



## SCOR CHAIR

### « Market Risk and Value Creation »

### Activity Report 2017

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*Co- Head of the Chair*                *Stéphane Villeneuve*

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- M. Sébastien Pouget Directeur IDEI
- M. Philippe Trainar Directeur des risques, SCOR
- M. Elyès Jouini Directeur de l'institut de Finance Dauphine
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*Last steering committee, SCOR headquarter, Paris May 15<sup>th</sup>, 2017.*



## 1 OBJECTIVE

The SCOR Chair "Risk Markets and Value Creation" was created in 2008 and renewed in 2012 for a period of 5 years. It has been the result of a process of reflection of the SCOR management that has led IDEI researchers to focus their research on different projects detailed below, all having in common: the study of risk sharing mechanisms.

The aim of the chair is to support the theoretical and applied research on risk sharing with the willingness to combine methodologies from financial economics, industrial organization and econometrics.

SCOR Chair "Risk Markets and Value Creation » is built around 5 projects involving a team of dedicated researchers. This report will provide below a synthetic presentation of each project.

We would like to emphasize that SCOR Chair "Risk Markets and Value Creation" is a long-term support for research and several working papers from previous years funded by it have been published in 2017.

## 2 DESCRIPTION OF THE PROJECTS

### a) *Ambiguity and Long-term Investments*

#### IDEI Team

Christian Gollier, Professor of Economics TSE

Sébastien Pouget, Professor of Finance TSE

Nicolas Treich, Research Director INRA-TSE

The aim of this research project is to understand long-term investment decisions under various types of uncertainty (small risk, catastrophic risk, ambiguity etc.), and in particular, the role of temporality and long-term interest rates. The typical applications are long term financial, insurance and environmental decisions.

The scientific production of this research project in 2017 consists in 1 published paper, 3 forthcoming articles, 2 downloadable working papers.

Catastrophe aversion and risk equity are important concepts in both risk management theory and practice. Keeney (1980) was the first to formally define these concepts. He demonstrated that the two concepts are always in conflict. Yet this result is based on the assumption that individual risks are independent and has thus limited relevance for real world catastrophic events. In Bernard, Rheinlander and Treich (2016), we extend Keeney's result to dependent risks and derive the conditions under which more correlation between two risks induces a more catastrophic risk. We then generalize some of the results for multiple correlated risks. This yields to the publication

1. Bernard C., C. Rheinberger and N. Treich (2017), Catastrophe Aversion and Risk Equity under dependent risks, Forthcoming Management Science.

In a second paper, Nicolas Treich with Xue-Zhong He has examined the properties of prediction market prices when risk averse traders have heterogeneous beliefs in state probabilities. They show that the equilibrium state prices equal the mean beliefs of traders about that state if and only if the traders' common utility function is logarithmic. They also provide a necessary and sufficient condition ensuring that the state prices are systematically below or above the mean beliefs of traders, thus providing a rational explanation to the favorite-longshot bias in prediction markets.

2. Xue-Zhong He and N. Treich, (2017), Prediction Market prices under risk aversion and heterogeneous beliefs, forthcoming Journal of Mathematical Economics

Mitigation reduces the expected future damages from climate change, but how does it affect the aggregate risk

borne by future generations? This raises the question of the 'climate beta', i.e., the elasticity of climate damages with respect to a change in aggregate consumption. In their paper « the climate beta », Dietz, Gollier and Kessler show that the climate beta is positive if the main source of uncertainty is exogenous, emissions-neutral technological progress, implying that mitigation has no hedging value. But these results are reversed if the main source of uncertainty is related to the carbon- climate-response and the damage intensity of warming. They show that in the DICE integrated assessment model the climate beta is positive and close to unity. In estimating the social cost of carbon, this would justify using a relatively high rate to discount expected climate damages. However, the stream of undiscounted expected climate damages is also increasing in the climate beta. We show that this dominates the discounting effect, so that the social cost of carbon is in fact larger than when discounting expected damages at the risk-free rate.

3. Dietz, S., C. Gollier, and L. Kessler, (2017), The climate beta, forthcoming, Journal of Environmental Economics and Management.

In the paper « Stochastic volatility implies fourth-degree risk dominance: Applications to asset pricing », Gollier demonstrates that increasing the risk surrounding the variance of future consumption generates a fourth-degree risk deterioration in future consumption, yielding an increase in its excess kurtosis. Its impact on the equilibrium risk premium is thus positive if only if the fourth derivative of the utility function is negative. Its impact on interest rates is negative only if its fifth derivative is positive. We also show that the persistence of shocks to the variance of the consumption growth rate, as assumed in long-run risk models, has no effect on the term structure of the variance ratio which remains flat in expectation, but it makes the term structure of the annualized fourth cumulant of log consumption increasing. It generates term structures of interest rates and risk premia that are respectively decreasing and increasing under constant relative risk aversion. Using recursive preferences does not qualitatively modify these results, which are counterfactual. However, the persistence of shocks to the variance of changes in log consumption is supported by the observation that their annualized 4th cumulant exhibits an increasing term structure over the period 1947Q1-2016Q4 in the United States.

