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Testing the Traditional CCAPM in the US: A Revisit

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Abstract

This study re-examines the traditional consumption-based capital asset pricing model (CCAPM) by largely updating US monthly samples of consumption and stock market return and following the methodology of generalized method of moments (GMM) with instrumental variables of Hansen and Singleton (1982). As a result, our investigations reveal the following facts for the US stock market. First, 1) in the cases of the CCAPM with consumption for nondurable goods and the CCAPM with consumption for nondurable goods and services, their discount rate parameters almost always take similar values that are slightly less than one. Next, 2) their risk aversion parameters more stably take small minus values in the CCAPM with consumption for nondurable goods than in the CCAPM with consumption for nondurable goods and services. Third, 3) in our empirical examinations, all estimated CCAPMs with two kinds of consumption are not rejected by the *J*-tests.

Keywords: asset pricing, CCAPM, GMM

1. Introduction

Asset pricing research by using the generalized method of moments (GMM) methodology (Hansen, 1982; Hansen and Singleton, 1982) is important since this enables us to focus on the stochastic discount factor in considering the determinants of asset prices (see, for example, Chochrane, 1996). As a significant foundation for many asset pricing models, the traditional version of consumption-based capital asset pricing model (CCAPM) is also important.

From the above viewpoints, we consider that it is worthwhile to revisit the classical CCAPM by using the GMM approach. Based on this motivation, this paper attempts to re-examine the traditional CCAPM by extending US monthly sample periods and by applying the GMM methodology conducted in Hansen and Singleton (1982).

Our investigations that cover the recent US data reveal the following facts. First, 1) in the cases of the CCAPM with consumption for nondurable goods and the CCAPM with consumption for nondurable goods and services, their discount rate parameters almost always take similar values that are slightly less than one. Second, 2) their risk aversion parameters more stably take small minus values in the CCAPM with consumption for nondurable goods than in the CCAPM with consumption for nondurable goods and services. Third, 3) in our empirical explorations, all estimated CCAPMs with two sorts of consumption are not rejected by the *J*-tests.

After this introduction, Section 2 briefly reviews the related existing literature and Section 3 explains our data and methodology that we employ in our tests for the US. Section 4 then describes the estimation results of our asset pricing models and finally, Section 5 summarizes the paper.

2. Literature Review

This section concisely reviews existing studies related with consumption-based asset pricing. In recent years, researchers interested in consumption-based asset pricing models pay attention to asset pricing models with recursive preferences, typically shown in such a study as Epstein and Zin (1989). In connection with this study, Vissing-Jørgensen and Attanasio (2003) suggested that considering the stockholders' consumption growth and asset returns was indeed helpful for yielding plausible values of the elasticity of intertemporal substitution (EIS) and for explaining the equity premium puzzle.

Moreover, an interesting study by Santos and Veronesi (2006) attempted to extend the standard consumption-based asset pricing model. In their model, the source of consumption was assumed to be, in particular, labor income and they empirically tested their model with actual data as well. Further, Menzly et al. (2004) suggested a consumption-based asset pricing model with habit formation and their proposed model also included the time-varying risk aversion.

From the methodological viewpoint, as we already stated, the GMM approach was proposed by such studies as those by Hansen (1982) and Hansen and Singleton (1982) to evaluate asset pricing models. After these studies, GMM has been highly popular for testing asset pricing

