Chapter 3
Market Timing

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A large fraction of retirement savings, valued at $23 trillion at the end of March 2014 in the USA, is managed by professional money managers (Investment Company Institute 2014). For example, mutual funds accounted for 60 % of households' assets in defined contribution retirement plans and 45 % of the assets in individual retirement account plans. Investment companies and pension funds held almost 40 % of total corporate equities in the first quarter of 2014 (Board of Governors of the Federal Reserve System 2014). While investors benefit by delegating the money management function to professional managers with specialized talents and skills, relying on others creates invisible indirect costs in addition to observable direct fees that those managers charge. These invisible costs arise from the need to monitor and evaluate the actions of the managers in order to ensure that those actions are consistent with investors' objectives and the explicit and implicit contractual terms. An investor allocating savings across several managers has to ensure that the investment objectives are satisfied, the bets that the different managers take do not cancel out, and the funds allocated to a particular manager are consistent with the manager's abilities and investment capacity. Hence, there is a need for a conceptual framework for evaluating and monitoring delegated fund managers.

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An investor always has the safe-harbor default option of allocating the savings across judiciously chosen passively managed index funds, each of which represents an asset class.[1] Therefore, it is natural to start with an appropriately chosen portfolio of such index funds as the benchmark for evaluating the performance of an active portfolio manager. In order to minimize the hidden and unknown risks that arise from delegating the portfolio management function, a fund manager's mandate will often limit the investment universe to securities that are in the benchmark and other securities that have certain characteristics. The weights assigned to the various securities in the manager's active portfolio will necessarily have to deviate from their weights in the benchmark if superior performance is to be delivered. The magnitude of such deviations will be limited by mandate restrictions.

The common practice is to decompose a fund manager's performance relative to the benchmark into two components: (a) the ability to identify which asset classes will perform better (and overweight those asset classes relative to the benchmark) and (b) the ability to identify securities within each asset class that will do better than others in the same asset class. The former skill is denoted as "allocation" or "timing" and the latter as "selection." Such a decomposition helps in at least three ways. First, it facilitates assessing the extent to which past performance may carry over into the future by providing a better understanding of the nature of a manager's skill set and, therefore, the predictability of performance. Second, as we will see later, a manager with timing skill provides the investor with valuable portfolio insurance. Valuing such insurance features involves the use of contingent claims valuation methods, and the standard CAPM or linear beta pricing models will typically understate the value of such features. Third, attempts to add value through security selection and timing expose investors to different sources of risk. An appropriate decomposition assists the investor in understanding the exposure attained through a managed portfolio.

When portfolio holdings are observed, attributing the ex post performance to these two components is straightforward. However, for many investors, managed portfolio holdings are reported infrequently, typically at quarterly intervals, yet they are subject to continuous revisions. Further, assessing whether the manager's skills are significant enough to consistently outperform the benchmark in the future requires a theoretical framework. For example, a manager might attempt to exploit the low-frequency nature of return or holdings observation. The theoretical underpinnings of such a strategy allow one to design tests for its existence. Our focus here is on assessing the performance of a fund manager based on the portfolio's historical returns and inferring the sources of superior performance, if any.

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[1]The question of how to choose from the vast collection of index funds to construct a portfolio to meet one's investment objectives has not received much attention in the academic literature and has been left to journals catering to the needs of investment advisers and individual and institutional investors. The exceptions include Elton et al. (2004) and Viceira (2009).

When the benchmark has only two asset classes, the aggregate market portfolio and the risk-free asset, allocation is referred to as "market timing." Treynor and Mazuy (1966) developed the basic theoretical framework for inferring the market-timing skills of a portfolio manager based on observations of the returns the manager generates under the assumption that the return on the market portfolio is unpredictable. Pfleiderer and Bhattacharya (1983) and Admati et al. (1986) examine the information structure and objectives of fund managers when the Treynor and Mazuy (1966) quadratic-regression approach can be used to identify the factor-timing skills of a portfolio manager. Merton (1981) developed the framework for assessing the value added by a portfolio manager who can successfully time the market. Henriksson and Merton (1981) empirically evaluate the performance of mutual fund managers using the Merton (1981) framework to separate their selection and timing skills. Subsequent researchers have relaxed the assumptions along several dimensions: Henriksson and Merton (1981) allow for timing across several asset classes; Jagannathan and Korajczyk (1986) expand the universe of securities to include assets that have embedded passive market timing-like features; Glosten and Jagannathan (1994) allow more-general trading and portfolio-rebalancing behavior on the part of the manager leading to complex option-like features in managed portfolio returns and show how to assess the value added by such a manager; and Ferson and Schadt (1996) allow predictability of the market portfolio return, and funds' market exposures, based on publicly available information. Ferson and Mo (2016) show how market return and volatility timing, discussed in Busse (1999), can be separated when portfolio weights are observed.

The literature that has grown out of the work of Treynor and Mazuy (1966) allows us to address several critical questions. Is there be a meaningful distinction between forecasting security-specific returns and forecasting systematic factor returns, particularly in a world with dynamic trading strategies and portfolio containing derivative securities? Do standard performance measures give accurate indications of the sum of selection and timing performance? If the market risk premium varies through time in predictable ways, how do we distinguish between timing based on public information versus timing based on true skill?

In Sect. 3.1 we discuss the main focus of this chapter, return-based performance measurement. We begin with measures that do not explicitly incorporate timing, the Treynor (1965) and Jensen (1968) measures. These are related to measures that test for timing ability, particularly the quadratic Treynor and Mazuy (1966) measure and piecewise-linear Henriksson and Merton (1981) measure. We then discuss the effects of derivative strategies, dynamic trading strategies at higher frequencies than return observations, and pseudo timing, on portfolio performance evaluation. The section finishes with a discussion of performance evaluation when risk premia have predictable components. Section 3.2 contains a brief discussion of holdings-based performance measures and Sect. 3.3 concludes.

3.1 Return-Based Performance Measurement

Modern asset pricing models make the important distinction between the systematic and idiosyncratic components of asset returns. The former is correlated with investors' marginal utility and, therefore, commands a risk premium, while the latter has no risk premium. This naturally leads to portfolio performance metrics that decompose portfolio returns into a component due to exposure to systematic risk and a component due to the ability to forecast the idiosyncratic returns of assets. The component due to exposure to systematic risk can be obtained through passive portfolios while the component due to the ability to forecast the idiosyncratic returns of assets (which are unconditionally unforecastable) represents skill. The skill component is often referred to as the risk-adjusted return, the abnormal return, Jensen measure, or alpha of the portfolio. This decomposition—or a scaling of it—is originally proposed in Treynor (1965) and Jensen (1968).

