# Subject Index


Accuracy. *See* Error measurement; Errors; Forecast accuracy; Probabilities
American Statistical Association (ASA), Business and Economics Statistics Section, 12, 17
Amplitude dependence, 284
ARIMA model forecasts, 60, 62–66
Asymptotic distribution theory, 307

Bayesian vector autoregressive (BVAR) forecasts: comparison with individual and group mean forecasts, 74–81; comparison with NBER-ASA survey data, 42–46; fitting, fitted, and performance of model, 6, 188–95
BAYESMTH program, 189
Biases: in analysis of business cycles, 155; in data for forecast observations, 86; in NBER business-cycle dating, 281
Business cycles: dating of, 98, 100, 114, 112n3, 264, 280–81; dependence on other than duration variables, 284; duration dependence of, 8–9, 255–56, 266–67, 270–75; errors associated with, 25–33; events used in forecasting recession, 5–6; judgment in analysis of, 154; NBER criterion, 264; variations in expectations in, 15. *See also* Chronology, business-cycle; Duration dependence; Economic indicators; Growth cycles (industrialized countries)

Calibration curve, 153
Cash flow hypothesis, 8
Chronology, business-cycle: international, 261–64; United States, 98, 261. *See also* Growth cycles (industrialized countries)
Coincident index, experimental (XCI), 4–5, 96, 103–5, 153; forecasts of growth, 115, 119–20; with revisions of data, 125–27
Coincident indicators: in Citibase series, 147; effect of revisions in, 125–27; in experimental leading and recession indexes (XLI2, XRI2), 103–5; in experimental recession index, 103–5; Kalman filter with revised, 102; in recession probability model, 4–5, 97
Cointegration: in BVAR forecasting model, 6, 184–86; deterministic, 207–8; for models of time series, 286–88
Commercial paper: default risk, 214, 224–26, 232–34, 247, 251; defined, 7, 222; differences from Treasury bills, 223–24; rise of quantity and interest rate, 234
Commercial paper–Treasury bill spread. *See* Paper-bill spread
Common trends model. *See* Cointegration
Comovements: of coincident variables, 97; dynamic index models for analyzing, 9–10, 286–92, 300; of macroeconomic aggregates, 155
Composite Index of Leading Indicators, 96, 113
Consensus forecasts. *See* Group mean (or consensus) forecasts
Consumer price inflation (CPI) forecasts, 78, 80–81

Cross-section analysis: of forecast errors, 23–25; of time series, 306
Cyclical turns. *See* Turning points

Data: from NIPA accounts, 303–5; real GNP series, 303; sampling for generating forecast observations, 85–86
Data sources: for analysis of forecast performance, 2, 3; coincident indicator revisions, 125–27; disaggregated for employment, 9; for economic forecasting, 85–86; for nonlinear model as forecasting tool, 316; in recession prediction analysis, 147–52; survey information as, 12. *See also* Surveys; Time series
Dating Committee. *See* NBER Business Cycle Dating Committee
Default risk (of commercial paper): changing perception of, 214, 232–34, 247; as determinant of paper-bill spread, 224–25, 251; time variation in short-term market, 232–33, 247
Department of Commerce (DOC) Composite Index of Leading Indicators, 96, 113
Depth (in recession), 98
Diffusion (in recession), 98
Duration dependence: of growth cycles in industrialized countries, 261–62; hazard function signals of, 256; in U.S. and European expansions and contractions, 8–9, 266–74, 275. *See also* Amplitude dependence
Duration (in recession), 98
Dynamic index models: single-index, 153, 154–55; for time series, 286–88

Economic indicators: contributions in recession probability indexes, 121–25; in experimental indexes, 96; forecasting 1990 downturn, 139–45; historical use of, 16; in stochastic simulation forecasting, 4–5. *See also* Coincident indicators; Leading indicators
EM algorithm, 9, 307–8
Error measurement: in differing time spans, 90; in revised survey data, 25–26; in time series, 26–33; using Kalman filter, 102–3. *See also* Mean absolute error (MAE); Mean error (ME); Root mean square error (RMSE)
Errors: in forecasting methods: 23–25; forecasting standard, 159–60; nonnormal, 6, 179; with revision of survey data, 26. *See also* Mean absolute error (MAE); Mean error (ME); Root mean square error (RMSE)
Event probability estimates, 160–75
Expectations, 14–15. *See also* Rational expectations
Exponential smooth transition regression (ESTR), 313, 315

