Consumption-based CAPM models: International evidence ☆

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ABSTRACT

We examine the performance of several types of the consumption-based CAPM (C-CAPM) models to explore if consumption factors matter for determining excess returns across 17 MSCI country indexes. While the classic world C-CAPM does exhibit some power in explaining cross-sectional variations of expected excess returns, the model seems to require an implausibly large coefficient of risk aversion. The more sophisticated models including the heterogeneous C-CAPM, the world surplus consumption and the habit-formation models provide more reasonable estimates and add substantial explanatory power for the variation in the cross section of excess stock returns. Our results suggest that country-specific consumption risk is not fully diversified thus implying that stock returns are related to idiosyncratic consumption risk.

1. Introduction

The consumption-based CAPM (C-CAPM) has become a popular approach in the study of asset pricing since the classic work of Lucas (1978), Breeden (1979), and Grossman and Shiller (1981) developed a simple relation of consumption to asset returns. Cochrane (2001, p. 5) notes, "An investor must decide how much to save and how much to consume, and what portfolios of assets to hold...the asset's price should equal the expected discounted value of the asset's payoff, using the investor's marginal utility to discount the payoff".

Empirical research on the world CAPM, where excess world returns play a role, is typically carried out using international asset pricing (Harvey, 1991; De Santis and Gerard, 1997; Li and Zhong, 2005, 2009; Bekaert et al., 2009). Other studies incorporate features from several models. Cho et al. (1986) consider factors from the international arbitrage pricing theory and find support for three or four factors. Ferson and Harvey (1993) include global economic factors, while Dumas and Solnik (1995) and De Santis and Gerard (1998) take account of exchange rate risk.

As discussed in Karolyi and Stulz (2003), the consumption-based asset pricing model appears superior to the world CAPM where differences in consumption baskets across markets is an important feature for determining cross-sectional variations in stock returns. The world CAPM is essentially a special case of the C-CAPM which assumes that goods and financial markets are perfect and investors have similar consumption patterns and access to the same investment opportunity sets. In this study, we explore the issue of whether consumption-based variables are related to market returns internationally, i.e. whether variations in expected market returns across countries can be explained by their differing consumption risk exposures.

Our paper contributes to the literature in several ways. First, many prior tests of the C-CAPM are confined to a domestic setting, although theory suggests that the model is equally applicable across countries. We conduct our tests of consumption-based models after collecting the seventeen market indexes of the Morgan Stanley Capital International (MSCI). International finance research (e.g., Bekaert and Harvey, 1995) typically assumes three types of market linkage. They are: (1) complete integration, (2) complete segmentation, and (3) mild segmentation. In a completely integrated market, asset prices are determined by a world stochastic discount factor (SDF). This implies that the SDFs for asset returns in each country should be related to aggregate world factors rather than to country-specific variables. Under complete segmentation, individual markets are perfectly segmented and tests of asset pricing models use domestic data. In turn, under mild

segmentations, local markets are partially integrated and thus asset returns are related to both domestic and world factors.

Second, this study provides a comprehensive set of tests for the consumption-based CAPM. Research work on the consumption-based CAPM in an international context remains scant although prior studies provide some evidence. For instance, using the Morgan Stanley Capital International (MSCI) market indexes, Cumby (1990) employs a consumption-based international asset pricing model for four developed economies (US, UK, Germany, and Japan). Sarkissian (2003) tests the C-CAPM in foreign exchange markets under the assumption of imperfect risk sharing across countries. Li and Zhong (2005) apply habit-formation models in an international setting to investigate cross-sectional returns and their predictability. More recently, Li and Zhong (2009) incorporate both habit formation and uninsurable idiosyncratic risks into an international C-CAPM to examine returns in equity and currency markets. We begin our analysis with the classic world C-CAPM under the assumption of complete market integration and complete risk sharing. World consumption growth becomes the only factor determining asset returns in the classic world C-CAPM given that representative investor has a power utility. However, with imperfect consumption risk sharing across countries, the investors may face persistent consumption shocks. Consequently, the cross-sectional variance of consumption growth can affect asset pricing (Constantinides and Duffie, 1996). Hence, in the heterogeneous C-CAPM, asset returns are not only related to world consumption growth, but also related to cross-country variations in consumption growth. Sarkissian (2003) uses the heterogeneous C-CAPM to study international currency premiums. In this paper, we investigate whether the heterogeneous C-CAPM has explanatory power for the cross-sectional differences in international equity returns. Moreover, we extend the habit models of Abel (1990) and Campbell and Cochrane (1999) to the international setting and investigate whether the more refined consumption models can improve explanatory power relative to the classic world C-CAPM. We use Hansen's (1982) GMM to estimate and test our models.

