FINC 688 Empirical Asset Pricing- Homework 1

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1 Data

NIPA expenditure on nondurable goods and services was measured on a real per-capita basis. The data was obtained from the Fred website. The excess market return that was used was obtained from Ken French's website. Cay was obtained from Martin Lettau's website. Price to Dividends was obtained from CRSP. The 25 FF portfolios were obtained from Ken French's website. nThe market return and consumption number from Tim Kroencke's website were also used in testing. Using his variables in the models gave closer results to the literature.

2 Coding Methodology

Please see the attached directory in the document for all code and results. The data folder contains the data in CSV format for the assignment. The $Programming\_code$ directory contains Matlab code used for the actual generation of the results and different GMM models. The $programming\_code\_python$ directory contains the code for cleaning the data from the various sources so that everything is on the same time dimension. Results contain the output from each exercise. All results for an exercise are in one table for easy reading.

The optimization scheme used was slightly different than what was used in the notes. Using Newton's method was not a great solution as it was extremely sensitive to the starting point. I implemented a two-stage optimization where I first did a grid search of the parameter set to find a solution. With this parameter set the $NelderMead$ method was used to find the local minimum. For problem 1 the results of this methodology were the same as using the "canned" $fmin\_custom$. Problem 2 the results were similar but extremely sensitive to assumptions such as the initially specified tolerance.

Exercise Descriptive Statistics

Stat	consumption	mkt-rf	lagged consumption	cay	log price to divided de-meaned
mean	1.0197	0.0578	1.0198	1.0016	1.0774
median	1.0207	0.0919	1.0207	1.004	0.9293
std	0.0134	0.17	0.0133	0.0191	0.473
corr	0.04	1	-0.3	0.25	-0.21
autocorr(lag 1)	0.45	-0.14	0.42	0.85	0.94
Min	0.9803	-0.381	0.9803	0.9553	0.5142
Max	1.0411	0.4175	1.0411	1.0312	2.5227

Exercise 1: Classical Model under Power Utility

To test the classical model under power utility(e.g., Hansen and Singleton, 1982), let us follow Savov(2011) to fix $\beta = 0.95$ so there is only one free parameter. Since we do not have data on garbage, let us use the NIPA expenditure on nondurable goods and services measured on a real percapita basis for C, which can be obtained from the St. Louis Fed's website, and the data from Tim Kroencke's website may be useful as well.To make things easier, you can use an annual frequency for your data

Part	gamma hat	tstat	se	jstat
Part 1_1	67.7217700039005	1.57560518106174E-05	4298143.39390948	0.032036077173163
Part 1_2	79.3760699922988	8.29508058849271	9.56905350653406	4.48817081206163
Part 1_3	125.022280132639	9.16689554069182	13.6384536703473	22.9912149935995

The estimates of risk aversion range from 67 for the test with no instruments to approximately 79 and 125 for 1.2 and 1.3. In part 1 the j-statistic with large standard error indicates that we fail to reject the null hypothesis. The J-statistic does increase from 1.2 to 1.3, however, the t-stat increases. Both have significant *tstats*. The estimates overall for risk aversion are slightly lower than what was published but in the range of acceptability. Obviously, risk aversion is too high.

Exercise 2: Epstein and Zin (1991) Recursive Utility

Following the literature (e.g., Da, Yang, and Yun, 2017), we can use the market portfolio return as a proxy for $r_{a,t+1}$, which is the return on the market consumption wealth portfolio. Now we have three parameters to estimate, delta, theta, phi, where delta is the subjective time discount factor, theta and phi are related to risk aversion and the elasticity of intertemporal substitution (EIS) as described in Epstein and Zin (1991) and Bansal and Yaron (2004).

	delta hat	theta hat	psi hat	tstat theta	se theta	jstat
Part 2_1	0.005456873543602	2.15767298818638	0.477996804299927	Inf	0	1.03114569825837E-09
Part 2_2	0.005456873543602	2.15767298818638	0.477996804299927	Inf	0	1.03114569825837E-09
Part 2_3	0.003742391944245	2.15829498642287	0.477989332863245	Inf	0	0

Exercise 2 is extremely sensitive to the optimization parameters. Using the Matlab optimization you get the above results, however, with the uncanned version of optimization the theta is very close to one with extremely small standard errors. Adding the instruments in part 3 does not change the parameters but does lower the j stat. Using a t stat where you test if theta is equal to one does not change the inference based on the optimization scheme above.

Exercise 3: Rare Disaster Model (Barro, 2006) with Alternative Consumption Data

In addition to GMM, let us also practice our calibration muscles a little bit. First, replicate Barro's (2006) Table V columns (1) and (2), using the same parameter values in the table. You do not need to replicate the bottom panel of "Levered results". How close is your replication to

the original values in the table? What if we change the value of sigma (0.02 in the table) to the value reported in Savor's (2011) paper? Briefly discuss.

Part	Part 3_1	Part 3_2	Part 3_3
Expected equity rate	0.1284	0.063053641547741	0.061335881547741
Expected bill rate	0.1268	0.033869516808934	0.030433996808934
Equity premium	0.0016	0.029184124738807	0.030901884738807
PE	9.68992248062015	23.3734194618317	24.4791081113164
Face Bill Rate	0.1268	0.035841516808934	0.032405996808934
Equity premium conditional	0.0016	0.032142124738807	0.033859884738807
growth rate	0.0252	0.02027	0.02048472
growth rate conditional	0.0252	0.0252	0.02541472
equity rate conditional	0.1284	0.067983641547741	0.066265881547741

I was able to match column 1 exactly with the paper. Part 2 is off slight but you do see that the equity premium increase and the same general trends as what is seen in the paper. Obviously the equation is highly nonlinear, which explains the difference between the two columns. Using the larger consumption volatility you do see the equity premium increase as predicted but the Barro model.

7 References

Bansal, Ravi, and Amir Yaron, 2004, Risks for the long run: A potential resolution of asset pricing puzzles, Journal of Finance 59, 1481–1509.

Barro, Robert, 2006, Rare disasters and asset markets in the twentieth century, QJE.

Becker, Gary, 1965, A theory of the allocation of time. The Economic Journal 75, 493-517.

Da, Zhi, Wei Yang, and Hayong Yun, 2017. Household Production and Asset Prices, Management Science.

Epstein, Larry,and Stan Zin, 1991, Substitution, risk aversion and the temporal behavior of asset returns, Journal of Political Economy99,263-286.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, Journal of Financial Economics 33, 3–56.

Ferson, W. E. and G. M. Constantinides,1991,Habit persistence and durability in aggregate consumption. Journal of Financial Economics29, 199.

Hansen, Lars P. and Kenneth J. Singleton, 1982, Generalized instrumental variables estimation of nonlinear rational expectations models, Econometrica50, 1269-1288.

Kroenck, Tim, 2017, Asset pricing without garbage, Journal of Finance

Lettau, Martin, and Sydney Ludvigson, 2001, Resurrecting the (c)CAPM: A cross-sectional test when risk premia are time-varying, Journal of Political Economy 109, 1238–1287.

Savov, Alexi. 2011. Asset pricing with garbage. Journal of Finance66,177-201.