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Re-exploring the CCAPM: The Case of US Industry Returns with Different Price Deflators

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Abstract

Extending US samples, this paper re-examines the classic consumption-based capital asset pricing model (CCAPM) by the generalized method of moments (GMM). Our re-exploration using US three industry returns and different price deflators supplies the following evidence. First, 1) regarding the CCAPM using the US consumption for nondurable goods and the deflator of total personal consumption expenditures (PCEs), the discount rate and risk aversion parameters show plausible values; and according to the *J*-tests, our above first CCAPM is generally supported. Second, 2) as for the CCAPM with the US consumption for nondurable goods and services and the deflator of total PCEs, both discount rate and risk aversion parameters generally exhibit plausible values and our *J*-tests show that our above second CCAPM is highly supported. Third, 3) as for the CCAPM using the US consumption for nondurable goods and the deflator of the PCEs for nondurable goods, both parameters of the discount rate and risk aversion are highly stable and our *J*-tests indicate that our above third CCAPM is highly supported. Finally, 4) as regards the CCAPM using the US consumption for nondurable goods and services and the calculated implicit deflator of the PCEs for nondurable goods and services, the parameters of the discount rate generally exhibit plausible values, while the risk aversion parameters are not so stable. However, according to the *J*-tests, our above fourth CCAPM is also highly supported.

Keywords: asset pricing, CCAPM, GMM

1. Introduction

For understanding asset pricing mechanisms, employing the approach of generalized method of moments (GMM) (Hansen, 1982; Hansen and Singleton, 1982) is effective because by this, we are able to focus on the pricing kernels of asset pricing models (see, e.g., Epstein and Zin, 1991; Campbell and Cochrane, 1999). On the ground that it forms an essential foundation for asset pricing models in financial economics, the basic consumption-based capital asset pricing model (CCAPM) is also crucial.

From the above two viewpoints, it is valuable to re-explore the classical CCAPM by applying the GMM estimation method. Based on this motivation, in this paper, we re-test the traditional CCAPM by expanding US samples and employing Hansen and Singleton's (1982) GMM. Our exploration using US three industry returns and different price deflators supplies the following evidence. First, 1) as regards the CCAPM using the US consumption for nondurable goods and the deflator of total personal consumption expenditures (PCEs), the discount rate and risk aversion parameters exhibit plausible values; and according to the *J*-tests, our above first CCAPM is generally supported. Second, 2) as to the CCAPM with the US consumption for nondurable goods and services and the deflator of total PCEs, both discount rate and risk aversion parameters generally show plausible values and our *J*-tests indicate that our above second CCAPM is highly supported. Third, 3) as for the CCAPM using the US consumption for nondurable goods and the deflator of the PCEs for nondurable goods, both parameters of the discount rate and risk aversion are highly stable; and our *J*-tests indicate that our above third CCAPM is highly supported. Finally, 4) regarding the CCAPM using the US consumption for nondurable goods and services and the calculated implicit deflator of the PCEs for nondurable goods and services, the parameters of the discount rate generally show plausible values, while the risk aversion parameters are not so stable. However, according to the *J*-tests, our above fourth CCAPM is also highly supported. Regarding the rest of this paper, Section 2 reviews past studies; Section 3 describes our data and variables; Section 4 explains our method; Section 5 documents our results; and Section 6 presents our conclusions.

2. Literature Review

This section briefly reviews existing studies. There are many past interesting studies that analyzed consumption-based asset pricing models theoretically and empirically. They are such studies as those by Epstein and Zin (1991), Campbell (1996), and Lettau and Ludvigson (2001), for example. Campbell (1996) attempted better understanding of risk and return in asset pricing and Hansen et al. (2007) also attempted clearer understanding for the intertemporal substitution and risk aversion in the asset pricing framework.

An interesting paper by Epstein and Zin (1991) suggested that separating the relative risk aversion parameter and the elasticity of intertemporal substitution parameter could be a solution of the so-called, 'risk-free rate puzzle.' In a study by Bansal and Yaron (2004), they modeled dividend growth rates and consumption while maintaining the linkages of preferences shown in Epstein and Zin (1991). They suggested their model was supported by actual data and could explain the dynamic evolution of asset markets.

Further, Campbell and Cochrane (1999) proposed a consumption-based asset pricing model, and their model incorporated the time-varying risk aversion and habit formation. Lettau and Ludvigson (2001) analyzed the variable of consumption-wealth ratio, a cointegrating residual for consumption, asset wealth, and labor income. They included this variable in the pricing kernel of their asset pricing model.

