vrije Universiteit amsterdam

School of Business and Economics

STUDENT NAME:
STUDENT NUMBER:

Exam:	Asset Pricing
Code:	E_FIN_AP
Examinator:	Prof.dr. Remco C.J. Zwinkels
Co-reader:	Prof.dr. H. Rijken
Date:	December 9, 2019
Time:	08:45 – 11:30
Duration:	2 hours and 45 minutes
Calculator allowed:	Yes
Graphical calculator allowed:	Yes
Number of questions:	6
Type of questions:	Open
Answer in:	English

Remarks: Give your answer in the designated boxes below the questions. Please be brief in your answers!

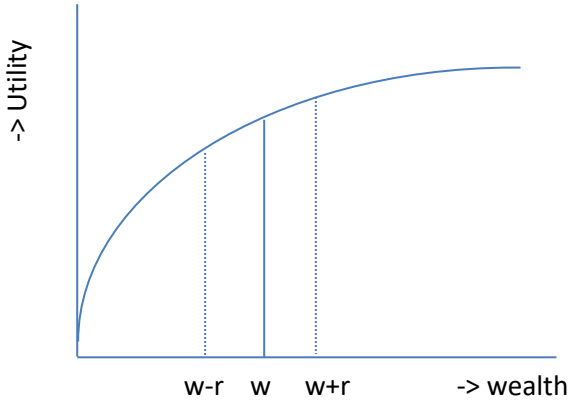
Credit score:	100 credits counts for a 10
Grades:	The grades will be made public within 10 working days.
Inspection:	On request
Number of pages:	16 (including front page)

Good luck!

Resit Asset Pricing
Master Finance - Vrije Universiteit Amsterdam
9 December 2019

Question 1: The Basics

A mean-variance utility function typically looks as follows, with wealth on the horizontal axis and utility on the vertical axis.



Assume an investor has a certain wealth w, and receives an investment opportunity that will give a pay-off of +r with 50% probability and –r with 50% probability.

a. Explain what happens with the expected utility of the investor using the figure if 1) the risk of the investment opportunity increases, and 2) the risk aversion of the investor increases (6 points).

1) Increasing risk implies that r increases, such that the vertical dotted lines will be further apart. Agents are risk averse, so increased risk will lead to lower expected return (3 points)
2) Increasing risk aversion means that the curve will become more concave. More concave curve, more risk aversion, given a certian amount of risk+return leads to lower expected return (3 points)

The most widely used method to test whether certain variables are related to expected stock returns, is the Fama and MacBeth (1973) method. The estimation model (second stage, cross-sectional) is given by

$$\tilde{R}_{it} = \tilde{\gamma}_{0t} + \tilde{\gamma}_{1t}\beta_i + \tilde{\gamma}_{2t}\beta_i^2 + \tilde{\gamma}_{3t}s_i + \tilde{\eta}_{it}.$$

In which β is the CAPM beta, *s* is idiosyncratic risk, and the γ's are the estimated coefficients.

b. Explain what is the economic interpretation of γ_1 (5 points).

Gamma_1 is the price of risk, or the risk premium.

Imagine you want to use the Fama-MacBeth method to test whether the value premium (=the book-to-market effect) is stronger or weaker for small stocks compared to large stocks.

c. Explain step-by-step how you would test the size-btm interaction effect as described above (7 points).

- Take 4 years to estimate stock-level market betas

- Sort stocks on estimated beta, and form beta portfolios

- Take the next 5 years to re-estimate betas

- Run, for each of the following months (from year 10) the following cross-sectional regression:

$r_i = \alpha + \gamma_1\beta + \gamma_2 Size + \gamma_3 BTM + \gamma_4 Size\ BTM + \varepsilon_i$

- Re-estimate betas each year.

<PLEASE TURN OVER FOR QUESTION 2>

Question 2: Factor Models

Fama and French (1992) whether size and book-to-market are related to expected returns. The table below shows the returns to 100 double-sorted portfolios on size and book-to-market.

	Book-to-Market Portfolios										
	All	Low	2	3	4	5	6	7	8	9	High
All	1.23	0.64	0.98	1.06	1.17	1.24	1.26	1.39	1.40	1.50	1.63
Small-ME	1.47	0.70	1.14	1.20	1.43	1.56	1.51	1.70	1.71	1.82	1.92
ME-2	1.22	0.43	1.05	0.96	1.19	1.33	1.19	1.58	1.28	1.43	1.79
ME-3	1.22	0.56	0.88	1.23	0.95	1.36	1.30	1.30	1.40	1.54	1.60
ME-4	1.19	0.39	0.72	1.06	1.36	1.13	1.21	1.34	1.59	1.51	1.47
ME-5	1.24	0.88	0.65	1.08	1.47	1.13	1.43	1.44	1.26	1.52	1.49
ME-6	1.15	0.70	0.98	1.14	1.23	0.94	1.27	1.19	1.19	1.24	1.50
ME-7	1.07	0.95	1.00	0.99	0.83	0.99	1.13	0.99	1.16	1.10	1.47
ME-8	1.08	0.66	1.13	0.91	0.95	0.99	1.01	1.15	1.05	1.29	1 55
ME-9	0.95	0.44	0.89	0.92	1.00	1.05	0.93	0.82	1.11	1.04	1.22
Large-ME	0.89	0.93	0.88	0.84	0.71	0.79	0.83	0.81	0.96	0.97	1.18

