Abstract

Standard asset pricing models assume that (i) there is complete agreement among investors about probability distributions of future payoffs on assets, and (ii) investors choose asset holdings based solely on anticipated payoffs; that is, investment assets are not also consumption goods. Both assumptions are probably unrealistic. We provide a simple framework for studying how disagreement and tastes for assets as consumption goods can affect asset prices.
Standard asset pricing models, like the capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965), Merton’s (1973) intertemporal CAPM (the ICAPM), and the consumption based model of Lucas (1978) and Breeden (1979), share the complete agreement assumption: all investors know the true joint distribution of asset payoffs next period (or in all future periods for intertemporal models). The assumption is unrealistic, and there are two strands of research that relax it.

The first begins with Lintner (1969). He makes all assumptions of the CAPM except complete agreement. Lintner (1969) takes the first-order condition on asset investments from the investor’s portfolio problem, aggregates across investors, and then solves for market clearing prices. The result is that current asset prices depend on weighted averages of investor assessments of expected payoffs (dividend plus price) and the covariance matrix of payoffs. Other research (Rubinstein 1974, Fama 1976 chapter 8, Williams 1977, Jarrow 1980, Mayshar 1983, Basak 2003) proceeds along the same lines. Much of this work focuses on the CAPM, but similar results hold for other models.

The pricing expressions in these papers imply that if the relevant weighted averages of investor assessments are equal to the true expected values and the true covariance matrix of next period’s payoffs, asset pricing is as if there is complete agreement. This is the sense in which disagreement can produce CAPM pricing, as long as investor expectations are “on average” correct. The way they must be correct is, however, quite specific, and thus unlikely, except perhaps as an approximation.

In the second strand of the disagreement literature, investors get noisy signals about future asset payoffs, but they learn from prices. This work examines conditions in which a rational expectations equilibrium produces fully revealing prices. In a fully revealing equilibrium, prices are set as if all investors know the joint distribution of future payoffs, so when the other assumptions of the CAPM hold, we get CAPM pricing. Again, the conditions required to produce this result are restrictive. Papers in this spirit include Admati (1985), DeMarzo and Skiadas (1998), and Biais, Bossaerts, and Spatt (2003).

Existing work on disagreement is quite mathematical. Our goal is to provide a simple framework for thinking about how disagreement can affect asset prices. We focus on a world that conforms to all assumptions of the CAPM, except complete agreement. We argue that our framework is useful for
characterizing the price effects that arise in behavioral models that assume expectations are irrational, for example, the models of underreaction and overreaction to information of DeBondt and Thaler (1987), Barberis, Shleifer, and Vishny (1998) and Daniel, Hirshleifer, and Subrahmanyam (1998).

Another common assumption in asset pricing models is that investors are only concerned with the payoffs from their portfolios; that is, investment assets are not also consumption goods. This assumption has many potential violations. For example, loyalty or the desire to belong may cause an investor to hold more of his employer’s stock than is justified based on payoff characteristics (Cohen 2003). Or some investors may get pleasure from holding the common stock of strong companies (growth stocks) and dislike holding distressed (value) stocks (Daniel and Titman 1997). Socially responsible investing (Geczy, Stambaugh, and Levin 2003), and home bias (French and Poterba 1991, Karolyi and Stulz 2002), are also examples. Finally, tax effects (for example, the lock-in effect of unrealized capital gains) and restrictions on holdings of securities (for example, stock issued to employees that must be held for a minimum period) can affect prices in the same way as tastes for assets as consumption goods.

Our second goal is to characterize the potential price effects of asset tastes. It turns out that the framework we use to study disagreement applies as well to this issue.

Our interest in these topics is in part due to evidence that the CAPM fails to explain average stock returns. Two CAPM anomalies attract the most attention and controversy. The first is the value premium (Statman 1980, Rosenberg, Reid, and Lanstein 1985, Fama and French 1992): stocks with low prices relative to book value have higher average returns than predicted by the CAPM. The second is momentum (Jegadeesh and Titman 1993): stocks with high returns over the last year tend to continue to have high returns for a few months, and low short-term past returns also tend to persist.

We argue that some of the stories offered to explain value and momentum returns fall under the rubric of disagreement while others in effect assume tastes for assets as consumption goods. Moreover, even models like Fama and French (1993) that propose multifactor versions of Merton’s (1973) ICAPM to explain CAPM anomalies leave open the possibility that ICAPM pricing arises because of investor
tastes for assets as consumption goods, rather than through the standard ICAPM channel – investor
demands to hedge uncertainty about future consumption-investment opportunities.

We add no new results likely to move readers toward one or another explanation of the empirical
failures of the CAPM. And we take no stance on which stories are more relevant. Our goal is just to
provide a simple way to frame competing stories.

We begin (Section I) with an analysis of the asset pricing implications of disagreement. Section
II turns to tastes for assets as consumption goods. Section III concludes.

I. Disagreement

We focus on a one-period world where all assumptions of the Sharpe (1964) – Lintner (1965)
CAPM hold except complete agreement. Specifically, suppose there are two types of investors: group A,
the informed, who know the joint distribution of one-period asset payoffs implied by all currently
knowable information, and group D, the misinformed, who misperceive the distribution of payoffs.
Group D investors need not agree among themselves, and they do not know they are misinformed. Does
asset pricing conform to the CAPM despite the absence of complete agreement? The answer is no, except
in special cases.