From the methodological viewpoints, although there are some papers that criticized empirical studies that tested asset pricing models (see, e.g., Lewellen and Nagel, 2006; Nagel and Singleton, 2011), the GMM approach proposed by Hansen and Singleton (1982) is indeed economically meaningful. Hence, in this paper, we conduct re-examinations of the CCAPM by extending US samples, employing their methodology, and applying different price deflators in below sections.

Table 1. Descriptive statistics for real industry returns and consumption in the US

Panel A. The case using the deflator of the total PCEs					
Statistics for the full sample period from February 1959 to December 2009					
	RCHEMT	RTRANST	RRTAILT	NDT	NDST
Mean	1.0058	1.0060	1.0073	5630.3945	17803.9778
Maximum	1.2159	1.1830	1.2644	7686.6118	29380.8496
Minimum	0.7167	0.7177	0.7050	4084.8268	8777.9915
Standard deviation	0.0547	0.0584	0.0551	866.4898	6197.8037
Skewness	−0.1384	−0.2456	−0.2043	0.2318	0.3530
Excess kurtosis	2.3310	1.2244	2.0646	−0.2796	−1.0403
Observations	611	611	611	611	611
Statistics for the first sub-sample period from February 1959 to December 1978					
	RCHEMT	RTRANST	RRTAILT	NDT	NDST
Mean	1.0018	1.0029	1.0035	4822.6642	11665.3346
Maximum	1.1963	1.1830	1.2644	5656.0585	15140.1583
Minimum	0.8123	0.8148	0.8190	4084.8268	8777.9915
Standard deviation	0.0504	0.0606	0.0531	490.1623	1906.9826
Skewness	0.2300	0.0775	0.0809	−0.1370	0.0560
Excess kurtosis	1.5773	0.5800	2.5925	−1.3974	−1.2838
Observations	239	239	239	239	239
Statistics for the second sub-sample period from January 1975 to December 1994					
	RCHEMT	RTRANST	RRTAILT	NDT	NDST
Mean	1.0088	1.0097	1.0109	5632.3416	17207.5538
Maximum	1.1963	1.1746	1.2644	5928.6829	21160.3982
Minimum	0.7167	0.7177	0.7050	5223.5344	13360.8432
Standard deviation	0.0558	0.0592	0.0601	152.0264	2326.4561
Skewness	−0.2700	−0.4520	−0.1179	−0.2594	0.11511
Excess kurtosis	3.0464	2.4754	3.1299	−0.5805	−1.3914
Observations	240	240	240	240	240
Statistics for the third sub-sample period from January 1990 to December 2009					
	RCHEMT	RTRANST	RRTAILT	NDT	NDST
Mean	1.0067	1.0060	1.0074	6431.8368	24413.7949
Maximum	1.2159	1.1403	1.1392	7686.6118	29380.8496
Minimum	0.7960	0.8323	0.8518	5678.5123	19541.5386
Standard deviation	0.0562	0.0527	0.0532	611.0340	3350.3895
Skewness	−0.0823	−0.3859	−0.1263	0.4041	0.0512
Excess kurtosis	2.0108	0.7649	0.2356	−1.2381	−1.4656
Observations	240	240	240	240	240