a. Explain for which size decile the book-to-market decile is strongest (5 points).

For ME-2 the spread between high and low is highest. Small-ME also correct.

Jegadeesh and Titman (1993) show that their momentum strategy generates much lower returns in January, on average, than in other months. They ascribe this finding to the January effect, i.e., the stock market yields higher returns in January than in other months.

b. Explain how the January effect might affect the bad returns on momentum in January (6 points).

Momentum is a long-short portfolio. The fact that momentum does bad in January, means that the SHORT leg is more sensitive to the January effect than the LONG leg.

McLean and Pontiff (2016) test whether factors are 1) risk, 2) mispricing, or 3) datamining. The do so by regressing the post-publication dummy on the excess return of each factor. In an additional test, they interact the post-publication dummy with the average size of the companies in the portfolio, and find a positive effect.

Variables	(1)	(2)	(3)	(4)
Post-Pub. (P)	−0.190	−0.139	0.215	−0.242
	(0.274)	(0.235)	(0.230)	(0.273)
P × Size	−0.138			
	(0.459)			
Size	−1.064**			
	(0.236)			
P × Spreads		−0.301		
		(0.603)		
Spreads		1.228**		
		(0.252)		
P × Dol.Vol.			−1.059*	
			(0.500)	
Dol. Vol.			0.215	
			(0.308)	
P × Idio. Risk				−0.047
				(0.554)
Idio. Risk				2.064***
				(0.330)

c. Explain why McLean and Pontiff include the size interaction term in their model (6 points).

Limits to arbitrage: Size is a proxy for implementation costs, noise trader risk, as well as idiosyncratic risk. With higher limits to arbitrage, we would expect the excess return to be more persistent because it is harder to arbitrage them away.

<PLEASE TURN OVER FOR QUESTION 3>

Question 3: Behavioral Finance

Arbitrage is a central concept within finance. Behavioral finance recognizes this, but argues that textbook arbitrage is not always perfect due to certain costs and risks: implementation costs, noise trader risk, and fundamental risk.
Momentum is a strong factor; at the same time, we do not see many products (ETFs, funds) in the industry that try to take advantage of momentum.

a. Explain which of the three limits to arbitrage might prevent investors from taking advantage of the momentum factor (6 points).

Implementation costs. Monthly rebalancing is costly for momentum, because the momentum score of a stock changes rapidly. Therefore, many transactions are necessary each month. This, for example, is different form size, which is very persistent.

One of the limits to arbitrage, 'noise trader risk', is further developed in the study by DeLong, Shleifer, Summer, and Waldman (1990). In their model, the pricing equation is given by:

$$p_t = 1 + \frac{\mu(\rho_t - \rho^*)}{1 + r} + \frac{\mu\rho^*}{r} - \frac{(2\gamma)\mu^2\sigma_\rho^2}{r(1 + r)^2}.$$

In which ρ^* is the average misperception of noise traders, r the risk-free rate, σ the variation in the misperception, and γ the risk aversion.

b. Explain whether the model of DSSW gives an explanation for momentum AND/OR mean reversion (6 points).

The model does NOT give an explanation for momentum, but it DOES explain mean reversion. Noise traders do not use momentum rules; their behavior of purely random. Therefore, no momentum. However, noise traders to push prices away from fundamentals. Because of reduced reaction of arbitrageurs, mean reversion takes longer.

In order to test the Halloween indicator, 'Sell in May and go away', Bouman and Jacobsen (2002) estimate the following equation on country-level stock indices:

$$(1) \quad r_t = \mu + \alpha_1 S_t + \varepsilon_t$$

In which *S* is a dummy that is equal to 1 in winter.

c. Explain why Bouman and Jacobsen do not (have to) control for the famous factors, such as size and book-to-market (6 points).

B&J study stock indices, the whole market per country, and not individual stocks. Therefore, there is no need to control for stock-level characteristics like size and BTM.

<PLEASE TURN OVER FOR QUESTION 4>

Question 4: Utility and Market Microstructure

Assume that my car is a BMW 5-series, my neighbor on the left has a BMW 3-series and my neighbor on the right a BMW 7-series (with 3<5<7, and 5-3=7-5).

a. Explain, based on prospect theory, how I feel about my car relative to my neighbors (5 points).