In the context of the single-index capital asset pricing model (CAPM) of Treynor (1962, 1999), Sharpe (1964), Lintner (1965), and Mossin (1966), systematic risk is measured by the sensitivity of asset returns to unexpected returns on the aggregate market portfolio. Let $r_{i,t}$ denote the return on asset i in period t; $r_{f,t}$ denote the return on a riskless asset in period t; $R_{i,t}$ denote $r_{i,t} - r_{f,t}$; $R_{m,t}$ denote the excess return on the aggregate market portfolio; and $\delta_{m,t}$ denote $R_{m,t} - E[R_{m,t}]$. The return generating process for asset returns is assumed to be

$$R_{i,t} = E[R_{i,t}] + \beta_{i,m}\delta_{m,t} + u_{i,t}. \tag{3.1}$$

Unexpected asset returns are driven by shocks to the market portfolio, $\delta_{m,t}$, and shocks uncorrelated with the market, $\varepsilon_{i,t}$. Under the assumptions of the CAPM, investors marginal utility is perfectly correlated with returns on the market. Therefore, investors demand higher returns on assets with greater exposure to market risk, and expected excess returns on assets are determined by $\beta_{i,m}$, in equilibrium:

$$E[R_{i,t}] = \beta_{i,m}E[R_{m,t}]. \tag{3.2}$$

Combining the data generating process (3.1) and the equilibrium model (3.2), we obtain

$$R_{i,t} = \beta_{i,m}[E[R_{m,t}] + \delta_{m,t}] + u_{i,t}, \tag{3.3}$$

or, equivalently,

$$R_{i,t} = \beta_{i,m}R_{m,t} + u_{i,t}. \tag{3.4}$$

When a portfolio manager possesses superior skills in evaluating individual assets, that manager's expected value of the nonsystematic returns on assets will be nonzero, thus leading to a relation, conditional on the manager's private signal,

$$R_{i,t} = \alpha_{i,t} + \beta_{i,m}R_{m,t} + \varepsilon_{i,t} \tag{3.5}$$

where $\alpha_{i,t} = E[u_{i,t}|X_{t-1}]$ and X_{t-1} is the information set of the informed manager. For an investor without skill, the unconditional expectation is zero: $E[\alpha_{i,t}] = 0$.

A portfolio manager with such skills would take active positions in assets with nonzero values of $\alpha_{i,t}$. That is, the manager will overweight assets, relative to their market weights, with $\alpha_{i,t} > 0$ and underweight assets with $\alpha_{i,t} < 0$ as in Treynor and Black (1973). Therefore, the portfolio-return generating process ($R_{p,t}$) for a manager with skill would be

$$R_{p,t} = \alpha_p + \beta_{p,m}R_{m,t} + \varepsilon_{p,t}, \tag{3.6}$$

with $\alpha_p > 0$. This risk-adjusted performance metric is first suggested in Treynor (1965) and Jensen (1968) and is commonly called the Jensen measure of performance. Treynor (1965) notes that α_p is a function of the manager's skill in predicting $\varepsilon_{i,t}$ and the aggressiveness with which the manager uses that information. For example, two managers with the same risky asset portfolio, but different levels of leverage, will produce different Jensen measures. Consider a manager who constructs portfolio p, with performance α_p, and a manager who takes 50% leverage (at the riskless rate) and invests the proceeds in an identical portfolio. Call this levered portfolio q. $R_{q,t} = 1.5 \times R_{p,t}$, which implies $\alpha_{q,t} = 1.5 \times \alpha_{p,t}$ and $\beta_{q,t} = 1.5 \times \beta_{p,t}$. In this case, the manager of portfolio q has no more skill than the manager of portfolio p. The higher value of alpha is merely a reflection of manager q's higher level of aggressiveness. Treynor (1965) suggests a variant of the Jensen measure that controls for the aggressiveness of the manager. Treynor's measure, which we denote T_p, scales Jensen's measure by the beta of the portfolio,

$$T_p = \frac{\alpha_p}{\beta_{p,m}}. \tag{3.7}$$

With this scaling $T_q = \frac{1.5 \times \alpha_p}{1.5 \times \beta_{p,m}} = \frac{\alpha_p}{\beta_{p,m}} = T_p$, giving a cleaner measure of skill adjusted for aggressiveness. The Jensen and Treynor measures extend naturally to other asset pricing models, such as the multifactor models of Merton (1973b) and Ross (1976), and the use of the single-index CAPM is merely meant to simplify the exposition.

Treynor and Black (1973) developed the above framework further, showing how the information in Eq. (3.7) can be used by an investor, who maximizes the expected return on her wealth portfolio subject to a target variance constraint, to allocate her wealth across actively managed funds and the market portfolio. Suppose the market portfolio has an expected return $E[R_m]$, variance σ_m^2, there is a single actively managed portfolio A with Jensen's alpha, α_A, and variance of the residual return in Eq. (3.6), $\sigma_{\varepsilon A}^2$. Then the investor who chooses a mean-variance efficient portfolio of the market portfolio and portfolio A will have a weight w_A in A and a weight $(1-w_A)$ in the market portfolio, where

$$w_A = \frac{\left[\alpha_A/\sigma_{\varepsilon A}^2\right]}{\left[E(R_m)/\sigma_m^2\right]}.$$

An investor will in general have access to several actively managed funds, $i, i = 1, 2 \ldots N$. Treynor and Black (1973) show that the weight w_i of the i'th actively managed fund in the portfolio of actively managed funds, A, will be given by

$$w_i = \sum_{k=1}^{N} \frac{\left[\alpha_i/\sigma_{\varepsilon i}^2\right]}{\left[\alpha_k/\sigma_{\varepsilon k}^2\right]}. \tag{3.8}$$

In deriving the above results, Treynor and Black (1973) assumed that $\mathrm{Cov}(\varepsilon_i, \varepsilon_k) = 0$. With this assumption, an investor can calculate how much to allocate across actively managed funds and the market portfolio based on knowledge of the parameters in Eq. (3.6) using a hand-held calculator. With the advent of personal computers, and spreadsheet software, the use of portfolio optimization has become prevalent among institutional investors and financial advisers. While the underlying framework is the same as in Treynor and Black (1973), it is no longer necessary to assume that $\mathrm{Cov}(\varepsilon_i, \varepsilon_k) = 0$, and multifactor extensions of Eq. (3.8) are widely used. However, the Treynor and Black (1973) model provides a huge amount of insight and intuition. It is still the textbook example for expositing the general principles underlying optimally combining actively managed funds with the market portfolio.[2]

In the formulation above, it is assumed that the manager's skill is in predicting the asset-specific, nonsystematic component of returns, $\varepsilon_{i,t}$. While there are many investors for whom this is an accurate description of their investment strategy, there are many other investors whose explicit strategy is to forecast market, or asset class, returns and adjust exposures to systematic risk (e.g., $\beta_{p,m}$ in the single-index, CAPM context) to take into account those forecasts. Such strategies have come under various labels, including market timing, tactical asset allocation, global macro investing, and others. In the analysis of Treynor and Black (1973), the optimal overall market exposure is determined by the market Sharpe Ratio expected by the investor, $\frac{E(R_{m,t})}{\sigma_m}$, scaled by $\frac{1}{\sigma_m}$. Therefore, the portfolio beta would vary with the expected market Sharpe Ratio, consistent with market timing.

