Financial Markets and the Real Economy

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Introduction

1.1 Risk premia

Some assets offer higher average returns than other assets, or, equivalently, they attract lower prices. These "risk premia" should reflect aggregate, macroeconomic risks; they should reflect the tendency of assets to do badly in bad economic times. I survey research on the central question: what is the nature of macroeconomic risk that drives risk premia in asset markets?

The central idea of modern finance is that prices are generated by expected discounted payoffs,

$$p_t^i = E_t(m_{t+1}x_{t+1}^i) \tag{1.1}$$

where x_{t+1}^i is a random payoff of a specific asset i, and m_{t+1} is a stochastic discount factor. Using the definition of covariance and the real riskfree rate $R^f = 1/E(m)$, we can write the price as

$$p_t^i = \frac{E_t(x_{t+1}^i)}{R_t^f} + cov_t(m_{t+1}, x_{t+1}^i). \tag{1.2}$$

The first term is the risk-neutral present value. The second term is the crucial discount for risk – a large negative covariance generates a low or "discounted" price. Applied to excess returns R^{ei} (short or borrow one asset, invest in another), this statement becomes[1]

$$E_t(R^{ei}_{t+1}) = -cov_t(R^{ei}_{t+1}, m_{t+1}). \tag{1.3}$$

The expected excess return or "risk premium" is higher for assets that have a large negative covariance with the discount factor.

The discount factor m_{t+1} is equal to growth in the marginal value of wealth,

$$m_{t+1} = \frac{V_W(t+1)}{V_W(t)}.$$

This is a simple statement of an investor's first-order conditions. The marginal value of wealth V_W answers the question "how much happier would you be if you found a dollar on the street?" It measures "hunger" – *marginal* utility, not total utility. Thus, the discount factor is high at $t+1$ if you desperately want more wealth – and would be willing to give up a lot of wealth in other dates or states to get it.

Equation (1.3) thus says that the risk premium is driven by the covariance of returns with the marginal value of wealth.[2] Given that an asset must do well sometimes and do badly at other times, investors would rather it did well when they are otherwise desperate for a little bit of extra wealth, and that it did badly when they do not particularly value extra wealth. Thus, investors want assets whose payoffs

[1] From (1.1), we have for gross returns R,

$$1 = E(mR)$$

and for a zero-cost excess return $R^e = R^i - R^j$.

$$0 = E(mR^e).$$

Using the definition of covariance, and $1 = E(m)R^f$ for a real risk-free rate,

$$0 = E(m)E(R^e) + cov(m, R^e)$$
$$E(R^e) = -R^f cov(m, R^e)$$

For small time intervals $R^f \approx 1$ so we have

$$E(R^e) = -cov(m, R^e).$$

This equation holds exactly in continuous time.

[2] m_{t+1} really measures the *growth* in marginal utility or "hunger." However, from the perspective of time t, $V_W(t)$ is fixed, so what counts is how the realization of the return covaries with the realization of time $t+1$ marginal value of wealth $V_W(t+1)$.

have a positive covariance with hunger, and they will avoid assets with a negative covariance. Investors will drive up the prices and drive down the average returns of assets that covary positively with hunger, and vice-versa, generating the observed risk premia.

These predictions are surprising to newcomers for what they do *not* say. More volatile assets do not necessarily generate a higher risk premium. The *variance* of the return R^{ei} or payoff x^i is irrelevant and does not measure risk or generate a risk premium. Only the *covariance* of the return with "hunger" matters.

Also, many people do not recognize that equations (1.2) and (1.3) characterize an *equilibrium*. They do not generate portfolio advice; they describe a market after everyone has settled on their optimal portfolios. *Deviations* from (1.2) and (1.3), if you can find them, can give portfolio advice. It's natural to think that high expected return assets are "good" and one should buy more of them. But the logic goes the other way: "Good" assets pay off well in bad times when investors are hungry. Since investors all want them, they get *lower* average returns and command higher prices in equilibrium. High average return assets are *forced* to pay those returns or suffer low prices because they are so "bad" – because they pay off badly precisely when investors are most hungry. In the end, there is no "good" or "bad." Equations (1.2) and (1.3) describe an equilibrium in which the quality of the asset and its price are exactly balanced.

