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Treasury Bond risk and return, the implications for the hedging of consumption and lessons for asset pricing

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ABSTRACT

All consumption-based models of asset pricing imply that the relation between the conditional mean and conditional volatility of *any* asset reflects the effectiveness of holding that asset as a hedge against intertemporal variation in the marginal utility of consumption. For Treasury Bonds of various maturities, we find significant positive relations. Our empirical findings support the conclusion that investors must sell bonds short to hedge shocks to marginal utility, because realized bond returns tend to be high (low) when investors least (most) desire an additional dollar of consumption. Implications for special cases of the general consumption-based model are also discussed.

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1. Introduction

All consumption-based models of asset pricing imply that the relation between the conditional mean and conditional volatility of *any* asset reflects the effectiveness of the asset as a hedge against intertemporal variation in the marginal utility of consumption. The relation is negative if a long position in an asset hedges shocks to the marginal utility of consumption. The relation is positive if a long position adds to consumption risk. We estimate the relation between the conditional mean and conditional volatility of excess returns on U.S. Treasury securities and find evidence of significant positive relations for all maturities. Our full sample results indicate that long positions in Treasury Bonds do not hedge shocks to the marginal utility of consumption. To hedge effectively against such shocks an investor must sell short or sell futures on bonds. In terms of statistical significance and robustness

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to changes in methodology, the positive relation is especially reliable for bond maturities of 5 years or less, so short positions on shorter-maturity bonds are the most statistically reliable means for an investor to hedge the marginal utility of consumption.

The general consumption-based model upon which we base our tests requires only minimal assumptions. Models such as the capital asset pricing model (CAPM), intertemporal capital asset pricing model (ICAPM) of Merton (1973), the intertemporal asset pricing model of Campbell (1993), and the habit-persistence model of Campbell and Cochrane (1999) are special cases.¹ Specializations of the general model add additional structure, but do not change the implications that are the focus of our empirical tests. The intuition of the general model is straightforward. A pure hedging asset has realized returns that are perfectly positively correlated with the marginal utility of wealth.² It provides high payoffs during “bad times” when the marginal utility of consuming an additional dollar of wealth is high and low payoffs during “good times” when the marginal utility of consuming an additional dollar of wealth is low. The volatility of the asset’s return is desirable and investors are willing to pay more for the asset, because holding the asset decreases intertemporal variation in the holder’s marginal utility. Thus, the key characteristics of a hedging asset are a negative risk premium and a perfect negative correlation between the conditionally expected excess return and conditional volatility of the asset. On the other hand, an asset that has returns that are perfectly negatively correlated with the marginal utility of wealth provides high payoffs when times are good and low payoffs when times are bad. The volatility of the asset’s return is undesirable because it increases intertemporal variation in the holder’s marginal utility. The expected risk premium on such an asset is positive and perfectly positively correlated with its conditional volatility. A short, rather than long, position in the asset is required to hedge consumption risk. Our empirical results for bonds are consistent with the latter case, indicating that realized returns on bonds tend to be high in good times when the marginal utility of receiving an additional dollar of wealth is low.

The beauty of the general consumption-based model is that it provides a simple and straightforward test of the hedging effectiveness of any asset that requires only modeling the first two moments of the asset’s return. The test does not require consumption data, nor does it require that the researcher choose a specific model of investor preferences. The model’s predictions regarding the first two moments of returns hold for any asset, for any two periods of a multi-period model, and require no assumptions regarding complete markets, return distributions, time- or state-separable utility, or the existence of labor income or human capital.

In addition to evidence of hedging effectiveness, our results provide evidence regarding which special cases of the consumption-based model capture key aspects of asset returns. Our full sample results are consistent with the conclusion that realized returns on Treasury Bonds are high when investors least value, and low when investors most value, the benefits of an additional dollar of consumption. Thus, for a special case of the consumption-based model to accurately reflect investor preferences, it must explain why investors associate bad times of high marginal utility with periods of low realized and high expected bond returns. Special cases that assume that the marginal utility of consumption is a function of at most wealth and investment opportunities, such as the ICAPM specializations of Merton (1973) and Campbell (1993), do not do so. Unless one assumes that the coefficient of relative risk aversion is very low (less than one), these specialized models associate bad times with low expected returns. Explaining why investors associate bad times with high expected returns requires a model that captures the fact that investors are concerned not only with the wealth effects of holding assets, but with the fact that assets do poorly at particular times or in particular states of nature (recessions). For example, Campbell and Cochrane (1999) do so by adding an argument to the utility function, habit that enters nonseparably over time

Turning to empirical results, we find that neither the sign nor the significance of the estimated relation between bond risk and return is sensitive to changes in methodology known to influence inferences in the literature on stock risk and return. Specifically, the results are similar whether

¹ For detailed discussion of the relation of these and other asset pricing models to the general model see Cochrane (2006, 2007).

² Once the consumer/investor has optimized, the marginal utility of an additional dollar of wealth is the same for all uses.

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