As we mentioned earlier, managers who can successfully time the market provide portfolio insurance, and the standard mean-variance optimization framework is inadequate in evaluating such fund managers and deciding how much to allocate to them. Further, the potential existence of market-timing skills raises a number of important issues for performance evaluation, including:

1. Can there be a meaningful distinction between forecasting security-specific returns and forecasting systematic factor returns? For example, in the CAPM example used above, the market return is a market-capitalization weighted average of the individual asset returns,

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[2]For example, see Bodie et al. (2011, Chap. 27.1).

$$R_{m,t} = \sum_{i=1}^{N} \omega_{j,t-1} R_{i,t}, \tag{3.9}$$

so having forecasting skills for $u_{i,t}$ must tell you something about $R_{m,t}$ since it contains a linear combination of the realizations of $u_{i,t}, i = 1, 2, \ldots n$. One approach is to think of $\alpha_{i,t}$ as the return implied by the manager's information, X_{t-1}, after accounting for any implications for $R_{m,t}$ [see, Admati et al. (1986, Sect. I)]. This implies that X_{t-1} cannot contain information only about $\alpha_{i,t}$ since the weighted average alpha most be zero. Another approach is to assume that asset returns are driven by an underlying factor model [see, Admati et al. (1986, Sect. I)].

2. Will the Jensen and Treynor measures give accurate indications of the sum of performance due to micro forecasting skills (often referred to as security selection) and macro forecasting skills (often referred to as market timing or asset allocation) of the portfolio manager?
3. Given the existence of securities and dynamic trading strategies that yield payoffs that are nonlinear in market (or factor) returns, can one separately measure the performance due to security selection and market timing, and does this dichotomy make sense?
4. Is it possible to create pseudo-timing performance? If so, how would that manifest itself in asset returns and performance measures?
5. If the market risk premium varies through time in predictable ways, how do we distinguish between timing based on public information versus timing based on true skill? For example, consider the following decomposition, where $E[R_m]$ is the unconditional market risk premium:

$$\Delta_{m,t} = R_{m,t} - E[R_m] = [R_{m,t} - E[R_{m,t}]] + [E[R_{m,t}] - E[R_m]] = \delta_{m,t} + \delta_{m,t}^*. \tag{3.10}$$

True market-timing ability is the ability to predict $R_{m,t}$ over and above the market's conditional expectation, $E[R_{m,t}]$, i.e., the ability to predict $\delta_{m,t}$. However, having ability to predict $\delta_{m,t}^*$ reflects one's ability to measure changes in the market's conditional risk premium.

3.1.1   Treynor and Mazuy (1966)

The pioneering paper in the measurement of market-timing ability is Treynor and Mazuy (1966). The essence of market timing or tactical asset allocation is to increase the portfolio's exposure to the market or a particular asset class when the manager expects high returns in that asset class and to decrease the portfolio's exposure when the manager expects low returns. When the manager has ability to forecast $\delta_{m,t}$ or uses public information to predict $\delta_{m,t}^*$, there will be a convex relation

between the return on the portfolio, $R_{p,t}$, and the return on the market or asset class, $R_{m,t}$. Treynor and Mazuy propose that the convex relation be approximated by a quadratic relation,

$$R_{p,t} = a_p + b_{p,m}R_{m,t} + c_{p,m}R_{m,t}^2 + \varepsilon_{p,t}. \qquad (3.11)$$

In this specification, $c_{p,m} > 0$ would be consistent with shifting into high-exposure assets when the manager's conditional expectation of $\delta_{m,t}$ is high or when $E[\delta_{m,t}^*]$ is high. Ability to forecast individual-asset nonsystematic returns, $u_{i,t}$ in (3.4), would, presumably, be captured by a_p (in the models of the return generating process and manager behavior in Jensen (1972) and Pfleiderer and Bhattacharya (1983) discussed below). That is, $a_p = \alpha_p^S$, where α_p^S is the alpha generated by *security selection* ability, while timing ability is captured by $c_{p,m}$.

Treynor and Mazuy (1966) apply their measures to 57 mutual funds over a 10-year period. The requirement of funds having a complete 10 years of data probably imparts an upward bias to any performance measures. Even so, only one of the 57 funds has a significantly positive value of $\hat{c}_{p,m}$ at the 5 % level of significance. Just by chance, one would expect that three funds would show significantly positive values of $\hat{c}_{p,m}$ since 5 % of 57 is 2.85 (assuming $\varepsilon_{p,t}$ is independent across funds). For this one significant fund, the positive value of $\hat{c}_{p,m}$ is accompanied by negative security selection ($\hat{\alpha}_p^S < 0$). We will address the negative cross-sectional relation between $\hat{c}_{p,m}$ and $\hat{\alpha}_p^S$ later.

Treynor and Mazuy conclude that there is little evidence to support the existence of timing ability in the sample of mutual funds they study.

3.1.2 The Relation Between $\beta_{p,m}$ and $R_{m,t}$

The quadratic functional form in (3.11) proposed by Treynor and Mazuy (1966) is meant to capture the notion that timing ability should exhibit a positive relation between market exposure, $\beta_{p,m}$, and $R_{m,t}$, which results in a convex relation between $R_{p,t}$ and $R_{m,t}$. A second-order polynomial is one way to approximate any general convex relation. The actual relation between $R_{p,t}$ and $R_{m,t}$ would be determined by the manner in which portfolio managers utilize any forecasting ability that they have.

3.1.2.1 Quadratic Characteristic Line

The quadratic relation is implied by reasonable models of manager behavior, studied in Jensen (1972), Pfleiderer and Bhattacharya (1983), and Admati et al. (1986). Assume that $\Delta_{m,t}$ is conditionally normally distributed and that the manager receives a signal, s_{t-1}, about $\Delta_{m,t}$ with $s_{t-1} = \Delta_{m,t} + \eta_t$, with η_t being a zero-mean normally

distributed random variable independent of $\Delta_{m,t}$ (Jensen (1972) also allows for biased signals). $E[\Delta_{m,t}|s_{t-1}] = \lambda \times s_{t-1}$ with $\lambda = \frac{\sigma_\Delta^2}{\sigma_\Delta^2 + \sigma_\eta^2}$.

