QUANTITATIVE MANAGEMENT RESEARCH INITIATIVE

2022

Activities and Events organized by the Research Initiative (QMI) – ANNUAL REPORT

This document describes the activities organized by the Quantitative Management Research Initiative (QMI) during its tenth year of existence. **For internal use only.**

Draft January 2023

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Quantitative Management Research Initiative

"QUANTITATIVE MANAGEMENT INITIATIVE (QMI)"

1. INTRODUCTION

Hosted within the Fondation du Risque (FdR) and with the support of the Institut Louis Bachelier (ILB), the work conducted within the framework of this Research Initiative is principally carried out by teams from the Université Paris Dauphine - PSL and the ENSAE (Ecole Nationale de la Statistique et de l'Administration Economique). It benefits from a partnership with LFIS Capital.

1.1. The objectives of the QMI

In the post-2007 financial-crisis context, Quantitative Management professionals from the French Financial sector came together in 2010 to create QuantValley to promote Quantitative Finance and its benefits in terms of research, risk management and value creation for investors. The association was joined by GFI and UBS, and thanks to their support, the Quantitative Management Initiative (QMI) was born in early 2012. Today, the Quantitative Management Initiative (QMI), who is supported by LFIS Capital, is investing even more in the promotion of research and the development of interactions between the academic world and the Professional world of Quantitative management and is structured around the following themes:

- Developing quantitative research applied to asset management;
- Facilitating knowledge transfer between academic environments and asset management agents;
- Responding to the research issues of various private partners;
- Encouraging collaboration with one or more companies that are leaders in fields relating to quantitative management;
- Promoting the image of asset management based on quantitative approaches;
- Increasing and consolidating the high level of excellence by organising reflexion, research and training activities on an international scale relating to one or more themes of general interest;
- Reflecting on the evolution of regulation pertaining to asset management.

1.2. Research axes of the QMI

Amongst the research areas of most interest to the QMI are:

1.2.1. Signal generation

Statistical Signal Processing & Machine Learning in Finance

Application of signal treatment to the estimation of factorial models, the detection of outliers, the filtering of trends and the robust estimation of Kalman models is historical research field of the IdR QMI. Our industrial partners were originally interested by using mathematical methods to take investment decisions. At that time, Statistical Signal Processing were the most promising approach to process the information encompassed in historical time series. A new publication - Chevalier, Darolles (2022), may be classified in this category. The objective is to allocate money to a portfolio of different trends following systems. The risk of this strategy is then linked to the probability of observe simultaneously breaks in trends characterizing different markets. Forthcoming working papiers will feed

this strand of research, and in particular through the use of machine learning techniques to rely observed trends to economic environment variables. This will make the link between this topic and the following one.

Machine Learning (ML) is indeed a promising technique to process large set of information. Arthur Stalla-Bourdillon and several co-authors test the usefulness of Machine Learning (ML) for sovereign risk assessment and pricing in the euro area. They show that their predictive accuracy compared to traditional econometrics methods and their assessment on what are the most important economic factors behind market perception of sovereign risk (see Belly et al. working paper page 14).

Serge Darolles, Gaëlle Le Fol, and Beatrice Sagna with another co-author are working on volume prediction (univariate and multivariate) models using machine learning method. Their first results presented in a working paper show that machine learning technics outperform ARMA and SETAR specification both in and out of sample. Two additional papers will be written in this strand of research. The first one discusses the impact of the discretization step in the tracking of the VWAP price. The second relies all this research on volumes to the development of factor investing strategies.

Finally, we have organized in February 2022 our fourth Hackathon – AI and ML in Asset management, with 66 participants/41 teams. See page 21.

Big data, machine learning and Alternative Data in Finance

Serge Darolles and Gaëlle Le Fol, with the support of an ENSAE Master Student, have studied the use of Nowcasters to predict changes in regime. The first results presented in Darolles, Deni, Le Fol (2022) are promising, and further developments will be tested.

Arthur Stalla-Bourdillon and his co-authors (Menzie Chinn and Nicolas Chatelais) published a paper in the Journal of International Money and Finance underlining how relying on a large datasets of sectoral equity prices performs better in macro-forecasting than using, as a predictor, the aggregate equity prices. Embedding these sectoral stock prices into a factor model also outperforms conventional benchmark, such as the term spread.

Finally, an « Alternative Data in Finance » special invited session leaded by Serge Darolles, Member of the QMI has been organised at the Computational Financial Econometrics (CFE) conference in London in December 2022 (see past conferences page 18). A companion publication in Option Finance (November) by Serge Darolles treated the same topic.

The development of ESG dataset is a new and promising field for this topic. Several research are conducted on the link between ESG rating and the risk premia of listed securities. Darolles, He and Le Fol (2022) are interested in the role played by institutional investors in this relationship, by analysing the change of sign in this relationship that institutional investors could cause. Darolles, Faverjon and Lambert (2022) are interested in the information contained in ESG scores. They first break down this information into a systematic part, resulting from a direct analysis of raw information, and an analysis part relative to each rating agency. They measure the predicting power on stock returns of these two separate parts, and then highlight the role of ESG rating agency on price formation.

Risk premia

Serge Darolles is working with his former PhD Student Charles Chevalier on the characterization of a Multi-asset Trend Following Risk Premia that can be used to explain the cross-sectional dispersion observed in the CTA space. The corresponding risk factor can be used to improve the explanatory power of the linear factor models generally used to analyse hedge fund portfolios. A first publication in Journal of Asset Management in 2019 reports all the results obtained on momentum strategies. A second paper ("Diversifying Trends") by the same co-authors is forthcoming in Econometrics and Statistics. The main objective of this research is to extract what is in common between trends observed on different markets.

