Corvinus University of Budapest
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Essays on the Nonlinear Transmission of Monetary Policy

Thesis Booklet

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I. Research Background and Justification of the Topic

Monetary policy is one of the principal instruments of macroeconomic stabilization. By shaping short- and long-term interest rates, financing conditions, asset prices and expectations, it influences aggregate demand and inflation dynamics, and hence real economic activity. Because these channels operate through a complex macro-financial system, understanding the transmission mechanism has long been a central objective of macroeconomic research and a key input for policy design.

This dissertation is built on two premises. First, following the tradition established by Sims (1980), it takes a data-driven approach. Rather than imposing a fully calibrated structural model on the data, the three essays let the reduced-form dynamics of macroeconomic and financial time series reveal the shape of the transmission mechanism. Second, the dissertation starts from the view that monetary transmission is unlikely to be well described by a single, linear relationship. As Akerlof and Shiller (2010) emphasize in their discussion of Keynesian "animal spirits," macroeconomic outcomes are shaped by shifting confidence, evolving perceptions of risk and episodes of market exuberance, all of which can alter how forcefully a given policy action passes through to the real economy. Financial frictions may bind more tightly when fear is elevated, balance-sheet channels may strengthen when leverage is high, and the reaction of expectations to policy communication may depend on the underlying state of the economy. Because major policy decisions are typically made precisely when conditions are atypical, focusing only on average, linear responses risks understating both the risks and the tradeoffs that policymakers actually face.

The dissertation consists of three essays that study this nonlinearity from complementary angles: (i) transmission of monetary policy intervention under economic uncertainty, (ii) state dependence linked to housing market imbalances, and (iii) the role of forward guidance and monetary policy in shaping not only the expected path of interest rates but also their conditional volatility.

The first essay is motivated by the sharp rise in geoeconomic fragmentation and fundamental uncertainty (Dequech, 2000) in the 2020s. The COVID-19 pandemic; the near-collapse of European gas imports from Russia after 2022;

the tightening of export controls on semiconductors and critical minerals; and a fresh wave of tariff escalation in 2024–2025 all shook up the geoeconomic landscape and pusehd uncertainty to multi-decade highs. A small literature already documents that monetary policy tends to be less effective under high uncertainty (e.g., Aastveit, Natvik and Sola, 2017; Aquino, Ramirez-Rondan and Yepez Salazar, 2022; Castelnuovo and Pellegrino, 2018). This evidence, however, typically imposes narrow, partial forms of regime dependence, relies on samples that predate the post-2008 environment, and is heavily US-centric. This leaves open whether, and through which channel, uncertainty alters transmission across a broad, contemporary, global country panel.

The second essay is motivated by the central role housing plays in the business cycle and in monetary transmission, through its asset-price, credit and wealth channels (Case and Shiller, 2003; Kydland, Rupert and Šustek, 2016). The prolonged low-rate period following the Global Financial Crisis fuelled a substantial expansion of mortgage lending and property prices, and the subsequent 2022 tightening cycle raises the question of how monetary policy interacts with a housing market that may itself be a source of financial fragility (Bernanke, Gertler and Gilchrist, 1999; Iacoviello, 2005; Mian and Sufi, 2011). Existing threshold-VAR evidence on state-dependent transmission during financial stress (e.g., Li and St-Amant, 2010; Fry-Mckibbin and Zheng, 2016; Schmidt, 2020) does not typically combine leverage and price-misalignment information into a single, housing-market-specific measure of boom-bust conditions, which motivates the construction of a dedicated composite indicator in this essay.

The third essay is motivated by the growing importance of forward guidance as a monetary policy tool since the Global Financial Crisis, once policy rates approached their effective lower bound. Campbell et al. (2012) suggests that Forward guidance can operate through two distinct mechanisms: commitments about future policy actions (“Odyssean” guidance) and revelations of the central bank’s own economic outlook (“Delphic” guidance). The net effect of monetary policy intervention and forward guidance on market uncertainty is theoretically ambiguous (Hanson and Stein, 2015; Andrade et al., 2019). The high-frequency identification literature built around the identification of monetary policy shocks via changes in futures contracts around Federal Open Market Committee meetings (Gurkaynak, Sack and Swanson, 2005; Nakamura

and Steinsson, 2018; Jarocinski and Karadi, 2020) has focused almost exclusively on how these shocks move the conditional mean of asset prices and transmit further tot he real economy. A separate literature on macroeconomic uncertainty (Bloom, 2009; Jurado, Ludvigson and Ng, 2015) and more specifically, monetary policy uncertainty (Husted, Rogers and Sun, 2020; Bundick, Herriford and Smith, 2017, 2024) suggests that a volatility, or "scale," channel could be economically important should monetary policy intervention endogenously interact with percieved economic and monetary policy uncertainty. This essay is motivated by the gap between these two literatures.