4. Gollier C.(2017), Stochastic volatility implies fourth-degree risk dominance: Applications to asset pricing, TSE working paper.

Suppose that the variance of the payoff of an asset is uncertain. How does this uncertainty affect the attitude towards this asset? More generally, how does a shift in the distribution of this variance influence expected utility? In the paper « Variance Stochastic orders », Gollier builds a theory of stochastic dominance on variance that is based on the seminal work of Eeckhoudt and Schlesinger (2006) who raised the following question: Do you prefer to bear a zero-mean risk for sure, or two independent and identically distributed zero-mean risks with probability 1/2? They showed that shifting from the first risk context to the second one is an example of fourth degree risk increase as defined by Ekern (1980), in the sense that it is perceived as undesirable by any von Neumann-Morgenstern individual with a negative fourth derivative of the utility function, a condition coined as "temperance" in decision theory (Kimball (1993), Gollier and Pratt (1996)). Golfer generalize s this result by showing that any Rothschild-Stiglitz increase in risk in the number of zero-mean risks attached to the gamble reduces expected utility if and only if the fourth derivative of the utility function is negative. In other words, in this context of additive i.i.d. risks, temperant people dislike increasing variance risk.

5. Christian Gollier, « Variance stochastic orders », TSE Working Paper, n° 17-828, juillet 2017.

Finally, Sauvagnat, Pouget and Villeneuve have published a paper funded by SCOR chair that studies the impact of the confirmatory bias on financial markets. Building on Rabin and Schrag (1999), they propose a model in which some traders may ignore new evidence when it is inconsistent with their favorite hypothesis regarding the state of the world. The confirmatory bias provides a unified rationale for several existing stylized facts including excess volatility, excess volume and momentum. It also delivers novel predictions: at the individual level, traders' belief updating depends on the sign of past signals and previous beliefs, and, at the stock level, differences of opinion should be larger when past subsequent signals have different signs. Using data on US firms' earnings

announcements and analysts' earnings forecasts from 1982 to 2014, they find strong empirical support for these predictions, suggesting that the confirmatory bias is at work in financial markets.

6. Sauvagnat J., S. Pouget and S. Villeneuve « A Mind is a Terrible Thing to Change: Confirmation Bias in Financial Markets », *The Review of Financial Studies*, vol. 30, n° 6, juin 2017, p. 2066–2109.

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3. Dietz, S., C. Gollier, and L. Kessler, (2017), *The climate beta*, forthcoming, *Journal of Environmental Economics and Management*.
4. Gollier C. (2017), *Stochastic volatility implies fourth-degree risk dominance: Applications to asset pricing*, TSE working paper.
5. Christian Gollier, « Variance stochastic orders », TSE Working Paper, n° 17-828, juillet 2017.
6. Sauvagnat J., S. Pouget and S. Villeneuve « A Mind is a Terrible Thing to Change: Confirmation Bias in Financial Markets », *The Review of Financial Studies*, vol. 30, n° 6, juin 2017, p. 2066–2109.

### b) *Dynamic Corporate Finance*

#### IDEI Team

Jean-Paul Décamps, Professor of Mathematics TSE

Jean-Charles Rochet, Professor of Banking University of Zurich and TSE

Stéphane Villeneuve, Professor of Mathematics TSE

The scientific production of this research project in 2017 consists in 1 published paper, 3 downloadable working papers.

i) One of the main objective of dynamic corporate finance is to apply the rigor of the mathematical techniques of continuous-time finance models to very concrete financial problems faced by firms, such as how to finance their investments, when to distribute dividends and when to default on their debt. IDEI researchers have pursued their research agenda on dynamic corporate finance focusing on financial frictions such as limited liability or agency problems that make the Modigliani and Miller theorem obsolete.

In the paper « *Corporate Policies with Temporary and Permanent Shocks* » (1), risk management in the presence of transitory and permanent shocks is analyzed to determine whether the management of these two sources of risk is substantially different.

One result is that hedging policies using derivatives with respect to transitory and permanent shocks are markedly different. The hedge ratio with respect to transitory shocks is constant while the hedge ratio with respect to permanent shocks is linear in scaled cash holdings. Furthermore, the signs of the optimal hedge ratios can be opposite.

An alternative to risk management using derivatives is to change the firm's assets to achieve a different exposure to transitory or permanent shocks. This is a version of asset substitution. An important difference between asset substitution and hedging with derivatives is that the former does not generate cash flows. Whether risk management generates cash flows or not is not important in models with unconstrained financing, but this is relevant in a model with financing frictions like ours. Managing permanent risk with either derivatives or asset substitution boils down to balancing the effect of risk management on the volatility and persistence of cash flows.