Julien Royer,Jean-Michel Zakoian and a coauthor, are extending the theory on the estimation of dynamic conditional betas. In particular, they alleviate the short memory assumption frequently imposed on the volatility models, which can be restrictive in empirical applications. They investigate the existence of a carbon risk premium in the cross-section of US industry portfolios.

Serge Darolles, Gaëlle Le Fol and Gulten Mero are working on a regime switching approach to study the existence of risk premia. They apply their methodology to the size premia and show that the size effect is not a statistical fluck. They use a Markov Regime Switching model to filter regime-dependent risk-adjusted size spreads, in order to capture the reward for bearing the risk inherent to the size effect. The corresponding paper is published in Finance (see publications page 16) in 2022 and some developments are currently works in progress.

Finally, Paul Ehling and Costas Xiouras in their project "Asset Pricing with Endogenous beta", founded in 2018, study the cross-section of expected returns in a framework where betas are determined endogenously. Their

theoretical analysis shows that the stocks' betas fluctuate significantly over time and are affected by both the state of the economy and the individual stock states, i.e. their characteristics.

1.2.2. Risk & Crowding

Crowding

Hector Chan and a co-author are developing, in paper published in Journal of Portfolio Management in 2022, a model whose aim is to study the relationship between crowding and liquidity shocks. One of the main results is that crowding is associated with a larger exposure to broader liquidity shocks on arbitrageurs. They confirm this link empirically by studying equity long-short strategies. They use short interest data both to identify liquidity shocks impacting sophisticated equity investors and to infer crowdedness for some of the well-known long–short equity factors. When liquidity shocks (such as the 2007 quant crisis or the more recent 2020 COVID-19–induced quant deleverage) occur, crowded strategies indeed tend to underperform.

Risk disaggregation and portfolio allocation

A change in the structure of a fund's client base affects the potential mismatch between the liquidity of its assets and liabilities. An asset/liability approach for liquidity management is therefore critical and requires a client behaviour model. Serge Darolles, Gaëlle Le Fol and Ran Sun are working on investor's behaviour and the consequences on funding liquidity risk.
Marius Zoican is working with a co-author on a new project where they look at institutional investor attention. They build a model where analysts who compete for scarce investor attention to maximize volume for brokerage houses end up clustering in a small subset of stocks. They find that it explains 21.39% of the cross-sectional variation in analyst coverage. This research has been presented at the Asian Finance Association in China in July.
Hugues Langlois in the project "Forecasting Portfolio Weights", funded in 2018, proposes a new methodology to compute dynamic mean-variance optimal portfolios. The originality of his approach is to directly forecast portfolio weights. This research was presented at the CFE conference in London in December 2021and in a webinar launched in 2021, see page 20.
Hugues Langlois in the project "Forecasting Portfolio Weights", funded in 2018, proposes a new methodology to compute dynamic mean-variance optimal portfolios. The originality of his approach is to directly forecast portfolio weights. This research appears in the QMI webinar series, see page 20.

Contagion and funds flows

Serge Darolles, Gaëlle Le Fol and her PhD Student Beatrice Sagna work with another co-author on some multivariate volume prediction methods applied to the circulation of liquidity within a portfolio. This paper research has been presented several times at some international conferences in the past and a new version of this paper has been submitted to an international academic journal.
Fabrice Riva and a coauthor are currently investigating the impact of Exchange-Traded Funds (ETFs) on their constituent securities. They find that, after the switch, constituent stocks experience greater commonality, both in returns and in liquidity. The effect on return commonality appears stronger for the least liquid stocks included in the ETF. Also, they present evidence that ETF arbitrage is the transmission mechanism of the comovements. Moreover, they show that the comovements do not appear excessive. This research has been accepted for presentation several times by well-established Finance conferences (FMA 2022, Eurofidai-ESSEC 2022).

Estimation risk for portfolios

In particular, in a paper forthcoming in Journal of Econometrics, Jean Michel Zakoian and a co-author are testing the existence of moments in the framework of GARCH processes, which is of particular interest as the existence of moments can be crucial for risk management, for instance when risk is measured through the expected shortfall (see Publications page 16).
Ophélie Couperier is also working on risk measures and on backtests of risk measures in two working papers, with different co-authors. Her research has been presented at several international conferences (see Diffusion of Research page 16).
Juan Imbet is currently working with three co-authors, robust option-implied measures of conditional volatility, skewness and kurtosis based upon quantiles and expectiles inferred from weekly options on the S&P 500. find that the option-implied robust indicators exhibit short-, medium- and long-term predictive ability for the U.S. equity risk premium, market volatility, skewness and kurtosis, both in- and out-of-sample, and outperform equal indicators

inferred from historical returns. The paper was also presented in a practitioner's conference called QuantMinds international 2022.

Systemic risk and stress exercises

Several researches have been conducted by Christian Gourieroux to detect the systemic risks present in a portfolio, define rating for systemic risk, or construct scenario generators to measure the impact of systemic shocks. Gagliardini, Gourieroux, Rubin (2019) develop a systematic factor model for a joint analysis of the ranking of portfolio managers based on a high dimensional analysis of 900 stocks returns. Boloorforosh, Christoffersen, Fournier, Gourieroux (2019) consider the market beta exposures of stocks and allows for stochastic market betas exposures of stocks and allows for stochastic market betas with possible comovements. Such nonlinear dynamic factor models are usually difficult to estimate by maximum likelihood due to the high dimensionality. Gagliardini, Gourieroux (2019) introduce a moment method based on Laplace transform to get consistent approximations in this big data framework. This method is particularly useful when we have to consider large panels of assets, such as in Brownlees, Darolles, Le Fol, Sagna (2022).