Third, the results presented in the paper provide some important implications. The evidence from the test of the heterogeneous consumption model suggests that country-specific consumption risk is not fully diversified. The negative relationship between stock returns and consumption dispersion contributes to the explanation of the equity premium puzzle. Given that consumption dispersion rises during economic downturns, consumption dispersion intensifies the risk faced by the individuals who require higher premium to hold risky assets.

Our findings from the cross-sectional tests suggest that the world consumption C-CAPM explains about 11% of the cross-sectional variation in expected excess returns on the MSCI country indexes, indicating that stocks tend to have high returns if their covariance with world consumption growth is also high. Distinct from the classic C-CAPM, the alternative models add substantial explanatory power for variations in the cross section of excess stock returns. In particular, the heterogeneous C-CAPM shows that the estimate of cross-country consumption dispersion is substantially significant indicating that an asset commands a positive risk premium when its returns covary negatively with consumption dispersion. This evidence sheds light on the importance of cross-country consumption dispersions as well as world consumption growth to explain the cross-sectional variations in expected excess returns. Additional tests document that the surplus consumption model and the Abel (1990) habit model provide lowered pricing errors and higher explanatory power. Overall, our evidence implies that the more sophisticated models of the C-CAMP outperform the classic world C-CAPM in the tests of international markets.

The remainder of the paper is organised as follows. Section 2 outlines various world consumption models, starting with the classic world C-CAPM and extending to the heterogeneous world C-CAPM. For comparability, we also discuss the world surplus consumption model and the Abel habit model. Section 3 describes the data and the variables used in asset pricing tests. Section 4 discusses the empirical results. Section 5 concludes.

2. The model

In this section, we first introduce the classic world C-CAPM with a representative agent in the complete world market. We then discuss the heterogeneous world C-CAPM under Constantinides and Duffie's (1996) assumption of incomplete consumption risk sharing where variations in idiosyncratic consumption growth are priced. Responding to the empirical failure of the classic C-CAPM, some researchers propose a number of habit-formation based models in which the utility of investors not only depends on current consumption (as in the classic C-CAPM) but also on habit which is a function of past consumption. Habit models can be categorized into internal habit models where habit depends on investor's own consumption and external habit models where habit depends on aggregate consumption. Due to the difficulty of obtaining individual consumption data, external habit models appear empirically more appealing. The Campbell and Cochrane (1999) surplus consumption model and the Abel (1990) ratio habit model are two notable examples of external habit models. We present results from both habit models in the international setting.

2.1. The classic world C-CAPM

Stulz (1981a,b) argues that asset prices from all countries are determined by a common stochastic discount factor under the assumption of complete international market integration and complete consumption risk sharing. In terms of the consumption-based asset pricing model, the expected returns of the assets that the representative investor holds in the world market are determined by their covariance with the per capita aggregate world consumption growth. Under the assumption of the power utility function, the representative investor maximizes his life-time utility:

$$E_t \sum_{t=0}^{\infty} \delta_w^t \frac{C_t^{1-\gamma_w}}{1-\gamma_w}, \tag{1}$$

where C_t is real per capita world consumption, δ_w^t is the subjective time discount factor, and γ_w is the utility curvature parameter also called the coefficient of relative risk aversion of the world representative investor. The Euler equation for the investor's optimization problem is:

$$E_t[M_{w,t+1} R_{i,t+1}^e] = 0, \tag{2}$$

where $R_{i,t+1}^e$ denotes the excess asset return in country i from date t to $t+1$, and $M_{w,t+1} = \left(\frac{C_{w,t+1}}{C_{w,t}}\right)^{-\gamma_w}$ is the stochastic discount factor. Expression (2) is the SDF representation of the classic world C-CAPM.

2.2. The heterogeneous world C-CAPM

The classic world C-CAPM is based on the complete market assumption. Constantinides and Duffie (1996) introduce heterogeneity effects into the C-CAPM framework. They assume an economy where an individual investor k has his own consumption level $C_{k,t}$, and all investors have the same power utility function with the same time discount factor δ, and coefficient of relative risk aversion γ. In the presence of permanent income shocks, they derive the following Euler equation for the heterogeneous C-CAPM: