Research Statement

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I am a macroeconomist working at the intersection of macroeconomic theory, quantitative methods and econometrics. My focus lies on the identification of the effects of economic policy measures, and the transmission channels though which they operate. To quantify these channels, I also develop tools to solve structural dynamic models, and to bring them to the data. My work hence is both empirical and theoretical. I am particularly interested in the macroeconomic effects of monetary and fiscal policy, their implications for the cross-sectional distributional dynamics of households, as well as the role of the financial sector for the transmission of economic policies.

Monetary Policy and the Financial System

The paper **"Monetary Policy and Speculative Asset Markets"** studies the conduct of monetary policy under speculative asset prices dynamics that generate spillovers to the real economy. To this end, I propose an estimated model with credit constraints where excess volatility in asset markets is endogenously amplified by speculation of boundedly rational agents. I find that (i) speculative behavior and its feedback to asset prices are key to replicate central empirical moments and (ii) speculative behavior can trigger endogenous financial crises that can have severe spillover effects to the macroeconomy. Optimal monetary policy is state-dependent. In normal times, monetary policy should not respond to asset price dynamics. In times of financial crisis, however, leaning-against asset prices is desirable as it helps to mitigate the economic downturn.

The paper **"The Micro & Macro of (Unconventional) Monetary Policy: the role of the banking sector"** investigates the causes for the spike in households' deposit rates of the Euro Area in 2009, against the background of the ECB's ultra expansionary monetary policy. In this period, we observed 3 key facts: (i) the ECB significantly lowered its reserve rate, (ii) banks started to accumulate massive amounts of excess reserves, but yet (iii) household deposit rates increased. To explain these facts, I develop an industrial organization model of the banking sector, embedded in a medium-scale macroeconomic model. In the model, household deposits are associated with a liquidity risk for banks, and banks hold reserves at the central bank to hedge this liquidity risk. This gives rise to a premium on the household deposit rate relative to the reserves rate. I show that, since liquidity costs fall and holding deposits becomes more attractive for banks, the deposit rate can actually increase if the central bank provides more reserves. In aggregate this can trigger an increase in households' saving and thereby decrease consumption, eventually leading to an economic contraction instead of the desired stimulus.

In recent years, we have observed a series of economic puzzles for which conventional theories fail to provide answers. In an attempt to document this issues, I maintain a public collection of such "Macro Puzzles".[1] One prominent example of such "Puzzle" is the well documented *flattening* of the Phillips Curve, which refers to the growing disconnect between inflation and economic activity since the late 2000s. In particular, during the Great Financial Crisis, many advanced economies experienced a small decline in inflation despite the severity of the recession,

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a phenomenon known as the *missing deflation puzzle.* In **"The Hockey Stick Phillips Curve and the Zero Lower Bound"** we show that the interplay between a binding lower bound on nominal interest rates and the costs of external financing weakens the disinflationary effect of financial shocks. In normal times, factor costs dominate firms' marginal costs and hence inflation dynamics; credit spreads and the nominal interest rate, which together constitute external financing costs, balance out. When nominal rates are constrained by the ELB, larger spreads can in part offset the effect of lower factor costs on firms' price setting. The observed Phillips curve is hence flat at the ELB, but features a positive slope in normal times and thus an overall hockey stick shape.

The Great Financial Crisis and its Consequences

In another branch of my research I investigate the empirical dynamics of the Global Financial Crisis and the Great Recession through the lens of structural economic models. The crisis has confronted economic research with novel phenomena. One is the effective lower bound (ELB) on nominal interest rates: In response to the sharp decline in economic activity, central banks in major advanced countries reduced nominal interest rates to historically low levels.

