

# Firmin Ayivodji

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Citizenship: Benin

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## Research Interests

**Primary:** Econometrics, Macroeconometrics, Big Data, Machine Learning/NLP, Generative AI.

**Secondary:** Causal Inference, Housing Economics, Real Estate, Climate Finance, ESG Investing.

## Education

2017–2024: PhD 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. *"Can Media Narratives Predict House Price Movements?"*, with [Christopher Rauh](#).
3. *"Identification and Estimation of Common Factors in Group Factor Models"*.
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. *"Monetary Policy in the Media Spotlight: Sentiments, Signals, and Economic Impact"*, with [Etienne Briand](#), [Kevin Moran](#) and [Dalibor Stevanovic](#).
2. *"Monetary Policy Narratives and House Price Expectations"*, with [Juste Djabakou](#).

## Research Grants, Scholarships, & Fellowships

- 2024: Rising Star in Management Science and Engineering (Stanford MS & E).
- 2024: Becker Friedman Institute Macro-Finance Research Summer Session for Young Scholars.
- 2024: Productivity Partnership Student Travel Grant.
- 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, Summer (2024), 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; BFI Macro-Finance Research Program Summer Session for Young Scholars; Econometric Society North American Summer Meeting\*; Econometric Society Economics and AI+ML Conference (ESIF-AIML)\*; 58<sup>th</sup> Annual Meetings of the Canadian Economics Association; NBER-NSF Time Series Conference; 17<sup>th</sup> International Conference on Computational and Financial Econometrics; 57<sup>th</sup> 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), 39<sup>th</sup> Annual Meeting of the Canadian Econometrics Study Group\*, Conference on Real-Time Data Analysis, Methods and Applications in Macroeconomics and Finance\*; Recent Developments in Econometrics, CIREQ; UdeM-Department of Mathematics and Statistics; Concordia University; Desautels McGill University\*; HEC Montreal; UdeM Macroeconomic Brown Bag; 1<sup>st</sup> CIREQ Interdisciplinary Conference on Big Data and Artificial Intelligence; 62<sup>th</sup> Congress - Société Canadienne de Science Économique; 3<sup>rd</sup> GREDI/CREATE/CIREQ PhD Student Research Workshop.

2022:

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

2021:

Econometrics and Machine Learning Reading Group; Eleventh Montreal Industrial Problem Solving Workshop (IPSW); 60<sup>th</sup> Congress - Société Canadienne de Science Économique (SCSE); Pan-African Scientific Research Council (PASR) Conference; 16<sup>th</sup> CIREQ PhD Students' Conference; Africa Meeting of the Econometric Society (AFES).

## Discussions

- ECONDAT 2024 spring meeting: Economics with Nontraditional Data and Analytical Tools (London, 2024): " Fed Transparency and Policy Expectation Errors: A Text Analysis Approach", Eric Fischer, Rebecca McCaughrin, Saketh Prazad, and Mark Vandergon (Federal Reserve Bank of New York).
- 58<sup>th</sup> Annual Meetings of the Canadian Economics Association (Toronto, 2024): "Housing Starts Estimation using Machine Learning and Time-Series Methods", Rohan Francis (CMHC).

## 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, L<sup>A</sup>T<sub>E</sub>X.

**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.