Typically, risk management of either type would increase beneficial persistence at the cost of an increased volatility. The difference between derivatives and asset risk management is that the former manipulates short-term cash flow volatility and the latter affects long-term asset-profitability volatility. This implies that the two strategies have different incentives with varying  $c$  for a financially constrained firm. For example, derivative hedging loses some of its potential when a firm is financially weaker, i.e. when the level of cash reserve is low. A firm with little cash, cannot afford to generate cash flow shocks to benefit from persistence, as this would put it at risk of running out of cash quickly. By contrast, a distressed firm would have strong incentives to engage in asset substitution to increase volatility.

(1) Jean-Paul Décamps, S. Gryglewicz, E. Morellec et Stéphane Villeneuve, « Corporate Policies with Temporary and Permanent Shocks », *The Review of Financial Studies*, vol. 30, n° 1, janvier 2017, p. 162–210.

*ii)* Our ongoing research program aims to answer the following question, what is the optimal liquidity management policy when the firm profitability is uncertain? Two working papers analyse this question.

Jean-Paul Décamps et Stéphane Villeneuve continued our research program on the interplay between profitability and liquidity concerns and the consequences in firm's management decision in

« *Integrating profitability prospects and cash management* », *TSE Working Paper*, n° 15-570, avril 2015. (2)

We enrich our previous study by introducing the possibility for firm's management to costly issue new securities. Specifically, we develop a dynamic model of corporate cash management in which cash constrained shareholders learn about the firm's long-term profitability by observing earnings. Shareholders weight the costs and benefit of holding cash and cope both a profitability concern (the risk to run a non-profitable project) and a liquidity concern (the risk to be forced to refinance, or even to liquidate a profitable project). At each date, firm's management decides whether or not to continue the project, the insurance and dividend policies as well as the issuance policy. Our study mainly concerns young innovative firms that do not precisely know their long-term prospects and learn their project's average profitability as time passes. We characterize the optimal payout and issuance policies, thereby explaining how profitability prospects and changes in corporate cash management are intertwined. In our model, issuance and dividend policies depend on a variable that relates profitability prospects and cash reserves and that summarizes the difference between performance records and counter performances of the firm. Cash target levels are non-monotonic in profitability prospects, and, beyond an endogenous threshold, refinancing is too costly and the firm is liquidated when cash reserves are depleted. These results yield novel insight into the relationship between profitability prospects, precautionary cash savings, dividend policy and the dynamics of the firm value. A preliminary version of our study will be soon available.

H. Mete Soner, Max Reppen et Jean-Charles Rochet, analyse in the paper

« *Optimal dividend policies with random profitability* », *TSE Working Paper*, n° 18-886, janvier 2018. (3)

an optimal dividend problem under a bankruptcy constraint where, in contrast to previous works, general cash flow drifts, including Ornstein–Uhlenbeck and CIR processes, are considered. We provide rigorous proofs of continuity of the value function, whence dynamic programming, as well as uniqueness of the solution to the Hamilton–Jacobi–Bellman equation, and study its qualitative properties both analytically and numerically. The value function is thus given by a nonlinear PDE with a gradient constraint from below in one dimension. We find that the optimal strategy is both a barrier and a band strategy and that it includes voluntary liquidation in parts of the state space. Finally, we present and numerically study extensions of the model, including equity issuance and gambling for resurrection.

*iii)* The liquidity management models we have discussed above rely on exogenous financial frictions (costly refinancing and bankruptcy costs). A crucial extension is to focus on endogenous

frictions arising from agency problems between management and shareholders. As a consequence, we have studied the long-term optimal contract between shareholders and the manager in Biais, Mariotti, Rochet and Villeneuve [1]. One of the major result is that the optimal contract uses cash-reserve as one of its instruments establishing a nice connection with the liquidity management models. In the submitted working paper « *A two-dimensional control problem arising from dynamic contracting theory* », TSE Working Paper, n° 18-884, janvier 2018. (4)

J.P. Decamps and S. Villeneuve study a corporate finance dynamic contracting model in which the firm's growth rate fluctuates and is impacted by the unobservable effort exercised by the manager. They focus on methodological aspects of the dynamic moral hazard problem. They show that the principal's problem takes the form of a two-dimensional Markovian control problem and prove regularity properties of the value function that are instrumental in the construction of the optimal contract that implements full effort, which we derive explicitly. These regularity results appear in some recent economic studies but with heuristic proofs that do not clarify the importance of the regularity of the value function at the boundaries.

