

## Research Statement

Irina Panovska

### I. Overview

I am a macroeconomist with a research focus on nonlinear business cycle dynamics. My work studies on the speed and duration of economic recoveries and the responses of macroeconomic conditions to different policy actions.

Recessions and expansions are cyclical phenomena; consequently, policy actions intended to mitigate the effects of downturns primarily target cyclical movements in macroeconomic aggregates. Correctly identifying cyclical and trend movements is therefore crucially important for designing policy. The first stream of my research is methodological and focused on identifying and estimating the unobserved cyclical components of output that define the state of the economy. In the second stream of my research, I study the nonlinear effects of demand shocks on aggregate economic activity. In short, my recent work focuses on studying why some recessions are followed by quick and robust recoveries, whereas others cause permanent damage and are followed by slow recoveries, and what policymakers can do to mitigate slow recoveries.

### II. Published Work on Trend Cycle Decomposition and Business Cycle Methodology: Measuring the Business Cycle and Economic Recoveries

The first stream of my research is focused on the intersection between econometric trend-cycle decompositions and identifying the drivers behind recessions and recoveries. I am particularly interested in the drivers that can help explain the changing nature of the business cycle, and why some recessions are followed by lackluster recoveries. In my paper “**Decomposing the Output Gap with Inflation Learning**” (2022, *Journal of Economic Dynamics and Control*), coauthored with Srikanth Ramamurthy, we augment the commonly used unobserved components trend-cycle decomposition method for output with a formal theoretical component and an adaptive learning process for inflation expectations. We study if augmenting the model to account for imperfect learning about inflation can help improve inference about the output gap, and we find that our model improves inflation forecasts and inference about the output gap. In a related working paper “**Estimated Output Gap in a Wage-Inflation Expectations Model**” (2026, working paper) coauthored with my PhD students Prajyna Barua Soni and Azharul Islam and with Srikanth Ramamurthy, we tackle a more complex problem. In this paper, we allow for bivariate feedback in the learning dynamics for wage and price inflation and augment the model with two Neo Keynesian Phillips Curves equations that describe the learning process for inflation and wage inflation expectations. This is the first paper in the literature that estimates the output gap endogenously and that allows for a bivariate endogenous learning process. Three interesting sets of results stand out. First, our model accurately captures turning points and the amplitude of the business cycle, especially compared to models with univariate learning that do not incorporate labor market data. Second, while the perceived persistence of inflation fell during the early stages of the pandemic, it increased sharply and substantially 2021-2023. Although it declined after 2024, it still remains at an elevated level compared to the pre-COVID period. Finally, we find that the cross-effects of wage and price inflation vary substantially over time.

In “**Recession-specific Recoveries: “L’s, U’s and Everything in Between”** (2021, *Economics Letters*) with Luigi Donayre we develop a new empirical model that allows for recession-specific recoveries where some recessions and recoveries cause permanent shifts in the economy and some only cause temporary disruptions with a full recovery. We model output growth as the weighted average of Markov-switching processes that temporarily alter the level of real GDP and those with permanent effects, where the recession-specific weight for each model is endogenously estimated. The majority U.S. recessions reflect a weighted combination of the two shapes, suggesting multiple sources of recessions where recessions are not a purely transitory phenomenon but can also be driven by permanent shocks. Consequently, models that imply only one possible path for a given recession may be insufficient to fully characterize the behavior of output during recessionary periods. This project is closely related to my previous work on slow recoveries in labor markets, and to a new project with Luigi Donayre “**The Speed of State-Level Recoveries**” (2026, **working paper**), discussed in the work in process section.

This stream of my research is related both to several other published works and to several works in progress. In “**Is Business Cycle Asymmetry Intrinsic in Industrialized Economies?**” (2020, *Macroeconomic Dynamics*), coauthored with James Morley, we use trend-cycle decompositions to answer an empirical question about business cycle nonlinearity in industrialized economies. We consider a modification of the model-averaged forecast-based estimate of the output gap to measure economic slack for ten industrialized economies. By accounting for model uncertainty our measure is robust to different assumptions about the underlying structure of the economy. Our modelling approach can be used to reliably extract estimates of the output cycle, is computationally simple, and can be very easily extended to estimate output cycles for economies that have shorter data samples. In a related more policy-focused work, “**Business Cycle Synchronization and Asymmetry in the Eurozone**” (2024, *Economic Modelling*, funded by the **Croatian Academy of Sciences Grant IP-2019-04-4500 and MacroHub Project 6785, 7031**) with Vladimir Arcabic and Josip Tica we extend this idea within the context of international business cycle synchronization. This is particularly salient within the context of the European Monetary Union: if countries have business cycles with different amplitudes or different phases, a policy action that may help one member can be detrimental to another member. We show that different assumptions about the output cycle can lead to very different implications when it comes to business cycle synchronization in the European Union. While both core and periphery countries experience nonlinear recessions and recoveries, the nature of nonlinearity is quite different across countries, which indicates that there is no “one size fits all monetary policy”. On the econometric side, in our paper “**Testing Stationarity with Unobserved Components Models**” (2017, *Macroeconomic Dynamics*) coauthored with James Morley and Tara Sinclair, we developed a new test for stationarity that can be used to help evaluate the evidence of a stochastic trend in cases when a variable has a stochastic trend and feedback between the trend and the cycle. We propose the use of a likelihood ratio test of stationarity based directly on the unobserved components models used in estimation of stochastic trends, meaning that our test is very straightforward to implement in empirical macroeconomic research.