Panel B. The case using the deflator of the PCEs for nondurable goods or the computed implicit deflator of the PCEs for nondurable goods and services				
Statistics for the full sample period from February 1959 to December 2009				
	CHEMND	TRANSND	RTAILND	CHEMNDS
Mean	1.0060	1.0062	1.0075	1.0056
Maximum	1.2044	1.1838	1.2661	1.2154
Minimum	0.7178	0.7188	0.7061	0.7168
Standard deviation	0.0551	0.0591	0.0559	0.0547
Skewness	−0.1332	−0.2549	−0.1948	−0.1326
Excess kurtosis	2.0937	1.2062	1.9336	2.3249
Observations	611	611	611	611
	TRANSNDS	RTAILNDS	ND	NDS
Mean	1.0058	1.0071	5306.0743	19320.5214
Maximum	1.1847	1.2626	7504.9700	29525.9610
Minimum	0.7178	0.7051	3545.6770	10110.4900
Standard deviation	0.0584	0.0551	1106.0018	5922.1236
Skewness	−0.2423	−0.2048	0.3058	0.1788
Excess kurtosis	1.2244	2.0443	−0.9082	−1.1770
Observations	611	611	611	611
Statistics for the first sub-sample period from February 1959 to December 1978				
	CHEMND	TRANSND	RTAILND	CHEMNDS
Mean	1.0019	1.0030	1.0036	1.0017
Maximum	1.1984	1.1838	1.2661	1.1955
Minimum	0.8066	0.8154	0.8130	0.8113
Standard deviation	0.0510	0.0611	0.0538	0.0504
Skewness	0.2241	0.0636	0.0520	0.2401
Excess kurtosis	1.6433	0.5800	2.5516	1.6010
Observations	239	239	239	239
	TRANSNDS	RTAILNDS	ND	NDS
Mean	1.0029	1.0034	4224.4464	13287.1220
Maximum	1.1847	1.2626	4961.3925	17036.0551
Minimum	0.8151	0.8177	3545.6770	10110.4900
Standard deviation	0.0605	0.0531	419.2764	2068.9618
Skewness	0.0795	0.0771	−0.2489	0.0404
Excess kurtosis	0.5881	2.5449	−1.3451	−1.2695
Observations	239	239	239	239
Statistics for the second sub-sample period from January 1975 to December 1994				
	CHEMND	TRANSND	RTAILND	CHEMNDS
Mean	1.0095	1.0105	1.0117	1.0086
Maximum	1.1984	1.1784	1.2661	1.1955
Minimum	0.7178	0.7188	0.7061	0.7168
Standard deviation	0.0563	0.0598	0.0607	0.0558
Skewness	−0.2695	−0.4497	−0.1181	−0.2645
Excess kurtosis	2.9772	2.4170	3.0301	3.0318
Observations	240	240	240	240
	TRANSNDS	RTAILNDS	ND	NDS
Mean	1.0096	1.0108	5201.1036	19069.1032
Maximum	1.1744	1.2626	5874.6897	23006.3817
Minimum	0.7178	0.7051	4421.2792	15113.1622
Standard deviation	0.0592	0.0601	386.2474	2336.7731
Skewness	−0.4524	−0.1214	−0.0965	0.0912
Excess kurtosis	2.4567	3.1037	−1.3572	−1.4036
Observations	240	240	240	240
Statistics for the third sub-sample period from January 1990 to December 2009				
	CHEMND	TRANSND	RTAILND	CHEMNDS
Mean	1.0068	1.0061	1.0074	1.0063
Maximum	1.2044	1.1399	1.1408	1.2154
Minimum	0.8120	0.8322	0.8525	0.7964
Standard deviation	0.0566	0.0537	0.0543	0.0562
Skewness	−0.0807	−0.4160	−0.1007	−0.0789
Excess kurtosis	1.5087	0.8223	0.1211	1.9916
Observations	240	240	240	240

	TRANSNDS	RTAILNDS	ND	NDS
Mean	1.0057	1.0070	6451.2555	25625.7685
Maximum	1.1402	1.1388	7504.9700	29525.9610
Minimum	0.8317	0.8518	5477.0453	21406.8489
Standard deviation	0.0527	0.0532	639.1300	2741.2816
Skewness	−0.3840	−0.1262	0.0249	−0.0735
Excess kurtosis	0.7632	0.2339	−1.4329	−1.4613
Observations	240	240	240	240

Notes. This table displays the descriptive statistics of the variables used for the analyses in this study. In this research, we have three sub-sample periods with a full sample period.

3. Data and Variables

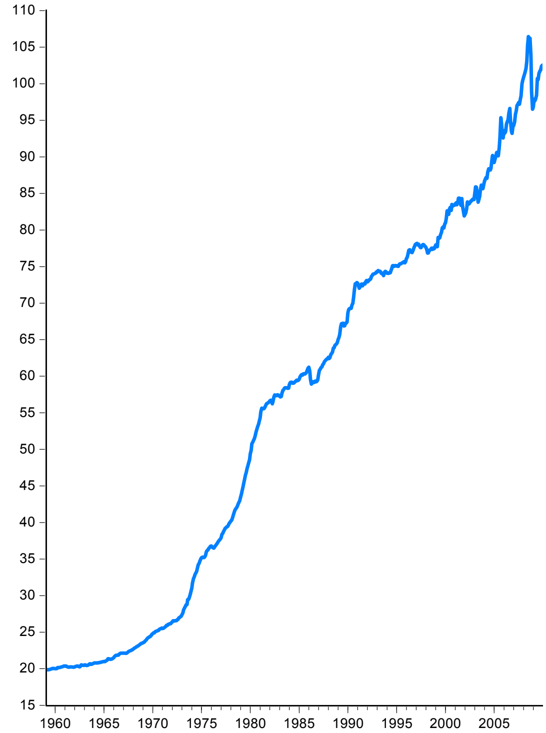
This section explains data and variables for our study. Using the data of consumption, stock returns, and price deflators in the US, we construct the variables for our tests. First, as to the consumption variables, NDT is the seasonally-adjusted real per capita US PCEs for nondurable goods, which is deflated by the seasonally-adjusted deflator of the US total PCEs. ND represents the seasonally-adjusted real per capita US PCEs for nondurable goods, which is deflated by the seasonally-adjusted deflator of the US PCEs for nondurable goods. In addition, NDS denotes the seasonally-adjusted real per capita US PCEs for nondurable goods and services, which is deflated by the corresponding implicit deflator that we computed from the seasonally-adjusted deflator as to the US PCEs for nondurable goods and the seasonally-adjusted deflator as to the US PCEs for services. This is because the exact corresponding deflator for the US PCEs for nondurable goods and services was not available.

Second, as for the stock return variables, RCHEMT denotes the real US chemical industry stock return deflated by the seasonally-adjusted deflator of the US total PCEs. RTRANST denotes the real US transportation industry stock return deflated by the seasonally-adjusted deflator of the US total PCEs. RRTAILT denotes the real US retail industry stock return deflated by the seasonally-adjusted deflator of the US total PCEs. Further, RCHEMND means the real US chemical industry stock return deflated by the seasonally-adjusted deflator of the US PCEs for nondurable goods. RTRANSND denotes the real US transportation industry stock return deflated by the seasonally-adjusted deflator of the US PCEs for nondurable goods. RRTAILND denotes the real US retail industry stock return deflated by the seasonally-adjusted deflator of the US PCEs for nondurable goods.

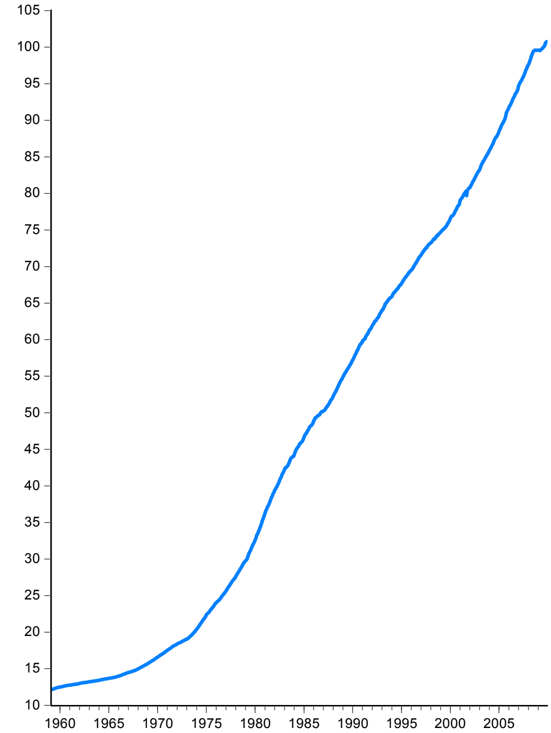
Moreover, RCHEMNDS means the real US chemical industry stock return deflated by the corresponding implicit deflator that we computed from the seasonally-adjusted deflator as to the US PCEs for nondurable goods and the seasonally-adjusted deflator as to the US PCEs for services. RTRANSNDS denotes the real US transportation industry stock return deflated by the corresponding implicit deflator that we computed from the seasonally-adjusted deflator as to the US PCEs for nondurable goods and the seasonally-adjusted deflator as to the US PCEs for services. Finally, RRTAILNDS denotes the real US retail industry stock return deflated by the corresponding implicit deflator that we computed as explained above.

In this study, our US samples are monthly and the full sample period spans February 1959 to December 2009. In addition, the first sub-sample period spans February 1959 to December 1978, the second sub-sample period spans January 1975 to December 1994, and the third sub-sample period spans January 1990 to December 2009. Four time-series of our four kinds of deflators of the US PCEs for the above full sample period are exhibited in Panels A to D of Figure 1. Moreover, Table 1 displays the descriptive statistics of the variables we explained above. This table shows that the skewness values for the three US stock returns are generally negative except for those values in our first sub-sample period. Second, excess kurtosis values of the three kinds of US stock returns are higher in our second sub-sample period.

