



Risk and return in a dynamic general equilibrium model[☆]

Levent Akdeniz

Bilkent University, Faculty of Business Administration, 06533 Bilkent Ankara, Turkey

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Abstract

In this paper we examine the relationship between risk and return on productive assets using the intertemporal general equilibrium model of Brock (1982, *Asset Prices in a Production Economy*, the University of Chicago Press, Chicago, pp. 1–42) as a basis for a simulation study. Current computational techniques are used to solve the growth model of Brock (1979, *An Integration of Stochastic Growth and the Theory of Finance — Part I: The Growth Model*, Academic Press, New York, pp. 165–192) in order to analyze the underlying financial model. Contrary to recent empirical findings, we find that there is a theoretical basis for the linear relationship between risk and return. This apparent contradiction is due in part to the fact that the dynamic relationship between risk and return depends on the level of output. © 2000 Elsevier Science B.V. All rights reserved.

1. Introduction

Over the last two decades researchers have spent a great deal of time to evaluate the performance of the Capital Asset Pricing Model (CAPM) by testing how well the model fits the data. The empirical evidence on the validity of the

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E-mail address: akdeniz@bilkent.edu.tr (L. Akdeniz)

CAPM is mixed. While some studies have concluded that the model is misspecified others have found support for the predictions of the model. All of these studies, however encountered serious and difficult econometric problems in their efforts to provide the best empirical tests of the model. To what extent their results are derived by these methods has been a source of controversy. However, many researchers have taken the mixed empirical evidence to imply that the CAPM is not the correct model of risk and have attempted to test other determinants of expected stock returns. In this study, we examine the prediction of the CAPM, the linear relationship between risk and return, using the intertemporal general equilibrium model of Brock (1982) as a basis for a simulation study. The dynamic structure of the model provides some insights about the dynamic relationship between risk and return which shed light on to the problems in empirical testing of the model. More specifically, we find that the dynamic relationship between risk and return depends on the level of output in the economy. In other words, the position of the economy on the business cycle matters in testing the relationship between risk and return.

Contradictory to the predictions of the CAPM, factors other than beta have been found to explain the cross-section of expected stock returns. These factors include market equity or in other words size (Banz, 1981; Reinganum, 1981), earnings price ratios (Basu, 1983), firm's book value of common equity to its market equity (Rosenberg et al., 1985), and leverage (Bhandari, 1988). Recently, Fama and French (1992) reconsider these different effects and find that size and book-to-market equity ratio provide the best characterization of the cross-section of stock returns and conclude that beta does not explain the cross-section of expected stock returns. This empirical evidence has led researchers to deduce that the pure theoretical form of the CAPM does not agree well with reality. Although Fama and French (1992) make a persuasive case against the CAPM, their study itself has been challenged. Kothari et al. (1995) show that Fama and French (1992) findings are crucially contingent on the methodology and data used. Black (1993) finds that the size effect, that is significant in some periods, disappears in others; therefore, Fama and French's results may simply result from their select sample. Jagannathan and Wang (1996) show that the CAPM is able to explain the cross-sectional variation in average stock returns when betas and expected returns are allowed to vary over the business cycle and when human capital is included in measuring wealth.

Stimulated by these empirical findings, a number of researchers have sought to find alternative explanations for equity premia. One line of attack has been that of Fama and French (1993,1995), who conclude that fundamental variables found to explain the variation in returns must be proxies for some unidentified risk. Another line has been that of Lakonishok et al. (1994), who argue that due to mispricing of assets, there are excess returns which are not accounted for by the standard measures of risk. As Fama and French (1993, p. 3) point out, this line of research relies on '... variables that have no special standing in

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