Chapter 24
Country and Multi-Country Macroeconometric Models: From Statistical Tools to Structural Policy Frameworks: Outline

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Abstract As the closing contribution of Part II, this chapter serves a synthesizing role. While previous chapters have examined specific econometric methods (Part I) and individual model classes such as DSGE or business-cycle models (Part II), macroeconomic policy institutions do not rely on any single modelling framework in isolation. Instead, they operate integrated suites of models—statistical, semi-structural, and structural—that jointly support forecasting, scenario design, and policy analysis. This chapter therefore provides the unifying macroeconometric framework in which these earlier techniques come together, showing how time-series tools, Bayesian methods, state-space techniques, and structural models collectively form a modern Forecasting and Policy Analysis System (FPAS). It also establishes explicit connections back to DSGE models and business-cycle approaches, clarifying their roles within country-level and multi-country policy environments.

24.1 Introduction: How Best-Practice Central Banks and Governmental Authorities Structure Their Forecasting and Policy Analysis (FPAS) Systems

Section 1 briefly describes how best-practice central banks and governmental authorities structure their FPAS systems.This part of the chapter will document the evolution of FPAS in leading institutions such as the Bank of Canada (of Canada, 2017, 2015), the Reserve Bank of New Zealand (of New Zealand, 2018), the European Central Bank (Christoffel et al., 2008), and the IMF (Berg et al., 2006; Berg & Portillo, 2018). It will explain how these institutions combine short-term statistical forecasting tools with medium-term structural models, and how formal judgmental processes interact with model-based projections. The section will

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explicitly highlight the rationale for operating a suite of models rather than relying on a single modeling approach, underscoring the complementarity among empirical tools, semi-structural frameworks, and structural models. However, it clearly states that at the core of modern FPAS frameworks there is one structural model, single or multi-country model, that simultaneously describes the monetary, real, and external sectors of a specific economy informed by other statistical methods. Multi-country extensions—whether through trade blocks, foreign demand, or global shock structures—naturally arise in open-economy versions used by the IMF, the ECB, or regional central banks.

Key points:

- Evolution of FPAS frameworks in monetary policy institutions
- Integration of short-term forecasting, structural analysis, and judgment
- Comparative examples (IMF FPAS, Bank of Canada, ECB, RBNZ, BoE)
- Why a suite of models is needed: complementarity rather than substitution

24.2 Suites of Models and the Historical Evolution of FPAS: From Early Macroeconometric Systems to Modern Policy Frameworks

Section 2 traces the historical evolution of country and multi-country macroeconometric models, from early large-scale estimated systems developed in the post-war period to the modular, suite-based forecasting frameworks used in modern policy institutions.

This section briefly introduces the conceptual foundation for the chapter by relying on the Pagan Diagram, which positions macroeconomic models along the dimensions of theoretical consistency and empirical fit (Pagan, 2003). This section will present the taxonomy of model classes—ranging from purely statistical models to VAR/VECM systems, semi-structural models, and DSGE frameworks—and explain how FPAS practices evolved from earlier macroeconometric systems such as Klein–Goldberger (Klein & Goldberger, 1955), the FRB-MIT-Penn model (de Leeuw & Gramlich, 1968), and OECD INTERLINK (Richardson, 1988). These historically important models illustrated both the potential and limitations of large-scale estimated systems, including parameter instability and the reliance on ad-hoc expectation formation.

Several multicountry macroeconometric frameworks also emerged from the 1970s onwards as early attempts to link national models into coherent global forecasting structures. Notable examples include Project LINK, which integrated national economies through commodity and financial flows, OECD's INTERLINK, the IMF's MULTIMOD and GEM, as well as FRB/GLOBAL and NIGEM, widely used for global forecasting and simulation (Welfe, 2013). These efforts illustrated

both the promise and complexity of multi-country modeling, foreshadowing later developments in open-economy structural frameworks.

As a conclusion, the section will explicitly articulate the main trade-off faced by policymakers: forecasting precision versus economically coherent narratives, consistent with the tension highlighted in Pagan & Robinson (2016). It will also clarify where each model class lies along the Pagan spectrum and what implications these positions carry for operational policy analysis.

Key points:

- The Pagan Diagram as a conceptual map (Pagan, 2003)
- Theoretical consistency vs empirical/statistical fit
- The continuum of macroeconomic models
- Where different model classes lie on the spectrum (VAR/VECM, QPM, DSGE)
  - BOX: Early macroeconometric systems (Klein–Goldberger, FRB-MIT-Penn, OECD INTERLINK)
  - Limitations of large-scale estimated systems: instability, ad-hoc expectations
- Implications for policymakers and forecasters

Lesson learned:

These early multicountry models highlighted the importance of institutional cooperation and the empirical discipline including data harmonization, however also demonstrated the limits of purely data-driven structural modeling and lessons that continue to inform modern FPAS design.

24.3 Purely Statistical and Econometric Models for Nowcasting and Near-Term Forecasting

From a historical perspective, purely statistical and econometric models proved remarkably resilient. While large structural systems lost prominence, time-series-based tools retained a central role in policy institutions due to their empirical robustness and forecasting accuracy.

Section 3 focuses on purely statistical and econometric models used for nowcasting and near-term forecasting, refering back to the previous chapters. Classical econometric foundations such as OLS, cointegration, ECM and VECM formulations build on the seminal contributions of Engle & Granger (1987) and Johansen (1988).