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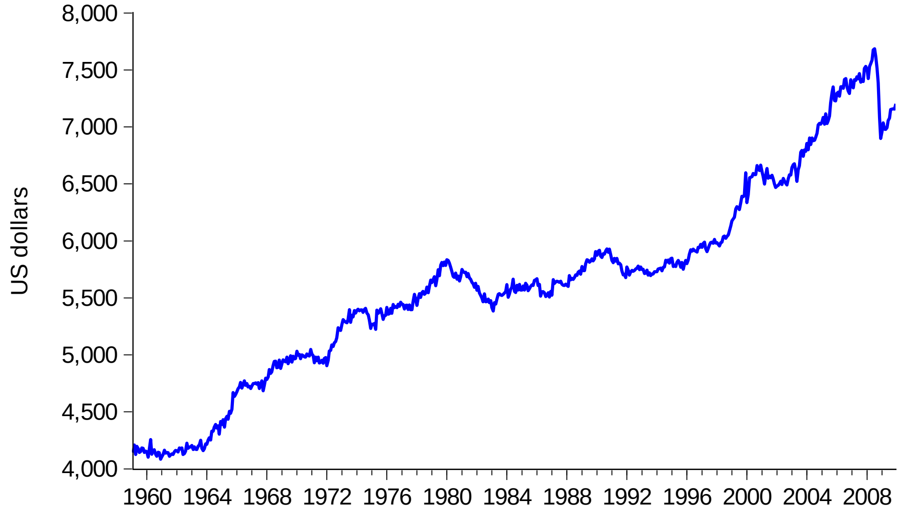
models. For example, Cochrane (1996) performed cross-sectional tests of multiple asset pricing models by combining the stochastic discount factor approach with GMM methodology. Further, Jagannathan and Wang (1996) empirically tested the conditional capital asset pricing models also by using GMM.

Moreover, an interesting study by Hansen et al. (2008) suggested that the cash flow variation and the consumption growth rate variation were important for asset valuation and they formalized and examined the long-run contribution to the value of the stochastic components of cash flows and discount factors. Using actual data, they also quantified the importance of macroeconomic risk in asset pricing.

Panel A. Consumption for nondurable goods



Panel B. Consumption for nondurable goods and services

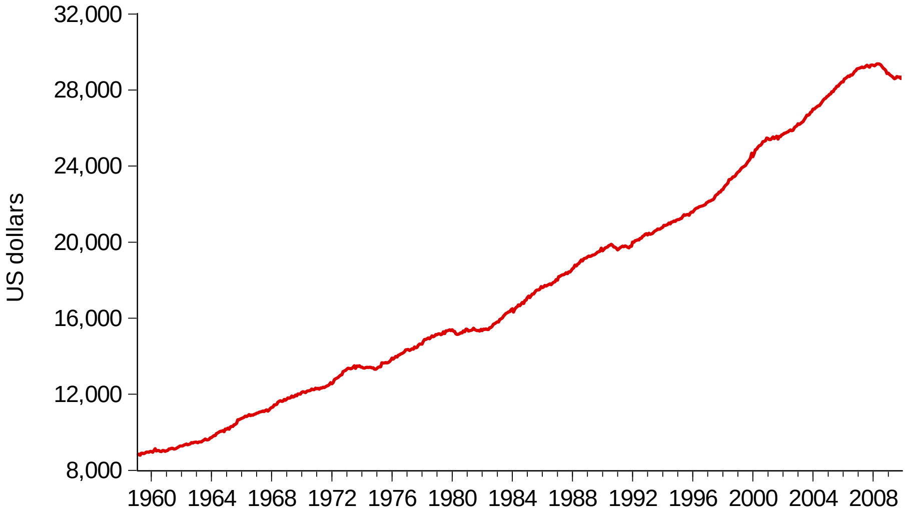


Figure 1. Trends of Per Capita Real Personal Consumption Expenditures in the US.

Table 1. Descriptive statistics for real stock market returns and real consumption in the US: For the full sample period and three sub-sample periods