Alternative Risk Premia

Given the sharp increase of the number of alternative risk premia discovered by academics and practitioners, several issues need to be addressed: the factor construction methodologies, the consequences for portfolio diversification, the persistence of the alternative risk premia.
Regarding the first two issues, Marie Lambert et al. are working on construction rules of risk factors and the design of smart beta strategies. A proper methodology to stratify stock universe into style buckets is key for the design of persistent risk factors, asset allocation and performance attribution.
The two working papers have been presented at academic and practitioner conferences and seminars (FMA – San Diego, Quant Vision Summit, AFFI, etc. see seminar and conferences). Marie Lambert et al. also works on the design of alternative risk premia capturing non-linear payoffs. The working paper on the gamma trading of hedge funds have also been presented at several conferences and seminars.
Regarding the persistence of the alternative risk premia, Serge Darolles and Marie Lambert are working on the economic cycle of alternative risk premia and the change in business model from active to passive management for those investment strategies.
On the same topic of alpha persistence, Serge Darolles, Gaëlle Le Fol and Gulten Mero are working on a regime switching approach to study the existence of risk premia. They apply their methodology to the size premia and show that the size effect is not a statistical fluck. They use a Markov Regime Switching model to filter regime-dependent risk-adjusted size spreads, in order to capture the reward for bearing the risk inherent to the size effect. The paper is published in 2022 in Finance (see publications page 16).

Derivatives in Asset Management

This new strand of research was initially related to the arrival of Jean-Guillaume Mémin in the research team. Jean-Guillaume started his PhD thesis at LFIS Capital, on the optimal use of derivatives in the design of trading strategies. Basically, different solutions exist to implement a trading idea, and the objective of this thesis is to develop a theoretical framework to study which is the best implementation solution – taking a position on the spot or using derivatives. We expected to publish several papers on this new topic. Unfortunately, Jean Guillaume decided to stop his thesis to pursue other personal projects. Even if the objective remains to capitalize on the research carried out, it will take longer to formalize.

1.2.3. Implementation challenges

Capacity

Recent studies have documented that market impact decays slowly through time. Hector Chan, in a recently published paper in Journal of Portfolio Management, studies the effect of such slow decay on trading strategies' capacity. To do so, he proposes a numerical methodology to estimate capacity. He shows that incorporating the slow decay of market impact leads to trading strategy capacity estimates are significantly lower than shown in previous capacity studies.

Listed market liquidity

Looking at serial correlations, Serge Darolles, Gaëlle Le Fol and Ran Sun are working on hedge funds liquidity and managers' skills (See 2.1.1. Working papers page 13).
Fabrice Riva is for his part, with two co-authors, working on ETF liquidity (See Working papers page 13). Marius Zoican and another researcher are also working on ETF liquidity ("The value of ETF liquidity"). They find that identical ETFs can exploit different investor clienteles to charge different management fees for holding identical portfolios. Highly liquid ETFs can extract 0.47 bps in higher fees than their competitors for each 1 bp of narrower bid-ask spread. This research has been presented in numerous international conferences in 2022 (see page 18). It received the award of Best paper semifinalist (Microstructure), Financial Management Association 2021 and is now Revise and Resubmit (round 2) at Review of Financial Studies.
In their project "Stock Market Liquidity and Trading Costs of Asset Pricing Anomalies", Tamara Nefedova, with some co-authors, uses transaction-level data from Ancerno to investigate implicit cost dynamics and estimate transaction costs associated with trading asset-pricing anomalies. They find that the related costs are considerably lower than documented by previous studies.

Algo and/or High frequency trading

Optimisation of the VWAP (Volume Weighted Average Price) replication algorithms, link between the speed of placing orders on the market and the arrival of information, liquidity trade-offs, maximum trading capacity are areas of research in which QMI is regularly investing.
Serge Darolles, Gaëlle Le Fol, and Béatrice Sagna with another co-author are working on basket VWAP strategies. They first have papers of the volume forecasting methodology and now use this approach to filter from the realized volume the connections between stocks belonging to a same market.
The current research of Ophélie Couperier and another co-author, aims at introducing functional covariates that takes into account the influence of intraday price variations in the volatility.

1.3. The QMI's organization

1.3.1. The steering committee

The steering committee reviews, monitors and prioritizes major QMI projects.

Scientifique Director

Gaëlle Le Fol, Professor, Université Paris-Dauphine – PSL and CREST

General Secretary

Fabrice Riva, Professor, Université Paris - Dauphine - PSL

Researchers from l'ENSAE and Université Paris-Dauphine - PSL

Serge Darolles, Professor, Université Paris-Dauphine - PSL
Jean-Michel Zakoïan, Professeur, CREST-ENSAE ParisTech

Other Members

Gouriéroux G., Professor, Université de Toronto

1.3.2. The Advisory Board

The Advisory board assists the Steering Committee in its supervising tasks over the activities of the project. The advisory Board members are:

Representing LFIS Capital : Sofiène Haj-Taieb

Representing l'ENSAE ParisTech : La Directrice Générale du GENES ou son représentant

Representing the Université Paris-Dauphine – PSL : Bruno Bouchard

Representing the Risk Fondation: Jean-Michel Beacco

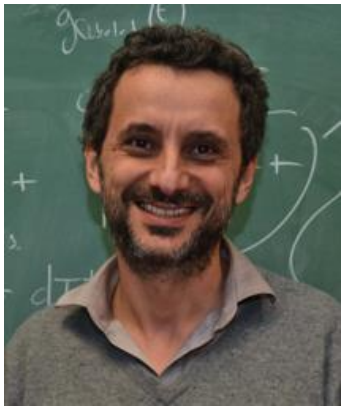
Qualified Person: Marie Brière (Amundi)

International Experts: Michel Crouhy (Natixis), René Garcia (Univ. Montreal & TSE), Michael Rockinger (University of Lausanne), and Ronnie Sadka (Boston College)

1.3.3. The secretariat

Pauline de Saint Quentin, the secretary of QMI can be contacted at Pauline.desaintquentin@dauphine.psl.eu or by telephone: +33 1 41 16 76 19.

1.3.4. The QMI's researchers



E. Bacry, CNRS and Ecole Polytechnique

J. Imbet, Université Paris – Dauphine - PSL

C. Gouriéroux, Toronto University

E. Jouini, Université Paris – Dauphine - PSL

S. Darolles, Université Paris - Dauphine - PSL

M. Lambert, HEC Liège (Liège Université)

G. Le Fol, Université Paris – Dauphine - PSL

F. Riva, Université Paris – Dauphine - PSL

G. Mero, Université de Cergy-Pontoise

J.-M. Zakoïan, CREST and University Lille 3.

T. Nefedova, ESCP Business School

M. Zoican, Toronto University

E. Benhamou, PhD Student, Université Paris-Dauphine

H. Chan, PhD Student, Université Paris - Dauphine

John Coadou, PhD Student, Université Paris-Dauphine, CIFRE Amundi

O. Couperier, PhD student, CREST-ENSAE, ATER Université Paris - Dauphine – PSL

A.

Faverjon, PhD Student, HEC Liège et Université Paris – Dauphine - PSL

J.-G. Mémin, PhD Student, Université Paris-Dauphine - PSL

B. Sagna, PhD Student, Université Paris- Dauphine - PSL

J. Royer, PhD Student, CREST-ENSAE

Arthur Stalla-Bourdillon, PhD Student, Université
Paris- Dauphine - PSL

2. RESEARCH ACTIVITIES

This research initiative aims to be a means of exchange and reflexion where research themes emerge naturally and become the starting point of research articles in the best international journals. The QMI must also be able to create a research community around themes of interest to management companies by calling for research projects nationally and internationally and by reinforcing the QMI member teams by recruiting research assistants and publishing doctoral contracts.

2.1. Research Publications

- Date: 2021
- Themes: Quantitative Management

2.1.1. Working papers

Ain Tommar S., S. Darolles and E. Jurczenko, Private equity fund performance around the world. Working paper.

Atif, J., A. Auger, E. Benhamou, and R. Laraki, A new approach to learning in Dynamic Bayesian Networks (DBNs). Working Paper.

Atif, J., A. Auger, E. Benhamou, and R. Laraki, A discrete version of CMA-ES. Working Paper.

Atif, J., A. Auger, E. Benhamou, and R. Laraki, Operator norm upper bound for sub-Gaussian tailed random matrices, Working Paper.

Benhamou E., A few properties of sample variance, Working paper.

Benhamou E., Variance Reduction in Actor Critic Methods (ACM), Working Paper and SSRN 3424668.

Benhamou E., Similarities between policy gradient methods (PGM) in reinforcement learning (RL) and supervised learning (SL), Working Paper and SSRN 3391216.

Benhamou E., S. Darolles and G. Le Fol, Risk Analysis and Large Dimensions: Applications to mutual Funds, Project selected by Europlace Institut of Finance, € 10,000.

Benhamou E., B. Guez, and N. Paris, Omega and Sharpe Ratio, Working Paper and SSRN 3469888.

Benhamou E., D Saltiel, B. Guez, N. Paris, Testing Sharpe ratio: luck or skill?, Working Paper and SSRN 3391214

Benhamou E., D. Saltiel, S. Ungari, A. Mukhopadhyay, J Atif, Augmented Asset Management with Deep Reinforcement Learning, arXiv preprint arXiv:2010.08497

Benhamou E., D. Saltiel, S. Ungari, A. Mukhopadhyay, Bridging the gap between Markowitz planning and deep reinforcement learnin, arXiv preprint arXiv:2010.09108 1 2020

Benhamou E., D. Saltiel, S. Ungari, A. Mukhopadhyay, Time your hedge with Deep Reinforcement Learning, arXiv preprint arXiv:2009.14136 2020

Benhamou E., D Saltiel, JJ Ohana, J Atif. Detecting and adapting to crisis pattern with context based Deep Reinforcement Learning, arXiv preprint arXiv:2009.07200 2 2020

Benhamou É., Ohana J., Saltiel D., Guez B. (2021), Detecting crisis event with Gradient Boosting Decision Trees, Paris, Working Paper.

Benhamou É., Ohana J., Saltiel D., Guez B. (2021), Regime change detection with GBDT and Shapley values, Paris, Working Paper.

Benhamou É., Saltiel D., Tabachnik S., Wong S., Chareyron F. (2021), Distinguish the indistinguishable: a Deep Reinforcement Learning approach for volatility targeting models, Paris, Working Paper.

Benhamou É. (2021), Distribution and statistics of the Sharpe Ratio, Paris, Working Paper.

Benoit S., O. Couperier, J. Leymarie, and O. Scaillet, Elicitability of Market-Based Systemic-Risk Measures, Working Paper.

Billio, M., M. Costola, S. Darolles, and L. Pelizzon, Measuring the relationship between ESG factors and firm's credit risk in Europe, Working Paper.

Boeckelmann L, and A. Stalla-Bourdillon, Structural Estimation of Time-varying Spillovers: an Application to International Credit Risk Transmission in the Euro Area, Working paper Banque de France.

Book A., J. Imbet, M. Reinke and C. Sala, The forecasting power of short-term options, Working paper.

Briere, M., C.-A. Lehalle, T. Nefedova, Tamara and A. Raboun, Stock Market Liquidity and the Trading Costs of Asset Pricing Anomalies. Université Paris-Dauphine – PSL Research Paper, SSRN No. 3380239.

Brown D., S. Kovbasyuk and T. Nefedova, On the Origin of IPO Profits, Working Paper.

Brownlees C., Darolles S., Le Fol G., and B. Sagna, Forecasting Intra-daily volume in large panels of assets for basket VWAP trading, Working paper.

Calamia A., Deville L. and F. Riva, The Provision of Liquidity in ETFs: Theory and Evidence from European Markets, Working Paper.

Cantin, L., Francq, C., and J.M. Zakoïan (2022): "Estimating Systemic Risk Measures", Working Paper 2022-11, CREST.

Chakpovski P., M. Khapo and M. Zoican, Does gamified trading stimulate risk taking?, Working paper. R&R at Management Science.

Chan H., A. Landier and Y. Wang, Currency and Stock Returns: An Example of Market Inattention, Working Paper.

Chapkovski P., M. Khapko, and M. Zoican, "Trading Gamification and Investor Behaviour", Working Paper, Revise & Resubmit at Management Science.

Chevalier C. and S. Darolles, Futures Market Liquidity and the Trading Cost of Trend Following Strategies, Working Paper.

Couperier O., C. Francq and J.-M. Zakoian, "Daily volatility forecasting using intraday returns and functional covariates", Working Paper R&R in International Journal of Forecasting.

Couperier O. and J. Leymarie, "Backtesting expected shortfall via multi-quantile regression", Working paper, R&R in Journal of banking and finance.

Dare W., Darolles S., Lambert M., and G. Monarcha: The Missing Link between Active and Passive Management, Working paper.

Darolles S., Deni, G, and G., Le Fol, Timing Equity Risk Premia via a NowCast Indicator, Working paper.

Darolles S., Faverjon, A., and M., Lambert, Predicting ESG ratings with neural networks, Working paper.

Darolles S., He, Y., and G., Le Fol, Who can better push firms to go green? A look at ESG effects on stock returns, Working paper.

Darolles S., and G. Roussellet, Managing hedge fund liquidity risks, working paper.

Eisele A., T. Nefedova, Tamara and G. Parise, Are Star Funds Really Shining? Cross-Trading and Performance Shifting in Mutual Fund Families, BIS Working Paper No. 577, Available at SSRN 2831690.

Evans R., T. Nefedova and G. Parise, Front-trading and Information Environment in Mutual Fund Families. Working paper.

Francq C., J. Royer, and J.-M. Zakoian. A multivariate ARCH(∞) model with exogenous variables and dynamic conditional betas. Working paper.

Francq C., Kandji B.M. and J.M. Zakoïan (2022): "Inference on Multiplicative Component GARCH without any Small-Order Moment", Working Paper 2022-09, CREST.

Garriott C., V. van Kervel and M. Zoican, "Do High-Frequency Market Makers Share Risks? ", Working paper.

Giroux T., J. Royer, and O.D. Zerbib. Empirical asset pricing with score-driven conditional betas, Working paper.

Gourieroux, C., and J., Jasiak, Dynamic Deconvolution of Independent AR(1) Sources, Working paper.

Gourieroux, C., and Y., Lu, Staying at the Zero-Lower Bound with Embedded Markov Chain, CREST-DP.

Gourieroux, C., A., Monfort, and J.P. Renne, Required Capital for Long-run Risks, Working Paper.

Gourieroux, C., and A., Tiomo, The Evaluation of Model Risk for Probability of Default and Expected Loss, Working paper.

Imbet J. F., "Stroke of a Pen: Investment and Stock Returns under Energy Policy Uncertainty", Working paper.

Khomyn M., T. J. Putniņš and M. Zoican, "The Value of ETF Liquidity", Working Paper, Revise and Resubmit at Review of Financial Studies, Best paper semifinalist (Microstructure), Financial Management Association 2021

Langlois H., Forecasting Portfolio Weights, Funded Project 2019, Webinar and Working Paper.

Lehar A., D. Parlour and M. Zoican, "Liquidity Fragmentation on Decentralized Exchanges", Working Paper.

Marta T. and F. Riva, Do ETFs increase the co-movements of their underlying assets? Evidence from a switch in ETF replication technique, Working paper.

Martineau C. and M. Zoican, A machine learning measure of analyst report contribution, Working paper.

Martineau C. and M. Zoican, "Retail trading and Analyst Coverage". Working Paper. Revise and resubmit at Journal of Financial Markets. Won “Outstanding Paper in Investments” Award at Southern Finance Association 2020.

Menkveld A., E. Pagnotta, and M. Zoican, Does Central Clearing Affect Price Stability? Evidence from Nordic Equity Markets, Working paper, R&R at Journal of Financial Economics.

Mero G, False discoveries in Hedge Fund performance and business cycles, Working Paper.

Nefedova T., G. Parise and M. Zoican, ETF fee competition and security lending, Working Paper.

Nefedova T., Tippers and tippees: Brokers’ pre-release of price-sensitive information to their VIP clients, Working paper.