For quadratic utility (Jensen 1972) or constant absolute risk tolerance (Admati et al. 1986; Pfleiderer and Bhattacharya 1983), the market exposure of the optimal portfolio is linear in s_{t-1}:

$$\beta_{p,m,t} = \beta_{p,m} + \theta \times \lambda \times s_{t-1}, \qquad (3.12)$$

where $\theta = \frac{1}{a \mathrm{Var}(\Delta_{m,t}|s_{t-1})}$ and a is the risk aversion that the manager assumes for the fund investors. The unconditional average beta is $\beta_{p,m}$, and the period-by-period betas deviate from $\beta_{p,m}$ depending on the manager's signal, s_{t-1}. The aggressiveness with which the manager adjusts market exposure depends on risk aversion and the quality of the signal the manager receives about $\Delta_{m,t}$, through the influence of $\mathrm{Var}(\Delta_{m,t}|s_{t-1})$ on θ and through λ. Additionally, the target level of beta (when $s_{t-1} = 0$) is given by $\theta E[R_m]$ (Pfleiderer and Bhattacharya 1983, p. 8). This leads to the following data generating process for portfolio returns:

$$R_{p,t} = \alpha_p^S + \theta E[R_m](1-\lambda)R_{m,t} + \theta \lambda R_{m,t}^2 + u_{p,t}, \qquad (3.13)$$

where

$$u_{p,t} = \theta \lambda R_{m,t} \eta_t + \varepsilon_{p,t}.$$

The expected value of $u_{p,t}$ is zero since $R_{m,t}$ and η_t are independent. However, the residuals in (3.13) exhibit conditional heteroskedasticity. From (3.13) we see that the parameters in the regression of Treynor and Mazuy (1966) are given by

$$a_p = \alpha_p^S \qquad (3.14)$$

$$b_{p,m} = (1-\lambda)\beta_{p,m} \qquad (3.15)$$

$$c_{p,m} = \theta \lambda. \qquad (3.16)$$

Thus, in this setting the Treynor and Mazuy (1966) intercept (a_p) and coefficient on the quadratic term ($c_{p,m}$) are consistent estimates of security-selection (α_p^S) and market-timing ($\theta \lambda$) skills. However, the coefficient on the linear term ($b_{p,m}$) is a downward-biased estimate of the target beta when the manager has ability to forecast the market return ($\lambda > 0$).

When the manager has both security-selection and market-timing skills and follows the Pfleiderer and Bhattacharya (1983) investment strategy, the fund data generating process follows (3.13). One could estimate the Jensen and Treynor measures specified in (3.6) and (3.7) for the fund. A reasonable assumption is that the estimated Jensen measure, $\hat{\alpha}_p$, would reflect both security selection, α_p^S, *and the* fact that the fund earns a higher return than one would expect given its average market beta, due to market-timing skill. In fact, this is not necessarily true since

the unconditional fund beta in (3.6) yields a biased estimator of the average beta, $\theta E[R_m]$ (Dybvig and Ross 1985; Grant 1977; Jensen 1968, 1972). Using (3.13) and the definition of the unconditional beta, we can derive the bias under the assumed manager behavior:

$$E(\hat{\beta}_{p,m}) = \frac{\text{Cov}(R_{p,t}, R_{m,t})}{\sigma_m^2} = \theta(1+\lambda)E[R_m] + \theta\lambda\sigma_m Sk_m, \qquad (3.17)$$

so that

$$E(\hat{\beta}_{p,m}) - E(\beta_{p,m,t}) = \theta(1+\lambda)E[R_m] + \theta\lambda\sigma_m Sk_m - \theta E[R_m] = \theta\lambda E[R_m] + \theta\lambda\sigma_m Sk_m,$$

where $Sk_m = \frac{E(R_{m,t}-E[R_m])^3}{\sigma_m^3}$ is the coefficient of skewness of the market return. Under the assumption of normality of market returns, $Sk_m = 0$ and the last term drops out of the expression. When the manager has no market-timing skills ($\lambda = 0$), $E(\hat{\beta}_{p,m}) = E(\beta_{p,m,t})$. From (3.17) we can determine the expected value of Jensen's performance measure:

$$E(\hat{\alpha}_p) = \alpha_p^S + \theta\lambda(\sigma_m^2 - E[R_m]^2) - \theta\lambda\sigma_m E[R_m]Sk_m. \qquad (3.18)$$

$E(\hat{\alpha}_p)$ clearly reflects security-selection skill, α_p^S, but $E(\hat{\alpha}_p)$ could be either higher or lower than α_p^S even when the manager has timing skill. A manager with timing skill creates a portfolio with non-normal returns even in a world where primitive assets have normally distributed returns. This is due to the fact that portfolio returns include terms that are the product of the manager's normally distributed signal and normally distributed returns, leading to the quadratic term in (3.13). The linear specification in Jensen's alpha does not take into account the skewness induced by the manager's skill.

A simple numerical example may be useful here. Let us assume that $E[R_m] = 0.10, \sigma_m = 0.20$, and the market returns are normal. In this case,

$$E(\hat{\alpha}_p) = \alpha_p^S + \theta\lambda \times 0.03,$$

so that Jensen's measure reflects both security selection and timing ability, although the measured timing ability is likely to be biased. We will return to this issue later. However, other parameter specifications and market skewness can lead to a Jensen's measure that is either above, or below, α_p^S. When there is no timing ability ($\lambda = 0$), Jensen's measure provides an unbiased measure of α_p^S, and this is true regardless of whether the manager reacts optimally to the signal (Jensen 1972). In this case, Treynor's measure, T_p, is also consistent.

3.1.2.2 Piecewise-Linear Characteristic Line

The quadratic relation between portfolio returns and market returns is consistent with a world in which managers receive noisy, normally distributed signals about future market returns and behave as if they maximize a constant absolute risk tolerance utility function. An alternate assumption about manager behavior is that managers receive a signal about whether the market excess return will be positive. They then choose between two levels of exposure to systematic risk: high beta when they expect positive excess returns and low beta if they expect negative excess returns. Merton ([1981]) shows that timing ability in this setting is equivalent to the manager creating free call options on the market index. Through put–call parity, timing ability is also equivalent to creating a free protective put strategy. Therefore, the value created by the timing ability is given by the value of the number of free options created by timing skill (less the manager's fee).

Henriksson and Merton ([1981]) develop both nonparametric and parametric methods for evaluating timing and security-selection skills. Under the assumed manager behavior, the data generating process for portfolio returns is

$$R_{p,t} = a_p^S + \beta_{p,m}^U R_{m,t} + \beta_{p,m}^{U-D} \max[0, -R_{m,t}] + \varepsilon_{p,t}. \tag{3.19}$$

In (3.19) a_p^S measures security-selection skill (under the assumed return generating process and managerial behavior), $\beta_{p,m}^U$ measures the beta of the portfolio during "up" markets (markets where $R_{m,t} > 0$), and $\beta_{p,m}^{U-D}$ measures the difference between the portfolio's beta in "up" markets and its beta in "down" markets. Successful timing skill should result in a positive value of $\beta_{p,m}^{U-D}$. In the option-based framework, $\beta_{p,m}^{U-D}$ is the number of free call options on the market generated by the manager's skill at timing.

Henriksson ([1984]) estimates (3.19) for a sample of 116 open ended mutual funds. The average of the estimated values of $\hat{\beta}_{p,m}^{U-D}$ is negative, and 62 % of the funds studied have negative values of $\hat{\beta}_{p,m}^{U-D}$, consistent with the findings of Treynor and Mazuy ([1966]). This seemingly anomalous evidence of negative timing skill (present whether the quadratic or piecewise-linear specification is estimated) has proven to be remarkably robust and is observed for both mutual funds (Henriksson [1984]; Jagannathan and Korajczyk [1986]; Kon [1983]), bond funds (Chen et al. [2010]), and hedge funds (Asness et al. [2001]; French and Ko [2006]; Connor et al. [2010], Chap. 13), although not universally observed (Chen and Liang [2007]). Hallerbach ([2014]) discusses the difference between the quadratic and piecewise-linear specifications for a portfolio's information ratio (defined by the conditional expected active return divided by active risk).

3.1.3 Derivative Strategies, Frequent Trading, Pseudo Timing, and Portfolio Performance

3.1.3.1 Derivative Strategies and Pseudo Timing

In evaluating the performance of a portfolio manager based only on observations of historical returns on a manager's portfolio, we rely on the assumption that the return on any primitive asset i is generated according to Eq. (3.4), i.e., primitive asset excess returns are linearly related to the excess return on the benchmark (market index) portfolio. This is not an innocuous assumption. A manager who invests in call options on the market will show spurious market-timing ability, since the value of a call option is a convex function of the return on the market. Such a manager will also show negative timing, as the following example, taken from Jagannathan and Korajczyk (1986), illustrates.

Consider a manager who buys the following one-period European call option on the total return market index (i.e., the index assumes reinvestment of dividends) at the beginning of each period. Let the value of the total return market index portfolio at time t be denoted by V_t. The call option has an exercise price, $K_t = V_t(1 + r_{f,t+1})$, and trades at price C_t. Let c_t and p_t denote the values of call and put options on the total return of the market index when the index value is 1.0 and the exercise price is $(1 + r_{f,t+1})$. The excess return on the call option, $R_{p,t+1}$, is given by

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\begin{aligned}
R_{p,t+1} &= \mathrm{Max}\left(\frac{V_{t+1} - V_t(1 + r_{f,t+1})}{C_t}, 0\right) - (1 + r_{f,t+1}) \\
&= \frac{V_t}{C_t}\mathrm{Max}\left(\frac{V_{t+1} - V_t(1 + r_{f,t+1})}{V_t}, 0\right) - (1 + r_{f,t+1}) \\
&= \frac{V_t}{C_t}\mathrm{Max}(R_{m,t+1}, 0) - (1 + r_{f,t+1}) \\
&= -(1 + r_{f,t+1}) + \frac{V_t}{C_t}R_{m,t+1} - \frac{V_t}{C_t}\mathrm{Min}(R_{m,t+1}, 0) \\
&= -(1 + r_{f,t+1}) + \frac{V_t}{C_t}R_{m,t+1} + \frac{V_t}{C_t}\mathrm{Max}(-R_{m,t+1}, 0) \\
&\equiv a_p^S + \beta_{p,m}^U R_{m,t+1} + \beta_{p,m}^{U-D}\mathrm{Max}[0, -R_{m,t+1}] + 0.
\end{aligned}
$$

Thus, $\beta_{p,m}^U = \beta_{p,m}^{U-D} = \frac{V_t}{C_t}$, and $a_p^S = -(1 + r_{f,t+1})$. The excess return on the manager's portfolio exactly fits Eq. (3.19), which measures the selection and timing skills of a manager. The value of selection skill will be the present value of $-(1 + r_{f,t+1})$ received one period from now (i.e., -1), and the value of timing skill equals the value of $\frac{V_t}{C_t}$ one-period put options on the total return market index with an index value of 1.0 and an exercise price of $(1 + r_{f,t+1})$, that is, $\frac{V_t}{C_t} \times p_t$. By Theorem 6 of Merton (1973a), this is also equal to the value of $\frac{1}{c_t}$ one-period

put options on the total return market index when the index value is 1 and an exercise price of $(1 + r_{f,t+1})$, or $\frac{p_t}{c_t}$. Even though the manager is not doing any selection or timing, the managed portfolio returns exhibit positive measured timing skill and negative measured selection skill when evaluated using the Henriksson and Merton (1981) model. It can readily be verified, using the put–call parity theorem for European options, that $p_t = c_t$ and, therefore, the value of the portfolio's pseudo timing is 1. Hence, the excess value provided by the manger is 0, i.e., the value of timing and the value of selectivity exactly offset each other, and the manger does not add any value. While this one-for-one trade-off between timing and selection skills for a manager with no timing skills does not generalize to investing in options with different exercise prices, it is possible to bound the value of the spurious timing and selection skills created by a manager with no timing ability.

As Jagannathan and Korajczyk (1986) point out, the returns on certain asset classes have embedded call option-like features, and therefore a portfolio manager need not invest directly in options in order to exhibit spurious selection and timing skills. They find that a manager who holds a passive, equally weighted stock index portfolio shows significant negative selection skill and positive timing skill when the value weighted stock index is used as the market index portfolio.

A number of hedge-fund strategies appear to provide nonlinear payoff structures. This might be due to a number of factors: superior timing ability, direct holding of option positions, dynamic trading strategies that mimic option positions, or strategies that are equivalent to either buying or selling insurance. Mitchell and Pulvino (2001) show that a merger-arbitrage investment strategy looks very much like a short position in a put option on the market portfolio. Asness et al. (2001) and Connor et al. (2010) find that the preponderance of hedge-fund indices they study demonstrate higher down-market betas than up-market betas. Figure 3.1 illustrates this by plotting the monthly returns on the Credit Suisse Event-Driven Hedge-Fund Index against the monthly return on the S&P 500 Index over the period from January 1994 to August 2009. The piecewise-linear relation plotted in the figure is the fitted Henriksson–Merton timing regression (3.19). The estimated parameters are $a_p^S = 0.0087$ (10.44 % annualized, t-statistic = 5.35), $\beta_{p,m}^U = 0.08$ (t-statistic = 1.80), and $\beta_{p,m}^{U-D} = -0.26$ (t-statistic = -3.54). The patterns in the returns to event-driven strategies look similar to selling insurance on the S&P 500, with the premiums reflected in the measured security selection, a_p^S.

3.1.3.2 Frequent Trading and Pseudo Timing

Much of the market-timing literature implicitly assumes that the interval over which the observer measures returns corresponds to the portfolio-rebalancing period of the portfolio manager. That is, if we observe portfolio returns on a monthly basis, then the manager rebalances on a monthly basis and at the time we observe returns. In actuality, many active portfolio managers are likely to rebalance on a daily, or intra-daily, basis. Pfleiderer and Bhattacharya (1983) consider an example of
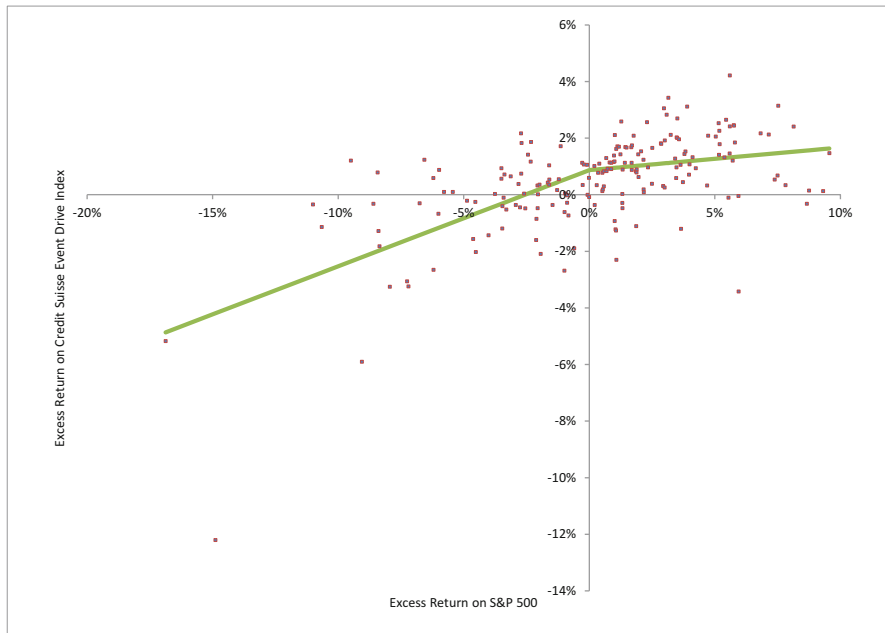
Fig. 3.1 Monthly excess returns on the Credit Suisse Event-Driven Hedge-Fund Index versus the excess returns of the S&P 500 Index. The piecewise-linear relation is the fitted Henriksson–Merton timing regression (Eq. 3.18). The regression parameter estimates are $\alpha^S = 0.0087$ (10.44 % annualized), $\hat{\beta}^U = 0.08$, and $\hat{\beta}^{U-D} = -0.26$

a manager who has no timing skill but rebalances the portfolio more frequently than the observation interval for portfolio returns. This manager is a "chartist" who bases the portfolio's beta on past market returns. The manager adjusts the portfolio positions each period, but portfolio returns are observed every second period. The return on the market from period t to $t + 2$ is

$$R_{m,t,t+2} = (1 + E[R_m] + \Delta_{m,t+1}) \times (1 + E[R_m] + \Delta_{m,t+2}) - 1. \qquad (3.20)$$

If the chartist chooses exposure to the market to be a linear function of the lagged values of Δ, the chartist's two-period return is

$$\begin{aligned}
r_{c,t,t+2} = {} & [1 + r_f + (b_1 + b_2\Delta_{m,t})(E[R_m] + \Delta_{m,t+1})] \\
& \times [1 + r_f + (b_1 + b_2\Delta_{m,t+1})(E[R_m] + \Delta_{m,t+2})]. \qquad (3.21)
\end{aligned}$$

This involves linear functions of $\Delta_{m,t+1}$ and $\Delta_{m,t+2}$ and a quadratic term in $\Delta_{m,t+1}$ which will yield a positive regression coefficient on the squared market return if b_2 is positive [see Pfleiderer and Bhattacharya (1983, Sect. 3)]. Since the chartist is creating measured timing ability without any true skill, the apparent

timing ability is accompanied by negative measured security selection (α_p^S). Thus, portfolio rebalancing at a higher frequency than the observation interval used to evaluate performance causes the same type of difficulty that positions in derivatives or dynamic trading strategies designed limit losses through synthetic portfolio insurance. Hence, it will be difficult to identify true timing and selection skills based only on observations of the managed portfolio returns. One way to detect this type of pseudo timing is to study the relation of multi-period fund return, $r_{c,t,t+2}$, to the higher-frequency market returns. For the pseudo-timing chartist in this example, $r_{c,t,t+2}$ is related to $\Delta_{m,t+1}^2$ but not to $\Delta_{m,t+2}^2$ while a manager with true timing skill would have portfolio returns positively correlated with both $\Delta_{m,t+1}^2$ and $\Delta_{m,t+2}^2$.

Pfleiderer and Bhattacharya (1983) propose an approach that utilizes the fact that one often has access to higher-frequency returns on the market or benchmark portfolios even when the fund returns are observed infrequently. In the example above, the chartist's return $r_{c,t,t+2}$ will be correlated with $R_{m,t+1}$ but not with $R_{m,t+2}$. An alternative approach, proposed by Ferson et al. (2006),

3.1.4   A Contingent Claims Framework for Valuing the Skills of a Portfolio Manager

Glosten and Jagannathan (1994) show that the approach in Jagannathan and Korajczyk (1986) can be generalized to provide a consistent estimate of the value added by a portfolio manager due to true as well as pseudo selection and timing skills when taken together. In order to assess the value added by a portfolio manager when the portfolio return exhibits option-like features, Glosten and Jagannathan (1994), following Connor (1984), assume that the intertemporal marginal rate of substitution of consumption today for consumption tomorrow of the investor evaluating the abilities of the active portfolio manager is a time-invariant function of the returns on a few selected asset class portfolios. When the dynamic version of the Rubinstein (1976) CAPM holds, there will be only one asset class portfolio and it will be the return on the aggregate market portfolio.

