I have a paper that proposes a comprehensive framework for quantifying economic uncertainty through a multidimensional index that captures various sources of predictive ambiguity. The index identify three primary dimensions of uncertainty: model dispersion, within-model variability, and temporal instability.

A comprehensive framework measuring economic uncertainty across three dimensions (model dispersion, within-model variability, and temporal instability) is supported by statistical evidence from multiple studies.

Abstract

Economic uncertainty is measured along three dimensions—model dispersion, within-model variability, and temporal instability—as evidenced by the papers reviewed. All ten studies address temporal instability, and eight incorporate both model dispersion and within-model variability through methods such as dynamic factor models, vector autoregression with stochastic volatility, Bayesian techniques, and composite index construction. For instance, one study shows that a composite index explains 43% of stock forecast errors and 37% of employment forecast errors, while another finds that macro-finance uncertainty can account for up to 87% of near-term forward spread forecast variability.

Across the studies, statistical decompositions (e.g., survey density forecasts and information-theoretic measures) distinguish uncertainty components by separating forecast disagreement from within-model variabilities and capturing time-varying effects. Real-time indices and rolling estimation further highlight that while advanced multidimensional frameworks better capture the dynamics of predictive ambiguity, challenges remain in proxy selection, data harmonization, and computational complexity.

Paper search

Using your research question "I have a paper that proposes a comprehensive framework for quantifying economic uncertainty through a multidimensional index that captures various sources of predictive ambiguity. The index identify three primary dimensions of uncertainty: model dispersion, within-model variability, and temporal instability.", we searched across over 126 million academic papers from the Semantic Scholar corpus. We retrieved the 50 papers most relevant to the query.

Screening

We screened in papers that met these criteria:

- **Framework Analysis**: Does the study propose, analyze, or evaluate economic uncertainty measurement frameworks, with consideration of multiple dimensions?
- **Quantitative Methods**: Does the study employ quantitative methods to develop or validate economic uncertainty indices?
- **Model Analysis**: Does the study analyze model dispersion, within-model variability, or temporal instability in economic predictions?
- **Predictive Analysis**: Does the study examine predictive ambiguity or uncertainty in economic forecasting?

- **Review Type**: Is the study either a primary research article, systematic review, or meta-analysis of economic uncertainty measurement approaches?
- **Dimensional Coverage**: Does the study examine more than one dimension of economic uncertainty?
- **Empirical Validation**: Does the study include empirical validation or quantitative support for its findings?
- **Uncertainty Focus**: Does the study specifically address economic uncertainty (not just risk measurement)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Uncertainty Measurement Approach**:

  Identify and describe the specific methodology used to quantify economic uncertainty in the study. Look in the methods or data section for:

- Specific dimensions of uncertainty captured (e.g., model dispersion, within-model variability, temporal instability)
- Theoretical framework or model used
- Mathematical or statistical techniques employed
- Sources of data used to construct uncertainty measures

If multiple approaches are described, list all. If the approach is not clearly stated, note "Unclear" and provide any available contextual details.

- **Data Sources and Sample Characteristics**:

  Extract information about the data used in the study:

- Primary data sources (e.g., Survey of Professional Forecasters, economic databases)
- Time period of data collection
- Geographic scope (e.g., US, global)
- Specific economic variables or indicators analyzed
- Sample size or number of observations

Provide precise details where possible. If information is partially missing, note the available details and mark any gaps.

- **Analytical Techniques**:

  Identify the primary analytical methods used:

- Statistical techniques (e.g., vector autoregression, Bayesian hierarchical models, principal component analysis)
- Specific modeling approaches
- Computational methods
- Any novel methodological innovations

If multiple techniques are used, list them in order of importance or sequence of application. If the analytical approach is complex, provide a brief summary of the key methodological steps.

- **Key Uncertainty Findings**:

  Extract the main findings related to economic uncertainty:

- Primary conclusions about uncertainty measures
- Quantitative results (with specific numerical values if available)
- Insights into the nature, sources, or impacts of economic uncertainty
- Any significant relationships or patterns discovered

Focus on the most important findings directly related to the uncertainty measurement or analysis. If multiple key findings exist, list them in order of significance.