A. The CAPM

Market equilibrium in this world is easy to describe. Each investor combines riskfree borrowing
or lending with what the investor takes to be the tangency portfolio from the minimum-variance frontier
for risky securities. The informed investors in group A choose the true tangency portfolio, call it T. But
except in special cases, the misinformed investors of group D do not choose T. Indeed, the perceived
tangency portfolio can be different for different group D investors. The aggregate of the risky portfolios
of the misinformed is called portfolio D.

Market clearing requires that the value-weight market portfolio of risky assets, M, is the wealth-
weighted aggregate of portfolio D and the true tangency portfolio T chosen by informed investors. If x is
informed investors’ share of the total wealth invested in risky assets, n is the number of risky assets, and $w_{JM}$, $w_{JT}$, and $w_{JD}$ are the weights of asset j in portfolios M, T, and D, the market clearing condition is,

$$w_{JM} = x w_{JT} + (1-x) w_{JD}, \quad j = 1, 2, \ldots, n;$$

or, in terms of returns,

$$R_M = x R_T + (1-x) R_D.$$

All variables in (1) are, of course, outputs of a market equilibrium. Equilibrium asset prices determine the weights of assets in M, T, and D, as well as the wealth shares of investors.

Figure 1 shows the relations among portfolios M, T, and D. The tangency portfolio T is the portfolio on the true minimum-variance frontier for risky assets (curve ABC) with the highest possible Sharpe ratio,

$$S_T = \frac{E(R_T) - R_F}{\sigma(R_T)},$$

where $E(R_T)$ and $\sigma(R_T)$ are the expected value and standard deviation of the return on T, and $R_F$ is the riskfree rate. Group D investors are misinformed, so their aggregate portfolio D is not typically the true tangency portfolio, and the Sharpe ratio $S_D$ is less than $S_T$. Since the market portfolio M is a positively weighted portfolio of T and D, M is between T and D on the hyperbola that links them, and $S_M$ is between $S_D$ and $S_T$.

In the CAPM, the true tangency portfolio is the market portfolio. When all assumptions of the CAPM hold except complete agreement – and there is at least one informed and one misinformed investor (so $0 < x < 1$) – equation (1) implies that T is M only if D is also M. In other words, the CAPM holds only if misinformed investors as a group hold the market portfolio. This can happen when the mistaken beliefs of the misinformed wash (they are on average correct) or when prices are fully revealing (which says that, given prices, beliefs are correct). But the message from (1) is that a necessary condition for CAPM pricing when there is disagreement is that the misinformed in aggregate hold the market portfolio.

Necessary does not imply sufficient. A problem arises when there are no informed investors ($x = 0$ in (1)). Although market clearing then requires that the aggregate of the risky portfolios chosen by the misinformed is the market portfolio ($D = M$), M is not likely to be the true tangency portfolio. The
demands of misinformed investors will not produce CAPM pricing except in the case where their erroneous beliefs happen to aggregate to rationality.

Put differently, market clearing implies that the aggregate portfolio $D$ of the misinformed moves toward the market portfolio $M$ as $x$ (the market share of the informed) approaches zero in (1). But this does not mean that $T$, the true tangency portfolio held by the informed, is closer to $M$. When the share of the informed in invested wealth is small, the misinformed can have a big effect on asset prices. (The calibration presented later illustrates this point.) As a result, though portfolio $D$ of the misinformed is close to the market portfolio $M$, both $D$ and $M$ can be far from the true mean-variance-efficient frontier.

In sum, without complete agreement, the central prediction of the CAPM – that securities are priced to make the market portfolio mean-variance-efficient (MVE) – holds only in special cases. When there is at least one informed investor, we get CAPM pricing (the market portfolio is MVE) if and only if, for whatever reason, the aggregate risky portfolio of the misinformed is the market portfolio $M$. The market clearing condition of equation (1) then implies that the informed must also choose $M$, which means securities must be priced so that $M$ is the tangency portfolio $T$. If there are no informed investors, the aggregate portfolio $D$ of the misinformed must be the market portfolio $M$. In this case, CAPM pricing holds only when the beliefs of the misinformed are on average correct, so $D = M$ is the true tangency portfolio $T$. With or without informed investors, the bottom line is that CAPM pricing requires that in aggregate misinformed investors choose the true tangency portfolio $T$.

**B. Limits to Arbitrage**

Shleifer and Vishny (1997) argue that because most arbitrage is risky, arbitrageurs do not fully offset the price effects of misinformed investors. Our analysis provides an equilibrium perspective on the problem. Market-clearing prices must be set so that the portfolios of the informed and the misinformed add up to the market. If the misinformed in aggregate do not hold the market portfolio $M$, then (in a world where all CAPM assumptions except complete agreement hold) the true tangency portfolio chosen by the informed cannot be $M$. Thus, the actions of the informed do not lead us back to CAPM pricing.
There is an obvious case where the informed totally offset the price effects of the misinformed. Misinformed beliefs cannot produce riskless arbitrage for the informed, that is, zero variance returns that exceed the riskfree rate. The actions of the informed ensure prices that preempt riskless arbitrage and so totally offset actions of the misinformed that might produce one.

C. Calibration

Do misinformed investors have a big impact on asset prices, or are small price changes enough to induce informed investors to counter the demands of the misinformed? To explore this issue, we compare two equilibria. The first is a standard CAPM: all investors hold the true tangency portfolio, which then must be the market portfolio. In the second equilibrium, misinformed investors do not hold the market portfolio, and asset prices must induce informed investors to hold the complement (in the sense of (1)) of the portfolio of the misinformed.

