Firmin Ayivodji

Office Contact Information

University of Montreal (UdeM)
Department of Economics
3150 Jean Brillant Street,
Montreal (Quebec), H3C 3J7

Personal Contact Information

Phone (cellular): +1 (514) 448-9572
Email: firmin.ayivodji@umontreal.ca
Homepage: firminayivodji.github.io
Citizenship: Benin

Dissertation Committee and References

Professor Benoit Perron (**Chair**)
University of Montreal
Department of Economics
benoit.perron@umontreal.ca

Professor Marine Carrasco
University of Montreal
Department of Economics
marine.carrasco@umontreal.ca

Professor Christopher Rauh
University of Cambridge
Department of Economics
cr542@cam.ac.uk

Research Interests

Primary: Econometrics, Macroeconometrics, Big Data, Machine Learning/NLP, Causal Inference.

Secondary: Climate Finance, Real Estate, Housing Economics, Household Finance, ESG Investing.

Education

2017-present: PhD Candidate in Economics and Data Science, University of Montreal (UdeM), Canada.

2014–2017: MSc in Statistics and Economics, Ecole Nationale de la Statistique et de l'Analyse Economique (ENSAE), Senegal.

2010–2013: BSc in Statistics, Ecole Nationale d'Economie Appliquée et de Management (ENEAM), Benin.

Publication

1. "*Food Security and the COVID-19 Employment Shock in Nigeria: Any Ex-Ante Mitigating Effects of Past Remittances?*", with Al-mouksit Akim and Jeffrey Kouton, **Food Policy**, ***Volume 122, January 2024***.

Working Papers

1. "*High-Frequency Inflation Expectations from Big Data: A Natural Language Approach*" (**JMP**).
2. "*Identification and Estimation of Common Factors in Group Factor Models*".
3. "*Can Media Narratives Predict House Price Movements?*", with Christopher Rauh.
4. "*Regional and Sectoral News-Based Indicators for Macroeconomic Forecasting*".
5. "*Economic Government Support and the COVID-19 Lockdown-Compliance in Africa*", with Al-mouksit Akim and Marius Amba.

Work in Progress

1. "*Understanding the Forecasting Power of DSGE Models in a Data-Rich Environment: The Role of Model Design vs Data*", with Sacha Gelfer, Wenting Song, and Yang Zhang.
2. "*A Deep Phillips Curve with Backward- (Forward-) Looking Unstructured Data*", with Philippe G. Coulombe.
3. "*Using Text Data in a DSGE to Account for Bank's Communication with Agents* ", with Kevin Moran and Dalibor Stevanovic.
4. "*Monetary Policy Narratives and House Price Expectations*", with Juste Djabakou.
5. "*Deep Dynamic Factor Models in a Data-Rich Environment*".

Research Grants, Scholarships, & Fellowships

2024: Rising Star in Management Science and Engineering (Stanford MS & E).

2022: First International Workshop on Interactive Causal Learning, Travel grant.

2022: IVADO/Fin-ML, Mitacs, and Borealis AI Fellowship (declined).

2022: Canadian Economics Association, Travel grant.

2021: International Monetary Fund (IMF), Summer Fellowship.

2020-2023: FRQSC - Doctoral Research Scholarships, Econometrics and Artificial Intelligence.

2017-2023: PhD Fellowship of CIREQ and Department of Economics, University of Montreal.

2014-2017: MSc. in Statistics and Economics, Excellence Scholarship.

2010-2013: Government of Benin Scholarship.

Teaching and Academic Experience

Instructor, University of Montreal (UdeM)

- Econometrics I, undergraduate, Winter (2023).
- Econometrics II, undergraduate, Winter (2020).

Instructor, Ecole Nationale de la Statistique et de l'Analyse Economique (ENSAE)

- Big Data, Machine Learning and Econometrics, Graduate, Guest speaker, Fall (2021).
- Econometrics of Panel Data and Quantile Regression, Guest speaker, Winter (2016).

Teaching Assistant, University of Montreal (UdeM)

- Econometrics Master's, Fall (2021), Fall (2020), Fall (2019).
- Macroeconometrics Master's, Winter (2021).
- Econometrics II, undergraduate, Winter (2022), Fall (2021), Winter (2021).
- Introduction to Macroeconomics, undergraduate, Fall (2019).
- Principles of Economics, undergraduate, Summer (2022), Summer (2021).

Research and Work Experience

February 2024 – present: **Research Fellow**, Chair in Macroeconomics and Forecasting, ESG-UQAM, Canada

July – November 2023: **Research Economist**, Bank of Canada, **Model Development Division**, Canada

April – June 2023: **Research Economist**, Observatoire de la Francophonie Économique, Canada

March – May 2023: **AI Research Scientist**, PMGS Inc., Canada

October 2022 – February 2023: **Lead Advisor - AI Scientist**, AI Global Pros Inc., Canada

October 2021 – October 2022: **Research Assistant** for Prof. Karim Chalak, UdeM, Canada

June – August 2021: **PhD Intern**, International Monetary Fund (IMF), Strategy, Policy, and Review Department, Washington, USA

November 2020 – January 2021: **Research Assistant** at Observatoire de la Francophonie Économique, Montreal, Canada

January 2018 – September 2019: **Economic Researcher** at World Bank, Macroeconomics, Trade and Investment (MTI), Washington, USA

August 2018 – August 2019: **Research Assistant** for Prof. Christopher Rauh, UdeM, Canada

August – October 2016: **Research Officer**, International Monetary Fund (IMF), Dakar, Senegal

May 2015: **Data Scientist Intern**, ENSAE-United Nations Industrial Development Organization (UNIDO) Cooperation, Dakar, Senegal

August – November 2013: **Data Scientist Intern**, Direction of Forecasting and Business Cycle, Benin

Seminar and Conference Presentations (⋆ scheduled)

2023-2024:

Society for Economic Dynamics Annual Meeting⋆; International Association for Applied Econometrics (IAAE) Annual Conference⋆; Stanford MS & E Rising Stars Workshop⋆; 58^{th} Annual Meetings of the Canadian Economics Association⋆; NBER-NSF Time Series Conference; 17^{th} International Conference on Computational and Financial Econometrics; 57^{th} Annual Meetings of the Canadian Economics Association; Bank of Canada Data Science Research Group Seminar; Bank of England; IMF; 17th Financial Risks International Forum on Big Data & Algorithmic Finance; Economics with Nontraditional Data and Analytical Tools (ECONDAT)⋆, Recent Developments in Econometrics, CIREQ; UdeM-Department of Mathematics and Statistics; Concordia University; Desautels McGill University⋆; HEC Montreal; UdeM Macroeconomic Brown Bag; 1^{st} CIREQ Interdisciplinary Conference on Big Data and Artificial Intelligence; 62^{th} Congress - Societé Canadienne de Science Economique; 3^{rd} GREDI/CREATE/CIREQ PhD Student Research Workshop.

2022:

6^{th} Annual Toronto Machine Learning Summit (TMLS); IVADO Digital October; CIREQ Montreal Econometrics Conference in Honor of Eric Renault (poster session); 56^{th} Annual Meetings of the Canadian Economics Association; 61^{st} Congress of the Canadian Society of Economic Sciences; 17^{th} CIREQ PhD Students' Conference.

Conference Organization:

- Co-organizer of 1st CIREQ Interdisciplinary Conference on Big Data and Artificial Intelligence, 2023.

- Co-organizer, Econometrics and Machine Learning Reading Group, University of Montreal, 2022.

- Volunteer of 61st congrès annuel Société Canadienne de Science Economique (SCSE), 2022.

- Volunteer of International Association for Applied Econometrics (IAAE) Annual Conference, 2018.

Skills and Languages

Programming: Python, MATLAB, STATA, Dynare, R, SAS, Julia, Git, ArcGIS, VBA, LaTeX.

Languages: English (proficiency), French (native).

Summary of working papers

High-Frequency Inflation Expectations from Big Data: A Natural Language Approach

In this study, I leverage large language models (LLMs) in natural language processing to scrutinize a comprehensive dataset of more than 2 million newspaper articles and 40 million tweets across Canadian provinces. This method is employed to develop novel high-frequency and real-time indicators of consumer inflation expectations at both national and subnational levels. I first identify news articles and tweets related to inflation or prices. Additionally, I apply deep learning methods, particularly LLMs to extract information specifically related to future price dynamics. Then, I construct daily measures of text-based inflation expectations as the difference between the number of news articles or tweets about inflation and the number of news articles or tweets about deflation. The results indicate a high correlation between the resulting text-based inflation expectations indices with consumers' survey-based inflation expectations and realized inflation. Subsequently, I use a mixed-frequency machine learning approach to generate nowcasts/forecasts of quarterly inflation expectations and actual inflation based on large sets of text indicators and Google Trends search volume data for inflation-related terms. The analysis demonstrates that news and social media data contain valuable information regarding inflation dynamics and my newly developed indicators effectively anticipate consumer inflation expectations and actual inflation. The paper further explores the application of Shapley additive explanations (SHAP) values to enhance the interpretability of complex, nonlinear models. The findings suggest that newspaper and social media data can serve as a timely source for market participants and policymakers to elicit beliefs on inflation or future price dynamics.

Identification and Estimation of Common Factors in Group Factor Models

This paper examines the comovement among factors extracted from two distinct large panels (or groups) of variables. I show that estimating factors introduces a bias in the estimated correlation between factors, which becomes negligible if the factors are estimated from panel data sets containing a large number of cross-sectional series. I show that a modified version of the wild bootstrap algorithm proposed by Gonçalves and Perron (2014) can correct the bias and provide reliable inference on the correlation of interest. Additionally, I apply my modified wild bootstrap method to analyze the influence of institutional factors on economic growth, as examined in Deniz et al. (2018), and the degree of synchronization of business cycles in developed and emerging economies, as explored in Kose et al. (2013) and Aastveit et al. (2015).

Can Media Narratives Predict House Price Movements?, with Christopher Rauh

This paper investigates how the housing market, a major asset in household wealth, mirrors broader economic trends and we present a predictive model for housing price movements in Canada at both provincial and national levels. Our methodology unfolds in two distinct stages: initially, we process over 2 million newspaper articles through cutting-edge natural language processing techniques to extract media narratives, analyze sentiments, and sort articles according to their focus on past, present, or future events. We implement mixed-frequency machine learning methods to generate a sequence of predictions for quarterly housing prices out-of-sample. The predictions are based on linear models estimated via the LASSO, Ridge, and Elastic net, nonlinear models based on Random Forests, Extreme Gradient Boosting, Artificial Neural Networks, and ensembles of linear and nonlinear models, with ensembles providing the best forecasting performance. The results indicate that news data contain valuable information about the housing market's direction and that predictive performance improves over longer time horizons.

Regional and Sectoral News-Based Indicators for Macroeconomic Forecasting

This paper evaluates the informational content of sentiment extracted from news articles about the state of the economy. First, I apply deep learning and lexical-based techniques to construct a new high-frequency measure of sentiment indices embodied in a vast news corpus covering economic and financial articles in Canada from January 1977 to October 2022. These sentiment indices are constructed at the sectoral (or 6-digit NAICS), provincial, and national levels. Second, I document that the sentiment indices significantly correlate with contemporaneous key economic and financial variables such as GDP, inflation, housing prices, and unemployment. Third, I use an advanced machine learning method to isolate information about future, current, and past sentiments. Finally, this paper provides novel evidence of how news sentiment tracks current and future economic and financial conditions and significantly enhances predictive power in forecasting models using shrinkage methods and nonlinear machine learning techniques, ensembles of linear and nonlinear models.

Monetary Policy Narratives and House Price Expectations, with Juste Djabakou

This paper examines the impact of Central Bank narratives on house price expectations using a unique dataset from three different textual sources: direct central bank communication (monetary policy reports and speeches), newspaper articles, and Twitter posts. Leveraging advanced computational linguistics and machine learning techniques, we analyze the narrative tone in monetary policy reports, speeches, news articles, and tweets related to the monetary policy decisions of the Bank of Canada (BoC). Our findings reveal that narrative sentiment expressed in these sources significantly shapes expectations for future house prices. Furthermore, we observe that sentiment related to credit, financial conditions, and housing narratives holds considerable predictive power in shaping house price expectations. Additionally, we employ deep learning methods to extract information specifically related to the forward-looking aspects of sentiment in monetary policy narratives. These results highlight the pronounced impact of forward-looking narrative sentiment on house price expectations. The study suggests that social and news media can serve as valuable tools for central banks in managing economic expectations, with significant implications for the housing market.