- **Theoretical or Practical Contributions**:

  Identify the study's key contributions to understanding economic uncertainty:

- Theoretical innovations
- Methodological advances
- Practical implications for economic forecasting or policy
- Unique insights into uncertainty measurement

Look for explicit statements in the discussion or conclusion sections about the study's significance. If no clear contributions are stated, synthesize the most important implicit contributions from the findings.

Results

Characteristics of Included Studies

Study	Study Design	Uncertainty Dimensions Covered	Measurement Approach	Key Findings	Full text retrieved
Rossi et al., 2016	Empirical, survey-based decomposition	Model dispersion, within-model variability, temporal instability	Decomposition of survey density forecasts (Survey of Professional Forecasters) into Knightian uncertainty (ambiguity), risk, and disagreement using Continuous Ranked Probability Score and Cumulative Distribution Functions	The decomposition distinguishes Knightian uncertainty and risk; ex-ante uncertainty decreases with forecast horizon; ex-post uncertainty has a larger negative effect on Gross Domestic Product; the authors suggest that policy should target ex-post uncertainty	Yes
Carriero et al., 2016	Empirical, large Vector Autoregression with stochastic volatility	Temporal instability, within-model variability	Large Vector Autoregression with stochastic volatility, Markov Chain Monte Carlo, Federal Reserve Economic Data - Macro Data	The study reports substantial commonality in uncertainty; uncertainty shocks affect real activity but are not primary macro drivers; moderate correlation between macro and financial uncertainty	Yes

Study	Study Design	Uncertainty Dimensions Covered	Measurement Approach	Key Findings	Full text retrieved
Byrne and Cao, 2024	Theoretical/empirical (abstract only), macro-finance term structure	Model dispersion, within-model variability, temporal instability	Arbitrage-free models, Bayesian methods	The abstract reports that macro-finance model uncertainty dominates near-term forward spread forecasts, up to 87% of predictive uncertainty pre-recession; strong dispersion in macro variable information	No
Charles et al., 2018	Empirical, composite indicator construction	Model dispersion, within-model variability, temporal instability	Dynamic Factor Model, quasi maximum likelihood, six uncertainty proxies	The study reports that the composite Uncertainty Composite Index captures business cycle dynamics and outperforms individual proxies, explaining 43% of stock and 37% of employment forecast errors	Yes

Study	Study Design	Uncertainty Dimensions Covered	Measurement Approach	Key Findings	Full text retrieved
Redl, 2018	Empirical, index construction for South Africa	Model dispersion, temporal instability	Generalized Autoregressive Conditional Heteroskedas-ticity models, forecaster disagreement, news, central bank reviews	The uncertainty index is reported as a leading indicator of recession; uncertainty shocks are inflationary; negative impact on Gross Domestic Product, investment, and employment	Yes
Zahran, 2021	Empirical (abstract only), firm/household uncertainty	Model dispersion, temporal instability	Dynamic Factor Model with time-varying parameters, Dynamic Model Selection procedure	The abstract reports novel time-varying indices; Dynamic Model Selection improves forecasts; uncertainty is sectorally broad; trade/investment and financial blocks drive firm uncertainty	No

Study	Study Design	Uncertainty Dimensions Covered	Measurement Approach	Key Findings	Full text retrieved
Keijsers and van Dijk, 2024	Empirical, real-time forecasting	Model dispersion, within-model variability, temporal instability	Principal Component Analysis of 15 measures, predictive regressions, quantile regression	The study reports that two factors explain most variance; uncertainty measures predict lower quantiles of activity, especially employment; factors outperform individual measures	Yes
Carriero et al., 2020	Empirical (abstract only), volatility decomposition	Within-model variability, temporal instability	Extension of Moving Average Index model, Gibbs sampling, US data	The abstract reports that a common volatility component explains at least 50% of overall volatility; driven by demand, supply, and financial shocks; contributions are variable-specific and time-varying	No

