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Market incompleteness and the equity premium puzzle: Evidence from state-level data

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ABSTRACT

This paper investigates the importance of market incompleteness by comparing the rates of risk aversion estimated from complete and incomplete markets environments. For the incomplete-markets case, we use consumption data for the 50 US states. We find that the rate of risk aversion under the incomplete-markets setup is much lower. Furthermore, including the second and third moments of the cross-sectional distribution of consumption growth in the pricing kernel lowers the estimate of risk aversion. These findings suggest that market incompleteness ought to be seen as an important component of solutions to the equity premium puzzle.

1. Introduction

The equity premium puzzle constitutes one of the central research questions in financial economics. Using a representative agent construction with time-separable, constant relative risk aversion preferences (TS-CRRA), Mehra and Prescott (1985) demonstrate that the standard consumption-based asset pricing model (CCAPM) of Lucas (1978) and Breeden (1979) is unable to explain the historically observed premium of equity over a riskless investment. This finding can be interpreted in several ways. It may indicate that the workhorse model of rational behavior in financial markets does not work, possibly suggesting that irrational behavior explains security prices. Alternatively, it may be that some of the maintained hypotheses in Mehra and Prescott's empirical analysis are incorrect, yet the fundamental logic of the consumption-based model is adequate.

The present paper is part of an extensive literature that attempts to explain Mehra and Prescott's findings by maintaining the basics of their theoretical consumption-based framework while altering some other maintained assumptions. One part of this literature maintains the representative-agent framework but uses a utility function other than TS-CRRA. That approach has enjoyed some success in explaining the equity premium puzzle.[1] Our paper contributes to another strand of this literature, which maintains the TS-CRRA utility function but relaxes the representative-agent assumption. Several papers have demonstrated that the full-insurance assumption underlying the representative-agent framework is not supported by the data.[2] Jacobs (1999) and Brav et al. (2002, henceforth BCG) use data on individual consumption in the United States to show that the analysis of Euler equations that hold under incomplete markets yields low rates of risk aversion, as opposed to the large rates of risk aversion needed to explain the equity premium in the Mehra–Prescott (1985) setup.[3] Sarkissian (2003) uses consumption data for several countries to show that

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[1] See Sundaresan (1989), Abel (1990), Constantinides (1990), Epstein and Zin (1991), Ferson and Constantinides (1991), Cochrane and Hansen (1992), Heaton (1995), Campbell and Cochrane (1999), and Bansal and Yaron (2004).
[2] See Cochrane (1991), Mace (1991), and Hayashi et al. (1996).
[3] Mankiw and Zeldes (1991), Vissing-Jørgensen (2002), Gomes and Michaelides (2008), and Malloy et al. (2009) provide related evidence on the importance of asset market participation. Telmer (1993), Heaton and Lucas (1996), Constantinides et al. (2002), and Storesletten et al. (2007) provide evidence on the relevance of market incompleteness using a simulation-based approach. See also Constantinides (2002) for an elaborate discussion.

market incompleteness is partly helpful for currency pricing.[4] Overall, this evidence suggests that market incompleteness may help resolve some of the main asset pricing puzzles.

Still, the evidence to date remains somewhat mixed in the case of the equity premium. Cogley (2002), for example, reaches conclusions at odds with Jacobs (1999) and BCG. The most often cited problem with studies such as BCG, Cogley (2002) and Jacobs (1999) is the quality of the individual consumption data used to conduct the empirical analyses. Some of the fluctuations in consumption present in data sets such as the Consumer Expenditure Survey and the Panel Study of Income Dynamics are due to measurement error – yet it is not evident how to correct for it. These data sets also have a relatively limited time-series dimension, which complicates the testing of rational-expectations models (Chamberlain, 1984). More extensive and reliable data sets containing data on individual consumption can obviously not be created overnight. It therefore becomes important to shed light on this issue using alternative methods and/or data sets.

This paper investigates market incompleteness using a data set on consumption growth in 50 US states for the period 1963–1995 (Del Negro, 2002). The finance literature on home biases at home has established the existence of regional financial market segmentation within the United States, and the related economics literature on intra-national risk sharing has documented that a large fraction of the asymmetric shocks that hit individual US states are not smoothed out across states.[5] In sum, there are economically significant differences in consumption patterns across states. Our objective is to learn about market incompleteness by interpreting state consumption and heterogeneity across states as a proxy for individual consumption and heterogeneity across consumers.[6]

Several studies in the asset pricing and consumption literatures have attempted to address the measurement error problem in individual consumption data by using proxies. Browning et al. (1985) and Attanasio and Weber (1995) construct consumption data for synthetic cohorts to reduce the effects of measurement error. The use of consumption data for synthetic cohorts – or, alternatively, for countries (Sarkissian, 2003) or states (Korniotis, 2008) – has limitations, and in a sense it contains a methodological contradiction. In the case at hand, it effectively amounts to assuming the existence of a representative consumer at the state level while questioning the relevance of the representative-agent assumption at the economy-wide level. Furthermore, a large amount of heterogeneity is averaged out with the construction of representative consumers at the state level. In all likelihood, however, this averaging out biases the results against us. Thus, if anything, the risk-aversion estimates in the present paper should be viewed as very conservative upper bounds. In our opinion, our empirical findings are of interest despite these limitations, as long as they are interpreted conservatively.