The Glosten and Jagannathan (1994) approach involves regressing the excess return of the managed portfolio on the excess return on the market index portfolio and J one-period options on the market index portfolio, corresponding to J different exercise prices as given below:

$$r_{p,t} = \alpha + \beta r_{m,t} + \sum_{j=1}^{J} \gamma_j \text{Max}(r_{m,t} - K_j, 0) + \varepsilon_{p,t},$$

where K_1 is set equal to 0, and the other $J-1$ options are chosen judiciously so that $\alpha + \beta r_{m,t} + \sum_{j=1}^{J} \gamma_j \text{Max}(r_{m,t} - K_j, 0)$ best approximates the return on the managed

portfolio, $r_{p,t}$, for some choice of the parameters $\alpha, \beta, \gamma_j, j = 1, ..J$. They show that the average value of the manager's skill embodied in $r_{p,t}$ can be reasonably well approximated by $\frac{\alpha}{1+r_{f,t}} + \sum_{j=2}^{J} \beta_j C_j$, where C_j is the average value of the one-period option that pays $\text{Max}(r_{m,t} - K_j, 0)$ at time t by suitably choosing the number of options and their exercise prices. The valuation approach in Jagannathan and Korajczyk (1986) corresponds to $J = 1$ and $K_1 = r_{f,t}$.

With the advent of hedge funds, investors have access to portfolio managers who either directly invest in derivative securities or engage in trading behavior that create option-like features in their returns. As mentioned earlier, Mitchell and Pulvino (2001) show that the return on merger arbitrage, one particular hedge-fund strategy, has some of the characteristics of a written put option on the market portfolio. Fung and Hsieh (2001) show that the return on CTAs, another commonly used hedge-fund strategy, resembles the return on look-back options. They develop several benchmark returns that include returns on judiciously chosen options on several asset classes that are particularly suitable for assessing the performance of hedge-fund managers, and they are widely used in the academic literature as well as in practice. These methods build on the generalized Henriksson and Merton (1981) framework in Glosten and Jagannathan (1994). Ferson et al. (2006) provide an alternative way of addressing these issues.

3.1.5 Timing and Selection with Return Predictability

In our original formulation, deviations of market returns from their unconditional mean come from two sources: (a) deviations of market returns from their conditional mean (true shocks about which skilled managers may have forecasting ability), and (b) time variation in the conditional mean; $\Delta_{m,t} = \delta_{m,t} + \delta_{m,t}^*$ in (3.10). For simplicity of exposition, we have assumed that market portfolio returns are unpredictable from public information (i.e., $\delta_{m,t}^* = 0$). A large literature provides evidence for predictable time variation in the equity risk premium [e.g., Rozeff (1984), Keim and Stambaugh (1986), Campbell (1987), Campbell and Shiller (1988, 1989), Fama and French (1988, 1989), Breen et al. (1989)]. Cochrane (2011) observes that "Now it seems all price-dividend variation corresponds to discount-rate variation," although there is some debate about the predictability of market returns [e.g., Goyal and Welch (2003), Welch and Goyal (2008), Neuhierl and Schlusche (2011), and Cornell (2014)].

Ferson and Schadt (1996) show how to measure timing and selection when returns have a predictable component based on publicly available information. They start with the assumption that the conditional version of Eq. (3.2) and hence the conditional version of Eq. (3.4) hold, i.e.,

$$R_{i,t} = \beta_{i,m}(Z_{t-1})R_{m,t} + u_{i,t} \tag{3.22}$$

$$E(u_{i,t}|Z_{t-1}) = 0 \tag{3.23}$$

$$E(u_{i,t}R_{m,t}|Z_{t-1}) = 0, \tag{3.24}$$

where Z_{t-1} is a vector of instrumental variables that represent the information available at time $t-1$, $\beta_{i,m}(Z_{t-1})$ denotes the functional dependence of $\beta_{i,m}$ on Z_{t-1}, and $E(.|Z_{t-1})$ denotes the conditional expectations operator based on observing the vector of instrumental variables Z_{t-1}. Ferson and Schadt (1996) assume that the function $\beta_{i,m}(Z_{t-1})$ can be approximated well by $\beta_{i,m}(Z_{t-1}) = b_{0p} + B'_p z_{t-1}$, where $z_{t-1} = Z_{t-1} - E(Z_{t-1})$. With this additional assumption, Ferson and Schadt (1996) derive a conditional version of the Treynor and Mazuy (1966) model for detecting timing ability:

$$R_{p,t} = a_p^S + b_p R_{m,t} + B'_p z_{t-1} R_{m,t} + \gamma_p R_{m,t}^2 + \varepsilon_{p,t}. \tag{3.25}$$

B'_p captures the response of the manager's beta to the public information, γ captures the sensitivity of the manager's beta to the private market-timing signal, and a_p^S is a measure of the selection ability of the manager. They show that the following conditional version of the Henriksson–Merton model also holds:

$$R_{p,t} = a_p^S + \beta_d R_{m,t} + B'_d z_{t-1} R_{m,t} + \gamma_c R_{m,t} I_{\{R_{m,t}-E(R_{m,t}|z_{t-1})>0\}} \tag{3.26}$$

$$+ \Delta' z_{t-1} R_{m,t} I_{\{R_{m,t}-E(R_{m,t}|z_{t-1})>0\}} + \varepsilon_{p,t},$$

where the function $I_{\{R_{m,t}-E(R_{m,t}|z_{t-1})>0\}}$ takes the value of 1 when $R_{m,t}-E(R_{m,t}|z_{t-1})>0$ and 0 otherwise.

Using monthly return data on 67 mutual funds during 1968–1990, Ferson and Schadt (1996) find that the risk exposure of mutual funds changes in response to publicly available information on the stock index dividend yield, short-term interest rate, slope of the treasury yield curve, and corporate-bond yield spread. Unlike the unconditional Jensen's alpha (selection measure), which is negative on average across funds, the conditional selection measure is on average zero. When the conditional models in Eqs. (3.26) and (3.25) are used, the perverse market timing exhibited by US mutual funds goes away, highlighting the need for controlling for predictable components in stock returns. However, the data pose an interesting puzzle since managers seem to pick market exposures that are positively correlated with $\delta_{m,t}$ but negatively correlated with $\delta_{m,t}^*$. Ferson and Warther (1996) show evidence indicating that the anomalous negative correlation between fund betas and $\delta_{m,t}^*$ is caused by flows of funds into mutual funds prior to high market returns. Delay in allocating those funds from cash to other assets causes a drop in beta prior to high return periods. Christopherson et al. (1998) find that alphas do not differ between conditional and unconditional performance measures for pension fund portfolios. This is consistent with the fund flows argument for perverse timing for mutual funds if pension funds are less subject to fund flows that are correlated with $\delta_{m,t}^*$. Ferson

and Qian (2004) expand the time period and cross-sectional sample of funds studies and find results that are broadly consistent with the earlier conditional performance evaluation literature.