II. Methods Applied

All three essays share a common methodological philosophy: rather than imposing a single, theory-consistent structural model, each essay lets a flexible, data-driven time-series model uncover nonlinear or higher-order dynamics, with structural shocks isolated through sign-restriction or high-frequency identification schemes. Each essay tailors this general strategy to its specific empirical question.

II.1 Bayesian Threshold VAR across a country panel (Essay 1)

The first essay, coauthored with Tohid Atashbar (IMF), estimates a two-regime Threshold Vector Autoregression (TVAR) separately for each of 30 advanced and emerging market economies, with regimes defined by the level of an uncertainty indicator. The model includes five endogenous variables (the policy interest rate, GDP growth, CPI inflation, the real effective exchange rate, and a measure of global uncertainty) and is estimated with Bayesian methods following Giannone, Lenza and Primiceri (2015), using a common degree of shrinkage across regimes so that differences between the high- and low-uncertainty impulse responses reflect genuine differences in dynamics rather than differences in priors. Monetary policy shocks, together with four additional structural shocks (domestic demand, cost-push supply, global uncertainty, and a UIP/risk-premium shock), are identified using sign restrictions following Arias, Rubio-Ramírez and Waggoner (2018). Country-level posterior impulse responses are pooled across the panel (and individually across relevant subsamples, such as advanced versus emerging economies) to characterize representative, regime-specific transmission dynamics. To

summarize the tradeoff between output and inflation, the paper constructs a sacrifice ratio, defined at each horizon and each posterior draw as the ratio of the cumulative impulse response of GDP growth to that of inflation, and reports its posterior median.

II.2 Threshold Factor-Augmented VAR with Generalized Impulse Responses (Essay 2)

The second essay develops a composite housing-market-stress indicator by applying principal component analysis to the rent-price ratio and the credit-to-GDP gap, and uses it as the threshold variable that classifies U.S. quarterly data (1970Q2–2024Q3) into housing boom and bust regimes. To manage the dimensionality of the underlying macro-financial dataset, the essay embeds a Factor-Augmented VAR (FAVAR, following Bernanke, Boivin and Eliasz, 2005) inside a threshold framework, extracting three principal components (jointly explaining roughly 93% of the variance) from seven macro-financial indicators. These three factors, together with the policy rate and the housing stress indicator, form a five-variable Threshold FAVAR (TFAVAR), estimated by conditional least squares with the threshold value chosen by grid search to minimize the residual sum of squares. Structural shocks are again identified via sign restrictions (Arias, Rubio-Ramírez and Waggoner, 2018), applied separately by regime. Because the model is nonlinear, impulse responses are computed as Generalized Impulse Response Functions (GIRFs, following Koop, Pesaran and Potter, 1996) using the simulation-based algorithm of Andreasen et al. (2021). Confidence bands are constructed via the Maximum Entropy Bootstrap of Vinod (2006), which accommodates the non-stationarity of several series.

II.3 Dynamic location-scale local projections with high-frequency shocks (Essay 3)

The third essay studies the U.S. Treasury term structure using the location-scale model of Rigby and Stasinopoulos (2005) estimated with the local projections framework of Jordà (2005). In such a model, separate equations describe the evolution of the conditional mean ("location") and of the conditional standard deviation ("scale") of daily yield changes at each maturity at different forecast horizons. The equations are estimated at horizons from the announcement day ($h = 0$) out to roughly one trading month ($h = 25$), using conditional volatility

proxied by the absolute residuals of the location equation and augmented with an ARCH term (Engle, 1982; Bollerslev, 1986) to capture volatility clustering, following the approach of Hubert and Labondance (2018). Monetary policy and forward guidance are captured through high-frequency, event-study shocks. A standard policy-rate ("Target") surprise accounts for interest rate shocks, while an "Odyssean" forward-guidance surprise, and a "Delphic" information surprise account for forward guidance shocks. The high-frequency shocks are constructed following the literature pioneered by Gurkaynak, Sack and Swanson (2005). Specifically, the estimations use the four-factor decomposition of Jarocinski (2024), and alternative identification schemes (of Scotti and Wright (2018) and Jarocinski and Karadi (2020)) are used as robustness tests. In addition to estimating the models ont he nominal zero-coupon term structure, the essay separately estimates the model on expected short rates, term premia, TIPS yields and breakeven inflation.

