Econ 497 Professor Ickes

Economics of the Financial Crisis Spring 2012

Midterm Exam 1

Please read over each question carefully before answering. Questions mean what they say. Allocate your time efficiently according to the point system. Feel free to use graphs whenever appropriate.

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

   (a) "High debt levels must be irrelevant for financial crises because the debt-equity ratio for a firm is irrelevant.

   brief answer *False. Even if MM holds and $\frac{D}{E}$ is irrelevant for the firm, higher debt levels can be very problematic, even ignoring the issue of government debt. High debt levels can lead to default, if cash flows decline suddenly and a firm has a high debt level it will not be able to make debt payments. And of course MM may not hold exactly, and there may be financial distress problems...*

   (b) "The Happy Meal theory of pricing is more applicable to financial assets than to McDonald's pricing."

   brief answer *True. The HM theory says that the price of an asset is a linear in the components. So the Happy Meal should cost the same as the sum of the hamburger, fries, coke, and toy. But this requires arbitrage, and you cannot short sell a hamburger. So it is easier to enforce with financial assets than with a good like the HM, which McDonald's uses as way to get parents to eat. Key point here is arbitrage.*

   (c) "A plausible, partial, explanation for the rise in tulip prices in the Netherlands in 1636 was the change in contracts from futures to options."

   brief answer *True. If the contract was changed to an option, and the prices quoted after the change are strike prices, then it makes sense that prices exploded. A futures price is an obligation, but an option is not. You pay a 3.5% premium and you only have to exercise the option if it is in your favor. It is a plausible explanation. Not the whole thing for sure, but plausible.*

   (d) "If firms can go bankrupt then excessive levels of debt can lead to financial distress. This may lead to violations of the Modigliani-Miller theorem."

   brief answer *True. If a firm has a debt overhang it may refuse to undertake profitable investment because the gains will go to the senior creditors, the bondholders, not to the equity holders. So the future earnings of the firm are effected by too much leverage, contra MM.*

   (e) "If investors can finance their asset purchases from banks that cannot monitor their investments, then excessive investment in risky assets may result, and bubbles may appear."

brief answer *True. The limited liability and incomplete monitoring means that investors face an asymmetric bet. Their downside loss is capped at zero. So risky assets will have higher expected returns than safe assets, and if the supply of risky assets is inelastic their price may rise.*

2. *(30 points)* Consider a firm that issues debt and equity, and assume that there are no taxes. Define the weighted cost of capital as $r_a = r_D \frac{D}{D+E} + r_E \frac{E}{D+E}$, where r_D is the interest rate on the firm's debt (D) and likewise for equity (E). 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 *The key point is that $r_e > r_d$ because equity is riskier than debt, so it lays above it, and that r_e is an increasing function of $\frac{D}{E}$. See figure 1. What we know is that*

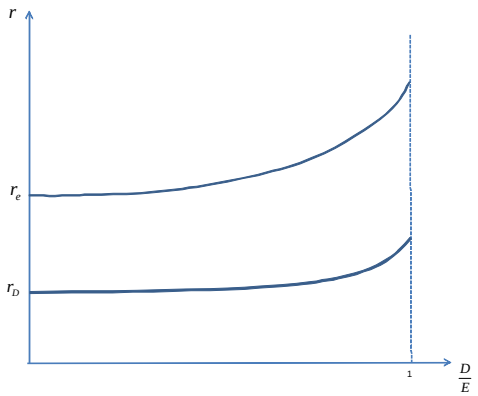

Figure 1: Return on Equity and Debt

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_D is independent of $\frac{D}{E}$. What happens to r_a 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 2

(b) Suppose the Modigliani-Miller Theorem holds what happens to r_a as $\frac{D}{E}$ increases? Plot this against $\frac{D}{E}$. Explain.

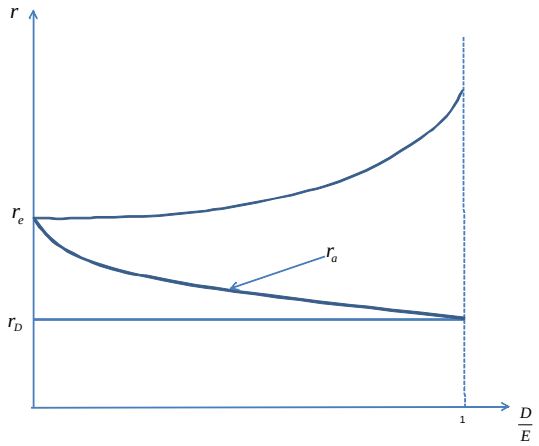

Figure 2: Weighted Cost of Capital when the rate of return on debt is independent of leverage

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 (WACC) 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_a *must be independent of* $\frac{D}{E}$*, and is thus constant. Moreover, when* $\frac{D}{E} = 0$ *we must have* $r_a = r_e$*, and when* $\frac{D}{E} = 1$ *we must have* $r_a = r_D$*, so the WACC must look like figure* 3.

