Econ 452 Professor Ickes

Economics of the Financial Crisis Spring 2014

Midterm Exam 1: Answer Sheet

1. *(8 points each) True, False, Uncertain, and Explain. Explain whether the statement is true, false, or uncertain.*

   (a) "If the efficient markets hypothesis is true then prices are always correct. Hence, the 2008 crisis proves that the hypothesis is false."

   brief answer *False. EMH says that available information is containted in prices. It does not say that predictions of future prices are correct, just that they are unbiased. The EMH does not say that people are not stupid or greedy or that policy is always correct so the second statement is also false..*

   (b) "Risk averse agents would never hold a risk free asset because it pays too little return."

   brief answer *False. Risk averse agents do not like risk, and risk free assets do not have risk. One could add that if there is a risk-free asset then everybody holds a portfolio that includes risky assets and the risk free asset.*

   (c) "The price of an asset will be greater than that of risk-free asset only if its payoff does not covary with the stochastic discount factor."

   brief answer *False. If there is zero covariance with the SDF then the return on the asset will be equal to that of the risk free asset. It supplies no insurance value in this case. Recall, that* $p = \frac{E(x)}{R_f} + \frac{cov[\beta u'(c_{t+1}), x_{t+1}]}{u'(c_t)}$*, so if the last term is zero then the payoff on the asset equals that of the risk free asset, e.g.,* $p = \frac{E(x)}{R_f}$*. If there is no covariance there is no insurance. Moroever, since* u' *declines as* c *rises, an asset's price is higher if consumption and payoffs are negatively correlated, and lower if the payoff postively covaries with consumption. The value of an asset is higher if it pays off when you need it most. An asset that pays off when consumption is low has a higher price. This is insurance. Riskier securities must offer higher returns to get investors to hold them, so if the covariance is negative (if it pays off when consumption is high) the price will be lower and the return will be higher.*

   (d) "Consumption growth increases when real interest rates decrease."

   brief answer *False. Lower* r *means that agents move consumption to the present. The interest rate is the premium we get to defer consumption. Recall the problem set where we had* $R_f = \frac{1}{\beta}\left(\frac{c_{t+1}}{c_t}\right)^{\gamma}$*, so lower interest rate means lower consumption growth.*

   (e) "Financial markets cannot be efficient if the market includes any noise traders. Only in the absence of noise traders will markets be efficient."

   brief answer *False. If there are no noise traders then there is a free rider problem. Everybody learns information from observing the price. Nobody will incur a cost to find information. The efficient markets paradox. It is only if there are some noise* *traders that markets can be efficient, but if there are too many then we have a problem again.*

2. *(25 points)* Consider a firm that issues debt and equity, and assume that there are no taxes. Suppose that the return on equity is given by $r_E = r_0 + \frac{D}{E}(r_0 - r_D)$, where r_0 is the firm's cost of capital if there is zero leverage, and r_D is the cost of debt. What is the relationship between r_E, r_D and r_0 (i.e., which is lowest and which is highest)? Explain. For any level of $\frac{D}{E}$ what is the relationship between r_E and r_D? In a graph with $\frac{D}{E}$ on the horizontal axis and r on the vertical axis, plot r_E and r_D. Explain.

   brief answer *If $D = 0$ then $r_0 = r_E$. Meanwhile, $r_D < r_E$ because debt is less risky than equity. Presumably both equity and debt get riskier as $\frac{D}{E}$ rises so the r_E and r_D both must increase with leverage. The curves will have positive slope. What we know is that equity must be riskier than debt, since debt is senior to equity and equity is a residual claimant to the cashflows of the firm. So r_e must lay above r_D. We further know that equity becomes more risky as leverage rises, so the return must rise to compensate the investors. Debt also becomes more risky, since there may be states where cashflows are insufficient to payoff all debt, so the r_D also increases with leverage.*

   (a) Suppose that r_E and r_D are independent of each other. Define r_w as the weighted average of r_E and r_D. What happens to r_w as $\frac{D}{E}$ increases from 0 to 1? Plot this against $\frac{D}{E}$. Explain.

   brief answer *If the return on debt is independent of leverage it must be constant, so it is a straight line. Since r_a is a weighted average of the two returns, it must equal r_e when $\frac{D}{E} = 0$, and it must equal r_D when $\frac{D}{E} = 1$, so it will be a decreasing function of leverage. There is no cost to the firm of leverage in this case, indeed, leverage is cheaper, so take all of it. Thus we would expect the firm to choose $\frac{D}{E} = 1$. See figure 1:*

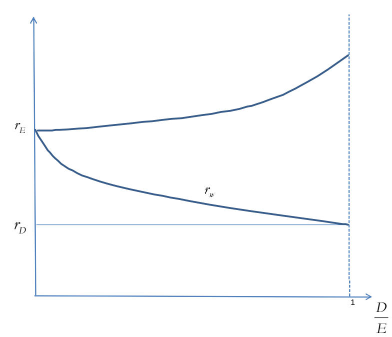

Figure 1: Figure 1: Debt Independent of Leverage

   (b) Suppose the Modigliani-Miller Theorem holds what happens to r_w as $\frac{D}{E}$ increases? Plot this against $\frac{D}{E}$. Explain. What is the relationship between r_w and r_0? Explain.

brief answer *The Modigliani Miller Theorem tells us that the size of the pie is independent of leverage. Capital structure is irrelevant. Hence, the weighted cost of capital, r_w to the firm must be irrlevant. If not, there would be an optimal capital structure, but the theorem tells us there is no optimal capital structure. So that means that r_w must be independent of $\frac{D}{E}$, and is thus constant. Moreover, when $\frac{D}{E} = 0$ we must have $r_0 = r_e$, and when $\frac{D}{E} = 1$ we must have $r_w = r_D$, so the r_w must look like figure 2*