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- (1) J.-P. Décamps, S. Gryglewicz, E. Morellec et S.Villeneuve, « Corporate Policies with Temporary and Permanent Shocks », *The Review of Financial Studies*, vol. 30, n° 1, janvier 2017, p. 162–210.
- (2) J.-P. Décamps et S. Villeneuve « Integrating profitability prospects and cash management », TSE Working Paper, n° 15-570, avril 2015.
- (3) H. Mete Soner, M. Reppen et J.-C. Rochet, « Optimal dividend policies with random profitability », TSE Working Paper, n° 18-886, janvier 2018.
- (4) J.P. Decamps et S. Villeneuve « A two-dimensional control problem arising from dynamic contracting theory », TSE Working Paper, n° 18-884, janvier 2018.

### c) Longevity risk, long term care and (social) insurance

#### IDEI Team

Helmuth Cremer, Professor of Economics TSE  
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Pierre Pestieau, Professor of Economics University of LIEGE  
Emmanuel Thibault, Professor of Economics University of Perpignan

In this research's theme, four main questions are considered: the optimal design of a long terme care (LTC) social insurance given the market and the family, the reimbursement rule: coinsurance or at benefit, the political support of LTC social programs, and finally the role of social norm and family altruism to explain informal care. We study these various aspects by using tools from the risk theory, microeconomics analysis, macroeconomic dynamics, optimal taxation, political economy, public economics and/or insurance theory.

In [1], we study LTC choices by bargaining families with mixed- or same-gender siblings. LTC care can be provided either informally by children, or formally at home or in an institution. A social norm implies that daughters suffer a psychological cost when they provide less informal care than the average child. We show that the laissez-faire (LF) and the utilitarian first-best (FB) differ for two reasons. First, because informal care imposes a negative externality on daughters via the social norm, too much informal care is provided in LF. Second, the weights children and parents have in the family bargaining problem might differ in general from their weights in social welfare. We show that the FB allocation can be achieved through a system of subsidies on formal home and institutional care. Except when children and parents have equal bargaining weights these subsidies are gender-specific and reflect Pigouvian as well as paternalistic considerations.

In [2] we study the design of LTC policy when children differ in their cost of providing informal care. Parents do not observe this cost, but they can commit to a bequests rule specifying a transfer conditional on the level of informal care. Care provided by high-cost children is distorted downwards in order to minimize the rent of low-cost ones. Social LTC insurance is designed to maximize a weighted sum of parents' and children's utility. The optimal uniform public LTC provision strikes a balance between insurance and children's utility. Under decreasing absolute risk aversion less than full insurance is provided to mitigate the distortion on informal care which reduces children's rents. A nonuniform policy conditioning LTC benefits on bequests provides full insurance even against the risk of having children with a high cost of providing care. Quite surprisingly the level of informal care induced by the optimal (uniform or nonuniform) policy always increases in the children's welfare weight.

In [3] we study the role of private and public LTC insurance when benefits cannot be conditioned on family aid. We compare the properties and optimality of the topping up versus opting out public insurance schemes. Under topping up, the required LTC is less than full insurance and should be provided publicly unless private insurance market for dependency is fair. With an opting out scheme, there will be three possible equilibria depending on the children's degree of altruism. These imply: full LTC insurance with no aid from children, less than full insurance just enough to induce aid, and full insurance with aid. Fair private insurance can support only the first equilibrium. Opting out policies are self-targeted and dominate topping up schemes when the degree of children's altruism is sufficiently large. However, when the degree of altruism is small the dominance goes in the opposite direction.

In [4], we show that the rotten kids mechanism combined with a contribution game to a household public good may lead to an astonishing equalization of consumptions between the spouses and their parents, even when their parents' wealth levels differ. We consider two families, each consisting of a parent and an adult child, who are linked by the young spouses. Children contribute part of their time to a household (couple) public good and provide attention to their respective parents in exchange for a bequest. Spouses behave towards their respective parents like Becker's rotten kids; they are purely selfish and anticipate that their altruistic parents will leave them a bequest. The most striking results obtain when wages are equal and when parents' initial wealth levels are not too different. For very large wealth differences the mechanism must be supplemented by a (mandatory) transfer that brings them back into the relevant range. When wages differ but are similar the outcome will be near efficient (and near egalitarian).

In [5], we consider an economy where individuals differ in productivity and in risk. We examine the role of uniform and non-uniform social insurance to supplement a general income tax when neither public nor private insurers can observe individual risk and when it is positively correlated with wages. Consequently, an equilibrium à la Rothschild and Stiglitz (1971) emerges in the private insurance market and low-wage/low-risk individuals are not fully insured. It shows that even when social insurance provided to the poor has a negative incentive effect, it also increases their otherwise insufficient insurance coverage. Social insurance to the rich produces exactly the opposite effects. Whichever of these effects dominates, some social insurance is always desirable. Finally, we introduce risk misperception which exacerbates the failure of private markets. The insurance term now reflects the combined failure brought about by adverse selection and misperception. Now the low-risk individuals are not only underinsured, but also pay a higher than fair rate. However, and rather surprisingly, it turns out that this does not necessarily strengthen the case for public insurance.