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

brief answer *We know that* r_a *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_a *does not change. So we have figure 3*

(d) What happens to r_a 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_a *must fall as* $\frac{D}{E}$ *rises. The more debt the bigger the savings. The optimal amount of leverage is 100% as in the first problem set.*

(e) What if there are costs of financial distress? How does your answer to part d change? Explain.

brief answer *There will be some limit to the leverage the firm will take since it may lose profitable opportunities if there is a debt overhang. The value of a levered firm increases until the costs of financial distress become severe. So* r_a *must fall but reach a minimum and then start increasing as leverage* $\longrightarrow 1$*. It may be easier to think about this in terms of the value of the firm. For an unlevered firm this is constant, but as leverage rises the value of the firm increases with a corporate income tax due to the tax shield. But at higher leverage ratios cost of financial distress appear. Moreover, the cost of financial distress is increasing in* $\frac{D}{E}$ *whereas the corporate tax*

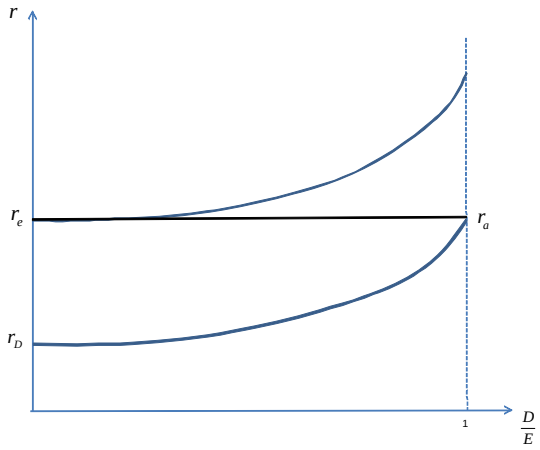

Figure 3: WACC Under MM

shield is not (the tax rate is a constant fraction of net income). So the value of the firm equals some maximum at a leverage ratio where $\frac{D}{E} < 1$.

3. *(30 points)* Suppose that the price of an asset is given by $p_t = v_t + b_t$, where v_t is the fundamental value of the asset and b_t is the bubble. If the bubble is rational why must it grow at rate at least as great as the rate of interest? Explain.

   brief answer *You are holding a bubble asset because of expected capital gains. If the expected capital gains are less than the rate of interest you can earn more by holding a bond that just pays that rate of interest.*

   (a) Suppose that agents are rational and realize that the bubble cannot persist forever. What is the relationship between the probability that the bubble will burst in any period and the growth rate of the bubble? Explain.

   brief answer *The bubble must grow faster if people expect that it could burst. If the bubble has not burst in* $t+1$ *then we have* $b_{t+1} = \frac{(1+r)b_t}{q}$*, where* q *is the probability the bubble survives another period. Thus* $\frac{b_{t+1}}{b_t} = \frac{1+r}{q} > 1 = r$*, as in a bubble that was never expected to bursts. So if* q *decreases,* $\frac{1+r}{q}$ *increases* $\longrightarrow$ *the bubble must grow faster to compensate, so the expected return is unchanged.*

   (b) Suppose that agents are rational and realize that the bubble cannot persist forever, but they are not sure how rational other agents are. What does this imply for the persistence of the bubble? Explain.

   brief answer *If agents are unsure about when other rational agents learned about the bubble they may want to ride it further. They face a trade-off. If they sell to soon, they may not be able to burst the bubble – if they are alone in their pessimism, the noise traders will dominate them. If they wait to long to sell, they also lose. So they need to calculate how likely it is that a sufficient number of other rational traders know that there is a bubble, and moreover, that a sufficient number know that a*

sufficient number know that there is a bubble. The time to attack will be delayed till there is sufficient mutual knowledge so that they know they can succeed with the attack. So this lack of synchronous knowledge leads to delay.

(c) Why do bubbles (or asset movements that look like bubbles) tend to occur when the general economy is doing well, and why do they tend to burst when some piece of bad news occurs?

brief answer *When times are good, risk is low, prospects for future earnings is high, it is easy to see that "this time is different." So earnings growth is high and people bid up the price of assets. When bad news occurs, it can act to coordinate the behavior of the rational traders and facilitate the attack on the bubble.*

extra *You could use the idea from the Gordon Growth Model, review question 8. Suppose we have* $p_t = D_t \frac{1+g}{k-g}$. *Then any optimism in future earnings causes* g *to rise, and any reduction in perceived risk causes* k *to fall, and if these are though permanent, because this time is different, then* $\frac{p_t}{D_t}$ *rises. So it looks like a boom. Bad news raises risk or depresses earnings, and the opposite happens.*