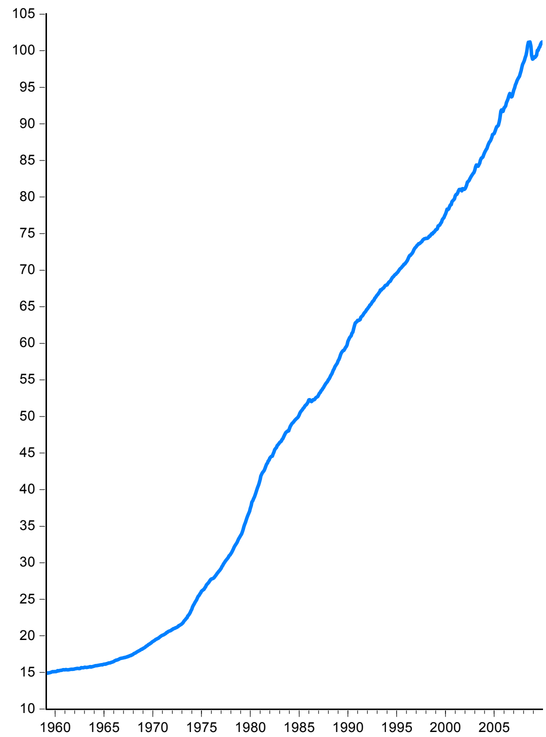
Panel A. The price deflator of personal consumption expenditures for nondurable goods



Panel B. The price deflator of personal consumption expenditures for services



Panel C. The calculated implicit corresponding deflator of personal consumption expenditures for nondurable goods and services



Panel D. The price deflator of total personal consumption expenditures

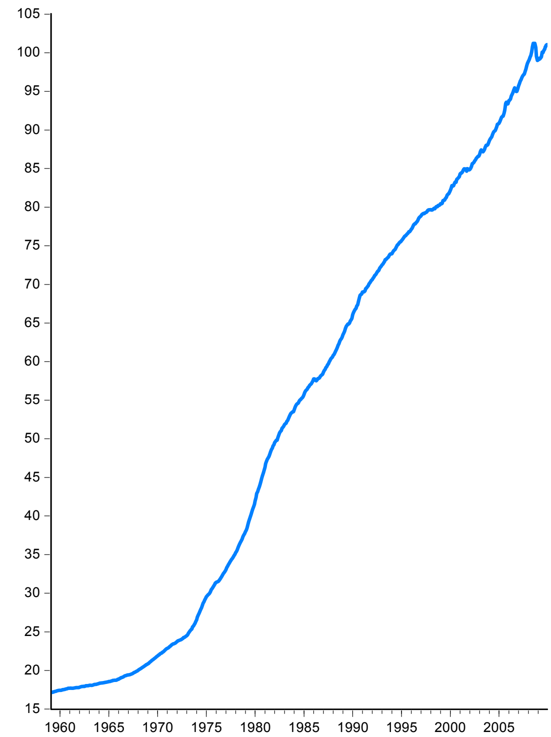


Figure 1. Three price deflators and a computed implicit deflator of the US personal consumption expenditures for testing the CCAPM in the US

4. Testing Method

Using the above data and the following specification by Hansen and Singleton (1982), we re-explore the traditional CCAPM in the US by updating sample periods.

$$E\left\{\left[\delta(v_{2t+1})^{\gamma}\mathbf{v_{1t+1}}-1\right]\otimes\mathbf{z_t}\right\}=0 \tag{1}$$

In the above system (1), $\mathbf{v_{1t+1}}$ is the vector of three industry returns and v_{2t+1} means the growth of consumption. Moreover, γ is the parameter of risk aversion and δ is the parameter of the discount rate. Further, $\mathbf{z_t}$ is the vector of instrument variables and $\otimes$ means the Kronecker product.

Applying the above system, we estimate the CCAPMs by using 1) RCHEMT, RTRANST, RRTAILT, and NDT and 2) RCHEMT, RTRANST, RRTAILT, and NDST. We next estimate the CCAPMs by using 3) RCHEMND, RTRANSND, RRTAILND, and ND and 4) RCHEMNDS, RTRANSNDS, RRTAILNDS, and NDS. As for the instrument variables, following Hansen and Singleton (1982), lags of consumption growth and the corresponding stock return variables in each case are used. We set the lag order of instrumental variables as 1, 2, 4, or 6 as the analyses in Hansen and Singleton (1982).