Ohana J., Benhamou É., Saltiel D., Guez B., Is the Covid equity bubble rational? A machine learning answer, Paris, Working Paper.

Ohana J., Ohana S., Benhamou É., Saltiel D., Guez B., Shapley values for LightGBM model applied to regime detection, Paris, Working Paper.

Rajesh, R., Vertier, P., Lemaire, T., Stalla-Bourdillon, A., and A. Le Métayer, Dynamics and Implications of the Recent Rise in Wheat Prices. Blog Banque de France.

Sagna B., Learning From Heightened Equity Premium, Job Market Paper.

Sagna B., "Intra-daily trading volumes and VWAP strategy: evidence from a horse race, Working Paper.

Saltiel D., E Benhamou, Sélection efficace de variables par descente par coordonnée avec garanties théoriques. Working paper.

Stalla-Bourdillon A., Stock Return Predictability: comparing Macro- and Micro-Approaches, Working paper.

Xiouros C., and P. Ehling, Asset Pricing with Endogenous beta, Funded Project 2019.

Zoican M., Asset management at the zero-fee bound, Working Paper.

Zoican and 341 co-authors, Non-standard errors, Working paper.

2.1.2. Published Papers

Belly, G., Boeckelmann, L., Caicedo Graciano, C. M., Di Iorio, A., Istrefi, K., Siakoulis, V., and A. Stalla-Bourdillon (2022), "Forecasting Sovereign Risk in the Euro Area via Machine Learning". Journal of Forecasting. Forthcoming.

Brolley M. and M. Zoican (2022), "Liquid Speed: A Micro-Burst Fee for Low-Latency Exchanges", Journal of Financial Markets, Available online.

Brolley M. and M. Zoican (2022), "On-demand Fast Trading on Decentralized Exchanges", Finance Research Letters, Forthcoming.

Chalmin P. and S. Darolles (2022), "Vers un nouvel équilibre mondial", Revue Banque, December.

Chan H. (2022), "Market Impact Decay and Capacity", Journal of Portfolio Management 48(6) 127-144.

Chan H. and T. Tan (2022), "Crowding and Liquidity Shocks", Journal of Portfolio Management, Forthcoming.

Chatelais, N., Stalla-Bourdillon, A., and M. Chinn (2022), "Forecasting Real Activity using Cross-Sectoral Stock Market Information". Journal of International Money and Finance, vol 131, available online.

Chevalier C. and S. Darolles (2022), "Diversifying trends", Econometrics and Statistics, in Press.

Darolles S. (2022), "Données alternatives en finance : quels champions pour demain ?" Option Finance, 25 November.

Darolles S. (2022), "Quelle feuille de route économique pour les prochaines élections ?" *Le Magazine de Professions Financière et de l'Économie*, April.

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Francq, C., and J.M. Zakoïan (2022), "Testing the existence of moments for GARCH processes", Journal of Econometrics, 227, 47-64.

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Gouriéroux, C., A. Monfort , and J.P. Renne (2022), "Required Capital for Long-Run Risks", Journal of Economic Dynamics and Control, vol. 144, n° 104502, novembre 2022.

Mhalla L., J. Hambuckers, and M. Lambert (2022), "Extremal Connectedness of Hedge Funds", Forthcoming in Journal of Applied Econometrics.

2.2. Call for projects

There was no call for project in 2022.

2.3. Completed projects

1. **beta**, Costas Xiouros, Associate Professor and Paul Ehling, Professor at BI Norwegian Business School, Norway.

We study the cross-section of expected returns in a framework where the CAPM holds either conditionally or unconditionally and dividend dynamics determine market βs. Calibrating the discount factor and aggregate dividends allows matching standard features of aggregate stock market returns and the market price-to-dividend ratio. In the calibration, we see significant fluctuations in market βs due to both aggregate and individual shocks. These results explain, on the one hand, why stock characteristics contain considerable power in predicting returns. On the other hand, they are consistent with empirical failures of the unconditional CAPM, even in our framework when it holds conditionally.

2. **Forecasting Portfolio Weights**, Hugues Langlois, Associate Professor at HEC.
We propose a new methodology to implement unconditionally optimal dynamic mean-variance portfolios. We model portfolio allocations using an auto-regressive process in which the shock to the portfolio allocation is the gradient of the investor's realized certainty equivalent with respect to the allocation. Our methodology can accommodate transaction costs, short-selling and leverage constraints, and a large number of assets. In out-of-sample tests using equity portfolios, long-short factors, government bonds, and commodities, we find that its risk-adjusted performance, net of transaction costs, is on average more than double that of other benchmark allocations.

2.4. Ongoing PhD thesis, PhD defense and placement

- Hector Chan, Three essays in quantitative asset management, ongoing thesis under the supervision of Serge Darolles. June 24, 2022 at Université Paris Dauphine.
- John Coadou, Topics on the ESG's uneven contribution over stock markets, ongoing thesis under the supervision of Serge Darolles. Cifre at Amundi.
- Ophélie Couperier, Three essays in Financial econometrics, under the supervision of Christian Franck, and Christophe Hurlin and Jean-Michel Zakoian. December 2, 2022 at Institut Polytechnique de Paris. Ophélie was also teaching assistant (ATER) at Université Paris Dauphine-PSL. Ophélie is on the Job Market.
- Anouk Faverjon, Three contributions on ESG ratings and their impacts on firm performance, under the supervision of Serge Darolles and Marie Lambert.
- Jean-Guillaume Mémin (Abandon), under the supervision of Serge Darolles.
- Julien Royer, Infinite ARCH processes, dynamic betas, and financial applications, under the supervision of Christian Franck, Jean-Michel Zakoian. December 9, 2022 at Institut Polytechnique de Paris. Julien Royer is now Quant researcher at Lombard Odier IM in Paris.
- Béatrice Sagna, Trading volumes in stock markets: Forecasts, Trading Strategies, Market Impact, Equity Premium, and Monetary Policy, under the supervision of Gaëlle Le Fol. November 29, 2022 at Université Paris Dauphine-PSL. Beatrice is on the Job Market.
- Arthur Stalla-Bourdillon, Systemic Financial Risk Analysis: from the Sectoral to the Aggregate Perspective, under the supervision of Gaëlle Le Fol. November 24, 2022 at Université Paris Dauphine-PSL. Arthur is now Economist at Banque de France