Federal funds rate, 250
Federal Reserve Bank, Philadelphia, 17
Forecast accuracy, 39–42, 68–71, 192–95; advantage of group mean (consensus), 90; components of evaluation of, 86–87; for inflation, 4; in recession probability model, 105–27
Forecasters: accuracy of, 39–41; sectoral distribution of, 22–23, 25; selection of information from, 20–21
Forecasts: combining different sources, 33, 36–38; comparison of NBER-ASA and RSQE, 53–57, 89; comparison of NBER-ASA and Sims's simulated, 56–61; comparison of NBER-ASA and univariate time-series models, 60, 62–66; from data of NBER-ASA surveys, 17–26; differentiation of, 66; errors in percentage change and levels, 48–53; estimating variances of exogenous-variable, 160; historical macroeconomic, 16–17; of indicators, 250; individual, 26–33, 34–35tt; individual compared with group, 33, 36–39; judgmental, 26, 86; measures of errors in macroeconomic, 25; out-of-sample, 180; over- and underestimates in, 28–31, 72, 78–91; probability, 153–54; stochastic simulation to estimate standard errors, 159–60; value of macroeconomic, 13–14. *See also* Bayesian vector autoregressive (BVAR) forecasts; Consumer price inflation (CPI) forecasts; Error measurement; Group mean (or consensus) forecasts; Individual forecasts; Theil *U*

GDP (gross domestic product) growth rates, 198f, 199–200
GNP (gross national product): forecasts of growth rates, 198f, 199–200. *See also* Real GNP (gross national product)

Group mean (or consensus) forecasts, 4, 13, 33, 36–38, 74–81, 88–90, 92
Growth cycles (industrialized countries), 261–62

Hazard function: defined, 256–58; with vector of covariates, 278–79
Hazard models: to analyze duration dependence, 8–9, 256–57, 275; exponential-quadratic and -linear, 8–9, 257–60, 266–69, 270–71, 275–79, 283; to study business-cycle dynamics, 257. *See also* Duration dependence
Hazard shapes, 257–58
Heteroskedasticity, 6, 180
Hill-climbing routine (in likelihood), 189, 260–61

Implicit price deflator (IDP) inflation rate, 25, 26–27
Indexes: experimental leading, coincident, and recession, 96, 103–5; extraction of unobserved, 306–7; with recession forecast indicators, 139–45. *See also* Coincident index, experimental (XCI); Composite Index of Leading Indicators; Leading index, experimental (XLI); Recession index, experimental (XRI)
Individual forecasts: comparison with group mean (consensus) forecasts, 74–81, 90; error distribution, accuracy, and variability, 33–38, 46
Inference theory (for dynamic index models), 308
Inflation: accuracy of forecasts for, 4, 78, 80–81; prediction of, 30–31; VAR forecasting of, 6–7. *See also* Implicit price deflator (IPD) inflation rate
Information: in commercial paper–Treasury bill spread, 215–23, 232, 248; cross-sectional, 286; in default risk changes, 251; in interest rate indicators, 250–51; in surveys of professional forecasters, 12–13
Interest rates: on commercial paper and Treasury bills, 215, 216f, 222–24; forecasts in 1990–92 period, 2, 196–97, 200–201; information in indicators of, 250–51. *See also* Paper-bill spread
IPD. *See* Implicit price deflator (IPD) inflation rate

Kalman filter: in BVAR forecasting model, 182, 187; with data irregularities, 102; in likelihood maximization, 189; modifications for measurement error, 102–3
Kalman-smoothed projections, 292, 298n10, 301

