Forecast Evaluation and Model Selection

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Course: 18 hours - TP: 0 hours

Description: The course (18 hours) is designed to acquire tools and techniques to evaluate the accuracy model based forecasts and operate model selection in a variety of settings. The tools and techniques can be applied to a variety of settings ranging from macroeconomic forecast evaluation to finance, although a specific focus is devoted to financial applications. The course has several specific objectives:

1- Discuss mathematical/statistical tools for forecast evaluation and model selection for scalar, vector and matrix valued outcomes and lay their theoretical foundation
2- Provide clear definition and interpretation of the metrics used to assess forecast accuracy
3- Focus on problems arising in forecast evaluation of latent target variables with emphasis on the case of volatility forecasts evaluation
4- Analyze recent work in forecast evaluation and model selection based on forecast accuracy and discuss their empirical implementation

Exam: written, 2 hours, closed book.

Material: Slides, notes, references

Content:

1) Measures of forecast accuracy: Notion of empirical ranking. Definition of statistical loss functions (in scalar/vector/matrix spaces), construction and interpretation. Definition of economic loss functions (Minimum variance portfolio, Option pricing accuracy). Regression-based evaluation of predictive accuracy. Observable vs. Latent target variables. (3h)

2) Special issues 1: Evaluation of nested models. Estimation sampling schemes (Expanding vs. rolling window). Structural breaks/time varying parameters. Absolute vs. conditional forecasting performance (1.5h)

3) Tests of Forecast Comparison – Theory and Hypotheses: Single hypothesis (Diebold-Mariano, West, Clark-McCracken, Giacomini-White, Mincer-Zarnowitz), Multiple hypotheses (Superior Predictive Ability, Model Confidence Set). Simple vs. Composite hypotheses (testing equalities vs. weak inequalities) (5h)

4) Special issues 2: Evaluation latent target variables forecasts (Volatility forecast evaluation):

a) Introduction to ex-post measures of volatility (semi and non.parametric univariate and multivariate) (realized variance, multi-power variations, realized kernels), related issues : microstructure noise, observation frequency, sampling schemes and prefiltering, seasonality, robustification, jump detection and synchronicity (3h)
b) Consistency of forecasts ranking under statistical and economic loss functions. Sufficient and necessary conditions for ranking consistency (4.5h)

Additional topic (depending on time)

5) Predictive density evaluation (Diebold-Gunther-Tay, Corradi-Swanson, Amisano-Giacomini) (1h)

References:

Measures of forecast accuracy and consistency of the ranking with latent target:

- *Bregman, L., (1967). The relaxation method of finding the common point of convex sets and its application to the solution of problems in convex programming. URSS Computational Mathematics and Physics 7, 200–217*
- *Gourieroux, C., Monfort, A., (1995). Statistics and Econometric Models. Cambridge University Press*
- *Hansen P, Lunde A. (2006), Consistent ranking of volatility models. J. of Econometrics, 131:97–121*
- *Laurent S, Rombouts JVK, Violante F. (2013), On loss functions and ranking forecasting performances of multivariate volatility models, J. of Econometrics 173 1–10*
- *Patton A. (2011), Volatility forecast comparison using imperfect volatility proxies. J. of Econometrics, 160*
- *Patton A, Sheppard K. (2009), Evaluating volatility and correlation forecasts. In: Andersen T, Davis R, Kreiss J,*

Mikosch T, eds. Handbook of Financial Time Series

Tests of Forecast Comparison (absolute and conditional predictive accuracy)