Our empirical exercise consists of determining the rate of relative risk aversion that solves the Euler equation associated with the equity premium, following the approach in Kocherlakota (1996) and Jacobs (1999) and BCG. The benchmark for this analysis solves the Euler equation for the representative-agent economy, using aggregate consumption data for the same period.

Our main conclusion is that the rate of risk aversion for the incomplete-markets case is much lower than the rate of risk aversion for the representative-agent case. We utilize Taylor-series expansions of the incomplete-markets pricing kernel, proposed by BCG, to show that higher moments play a critical role in this regard. Including the cross-sectional variance in the expansion lowers the estimate of the rate of risk aversion, compared to the case where only the cross sectional average consumption growth is included. This indicates that, conditional on the first moment, the second moment of the cross-sectional distribution is negatively correlated with the equity premium. Including cross-sectional skewness further lowers our estimate of the rate of risk aversion, indicating positive (conditional) correlation between the third moment and the equity premium. Including cross-sectional kurtosis does not, however, appear to further resolve the equity premium puzzle.

The paper proceeds as follows. Section 2 outlines the analytical framework. Section 3 discusses the data. Section 4 summarizes the empirical results. Section 5 concludes.

2. Analytical framework

We investigate the equity premium puzzle under the maintained assumption of TS-CRRA utility but with incomplete markets. Essentially, we utilize the analytical framework of Jacobs (1999) and, especially, BCG in order to carry out an empirical exercise with state-level (rather than individual) consumption data.

Assume that consumer i is at an interior solution with respect to her choice of asset j, which leads to the following optimality condition:

$$E\left[\beta(cg_{i,t})^{-\gamma}R_{j,t}|\Omega_{t-1}\right]=1 \tag{1}$$

where $cg_{i,t}=c_{i,t}/c_{i,t-1}$, $c_{i,t}$ is the consumption of consumer i in period t, β denotes the rate of time preference, γ denotes the rate of relative risk aversion, $R_{j,t}$ is the gross rate of return on asset j between periods $t-1$ and t, and Ω_{t-1} is the information set in period $t-1$. In our empirical application, we use data on state consumption instead of data on individual consumption. Henceforth, we will therefore refer to the consumption of state i rather than consumer i.

Consider the returns on two assets: the market return, denoted R_{MA}, and the return on the risk-free asset, denoted R_{RF}. Focus on the difference between the Euler Eqs. (1) for these two assets

$$E\left[\beta(cg_{i,t})^{-\gamma}(R_{MA,t}-R_{RF,t})|\Omega_{t-1}\right]=0. \tag{2}$$

The empirical analysis of (2) depends on the choice of information set Ω_{t-1}. In the particular case where Ω_{t-1} exclusively contains a constant, the resulting differenced Euler equation is usually referred to as an unconditional Euler equation. Analyzing it amounts to an investigation of the equity premium puzzle, which refers to the difference in the unconditional mean return between the market and a risk-free investment. Focus therefore on

$$E\left[\beta(cg_{i,t})^{-\gamma}(R_{MA,t}-R_{RF,t})\right]=0, \tag{3}$$

assuming without loss of generality that the constant is equal to one. It must be noted that (3) amounts to one equation in the two unknowns, β and γ. However, β is clearly not identifiable from (3). Setting it it equal to one in the empirical analysis has certain numerical implications (it scales the pricing errors) but does not affect the central issue of interest in this paper – which is the rate of risk aversion γ implied by the data.

In (1)–(3), $\beta\,(cg_{i,t})^{-\gamma}$ is a pricing kernel that discounts future returns. Part of the asset pricing literature consists of the search for

[4] There is a rich literature that investigates the importance of market incompleteness for international asset pricing and currency fluctuations, as well as the degree of international risk sharing. See, e.g., Tesar (1993, 1995), Lewis (1996, 2000), Ramchand (1999), and Bali and Cakici (2010).

[5] See, e.g., Coval and Moskowitz (1999), Huberman (2001), and Ivkovic and Weisbenner (2005) for evidence that US investors prefer local investment, and Del Negro (2002) and Korniotis and Kumar (2011) and references cited therein for evidence of imperfect intra-national risk sharing.

[6] Korniotis (2008) also uses state consumption data to answer an asset pricing question. His rationale for doing so (the poor quality of individual consumption data) is similar to ours. He focuses on the cross-section of stock returns, while we analyze the equity premium puzzle.