Lagging indicators, 1
Lagrange multiplier (LM)-type test, 312, 314
Leading index, experimental (XLI), 4–5, 96, 103, 152; estimates of model, 115–20; in predicting recession (1988:1–1991:10), 121–25, 127–28
Leading indicators: Composite Index of Dept. of Commerce, 96, 113; in experimental leading index, 105, 147–48; in experimental recession index, 103–5; modeling relationship with GNP, 316–21; paper-bill spread as, 7; in recession forecasting, 4–5; in recession probability model, 96–97, 102, 104t, 105; used by survey participants, 23; using Kalman filter with revised, 102
Likelihood: estimation of maximum 101–2; maximizing, 188–90; maximizing in duration dependence analysis, 260–61
Likelihood function: of Bayesian vector autoregressive model, 179, 181; evaluation of sample, 187; maximum, 188–89
Linearity tests, 312, 314, 321
Linear models: transition between two, 312–16; uses for, 311. *See also* Smooth transition regressions (STRs); Nonlinearity; Nonlinear models
Liquidity: of commercial paper, 8, 226–27; time variation in short-term market, 232–33; of Treasury bills, 8, 214, 226–27
Livingston surveys, 16–17
Logistic smooth transition regression (LSTR), 313, 315

MAE. *See* Mean absolute error (MAE)
Maximum likelihood. *See* Likelihood; Likelihood function
Mean. *See* Group mean (or consensus) forecasts; Posterior mean; Priors; Root mean square error (RMSE)
Mean absolute error (MAE), 25–27, 33; of recession forecast indicators, 140–45; in recession probability forecasts, 119–20
Mean distribution, 182. *See also* Priors

Mean error (ME), 25, 31–32
Michigan Research Seminar in Quantitative Economics (RSQE). *See* University of Michigan Research Seminar in Quantitative Economics (RSQE)
Misspecification (using stochastic simulation), 159
Moment matrix calculations, 292
Monetary policy: effect of tightened, 234–36, 248; paper-bill spread as indicator of, 8

National Association of Business Economists (NABE), 22–23
National Economic Information System, 89
NBER-ASA surveys, 2, 3, 12–13, 17–26; comparison of forecasts with ARIMA model forecasts, 60, 62–65tt, 66; comparison of forecasts with BVAR forecasts, 42–53, 54t; comparison of forecasts with RSQE forecasts, 53–55, 56t, 57t, 89–90; comparison of forecasts with Sims's probabilistic forecasts, 56–60, 61t
NBER Business Cycle Dating Committee, 98, 100, 112n3, 114, 130, 264, 280–81
NBER business-cycle filter, 281
NBER (National Bureau of Economic Research), 12, 17, 20
Neural network models, 312, 318
Nonlinearity: evidence for, 114, 155; in interest rate forecasts, 197; modeling with presence of, 318–21, 326; models to approximate, 311–12; testing linearity against, 314; in time series, 10, 311
Nonlinear models: after tests for linearity, 321, 323–24; to forecast GNP, 10, 316–21; identification schemes for, 203; properties of, 326; uses for, 311, 324
Nonnormality: in BVAR model disturbance distribution, 182–83, 189; errors in BVAR forecasting model, 6, 179–80
Nonnormal models, 203
Normals mixture (BVAR forecasting model), 181–83, 187–88, 204, 209–10. *See also* Nonnormality; Priors

Paper-bill spread: determinants of, 229–36, 247–48; effect of default risk on, 251; factors differentiating, 223–32, 247; influences of, 214, 247; as predictor of economic activity, 7–8, 213–14, 247, 249–51, 253; prior to and during recessions, 215, 217t, 233–34; with tightened monetary policy, 234–36. *See also* Default risk; Liquidity; Taxation (of commercial paper earned interest)
Pattern recognition approach, 95–96, 98–101, 114
Perturbation (in probabilistic forecast model), 197
Posterior mean (with Kalman filter), 185
Predictions: accuracy of forecasters, 39–41; graphic comparisons, 26–31; of 1990 recession, 127–46, 162–72, 195–200. *See also* Error measurement; Forecasts
Priors: hierarchical, 306; means in BVAR forecasting model, 183, 184–87, 206; means in Litterman probabilistic forecasting model, 184; means with Kalman filtering, 185–86; Minnesota, 306; standard deviation in BVAR forecasting model, 190–91
Probabilities: estimates to evaluate models, 166–72; estimating event, 160–61; estimating for three events, 161–66; estimation model, 161–62; measures of accuracy, 166
Probability density function, 205