In [6], we study the determination of informal LTC (family aid) to dependent elderly in a worst case scenario concerning the harmony of family relations. Children are purely selfish, and neither side can make credible commitments (which rules out efficient bargaining). We show that when family aid (and long-term care services in general) are introduced the outcome is likely to be inefficient. Still, the rotten kid mechanism is at work and ensures that a positive level of aid is provided as long as the bequest motive is operative. We identify the inefficiencies by comparing the laissez-faire (subgame perfect) equilibrium to the first-best allocation. We initially assume that families are identical ex ante. However, the case where dynasties differ in wealth is also considered. We study how the provision of LTC can be improved by public policies under various informational assumptions. Interestingly, crowding out of private aid by public LTC is not a problem in this setting. With an operative bequest

motive, public LTC will have no impact on private aid. More amazingly still, when the bequest motive is (initially) not operative, public insurance may even enhance the provision of informal aid.

In [7], ambiguity aversion to uncertain survival probabilities is introduced in a static life-cycle model with a bequest motive to study the optimal demand for annuities. Provided that annuities' return is sufficiently large, and notably when it is fair, positive annuitization is known to be the optimal strategy of ambiguity neutral individuals. Conversely, we show that the demand for annuities decreases with ambiguity aversion and that there exists a definite degree of aversion above which the demand is non positive: the optimal strategy is then to either sell annuities short or to hold zero annuities if the former option is not available. To conclude, ambiguity aversion appears to be a relevant candidate for explaining the annuity puzzle.

In [8], we study the political determination of the level of social LTC insurance when voters can top up with private insurance, saving and family help. Agents differ in income, probability of becoming dependent and of receiving family help, and amount of family help received. Social insurance redistributes across income and risk levels, while private insurance is actuarially fair. We obtain that family support crowds out the demand for both social and, especially, private insurance, while the availability of private insurance decreases the demand for social insurance but need not decrease its majority chosen level.

The purpose of [9] is to test alternative models of long-term caring motives. We consider three main motives: pure altruism, exchange and family norm. Our database is the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) which allows linking almost perfectly and with complete information children and their parents' characteristics. Comparing the empirical results to the theoretical models developed, it appears that, depending on the regions analyzed, long-term caring is driven by moderate altruism or by family norms.

With the rapid increase in LTC needs, the negligible role of the market and the declining role of informal family care, one would hope that the government would take a more proactive role in the support of dependent elderly, particularly those who cannot, whatever the reason, count on assistance from their family. The purpose of [10] is to analyze the possibility of designing a sustainable public LTC scheme that would meet a widespread concern, that of going bankrupt and being unable to bequeath any saving to one's children.

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## d) *Nonexclusivity in Insurance and Financial Markets*

### IDEI Team

Andrea Attar, chargé de recherche CNRS  
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François Salanié, directeur de recherche INRA

Attar, Mariotti and Salanié have pursued their fruitful research agenda about theoretical models of insurance provision under adverse selection .

In the paper « On a class of smooth preferences » which is revised and resubmit in Economic theory, Attar, Mariotti and Salanié construct a complete space of smooth strictly convex preference relations defined over physical commodities and monetary transfers. This construction extends the classic one by assuming that preferences are monotone in transfers, but not necessarily in all commodities. We thereby provide a natural framework to perform genericity analyses in situations involving inventory costs or decisions under risk. The space of preferences we construct is contractible, which allows for a natural aggregation procedure in collective decision situations.

In the paper « Entry-proofness and Market breakdown under Adverse selection », Attar, Mariotti and Salanié provide a necessary and sufficient condition for entry to be unprofitable under adverse selection; namely, that no buyer type be willing to trade at a price above the expected unit cost of serving the types who are at least as eager to trade than her. We give two applications of this result. First, we clarify the circumstances under which adverse selection causes market breakdown. Second, we consider nonexclusive active markets in which buyers can simultaneously trade on the market and with an entrant, and we fully characterize the unique entry-proof market tariff. By emphasizing the formal analogy between these two situations, our general approach offers a unified perspective on entry-proofness in adversely selected markets. We argue that estimates of upper-tail conditional expectations of unit costs are a key variable for tests of adverse selection, and we outline such a test in nonexclusive insurance markets.