We sort assets into two portfolios. Assets the misinformed underweight in the second equilibrium are assigned to portfolio G and those they overweight are in portfolio H. To simplify the notation, we scale G and H so in aggregate the market portfolio of informed investors in the first (CAPM) equilibrium is one unit of each. To simplify the analysis, we assume that the riskfree rate, \( R_F \), and the Sharpe ratio for the tangency portfolio, \( S_T \), do not change when the misinformed alter their weights in G and H. We also assume aggregate investments in the riskfree asset by group A investors, and by group D, do not change. (Allowing the misinformed to change what they invest in the riskfree asset, with an offsetting adjustment by the informed, complicates the analysis without new insights.)

In the first equilibrium, all investors hold the market portfolio and the expected returns on G and H satisfy the standard CAPM pricing relation,

\[
E(R_i) - R_F = \left[ E(R_M) - R_F \right] \frac{\text{Cov}(R_i, R_M)}{\sigma^2(R_M)} = S_T \frac{\text{Cov}(R_i, R_M)}{\sigma(R_M)} \quad i = G, H
\]

where \( R_G, R_H, R_F, \) and \( R_M \) are the gross (one plus) returns on portfolios G and H, the riskfree asset, and the market. Since the market is the tangency portfolio in this equilibrium, we can use the exogenously specified Sharpe ratio for the tangency portfolio, \( S_T \), in the CAPM equation.
In the second equilibrium, we assume informed and misinformed investors are initially endowed with market portfolios. The misinformed then sell $\theta_G$ units of G and $\theta_H$ units of H to informed investors. Thus, the informed own $\phi_G = 1 + \theta_G$ units of G and $\phi_H = 1 + \theta_H$ units of H. Since we assume the informed and the misinformed do not alter their positions in the riskfree asset, informed investors must finance their purchases of G with sales of H; if $\theta_G$ is positive, $\theta_H$ must be negative. More precisely, if $V_G$ and $V_H$ are the market clearing prices per unit of G and H at the time of the trade,

$$0_GV_G + \theta_H V_H = 0. \tag{5}$$

Since T is the tangency portfolio linking the risk free asset and the minimum variance frontier, the expected excess return on G is,

$$E(R_G) - R_F = [E(R_T) - R_F] \frac{\text{Cov}(R_G, R_T)}{\sigma^2(R_T)} = S_T \frac{\text{Cov}(R_G, R_T)}{\sigma(R_T)}. \tag{6}$$

Suppose the dollar payoffs on portfolios G and H at the end of the period are $P_G$ and $P_H$, with expected values $E(P_G)$ and $E(P_H)$, standard deviations $\sigma_G$ and $\sigma_H$, and correlation $\rho$. We can rewrite the expected excess return on G (derivation in the Appendix) as,

$$E(R_G) - R_F = S_T \left( \frac{\text{Cov}(P_G, P_G + \phi_H P_H)}{\sigma^2(P_G + \phi_H P_H)} \right) \left( 1 - \frac{\phi_G^2 \sigma_H^2 (1 - \rho^2)}{\sigma^2(P_G + \phi_H P_H)} \right)^{1/2}. \tag{7}$$

And the current price of a unit of G is

$$V_G = \frac{E(P_G)}{R_F} - S_T \left( \frac{\phi_G \sigma_H (1 - \rho^2)}{\sigma^2(P_G + \phi_H P_H)} \right)^{1/2}. \tag{8}$$

There is a similar equation for the price of a unit of H,

$$V_H = \frac{E(P_H)}{R_F} - S_T \left( \frac{\phi_H \sigma_G (1 - \rho^2)}{\sigma^2(P_G + \phi_H P_H)} \right)^{1/2}. \tag{9}$$

Equations (8) and (9) describe the prices of G and H as functions of: (i) $R_F$ and $S_T$, which we assume are fixed; (ii) the parameters of the joint distribution of the payoffs $P_G$ and $P_H$; and (iii) the quantities of G and H the misinformed decide to sell, $\theta_G$ and $\theta_H$. (Recall that $\phi = 1 + \theta_i$.) Using equations
(5), (8), and (9). Figure 2 shows the expected returns on G and H for different values of \( \theta_G \) and \( \rho \). In the figure, we assume the annual riskfree rate is 2\% \( (R_F = 1.02) \); the expected return on the market in the CAPM equilibrium is 10\% \( (E(R_M) = 1.10) \); and the payoffs on G and H have the same expected value \( (E(P_G) = E(P_H)) \) and the same standard deviation \( (\sigma_G = \sigma_H). \)

Since the payoffs on G and H have the same expected value and standard deviation, their expected returns in the CAPM equilibrium are equal to the expected market return, 10\%. Figure 2 then shows that the misinformed can have a big impact on expected returns. For example, if the correlation \( (\rho) \) between G and H is 0.5 and the misinformed underweight G by 50\% of informed investors’ initial (CAPM) holdings \( (\theta_G = 0.5) \), the expected return on G increases from 10\% to about 11\%. The price effect is larger for the assets the misinformed overweight. If \( \rho = 0.5 \) and \( \theta_G = 0.5 \), the expected return on H falls from 10\% to 8.3\%.

Two patterns are clear in Figure 2. First, the price effects of erroneous beliefs are larger the lower the correlation between the payoffs on G and H. When \( P_G \) and \( P_H \) are perfectly correlated, G and H are perfect substitutes for the informed, so no price changes are needed to induce them to offset the actions of the misinformed, and G and H continue to have expected returns of 10\%. As the correlation falls, the impact of the misinformed on expected returns grows. For example, if \( \theta_G = 0.5 \), the expected return on H is 10\% for \( \rho = 1.0 \), 8.3\% for \( \rho = 0.5 \), and 5.6\% for \( \rho = 0.0 \). In economic terms, lower correlation between the payoffs on G and H makes diversification more effective, and the price of H must increase more to induce the informed to hold less of it.