To make these ideas operational, we need some procedure to measure the growth in the marginal value of wealth or "hunger" m_{t+1}. The traditional theories of finance, CAPM, ICAPM, and APT, measure hunger by the behavior of large portfolios of assets. For example, in the CAPM, a high average return is balanced by a large tendency of an asset to fall just when the market as a whole falls – a high "beta." In equations,

$$E_t(R^{ei}_{t+1}) = cov_t(R^{ei}_{t+1}, R^m_{t+1}) \times \lambda$$

where λ is a constant of proportionality. Multifactor models such as the popular Fama-French [65] three-factor model use returns on multiple portfolios to measure the marginal value of wealth.

Research connecting financial markets to the real economy – the subject of this survey – goes one step deeper. It asks what are the *fundamental, economic* determinants of the marginal value of wealth? For example, I start with the consumption-based model,

$$E_t(R^{ei}_{t+1}) = cov_t\left(R^{ei}_{t+1}, \frac{c_{t+1}}{c_t}\right) \times \gamma,$$

which states that assets must offer high returns if they pay off badly in "bad times" as measured by consumption growth. As we will see, this simple and attractive model does not (yet) work very well. The research in this survey is aimed at improving that performance. It aims to find a good measure of the marginal value of wealth, rooted in measures of economic conditions such as aggregate consumption, that explains the pattern by which mean returns $E_t(R^{ei}_{t+1})$ vary across assets i and over time t.

1.2 Who cares?

Why is this important? What do we learn by connecting asset returns to macroeconomic events in this way? Why bother, given that "reduced form" or portfolio-based models like the CAPM are guaranteed to perform better?

1.3 Macroeconomics

Understanding the marginal value of wealth that drives asset markets is most obviously important for macroeconomics. The centerpieces of dynamic macroeconomics are the equation of savings to investment, the equation of marginal rates of substitution to marginal rates of transformation, the allocation of consumption and investment across time and states of nature. Asset markets are the mechanism that does all this equating. If we can learn the marginal value of wealth from asset markets, we have a powerful measurement of the key ingredient of all modern, dynamic, intertemporal macroeconomics.

In fact, the first stab at this piece of economics is a disaster, in a way made precise by the "equity premium" discussion. The marginal value of wealth needed to make sense of the most basic stock market facts is orders of magnitude more volatile than that specified in almost all macroeconomic models. Clearly, finance has a *lot* to say about macroeconomics, and it says that something is desperately wrong with most macroeconomic models.

In response to this challenge, many macroeconomists simply dismiss asset market data. "Something's wacky with stocks" they say, or perhaps "stocks are driven by fads and fashions disconnected from the real economy." That might be true, but if so, by what magic are marginal rates of substitution and transformation equated? It makes no sense to say "markets are crazy" and then go right back to market-clearing models with wildly counterfactual asset-pricing implications. If asset markets are screwed up, so is the equation of marginal rates of substitution and transformation in every macroeconomic model, so are those models' predictions for quantities, and so are their policy and welfare implications. Asset markets can have a greater impact on macroeconomics if their economic explanation *fails* than if it succeeds.

1.4 Finance

Many financial economists dismiss macroeconomic approaches to asset pricing because portfolio-based models "work better" – they provide smaller pricing errors. This dismissal of macroeconomics by financial economists is just as misguided as the dismissal of finance by macroeconomists.

First, a good part of the better performance of portfolio-based models simply reflects Roll's [137] theorem: We can always construct a reference portfolio that perfectly fits all asset returns: the sample mean-variance efficient portfolio. The *only* content to empirical work in asset pricing is what constraints the author put on his fishing expedition to avoid rediscovering Roll's theorem. The instability of many "anomalies" and the changing popularity of different factor models [142] lends some credence to this worry.