## e) *Econometrics of risk, volatility and predictability of asset returns*

### IDEI Team

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The main contribution of the paper Dovonon, P., S. Gonçalves, U. Hounyo and N. Meddahi (2016): “Bootstrapping high-frequency jump tests,” which has been accepted in the *Journal of the American Statistical Association* is to propose a bootstrap test for jumps based on functions of realized volatility and bipower variations. Bootstrap intraday returns are randomly generated from a mean zero Gaussian distribution with a variance given by a local measure of integrated volatility. We first discuss a set of high level conditions on the estimators of the local volatilities such that any bootstrap test of this form has the correct asymptotic size and is alternative-consistent. Our results show that the choice of these local estimators is crucial for the power of the test. In particular, we should choose these estimators in a way that is robust to jumps. We then focus on a thresholding-based estimator for these local volatilities and provide a set of primitive conditions under which our bootstrap test is asymptotically valid. We also discuss the ability of the bootstrap to provide second-order asymptotic refinements under the null of no jumps. The cumulants expansions that we develop show that our proposed bootstrap test is unable to mimic the first-order cumulant of the test statistic. The main reason is that it does not replicate the bias of the bipower variation as a measure of integrated volatility. We propose a modification of the original

bootstrap test which contains an appropriate bias correction term and for which second-order asymptotic refinements obtain.

The paper Bontemps, C. (2016): "Moment-based test under parameter uncertainty," forthcoming in Review of economics and statistics is a substantial revision of the former paper "Moment-based tests for discrete distributions". In this paper, we deal with the parameter uncertainty. When one tests moment assumptions (no correlation, kurtosis, number of Hit violations in a VaR model), one has to take into account that it is implemented on estimated quantities rather than observed ones. Ignoring it would lead to invalid procedures that might conclude wrongly. Assume for example that we are interested in a linear forecasting model for  $Y(t)$  at the next period, based on explanatory variables  $X(t)$ . The model does a good job if there is no longer any autocorrelation within the error terms of the regression of  $Y(t)$  on  $X(t)$ . This can be tested by testing that the first auto-covariance is equal to zero. Unfortunately, we do not observe the true error terms and our testing procedure is based on the residuals, i.e. quantities derived from an estimation step.

### **3 SUMMARY OF THE ACTIVITIES OF 2017 FUNDED BY THE CHAIR**

#### **a) *Steering committee***

The activity of the chair is coordinated with the SCOR representatives through the steering committee which meets at least once a year. The latest steering committee was held on May 15th, 2017 in the presence of Philippe Trainar director of the SCOR corporate foundation for science, Stéphane Buttigieg as the ILB representative, Christian Gollier and Stéphane Villeneuve as IDEI representatives.

The orientation committee of May 15, 2017 has been of particular importance for the last of the five-year contract linking the various partners of the "risk market and value creation" chair that are SCOR, IDEI and the ILB. It had two objectives: to take stock of research within the framework of the Chair and to discuss the possible renewal of the partnership for a further 2 years. The discussion has led to the drafting of a convention that has been submitted to a vote Scientific Council of the Foundation SCOR on June 20, 2017. The final convention for the renewal of the partnership is currently under writing.

The committee is an opportunity for IDEI researchers to present their research results and enables the SCOR representatives to express their needs in terms of research. It also determines the orientation of applied research to meet the needs expressed by the SCOR management. Monitoring is done in two ways: the delivery of research papers and the development of internal seminars. Hence, SCOR teams are in constant contact with the IDEI researcher.

Philippe Trainar has recommended through the steering committee that Toulouse researchers continue to work on the following themes in the next two years: ambiguity risk and long-term allocation; mechanism of coverage of the dependency; effective risk-sharing mechanisms under limited liability constraints and robust risk measures.

#### **b) *Events and Conferences organized by the chair :***

-In 2017, S. Villeneuve has been co-editor of the special issue « L'industrie de l'assurance et ses mutations » of the revue d'économie financière. In particular, he wrote with J.P. Decamps the paper « Jusqu'où les compagnies d'assurances peuvent-elles investir dans le financement des dettes des PME/ETI? »  
-Financial Econometrics Conference, Toulouse May 12-13, 2017.

#### **c) *Conferences scheduled by the chair :***

The Chair SCOR will organize a conference celebrating the 60th birthday of Jean-Charles Rochet that will be held on May 31 - June 1, 2018 in Toulouse School of Economics. The confirmed speakers are Bruno Biais ( TSE- HEC ), Fabrice Collard ( University of Bern ), Jean-Paul Décamps ( TSE ), Gabrielle Demange ( PSE – EHESS ), Ivar Ekeland ( University Paris Dauphine ), Xavier Freixas ( UPF Barcelona ), Hans Gersbach ( ETH Zurich ), Thomas Mariotti ( TSE ), David Martimort ( PSE – EHESS ), Hervé Moulin ( University of Glasgow ), Martine Quinzii ( University of California, Davis ), Lars Stole ( The University of Chicago Booth School of Business ), Jean Tirole ( TSE ), Stéphane Villeneuve ( TSE )

#### **d) *Presentation in connection with the Chair :***

We list below some talks that have been made last year in connection with the research initiative

C.Gollier: Seminar at Grantham Institute, London School of Economics. Présentation de « Term structures of discount rates: An international perspective » January 2017.

