# IDRISS TSAFACK TEUFACK


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| CONTACT INFORMATION | University of Montreal (UdeM)<br>Department of Economics<br>3150 rue Jean-Brillant<br>Montréal, QC H3T 1N8<br>Canada | Phone (office): +1(514) 343-6111 #37383<br>Phone (cellular): +1 (514) 632-3034<br>Email: idriss.tsafack.teufack@umontreal.ca<br>Site: http://idrisstsafack.com<br>Languages: English (fluent), French (native). |


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| RESEARCH AREAS | Primary: Econometrics, Functional data Analysis, Big Data and Forecasting<br>Secondary: Financial Market |
| PH.D. THESIS | University of Montreal (2014-2020)<br>Thesis: Three essays in functional econometrics and financial markets.<br>Advisor: Marine Carrasco (University of Montreal, Canada).<br>Date of Completion: September 2020 (Expected). |
| OTHER STUDIES | M.SC. in Statistics and Economics, with a specialization in Finance and Insurance, Sub-Regional Institute of Statistics and Applied Economics (ISSEA), Cameroon, (2009 – 2012).<br>B.SC. in Mathematics, Yaoundé, Cameroon, (2005-2008). |
| CERTIFICATIONS | Certificate in Machine Learning, Stanford University, Online, 2019.<br>Certificate in Data Scientist and Big Data Analytics, MIT, Online, 2019 (Expected).<br>International Certificate in Algorithmic Trading, QuantInsti, 2019 (Expected). |
| PROFESSIONAL EXPERIENCE | Regional Chief Officer of Economics, Cameroon, (2012 - 2014).<br>External Consultant in the Community Development Program and Project, financed by the World Bank, Cameroon, (2013-2014).<br>Junior Consultant in the Project related to the automation of trade procedures, a project realized by the Sub-Regional Institute of Statistics and Applied Economics and Financed by the World Bank, Cameroon, (2012-2013).<br>Intern as a Business Intelligence Analyst at Mobile Telephone Network (MTN), best telecommunication company in Africa, Cameroon, (June 2011-September 2011). |
| WORKING PAPERS | ○ Intraday Stock Market Forecasting via Functional Time Series, 2019 (Job Market Paper).<br>○ Theoretical Comparison of Functional Principal Component and Functional Partial Least Squares, with Marine Carrasco, 2019.<br>○ Interpretable Risk Neutral Density Estimation with a Functional Linear Models, 2019. |
| WORKS IN PROGRESS | ○ Phillip-Perron unit root Test for Functional Time Series.<br>○ Statistical Arbitrage in the Stock Market with the Partial Least Square Approach.<br>○ Predicting the Stock Market Trend using the Functional Logistic Model. |
| CONFERENCES AND SEMINARS | 2019: Canadian Economic Association (CEA), Calgary (Banff);<br>Societé Canadienne de Science Economique (SCSE), Université Laval, Quebec City.<br>2018: Societé Canadienne de Science Economique (SCSE), UQAM, Montréal;<br>CIREQ Econometrics Conference, Advanced Methods on GMM models;<br>14th CIREQ Conference at Université de Montréal, Montréal.<br>2017: 13th CIREQ Conference at Concordia University, Montréal;<br>CIREQ Econometrics Conference on Inference in large-dimensional models, Montréal.<br>2016: CIREQ Econometrics Conference in Honor to Jean Marie Durfour, Montréal. |

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| | 2015**:** 11th Econometric Society World Congress, Montréal. |
| FELLOWSHIPS | Ph.D. Fellowship, CIREQ & Economics Department, UdeM, 2014-2019.<br>CIREQ Association Graduate Travel Scholarship, 2019.<br>M.sc. in Statistics Fellowship, Government of Cameroon, 2009-2012.<br>Central African Economic and Monetary Community (CEMAC) Scholarship, 2009 – 2012.<br>B.sc. in Mathematics Fellowship, Government of Cameroon, 2005-2008. |
| TEACHING | Lecturer, University of Montréal, Canada :<br>o Introduction to Econometrics (ECN 1260), Winter 2018, Fall 2018, Winter 2019, Fall 2019.<br>o Introduction to Microeconomics (ECN 1040), Fall 2016.<br><br>Teaching Assistant, University of Montréal, Canada :<br>o Advanced Econometrics, P.hD. Students track (ECN 7065), 2016 - Present.<br>o Quantitative Methods, PhD. Students (ECN 7075), 2016.<br>o Economic Data Analysis (ECN 1160), 2016.<br>o Introduction to Microeconomics (ECN 1040), 2016.<br>o Introduction to Macroeconomics (ECN 1050), 2018. |
| LEADERSHIP EXPERIENCE | Organizer of the PhD. Students weekly discussion Workshop, UdeM, 2018 – 2019, Montréal, Canada.<br>Volunteer at the Econometric Society World Congress, 2015, Montréal, Canada.<br>Volunteer at the Beer World Congress, 2015, Montréal, Canada. |
| OTHERS | **Memberships:** Center for Interuniversity Research and Quantitative Economics (CIREQ), Canadian Economic Association (CEA), Société Canadienne de Science Économique (SCSE), American Economic Association (AEA).<br>**Computer skills:** MATLAB, Python, R, STATA, Latex, Excel, Word and others.<br>**Other Interests:** Soccer, Travelling. |
| ACADEMIC REFERENCES | **Marine Carrasco**, Economics Department, University of Montreal, CANADA<br>(+1) 514-343-2394<br>marine.carrasco@umontreal.ca<br><br>**Benoit Perron**, Economics Department, University of Montreal, CANADA<br>+1 (514) 343-2449<br>benoit.perron@umontreal.ca<br><br>**René Garcia**, Economics Department, University of Montreal, CANADA<br>+1 (514) 343-6111<br>rene.garcia@umontreal.ca |