Random fields: defined, 300; dynamic index models for, 288–92, 300
Rational expectations, 88
Real GNP (gross national product): BVAR forecasts of, 45t, 46; forecasts of, 2, 4, 31–33
Recession index, experimental (XRI), 4–5, 96, 103–5, 115–20, 153
Recession probability model, 97–105; out-of-sample performance of, 115–27; prediction of 1990–91, 127–46; within-sample performance of, 105–15
Recessions: definition and definition change, 98, 128–30; forecast probabilities for 1990–91, 4, 162–66, 195–200; hazard rate for postwar, 9; indicators forecasting 1990 downturn, 139–45; paper-bill spread before and during, 236–40; paper-bill spread forecast of 1990, 251; pattern recognition to identify, 95–96, 98–101, 114
Regime switching, 313
Reliability diagram, 152
RGNP. *See* Real GNP (gross national product)

Root mean square error (RMSE), 25–27; in analysis of forecasting methods, 23–25; in BVAR analysis, 43–46; in individual and group forecasts, 33, 35–38; of recession forecast indicators, 140–45; in recession probability forecasts, 119–20; in Theil *U* statistics, 183–84n4, 192t, 193
Root mean square values (RMSVs), 36, 39
RSQE forecasts. *See* University of Michigan Research Seminar in Quantitative Economics (RSQE)

Shwarz information criterion, 140
Smooth transition autoregression (STAR), 10, 316, 321
Smooth transition regressions (STRs), 312–16. *See also* Exponential smooth transition regression (ESTR); Logistic smooth transition regression (LSTR); Smooth transition autoregression (STAR)
Stochastic simulation: to estimate event probabilities, 166–75; to estimate forecast standard errors, 159–60; probability estimates for 1990 recession, 165–66
Stock-Watson regression, 218–19
STR. *See* Smooth transition regressions (STRs)
Substitutability (in paper-bill market), 235–36, 241, 243, 247, 252
Surveys: of National Association of Business Economists, 22–23; of professional forecasters, 2, 3, 12–13, 17. *See also* NBER-ASA survey

Taxation (of commercial paper earned interest): effect on paper-bill spread, 223–25, 232; influence of, 236–37
Theil *U* statistics, 183–84n4, 192t, 193
Time series: cross-sectional analysis of, 306; dynamic behavior of, 184; dynamic index and cointegrated models for, 286–88; forecasting methods using, 87–88; in measuring forecast errors, 25; modeling comovements of, 9–10; multivariate forecasting models for, 6; nonlinearity in, 10, 311; in VAR forecasting models, 6
Time trends: in paper-bill spread, 227–28, 241; treatment of, 207–8, 210
Time variation: in BVAR forecasting model, 179, 180–81; in distribution of disturbances, 209; in modeling forecasting, 154–55; parameters with, 211; in short-term credit markets, 232, 247. *See also* Heteroskedasticity
Treasury bills: defined, 222; differences from commercial paper, 223–24; liquidity of, 214, 226–27; market fluctuations, 228–29; paper-bill spread related to rate of, 229
Turning points: forecasting, 88; identified by NBER Dating Committee, 114; judgment in dating, 155; prediction of business cycle, 16, 95

Uncertainty: in business cycle forecasting, 14–15; dissent in forecasts as signal of, 66; exogenous-variable, 160, 161–62; in recession forecasting, 5; sources in forecast model of, 159–60
University of Michigan Research Seminar in Quantitative Economics (RSQE), 53–57, 89

Variables, exogenous, 160
Vector autoregressive (VAR) models: as forecasting models, 6; stationary, 202, 210. *See also* Bayesian vector autoregressive (BVAR) forecasts