C.Gollier: 21/2/17 : Seminar at Oxford. Présentation de « Term structures of discount rates: An international perspective » February 2017.

C. Gollier: Seminar at University College London. Présentation de « Stochastic volatility implies fourth-degree risk dominance: Applications to asset pricing” April 2017.

C. Gollier: Seminar at KUL (Leuven, Belgique). Présentation de « Stochastic volatility implies fourth-degree risk dominance: Applications to asset pricing” April 2017.

S.Villeneuve: Bachelier Seminar at Institut Henri Poincaré: How do probabilists understand Holmstrom-Milgrom model with limited liability, March 2017.

S.Villeneuve: Invited Speaker « Conférence PDE and Probability Methods for Interactions », Inria Sophia Antipolis, March 2017.

**e) Prize and award :**

Christian Gollier has been elected President of the European Association of Environmental and Resources Economists (EAERE) for a period of 6 years starting on January 1, 2018.

**f) 2017 Scor Prize :**

During the 44th annual seminar of the European Group of Risk and Insurance Economists, the prize "SCOR-EGRIE 2017 for the best paper written by a young economist" was awarded to

*Sebastian Ebert for his article " Decision making when things are only a matter of time ".*

The jury was chaired by Michael Hanselmann, Ludwig-Maximilians University Munich, executive secretary of EGRIE.

The SCOR-EGRIE prize for best paper written by a young economist is organized under the responsibility of the "Risk Markets and Value creation" chair of the Institut d'économie industrielle (IDEI) de Toulouse and the Dauphine University of Paris. It is sponsored by the SCOR Foundation for Science and the Risk Foundation. During the EGRIE seminar, another prize, sponsored by the Risk Markets and Value Creation Chair (which brings together SCOR, IDEI, Risk Foundation and Paris Dauphine), is also awarded: the SCOR-Geneva Risk and Insurance Review Award Best Paper Award for the best paper in the journal Geneva Risk and Insurance Review. In 2017, the price was awarded to

*Michel M Denuit, Louis Eeckhoudt, Liqun Liu, Jack Meyer for their paper "Tradeoffs for Downside Risk-Averse Decision-Makers and the Self-Protection Decision".*

**g) PhD Student and Internship**

In 2017, Vincent Téna from the University Toulouse 1 Capitole has pursued a Ph-D thesis under the supervision of Stéphane Villeneuve on Incentives, Dynamic contracting and Limited liability.

The SCOR chair has also contributed to the funding of two Ph-D students of Nour Meddahi, S. Nyawa and J.Tinang who have been on the job markets this year with the papers

Nyawa S. (2017), "A Factor Model for Systemic Risk Using Mutually Exciting Jumps", working paper, Toulouse School of Economics.

Tinang J. (2017), "Macro Uncertainty and the Term Structure of Risk Premium", working paper, Toulouse School of Economics.

## APPENDICE

- Program of Financial Econometrics Conference, TSE - Manufacture de Tabacs, Toulouse, May 12-13,2017

# Programme

## Financial Econometrics Conference

***Toulouse, May 12-13, 2017***

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### **Conference venue**

Toulouse School of Economics (TSE)  
Manufacture des Tabacs – Auditorium MS 001 – S Building  
21 allée de Brienne - 31000 Toulouse, France

### **Conference Organizers**

Jihyun Kim  
Nour Meddahi

### **Conference Secretariat**

Marie-Hélène Dufour  
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**Friday, May 12, 2017**

**9h00-9h05 Welcome Address: Ulrich Hege**

**9h05-10h40 Session F-I. Chair: Jean-Pierre Florens**

**Yoosoon Chang (Indiana University)** (with Hwagyun Kim and Joon Y. Park)

**Efficient Inference in Continuous-Time Asset Pricing Models with Heteroskedasticity, Endogeneity, Latency and Persistency**

*Discussant:* **Dennis Kristensen (University College London)**

**Jia Li (Duke University)** (with Tim Bollerslev and Yuan Xue)

**Volume, Volatility and Public News Announcements**

*Discussant:* **Julio Crego (CEMFI)**

**Christian Brownlees (University of Pompeu Fabra)** (with Geert Mesters)

**Detecting Granular Time Series in Large Panels**

*Discussant:* **Kevin Sheppard (University of Oxford)**

**10h40-11h10 Coffee & Tea Break**

**11h10-12h45 Session F-II. Chair: Stéphane Villeneuve**

**Christian Gollier (Toulouse School of Economics)**

**Stochastic Volatility Implies Fourth-Degree Risk Dominance: Applications to Asset Pricing**

*Discussant:* **René Garcia (Université de Montréal and Toulouse School of Economics)**