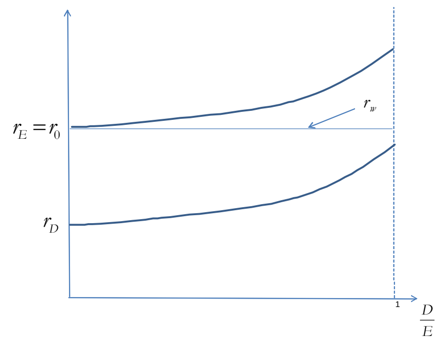

Figure 2: Figure 2: r_w According to MM T

(c) How can your result in part *b* be true if equity becomes riskier with more leverage? Explain.

brief answer *We know that r_w is independent of leverage but r_e is not. This can only be possible if the return to debt also depends on leverage, especially at higher leverage ratios..The reason this occurs is that if $\frac{D}{E}$ is very high there is some chance the debt won't get paid back, so the risk premium on debt also rises, but r_e and r_D must both rise so that r_w does not change.*

(d) What happens to r_w if corporate debt is tax deductible? Explain.

brief answer *Then debt is a tax shield. As we increase leverage the value of the tax shield rises so r_w must fall as $\frac{D}{E}$ rises. The more debt the bigger the savings. The optimal amount of leverage is 100%.*

3. *(35 points)* Consider a stock that pays a dividend, d_t. Then the price of the stock should be given by:

$$p_t = E_t \left[\frac{p_{t+1} + d_{t+1}}{1+r} | \Omega_t \right] \tag{1}$$

Explain this expression (for the purposes of this question assume r is constant through time).

brief answer *The expression says that the price today is the expected present value of next year's price plus dividend, where the expectation is based on currently available information.*

(a) Given that price depends on next year's price and dividends, explain how it is possible to write:

$$p_t = E_t\left[\sum_{i=0}^{\infty}\left(\frac{1}{1+r}\right)^{i+1} d_{t+i}|\Omega_t\right] \tag{2}$$

What does expression (2) mean? How is it possible to go from expression (1) to expression (2)? Are there any important assumptions required to obtain expression (2) from expression (1)?

brief answer *Given (1), then it follows that* $p_{t+1} = E_{t+1}\left[\frac{p_{t+2}+d_{t+2}}{1+r}|\Omega_{t+1}\right]$, *so* $p_t = E_t\left[\frac{d_{t+1}}{1+r}|\Omega_t\right] + E_t\left[\frac{d_{t+2}}{(1+r)^2}|\Omega_t\right] + E_t\left[\frac{p_{t+2}}{(1+r)^2}|\Omega_t\right]$, *but I can similarly substitute for the last term and write:* $p_t = E_t\left[\frac{d_{t+1}}{1+r}|\Omega_t\right] + E_t\left[\frac{d_{t+2}}{(1+r)^2}|\Omega_t\right] + E_t\left[\frac{d_{t+3}}{(1+r)^3}|\Omega_t\right] + E_t\left[\frac{p_{t+3}}{(1+r)^3}|\Omega_t\right]$. *I can continue to do this, pushing the expected price term further and further out into the future. Eventually, I will have the sum of expected future discounted dividends, plus some term like* $E_t\left[\frac{p_{t+i}}{(1+r)^i}|\Omega_t\right]$ *for i really big!! What I need for obtain (2) is that as* $t \to \infty$ *that the last term goes to zero (that the* $\lim_{i\to\infty} E_t\left[\frac{p_{t+i}}{(1+r)^i}|\Omega_t\right] = 0$, *this means that in the limit as t gets really big the expression goes to zero).*

(b) What is the economic content of this important assumption? What does it imply?

brief answer *This is sometimes called a no-Ponzi game condition. The reason, of course, is that if the condition did not hold, then prices would rise so fast that this condition was not satisfied it means that there is somebody out there far out in the future willing to pay an enormous amount for the asset. We can then run a con. This just means that I do not expect the price to grow faster than the rate of interest forever. We are ruling out cases where the price grows so exponentially fast that even way out in the future the expected discounted price is greater than zero.*

(c) Suppose the future path of dividends were known, call this p'_t. Would we expect the variance of p'_t to be greater or small than the variance of p_t? Explain.

brief answer *Expression (2) is a forecast of* p'_t, *but when we forecast we do not know the future. So the variance of* p'_t *should be at least as great as the variance of* p_t. *This follows because what actually happens we do not know, that is why we did not forecast it. That is,* $p_t = p'_t + \mu_t$, *where* μ_t *is the forecast error. This is mean zero under rational expectations and uncorrelated with* p_t. *Then it follows that* $var(p'_t) = var(p_t) + var(\mu_t)$. *But* $var(\mu_t) = var(p_t - p'_t)$, *so* $var(p'_t) = var(p_t) + var(p_t - p'_t) \geq var(p_t)$. *In words, the variance of the actual dividend stream is equal to the variance of the expected dividend stream plus the variance of our forecast errors. If we make some forecast errors then* $var(p'_t) > var(p_t)$.

(d) Is the prediction in (c) typically observed in empirical studies? Why might this be interesting?

brief answer I*n many, many studies we find the opposite. Actual prices seem more volatile than perfect foresight prices in almost all studies. It might be interesting because it could mean that markets are not efficient, the variance bound is violated. This is what Shiller found. Of course there could be other explanations of this finding (we know that all hypothesis tests are joint tests, etc.). But for the purposes of this question all you need to point out is that the empirical observation contradicts the* *prediction of the theory. That is interesting. The question only asked why it might be interesting.*