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## SUMMARY OF THE THESIS

**Three essays in functional econometrics and financial markets.**

The thesis delivers an understanding of the question concerning the consideration of a functional data analysis framework in order to develop statistical inference and econometric analysis in the context of in-sample prediction and out-of-sample forecasting in the financial market. Functional data analysis is a statistical field where the observations are curves and not scalars as usually observed in the traditional financial econometrics. Therefore, very dense data are used to construct functions observed at equal intervals. With the high frequency data becoming more available, this thesis shows how to take advantage of this information to construct functional objects for estimation and forecasting. Manipulation of these objects contribute to discover new patterns in terms of functions or surface estimations and curve forecasting. More generally, functional data analysis offers an improved description of traditional model and help to provide a functional version of traditional tools and other analysis objects relative to traditional models. Moreover, it contributes to improve prediction performance.

(1) **Intraday stock market forecasting via functional time series (Job Market Paper)**

*Abstract:* This paper considers the intraday S&P500 price values at the 1-minute frequency are used to construct a collection of curves observed sequentially on a daily basis and an autoregressive model is deployed to forecast one-day-ahead market return curve using the functional data analysis (FDA). In contrast to the standard AR model where each observation is a scalar, each daily return curve is considered as one observation. This approach is practically important because it exploit the potential of high frequency data to improve the forecast. This model estimation lead to an ill-posed inverse problem and a comparative analysis of 4 dimensions reduction methods is conducted including the Functional Tikhonov method (FT), the Functional Landweber Fridman technique (FLF), the Functional spectral-cut off (FSC), the Functional Partial Least Squares (FPLS). The convergence rate, asymptotic distribution and model selection strategy are derived for the proposed methods. The relevance of theoretical results is supported by Monte Carlo simulations and empirical analysis show the performance of the proposed methods. Moreover, empirical application show that FPLS method document a remarkable out-of-sample $R^2$ of 8% especially in the periods 09:30 AM - 10:30 AM and 02:30 PM - 04:00 PM within a day, that is almost 4 times the one obtained by preceding papers and this is due to its nonlinearity. Market participants can use this model estimation approach to tactically adjust their market timing strategy.

(2) **Theoretical comparison of functional principal component and functional partial least squares**

*Abstract:* In this paper we consider a functional regression model where the predictor variable is a function and the target variable is a scalar. The main interest is to compare the Functional Principal Component Analysis (FPCA) and Functional Partial Least Squares (FPLS) techniques based. We derive the convergence rate of the conditional Mean Squared Prediction Error (MSPE) for both the estimation methods. We find that the regularization bias of the FPLS method is usually smaller than the one of the FPCA approach, while the estimation error with the FPLS approach is usually larger than the one of FPCA and may explode. Under some smoothness conditions of the predictor variable and the slope function, both the estimation methods reach the optimal convergence rate and in other situations the FPLS tend to outperform the FPCA in terms of prediction. Some Monte Carlo simulation and an empirical evidence on the momentum strategy for Apple stock price in the equity market are provided to evaluate the theoretical results.

(3) **Interpretable risk neutral density estimation with a functional linear model**

*Abstract:* Estimating the Risk neutral density (RND) has been an important topic of the financial market. This tool is useful for options pricing and to analyze the market risk sentiment. This paper consider that the RND is observed as a curve that takes its values in a very fine grid. We propose a functional regression model and a constrained Tikhonov regularization method approach is used to estimate the RND in order to overcome the high dimensionality issues. This approach has the advantage to take into account the functional feature of the RND and of future gain of derivatives. Another advantage is that the proposed method ensures the positivity of the RND and it makes possible to provide asymptotic results that is an advantage to produce the confidence set of the estimators. We provide consistency and asymptotic normality results of the estimator. For the application we compare our method with the competitive one in terms of estimation purpose and predictive power.

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