Study	Study Design	Uncertainty Dimensions Covered	Measurement Approach	Key Findings	Full text retrieved
Rogers and Xu, 2019	Empirical, forecasting performance	Model dispersion, within-model variability, temporal instability	Dynamic Factor Model, Ordinary Least Squares, quantile regression, real-time data	The study reports that all measures have explanatory power; macro uncertainty performs best; real-time measures underperform ex-post; strong predictive power at lower Gross Domestic Product quantiles	Yes
Shoja and Soofi, 2016	Theoretical/empirical, information-theoretic	Model dispersion, within-model variability, temporal instability	Information framework, mixture model, Jensen–Shannon divergence, Bayesian hierarchical models	The study reports that the information framework generalizes uncertainty measures; normalized entropy index corrects data distortions; explores dynamics of individual and aggregate uncertainty	No

Study Design:

- Eight studies used empirical designs, including survey-based, Vector Autoregression, factor models, index construction, real-time forecasting, and volatility decomposition.
- Two studies used a combined theoretical and empirical approach.
- No studies were purely theoretical.
- Some studies were only available as abstracts, which may limit the depth of findings.

Uncertainty Dimensions Covered:

- Temporal instability was addressed in all ten studies.
- Model dispersion was addressed in eight studies.
- Within-model variability was addressed in eight studies.

Measurement Approaches:

- Three studies used Dynamic Factor Models.
- Two studies used large Vector Autoregression or related models with stochastic volatility.
- Two studies constructed composite indicators or indices.
- Two studies used real-time forecasting or real-time data.
- Two studies used Bayesian methods.
- Two studies used predictive or quantile regression.
- One study used survey density forecast decomposition.
- One study used Generalized Autoregressive Conditional Heteroskedasticity models.
- One study used Principal Component Analysis.
- One study used an information-theoretic framework (including entropy and Jensen–Shannon divergence).
- One study used a mixture model.
- One study used Dynamic Model Selection.
- One study used arbitrage-free models.
- One study used the Moving Average Index model.
- One study used Ordinary Least Squares.
- One study used news and central bank reviews.
- Two studies used Markov Chain Monte Carlo or Gibbs sampling.
- No studies used only qualitative or narrative measurement approaches.

Thematic Analysis

Measurement Frameworks

- Use of advanced statistical frameworks:Most studies employ advanced statistical or econometric frameworks to capture the multidimensionality of economic uncertainty. These include:
  - Dynamic Factor Models (Charles et al., 2018; Zahran, 2021)
  - Principal Component Analysis (Keijsers and van Dijk, 2024)
  - Information-theoretic approaches (Shoja and Soofi, 2016)
- Integration of multiple proxies:These frameworks allow for the integration of multiple uncertainty proxies, capturing both cross-sectional and temporal variation.
- Bayesian and simulation-based methods:Bayesian and simulation-based methods (Byrne and Cao, 2024; Carriero et al., 2016) are used to quantify uncertainty in model parameters and predictive distributions.

Integration of Uncertainty Dimensions

- Explicit decomposition:Several studies explicitly decompose uncertainty into model dispersion (e.g., forecast disagreement, multiple proxies), within-model variability (e.g., stochastic volatility, entropy measures), and temporal instability (e.g., time-varying parameters, real-time data).
- Composite indices and decompositions:Composite indices (Charles et al., 2018; Keijsers and van Dijk, 2024) and decompositions (Rossi et al., 2016; Carriero et al., 2020) are reported to be effective in

integrating these dimensions, providing a more holistic measure of uncertainty.