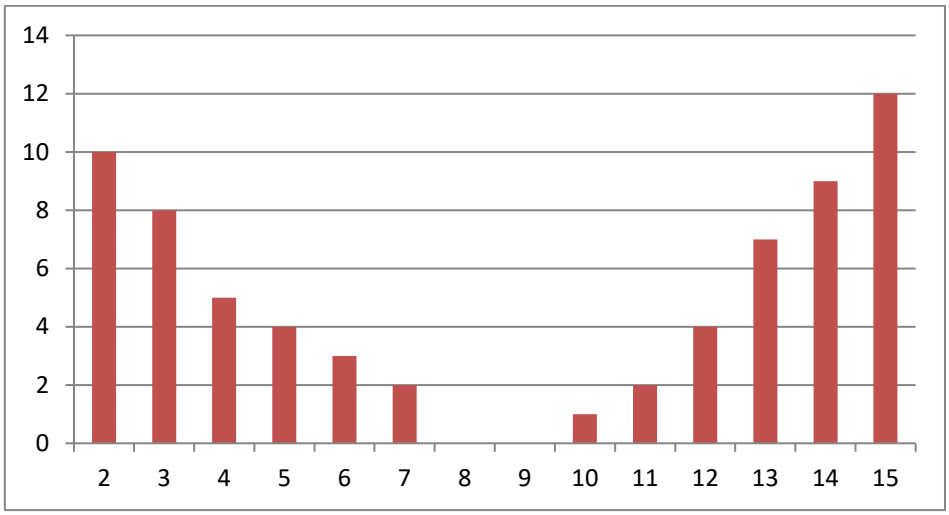
I feel bad, because the loss relative the 7-series weighs more than the gain relative the 3-series because of loss-aversion.

Apart from Prospect Theory, the distribution of stock returns also affects investor behavior.

b. Explain why you would expect the skewness of stock returns to have a larger effect on expected return than the kurtosis of stock returns (5 points).

Skewness implies asymmetry between positive and negative returns; therefore, one can expect an effect on preferences. Kurtosis, however, means more extreme returns as well as more zero returns. This is less obviously better or worse.

Consider a purely order driven market, with a certain number of quotes on both the bid and the ask price of the book; see the figure. Now assume an investor puts in a market buy order of 4 stocks, which is directly executed.



c. Explain what the market buy order does to the bid-ask spread and quoted volume, all else equal (6 points).

The market buy-order will take out the ask of €10, €11, and one unit of €12. Thefore, the bid-ask spread will increase from 7-10 to 7-12. The quoted volume reduces because there are less asks in the order book.

<PLEASE TURN OVER FOR QUESTION 5>

Question 5: Market Frictions

Pastor and Stambaugh (2003) study whether liquidity is priced in the cross-section of stock returns. They measure liquidity through the following equation:

$$r^{e}_{i,d+1,t} = \theta_{i,t} + \phi_{i,t} r_{i,d,t} + \gamma_{i,t} \text{sign}(r^{e}_{i,d,t}) \cdot v_{i,d,t} + \epsilon_{i,d+1,t}$$

In which $r_{i,d,t}$ is return of stock *i* , day *d*, month *t*, sign(x) is the sign of x, *v* is traded volume, and the estimated γ is their liquidity measure.

a. Explain why the average estimated γ is negative (5 points).

The gamma measures the mean-reversion after a given volume. If the stock is illiquid, price will react strongly, so mean reversion will be strong. In a perfectly liquid market, gamma is zero because the market will be able to absorb the volume and not impact prices.