Panel A. Statistics for the period from February 1959 to December 2009			
	VWR	ND	NDS
Mean	1.0057	5630.3945	17803.9778
Maximum	1.1589	7686.6118	29380.8496
Minimum	0.7703	4084.8268	8777.9915
Standard deviation	0.0447	866.4898	6197.8037
Skewness	−0.5340	0.2318	0.3530
Excess kurtosis	1.8742	−0.2796	−1.0403
Panel B. Statistics for the period from February 1959 to December 1978			
	VWR	ND	NDS
Mean	1.0030	4822.6642	11665.3346
Maximum	1.1589	5656.0585	15140.1583
Minimum	0.8700	4084.8268	8777.9915
Standard deviation	0.0429	490.1623	1906.9826
Skewness	−0.0960	−0.1370	0.0560
Excess kurtosis	1.1490	−1.3974	−1.2838
Panel C. Statistics for the period from January 1975 to December 1994			
	VWR	ND	NDS
Mean	1.0088	5632.3416	17207.5538
Maximum	1.1362	5928.6829	21160.3982
Minimum	0.7703	5223.5344	13360.8432
Standard deviation	0.0449	152.0264	2326.4561
Skewness	−0.5690	−0.2594	0.1151
Excess kurtosis	3.3569	−0.5805	−1.3914
Panel D. Statistics for the period from January 1990 to December 2009			
	VWR	ND	NDS
Mean	1.0059	6431.8368	24413.7949
Maximum	1.1097	7686.6118	29380.8496
Minimum	0.8340	5678.5123	19541.5386
Standard deviation	0.0446	611.0340	3350.3895
Skewness	−0.6905	0.4041	0.0512
Excess kurtosis	1.1108	−1.2381	−1.4656

Notes: In this table, VWR denotes the real value-weighted stock market return in the US, ND means per capita real PCEs for nondurable goods in the US, and NDS denotes per capita real PCEs for nondurable goods and services in the US. Excess kurtosis in this table means the kurtosis value over three.

3. Data and Testing Methodology

This study uses the data of stock market return, consumption, and a price deflator; and the latter two are seasonally adjusted data. More concretely, VWR denotes the real value-weighted stock market return in the US, ND means the US per capita real personal consumption expenditures (PCEs) for nondurable goods, and NDS denotes the US per capita real PCEs for nondurable goods and services. We deflated nominal values of the stock return and two kinds of PCEs by the deflator of total PCEs. The time-series trends of ND and NDS are shown in Figure 1. In addition, the descriptive statistics studied in this paper are shown in Table 1. We use three sub-sample periods with a full sample period. Our full sample period is from February 1959 to December 2009, the first sub-sample period is from February 1959 to December 1978, the second sub-sample period is from January 1975 to December 1994, and the last sub-sample period is from January 1990 to December 2009.

Using the above deflated data, following Hansen and Singleton's (1982) specification (1), we re-examine the traditional CAPM in the US by using the extended data.

$$E_t h(\mathbf{x_{t+1}}, \mathbf{b_0}) = E_t\left[\beta(x_{2t+1})^{\alpha} x_{1t+1} - 1\right] = 0 \tag{1}$$

In the above equation, h includes the parameter vector $\mathbf{b_0}$ and the variable vector $\mathbf{x_{t+1}}$. Further, β is the discount rate; α is the risk aversion parameter; x_{2t+1} means the growth of consumption (ND or NDS); and x_{1t+1} means the real market return. We estimate CCAPMs by using ND and NDS with GMM and in estimations, following Hansen and Singleton (1982), lag variables of VWR and consumption growth of ND or NDS are used as instrument variables.

Table 2. Estimation results of CCAPM with consumption for nondurable goods

Panel A. Results for the period from February 1959 to December 2009						
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	1	0.9946**	0.0000	–1.4773	0.0869
			Results of the J-test			
χ^2			DF		p-value	
2.6882			1		0.1011	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	2	0.9944**	0.0000	–0.9909	0.2083
			Results of the J-test			
χ^2			DF		p-value	
5.7545			3		0.1242	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	4	0.9944**	0.0000	–1.1603	0.1304
			Results of the J-test			
χ^2			DF		p-value	
7.6900			7		0.3607	

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Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	6	0.9942**	0.0000	–1.2175	0.1091
			Results of the *J*-test			
χ^2			DF		*p*-value	
12.2330			11		0.3464	
Panel B. Results for the period from February 1959 to December 1978						
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	1	0.9976**	0.0000	–1.5852	0.0536
			Results of the *J*-test			
χ^2			DF		*p*-value	
1.7067			1		0.1914	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	2	0.9975**	0.0000	–0.9068	0.2091
			Results of the *J*-test			
χ^2			DF		*p*-value	
6.8719			3		0.0761	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	4	0.9980**	0.0000	–0.6340	0.3509
			Results of the *J*-test			
χ^2			DF		*p*-value	
10.7907			7		0.1480	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	6	0.9982**	0.0000	–0.8383	0.1842
			Results of the *J*-test			
χ^2			DF		*p*-value	
18.1214			11		0.0788	
Panel C. Results for the period from January 1975 to December 1994						
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	1	0.9920**	0.0000	–0.9311	0.4056
			Results of the *J*-test			
χ^2			DF		*p*-value	
0.1620			1		0.6873	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
ND	VWR	2	0.9916**	0.0000	–1.3632	0.2127
			Results of the *J*-test			
χ^2			DF		*p*-value	

2.7262			3		0.4358	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	4	0.9916**	0.0000	–1.5852	0.1391
			Results of the J-test			
χ^2			DF		p-value	
6.0948			7		0.5287	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	6	0.9908**	0.0000	–1.3345	0.1834
			Results of the J-test			
χ^2			DF		p-value	
12.2360			11		0.3462	
Panel D. Results for the period from January 1990 to December 2009						
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	1	0.9961**	0.0000	–3.3489	0.1930
			Results of the J-test			
χ^2			DF		p-value	
0.1446			1		0.7038	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	2	0.9944**	0.0000	–1.4203	0.3950
			Results of the J-test			
χ^2			DF		p-value	
1.5257			3		0.6764	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	4	0.9942**	0.0000	–1.0734	0.4393
			Results of the J-test			
χ^2			DF		p-value	
3.0137			7		0.8837	
Cons.	Return	NLAG	β	p-value	α	p-value
ND	VWR	6	0.9938**	0.0000	–0.9996	0.4428
			Results of the J-test			
χ^2			DF		p-value	
3.2526			11		0.9869	

Notes: VWR is the US real value-weighted stock market return, ND is per capita real PCEs for nondurable goods in the US, and Cons. means consumption. NLAG is the lag of instrument variables, χ^2 denotes the chi-square statistic, and DF means the degree of freedom. ** and * mean the statistical significance at the 1% and 5% levels, respectively.

Table 3. Estimation results of CCAPM with consumption for nondurable goods and services

Panel A. Results for the period from February 1959 to December 2009						
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	1	0.9948**	0.0000	–0.8606	0.6543
			Results of the J-test			
χ^2			DF		p-value	
3.4536			1		0.0631	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	2	0.9940**	0.0000	–0.4171	0.8288
			Results of the J-test			
χ^2			DF		p-value	
6.4327			3		0.0924	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	4	0.9932**	0.0000	–0.0769	0.9557
			Results of the J-test			
χ^2			DF		p-value	
7.9449			7		0.3375	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	6	0.9929**	0.0000	–0.0502	0.9700
			Results of the J-test			
χ^2			DF		p-value	
12.1544			11		0.3521	
Panel B. Results for the period from February 1959 to December 1978						
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	1	0.9991**	0.0000	–1.4270	0.5130
			Results of the J-test			
χ^2			DF		p-value	
1.3540			1		0.2446	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	2	0.9955**	0.0000	0.4755	0.8063
			Results of the J-test			
χ^2			DF		p-value	
4.0130			3		0.2601	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	4	0.9955**	0.0000	0.4053	0.8062
			Results of the J-test			

χ^2			DF		p-value	
5.6960			7		0.5757	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	6	0.9975**	0.0000	–0.3223	0.8372
Results of the J-test						
χ^2			DF		p-value	
9.9509			11		0.5348	
Panel C. Results for the period from January 1975 to December 1994						
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	1	0.9910**	0.0000	0.1793	0.9437
Results of the J-test						
χ^2			DF		p-value	
0.4108			1		0.5215	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	2	0.9904**	0.0000	–0.400	0.9874
Results of the J-test						
χ^2			DF		p-value	
3.4710			3		0.3245	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	4	0.9939**	0.0000	–1.3723	0.4979
Results of the J-test						
χ^2			DF		p-value	
10.9577			7		0.1405	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	6	0.9969**	0.0000	–2.9921	0.1160
Results of the J-test						
χ^2			DF		p-value	
16.0265			11		0.1402	
Panel D. Results for the period from January 1990 to December 2009						
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	1	1.0078**	0.0000	–9.4492	0.2775
Results of the J-test						
χ^2			DF		p-value	
1.1760			1		0.2782	
Cons.	Return	NLAG	β	p-value	α	p-value
NDS	VWR	2	0.9857**	0.0000	4.0526	0.4947

Results of the *J*-test						
χ^2			DF		*p*-value	
4.3473			3		0.2263	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
NDS	VWR	4	0.9915**	0.0000	0.3314	0.9141
Results of the *J*-test						
χ^2			DF		*p*-value	
6.8448			7		0.4452	
Cons.	Return	NLAG	β	*p*-value	α	*p*-value
NDS	VWR	6	0.9926**	0.0000	–0.0907	0.9761
Results of the *J*-test						
χ^2			DF		*p*-value	
8.4820			11		0.6696	

Notes: In this table, VWR is the US real value-weighted stock market return, NDS denotes per capita real PCEs for nondurable goods and services in the US, and Cons. means consumption. NLAG is the lag of instrument variables, χ^2 denotes the chi-square statistic, and DF means the degree of freedom. ** and * mean the statistical significance at the 1% and 5% levels, respectively.

4. Empirical Results

This section documents our empirical results. Estimation results of the CCAPM with consumption for nondurable goods (ND) are shown in Table 2 and those of the CCAPM with consumption for nondurable goods and services (NDS) are exhibited in Table 3. In both tables, the lag of instrument variables is 1, 2, 4, or, 6 as in Hansen and Singleton (1982). In the case of the CCAPM with ND shown in Table 2, discount rate parameters always take similar values, which are slightly less than one; while risk aversion parameters stably take small minus values in general. Further, no estimated CCAPM with ND is rejected by the *J*-tests when judged by the 5% statistically significance level.

Next, in the case of the CCAPM with NDS exhibited in Table 3, discount rate parameters always take similar values, which are slightly less than one, except for the only one case in Panel D. As for risk aversion parameters, although some inconsistent parameter values are seen in Table 3, they generally take small minus values. Further, like the case of the CCAPM with ND, all estimated CCAPMs with NDS are not rejected by the *J*-tests when judged by the 5% statistically significance level.

5. Conclusions

This paper re-examined the traditional CCAPM by updating and extending US monthly samples. In our investigations, we followed the methodology of GMM with instrumental variables developed by Hansen and Singleton (1982). Our examinations derived the following facts. First, 1) in the cases of the CCAPM with consumption for nondurable goods and the CCAPM with consumption for nondurable goods and services, their discount rate parameters almost always took similar values that were slightly less than one. Second, 2) their risk aversion parameters more stably took reasonable small minus values in the CCAPM with consumption for nondurable goods than in the CCAPM with consumption for nondurable goods and services. Third, 3) all estimated CCAPMs with two kinds of consumption were not rejected by the *J*-tests in our empirical examinations.

In asset pricing research, the methodology by Hansen and Singleton (1982) is important and the traditional CCAPM model as studied in this paper is also important. We consider that the findings derived from our reexaminations are highly informative for future research since we largely updated the US samples compared with those in Hansen and Singleton (1982). Nevertheless, since new researches are also emerging (e.g., Park, 2014; Kwan et al., 2015; Boons, 2016), further investigation by using other data and other models is one of our future tasks.

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