Some perspective is helpful. Suppose the misinformed over and underweight stocks at random, and G and H are highly diversified. Then the returns on G and H are likely to be highly correlated, and the beliefs of the misinformed have little effect on expected returns. On the other hand, if the choice of assets to over and underweight is systematically related to specific common factors in returns, perhaps because of herding (Froot, Scharfstein, and Stein 1992), fads (Shiller 1984), or style investing (Barberis and Shleifer 2003), the misinformed are more likely to have a bigger impact on expected returns. For example, value stocks are more highly correlated with other value stocks, growth stocks are more highly
correlated with growth stocks, and value and growth stocks are less correlated with one another (Fama and French 1993). If misinformed investors underweight value stocks and overweight growth stocks (DeBondt and Thaler 1987, Lakonishok, Shleifer, and Vishny 1994), the relatively low correlation between value and growth returns can magnify the impact of misinformed investors on prices.

The second clear pattern in Figure 2 is the relation between expected returns and the amount of over and underweighting forced on informed investors. If the payoffs on G and H are not perfectly correlated, an increase in \( \theta_G \) produces an increase in \( E(R_G) \) and a decrease in \( E(R_H) \); the expected return on G rises to induce informed investors to hold more G and the expected return on H falls to induce them to give up part of their position in H. Note that it is the size of the position changes forced on informed investors that matters. Thus, if informed investors have little wealth, small shifts away from the market portfolio by the misinformed push the tangency portfolio far from the market portfolio (\( \theta_G \) and \( \theta_H \) are far from 0) and cause big changes in the expected returns on G and H. On the other hand, if most wealth is in the hands of the informed, large reallocations by the misinformed have little effect on prices.

The relative sizes of the payoffs on G and H also matter. Figure 2 assumes the payoffs on G and H have the same the expected value and the same standard deviation, but in Figure 3, \( E(P_H) = 2E(P_G) \) and \( \sigma_H = 2\sigma_G \). In the CAPM equilibrium (\( \theta_G = 0 \)), H now contributes more to the volatility of the payoff on the market portfolio, its market beta is above 1, and its expected return is above the expected return on G. As \( \theta_G \) increases from 0 to 1, the weight of G in the tangency portfolio of informed investors increases and the weight of H declines. To induce these reallocations by the informed, \( E(R_G) \) increases and \( E(R_H) \) declines. The two expected returns cross at \( \theta_G = 0.5 \) in Figure 3, and for higher values of \( \theta_G \), \( E(R_G) \) is above \( E(R_H) \).

Figures 2 and 3 are situations where misinformed investors can induce big price effects. The misinformed have less impact when their bad information is limited to assets that are a small part of the market, so their shift away from the market portfolio requires small adjustments by informed investors. For example, suppose bad information is restricted to the assets in portfolio G, but the expected value and standard deviation of the payoff on H are 100 times those of G. Now G contributes little to the volatility
of the market payoff, and (if we rule out extreme short positions) forcing the informed to overweight G has little impact on their overall portfolio and on expected returns. For example, if the correlation between the payoffs on G and H is 0.5 and \( \theta_G \) increases from 0 to 1 (so the informed must double their holdings of G), the expected return on G increases by only 0.03%, from 5.93% (in the CAPM equilibrium) to 5.96%. This is essentially the case analyzed by Petajisto (2004), who finds that an exogenous change in the demand for an individual stock has little impact on prices in a CAPM framework. But this conclusion presumes misinformed investors are misinformed about only this stock; their demands for other stocks are in line with the demands of informed investors.

D. Empirical Implications

In principle, one can measure the extent to which prices are irrational. In the CAPM the market portfolio is the tangency portfolio. Thus, if all CAPM assumptions hold except complete agreement, the difference between the Sharpe ratio for the true tangency portfolio and the Sharpe ratio for market portfolio, \( S_T - S_M \), is an overall measure of the effect of misinformed beliefs on asset prices.

Since all investors try to combine the riskfree asset with the risky portfolio that has the highest Sharpe ratio, it is tempting to conclude that \( S_T - S_M \) and \( S_M - S_D \) measure (respectively) the gain to informed investors and the loss to the misinformed due to market inefficiency, that is, the effects of erroneous beliefs on asset prices. This is true, but only relative to the equilibrium obtained with informed and misinformed investors. One cannot conclude that the presence of misinformed investors makes the informed better off, since this involves a comparison of the welfare implications of alternative equilibria, about which we know nothing.

Jensen’s (1968) alpha is another measure of deviations from CAPM pricing that can be applied to portfolios or individual assets. Jensen’s \( \alpha \) is the deviation of the actual expected return on asset \( j \) from its CAPM expected value,

\[
\alpha_{jM} = E(R_j) - \{R_f + \beta_{jM}[E(R_M) - R_f]\},
\]

where \( \beta_{jM} \) is the slope in the regression of \( R_j - R_f \) on \( R_M - R_f \), and \( \alpha_{jM} \) is the intercept.
Unless the misinformed happen to hold the true tangency portfolio \( T \), so \( T \), \( M \), and \( D \) coincide, Jensen’s alpha for \( T \) is positive. To see this, divide \( \alpha_{TM} \) by the standard deviation of \( R_T \),

\[
\frac{\alpha_{TM}}{\sigma(R_T)} = \frac{E(R_T) - R_T}{\sigma(R_T)} - \beta_{TM} \frac{E(R_M) - R_T}{\sigma(R_T)} = S_T - \rho(R_T, R_M) S_M, \tag{11}
\]