This part of the chapter will also overview multivariate time-series methods—reduced-form VARs (Sims, 1980), Bayesian VARs (Bańbura et al., 2010),

factor-augmented VARs (FAVARs), and identified structural VARs using long-run restrictions (Blanchard & Quah, 1989) or sign restrictions (Uhlig, 2005). Mixed-frequency approaches including MIDAS regressions (Ghysels et al., 2004) and modern ML-augmented versions will also be introduced.

The section's explicit message will be that these models excel at capturing high-frequency dynamics and turning points, but by design do not generate the medium-term structural narratives required for policy formulation (Lütkepohl, 2005; Hamilton, 1994).

24.3.1 The role of classical econometric methods

- OLS, cointegration, VECM, ECM formulations (Engle & Granger, 1987; Johansen, 1988)
- Strengths: fit, interpretability, simplicity

24.3.2 Time-series models and vector autoregressions

- Reduced-form VARs (Sims, 1980), BVARs (Bańbura et al., 2010), FAVARs
- Structural VARs: Cholesky, long-run, sign-restriction identification (Blanchard & Quah, 1989; Uhlig, 2005; Kilian & Lütkepohl, 2017)
- Most country applications estimate VAR/VECM systems using domestic variables augmented with foreign or global indicators, effectively generating country-embedded multi-country linkages.

24.3.3 Mixed-frequency and high-frequency approaches

- MIDAS models (Ghysels et al., 2004)
- ML-based and data-rich extensions

Takeaway: These models provide excellent short-term accuracy but do not produce coherent policy narratives.

24.4 Applied DSGE Models in Central Bank FPAS Frameworks

Section 4, as the main section of this chapter, examines the role of applied DSGE models within FPAS frameworks. Foundational applied DSGE examples include Christiano et al. (2005), Smets & Wouters (2003), and Smets & Wouters (2007), while An & Schorfheide (2007) provides a reference for Bayesian estimation. This

section will explicitly address the tension between theoretical rigor and empirical flexibility, consistent with critiques such as Pagan (2004).

It provides examples for the main central bank models used for macro forecasting, but will also review identification challenges, sensitivity of estimation to priors, and the practical reliance on calibration rather than full estimation. The section will articulate why Bayesian estimation serves more as a discipline-imposing device than a purely empirical tool, and why many policy institutions continue to use calibrated structures informed by broader evidence. Country DSGE models are often complemented by multi-country DSGE frameworks (such as the ECB's NAWM), especially when external spillovers or exchange-rate regimes are central to the analysis.

24.4.1 Challenges and limitations

- Drawback of theoretical rigor (Pagan, 2004)
- Sensitivity to assumptions and steady-state structure

24.4.2 Bayesian estimation vs calibration

- Bayesian tools as discipline rather than pure estimation (An & Schorfheide, 2007)
- Calibration informed by micro/macro evidence
- Practical reasons many institutions calibrate rather than estimate

24.4.3 Role of DSGE models in policy advising

- Contributions to FPAS: conceptual anchor rather than forecast engine
- Shock decomposition, counterfactual analysis, welfare implications (Smets & Wouters, 2007)

Lesson learned:

DSGE models brought theoretical coherence back into macroeconomic modeling, but at the cost of empirical flexibility, limiting their role as real-time forecasting tools.

24.5 Semi-Structural Models: The Practical Compromise for Quarterly Projection Exercises

Section 5 presents semi-structural models (single and multi-country versions) as the practical compromise for quarterly projection exercises. These models typically sit at the center of modern FPAS: they balance empirical grounding with forward-looking theoretical structure (of Canada, 2015; Berg et al., 2006).

The discussion will emphasize their generic architecture (hybrid Phillips curves, IS curves, external block, policy rule) and their use of state-space methods and the Kalman filter (Harvey, 1990; Durbin & Koopman, 2001). Country QPMs are also naturally extendable to multi-country settings through foreign demand blocks, global interest rates, or cross-country shock transmission channels

24.5.1 Generic structure and benefits

- Why these models strike the right balance for real-time policy?
- Partial equilibrium equations with structural and empirical grounding
- Forward-looking IS and Phillips curves with hybrid expectations
- Exchange rate, external block, policy rule

BOX: Kalman-filter-based analysis

- State-space representation (Harvey, 1990; Durbin & Koopman, 2001)
- Estimation of unobserved components (potential output, gaps, trends)
- Filtering vs smoothing
- Judgmental adjustments and shock decomposition

24.5.2 Model verification and validation

- Back-testing, forecast evaluation
- Decomposition and diagnostic tools
- Cross-model consistency checks
- Where judgment enters the projection process

Lesson learned:

Semi-structural models emerged as a durable compromise, integrating the strengths of earlier approaches while mitigating their weaknesses.

24.6 Conclusion

The chapter argues that while contemporary forecasting systems typically organize around a central macroeconomic model, effective policy analysis in practice relies on the continuous interplay of statistical forecasting tools, theoretically grounded structural models, and adaptable semi-structural systems. Econometric methods appear most directly in short-term forecasting, but they also underpin calibration, validation, shock identification, and signal extraction across the entire model suite. These modeling traditions— single or multi-country—form the backbone of operational policy frameworks in national and international institutions. In policy institutions, real-time decision-making requires a flexible and judgment-based application of these tools—an environment in which econometric reasoning and model-based narratives operate jointly rather than in isolation (Pagan & Robinson, 2016).

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