The binding ELB constraint on nominal rates poses a major problem for a quantitative-structural analysis. Traditional solution, filtering and estimation methods typically do no work in the presence of a nonlinearity such as the ELB. Existing alternatives tend to be highly demanding computationally. Yet, the ability to *estimate* DSGE models is important: estimated models allow to assess the macroeconomic effects of different policies based on counterfactual analysis and credible policy simulations. To close this gap, the paper **"Efficient Solution and Computation of Models with Occasionally Binding Constraints"** proposes a novel method to calculate robust and efficient solutions to dynamic-stochastic general equilibrium (DSGE) models with an occasionally binding ELB.[2]

Complementary, the paper **"An Ensemble MCMC Sampler for Robust Bayesian Inference"** develops a sampling algorithm that allows robust sampling from the posterior distribution of large-scale DSGE models. Particularly, the method allows efficient parallelization, which is an important prerequisite to estimate models that are computationally expensive to evaluate. The sampler effectively combines the tasks of mode-finding and posterior sampling and is essentially parameter-free, which makes it very robust across applications. As a proof of concept, the sampler is used for the estimation of a large-scale heterogeneous agent New Keynesian (HANK) model. Here, for the first time, my method allows to estimate parameters that are typically excluded in the estimation procedure due to computational constraints, such as household parameters which determine the endogenous stationary distribution of assets. I also show that the sampler can be used to estimate large scale models with odd-shaped and bimodal posterior distributions.[3]

In the paper **"Estimation of DSGE Models with the Effective Lower Bound"** (jointly with Felix Strobel) the methods from the above papers are combined with a novel Bayesian filter to enable the efficient and robust Bayesian estimation of medium- and large-scale DSGE models while fully accounting for the ELB. We show that our nonlinear approximative Bayesian filter allows for the efficient likelihood approximation even of nonlinear models with very large state spaces. Using simulated data, we show that our method captures the true parameters of medium-scale models, even when the ZLB binds for a very long time. We apply our approach to analyse the post-2008 US business cycle properties. To my best knowledge, this paper is the first one estimating a range of full medium-scale models while fully including an endogenously binding ELB. Thus, it provides reference calibrations for future research.

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[2]The package is developed and made available on GitHub: https://github.com/gboehl/pydsge
[3]The project is also developed on GitHub: https://github.com/gboehl/emcwrap

We apply the proposed methodology in **"A Structural Investigation of Quantitative Easing"** to study the macroeconomic effects of the Fed's unconventional monetary policy conducted by the FED during the last decade. Together with my coauthors I extend the medium-scale DSGE model to include a banking sector as well as financial frictions. We incorporate several important channels through which QE can affect the economy. We provide evidence that QE – which lead to an easing of financial conditions – had in fact deflationary effects: QE increased aggregate investment, which in turn expanded firms' production capacities and lowered marginal cost, putting downward pressure on prices. The disinflationary supply side effects dominated over the inflationary effects from initially higher aggregate demand. The concomitant rise in the real interest rate at the ELB then induces a net fall in aggregate consumption.

Another application of my methodology is the paper **"The Empirical Performance of the Financial Accelerator since 2008"** (also with Felix Strobel), which evaluates the performance of financial frictions á la Bernanke et al. (1999) during and after the Global Financial Crisis. We find that, despite the attention received in the literature, the inclusion of these frictions into canonical DSGE models does not improve the model's ability to explain macroeconomic dynamics in the US in the Great Recession. These models fail to explain central macroeconomic dynamics during the Great Recession: a drastic fall in investment, a more modest decline in consumption, and a temporary dip of inflation. Instead, the results stress the overall importance of elevated risk premia for households following the crisis to explain the post-2008 empirical dynamics.

Heterogeneity and Complex Dynamics

In **"Rational vs. Irrational Beliefs in a Complex World"** (jointly with Cars Hommes) we contribute to the literature on bounded rationality. We develop a highly nonlinear heterogeneous agents model with rational forward looking versus boundedly rational backward looking agents. Market shares of each type evolve according to their relative performance. Our novel numerical solution method detects equilibrium paths characterized by complex bubble and crash dynamics. Boundedly rational trend-extrapolators amplify small deviations from fundamentals, while rational agents anticipate market crashes after large bubbles and drive prices back close to fundamental value. Overall rational and non-rational beliefs co-evolve over time, with time-varying impact, and their interaction produces complex endogenous bubble and crashes, without any exogenous shocks.