Temporal Dynamics and Stability

Framework Component	Implementation Methods	Validation Approaches	Limitations
Time-varying models (Vector Autoregression, Dynamic Factor Model, Generalized Autoregressive Conditional Heteroskedasticity)	Stochastic volatility, dynamic factor models, Generalized Autoregressive Conditional Heteroskedasticity, Dynamic Model Selection	Out-of-sample forecasting, impulse response analysis, quantile regression	Some studies only available as abstracts; limited non-US data; real-time data challenges
Real-time data integration	Rolling estimation, vintage data, real-time uncertainty indices	Comparison of real-time vs. ex-post performance, forecast accuracy metrics	Real-time measures often underperform ex-post; data revisions
Composite/factor-based indices	Principal Component Analysis, Dynamic Factor Model, information-theoretic aggregation	Variance explained, predictive power, robustness checks	Choice of proxies affects results; potential overfitting

Implementation Methods:

- Dynamic Factor Models were used in three studies.
- Other methods (stochastic volatility, Generalized Autoregressive Conditional Heteroskedasticity, Dynamic Model Selection, rolling estimation, vintage data, real-time uncertainty indices, Principal Component Analysis, information-theoretic aggregation) were each used in one or two studies.

Validation Approaches:

- Out-of-sample forecasting, impulse response analysis, quantile regression, comparison of real-time vs. ex-post performance, forecast accuracy metrics, variance explained, predictive power, and robustness checks were each used in one or two studies.
- No validation approach was used in more than two studies.

Limitations:

- Each limitation (studies only available as abstracts, limited non-US data, real-time data challenges, real-time measures underperforming ex-post, data revisions, choice of proxies, potential overfitting) was reported in one or two studies.

Comparative Analysis

Model Performance and Robustness

- Composite and multidimensional measures:Several studies report that multidimensional or composite uncertainty measures outperform individual proxies in explaining economic activity and forecasting downturns.
- Factor-based and dynamic models:Factor-based approaches (Keijsers and van Dijk, 2024; Charles et al., 2018) and dynamic models (Carriero et al., 2016; Zahran, 2021) are reported to be robust to omitted variable bias and capture more of the underlying uncertainty structure.
- Real-time vs. ex-post measures:The performance of real-time measures is generally reported to be weaker than ex-post counterparts (Rogers and Xu, 2019).

Cross-dimensional Relationships

Uncertainty Dimension	Cross-study Findings	Implementation Challenges	Best Practices
Model dispersion	Captured via forecast disagreement, multiple proxies, factor models; important for composite indices	Proxy selection, data harmonization	Use multiple proxies, factor analysis, survey-based measures
Within-model variability	Addressed via stochastic volatility, entropy, information divergence	Model complexity, parameter estimation	Stochastic volatility models, information-theoretic measures
Temporal instability	Time-varying parameters, real-time data, rolling estimation	Data revisions, computational intensity	Dynamic models, real-time validation, rolling windows

- Best practices for model dispersion were supported by five studies; for within-model variability by three studies; and for temporal instability by three studies.
- Across all uncertainty dimensions, eight unique studies were referenced in the best practices.
- The most common best practices were:
  - For model dispersion: use multiple proxies, factor analysis, and survey-based measures (five studies)
  - For within-model variability: stochastic volatility models and information-theoretic measures (three studies)
  - For temporal instability: dynamic models, real-time validation, and rolling windows (three studies)
- Some studies were referenced in more than one uncertainty dimension; no best practice was referenced in all three dimensions.
- Main cross-study approaches:
  - Model dispersion: forecast disagreement, multiple proxies, factor models, composite indices
  - Within-model variability: stochastic volatility, entropy, information divergence
  - Temporal instability: time-varying parameters, real-time data, rolling estimation

- The main challenges reported were proxy selection and data harmonization (model dispersion), model complexity and parameter estimation (within-model variability), and data revisions and computational intensity (temporal instability).

Summary

- The included studies provide empirical and theoretical support for developing multidimensional indices of economic uncertainty that integrate model dispersion, within-model variability, and temporal instability.
- Composite and factor-based approaches are reported to be particularly effective.
- Dynamic, real-time modeling is considered essential for practical forecasting and policy relevance.
- Limitations remain regarding data availability, especially outside the United States, and the performance of real-time measures.
- The evidence base is strongest for studies using advanced statistical frameworks and multiple proxies, but findings from studies available only as abstracts should be interpreted with caution due to limited methodological detail.

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