### III. Published Work on Economic Recoveries and Policy

In my early work, “**What Explains the Recent Jobless Recoveries**” (2017, *Macroeconomic Dynamics*), I analyzed how the nature of recoveries in the US labor market has changed over

time. The slow “jobless” labor market recovery was one of the primary concerns when it came to policy normalization in the aftermath of the Financial Crisis. When this paper was published, it was the first study at the time that jointly considered the link between the trends and the cycles in output, employment, and hours as potential explanation for jobless recoveries. I found significant evidence in favor of a change in the relationship between the cyclical components of output and labor market variables, supported by the fact that employment is more sensitive to demand shocks post-1984. This has important potential implications for policy because it indicates that there have been structural changes in the nature of the business cycle. This project is related to two studies I recently coauthored with my PhD students. “**A Look at Jobless Recoveries in G7 Countries**”, coauthored with my former PhD student Ahmed Elroukh and with Alex Nikolsko-Rzhevskyy (2020, *Journal of Macroeconomics*) is a continuation of this research stream. Using both revised and real-time data, we consider several popular measures of the output cycle to study how the nature of employment growth in G7 countries has changed over time. Our results show that jobless recoveries are a global phenomenon. However, we also find evidence in favor of heterogeneity across countries, both in the responses of employment growth to cyclical movements in employment and in the responses of employment to the output cycle. In “**Jobless Recoveries and Time Variation in Labor Markets**” (2024, *Journal of Macroeconomics*), coauthored with my former PhD student Licheng Zhang, we explored this topic from a different angle. We study whether the breakdown in the relationship between the employment cycle and the output cycle is restricted to limited periods or stages of the business cycle, or whether it is a more systemic gradual process. The previous literature, including my own work, has used more restrictive models that focus on select stages of the business cycle and on one or two variables of interest such as payroll employment or hours. In this paper we use a flexible time-varying-parameter model to explore how the relationship between output and a large set of labor market inputs has changed over time. We find that the responses of overall employment and unemployment to GDP became abruptly weaker. However, the responses on the intensive margin and the responses of part-time employment and employment in specific sectors became gradually stronger. A particularly interesting implication of this gradual evolution is that it implies uneven changes in the nature of the business cycle across sectors.

There is a complex relationship between the nature of economic recoveries and the efficacy of policy. The changing nature of economic recoveries can affect the efficacy of policy, and economic policy can hinder or accelerate the speed of economic recoveries. In my early work “**State-Dependent Effects of Fiscal Policy**” (2015, *Studies in Nonlinear Dynamics and Econometrics*), coauthored with James Morley and Steven Fazzari, we studied whether the impact of an increase in fiscal spending is different depending on the time when the increase was implemented and its efficiency across recessions, recoveries, and mature expansions. Our model differed from the related literature in three important ways. First, we found that capacity utilization is more economically relevant than a simple binary dummy variable for recessions. Second, we allowed for the possibility that there could be asymmetries in the middle of the business cycle. We find that when the threshold is estimated, rather than imposed, the US is in the high-impact state about 60% of the time, more often than just in recessions, indicating that policy changes implemented in lackluster recoveries could be effective. Third, we introduced a comparison method for the posterior distribution of the impulse responses, which allowed us to directly evaluate whether there is evidence of state-dependence for any two given initial states. This paper received an Institute for New Economic Thinking grant (IN01100009) and an

Australian Research Council grant (DP130102950). In our related study “**When is Discretionary Fiscal Policy Effective**” (2021, *Studies in Nonlinear Dynamics and Econometrics*), we jointly evaluated whether spending and tax changes have nonlinear effects, and whether the effects of austerity measures are different in magnitude from the effects of stimulus measures. This related project was also funded by the same ARC grant (DP130102950), and presented at the Australian Treasury in 2017. The fiscal response to the COVID crisis in 2020 in Australia reflected a recently revised view at the Treasury of the effectiveness of policy that was more consistent with our findings.

In “**State-Dependent Exchange Rate Pass-Through Behavior**”, with Luiggi Donayre (2016, *Journal of International Money and Finance*) we also focused on the state-dependent transmission of demand shocks but through an international lens. We studied the effects of nonlinear demand shocks on prices through the exchange rate pass-through channel, and we find that the pass-through is higher in expansions. This project is linked to my other projects in two ways. First, we evaluate whether prices respond differently to demand shocks across different stages of the business cycle, with exchange rate shocks being a specific example of a demand shock. More broadly, the paper is linked to the nonlinear policy literature because the pass-through directly determines the degree of independence when designing monetary policy at different stages of the business cycle.

