Johns Hopkins University

440.643 Instructor: John Teall

Economics of Investments and Financial Management Summer Term 2022

Mid-term Quiz: Sample Version 1, Part 1, Closed-Book

1. What is the function of the Depository Trust Corporation?

2. What is *SIAC*? What are its functions?

3. Under what circumstances might you expect a call market system to be more practical than a continuous market system?

4. Several of the U.S. options exchanges have implemented technological systems intended to enable options market members and other exchange members to trade from home or off-exchange floors. What are the more significant of these systems?

5. Describe what crossing networks are, the extent to which they display quotations and how trades are priced.

6. Numerous statistical studies have documented an asymmetric reaction to institutional buy and sell orders. In particular, studies have found that buy orders have a more significant impact on stock prices than sell orders. What explanations might you offer for this asymmetric effect?

7. What were the provisions of the so-called Buttonwood Agreement?

8. Over many years, major statistical rating agencies (credit rating firms) such as Moody's, Standard&Poors and Fitch had built solid reputations for providing reliable assessments of corporate, municipal and other issuers or bonds and other obligations to the general public. These reputations were damaged by the 2008 financial crisis. What are the most significant accusations have been leveled at credit rating agencies that have damaged their reputations?

9. What are the primary provisions of the Securities Act of 1933?

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Mid-term Quiz: Sample Version 1, Part 2, Open-Book

10. An investor needs to invest $10,000 into a portfolio of three securities that enables him to minimize risk while maintaining an expected return of at least 15%. The following table represents the expected returns, standard deviations and covariances for the securities:

i	E[Ri]	σ_i	$\sigma_{i,j}$
1	.06	0	$\sigma_{1,2}=0$
2	.11	.3	$\sigma_{1,3}=0$
3	.25	.6	$\sigma_{2,3}=0$

How much money should the investor put into each of the stocks?

11. Consider an auction example with two bidders, where each of whom have the opportunity to bid on some random amount of cash between zero and $10, such that E[V] = $5. Each bidder has equal access to information. Suppose that each of the two bidders will obtain a noisy signal, s_1 and $s_2 \in (0, 10)$ concerning the value of the bundle of cash such that the mean of the signal amounts equal the value of the bundle: $(s_1 + s_2)/2 = V$. Suppose that Bidder 1's signal is $s_1 = 7$. What is the optimal bid for Bidder 1?

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Mid-term Quiz Solutions: Sample Version 1

1. The primary function of the Depository Trust Corporation is to simplify the paperwork and record keeping associated with stock ownership and transfer. It holds stock certificates of member firms, registering them in member names and maintaining computerized records of ownership. Ownership transfers are accomplished with book entries.

2. The primary facility for clearing for the NYSE and Nasdaq is the *Securities Industry Automated Corporation* (SIAC), which maintains the computer systems for clearing. This means that SIAC clears transactions for the NYSE and Nasdaq was established the NYSE. The *National Securities Clearing Corporation* (NSCC, a division of the Depository Trust and Clearing Corporation, described below) is the successor to the combined clearing corporations of NYSE, AMEX (now merged into NYSE) and NASD. NSCC serves as the clearing agent for these markets as well as for many bond markets.

3. The call market may provide for better price discovery when markets are illiquid, when there are few participants in the market or when securities are traded infrequently.

4. Options exchanges have innovated substantial technological advances to maintain and even anticipate developments in other markets. For example, among the exchange-initiated technological advances include NASDAQ's automated exchange, SuperMontage. Options exchanges have experienced launching of the Chicago Board Options Exchange (CBOE) proprietary order routing and quotations *HyTS Terminals* (Hybrid Trading Systems) that offer trading desks point-and-click access (CBOEdirect) to all exchanges on one screen. Such point-and-click trading systems provide for instantaneous filling and confirmation of orders at the best prices along with transparency of trades. Asset managers rely on such systems to obtain speedy access to information, route and execute orders and to obtain trade confirmations. Several exchanges are providing for off-site market makers such as the CBOE Remote Market Makers (RMM's). These systems facilitate trading by off-floor investors and enhance liquidity by expanding the membership of market makers. These systems offer market makers direct access to the trading floor, enabling them to participate in the provision of market liquidity and subjecting them to the same market-enhancing responsibilities without requiring their physical presence.