**Barbara Rossi (University of Pompeu Fabra)** (with Tatevik Sekhposyan)

**Alternative Tests for Correct Specification of Conditional Forecast Densities**

*Discussant:* **Christian Bontemps (Toulouse School of Economics)**

**Sophie Moinas (Toulouse School of Economics)** (with Minh Nguyen and Giorgio Valente)

**Funding constraints and market liquidity in the European Treasury Bond Market**

*Discussant:* **Andreas Rapp (Tilburg University)**

**12h45-14h00 Lunch**

**14h00-15h35 Session F-III. Chair: Christian Bontemps**

**Andrew Patton (Duke University)** (with Johanna F. Ziegel and Rui Chen)  
**Dynamic Semiparametric Models for Expected Shortfall (and Value-at-Risk)**  
*Discussant: Nour Meddahi (Toulouse School of Economics)*

**Kamil Yilmaz (Koç University)** (with Dimitris Korobilis)  
**Measuring Dynamic Connectedness with Large Bayesian VAR Models**  
*Discussant: Christian Brownlees (University of Pompeu Fabra)*

**Hwagyun Kim (Texas A&M University)** (with Joon Y. Park)  
**Risk, Ambiguity, and Time-Varying Stochastic Volatility**  
*Discussant: George Tauchen (Duke University)*

**15h35-16h05 Coffee & Tea Break**

**16h05-17h40 Session F-IV. Chair: Enrique Sentana**

**René Garcia (Université de Montréal and Toulouse School of Economics)** (with Eric Jondeau and Florian Pelgrin)  
**A Macro-Finance Model of the Term Structure with Time-Varying Market Prices of Risk**  
*Discussant: Franck Portier (Toulouse School of Economics)*

**Irina Zviadadze (Stockholm School of Economics)**  
**Term Structure of Risk in Macrofinance Models**  
*Discussant: Philippe Mueller (London School of Economics)*

**Jihyun Kim (Toulouse School of Economics)** (with Nour Meddahi)  
**Volatility Regressions with Fat Tails**  
*Discussant: Anders Rahbek (University of Copenhagen)*

**19h45 - Dinner**

**Saturday, May 13, 2017**

**9h00-10h10 Session S-I. Chair: Nour Meddahi**

**Enrique Sentana (CEMFI) (with Gabriele Fiorentini)**  
**Consistent Non-Gaussian Pseudo Maximum Likelihood**  
*Discussant: Eric Gautier (Toulouse School of Economics)*

**Ye Lu (Indiana University) (with Joon Y. Park)**  
**Incremental Factor Model for High Frequency Observations with Large Dimension and Long Span**  
*Discussant: Serge Nyawa (Toulouse School of Economics)*

**10h10-10h40 Coffee & Tea Break**

**10h40-12h15 Session S-II. Chair: George Tauchen**

**Jean Jacod (Université Pierre et Marie Curie) (with Viktor Todorov)**  
**Jump Activity Estimation, a New Method based on the Empirical Characteristic Function Approach**  
*Discussant: Shin Kanaya (Aarhus University and CREATES)*

**Abdelaati Daouia (Toulouse School of Economics) (with Stéphane Girard and Gilles Stuper)**  
**Estimation of Tail Risk based on Extreme Expectiles**  
*Discussant: Andrew Patton (Duke University)*

**Marianne Andries (Toulouse School of Economics) (with Thomas Eisenbach, Martin Schmalz and Yichuan Wang)**  
**The Term Structure of the Price of Variance Risk**  
*Discussant: Dante Amengual (CEMFI)*

**12h15-13h25 Lunch**

13h25-15h00 Session S-III. Chair: René Garcia

Yacine Ait-Sahalia (Princeton University) (with Mehmet Saglam)

High Frequency Market Making: Optimal Quoting

Discussant: Sophie Moinas (Toulouse School of Economics)

Giuseppe Cavaliere (University of Bologna) (with Heino Bohn Nielsen and Anders Rahbek)

Bootstrapping Non-Causal Autoregressions: with an Application to Explosive Bubble Modelling

Discussant: Jihyun Kim (Toulouse School of Economics)

Jeroen Rombouts (ESSEC Business School) (with Lars Stentoft and Francesco Violante)

Modelling Variance Risk Premia via Variance Swap Payoffs

Discussant: Jules Tinang (Toulouse School of Economics)

15h00 Adjourn

Sponsors: SCOR

ANR (Grants held by Jean-Pierre Florens and Sophie Moinas)

ERC (Grant held by Thierry Magnac)

Time allocation: 22 minutes for presenter, 7 minutes for discussant, rest of time for the audience.

Map of  
Manufacture des  
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Conference venue :  
21 allée de Brienne  
S Building  
Auditorium MS 001  
31000 Toulouse