III. Scientific Results of the Dissertation

The following theses summarize the dissertation's principal new scientific results.

Thesis 1. Under high economic uncertainty, the real (GDP) response to a contractionary monetary policy shock is essentially unchanged relative to low-uncertainty periods, but the disinflationary response is markedly weaker and less persistent. As a result, the sacrifice ratio (cumulative growth-loss per unit of disinflation) is several times larger when uncertainty is high than when it is low. This result, obtained from a Bayesian Threshold VAR estimated across a global panel of 30 economies, differs from much of the existing literature, which typically finds that uncertainty weakens the real effects of monetary policy. Here, instead, uncertainty appears to weaken specifically the inflation side of the transmission mechanism, consistent with either a flattening of the Phillips curve under a "wait-and-see" pricing motive or weaker anchoring and updating of inflation expectations.

Thesis 2. The uncertainty-dependence documented in Thesis 1 is robust across the full country panel, across advanced and emerging economies, and across alternative definitions of the uncertainty threshold, but it is considerably

stronger for narrative, text-based measures of economic policy uncertainty than for a model-based macro-uncertainty index or a geopolitical risk index specifically. This indicates that the channel identified is linked more closely to policy-related uncertainty (and, by extension, to episodes of geoeconomic fragmentation that generate this type of uncertainty) than to uncertainty in a broader, undifferentiated sense.

Thesis 3. A newly constructed composite housing-market-stress indicator, obtained via principal component analysis of the rent-price ratio and the credit-to-GDP gap, identifies historical U.S. housing boom-bust episodes more accurately than either underlying series used alone. Embedded as the threshold variable of a Threshold Factor-Augmented VAR, the indicator shows that the response of house prices themselves to a monetary policy shock is nearly identical across housing boom and bust regimes, implying that the asset-price channel of transmission is not strongly amplified by housing-market imbalances.

Thesis 4. What differs sharply across housing-market regimes is not the size of the shock's impact but the conduct of monetary policy itself: following a contractionary shock, the policy rate is held higher for longer and normalizes considerably more gradually during housing booms than during busts, even though output, prices and credit volumes contract only somewhat more strongly in booms. This pattern suggests that the central bank internalizes broader macro-financial and deleveraging risk beyond what a standard Taylor-type policy rule would imply.

Thesis 5. Using a dynamic location-scale model estimated via local projections with high-frequency monetary shocks, standard policy-rate surprises significantly raise the conditional volatility of U.S. Treasury yields across the term structure, whereas forward guidance (both explicit policy commitments and information-revealing statements) compresses conditional volatility, particularly at medium and long maturities. This establishes a "scale channel" of monetary policy transmission, distinct from and in addition to its conventional effect on the conditional mean (the "location channel") of yields.

Thesis 6. The estimated scale responses are an order of magnitude smaller and far less persistent than the corresponding location responses, dissipating within

a few trading days, and they are asymmetric across shock type and maturity. For example, the ten-year yield's volatility response to a policy-rate shock is comparatively large and persistent and is not offset by forward guidance. Nonetheless, an illustrative counterfactual decomposition shows that during the near-zero-lower-bound period following the COVID-19 pandemic, the scale channel of Odyssean forward guidance contributed measurably (on the order of a few basis points), on top of its larger location effect, to holding the 2-year Treasury yield below what it would otherwise have been.

IV. Main References

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V. List of Publications Related to the Topic

1. Horváth, P., and Atashbar, T. “Monetary Transmission in a Fragmented, Uncertain World.” Working paper, Corvinus University of Budapest. [Chapter 1 of the dissertation; not yet submitted for publication.]

2. Horváth, P. “Nonlinear Transmission of Monetary Policy and Housing Market Imbalances: Evidence from a Factor-Augmented Threshold VAR Analysis.” The Manchester School. https://doi.org/10.1111/manc.70034. [Chapter 2 of the dissertation.]

3. Horváth, P. “A Distributional Perspective on Forward Guidance and Monetary Policy along the US Term Structure.” Working paper, Corvinus University of Budapest. [Chapter 3 of the dissertation; not yet submitted for publication.]