where \( \rho(R_T, R_M) \) is the correlation between \( R_T \) and \( R_M \). Since the Sharpe ratio for \( T \) is greater than the Sharpe ratio for \( M \) and \( \rho(R_T, R_M) \) is less than one, \( \alpha_{TM} \) is positive. Like \( S_T - S_M \), \( \alpha_{TM} \) is an overall measure of the effects of mispricing on expected returns. Moreover, Jensen’s alpha for the market portfolio, \( \alpha_{MM} \), is zero. Since (10) implies that,

\[
\alpha_{MM} = x \alpha_{TM} + (1 - x) \alpha_{DM}, \tag{12}
\]

we can infer that \( \alpha_{DM} \), Jensen’s alpha for the risky portfolio of misinformed investors, is negative. Like \( S_M - S_D \), \( \alpha_{DM} \) is a measure of the overall cost borne by misinformed investors due to mistaken beliefs.

An obvious problem is that we do not know the composition of the tangency portfolio \( T \). And the problem is serious. The power of complete agreement is that, along with the other assumptions of the CAPM, it allows us to specify that the mean-variance-efficient (MVE) tangency portfolio \( T \) is the market portfolio \( M \). Thus, the composition of \( T \) is known. The first-order condition for MVE portfolios, applied to \( M \), can then be used to specify expected returns on assets – the pricing equation of the CAPM.

Without complete agreement, the assumptions of the CAPM do not suffice to identify \( T \) or any other portfolio that must be on the true MVE boundary. This means that, without complete agreement, testable predictions about how expected returns relate to risk are also lost. And the problem is not special to the CAPM. In short, complete agreement is a necessary ingredient of testable asset pricing models – unless we are willing to specify the nature of the beliefs of the misinformed and exactly how they affect portfolio choices and prices (for example, De Long, Shleifer, Summers, and Waldmann 1990).

If disagreement is the only potential violation of CAPM assumptions, however, we can use the F-test of Gibbons, Ross, and Shanken (GRS 1989) to infer whether disagreement indeed affects asset prices. The GRS test constructs an empirical tangency portfolio using sample estimates of expected returns and the covariance matrix of returns on the assets in the test, including the market portfolio. The test then
measures whether the tangency portfolio constructed from the full set of assets has a reliably higher Sharpe ratio than the market portfolio alone ($S_T > S_M$). If disagreement is the only potential violation of CAPM assumptions, the GRS test allows us to infer whether it has measurable effects on asset prices.

E. Examples

Some examples give life to the analysis. Suppose the assumptions of the CAPM hold except that there are misinformed investors who underreact to firm-specific news in the way proposed by Daniel, Hirshleifer, and Subramanyam (1998) to explain momentum and other firm-specific return anomalies. The misinformed buy too little (relative to market weights) of the assets with positive news and too much of the assets with negative news. Since all assets must be held, asset prices induce informed investors to hold the complement (in the sense of (1)) of the portfolio of the misinformed. This complement is the tangency portfolio $T$, but it is not the market portfolio $M$, so we do not get CAPM pricing.

It is important to note that in a multiperiod world, the price effects of bad beliefs do not disappear with the passage of time, unless the beliefs of the misinformed about today’s news converge to the beliefs of the informed. Without movement by the misinformed, the informed (who always hold the complement of portfolio $D$) have no incentive to take further actions that erase the price effects of the misinformed. For prices to converge to rational values, the misinformed must learn the errors of their ways, so eventually there is complete agreement about old news.

Another behavioral story is that investors do not understand that profitability is mean-reverting. As a result, investors over-extrapolate past persistent good times or bad times of firms, causing growth stocks to be overvalued and distressed (value) stocks to be undervalued (DeBondt and Thaler 1987). Suppose such overreaction is typical of misinformed investors. Then (given a world where all CAPM assumptions except complete agreement hold) the misinformed underweight value stocks (relative to market weights) and overweight growth stocks, and prices must induce the informed to overweight value stocks and underweight growth stocks. The portfolio of the informed is the true tangency portfolio, but it is not the market portfolio, so we do not get CAPM pricing. This seems to be the scenario Deboandt and
Thaler (1987), Haugen (1995), and Barberis, Shleifer, and Vishny (1998) have in mind, with the cycle repeating for each new vintage of growth and value stocks, and with the misinformed never coming to understand their initial overreaction to the past performance of growth and value stocks.

Does asset pricing in a world where the misinformed over-extrapolate the past fortunes of growth and value stocks move away from the CAPM to a multifactor version of Merton’s (1973) ICAPM? Generally, the answer is no. In an ICAPM, the market portfolio is not mean-variance-efficient, but it is multifactor efficient in the sense of Fama (1996). Since the portfolio choices of the misinformed are based on incorrect beliefs, it is unlikely they produce price effects that put the market portfolio on the multifactor efficient frontier implied by all currently knowable information.

There is a situation where overreaction and other behavioral biases can lead to an ICAPM, but one with irrational pricing. This happens when the biases produce expected return effects that are proportional to covariances of asset payoffs with state variables or common factors in returns. Style investing may be an example. Thus, defined benefit pension plans often allocate investment funds based on groupings of assets into so-called asset classes (large stocks, small stocks, value stocks, growth stocks, etc.). The groupings seem to correspond to common factors in returns (Fama and French 1993). And asset allocation decisions are often based on exposures to (covariances with) these factors. If plan sponsors do not choose the market portfolio, their actions can lead to an ICAPM that may be driven by behavioral biases. For example, the overreaction to the recent past return performance of asset classes proposed by Barberis and Shleifer (2003), or the overreaction to past profitability and growth proposed by Debondt and Thaler (1987), Lakonishok, Shleifer, and Vishny (1994), and Haugen (1995) might produce ICAPM or near-ICAPM pricing.

