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Research Statement

I am a financial economist with expertise in dynamic, stochastic, general equilibrium models and in the application of natural language processing and machine learning techniques to large textual datasets. As an Assistant Professor at Warwick Business School, I study fundamental questions in three areas of financial economics:

- **International Finance.** My work in international finance examines the determinants of exchange rates, the effectiveness of central bank interventions, the role of international financial intermediaries, and risk-taking in currency markets. My contributions in this area are primarily in applied theory and the modeling of cross-currency markets.
- **Heterogeneity.** I study how heterogeneity among firms and households shapes macroeconomic aggregates and asset prices. In this research, I develop and solve general equilibrium models that feature novel micro-foundations, on both the firm side and the household side. I focus on deriving closed-form solutions using perturbation methods to reveal the aggregate implications of heterogeneity at the micro level.
- **Technology.** My technology-focused research emphasizes firm decisions around technology adoption and use, the measurement of technology use at the firm level, and implications of technology for firm productivity and asset pricing. Central to this agenda has been the creation and analysis of a novel, large-scale dataset using positive and unlabeled machine learning and natural language processing methods.

With each of my projects, I aim to contribute novel methodological advances—from extending solution techniques for heterogeneous-agent models to deploying state-of-the-art machine learning at scale—and economically meaningful insights for financial economists and policymakers. Below, I summarize my current projects, indicating their status and how each contributes to my agenda in international finance, heterogeneity, and technological innovation. I conclude by describing my future research directions.

Research Projects

Foreign Exchange Intervention and Intermediary Constraints
with Alex Ferreira, Giovanni Ricco, Ganesh Viswanath-Natraj, and Zijie Wang
Status: Under Review (SSRN Link)

International Finance

How effective are sterilized foreign exchange interventions (FXI), and under what conditions do they matter most? In this paper, we provide empirical and theoretical evidence emphasizing the role of constrained financial intermediaries in amplifying the effects of FXI. Using a newly constructed dataset covering over 8,000 FXI events by Banco Central do Brasil from 1999 to 2023, we document that unanticipated central bank sales of USD reserves significantly appreciate the Brazilian currency, alleviate liquidity shortages, and reduce deviations from covered interest parity. These effects are particularly strong during periods when financial intermediaries face constraints on their ability to supply USD liquidity. To explain these findings, we extend the theoretical framework of Gabaix and Maggiori (2015) to incorporate anticipated and unanticipated interventions and distinguish between spot and swap operations. Our results highlight an important new trade-off for policymakers: FX interventions that reduce currency market frictions may simultaneously crowd out private intermediation.

Who Carries?
with Alex Ferreira, Giuliano Ferreira, and Miguel León-Ledesma
Status: Under Review (SSRN Link)

International Finance | Heterogeneity

Currency carry trade returns are difficult to rationalize within standard representative-agent models: high returns imply high risk aversion, but highly risk-averse agents would avoid risky carry trade positions. In this paper, we show theoretically that introducing heterogeneity in risk aversion resolves this puzzle. We develop a novel solution method that extends the Samuelson-Devereux-Sutherland higher-order approximation technique to heterogeneous-agent models, deriving closed-form solutions for the complete cross-sectional distribution of portfolios in a two-country dynamic stochastic general equilibrium model with incomplete markets. This methodological advance allows us to characterize how agents with different risk preferences endogenously sort into distinct portfolio strategies: a minority of risk-tolerant agents engage in carry trades, while the majority exhibit domestic portfolio bias, consistent with empirical observations for large economies such as the United States, Germany, and Japan. The model's heterogeneity generates a novel wedge between aggregate risk aversion and intertemporal substitution, offering new insights into macroeconomic dynamics and international asset pricing. Beyond the carry trade application, this solution method opens new avenues for studying distributional effects of international economic policies and endogenous market segmentation in open economies.

On Aggregate Fluctuations, Systemic Risk, and the Covariance of Firm-Level Activity
solo-authored
Status: Under Review (SSRN Link)

Technology | Heterogeneity

Why do high-productivity firms contribute disproportionately to aggregate fluctuations but expose investors to lower returns? In this paper, I offer a novel explanation rooted in firms' technology diversification decisions. Using a unique firm-level technology dataset developed in my related project on firm-level technology use, I document that firm-level comovement, driven by overlapping technology usage, accounts for more than 80% of aggregate volatility in productivity, sales, and profits. To rationalize these facts, I introduce a general equilibrium model in which firms strategically choose their exposure to technology-specific risks through diversification. In equilibrium, high-productivity firms operate multiple, distinct technological segments, reducing their covariance risk relative to their market value and thus offering investors lower returns per unit of risk. This endogenous mechanism provides fresh insights into the microeconomic foundations of systemic risk and offers a unified explanation for observed patterns in aggregate fluctuations and cross-sectional asset pricing.

Beyond Patent Ownership: Learning About Technological Usefulness
with Jesus Gorrin
Status: Preparing for Submission (SSRN Link)

Technology

Existing technology datasets are limited in the combination of scale, scope, span, and specificity they offer. These limitations have left researchers with an incomplete understanding of how the majority of firms use technology and how markets process technological information. In this major empirical project, we address the shortcomings of existing datasets by constructing a comprehensive firm-level technology usage dataset covering the universe of public firms and patent grants in the United States over a period of three decades. To achieve this, we apply state-of-the-art natural language processing methods—including transformer-based language models—and novel machine learning techniques (positive and unlabeled learning) to textual descriptions from millions of patent filings and tens of thousands of business descriptions. This large-scale computation is implemented using cloud computing resources. We validate our estimates by predicting patent litigation and reassignment events, and demonstrate the dataset's economic significance by showing that investors systematically underestimate the technological relevance of patents to non-owning firms, leading to significant abnormal returns from a technology-based momentum trading strategy. By focusing explicitly on patent usefulness rather than ownership, our methodology goes beyond traditional patent datasets, broadening our understanding of firm-level technology use and its implications for asset prices. The dataset is publicly available at techtext.org.

Future Directions

My future research will deepen my focus on technology, particularly through the ongoing development of the TechText firm-level technology dataset and platform. Through this multi-year project, I have constructed a comprehensive dataset using natural language processing, transformer-based language models, and machine learning methods deployed on AWS cloud infrastructure. The dataset, available at techtext.org, will be updated regularly as new data become available and as methods evolve.

I have follow-up projects planned to leverage this data to study technology diffusion, firm productivity, innovation dynamics, and asset pricing. By sharing the data publicly, I hope to provide a platform that enables the broader academic community to create new technology-focused research. I will continue to study household and firm heterogeneity, maintaining a strong emphasis on the intersections with asset pricing, macrofinance, and international finance. Details of my ongoing research, including working papers, datasets, and presentation slides, can be found at rorymullen.net/research.

Sincerely,

Rory Mullen
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