Dimension Reduction Using Inverse Regression and Nonparametric Factors

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Abstract:

We develop a nonparametric method to reduce the dimension of econometric models that contain many input variables and many regression functions. To enable nonparametric regression, we reduce the many input variables to a few inverse regression variates. We then reduce the many regression functions to a few nonparametric factors. Not only may these nonparametric factors represent economically meaningful objects, but they also facilitate high dimensional data visualization and parametric model specification. To estimate the number of nonparametric factors, we propose a root-n consistent nonparametric test. We apply our method to financial asset pricing by studying the relationship between the excess returns on 25 stock portfolios and a set of 18 macroeconomic variables. Our method reduces the 18 input variables to one inverse regression variate, and it reduces the 25 regression functions to two nonparametric factors. The first factor captures the essence of the CAPM, and the second factor is a nonlinear term that represents downside risk.