3.2 Holdings-Based Performance Measurement

We have focussed on returns-based performance evaluation of market timing, in the spirit of Treynor and Mazuy (1966). When the fund manager's portfolio holdings are observed, the investor can use that additional information in measuring the timing and selection abilities of the manager with more precision. There is a vast literature on holdings-based performance evaluation going back, at least, to Fama (1972). Holdings-based performance evaluation is quite common in practice when the investor is in a position to see the portfolio positions on a frequent basis. A common practice in industry is to attribute the performance difference between the managed portfolio and the benchmark into two components: that due to "allocation" and that due to "selection". As discussed in Sharpe (1991), *allocation* takes the weights assigned by the manager to the different sectors and compare them with the weights for those sectors in the benchmark, and computes the effect of those deviations from benchmark allocation weights. The residual is classified as *selection*. Daniel et al. (1997) build on these practices to decompose the return on an actively managed portfolio into three components: characteristics-based selection, characteristics-based timing, and average characteristics-based style. We cannot do justice to that literature here but briefly touch on it.

Following Kacperczyk et al. (2014), define timing as follows:

$$Timing_{j,t} = \sum_{i=1}^{N^j} \left(w_{i,t}^j - w_{i,t}^m \right) \beta_{i,t} R_{m,t+1} = (\beta_{p,t}^j - 1) R_{m,t+1} \qquad (3.27)$$

where $Timing_{j,t}$ is the timing skill of manager j at time t, $w_{i,t}^j$ is the weight of security i at time t in manager j's portfolio, $w_{i,t}^m$ is the corresponding security's weight in the market portfolio, N_t^j is the number of securities in manager j's portfolio at time t, and $\beta_{i,t}$ is the covariance of security i's excess return with the excess return on the market portfolio divided by the variance of the market portfolio's excess return based on information available at time t. Note that $\left(w_{i,t}^j - w_{i,t}^m \right) \beta_{i,t}$ is multiplied by $R_{m,t+1}$, the excess return on the market portfolio at time $t + 1$. We would expect that a manager with timing ability would construct the portfolio such that there is positive correlation between $\beta_{p,t}^j$ and $R_{m,t+1}$. In a similar way, define the selection skill as

$$\text{Selection}_{j,t} = \sum_{i=1}^{N^j} \left(w_{i,t}^j - w_{i,t}^m \right) (R_{i,t+1} - \beta_{i,t} R_{m,t+1}) = \varepsilon_{p,t}^j. \qquad (3.28)$$

Notice that observing the portfolio holdings of the fund manager facilitates measuring the systematic risk exposure of the manager's portfolio at any given point in time, t, more precisely. When the weights assigned to the securities in the manager's portfolio changes over time, the managed fund's beta will also vary over time even when the betas of individual securities remain constant. Hence, the holdings information helps assess the manager's abilities better.

Kacperczyk et al. (2014) estimate the selection and timing skills of a manager using the following time-series regressions:

$$\text{Timing}_{j,t} = a_0 + a_1 \text{Recession}_t + a_2 X_t^j + u_t^j \qquad (3.29)$$

$$\text{Selection}_{j,t} = b_0 + b_1 \text{Recession}_t + b_2 X_t^j + v_t^j, \qquad (3.30)$$

where Recession_t^j is an indicator variable equal to one if the economy in month t is in a recession as defined by NBER and zero otherwise. X_t^j is a set of fund-specific control variables, including age, size, expense ratio, turnover, percentage flow of new money, load fees, other fees, and other fund style characteristics. The use of a recession dummy variable is based on the evidence that the equity premium is countercyclical. The authors find that a subset of managers do have superior skills. The same managers exhibit both superior timing and selection skills. Superior performance due to timing is more likely during recessions while selection is dominant during other periods.

3.3 Summary

Most individual and institutional investors rely on professional money managers. While delegation provides gains through specialization, it also imposes invisible agency costs: an investor has to evaluate managers as well as select and monitor the ones with superior skills. Return-based and portfolio holdings-based performance measures complement each other in identifying portfolio managers with superior abilities. While we briefly cover holdings-based performance measures, our main focus is on return-based performance measures. Treynor (1965) and Treynor and Mazuy (1966) are the earliest examples of return-based performance measures assuming constant and variable exposures to market risk, respectively.

Measuring performance requires a conceptual framework. The literature has evolved by examining whether a representative investor would benefit from access to an actively managed fund. In order to answer the question, we need to know the objectives of the representative investor and which portfolio the investor will hold in the absence of access to the active manager. The CAPM provides a natural starting

point. According to the CAPM, investors care only about the mean and the variance of the return on their wealth portfolio and, furthermore, the representative investor will hold the market portfolio of all assets. Treynor (1965) and Jensen (1968) develop security-selection ability measures that are valid from the perspective of such a representative investor. These measures assess value at the margin for a small incremental investment in the active fund from the perspective of the representative investor holding the market portfolio. The value at the margin is not sufficient for deciding how to allocate funds across the market and actively managed funds, since allocating nontrivial amounts in active funds will lead to the investor's portfolio deviating significantly from the market portfolio, and the marginal valuations will change. Treynor and Black (1973) solve for optimal portfolio choice when funds or individual assets provide abnormal returns, creating a framework for asset allocation that provides the conceptual foundation for many modern-day quantitative investment strategies.

The performance measures of Treynor (1965) and Jensen (1968) and the asset-allocation framework of Treynor and Black (1973) assume, in addition to the assumptions leading to the CAPM, that security returns are linearly related to the return on the market index portfolio; i.e., the up and down market betas of a security or managed portfolio are the same. Treynor and Mazuy (1966) make the important observation that the return on the portfolio of a fund manager who successfully forecasts market returns and adjusts market exposure will resemble the return on a call option and will be nonlinearly related to the return on the market with higher beta in up markets. Dybvig and Ingersoll (1982) show that while the CAPM may provide a reasonable framework for valuing major asset classes, and securities whose returns are linearly related to the market return, the CAPM will in general assign the wrong value to payoffs with option-like features. Merton (1981) addresses this issue by developing a framework for assessing the value, at the margin, of a successful market-timing fund manager. Pfleiderer and Bhattacharya (1983) and Admati et al. (1986) provide additional insights by modeling the behavior of a fund manager with access to informative signals. Their analysis shows the rather restrictive nature of the assumptions that are needed to support the dichotomous classification of the abilities of a fund manager into timing and selection.

Jagannathan and Korajczyk (1986) and Glosten and Jagannathan (1994) show that, while the timing and selection skills of an active fund manager cannot be disentangled, classifying the skill into two types—selection and market timing (or asset allocation)—facilitates assessing the correct value, at the margin, created by the manager; the combined value of timing and asset selection is the crucial variable of interest, and that can be assessed with reasonable precision. While zero-value strategies that involve taking positions in securities with option-like features or mimicking timing skill through frequent rebalancing can show superior performance in one dimension (timing or selection), that performance will come at the expense of poor performance in the other dimension. