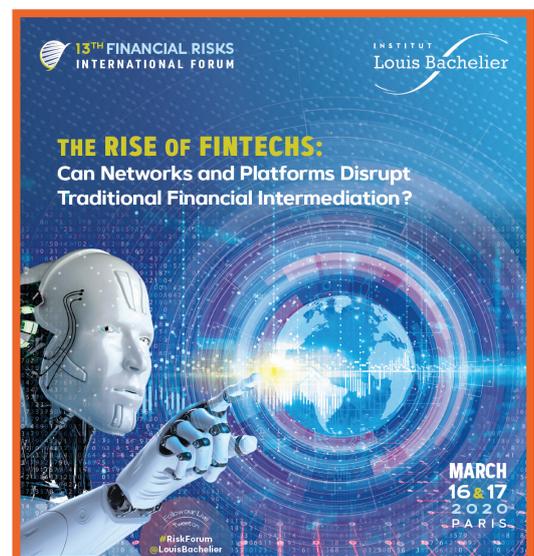
This year is the 13th edition of the event. How do you see the future? And what are the prospects for change?

"The Risk Forum is based on a format that works, with more than 500 participants last year, and increasing numbers every year. We intend to continue with this format, focussing on topics that are important for the evolution of the financial industry and bringing together the leading specialists on the subjects addressed during this yearly conference in Paris."



Marie Brière, Risk Forum 2019

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THE IEF/SCOR FOUNDATION FOR SCIENCE PRIZE: THE BEST YOUNG RESEARCHER IN FINANCE AND INSURANCE

The winner of the 2020 Best Young Researcher in Finance and Insurance Prize is awarded during the Risk Forum.

The SCOR Corporate Foundation for Science, in partnership with Institut Europlace de Finance and Institut Louis Bachelier, is proud to present the prize for the Best Young Researcher in Finance and Insurance for the fifth consecutive year.

Created at the end of 2011, the SCOR Corporate Foundation for Science is part of the Group's long-term commitment to research and the dissemination of knowledge about risk. This involvement is part of SCOR's identity, as evidenced by its signature "The Art & Science of Risk". Risk is in fact the "raw material" of reinsurance and SCOR intends to be at the forefront of risk expertise and research through its extensive network of academic institutions and the support it provides to numerous disciplines, including mathematics, actuarial science, physics, chemistry, geophysics, climatology, economics and finance.

The creation of the SCOR Corporate Foundation for Science marked a new stage in the Group's commitment to scientific disciplines and, more broadly, to its societal mission, in line with its CSR policy.



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BEST YOUNG RESEARCHER IN FINANCE AND INSURANCE, 2019

The Scientific Council of the Institut Europlace de Finance (IEF) has jointly awarded the 2019 Prize for the Best Young Researcher in Finance and Insurance to two researchers, who tied in the deliberation process. The award ceremony took place on 19 March 2019, during the twelfth edition of the International Financial Risk Forum.

The winning candidates were Aurélien Alfonsi, researcher in financial mathematics at the École Nationale des Ponts et Chaussées, and Guillaume Vuilleme, researcher in finance at HEC Paris. These two winners received the IEF prize along with a cheque for 7,500 euros each, in recognition of their previous work and their future potential for new research. To be eligible for this prize, researchers must be no more than 40 years of age and be affiliated with a French academic institution.

As a reminder, the Best Young Researcher Prize was created in 2005 and has been sponsored by the SCOR Foundation for Science since 2016. The IEF Scientific Council decided to extend this prize to insurance research in 2017.

Aurélien Alfonsi is a Researcher at CERMICS (Ecole Nationale des Ponts et Chaussées) and Professor at the Ecole Polytechnique. He defended his thesis, written under the supervision of Benjamin Jourdain, on 26 June 2006. He then became a post-doctoral student in Berlin (TU) before joining CERMICS as a researcher. He has made major contributions to several areas of financial mathematics, including numerical simulation (his paper "On the discretization schemes for the CIR (and Bessel squared) processes" has been cited 212 times according to Google Scholar), optimal execution (his paper "Optimal execution strategies in limit order books with general shape functions", co-authored with A. Fruth and A. Schied has been cited 379 times according to Google Scholar) and price impact models, multi-dimensional stochastic volatility models based on the Wishart process, and the use of optimal transport theory of measures. Deputy Director of CERMICS, he has directed five PhD theses and is the author of a book on the simulation of affine diffusion processes.

Guillaume Vuilleme is assistant professor of finance at HEC Paris. His research focuses on banking economics, derivatives markets and risk management, bank financing, central clearing and financial history. His work has been published in the Journal of Finance, the Review of Financial Studies and the Journal of Financial Economics, among others. He is also a research fellow at the CEPR (London) and the Autorité de Contrôle Prudentiel et de Régulation (ACPR). He was awarded the Best Young Researcher in Finance prize by the Autorité des Marchés Financiers (AMF) in 2016. He holds a PhD in economics from Sciences-Po (Paris).

ReFinE at the commercial real estate fair, SIMI

ReFinE (Real estate Finance and Economics network), the ILB's real estate research network, presented its work at SIMI (Salon de l'Immobilier d'Entreprise) during a conference for professionals in the sector.

The discussions took place in the form of a round table with contributions from:

Kévin BEAUBRUN-DIANT, Lecturer, PSL Paris-Dauphine; Scientific Director, ReFinE

Jean BOISSINOT, Adviser to the Governors, Banque de France

Jérôme COFFINET, Head of the Statistical Methodology Unit, Banque de France

Thomas GRJEBINE, Economist, CEPII

Béatrice GUEDJ, Director of Research and Innovation, Swiss Life

Camille REGNIER, Lecturer, ERUDITE, University of Paris-Est Créteil

Moderator: Pierre SCHOEFFLER, Senior Advisor, IEIF

Kévin Beaubrun-Diant opened the conference with a presentation of the ReFinE network and its main issues. "ReFinE will help build a common understanding of the commercial real estate market by public authorities, regulators and real estate professionals, based on independent, high-quality and internationally recognised academic research."

For a long time, some of those in the profession had been aware of the lack of research work on the French market and the lack of scientific publications on commercial real estate in academic journals. Most of such publications and references were American or British. While their theoretical models can be used, empirical work, particularly on market risks, does not correspond to the reality of our commercial real estate market.

Camille Régnier then detailed her spatial economy project based on the relationship between residential and commercial vacancies in declining cities, the assessment of their negative externalities and their cumulative nature. For Pierre Schoeffler, moderator of the event: Camille Régnier's project is key to defining economic policies to support these cities and to inform investors on the appropriate investment formats for residential and commercial real estate.

Another major project was presented by **Thomas Grjebine** on sectoral macro-economics applied to Europe. Its aim: to measure the effect of real estate prices on the productivity of economic sectors according to their capital intensity in real estate.

Béatrice Guedj agreed: "This is important for the macro-economic guidance of economies and for understanding the formation of property prices as a whole, i.e. including owner-occupiers and property investors."

Lastly, **Jérôme Coffinet** described the two projects he is currently leading with his team.

The first focuses on extreme risks in real estate related to the non-normality of performance distributions.

Jean Boissinot commented: "Crucial information for a fair assessment by regulators of the risks carried by real estate investment, whether at the level of insurance companies (Solvency II) or funds intended for individual investors (PRIIPS regulation)."

The second project deals with the relationship between commercial property prices and residential property prices at the local level, in particular through the issue of changes in use. Work considered "essential" by Pierre Schoeffler "Both for urban development policies and for understanding the fluidity of the investment property market and the capacity for diversification between property segments."

By way of conclusion to this round table, **Kévin Beaubrun-Diant** announced a series of regular workshops and presentations throughout 2020, in order to maintain, through the dynamism of the ReFinE network, the link between researchers and professionals in the sector. The objective is twofold. On the one hand, to continue to stimulate research work that meets the expectations of the public authorities responsible for policy-making and macro-prudential measures. On the other, to provide food for thought for institutional players holding commercial real estate assets.

Visit institutlouisbachelier.org for more information on the ReFinE programme.

GSF (Green and Sustainable Finance): Blockchain and sustainable development

The ILB has participated in the drafting of the white paper “Blockchain and Sustainable Development” with Coreum and Blockchain-X.

The starting point of this report is: “Can blockchain significantly and sustainably accelerate the attainment of Sustainable Development Goals?”. Such an ambition raises numerous questions. Is it possible to reconcile certain types of blockchain and the energy expenditure required to operate them with sustainable development goals? Are there public blockchains whose secure transactions have divergent energy impacts? Is the increase in the use of “Blockchain for social good” the result of a natural convergence between the principles of transparency, traceability, collaboration and decentralisation in particular, which underlie blockchain-type distributed registers and which are implicit in the aims of sustainable development?

[...]

This white paper “Blockchain & Sustainable Development” has identified some two hundred blockchain projects – each of which relates to the pursuit of one or more Sustainable Development Objectives. These projects can be grouped into nine main themes: (1) Finance and Donation, (2) Environment, Energy and Climate, (3) Food and Agriculture, (4) Gender and Sexuality, (5) Government and Public Services, (6) Health and Medicine, (7) Banking and Economics, (8) Information, Journalism, Education and Culture, and (9) a transversal and central theme, Digital Identity. The first observation is that there is a significant gap between the ambitions at all levels, supported by a wide variety of initiatives and actors, and the reality of the implementation of these projects, which still come up against various technical, legal, financial, administrative and social constraints.

Though necessarily fragmentary, the work underlying this first report will have made it possible to define the main principles and the structuring of an ecosystem of so-called programmable currencies or crypto-assets linking different blockchain protocols to the pursuit of sustainable development objectives. The analysis of the many projects, some of which have already gone beyond the proof of concept stage, also makes it possible to validate the relevance and effectiveness of the models based on a technical architecture that induces trust among its users, according to predefined rules, and governance without head or centre, heralding new social interactions.

[...]

For this first edition, we have focused on five main themes: (1) programmable money and sustainable development, (2) blockchain for more efficient public services, (3) more responsible trade, (4) solidarity energy, and (5) blockchain in support of climate action. In so doing, we can address the issue of “tokenization” and impact measurement, and think about the concept of sustainable development by design.

[...]

The use of blockchain in the field of renewable energy has concrete applications in five main areas. **Guaranteeing the origins of the energy used**, such as with the German company Lition or the TEO initiative led in France by Engie and Air Products and Chemicals. **Developing collective self-consumption**, i.e. bringing together producers and consumers of electricity on a local scale, such as Power Ledger in Australia, ElectraSeed in Africa, or the French experiment in Lyon, led by Bouygues Construction, Microsoft, Energisme and Stratum. **Promoting the production of solar power**, with SolarCoin, whose currency is also used to pay bills for electricity generated from renewable energy. **Carrying out automated and reliable energy saving calculations**, so as to quantify and document carbon performance. And finally, **inaugurating new methods of financing renewable energies**, such as with Enerfip, Lendosphère and Lumo.

[...]



The complete white paper is available on gsf.institutlouisbachelier.org

GSF is the ILB's Interdisciplinary Research Programme on Green and Sustainable Finance.

FaIR (Finance & Insurance Reloaded)

The interdisciplinary research programme FaIR embraces all ILB initiatives that bring together industry and research partners related to the impact of new technologies on the world of finance and insurance. More specifically, it concerns AI and Blockchain applied to the distribution of financial products, improvement of risk intermediation and a better connection to the real economy. Seminars on these topics are held at ACPR (Autorité de Contrôle Prudentiel et de Résolution, Banque de France), where two guest speakers present their research results and innovative industrial solutions and interact with participants during a round table discussion.

“Digitisation of financial contracts: blockchain contributions”

The FaIR Interdisciplinary Research Programme hosted a round table discussion on the subject of blockchain on 20 May 2019 at ACPR.

Extract 1:

“Stablecoin, Crypto-currency or Eurocoin? Towards a settlement currency”

Charles-Albert LEHALLE, Senior Research Advisor, CFM Paris and Imperial College London

“If we return to the subject of stablecoins as a support facilitating the use of blockchain in the financial system, is it realistic to think that any other “crypto-asset”, such as Bitcoin, could replace the proposals of JP Morgan, Facebook or a group of academics such as MIT?”

Thibaud DE MAINTENANT, CEO, LiquidShare

“Using a crypto-currency such as Bitcoin seems to me to be much more complex than most of the proposals we have discussed so far. These broadly consist of having a portion in cash with an institution that issues Coins without variation, which effectively makes it possible to make a transfer of ownership for the amount negotiated. Otherwise, this would be tantamount, for example, to saying within the framework of LiquidShare that the quotation of SME shares would be made in a crypto-currency whose exchange rate is uncertain, thereby adding exchange rate risk to the natural risk of holding a company’s shares, i.e. roughly on the basis of the economic sector, the business model and the governance of the company. This is no longer a market, and I’m not sure anyone is interested in that. We have a pretty clear view on this. I think we need to bring some simplification.

Especially since today, in a regulated environment, you cannot legally have a crypto-currency account that is not regulated. If you come in with Bitcoin, it won’t work.”

Sébastien Choukroun, Manager of the Blockchain Lab, PwC France

“It’s not even clear today. What does it mean to be a crypto-asset custodian? It would still be banks that would keep crypto-assets for small business investors. Hard to imagine a mechanism that works without that.”

David DUROUCHOUX, Forge Digital Capital Markets, co-founder et SGCIB

“When we discuss missions with the Banque de France and explain the Custody systems, we tell them that we do not particularly want a Eurocoin. Because it is already has political connotations, calling into question a political prerogative. In fact, what we would like is a Settlement Coin. At the very least, it could be a technical instrument, as long as it has the same properties as a central bank guarantee on the currency. This would allow us to find a simple and direct answer to the problem of Delivery versus Payment.

Until we can guarantee that the code of a Smart Contract can be exchanged simultaneously between two technologically similar elements, we are obliged to have two uncorrelated networks, thus spending our time reconciling the two. We can actually reconcile it like Liquid Share does, that’s a solution.

At the beginning of our project we looked at what was needed, at the time, to issue a stablecoin. It is important to know that in a low rate environment, it is essentially a quantitative issue, and will necessarily have a cost. And, in short, that cost amounts to the immobilization of the collateral that would have to be put up against a stablecoin. And in any case, there will be counterparty risk. So stablecoins as such, while we are looking for a technical tool, are likely to entail financial costs. In fact, it is the end customer who will have to bear this cost. Or else customers will not come to us, because the price of our bond, because of these costs, will be higher than that of a traditional bond, and they will turn to traditional, highly optimised and already regulated flows. At some point, we are going to need a Coin tool for settlement. Approaching things in this way does not necessarily mean putting the Central Bank at risk, it means offering market optimisation. It also means offering lower financial and operational costs, in complete transparency, for a certain number of products. This may be of interest to markets, regulators and customers alike.”

Extract 2:**“The French marketplace: a breeding ground for scientists and an area of custodian expertise.”****Charles-Albert LEHALLE**

“I have the feeling that the London marketplace is a little more active than Paris. Do you have that impression?”

Sébastien CHOUKROUN

“It’s the impression I get from where I stand. PwC France is not necessarily behind PwC UK with regard to Blockchain.

But apart from that, there is relatively little Initial Coin Offering (ICO) or Security Token Offering (STO), and there is not really an ecosystem. Nowadays, if you want to recruit developers in London, it’s not that simple. The ecosystem that has been developing very fast is the Swiss ecosystem. But in some cases the people who have gone there have come back. And I think France has a strong hand to play, because we have a breeding ground. Our INRIA project is paradigmatic of what France can do. We have a pool of mathematicians and computer scientists that few, if any, other marketplaces have. One that is very strong, from what we see, is Hong Kong. Our Blockchain leader must be one of the few people in the world who has the support of some fifty ICOs worldwide. However, I’m not sure that there are any major custodian banks in Hong Kong. Paris has a real advantage. What we didn’t necessarily expect is that, for the moment, we are somewhat ahead of the Americans.

I haven’t said anything about the Germans. If I compare us to them, there are more Blockchain-based projects there that have energy and sustainable development applications. However, the market structure is more conducive to the development of this technology, which in particular makes it possible to reduce the cost of intermediation because there are more players. On the other hand, in finance for the moment, we see more projects in Paris than in Frankfurt, but the game is far from over. To be frank, we are more afraid of Frankfurt or New York than London. The problem for the Germans is that Frankfurt is not a breeding ground for mathematicians, at least not comparable to Paris, and that also plays a role.

There is another aspect of these questions, and that is taxation. The Germans have developed a very special status for cryptocurrency as “digital gold”; in short, they have ruled that Bitcoin is like gold. So taxation on it is very low. It’s a historical legacy, stemming from the trauma of German hyperinflation during the 1930s. It is therefore important that civil society can move towards alternative investment vehicles for savings. France, on the contrary, has its vision of a strong euro. When the Germans gave Bitcoin the status of gold in 2014, it looked great, everyone applauded. But in fact it meant that, by extension, a financial security had the status of a currency, that is, the worst possible status to issue anything. They fell behind on STOs because of that. What should have been a huge lead in 2014 has paradoxically become backwardness, which shows that regulators have to be very active and monitor the situation over time. As a result, there have been slightly more ICOs and STOs in France than in Germany, and French regulation has taken the lead, but the Germans are trying to catch up. So there is a contest, and I am convinced that Paris can win it if favourable decisions are taken in the coming months by the regulators, and also, as has been mentioned, because we still have an advantage. French custodian banks are ultra-dominant at a European level, especially compared to their German competitors.”

Thibaud DE MAINTENANT

“I worked for 17 years in a German bank, and I can confirm that German banks are not very present on the custodian side. On the other hand, I think we have to pay attention to JP Morgan and their Stablecoin. They were involved in creating Euroclear Bank at the time, and all our Eurobonds went through JP Morgan. So we can very well imagine JP Morgan with its power, again doing what it did at the time, a sort of standard for a Eurocoin or Dollarcoin, which would become the Blockchain standard. This Stablecoin dimension is important, and in terms of the marketplace it would be desirable to have a Euro Stablecoin to facilitate its usage in practice.”

“Robo-advisors in the financial sector”

The Fair Interdisciplinary Research Programme organised a seminar, followed by a round table, on the theme of robo-advisors on 16 January, at the ACPR.

Extract 3: “The specificities of robo-advisors”

Matteo Rava, Senior Policy Officer, ESMA

“We have dealt with the issue of robo-advisors from a political perspective, and we have always tried to define them as actors which interact directly with customers, with little or no human interaction. The reason we did so is because we realized that in the real world, there are of course many models. But if we were to consider as robo-advisors everything that could be defined in this way, we would be back at the starting point and advisors of all kinds of would be included. However, I think it’s interesting to focus on this specific area, because that’s where we have found some of the barriers to the development of this technology. As regulators, there is much else we could do to assist their development and to remove the cultural barriers that we sometimes find with investors and the difficulties they have in trusting this type of purely technological advisor compared to the old traditional models, where human interaction was the norm. That’s why we prefer to focus on this point (...) In fact, as I said, on the basis of our experience, hybrid models, that is, robots with a human element, seem to be the most successful, because they overcome this psychological barrier, where the customer is sometimes reluctant to interact solely with an algorithm. But again, even in our policy studies, we try to focus on purely robot advisors. So here there is little or no human element, except in the fact that someone is making a complaint or asking a question, but not in terms of financial advice per se.”

David Furcajg, President and Co-Founder HighWave Capital

“We use behavioural finance for asset allocation profiling. We do not use Markovitz or any other traditional profiling tool to understand the end customer. So how do we do it? First of all, if you are looking at almost 90% or 100% of robo-advisors, they will profile their end customer like any other bank. That’s not a big innovation. They will ask almost the same questions. The problem is that these

questions need a channel, and your way of answering them won’t be the same as mine. And you may have a question just as much as you can have different ways of understanding that question. So, in the end, banks are going to advise their customers without any clear understanding of the profile of their end customer. In fact, the best way for us is not to ask such questions, but to provide a more challenging exercise, with no questions related to the financial markets or the economy, because that leads to interpretation and bias. So we provide a questionnaire on gambling with a sum of money, and you can be 15 years old, you can be from the United States or Europe, you can be a man or a woman, the way you interpret this game of chance is the same in fact, so there is no bias, no interpretation bias, which is very important. And the more you fill out the questionnaire, the more the questions, as always, match your profile. And in the end, there are thousands of profiles available, and in fact it’s a scientific way of assessing risk profile. That’s the first part of the answer. The second part is that we don’t use Markowitz, we don’t use fundamental analysis, and instead we analyse the psychology of the markets, and we adjust, of course, based on profiling, the mix between stocks and bonds. But only using market psychology analysis.”

Marie Brière, Head of the Investor Research Centre, Amundi

“I think one of the biases that robo-advisors can correct is people’s inability to rebalance their investments. A lot of people don’t monitor their savings and don’t balance them enough. But it has been proven that rebalancing, depending on market conditions, is something that enhances performance.”



“Market finance in the age of accessible intelligence”.

by Charles-Albert Lehalle, Scientific Director of FaIR and Senior Research Advisor, Capital Fund Management.

While Artificial Intelligence (AI) has had many successes recently, it is by no means a new discipline, but the tools provided by data sciences have taken it to a new level, allowing it to “solve complex tasks without being intelligent”. The market finance industry will be affected by AI’s secondary innovations in three ways: in relation to customers and custom product manufacturing, in relation to the real economy and nowcasting, and in relation to risk management. These innovations are already shaking up the professional activities of actors in this sector, who are modularising their services and organising themselves into platforms. In a sector that is justifiably highly regulated, certain characteristics of AI technologies, namely the importance of data and the use of third-party software libraries, may give rise to new sources of uncertainty.

AI IS A “GENERIC TECHNOLOGY” THAT DISINTERMEDIATES AND MODULARISES.

In the 1990s, investment banks were among the owners of some of the greatest computing power and storage capacity on the planet. One might therefore expect them to be at the forefront of innovations produced by data sciences and Artificial Intelligence (AI), but in fact they are not. Although private companies that have taken the top spots on the podiums for image recognition or automatic natural language interpretation from the major universities, these are the GAFAMs, not financial institutions. Actors in the market finance sector are trying as best they can to catch up, as is evident from the growing number of research initiatives they have been funding at the ILB for the past two years.

Over and beyond the somewhat naïve transposition of successful innovations in other sectors, this article attempts to identify the major areas of application that can be expected from AI technologies in this sector. But this is not enough for envisaging the changes that will accompany these innovations. Here again, a superficial analysis, based on the successes of the GAFAMs, might stop at anticipating a “disintermediation” of this sector, since this is the common point shared by the effect of these giants in their fields, often summed up as “uberisation”. However, since the market finance industry is already a network of intermediaries, it is more appropriate to look at the literature on the organisational impact of modularity (e.g. Frigant (2005)) to understand the effect of AI technologies on the actors in this sector.

This article focuses on artificial intelligence technologies and their impact on the organization of the financial markets industry. It explains what these technologies really are, and particularly that they are made up of an assembly of a very large number of computer codes and reference data that are necessary for their operation. This presentation provides an overview of the main areas of application of AI in market finance, but this is insufficient for understanding the likely changes in this sector when it comes into contact with them. Indeed, AI does not stand in isolation, but brings with it a large number of recent practices in the software industry, which revolve around the notion of modularity. I defend the position that it is these practices which have led to the platforming of players, already underway among the most innovative companies, such as BlackRock and Goldman Sachs.

AI WILL EFFECT THE CORE OF THE FINANCIAL INDUSTRY: PERSONALISING CUSTOMER EXPERIENCE, IMPROVING RISK MANAGEMENT AND BRINGING PRICES CLOSER TO ECONOMIC REALITY.

The ILB, as part of its cross-disciplinary research programme on the impact of technologies on finance and insurance (FaIR: “Finance and Insurance Reloaded”), has identified three areas in which the typical functionalities provided by AI (perception, statistics covering large databases, and approximate resolution of combinatorial problems) may impact market finance practices.

[...]



The latest application of AI to financial markets is associated with the emergence of what is now known as “alternative data”. This concerns non-financial data, but also reflects an economic reality linked to the valuation of financial products. Satellite images, which have become more accurate and cheaper over the last ten years, provide a good example: they make it possible to assess the quality of crops, measure the luminosity of cities (and therefore their economic activity), count vehicles in car parks, and so on. Transcripts of speeches made by company executives at general meetings, communications to financial analysts, or mandatory corporate statements are also available, often free of charge. The texts of patents filed by companies, job offers, or traffic on their web pages, are also part of this “new data” that allows the evaluation or revaluation of many economic variables. Since enormous amounts of data are involved, it cannot be analysed, even approximately, by humans. Recent advances in AI, which can be used to understand images or to grasp the meaning of a text, make it possible to use this information to construct new indices of the good or bad health of the economy at all scales: macroeconomic or microeconomic, or even simply indices of supply or demand in certain sectors or sub-sectors. As Banbura et al. (2014) point out, these real-time or near real-time estimators of economic variables are not prediction; rather they attempt to estimate the current state of the economy in small increments. This area has been called “nowcasting”, by analogy with “forecasting”. Management companies, decision-makers and bank strategists and traders are now able to construct performance dashboards using these indices. By means of nowcasting, their decisions, which play a major role in shaping prices and allocating

capital, are more in tune with the state of the economy, thus reducing the risk of “virtual” price formation, which would only result from endogenous financial activity, in order to come up with innovative solutions.

[...]

In order to understand and support AI innovations, it is therefore not enough to list the most likely application areas. Rather it is crucial to understand the process that will give rise to these applications, and how they are likely to propagate in the market enterprise ecosystem. The work of David (1989) provides a framework for understanding this process: Artificial Intelligence should be seen as a “general purpose technology” in the same way that the steam engine and electricity have been. Therefore its use in a specific sector or for a particular activity is not always self-evident and does not always come at zero cost. Investment is necessary to obtain “secondary innovations” adapted to each use. The Interdisciplinary Institutes of Artificial Intelligence (3IA), created following the Villani report, are organisations designed to stimulate secondary innovations by promoting contacts and projects around a cluster of experts in AI and data sciences: each industry can host innovative projects, led by experts in the field of application. Since the financial sector has been excluded from the 3IAs, it is up to financial institutions to create similar organisations. The Banque de France, investment banks and insurance companies have often created “Labs” on a similar basis: a small group of experts in AI and data science hosts business teams around well-defined projects and over short periods of time, in order to develop innovative solutions.

The complete version of “La finance de marché à l’ère de l’intelligence bon marché” is available on hal.archives-ouvertes.fr/hal-02314348v5

Cahier Louis Bachelier: “How is the carbon pricing puzzle to be resolved?”

To limit global warming to two degrees Celsius by the end of the century, it will be necessary to put a price on carbon. The level and rate of growth of this price over time depend on expectations regarding the emergence of economically mature green technologies in the coming decades. The researcher Christian Gollier has developed an innovative model in incorporating the main technological uncertainties into the determination of the evolution of the carbon price so that the climate objectives set by different countries can be achieved.