The paper **"Can Taxation Predict US-Top-Wealth Share Dynamics?"** makes a contribution to the growing literature that studies the dynamics of wealth inequality. Our estimated, micro-founded portfolio-choice model generates an analytically tractable fat-tailed Pareto distribution for the top-wealthy, which allows us to decompose the sample into periods of transient and stationary wealth concentration. We show that the degree of capital gains taxation can retrace the data of the US from the 1920s up to the most recent observations. In a companion paper (**"The Quantitative Effects of Taxation on Inequality Dynamics"**) we develop an econometric methodology that, based on generic partial differential equations, provides a general structural model for Bayesian inference of the dynamics of distributions. Using data on the distributions of wealth and income for the UK, France and Sweden we show that the evolution of tax rates is a good predictor of the long-run dynamics of economic inequality.

In work in progress with Ralph Luetticke **"(Unconventional) Fiscal Policy at the ELB"** we study the effects of the ELB in an estimated medium-scale heterogeneous agent New Keynesian ("HANK") model. We document that the effects of the ELB on inequality dynamics can be decomposed in two channels: first, the real rate channel compounds the effects of a recessionary shock on inequality while, secondly, the liquidity premium channel compresses the spread between liquid and illiquid assets, thereby reducing inequality. We find that the real rate channel dominates for income inequality whereas wealth inequality is driven by the liquidity premium

channel. We analyze the role of fiscal transfers, government spending and a VAT reduction in stimulating the economy and on economic inequality. While each of these measures effectively increases consumption and lowers wealth and income inequality, we find that a VAT reduction also has favorable impact on investment dynamics and can be self-financing. Government spending multipliers at the ELB are large.

Perspective and Future Work

Currently, I am concentrating my research on bringing models with a rich heterogeneity of agents to the data, and using these models to generate meaningful policy advice. For example, I use tools from machine learning to calculate fully nonlinear rational expectations solutions to models with heterogeneous agents.[4] Combined with the econometric tools sketched above, this approach can be used to effectively discipline these models using cross-sectional panel data. The methodology is applied in the two projects **"Helicopter Money and the Cross-Section of Households"** (with Keith Kuester) and **"Low nominal rates and the saver: The dark side of lower(ing) interest rates"** (with Pablo Guerrón-Quintana and Keith Kuester).

Publications

1. A Structural Investigation of Quantitative Easing (with Gavin Goy and Felix Strobel), forthcoming at the *Review of Economics and Statistics*

2. Monetary Policy and Speculative Asset Markets, *European Economic Review*, 2022

3. Efficient Solution and Computation of Models with Occasionally Binding Constraints, *Journal of Economic Dynamics and Control*, 2022

Working papers

4. Estimation of DSGE Models with the Effective Lower Bound (with Felix Strobel)

5. The Empirical Performance of the Financial Accelerator since 2008 (with Felix Strobel)

6. Rational vs. Irrational Beliefs in a Complex World (with Cars Hommes)

7. The Hockey Stick Phillips Curve and the Zero Lower Bound (with Philipp Lieberknecht)

8. An Ensemble MCMC Sampler for Robust Bayesian Inference

9. HANK on Speed: Robust Nonlinear Solutions using Automatic Differentiation

10. The Micro & Macro of (Unconventional) Monetary Policy: the Role of the Banking Sector

11. Can Taxation Predict US-Top-Wealth Share Dynamics? (with Thomas Fischer)

Work in progress

12. Low nominal rates and the saver: The dark side of lower(ing) interest rates (with Pablo Guerrón-Quintana and Keith Kuester)

13. Helicopter Money and the Cross-Section of Households (with Keith Kuester)

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[4]The toolbox, based on the machine learning library "JAX", is developed at GitHub: https://github.com/gboehl/econpizza.

14. (Unconventional) Fiscal Policy at the ELB (with Ralph Luetticke)

15. The Quantitative Effects of Taxation on Inequality Dynamics