5. Results

We first explain the estimation results of the CCAPM for our three US industry returns by using one deflator of total PCEs for the US. First, as to the CCAPM with PCEs for nondurable goods, Table 2 shows that 1) the discount rate parameters are always estimated as the values that are slightly below one with no exception. In addition, Table 2 also suggests that 2) the risk aversion parameters in the models generally take small negative values stably except for the only one case in Panel A of Table 2. Moreover, all the above estimated CCAPMs with PCEs for nondurable goods by using the deflator of the total PCEs in the US are always supported by the *J*-tests except for the three cases in Panel A of Table 2. Thus, our above first CCAPM for the three industry returns is considered to be generally well estimated.

We next explain the estimation results of our second CCAPM for the three US industry returns by using one deflator of total PCEs for the US. Namely, regarding the CCAPM with PCEs for nondurable goods and services, Table 2 shows that 1) the discount rate parameters are always estimated as the values that are slightly below one except for the one case in Panel B and the one case in Panel D. In addition, Table 2 also suggests that 2) the risk aversion parameters in the models generally take small negative values stably except for the two cases in Panel B and the three cases in Panel D of Table 2. Moreover, all the above estimated CCAPMs with PCEs for nondurable goods and services by using the deflator of the US total PCEs are always supported by the *J*-tests except for the only one case in Panel A of Table 2. Thus, our above second CCAPM for the three industry returns is considered to be rather well estimated.

Moreover, we document the estimation results of the CCAPM for the three US industry returns by using the deflator of the PCEs for nondurable goods or the implicit deflator of the PCEs for nondurable goods and services in the US. First, as for the CCAPM with PCEs for nondurable goods, Table 3 shows that 1) the discount rate parameters are always estimated as the values that are slightly below one with no exception. In addition, Table 3 also suggests that 2) the risk aversion parameters in the models generally take small negative values stably with no exception. Moreover, all the above estimated CCAPMs with PCEs for nondurable goods by using the deflator of the PCEs for nondurable goods are always supported according to the results of the *J*-tests except for the only one case in Panel A of Table 3. Hence, our above third CCAPM for the three industry returns is considered to be very well estimated.

Furthermore, as for the CCAPM with the computed implicit deflator of the US PCEs for nondurable goods and services, Table 3 shows that 1) the discount rate parameters are always estimated as the values that are slightly below one except for the one case in Panel B and the one case in Panel D of Table 3. Further, Table 3 also suggests that 2) the risk aversion parameters in the models generally take small negative values stably except for the one case in Panel A, three cases in Panel B, and three cases in Panel D of Table 3. Moreover, all the above estimated CCAPMs with PCEs for nondurable goods and services by using the calculated implicit deflator of the US PCEs for nondurable goods and services are always supported by the *J*-tests except for the only one case in Panel A of Table 3. Thus, our above fourth CCAPM for the three industry returns is considered to be very well modeled; however, as we explained, risk aversion parameters are somewhat unstable. We consider that this might be because of the goodness of fit of the deflator.

Table 2. Estimation results of the CCAPMs in the US: The case using the deflator of total PCEs