Carbon pricing is essential for combatting climate change within the time-frame between now and 2050 with a view to meeting the targets set by the Paris Agreement, because carbon emissions will affect future generations,” Christian Gollier emphasizes. Furthermore, this economic instrument is particularly effective in promoting a low-carbon energy transition with the least impact on purchasing power. But implementing the transition will be far from easy and gives rise to various technical questions, quite apart from its acceptability to the public. At what price should a tonne of carbon be set? How fast should it increase each year? How are macroeconomic and technological uncertainties to be incorporated into the pricing mechanism? What is the cost of the long-term damage caused by a tonne of carbon emitted into the atmosphere now? What are the social and private benefits of carbon pricing? At present there is little consensus on these and other issues within the scientific community and on the part of the governments of the various countries. In France, for example, in early 2019 the Quinet 2 commission on the shadow price of carbon recommended applying an annual growth rate of 8% to the carbon price with a floor price of €69 in 2020. On that basis, a tonne of carbon would be priced at €775 in 2050 – twenty times the current level! In the United Kingdom, the Department for Business, Energy and Industrial Strategy estimates the growth rate per tonne of CO₂ at 15% and a price of £13.84 in 2020, whereas in the United States, the figure is only 1.65% with a price of \$42 per tonne in 2020. Given such disparities, it is difficult to address the issues mentioned above.

TWO DIFFERENT APPROACHES TO PRICING CARBON

To make matters worse, there are two different methods for setting a carbon price. – The first is a cost-benefit calculation based on the polluter pays principle. This has been used for the past twenty years and has been popularized by William Nordhaus, winner of the Nobel Prize in economics in 2018. This method presupposes that the price of carbon will be higher in the future, due

to the greater concentration of carbon in the atmosphere and greater marginal damage in the long term. “This method is the first option, but it has many limitations. Most international negotiations are not based on a carbon price, but on each country limiting emissions over time, with a carbon budget for each region,” Christian Gollier says. – The second is a cost-effective approach, with the aim of defining an optimal strategy for allocating the carbon budget over the next three decades, so that it is compatible with the objective of limiting global warming to 2 degrees. “This method has developed because the damage functions are very difficult to calculate in the long term, in particular estimating the damage in 30 years time of a tonne of CO₂ released today. It is, in addition, better aligned with the Paris Agreement, which is also based on the quantity of emissions and not on a carbon price,” Christian Gollier explains. In his opinion, the outstanding question is whether to impose a high price immediately, or whether a lower price would be acceptable in the short term if it is compensated by a high price in the long term.

MANY UNCERTAINTIES BETWEEN NOW AND 2050

While both these calculation methods and the difference in carbon price growth rates present problems, the Intergovernmental Panel on Climate Change (IPCC) has also addressed this issue. On the basis of 356 different models, the average annual carbon price growth rate is 7.90%, a figure very close to the one calculated by the Quinet 2 commission in France. “According to Hotelling’s theory, the growth rate of the carbon price should be equal to the risk-free interest rate. But this theory does not take into account the major uncertainties mentioned above. Moreover, if the carbon price were to increase by 8% per year with certainty, investors would be happy to trade this carbon asset, which shows that it cannot be in equilibrium. But the IPCC models do not incorporate uncertainties,” Christian Gollier says. However, if the relevant technologies improve in the coming years, the fight against global warming would be less costly and would call for less effort today.

“Technological uncertainty must be taken into account. So we need to review the Hotelling rule,” Christian Gollier says. In addition, calculating a growth rate for the carbon price taking into account uncertainties could encourage investment in the low-carbon energy transition.

A NEW MODEL FOR CALCULATING THE GROWTH RATE OF THE CARBON PRICE

To calculate an annual growth rate of the carbon price taking into account uncertainties, Christian Gollier developed a Consumption Capital Asset Pricing Model (CCAPM) that incorporates macroeconomic and technological uncertainties and optimizes the emissions reduction effort over time. “With a limited carbon budget, it is not possible to guarantee a rate of return on a low-carbon investment that matches the growth rate of the carbon price,” Christian Gollier explains. In other words, we cannot make the price of carbon play the role of a price signal associated with the country’s carbon budget and at the same time guarantee stable returns on today’s green investments, much to the regret of renewable energy producers. But Christian Gollier offers a way of overcoming this problem: “The risks taken by investors in low-carbon projects can be offset by a positive risk premium. This can be done by offering a carbon price growth trend higher than the risk-free rate. End of the Hotelling rule!” In addition, to determine the sign and level of the risk premium offered to investors to encourage them to invest now, the “beta” of the marginal abatement cost of a tonne of CO₂ needs to be measured. If the abatement cost is positively correlated with economic growth, the idea of postponing most

of the effort makes sense, since the effort will be less costly in the event of a recession. In this positive beta configuration, one can start with a low carbon price, offset by an expected high price growth rate, even if it means reducing the price in ten or twenty years time if the secular stagnation hypothesis put forward by some economists is confirmed. A Monte Carlo simulation of the model shows that the carbon price is positively correlated with growth, as shown by the fall in carbon prices on the European allowance market during the 2008 economic recession. Without going into technical details, the mathematical determination of the researcher’s model shows that the optimal real growth rate of the carbon price should be set at about 3.5% per year. “The carbon price is fundamental and must be compatible with other assets in the economy, but governments fail to understand that quantitative emissions reduction targets entail the pricing of carbon. The carbon price in 2050 needed to meet European commitments is very uncertain, and this is a problem for responsible financial management. The good news, however, is that these risks can be offset by a rate of carbon price growth that is higher than the interest rate, without it being unduly high,” Christian Gollier concludes. Whether or not the recommendations of scientific research on the carbon tax are implemented remains to be seen, while in the meantime the climate emergency is becoming ever more critical.