5. Crossing networks such as Liquidnet are alternative trading systems that match buyers and sellers with respect to agreed-upon quantities. Crossing networks do not publicly display quotations, thereby enabling participants some degree of anonymity. Trades are priced by reference to prices obtained from other markets rather than by the more traditional auction systems.

6. Chan and Lakonishok [1993] argue that buy orders convey more information than sell orders because liquidity needs drive many sales and most institutions have a much larger pool of stocks from which to buy than to sell. Saar argues that mutual funds are reluctant to short sell, so that they focus their research efforts on shares that they might buy and might serve as good

diversification mechanisms. In addition, mutual funds cannot borrow to invest, so that they have to be particularly selective in their purchases. Thus, these observations suggest that there will be more information content in stock purchases than stock sells.

7. The Buttonwood Agreement provided for the formation of what was to become the New York Stock Exchange. It fixed brokerage commissions among its signatories and prohibited off-board trading (i.e., traders and brokers were to trade only with each other).

8. Major criticisms of credit rating agencies have included the following:
   1. Many rating agencies are paid by the firms that issue debt instruments, creating potential conflicts of interest.
   2. Rating services have provided consulting services to issuing firms, advising them on strategies to improve their ratings.
   3. Credit agencies have been accused of strong-arming clients and potential clients. For example, Moody's published an "unsolicited" rating of Hannover Re, a German re-insurance firm. It sent a letter to Hannover indicating that "it looked forward to the day Hannover would be willing to pay." Hannover management refused payment, perhaps based on its paid use of two competing ratings agencies for its debt. Moody's continued to rate Hannover debt, which continued to pay. Over time, Moody's cut Hannover ratings to junk status, despite high ratings given by other agencies.
   4. Rating agencies have missed major bond crises.

9. The Securities Act of 1933: Sometimes called the "Truth in Securities Law", it deals primarily with new issues of securities. Its major provisions are as follows:
   1. All primary issues must be registered with an appropriate government agency (later to be the S.E.C.). The registration will include proper statements and documentation.
   2. A prospectus must accompany each new issue. This prospectus must contain a complete and accurate accounting of the firm's condition, risks and prospects and state how the proceeds of the new issue will be used.
   3. Small & private issues are exempt from registration rules.
   4. Firms are prohibited from making false statements regarding their new issues.

10. Asset 1 is riskless. Solve the following for z(1) and z(2):

$$.09z(2) + 0z(3) = (.11-.06)$$
$$0z(2) + .36z(3) = (.25-.06)$$

Solve this linear system simultaneously: z(2) = .5556; z(3) = .5278;
Without the riskless asset, w(2) = .5128; w(3) = .4872
The risky portfolio return is .5128×.11 + .4872×.25 = .1782
Since the portfolio target return is .15, we have w(risky)×.1782+[1-w(risky)]×.06 =. 15
w(risky) = .7614 and (1-w(risky)) = w(riskless) = w(1) = .2386
w(1) = .238611 w(2) = .390455 w(3) = .370932
Thus, we should invest $2386 into security 1, $3905 into 2, and $3709 into 3. This solution could also have been obtained by using the LaGrange optimization procedure, with the return constraint set at .15.

11. Bidder 1's estimate of the value of the bundle is $E[V_1 \mid s_1 = 7] = (\$7 + \$5)/2 = \$6$. If Bidder 1 is risk neutral, $6 is the value that he attributes to the bundle. However, because of the Winner's Curse problem, if Bidder 1 wins the auction by bidding $6, this will mean that the

other bidder received a lower value signal than Bidder 1, indicating that $7, the signal received by Bidder 1 certainly exceeded the bundle value. Thus, winning the auction is a negative signal (ex-post) as to the value of the bundle. If Bidder 1 wins the auction by bidding $6, he will have overbid and will suffer from the Winner's Curse. This means that, from the perspective of Bidder 1 if he wins, the distribution of bundle value must range from 0 to 7 rather than from 0 to 10. Thus, the anticipated mean signal values received by other bidders should be $3.5. Thus, based on this information, Bidder 1 should revise his bid for the bundle to $[B_1 \mid s_1 = 7] = (\$7 + \$3.5)/2 = \$5.25$.