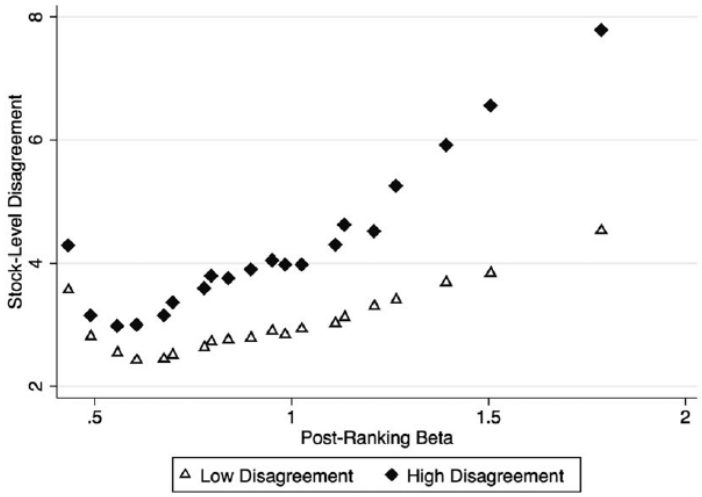
Beber and Pagano (2013) study the effect of short sale bans on market liquidity (i.e., bid-ask spread). This is what they find:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Countries	All	All	All	All	Partial Bans	Partial Bans	Partial Bans
Constant	3.93***	3.76***	4.97***	4.90***	4.20***	0.0005***	0.71***
	(1993.65)	(749.94)	(3290.72)	(3092.86)	(997.52)	(3.71)	(42.76)
Naked ban	1.28***	0.86***	0.89***	0.90***	2.43***	0.23***	0.56***
	(76.04)	(6.50)	(29.31)	(29.60)	(20.06)	(3.99)	(2.82)
Covered ban	1.98***	2.14***	1.63***	1.63***	2.75***	0.46***	1.19***
	(150.74)	(14.84)	(57.44)	(57.61)	(24.75)	(2.39)	(3.66)
Disclosure	−0.65***	−0.27**	−0.37***	−0.37***	−1.79***	−0.50***	−0.55*
	(−37.84)	(−1.84)	(−11.54)	(−11.59)	(−15.10)	(−2.25)	(−1.75)
Volatility				0.99***	−0.36***		
				(35.84)	(−14.65)		

b. Explain why the coefficient on 'disclosure' is consistently negative (5 points).

With increased disclosure, market participants have more information about the outstanding short positions. More information means less uncertainty (less adverse selection in this case) and ftherefore more liquidity (tigher bid-ask).

Hong and Sraer (2016) try to 'save' the CAPM by taking disagreement and short-sale constraints into account. They find the following relation between beta and stock-level disagreement:



c. Explain the upward sloping trend in the figure (6 points).

H&S consider disagreement about the common factor of cash flows (so: the market factor). Therefore, stocks with a higher beta (=more exposure to common cash flow/market) will experience a higher stock-level disagreement.

<PLEASE TURN OVER FOR QUESTION 6>

Question 6: Delegated Asset Management

Carhart (1997) studies the drivers of mutual fund returns, and finds:

Portfolio	Monthly Excess Return	Std Dev	CAPM Alpha	CAPM VWRF	CAPM Adj R-sq
1 (high)	0.68%	5.04%	0.22%	1.03	0.834
			(2.10)	(43.11)	
2	0.59%	4.72%	0.14%	1.01	0.897
			(1.75)	(57.00)	
3	0.43%	4.56%	−0.01%	0.99	0.931
			(−0.08)	(70.96)	
4	0.45%	4.41%	0.02%	0.97	0.952
			(0.33)	(85.70)	
5	0.38%	4.35%	−0.05%	0.96	0.960
			(−1.10)	(93.93)	
6	0.40%	4.36%	−0.02%	0.96	0.958
			(−0.46)	(91.94)	
7	0.36%	4.30%	−0.06%	0.95	0.959
			(−1.39)	(92.90)	
8	0.34%	4.48%	−0.10%	0.98	0.951
			(−1.86)	(85.14)	
9	0.23%	4.60%	−0.21%	1.00	0.926
			(−3.24)	(67.91)	
10 (low)	0.01%	4.90%	−0.45%	1.02	0.851
			(−4.58)	(46.09)	

a. Explain based on the table above whether the Carhart results are in line with CAPM (5 points).

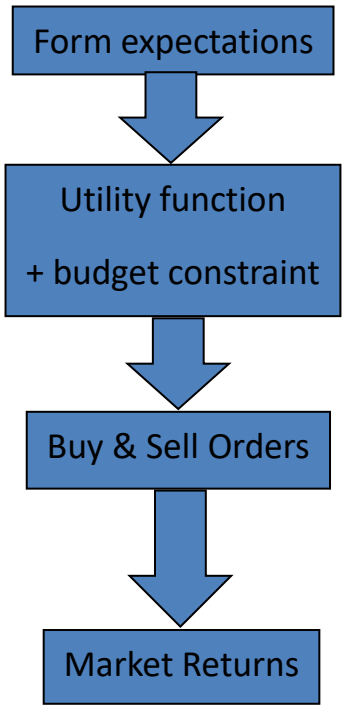
No, not in line because there is no relation between beta and returns.

In her guest lecture, Kristina Usaite discussed that there are several methods how to apply ESG investing.

b. Explain the difference between the “exclusion” and “integration” approaches to ESG investing (4 points).

Exclusions: exclude “sin” – stocks.
Integration: integrate an ESG measure into the portfolio formation process.

The neo-classical approach to investing is given in the following figure:



c. Explain how the above structure changes when taking prospect theory into account. (6 points).

Prospect theory shows that there is a relation between returns and utility. So, an arrow from "market returns" to "utility function".

<END OF THE EXAM!>

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