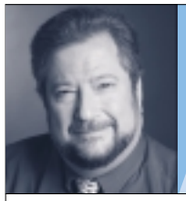

Aaron Brown

Toward a New Theory of Corporate Finance

Work in Corporate Finance lacks a consistent basic theory to organize it; time for a constructive approach to remedy this …

Last month I had occasion to give some advice to the Master of Financial Engineering 2006 graduating class at the Haas School of Business, University of California. I took the opportunity to list some of the major challenges of quantitative finance including:

50 years ago we had the three M's of quantitative finance: Markowitz on Securities and Modigliani and Miller on Corporate Finance. Today we have a mountain of progress in Securities, both in theory and practice. In Corporate Finance we have … Modigliani and Miller. We lack any useful theory of corporate governance, mergers and acquisitions, all we know about capital structure is that it doesn't matter (but it does), and what we think we know about capital budgeting is wrong.

I caught some heat for that comment at the reception afterward. I should have considered that the audience included some prominent researchers in Corporate Finance, and the people who love them. However, as I said at the time, I don't claim there is no useful work in Corporate Finance, just that we don't have a consistent basic theory to organize it. As a result our introductory courses are taught in the wrong order and with the wrong emphasis, self-interested people can peddle any sort of nonsense and research is not linked for maximum insight.

At the suggestion (probably sarcastic) of one critic in the audience, I will address this subject in a constructive way by pointing to a new theory of Corporate Finance. Please rein in your expectations. I do not have a dramatic new insight like Johannes Kepler's proofs that the earth revolves around the sun or Albert Einstein's $E = mc^2$. It's more like Dmitri Mendeleev's periodic table, which organized known properties of the chemical elements in a

new way. And even that's too ambitious. I don't have a periodic table of Corporate Finance. I'm trying to imitate one of the dozen or so 19th century chemists who had some kind of idea about arranging the elements in patterns.

Capital adequacy?

The standard theory of Corporate Finance today is centered on the concept of capital. Firms raise capital, mainly by issuing securities, and use it to fund projects. The firm creates economic value by funding projects with a higher weighted average return than its weighted average cost of capital. Corporate Finance has two jobs: select the proper mix of capital sources and select the proper mix of projects. The goal is to maximize shareholder wealth.

This is not all of Corporate Finance, it's just the theoretical part. An introductory course will also cover institutional chores like cash and receivables management, taxes and legal organization. Also, at this level it's very abstract. Sources of capital are not limited to loans and securities, they include things like cash float, employee stock options and trade credit. Projects can include any decision the firm makes including things like closing down a line of business, refurbishing the executive offices or changing the name.

Why don't I like this theory? It's consistent, which is essential. At first glance, it's too simple to be wrong. And it is certainly an advance from its non-quantitative predecessors.

The problem is the theory left out the firm. There's no place for the corporation in Corporate Finance. Each project has a positive risk-adjusted expected net present value. Each project could be sold directly to the market for that value. All the firm does is bundle them up, then sell off the future cash flows to investors, but in theory it doesn't matter how the firm does that either, the sum of the value of all the securities a firm sells has to equal the sum of the value of all the projects it undertakes.

If this view is correct, finance plays no part in how firms are organized or run. There might be administrative, legal, tax, organizational or other reasons to bundle projects in certain ways; and to combine cash flows into securities in certain ways; but there's no financial theory involved.

I don't believe that. I believe that public corporations are essentially financial creations. They exist for financial reasons, not details of the tax code or tradition. Determining the optimal mix of projects and securities is a financial problem. That means we need a better theory.

Not only doesn't the standard theory answer basic questions about the firm, it cannot explain observations. Why, for example, have leverage ratios increased dramatically? How can a firm be worth two or three times as much to an acquirer as it was to public investors? Why do firms typically demand real after-tax project returns two or three times as high as real after-corporate-tax returns delivered to investors? How can a firm maximize shareholder value without asking its shareholders basic financial questions, like marginal tax rates? Why do firms consistently overpay taxes by things like paying dividends and underfunding pension plans?

I'm not the first person to ask these and other questions, and there are many answers to them in the literature. But all the answers turn on specific institutional factors, none can be derived from the basic theory. People can say absurd things, such as employee stock options are not an expense, or boards of directors act in shareholder interest when spending corporate funds to fight someone who wants to pay $20 for their shares so the company can be delivered to management for $15 per share. All finance professors disagree with these kinds of things, but they cannot point to a simple, unifying theory that contradicts them.

Shifting sands

I think the standard theory fails because it is built on the concept of capital, which is ill-defined. It is slippery, it means different things to different people and it is hard to measure. A firmer foundation is the concept of economic capital, developed for risk management.

In the simplest form, economic capital assumes the company is funded with one class of debt and one class of equity. The debt is held to a constant credit rating, which is translated to a one year probability of default. If that probability is 0.1 per cent (somewhere between A and BBB), the firm must hold enough equity such that there is a 99.9 per cent probability one-year losses will not exceed the equity amount. This is the firm's economic capital. Note that, despite the name, it is a measure of risk rather than of capital. The cost of both debt (at a known credit rating) and equity (at a known risk level) can be estimated from market observation, so we know the cost of capital. The amount of debt and equity capital consumed by any corporate decision can also be estimated.

True economic capital is multidimensional. It has a time dimension and depends on all fractiles of profit and loss distributions, not just the 0.1 per cent tail. The firm has more than two capital sources, and projects consume more than two types of capital. But in principle at least, the concept of economic capital can link capital structure to capital budgeting. In practice, the job is proving to be difficult but possible.

One way to think about this shift is to consider the first question many intelligent students ask about Corporate Finance: why do firms need capital at all? After all, if a firm only engages in positive net present value projects it will collect more revenue than it pays in expenses. Why not just set up in business to do that, without worrying about raising capital?

The traditional answer, at least the one I was given many years ago, is timing. While there are some self-financing economic projects, most projects require net outlays before revenues arrive. Thus you must borrow money or raise equity to buy raw materials, tools and labor; and only later will you be paid for your finished products.

That answer relies on market inefficiencies, thus cannot be admitted to the theory. In perfect financial markets, you should be able to sell the project revenues today for their present value, and use that cash to produce the finished goods.

The real deal

I think a better answer, in line with the concept of economic capital, makes risk the central consideration. Suppose a movie studio is considering two pictures, each of which will cost $100 million to make. One is a standard genre sequel, which will return revenue with a uniform distribution between $100 million and $140 million. The other is a daringly original idea. It will return rev-

enue with a uniform distribution between $0 and $240 million. Both projects have an expected return of 20 per cent. Assuming the revenue has positive correlation with the stock market, the first one would have a higher risk-adjusted net present value if offered on the market.

However, the second project is much more valuable to the studio. Most of the value of business projects comes from the embedded real options. The value of options increases with the volatility of the project. Introductory corporate finance books teach real options as an add-on to the basic theory. I think real options are the core. If the second picture succeeds, it can attract new audiences, and create potential for further profitable ventures. It will attract more talented people to the studio, as employees, contractors, suppliers and customers.

The second picture also has a more valuable option to abandon. Suppose 40 per cent of the way through the picture, the studio will know its revenue potential. That information is useless with the safe picture, even if the revenue will be the minimum $100 million it will be worth the additional $60 million to finish the picture. But 25 per cent of the time with the risky picture, the revenue will be less than $60 million, and the picture can be abandoned with an average savings of $30 million. That extra expected $7.5 million raises the expected return of the project from 20 per cent to 27.5 per cent.

Generally speaking, it makes sense to maximize risk at the project level to maximize the value of the real options and get the best performance from everyone. At the firm level, however, since almost all projects have positive correlation with the overall economy, you want to minimize risk. And it's not just systematic risk that hurts at the firm level. Standard deviation, even if uncorrelated with the market, makes the business less efficient. A movie studio that makes only risky pictures will find its corporate staff underemployed after a series of failures and abandonments. If it gets a series of hits, it will not have the resources to capture full advantage of the associated options. Ambitious, talented people work best in high-risk projects, but the firm also needs steadier, risk-averse people who want predictable routine and safe jobs. Volatile results make it hard to enforce the discipline to control costs, when results are more even it's easier to optimize things.

Now the firm has an active role in Corporate Finance, it's not a passive packaging of projects. The firm's role is to hold valuable options on risky underlyings. The risk of the underlyings is the main economic value of the firm, through its effect on the firm's options. But the options are designed to minimize risk, both for efficient corporate operation and to reduce the cost of capital.

Why can't the individual projects be sold directly to the market? Once sold, there is no incentive for managers to exercise the option to abandon; and no way for investors to capture the profits from the option to expand. In principle, we could thing about devising financial contracts to address this. This might be the next generation of financial innovation, but to date no one has done this. It might prove impossible due to the difficulties of trading human capital (including laws against slavery) and intellectual capital.

The firm can also provide corporate level services more efficiently than individual projects could outsource them. Again, this could change from innovation, in this case innovation in business organization. Certainly many functions that used to be considered core are routinely outsourced today. But there might turn out to be a fundamental barrier imposed by information flows. If a firm outsources too much, it loses its control of project information, and therefore its ability to capture the value of options to expand.

Neither economic capital nor real options are new ideas, but to my knowledge, no one has suggested putting them at the core of Corporate Finance theory replacing physical capital and timing of cash flows. I think they are promising foundations for a complete theory that addresses shortcomings of current theory. They are both subject of considerable academic attention as well as private-sector implementation.

I have no doubt there are other approaches to fixing Corporate Finance, but I think all of them have to start at the core, and all of them will be founded on risk concepts. The existing theory is deterministic at the core, risk is added at an intermediate step. At the time the theory was developed, no one had the tools to do anything else. Now we do. So let's get to work.