F. Active Management

It is widely believed that active investment managers (stock pickers) help make prices rational and that prices are less rational if active managers switch to a passive market portfolio strategy. Indeed, this is often offered as a justification for the existence of active managers, despite poor performance.
In our model, the price effects of misinformed managers are like those of other misinformed investors: trading based on bad beliefs makes prices less rational. And the world is a better place (prices are more rational) when misinformed investors admit their ignorance and switch to a passive market portfolio strategy. This typically reduces the over and underweighting of assets that informed investors must offset. The difference between the tangency portfolio $T$ and the market portfolio $M$ shrinks and market efficiency improves. (Recall the calibrations in Figures 2 and 3.)

This argument has a striking corollary. If all misinformed investors turn passive and switch to the market portfolio, asset prices must induce the informed to also hold $M$. The tangency portfolio $T$ is then the market portfolio, the CAPM holds, and prices are the rational result of the beliefs of the informed. Moreover, if all misinformed investors switch to the market portfolio, most of the informed can turn passive and just hold the market. More precisely, when all misinformed investors hold the market portfolio, complete rationality of prices requires just one active informed investor, who may have infinitesimal wealth, but whose rational beliefs nevertheless drive asset prices.

In general, however, when active managers have better information, they are among the informed who partially offset the actions of the misinformed and so make asset prices more rational. Except in the special case where misinformed investors hold the market portfolio, market efficiency is reduced when informed investors switch to a passive market portfolio strategy. Because the remaining informed investors are risk averse, they do not take up all the slack left by newly passive informed investors, and the misinformed have bigger price effects. (Again, the calibrations discussed earlier provide examples.)

In our model informed investors generate positive values of Jensen’s alpha, and the misinformed have negative alphas. The performance evaluation literature (for example, Carhart, 1997) suggests that, judged on alphas, the ranks of the informed among active managers are at best thin. Perhaps informed active managers act like rational monopolists and absorb the expected return benefits of their superior information with higher fees and expenses. But the performance evaluation literature suggests that the ranks of the informed remain thin when returns are measured before fees and expenses.
Carhart (1997) is puzzled by his evidence that there are mutual fund managers (about ten percent of the total number but a smaller fraction of aggregate mutual fund assets) who generate reliably negative estimates of Jensen’s alpha before fees and expenses. This is a puzzle only if prices are rational so the misinformed are protected from the adverse price effects of erroneous beliefs. But in our model, if the misinformed do not in aggregate hold the market portfolio, their beliefs affect prices, and they pay for their beliefs with negative alphas.

Overall, the performance evaluation literature suggests that it is difficult to distinguish between informed and misinformed active managers. This is good news about the performance of markets if it means that informed investors dominate prices, which, as a result, are near completely rational.

Finally, our simple model ignores portfolio management costs, but it does produce insights about their potential price effects. Because costs deter trading by the misinformed, costs tend to reduce the price effects of erroneous beliefs. But portfolio management costs also dampen the response of informed investors to the actions of the misinformed. Since costs impede both the misinformed, who distort prices, and the informed, who counter the distortions, their net effect on market efficiency is ambiguous.

There is confusion on this point in the literature. For example, going back at least to Miller (1977), it is often assumed that limits on short-selling make asset prices less rational. In our model, this is true when all short-selling is by informed investors. But it may be false when short-selling can be the result of misinformed beliefs.

II. Tastes for Assets

A common assumption in asset pricing models is that investors are concerned only with the payoffs from their portfolios; that is, investment assets are not also consumption goods. We provide a simple analysis of how tastes for assets as consumption goods can affect asset prices. We consider two cases. (i) Utility depends directly on the quantities of assets held. (ii) Tastes for assets are related to the covariances of asset returns with common return factors or state variables.
A. Tastes for Assets Do Not Depend on Returns

To focus on the effects of tastes, we assume there is complete agreement and asset prices are rational. At time 1, investors allocate current wealth, \( W_1 \), to pure time 1 consumption goods and to \( n \) assets that generate the wealth to be split between consumption and investment at time 2. The tastes of investor \( i \) are described by the utility function \( U_i(C_1, q_1, \ldots, q_n, W_2) \), where \( C_1 \) is the dollar value of time 1 pure consumption goods, \( q_1, \ldots, q_n \) are the dollar investments in the \( n \) portfolio assets, \( W_2 = \sum q_j(1 + R_j) \) is the wealth at time 2 from investments at time 1, and \( \sum q_j = W_1 - C_1 \).

The idea conveyed by \( U_i(C_1, q_1, \ldots, q_n, W_2) \) is that the investor gets utility from the dollar amounts of different assets held at time 1, as well as from \( C_1 \). Utility need not depend on time 1 holdings of all assets, and the holdings with zero marginal utility can differ across investors. We also assume that some investors, called group A, have no tastes for assets as consumption goods. Investors who do have such tastes are called group D.