This is an extract from *Les Cahiers Louis Bachelier* n° 35 | December 2019:

“Mobilizing economic research against climate change”.

KEY POINTS

Carbon pricing is essential to fight global warming.

The abatement cost of a tonne of CO₂ is positively correlated with aggregate consumption. This implies that the price per tonne of CO₂ must increase in expectation of a higher rate than the current interest rate, in order to stimulate green investment.

The carbon price growth rates recommended by the IPCC models are too high, and this in turn implies a price that is currently too low. The innovative model developed by Christian Gollier recommends applying an annual growth rate of 3.5%.

METHODOLOGY

Christian Gollier developed an optimization model to estimate the changing price of carbon over time. His model is distinctive in that it incorporates uncertainties about the future cost of carbon abatement. He thus modified the Consumption Capital Asset Pricing Model (CCAPM) with the internalizing of macroeconomic and technological risks, as well as those pertaining to the carbon budget and the endogenous climate effort. He calibrated this model using IPCC figures and incorporated into it macroeconomic disaster risks. Finally, he used Monte Carlo simulations to solve his model and obtain quantified results.



CHRISTIAN GOLLIER

is director of Toulouse School of Economics, which he founded with Jean Tirole. He is an internationally renowned researcher in Decision Theory under Uncertainty and its applications in climate economics, finance, and cost-benefit analysis, with a special interest in long-term (sustainable) effects. He is one of the lead authors of the last two IPCC reports.

He is also president-elect of the European Association of Environmental and Resource Economists (EAERE).



BOOK

In his book “Le climat après la fin du mois”, published by Presses Universitaires de France in May 2019, Christian Gollier provides an uncompromising analysis of the efforts that humanity must make to fight global warming. Without giving way to catastrophism, he argues that climate issues must be made a priority not only by governments around the world, but also by people, especially in developed countries. This publication has been awarded the AEE 2019 Marcel Boiteux Prize for Energy Saving, the Turgot Prize, and the Montpensier - BFMTV Prize for the best environmental book of 2019.

ILB online

ILB MOOC: A PLATFORM DEDICATED TO TRAINING

The ILB has been involved in the production and dissemination of training content through MOOCs since 2014. Various teachers have taken part in the exercise on a variety of topics. In order to make its content available to the greatest number of people free of charge, the ILB has integrated a digital platform in its new portal, where all its MOOCs can be found in French and English.

MOOC “Climate: A challenge for finance” (reedition March 2020)

PIERRE DUCRET

Chairman of I4CE, Caisse des Dépôts Group Climate Advisor, Institute for Climate Economics.

MARIA SCOLAN

Director of Climate Projects, Caisse des Dépôts.

MOOC “ Practical introduction to market microstructure “ (launch May 2020)

PAUL BESSON

Head of Quantitative Research, Kepler-Cheuvreux.

MOOC “The fundamentals of financial risk management” (original version 2017)

JUSTIN MCCARTHY

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MOOC “Financial regulation at the service of the economy” (original version 2016)

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INSTITUTLOUISBACHELIER.ORG: THE NEW PORTAL FOR PARTNERSHIP DRIVEN RESEARCH

Since November 2019, institutlouisbachelier.org integrates all the activities of the Network and the ILB Group. With this new portal we wish to bring value to our stakeholders by :

- Making the ILB research and programs more accessible.
- Connecting all contact points through one portal.

ILB organizes events like the yearly Risk Forum and hosts networks such as the ReFinE (Real Estate Finance and Economics Network). It is also ILB that accompanies the various research projects and interdisciplinary programs in terms of administrative assistance, organization of workshops and communication of activities. Come join us online!

If you have suggestions for improvements, please send an email to Stine Hansen, Director of Communication & Engagement, stine.hansen@institutlouisbachelier.org.



ILB METHODS: A VIDEO TOOL TO DEMYSTIFY QUANTITATIVE MODELS

The third issue of the ILB Methods collection, **Climate Data for Physical Risk Assessment in Finance**, was produced by Peter Tankov (Professor of Quantitative Finance at ENSAE) and Alexis Tantet (contract researcher at the Dynamic Meteorology Laboratory at the Ecole Polytechnique). The summary note and the video illustrating the model will soon be posted on the ILB portal.



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