Corporate Finance, Module 17: "Capital Structure"

The World Before Miller and Modigliani

(The attached PDF file has better formatting.)

A firm has assets of \$200 million and expected annual income of \$20 million, for a 10% expected return on assets. The actual return may vary between \$15 million and \$25 million each year.

The firm has no debt; all \$200 million of assets is funded by shareholders equity. The firm can borrow at 8% per annum. If the firm borrows \$100 million, the annual interest payments are 8% × \$200 million = \$8 million. Since the annual income of the firm varies between \$15 million and \$25 million, the chance of not being able to meet the interest payments is nil.

If the firm borrows \$100 million and buys back stock worth \$100 million, the remaining stock receives an expected \$12 million of annual income. Since the shareholders expected a 10% annual return on their funds, their stock has increased in value to \$120 million.

This illustration examines whether financing decisions can affect the worth of a firm (without taxes). By borrowing at an 8% yield when shareholders are expecting a 10% yield, can the firm's managers increase the value of each share of stock? By arbitrage arguments, Miller and Modigliani show that they cannot.

Arbitrage

Suppose two firms have the same assets (\$200 million apiece) and expected annual income of \$20 million, varying between \$15 million and \$25 million. One firm, V^U, is unlevered: all \$200 million of assets are funded by shareholder equity. The other firm, V^L, is levered at a 50% debt ratio: half the assets are funded by \$100 million of debt at an 8% annual yield and the other half of the assets are funded by shareholder equity.

Consider two investment portfolios, P^U (all equity) and P^L (half equity and half bonds). P^U is 10% of the stock of firm V^U; P^L is 10% of the stock of firm V^L plus 10% of the debt of firm V^L. We consider the cash flows to the investments under three scenarios: high, medium, and low income to the firms, or income of \$25 million, \$20 million, and \$15 million.

Firm V^U pays all the income to its shareholders. Firm V^L pays \$8 million to its bondholders, and the remaining income goes to its shareholders.

Medium: If income is \$20 million, V^U pays \$20 million to its shareholders, and investment portfolio P^U gets \$2 million. V^L pays \$8 million to its bondholders and \$12 million to its shareholders. Investment portfolio P^L gets 10% × \$8 million + 10% × \$12 million = \$2 million.

High: If income is \$25 million, V^U pays \$25 million to its shareholders, and investment portfolio P^U gets \$2.5 million. V^L pays \$8 million to its bondholders and \$17 million to its shareholders. Investment portfolio P^L gets 10% × \$8 million + 10% × \$17 million = \$2.5 million.

Low: If income is \$15 million, V^U pays \$15 million to its shareholders, and investment portfolio P^U gets \$1.5 million. V^L pays \$8 million to its bondholders and \$7 million to its shareholders. Investment portfolio P^L gets 10% × \$8 million + 10% × \$7 million = \$1.5 million.

The cash flows to P^U and P^L are the same in all scenarios, so the portfolios must have the same value. But if the stock of firm V^L is worth \$120 million instead of \$100 million, an arbitrageur would buy 10% of the stock of firm V^U for \$20 million and sell short 10% of the stock of firm V^L for \$12 million plus 10% of the debt of firm V^L for \$10 million. The arbitrageur would get \$12 million + \$10 million – \$20 million = \$2 million at time 0. Since the cash flows to the two investment portfolios are identical, the arbitrageur would have zero income in all subsequent periods; the \$2 million of profit at time 0 is risk free.

Home-Made Leverage

The arbitrage argument shown above was not convincing to many analysts at first. Some analysts argued either that V^U was a sub-optimally financed firm and P^U was a sub-optimal portfolio or that short selling investment portfolio P^L was not necessarily possible.

Miller and Modigliani showed that if shareholders can borrow at the risk-free interest rate, they can replicate a firm's leverage on their own. There should be no value to a firm's borrowing if its shareholders can borrow on their own.

If individuals can borrow at an 8% annual yield, the a shareholder of firm V^U, instead of holding $100 of stock, can borrow $100 and hold $200 of stock. The expected return to $100 of firm V^U stock is $10. The expected cost of borrowing $100 is $8 (at an 8% yield), so by borrowing $100 and holding $200 of stock, shareholders have an expected return of $20 – $8 = $12. This is also the expected return on the stock of firm V^L.

One might object (at first) that individuals can not borrow at the same yield as corporations can borrow. But this is true only for small (personal) shareholders. Large corporate shareholders, such as pension funds and insurance companies, can borrow just as easily as other firms can borrow. They can construct "home-made leverage" as easily as firms can construct corporate leverage.