Suppose all assumptions of the CAPM hold, except some investors have tastes for assets as consumption goods. As usual, group A investors (no such tastes) combine the riskfree asset with the true mean-variance-efficient (MVE) tangency portfolio \( T \) of risky assets. A group D investor also combines riskfree borrowing or lending with a portfolio of risky assets. But the risky portfolio chosen in part depends on the investor’s tastes for assets, so it is not typically the unconditional tangency portfolio \( T \). Given risk aversion, however, the investor’s portfolio is conditionally MVE: given the investments in assets with non-zero marginal utility as consumption goods, the portfolio maximizes expected return given its return variance and minimizes variance given its expected return.

As usual, market clearing prices require that the market portfolio of risky securities is the aggregate of the risky portfolios chosen by investors. We can again express this condition as,

\[
(13) \quad w_{jm} = x w_{jT} + (1-x) w_{jd}, \quad j = 1, 2, \ldots, n,
\]

where \( w_{jd} \) is the weight of asset \( j \) in the wealth-weighted aggregate portfolio of the risky portfolios of group D investors, and \( x \) is the share of group A investors in total wealth invested in risky assets.
As indicated by the choice of symbols, this equilibrium is like the one obtained when deviations from CAPM pricing are due to misinformed investors. Again, asset prices must induce group A to choose the complement (in the sense of (13)) of the portfolio of group D. And again, we do not get CAPM pricing except when the tastes of group D investors are perfectly offsetting and in aggregate they hold the market portfolio M, so group A investors also hold M, and M must be the tangency portfolio T.

If tastes for assets as consumption goods undermine the CAPM, testable predictions about expected return and risk are again lost. Conceptually, we could use the tangency portfolio of group A to describe expected returns, but because we have not identified the composition of the aggregate portfolio of group D, we cannot identify the tangency portfolio of group A. If tastes for assets are the only potential problem for the CAPM, however, we can use the GRS test and estimates of Jensen’s alpha to infer whether such tastes actually affect asset prices.

Examples are plentiful. “Socially responsible investing” is an extreme form of tastes for assets as consumption goods that are unrelated to returns. Thus, some investors do not hold the stocks of tobacco companies or gun manufacturers. Another example is loyalty or the desire to belong that leads to utility from holding the stock of one’s employer (Cohen 2003), one’s favorite animated characters, or one’s favorite sports team that is unrelated to the payoff characteristics of the stock. The home bias puzzle (French and Poterba 1991, Karolyi and Stulz 2003), that is, the fact that investors hold more of the assets of their home country than would be predicted by standard mean-variance portfolio theory is perhaps another example. Finally, there may be investors who get pleasure from holding growth stocks and dislike holding distressed (value) stocks, and these tastes influence investment decisions. This is the thrust of the characteristics model of Daniel and Titman (1997).

Even when employees do not have tastes for employer stock as a consumption good, options and grants that constrain an employee to hold the stock for some period of time affect portfolio decisions in the same way as tastes for the stock. The lock-in effect of capital gains taxes and tax rates on investment returns that differ across assets can also affect portfolio decisions and asset prices in much the same way as tastes for assets as consumption goods.
There is one important respect in which price effects induced by tastes may differ from those due to disagreement. Tastes are exogenous, and there is no economic logic that says tastes for assets as consumption goods eventually disappear. But economic logic does suggest that the price effects of disagreement are temporary. Misinformed investors should eventually learn they are misinformed and switch to a passive market portfolio strategy or turn portfolio management over to the informed.

B. Tastes for Assets Depend on Their Returns

If investor utility depends directly on the amounts invested in specific assets, asset prices do not conform to the CAPM. And prices are unlikely to conform to Merton’s (1973) ICAPM. ICAPM pricing arises when the utility of time 2 wealth, \( U_i(C_1, W_2 | S_2) \), depends on stochastic state variables, \( S_2 \). Covariances of time 2 asset returns with the state variables then become an ingredient in portfolio decisions and asset pricing. In contrast, when utility \( U_i(C_1, q_1, \ldots, q_i, W_2) \) depends on the quantities of assets chosen at time 1, we do not typically get ICAPM pricing.\(^1\)

ICAPM pricing does arise if investor tastes for assets as consumption goods depend not on the amount of each asset held, but instead on covariances of asset returns with common return factors or state variables. This is not, of course, the motivation for the ICAPM in Merton (1973). He emphasizes that the utility of wealth depends on how it can be used to generate future consumption and the portfolio opportunities that will be available to move wealth through time for consumption. Thus, the state variables, \( S_2 \), are usually assumed to be related to future consumption and investment opportunities.

As a logical possibility, however, ICAPM pricing can also arise because some state variables or common factors in returns affect investor utility solely as a matter of tastes. For example, Fama and French (1993) argue that the value premium is explained by a multifactor version of Merton’s (1973) ICAPM that includes a value-growth return factor. But this leaves an open issue. Does the value

\(^1\) To be precise, we get ICAPM pricing only if we trivialize the model by including the returns for all assets as state variables. The ICAPM assumes the covariance matrix of asset returns is known and positive definite, so there is a one-to-one mapping between the vector of quantities, \( q_1, \ldots, q_n \), and the vector of covariances of \( W_2 \) with all asset returns. Thus, we can rewrite utility that depends on the quantity invested in each asset, \( U(C_1, q_1, \ldots, q_n, W_2) \), as a function of the covariances between \( W_2 \) and all asset returns, \( U'(C_1, \text{Cov}(W_2, R_1), \ldots, \text{Cov}(W_2, R_n), W_2) \) or, with all asset returns included as state variables, \( U'(C_1, W_2 | S_2) \). Since every asset has its own state variable, this ICAPM is vacuous.
premium trace to a state variable related to uncertainty about consumption-investment opportunities (the
standard ICAPM story of Fama and French 1993), or to tastes for a return factor related to the value-
growth characteristics of firms (which can be viewed as a variant of the characteristics model of Daniel
and Titman 1997), or to irrational optimism about growth firms and pessimism about value firms
(DeBondt and Thaler 1987, Lakonishok Shleifer and Vishny 1994, Haugen 1995)? Distinguishing among
these alternatives is likely to be difficult.