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Final Exam: Sample Version, 2.5 hours

1. Your analysis reveals that a particular company's stock realizes 285 runs in each series of 900 closing prices. When price declines occur, they tend to be no larger or smaller than price increases when they occur, and declines and increases occur with the same frequencies. You believe that this runs test on historical data is statistically significant. Furthermore, you believe that this same relationship between closing prices and prior day closing prices will prevail in the future. Assume that you will trade for short term profits if you are able to forecast one day returns. What transaction (buy or sell) should you execute on the day following a price decline?

2. Is it possible for a market to be weak form efficient and not semi-strong form efficient? If so, when? If not, why not?

3. A particular market consists of three securities: a riskless asset paying 10%, shares of common stock and calls written on these shares with an exercise price of 8. This market exists in a one time period framework with three potential outcomes. The stock, which is currently selling for 10 will either decrease to 5 next year, remain unchanged at 10 or increase to 15. Outcome probabilities are unknown. In this market, can a "trinomial" option pricing model based on construction of hedge portfolios be derived to provide a numerical value this option? If so, how? If not, why not?

4. In a perfectly efficient capital market, is it possible for a high-risk security to have a higher NPV (Net Present Value: Present value less initial cash investment) than a low risk security? Why or why not?

5.a. Why is a call and put hedge strategy less expensive for hedging risk than a put hedge alone?
b. Describe a zero-cost collar.

6. Smedley Company stock is currently selling for $40 per share. Its historical variance of returns is .25, compared to the historical market variance of .10. The current one-year treasury-bill rate is 5%. Assume that all of the standard Black-Scholes Option Pricing Model assumptions hold. What is the current value of a put on this stock if it has an exercise price of $35 and expires in one year?

7. A stock currently selling for $40 in a one-period binomial environment has a one-year call option trading on it with an exercise price equal to $40. The current Treasury bill rate equals .10 and the probability of an upward price movement is projected to be .52. What are the projected multiplicative upward and downward price movements? Your answer should be within .05.

8. Describe how investors use political intelligence units of law firms to obtain useful trading information before this information becomes public.

9. Shiv et al [2005] studied the relative abilities of brain-damaged study participants to make gambling decisions. Describe the methodology and results of their study, along with potential implications for investing.

10. Bond A, a two-year, 12% coupon issue can be purchased for $957.9920. Bond B, a two-year, 5% coupon issue can be purchased for $840.2471.

a. What would be the value of a $1000 face value pure discount bond maturing in two years?
b. The two-year pure discount bond in part a can be replicated with a portfolio comprised of bonds A and B. What should the portfolio weights or combinations of these bonds be? (Short selling and fractional bond amounts are permitted.)
c. I need to raise $15,000 at the end of year one and $12,000 at the end of year two to repay some debts. How much should I buy (sell) of each of Bonds A and B to exactly match my debt payments? (Fractional purchases and sales of bonds are permitted.)

11. Estimate the implied Black-Scholes volatility (standard deviation) for the following call: $c_0 = 10$, $S_0 = 25$, $T = .5$, $X = 35$ and $r_f = .10$. Your answer should be within .03.

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Final Exam: Sample Version Solutions

1. The number of runs associated with a set of 900 uncorrelated prices equals (900+1)/2 = 450.5. 285 runs is significantly less, implying that there exists a positive intertemporal correlation in stock prices. This means that I should expect a price decrease on the day following a price decline. Hence, I should sell stock at the open on the day following a price decline.

2. Yes: When prices cannot be forecast based on their historical sequences, but prices do not reflect announcements or other public information of some type.