#### **IV. Recent Published Interdisciplinary Work**

Two of my recent interdisciplinary papers incorporate a combination of conventional macro econometric methods and machine learning approaches applied to economics and finance. In McInnish, Nikolsko-Rzhevskyy, Nikolsko-Rzhevskaya, and Panovska (2020, *Financial Management*), coauthored with coauthors from the economics and finance department at Lehigh University and the University of Memphis, I compared conventional nonlinear models to new machine learning models in financial markets. In Dey et al. (2020, *PhysicaA*), coauthored with collaborators from the Statistics Department at UT Dallas, Lamar University, and the University of Louisiana at Lafayette, I incorporated the nonlinear models I have developed in previous work and a machine learning approach based on a large data set and a graph theory model from statistical theory to predict outcomes in macroeconomic and financial variables.

#### **V. Selected Working Papers and Research in Progress**

My current work in progress lies at the intersection of my two research streams and focuses on modelling economic recoveries and their intersection with business cycle nonlinearities.

In “**From Beliefs to Prices: Analyzing How Inflation Expectations Affect the Inflation Distribution**”, coauthored with UTD PhD alumnus Azharul Islam and with Jose Barrales-Ruiz and Mikidadu Mohammed (2026, revised and resubmitted at *Journal of Economic Dynamics and Control*), we investigate how the distribution of inflation expectations influences realized inflation across its entire distribution, and the role of state dependence when it comes to this relationship. We find that shocks to median inflation expectations increase the median inflation rate for up to three years and subsequently generate persistent upside risks in inflation that endure for more than six years. By analyzing higher-order moments; specifically,

the standard deviation and skewness of inflation expectations, we show that greater disagreement among agents has distinct impacts on the distribution of the inflation rate. While an increase in the standard deviation amplifies right-tail inflation risks and generates quantile-dependent effects at the 90th percentile of the inflation distribution, a negative skewness shock temporarily shifts the distribution without any quantile-dependent effects. Our results highlight the critical importance of the distributional properties of inflation expectations for understanding and managing inflation risks. The results also underscore the need for well-anchored expectations to promote macroeconomic price stability.

In my paper with Luigi Donayre “**The Speed of State-Level Recoveries**” (2026, working paper), we build on our initial work (Donayre and Panovska, 2021, *Economic Letters*) to develop a model that studies economic recoveries at the state level. We find significant heterogeneity both in the speed and the duration of recessions and recoveries at the state level, and both are informative when trying to capture the dynamics of the macroeconomy at the aggregate level. This is a multi-paper project, and our next steps entail exploring the determinants of the speed of recoveries.

In “**Estimated Output Gap in a Wage-Inflation Expectations Model**” (2026, working paper) coauthored with my former PhD students Prajyna Barua Soni and Azharul Islam and with Srikanth Ramamurthy, we tackle a more complex problem. In this paper, we allow for bivariate feedback in the learning dynamics for wage and price inflation and augment the model with two Neo Keynesian Phillips Curves equations that describe the learning process for inflation and wage inflation expectations. This is the first paper in the literature that estimates the output gap endogenously and that allows for a bivariate endogenous learning process. Three interesting sets of results stand out. First, our model accurately captures turning points and the amplitude of the business cycle, especially compared to models with univariate learning that do not incorporate labor market data. Second, while the perceived persistence of inflation fell during the early stages of the pandemic, it increased sharply and substantially 2021-2023. Although it declined after 2024, it still remains at an elevated level compared to the pre-COVID period. Finally, we find that the cross-effects of wage and price inflation vary substantially over time.

In our working paper “**Mexico’s Labor Market through the Lens of the Beveridge Curve**” (2026, Bank of Mexico Working Paper), coauthored with UTD PhD alumni Luis Fernando Colunga Ramos and Prajyna Barua, and Miroslava Quiroga-Trevino and Benjamin Rodriguez-Alcaraz from the Bank of Mexico, we also focus on the shape of economic recoveries and their heterogeneity. This paper presents the first Beveridge Curves for Mexico and its regions, constructed from a newly compiled dataset on job vacancies. Focusing on the post-COVID-19 period, the evidence reveals a sharp rise in labor market slack at the onset of the pandemic, followed by a gradual tightening from 2021 onward, with northern regions experiencing a faster recovery. By 2023, vacancy rates had declined without a corresponding increase in unemployment, suggesting a rebalancing of labor demand across regions. Building on the vacancy–unemployment relationship that defines the Beveridge Curve, the paper also develops the first measure of labor market slack for Mexico: the vacancy to unemployment (V/U) ratio, which is then used to analyze the relationship between labor market conditions and inflation. In addition, incorporating vacancy data into a Structural Bayesian VAR allows for the identification of structural labor market shocks and the examination of business cycle dynamics. The results

indicate that Beveridge Curve variables are primarily driven by labor market shocks: unemployment dynamics are explained mainly by labor supply and matching efficiency shocks, while wage bargaining shocks account for most of the variation in vacancies at the national level, with notable heterogeneity across regions.

My future work will continue to focus on nonlinear models of the business cycle, both using structural and quasi-structural models and by leveraging new approaches in machine learning such as alternative model averaging schemes that allow us to account for model uncertainty.