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Joint Estimation of Factor Sensitivities and Risk Premia for the Arbitrage Pricing Theory: Discussion

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DISCUSSION

STEPHEN J. BROWN*: This paper represents something of a progress report on a major research program to reexamine the empirical basis of the Arbitrage Pricing Theory of Ross [7]. Not content merely to refine and extend the path-breaking work of Roll and Ross [6] and Chen, Roll and Ross [4], this research provides new measures and interpretations of the factors of the Arbitrage Pricing Theory. With the application of new and powerful econometric methods, the authors can derive interesting results of the kind reported in this paper.

The set of macroeconomic factors studied by McElroy and Burmeister [5] is similar to the factors of Chen, Roll and Ross [4], and is described in Burmeister and Wall [2]. The economic interpretation of those factors is explored in Berry, Burmeister and McElroy [1]. The factors differ from those of Chen, Roll and Ross [4] in that the unexpected-inflation variable is defined by means of a state-space modeling procedure described in Burmeister, Wall and Hamilton [3]. The remaining macroeconomic factors are defined to be orthogonal to this measure of unexpected inflation. If there were significant gains to using the state-space procedure in the present context, it is unclear why the authors did not employ the obvious multivariate extension to estimate all of the macroeconomic factors simultaneously. An interesting feature of this work is the inclusion of an additional implicit factor, interpreted as a residual market factor. This factor could be thought of as a proxy for otherwise omitted or incompletely specified factors. In addition, the existence of such a factor allows the Capital Asset Pricing Model to be empirically nested within the Arbitrage Pricing Theory which is in turn nested within some more general linear factor model. Thus it is possible to construct unambiguous statistical tests of the Arbitrage Pricing Theory and the Capital Asset Pricing Model.

In addition to providing new measures and interpretations of the macroeconomic factors of the Arbitrage Pricing Theory, this research has developed new and innovative methods of jointly estimating factor sensitivities and risk premia. Referred to by the unpronounceable acronyms ITNLSUR (*Iterated Nonlinear Seemingly Unrelated Regressions*) and ITNLWLS (*Iterated Nonlinear Weighted Least Squares*), these methods provide maximum-likelihood estimates of the system of equations implied by the models, and allow for the cross-sectional constraints that define the APT and the CAPM to be tested.

The present paper illustrates quite well how the model is estimated and applied to the available data. One particular issue the paper is concerned with is the existence of 'mimicking' portfolios. Do portfolios exist with no residual risk whose returns correspond exactly to the factors? This assumption is implicit in the ITNLSUR and ITNLWLS procedures, and is explicit in most of the other empirical examinations of the Arbitrage Pricing Theory. Considering a more general estimation procedure, ITNL3SLS, that relaxes this particular assumption, the authors show that the results are indeed sensitive to it. The authors are careful to point out that this result has little impact on tests of the cross-sectional constraints of the Capital Asset Pricing Model and Arbitrage Pricing Theory.

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However, potential applications of the model to the study of economic structure, the allocation of risk and the relative factor sensitivities of firms within particular industries are indeed affected by the violation of such an assumption.

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