3. A "trinomial" option pricing model cannot be derived because a hedge portfolio cannot be constructed in a single time period, three-potential outcome scenario. At least three securities with known prices would be needed to complete the hedge in this case, but only two are offered. That is, no single value for α satisfies:

$$\alpha u P_0 - c_u = \alpha P_0 - c_{\text{no change}} = \alpha d P_0 - c_d$$
$$\alpha 15 - 7 = \alpha 10 - 2 = \alpha 5 - 0$$

4. No - In a perfectly efficient market, all securities have zero NPV (by definition of a perfectly efficient market).

5.a. The put in the put-call hedge is financed with the proceeds from the sale of the call. It is, in effect, a zero- or low- cost collar.

b. A *Zero Cost Collar* is a package of options designed to require zero net investment. Typically, the collar consists of a package with a long position in a put enabling its owner to sell the underlying security if its price drops to a specified price along with a short position in a call whose exercise price is set so that it exactly offsets what is paid for the put. Hence, such a collar requires no net investment.

6. The market variance is irrelevant. S = 40, X = 35, r = .05, σ = .5, T = 1. Using Black Scholes, we find that the call is worth 11.05. Using put-call parity, we find that the put is worth $p = Xe^{-rT} + c - S = 4.35.$

7. Solve the following for u:

$$p = \frac{e^{r_f T} - d}{u - d} = .52 = \frac{e^{.1\times 1} - 1/u}{u - 1/u}$$

The multiplicative upward and downward movements for the stock are projected to be 1.5 and .6667, respectively. Substitute 1.5 for u to verify.

8.a. Investors with money at stake have obvious incentives to access and quickly exploit information. Many investors and institutions are able to access and exploit important information before it can be gathered and disseminated by the news agencies. Several law firms, including Sonnenschein Nath & Rosenthal, LLP and DLA Piper have operated “political intelligence” units enabling their clients to obtain public policy information from lobbyists operating in

Washington. These units place representatives in key government buildings and pay them to access information relevant to potential investment transactions. These political intelligence units include hedge funds as clients. While it is not yet clear whether any laws have been broken, it does appear that these hedge funds may have successfully gained an information edge in their trading.

9. This study gathered 19 subjects that had incurred damage (stable focal lesions) to parts of their brains impairing their abilities to process emotions. The subjects were asked to participate in a series of gambles along with two control groups, one that had experienced no brain damage and a second group that had experienced some other type of brain damage. Each study participant was asked to participate in a sequential series of 20 gambles, betting $1 against a 50/50 chance at either 0 or $2.50. The expected value of each gamble was $1.25, $.25 higher than its cost. The subjects experiencing damage to their emotional circuitry bet more consistently than their "normal" counterparts and earned more money. The performance differences were more pronounced after non-impaired subjects experienced losses, making them even more reluctant to take advantage of expected wealth-increasing gambles. The performance of the emotionally damaged group compared favorably to the control group of participants who had experienced no brain damage and to the second control group who had experienced unrelated types of brain damage. A potential implication of this study is that emotions may impair investors' abilities to respond rationally to situations involving risk, particularly after experiencing series of losses.

10.a. Solve part b first.

$P_0 = -.714285*957.9920 + 1.714285*840.2471 = 756.1437$

b. $120w_A + 50w_B = 0$ $\quad w_A = -.714285$

$1120w_A + 1050w_B = 1000$ $\quad w_B = 1.714285$

c. $15{,}000 = 120\#A + 50\#B$

$12{,}000 = 1120\#A + 1050\#B$

$\#A = 216.42857$; $\#B = -219.42857$

Thus, sell 219.42857 B bonds for $184,374.22 and pay $207,336.83 for 216.42857 A Bonds

11. Try an initial guess for standard deviation equal to, for example, .5. This results in a call value equal to 1.93. This call value is much too small, so increase the standard deviation estimate. Try a much larger estimate, say = 1.15. This estimate results in a call value that is a little large, but reasonably close. So, we try a smaller estimate. Ultimately, we arrive at an estimate within .03 of the correct standard deviation of 1.798.