German Institute for Economic Research (DIW Berlin) March 11-12, 2013

Marco Lippi. Course on large-dimensional factor models

1. The course gives a presentation of factor models, thoroughly studied in the last fifteen years, in which n, the number of variables, and T, the number of observations for each variable, are of the same order of magnitude, this having the consequence that the corresponding asymptotic theory has both n and T tending to infinity.

2. Particular attention is devoted to the dynamics of the common components, and therefore to static, quasi-static and dynamic models, and the corresponding dimension of the common-factor space.

3. The course also deals with dynamic modeling of the common components. These are singular stochastic processes, i.e. processes whose rank is strictly less than the dimension.

4. I analyze the links between factor analysis and VAR models. In particular, I show that the fundamentalness problem, arising with VAR models, has an acceptable solution within the factor approach.

5. Lastly, results from a recent paper by myself and coauthors, see [9] below, are illustrated.

6. I assume basic knowledge of stochastic processes, both scalar and multidimensional, ARMA and VARMA. Some results requiring the frequency-domain approach can be presented, depending on the audience.

A basic reading list is the following:

References

[1] Anderson, B. and M. Deistler (2008a). Properties of zero-free transfer function matrices, *SICE Journal of Control, Measurement and System Integration* **1**, 1-9.

[2] Anderson, B. and M. Deistler (2008b). Generalized linear dynamic factor models—A structure theory, *2008 IEEE Conference on Decision and Control.*

[3] Bai, J. (2003). Inferential theory for factor models of large dimensions, *Econometrica* **71**, 135-171.

[4] Bai, J. and S. Ng (2002). Determining the number of factors in approximate factor models, *Econometrica* **70**, 191-221.

[5] Forni, M., M. Hallin, M. Lippi and L. Reichlin (2000). The generalized dynamic factor model: identification and estimation, *The Review of Economics and Statistics* **82**, 540- 554.

[6] Forni, M., M. Hallin, M. Lippi and L. Reichlin (2004). The generalized dynamic factor model : consistency and rates, *Journal of Econometrics* **119**, 231-255.

[7] Forni, M., M. Hallin, M. Lippi and L. Reichlin (2005). The generalized factor model: one-sided estimation and forecasting, *Journal of the American Statistical Association* **100**, 830-40.

[8] Forni, M., D. Giannone, M. Lippi and L. Reichlin (2009). Opening the black box: structural factor models with large cross-sections, *Econometric Theory* **25,** 1319-1347.

[9] Forni, M., M. Hallin, M. Lippi and P. Zaffaroni (2011) One-sided representations of dynamic factor models, Einaudi Institute for Economics and Finance, WP 11/6.

[10] Stock, J.H. and M.W. Watson (2002a). Macroeconomic Forecasting Using Diffusion Indexes, *Journal of Business and Economic Statistics* **20**, 147-162.

[11] Stock, J.H. and M.W. Watson (2002b). Forecasting using principal components from a large number of predictors, *Journal of the American Statistical Association* **97**, 1167-1179.

[12] Stock, J.H., and M.W. Watson (2005). Implications of dynamic factor models for VAR analysis, NBER Working Papers no. 11467.