3. RESEARCH EXPOSURE AND DIFFUSION

Over and above research production, the QMI aims to distribute quantitative management academic research throughout the scientific community but also towards quantitative management professionals (knowledge diffusion). To this end, the QMI's research will be presented in international conferences, within the framework of an annual conference addressed to academics and professionals. Furthermore, training (research

applications) will be developed, and the website will propose research articles and webinars than put that research into practice.

3.1. VISIBILITY & DIFFUSION OF RESEARCH

3.1.1. 16th CSDA International Conference (CFE 2022)

Organization of two sessions at the Computational and Financial Econometrics, December 2022

- Alternative data in Finance, Special invited session CI023

S. Darolles, Chairman and organizer, Université Paris Dauphine - PSL, Members of the QMI

- Does alternative data improve financial forecasting?, **T. Foucault**, HEC Paris
- When are Google data useful to nowcast GDP: An approach via preselection and shrinkage, **A. Simoni**, CNRS – CREST France
- Alternative data for ESG events monitoring using NLP: Practical quantitative results, **S. Forte**, SESAMm, France

- Financial Times series, Organized session CO078

J. M. Zakoïan Chairman and organizer, CREST, Members of the QMI

- Optimal estimating function for weak location-scale dynamic models, **C. Francq**, CREST France
- Empirical asset pricing with score-driven conditional betas, **J. Royer**, CREST France.
- Strict stationarity and existence of moments for a family of functional GARCHs, **B.M. Kandji**, CREST, Institut Polytechnique de Paris, France.

3.1.2. Seminar and conference participations

QMI's researchers have presented their work at several conferences and seminars:

"A multivariate ARCH(∞) model with exogenous variables and dynamic conditional betas", Francq C., J. Royer, and J.M. Zakoian

- 3rd Italian Workshop of Econometrics and Empirical Economics, Rimini (Italy), January 20-21.
- 15th Financial Risks International Forum, Paris, March 21-22.
- Vienna–Copenhagen Conference on Financial Econometrics, Copenhagen (Denmark), June 2-4.
- Quantitative Finance & Financial Econometrics, Marseille, June 16-17.
- 14th annual meeting of the Society for Financial Econometrics (SoFIE), Cambridge (UK), June 24-26.
- 24th International Conference on Computational Statistics, Bologna (Italy), August 23-26.

"Do High-Frequency Market Makers Share Risks? ", Garriott C., V. van Kervel and M. Zoican

- Western Finance Association, Portland (USA), June 24 -27
- Northern Finance Association Meeting, Alberta (USA), September 23-25.
- EUROFIDAI-ESSEC Paris December Finance Meeting, Paris (France), December 15.

"Elicitability of marginal expected shortfall and related systemic-risk measures", Benoit S., O. Couperier, J. Leymarie, and O. Scaillet

- 16th International Conference on Computational and Financial Econometrics, London (United Kingdom), December 17-19.

"Empirical asset pricing with score-driven conditional betas", Giroux T., J. Royer, and O.D. Zerbib,

- 33rd European Conferences of the Econom[etr]ics Community (EC^2), Paris, December 9-10.
- 16th International Conference on Computational and Financial Econometrics, London (UK), December 17-19.

"Estimating conditional systemic risk measures in semi-parametric volatility models.", C. Francq, and J.-M. Zakoïan

- 3rd Italian Workshop of Econometrics and Empirical Economics: "High-dimensional and Multivariate Econometrics: Theory and Practice" (IWEEE 2022), Rimini (Italy), January 20-21.

"Estimating dynamic systemic risk measures", L. Cantin, C. Francq, J.-M. Zakoïan

- NBER-NSF Time Series Conference, Boston (USA), September 23-24.

"Estimation of Systemic Risk in Semi-Parametric Dynamic Models based on the Empirical Distribution of Residuals.", L. Cantin, C. Francq and J.-M. Zakoïan

- 15th International Conference on Computational and Financial Econometrics, London, December 17-19.

"Forecasting Intra-daily Volume in Large Panels of Assets", Christian Brownlees, Serge Darolles, Gaëlle Le Fol, and B. Sagna

- 33rd (EC)2 Conf. on the Econometrics of High Frequency Data and Factor Models, Paris (France), poster session, December 9-10.
- CIREQ Montreal Econometrics Conference in Honor of Eric Renault, Montreal (Canada), May 27-28.

"Forecasting Real Activity using Cross-Sectoral Stock Market Information", Chatelais, N., Stalla-Bourdillon, A., and M. Chinn

- 3rd Financial Economics Meeting, Paris (France), June 30 - July 1st.
- 24th Federal Forecasters Conference, Washington DC (USA), September 22.
- ILB Scientific Session, online, November 15.