The main fishing constraint one can imagine is that the factor portfolios *are* in fact mimicking portfolios for some well-understood macroeconomic risk. Fama [58] famously labeled the ICAPM and similar theories "fishing licenses," but his comment cuts in both directions. Yes, current empirical implementations do not impose much structure from theory, but no, you still can't fish without a license. For example, momentum has yet to acquire the status of a factor despite abundant empirical success, because it has been hard to come up with stories that it corresponds to some plausible measure of the marginal utility of wealth.

Second, much work in finance is framed as answering the question whether markets are "rational" and "efficient" or not. *No* amount of research using portfolios on the right-hand side can *ever* address this question. The only possible content to the "rationality" question is whether the "hunger" apparent in asset prices – the discount factor, marginal value of wealth, etc. – mirrors macroeconomic conditions correctly. If Mars has perfectly smooth consumption growth, then prices that are perfectly "rational" on volatile Earth would be "irrational" on Mars. Price data alone *cannot* answer the question, because you can't tell from the prices which planet you're on.

In sum, the program of understanding the real, macroeconomic risks that drive asset prices (or the proof that they do not do so at all) is not some weird branch of finance; it is the trunk of the tree. As frustratingly slow as progress is, this is the only way to answer the central questions of financial economics, and a crucial and unavoidable set of uncomfortable measurements and predictions for macroeconomics.

1.5 The mimicking portfolio theorem and the division of labor

Portfolio-based models will always be with us. The "mimicking portfolio" theorem states that if we have the perfect model of the marginal utility of wealth, then a portfolio formed by its regression on to asset returns will work just as well.[3] And this "mimicking portfolio" will have better-measured and more frequent data, so it will work better in sample and in practice. It will be the right model to recommend for many applications.

[3] Start with the true model,

$$0 = E(mR^e)$$

where R^e denotes a vector of excess returns. Consider a regression of the discount factor on excess returns, with no constant,

$$m = b'R^e + \varepsilon.$$

This theorem is important for doing and evaluating empirical work. First, together with the Roll theorem, it warns us that it is pointless to engage in an alpha contest between real and portfolio-based models. Ad-hoc portfolio models must always win this contest – even the *true* model would be beaten by its own mimicking portfolio because of measurement issues, and it would be beaten badly by an ad-hoc portfolio model that could slide a bit toward the sample mean-variance frontier. Thus the game "see if macro factors do better than the Fama–French three factor model" in pricing the Fama–French 25 portfolios is rather pointless. Even if you do succeed, a "small-growth/large-value" fourth factor or the increasingly popular momentum factor can always come back to trump any alpha successes.

Portfolio-based models are good for relative pricing; for describing one set of asset returns given another set. The CAPM describes average returns of stock portfolios *given* the market premium. The Fama–French model describes average returns of 25 size and book/market sorted portfolios *given* the average returns of the three factor portfolios. But why is the average market return what it is? Why are the average returns of the Fama–French value and size portfolios what they are? Why does the expected market return vary over time? By their nature, portfolio models *cannot* answer these questions. Macroeconomic models are the *only* way to answer these questions.

With this insight, we can achieve a satisfying division of labor, rather than a fruitless alpha-fishing contest. Portfolio models document whether expected returns of a large number of assets or dynamic strategies can be described in terms of a few sources of common movement. Macro models try to understand why the common factors (market, hml, smb) are priced. Such an understanding will of course ultimately pay off for pure portfolio questions, by helping us to understand which apparent risk premia are stable rewards for risk, and which were chimeric features of the luck in one particular sample.

By construction, $E(R^e\varepsilon) = 0$, so

$$0 = E\left[\left(b'R^e\right)R^e\right]$$

Therefore, the zero-cost portfolio $b'R^e$ is a discount factor as well.

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