- *Clark, T. and M. McCracken (2011), Advances in Forecast Evaluation, in: G. Elliott and A. Timmermann (eds.), Handbook of Economic Forecasting Vol. 2*
- *Diebold. F. and R. Mariano (1995), Comparing Predictive Accuracy, J. of Business and Economic Statistics 13*
- *Giacomini, R. and H. White (2006), Tests of Conditional Predictive Ability, Econometrica 74(6).*
- *Hansen P. (2006) A test for superior predictive ability, J. Business and Economic Statistics, 23:365–380.*
- *Hansen P, Lunde A, Nason J. (2011) The model confidence set, Econometrica, 79:453–497.*
- *Mincer, J. and V. Zarnowitz (1969), The Evaluation of Economic Forecasts, in J. Mincer, ed., Economic Forecasts and Expectations, 3-46*
- *West, K. (1996), Asymptotic Inference about Predictive Ability, Econometrica 64, 1067-1084.*
- *West, K. (2006), Forecast Evaluation, in: Granger, C., G. Elliott and A. Timmermann (eds.), Handbook of Economic Forecasting Vol. 1*
- *West K, McCracken M. (1998), Regression-Based Tests of Predictive Ability, Int. Economic Review 39, 817-40*
- *White H. (2000) Reality check for data snooping. Econometrica, 68:1097–1126*

Nested models and Parameter instabilities

- *Clark, T. and M. McCracken (2015), Nested Forecast Model Comparisons: A New Approach to Testing Equal Accuracy, J. of Econometrics, Vol. 186, 160-177*
- *Clark, T. and M. McCracken (2005), The Power of Tests of Predictive Ability in the Presence of Structural Breaks, J. of Econometrics 124(1), 1-31*
- *Clark T, McCracken M. (2001) Tests of equal forecast accuracy and encompassing for nested models. J. of Econometrics, 105:85–110*
- *Clark T, West K. (2007) Approximately normal tests for equal predictive accuracy in nested models. J. of Econometrics 138:291–311*
- *Elliott G., Timmermann A, (2008). Economic forecasting. J. of Economic Literature 46, 3–56.*
- *Giacomini, R. and B. Rossi (2010), Forecast Comparisons in Unstable Environments, J. of Applied Econometrics 25(4) 595-620*
- *McCracken M. (2000) Robust out-of-sample inference. J. of Econometrics, 99:195–223*
- *Rossi B. (2011) Advances in Forecasting under Model Instabilities, in: G. Elliott and A. Timmermann (eds.), Handbook of Economic Forecasting Vol. 2*

Non-parametric variance estimators

- *Andersen T, Bollerslev T, Diebold F, Labys P. (2003) Modeling and forecasting realized volatility. Econometrica 71, 579–625*
- *Barndorff-Nielsen O, Hansen P, Lunde A, Shephard N. (2008) Designing realized kernels to measure the ex post variation of equity prices in the presence of noise. Econometrica, 76:1481–1536*
- *Barndorff-Nielsen O, Shephard N. (2002) Estimating quadratic variation using realized volatility. J. of Applied Econometrics, 17:457–477*
- *Barndorff-Nielsen O, Shephard N, Winkel M. (2006) Limit theorems for multipower variation in the presence of jumps, Stochastic Processes and their Applications, Vol. 116(5) 796-806*
- *Hansen P, Lunde A. (April 2006) Realized variance and market microstructure noise. J. of Business and Economic Statistics. 24: 127–218*
- *Mancini C. (2009). Non-parametric Threshold estimation for models with stochastic diffusion coefficient and jumps. Scandinavian Journal of Statistics, vol. 36, pp. 270-296*
- *Zhang L, Mykland P, Ait-Sahalia Y. (2004) A tale of two time scales: determining integrated volatility with noisy high frequency data. J. of the American Statistical Association, 100:1394–1411*

Predictive Densities

- *Diebold, F., Gunther and Tay (1998) Evaluating Density Forecasts with Applications to Financial Risk. International Economic Review 39(4)*

- *Corradi, V. and N. Swanson (2001) Predictive Density Evaluation, in: Granger, C., G. Elliott and A. Timmermann (eds.), Handbook of Economic Forecasting Vol. 1*
- *Amisano, G. and R. Giacomini (2007), Comparing Density Forecasts via Weighted Likelihood Ratio Tests, J. of Business and Economic Statistics 25, 177-190*