Team Project 3: Examination of dynamic predictability of excess returns

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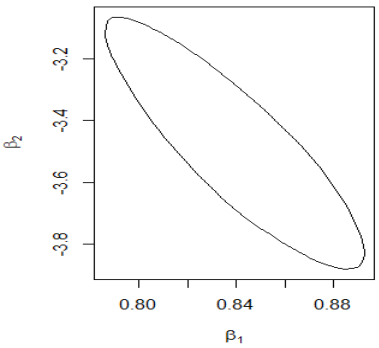
Goal of Project. As an important research topic in economics and finance, the predictability of stock returns has been studied in decades. In many financial applications, for example, the mutual fund performance, the conditional capital asset pricing, and the optimal asset allocations, the predictability problem is routinely examined. Tremendous empirical studies demonstrate the predictability of stock returns using various lagged financial variables, such as the book-to-market ratio, the dividend yield, the dividend-price (D-P) ratio, the earning-price (E-P) ratio, the interest rates, and the term spread and default premia, among others (Campbell and Yogo, 2006; Paye and Timmermann, 2006; Amihud et al., 2009). An essential question is often asked about whether the returns are predictable in a specific financial application. Because many of the predictive financial variables are highly persistent and even nonstationary (Rossi, 2007), it is challenging to answer this question.

A long term goal of the mentor is to use time-varying coefficient models to exam dynamically predictive ability of state variables on excess returns. It involves in statistical modeling, rigorous reasoning, numerical simulation, and real data analysis. The mentor and his student (Hong and Jiang, 2017) discovered that the long-short yield spread (s_t) and the log E-P ratio (x_t) are cointegrated and have joint predictive power for the excess return (r_t) of monthly NYSE/AMEX value-weighted index data (1926-2002) from the Center for Research in Security Price, based on the following model



$$r_t = \beta_1 x_{t-1} + \beta_2 s_{t-1} + \theta(\hat{e}_t) + v_t, \tag{1}$$

where $\theta(\cdot)$ is a nonlinear error correction term (Engle and Granger, 1987), reflecting a cointegrating relationship between x_t and s_t and $\hat{e}_t$ is the residual from the ordinary least squares regression model, $x_t = a + bs_t + e_t$. The figure on the right-hand side displays a 95% confidence region from the empirical likelihood method (Owen, 2001), showing r_t is predictable with s_{t-1} and x_{t-1}, since the region does not contain the origin. However, the economic conditions change over time. It is more reasonable to predict the excess return dynamically. Therefore, model (1) can be extended using time-varying coefficients $\beta_1(t)$ and $\beta_2(t)$. Such a model can adapt the change of economic conditions. Problems that will be investigated in this project will include estimation of coefficient functions and misspecification test of model (1). Another task is to check the predictability of other excess returns using corresponding state variables.

REU students' role. The appeal of this project to students is two fold: it is a direct application of statistics to real economic problems with a lot of potential, and the statistical model involved is well formulated. This project is very suitable for one summer undergraduate students with proper background, since the basic knowledge required can be quickly learned and mastered. Students in this project will spend 2 weeks to learn the basic knowledge in regression models. Topics will include the linear and partly linear regression models, the concept of empirical likelihood, and the properties and computation of profile least squares estimation and maximization of empirical likelihood. The students will then spend the next 3 to 4 weeks to study and implement algorithms that solve profile least squares score equations and maximize the empirical likelihood, and to carry out numerical studies to determine if the excess return is predictable with some state variables. The students are responsible for collecting data and identifying the predictable excess return with corresponding predictors in their study.

References

[1] Amilud, Y., Hurvich, C. M. and Wang, Y. (2009). Multiple-Predictor Regressions: Hypothesis Testing. *The Review of Financial Studies* **22**, 413–434.

[2] Campbell, J. Y. and Yogo, M. (2006). Efficient tests of stock return predictability. *Journal of Financial Economics* **81**, 27–60.

[3] Engle, R. F. and Granger, C.W. J. (1987). Co-integration and error-correction: Representation, estimation and testing. *Econometrica* **55**, 251–76.

[4] Hong, S. and Jiang, J. (2017). Interval Estimation for Semiparametric Predictive Regression. Preprint.

[5] Owen, A. B. (2001). Empirical Likelihood. *CRC Press*.

[6] Paye, B. S. and Timmermann, A. (2006). Instability of return prediction models. *Journal of Empirical Finance* **13**, 274–315.

[7] Rossi, B. (2007). Expectations hypotheses tests at Long Horizons. *Econometrics Journal* **10**, 1–26.