"Futures market liquidity and the trading cost of trend following strategies", C. Chevalier and S. Darolles

- AFFI Conference, Saint-Malo, 23-25 May 2022.
- Quantitative Finance and Financial Econometrics (QFFE 2022) , Marseille (France), June 16 -17.

"Learning from Heightened Equity Premium", B. Sagna

- ESSEC Asset Pricing Breakfasts series – Paris (France), November 18.
- Institut Louis Bachelier, Paris (France), November 15.
- Toulouse School of Economics (TSE) – Toulouse (France), November 8.
- Financial Management Association (FMA), Atlanta (USA), October 19-22.
- International Risk Management Conference (IRMC), Bari (Italy), July 4-5.
- Global Finance Conference (GFC), Braga, presenter and discussant, June 20-22.
- French Finance Association (AFFI), Saint-Malo, (France) May 23-25.

" On the Origin of IPO Profits", Brown D., S. Kovbasyuk and T. Nefedova

- American Finance Association Meeting, Boston (USA), online, January 6-9.

"Stock Return Predictability: comparing Macro-and Micro-Approaches", A. Stalla-Bourdillon

- 2022 RCEA conference on Recent Developments in Economics, Econometrics and Finance, online, March 4-6
- 38th International Conference of the French Finance Association, Saint-Malo (France), May 23-25.
- Banque de France seminar, September 7.

"Testing hypotheses on the innovations distribution in semi-parametric conditional volatility models", C. Francq, and J.-M. Zakoïan

- International Symposium on Nonparametric Statistics (ISNPS 2022), Paphos (Cyprus) , June 20-24.

"Testing the existence of moments and estimating the tail index of augmented GARCH processes", J.-M. Zakoïan

- 2nd International Conference on Econometrics and Business Analytics (ICEBA), Erevan and Dilijan (Armenia), September 8-10.
- Keynote speaker, COMPSTAT 2022, Bologna (Italy), August 23-26.

"The forecasting power of short-term options", Book A., J. Imbet, M. Reinke and C. Sala

- International risk management consortium, Bari (Italy)

"Trading Gamification and Investor Behaviour", Chapkovski P., M. Khapko, and M. Zoican

- Plato Market Innovator (MI3) Conference, online, June 14-15.
- Society for Experimental Finance, Bonn (Germany), June 18-19.

3.2. Webinars

Because of the pandemic, we were not able to organize our annual events (QuantVision Summit & Round table) and as a consequence, we could not have a presentation of the two projects that we funded and are now completed (see Completed Project page 20). However, the two papers have been presented in a "quantitative finance" session organized online at the 15th CSDA International Conference (CFE 2021) and we launched the Webinar series based on funded projects.
Hugues Langlois, Associate Professor at HEC, is the first to present his research on "Forecasting Portfolio Weights" based on his paper "**A New Benchmark for Dynamic Mean-Variance Portfolio Allocations**". Follow the link below to get more information and watch the video.

3.3. Annual events

Every year, the QMI organizes some events. Intended for quantitative management experts – academics, professionals and journalists – it will aim to combine the research undertaken by members of the QMI, projects financed by the QMI and research by internationally renowned researchers, by organizing a guest session and presentation sessions for research articles. A roundtable has also been organized in which academics, journalists and professionals will be invited to take part in a debate.
However, this year we only had a roundtable.

3.3.1. Annual conference and annual round table

Unfortunately, there could not be any conference nor any round table in 2022.

3.3.2. Hackathon

We organized on March 10-11, 2022, the fourth Hackathon - Intelligence Artificielle & Machine Learning only and in person at Dauphine, place du Maréchal de Lattre de Tassigny, Paris.

This event was organized by QMI, led by research teams of Université Paris Dauphine, ENSAE and the support of LFIS and SESAMm.

66 candidates/41 teams composed of students, young graduates, researchers and engineers, from 20 different institutions : Centrale Supelec, Ecole Polytechnique, ENSAE, ENSAI, ENSEEIHT – TOULOUSE INP, ESSEC, IAE NICE, IMT Atlantique, INRAe, INRIA, ISCID – CO, SUPCOM Tunisie, TEKUP Tunisie, Université Aix-Marseille, Université de Lorraine, Université Paris 1 Panthéon - Sorbonne, Université Paris Dauphine-PSL, have been working for 24 hours to explore the fields of artificial intelligence and machine learning in the asset management industry. The results of the competition are below.

NOM	PRENOM	PROGRAMME	ECOLE/UNIV.	EQUIPE	SCORE
BATARDIERE	Bastien	PhD	INRAe	CHEF	5.6738
WAGNER	Nicolas	M2 MASH	Université Paris-Dauphine		
MULLER	Elliot	M2 MASH	Université Paris-Dauphine		
LEGER	Raphaël	M2 104	Université Paris-Dauphine		
PINTO	Antoine	M2 EBDS	Aix Marseille School of Economics	DATA	2.8255
				TMZC	NA
				TMZC	
				RBLS	NA

Follow the link below to get more information and watch the video.

3.4. Media coverage

Darolles, S., "Les hedge funds débarques à Paris," Option Finance, 19 April 2022

Darolles, S., "La connaissance du passif est clé," L'Agefi Hebdo, 24 February 2022

3.5. Website

The goal of the website is to become a showcase for the QMI and to encourage exchange between research and professionals by becoming for example a public library of research articles and computer code relating to quantitative management themes. Address: QMinitiative.org.

The website is a way to manage the annual conference and workshops registrations. Moreover, it is continuously updated.

After 9 years, we have decided to launch a completely new website. After 6 months of work, the new website was out at the beginning of June 2021.