	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
Panel A. Results for the full sample period from February 1959 to December 2009								
The case of the PCEs for nondurable goods								
ND	1	0.9937**	0.0000	−0.2223	0.7946	29.2063**	13	0.0061
ND	2	0.9933**	0.0000	0.1792	0.8217	36.9981	25	0.0578
ND	4	0.9937**	0.0000	−0.3175	0.6725	70.6627*	49	0.0230
ND	6	0.9937**	0.0000	−0.4499	0.5162	96.9233*	73	0.0321
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9972**	0.0000	−1.9136	0.3931	24.5053*	13	0.0268
NDS	2	0.9954**	0.0000	−0.9557	0.6603	34.8975	25	0.0901
NDS	4	0.9941**	0.0000	−0.3334	0.8331	56.9362	49	0.2037
NDS	6	0.9945**	0.0000	−0.5921	0.6890	81.6083	73	0.2294
Panel B. Results for the first sub-sample period from February 1959 to December 1978								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9984**	0.0000	−0.7005	0.4439	14.1470	13	0.3636
ND	2	0.9981**	0.0000	−0.3421	0.6704	20.8734	25	0.6996
ND	4	0.9981**	0.0000	−0.3912	0.6141	43.8749	49	0.6804
ND	6	0.9986**	0.0000	−0.9269	0.1785	79.7677	73	0.2748
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9981**	0.0000	−0.2395	0.9287	12.5675	13	0.4817
NDS	2	0.9974**	0.0000	0.1513	0.9437	19.1428	25	0.7902
NDS	4	0.9973**	0.0000	0.1563	0.9328	41.4042	49	0.7712
NDS	6	1.0022**	0.0000	−2.0889	0.1944	76.6985	73	0.3609
Panel C. Results for the second sub-sample period from January 1975 to December 1994								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9912**	0.0000	−0.3862	0.7596	14.9832	13	0.3084
ND	2	0.9916**	0.0000	−0.7759	0.5219	22.6128	25	0.6002
ND	4	0.9918**	0.0000	−1.6882	0.1701	50.4528	49	0.4158
ND	6	0.9912**	0.0000	−1.0568	0.3035	76.3930	73	0.3701
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9933**	0.0000	−1.1315	0.6640	14.0852	13	0.3679
NDS	2	0.9932**	0.0000	−1.0460	0.6849	23.7750	25	0.5324
NDS	4	0.9942**	0.0000	−1.5468	0.4606	51.5654	49	0.3738
NDS	6	0.9942**	0.0000	−1.7875	0.3608	76.7737	73	0.3587
Panel D. Results for the third sub-sample period from January 1990 to December 2009								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9931**	0.0000	−0.2003	0.9068	15.0487	13	0.3043
ND	2	0.9930**	0.0000	−0.1134	0.9351	28.5825	25	0.2817
ND	4	0.9930**	0.0000	−0.2903	0.8133	59.9748	49	0.1353
ND	6	0.9923**	0.0000	−0.0657	0.9520	86.1224	73	0.1398
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	1.0091**	0.0000	−10.2178	0.2678	8.1325	13	0.8349
NDS	2	0.9836**	0.0000	5.8770	0.2351	21.5928	25	0.6591
NDS	4	0.9874**	0.0000	3.4213	0.2487	44.3220	49	0.6630
NDS	6	0.9883**	0.0000	2.5768	0.3425	71.4744	73	0.5286

Notes: ** and * indicate the statistical significance of the parameter or the chi-squared statistic at the 1% and 5% levels, respectively.

Table 3. Estimation results of the CCAPMs in the US: The case using the deflator of the PCEs for nondurable goods or the implicit deflator of the PCEs for nondurable goods and services