Another problem is that when one opens the door to tastes for assets as consumption goods as a
source of ICAPM pricing, there may be a flood of applicants, and meaningful restrictions on expected
returns may be lost. But this is a general problem in moving from the CAPM to the ICAPM. The
ICAPM has interesting testable content only when the number of priced state variables is relatively small,
whether the state variables trace to consumption-investment opportunities or to tastes.

III. Conclusions

How important are the price effects of disagreement and tastes for assets as consumption goods?
Our calibrations imply that the price effects are large when (i) misinformed investors or investors with
asset tastes account for substantial invested wealth, and (ii) they are misinformed about or have tastes for
a wide range of assets with returns less than perfectly correlated with the returns on other assets. Whether
in fact the effects are large, we cannot say. But we hope we have convinced readers that our analysis does
provide a simple way to frame the problem.

Finally, our analysis may provide perspective on the asset pricing information delivered by the
three-factor model of Fama and French (1993). It is possible that disagreement, tastes for assets as
consumption goods, and state variable risks all play a role in asset pricing. Whatever the forces
generating asset prices, the mean-variance-efficient tangency portfolio T can always be used, along with
the riskfree rate, to describe differences in expected asset returns. In the Sharpe-Lintner CAPM, T is the
market portfolio M. But when asset pricing is affected by disagreement, tastes for assets as consumption
goods, and state variable risks, T is no longer M, and theory no longer specifies the composition of the
tangency portfolio. One (perhaps the only) approach to capturing $T$ is to form a set of diversified portfolios that seem to cover observed differences in average returns related to common factors in returns. If these portfolios span $T$, they can be used (along with the riskfree rate) to describe differences in expected asset returns (Huberman and Kandel 1987). And one can be agnostic about whether the tangency portfolio is not the market portfolio because of disagreement, tastes for assets as consumption goods, state variable risks, or an amalgam of the three. This may, in the end, be a reasonable view of the pricing information captured by the three-factor model.
Appendix

We derive equation (8). Equation (7) then follows easily. Since T is the tangency portfolio, and \( R_G = P_G / V_G \),

\[
E(R_G) - R_f = \left[ E(R_T) - R_f \right] \frac{\text{Cov}(R_G, R_T)}{\sigma^2(R_T)} = \frac{S_T \text{Cov}(P_G, R_T)}{V_G} \frac{\sigma(R_T)}{\sigma(R_T)}
\]

\[
V_G = \frac{E(P_G)}{R_f} - \frac{S_T \text{Cov}(P_G, R_T)}{R_f} \frac{\sigma(R_T)}{\sigma(R_T)}
\]

\[
= \frac{E(P_G)}{R_f} - \frac{S_T \text{Cov}(P_G, \phi_G P_G + \phi_H P_H)}{R_f} \frac{\sigma(\phi_G P_G + \phi_H P_H)}{\sigma(\phi_G P_G + \phi_H P_H)}
\]

\[
= \frac{E(P_G)}{R_f} - \frac{S_T \left[ \sigma_G^2 + \phi_H \sigma_H \sigma_H \right]}{R_f} \frac{\sigma(\phi_G P_G + \phi_H P_H)}{\sigma(\phi_G P_G + \phi_H P_H)}
\]

\[
= \frac{E(P_G)}{R_f} - \frac{S_T \sigma_G \left\{ \frac{\left( \phi_G \sigma_G + \phi_H \sigma_H \right)^2}{\sigma^2(\phi_G P_G + \phi_H P_H)} \right\}^{1/2}}{R_f} \frac{\sigma(\phi_G P_G + \phi_H P_H)}{\sigma(\phi_G P_G + \phi_H P_H)}
\]

\[
= \frac{E(P_G)}{R_f} - \frac{S_T \sigma_G \left\{ \frac{\phi_G \sigma_G^2 + \phi_H \sigma_H^2 + 2 \phi_G \phi_H \sigma_G \sigma_H \sigma_H}{\phi_G \sigma_G^2 + \phi_H \sigma_H^2 + 2 \phi_G \phi_H \sigma_G \sigma_H \sigma_H} \right\}^{1/2}}{R_f} \frac{\sigma(\phi_G P_G + \phi_H P_H)}{\sigma(\phi_G P_G + \phi_H P_H)}
\]

\[
= \frac{E(P_G)}{R_f} - \frac{S_T \sigma_G \left\{ \frac{1 - \rho^2}{\sigma^2(\phi_G P_G + \phi_H P_H)} \right\}^{1/2}}{R_f} \frac{1}{\sigma(\phi_G P_G + \phi_H P_H)}
\]

(8)

Equation (7), the expected return version of (8), then follows simply by noting that \( E(R_G) = E(P_G) / V_G \).
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Figure 1-- Investment Opportunities and Portfolios T, M, and D
Figure 2 -- Expected Return on G and H as a Function of $\theta_G$ for Different Correlations ($\rho$) between $P_G$ and $P_H$,

$E(P_H) = E(P_G), \quad \sigma_H = \sigma_G$
Figure 3 -- Expected Return on G and H as a Function of $\theta_G$ for Different Correlations ($\rho$) between $P_G$ and $P_H$, 

\[ E(P_H) = 2E(P_G), \quad \sigma_H = 2\sigma_G \]