	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
Panel A. Results for the full sub-sample period from February 1959 to December 2009								
The case of the PCEs for nondurable goods								
ND	1	0.9943**	0.0000	−0.8642	0.2104	27.2758*	13	0.0114
ND	2	0.9942**	0.0000	−0.7915	0.2078	36.5553	25	0.0636
ND	4	0.9944**	0.0000	−0.9654	0.1117	58.7730	49	0.1600
ND	6	0.9944**	0.0000	−1.1003	0.0608	81.9297	73	0.2220
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9980**	0.0000	−2.5097	0.3695	24.8483*	13	0.0242
NDS	2	0.9946**	0.0000	−0.5198	0.8459	36.8570	25	0.0596
NDS	4	0.9935**	0.0000	0.1103	0.9523	57.7984	49	0.1822
NDS	6	0.9941**	0.0000	−0.2847	0.8685	82.1183	73	0.2177
Panel B. Results for the first sub-sample period from February 1959 to December 1978								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9984**	0.0000	−0.6955	0.4443	14.0743	13	0.3686
ND	2	0.9983**	0.0000	−0.4373	0.5858	21.2250	25	0.6800
ND	4	0.9985**	0.0000	−0.6996	0.3419	45.6964	49	0.6079
ND	6	0.9994**	0.0000	−1.4630*	0.0262	75.9359	73	0.3841
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9960**	0.0000	0.7480	0.8482	12.7481	13	0.4675
NDS	2	0.9958**	0.0000	0.8868	0.7617	19.2305	25	0.7859
NDS	4	0.9965**	0.0000	0.5926	0.8052	41.1623	49	0.7794
NDS	6	1.0036**	0.0000	−2.7621	0.1854	75.0508	73	0.4117
Panel C. Results for the second sub-sample period from January 1975 to December 1994								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9915**	0.0000	−0.9813	0.3695	15.4671	13	0.2791
ND	2	0.9920**	0.0000	−1.2461	0.2171	22.9298	25	0.5817
ND	4	0.9923**	0.0000	−1.6328	0.1069	50.8579	49	0.4003
ND	6	0.9916**	0.0000	−1.3066	0.1561	76.6579	73	0.3621
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	0.9936**	0.0000	−1.3716	0.6173	14.2927	13	0.3536
NDS	2	0.9932**	0.0000	−1.0379	0.7007	25.2902	25	0.4462
NDS	4	0.9938**	0.0000	−1.3768	0.5296	52.3584	49	0.3450
NDS	6	0.9941**	0.0000	−1.7774	0.3863	78.0380	73	0.3218
Panel D. Results for the third sub-sample period from January 1990 to December 2009								
The case of the PCEs for nondurable goods								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
ND	1	0.9930**	0.0000	−0.1573	0.9145	9.4261	13	0.7401
ND	2	0.9934**	0.0000	−0.5622	0.6499	22.0673	25	0.6319
ND	4	0.9929**	0.0000	−0.0821	0.9450	45.0890	49	0.6324
ND	6	0.9925**	0.0000	−0.1814	0.8736	72.2805	73	0.5018
The case of the PCEs for nondurable goods and services								
	NLAG	δ	*p*-value	γ	*p*-value	χ^2	DF	*p*-value
NDS	1	1.0031**	0.0000	−8.1912	0.3250	8.4063	13	0.8162
NDS	2	0.9859**	0.0000	6.0897	0.2369	21.5738	25	0.6602
NDS	4	0.9887**	0.0000	3.7534	0.2326	43.8221	49	0.6825
NDS	6	0.9892**	0.0000	2.9895	0.2950	70.4959	73	0.5613

Notes: ** and * indicate the statistical significance of the parameter or the chi-squared statistic at the 1% and 5% levels, respectively.

6. Summary and Conclusions

By extending US samples, this paper empirically re-examined the traditional CCAPMs with GMM. Our re-exploration using US three industry returns and different price deflators supplied the following evidence. First, 1) regarding the CCAPM using the US consumption for nondurable goods and the deflator of total PCEs, the discount rate parameters presented plausible values. In addition, their risk aversion parameters in the models also well exhibited plausible values. Moreover, according to the *J*-tests, the estimated CCAPMs for US three industry returns, which used the consumption for nondurable goods and the deflator of total PCEs, were generally supported. Second, 2) with regard to the CCAPM with the US consumption for nondurable goods and services and the deflator of total PCEs, the parameters of both the discount rate and risk aversion generally exhibited plausible values. Moreover, according to the *J*-test results, the estimated CCAPMs using the consumption for nondurable goods and services and the deflator of total PCEs were highly supported.

Third, 3) as to the CCAPM using the US consumption for nondurable goods and the deflator of the PCEs for nondurable goods, both the parameters of the discount rate and the risk aversion were highly stable. In addition, according to the *J*-test results, the estimated CCAPMs with the US consumption for nondurable goods and the deflator of PCEs for nondurable goods in the US were highly supported. Finally, 4) with regard to the CCAPM using the US consumption for nondurable goods and services and the calculated implicit deflator of the PCEs for nondurable goods and services, the parameters of the discount rate generally exhibited plausible values, while the risk aversion parameters were not so stable. However, according to the *J*-test results, the estimated CCAPMs with the US consumption for nondurable goods and services and the calculated implicit deflator of PCEs for nondurable goods and services in the US were highly supported.

As above, in the US, the CCAPMs using consumption for nondurable goods were generally better than the CCAPMs using consumption for nondurable goods and services. In addition, we note that the CCAPMs using consumption for nondurable goods and the deflator of the PCEs for nondurable goods were better than the CCAPMs with consumption for nondurable goods and the deflator of total PCEs. We consider that the differences of our estimation results may be because of the goodness of fit of the deflators. This is one of the very interesting findings and implications from our present study. As this paper demonstrated, Hansen and Singleton's (1982) GMM methodology matters in asset pricing research, and many extended consumption-based models and studies have recently emerged (e.g., Dreyer et al., 2013; Ghonghadze and Lux, 2016). Further investigations with this methodology and various other viewpoints are our future works.

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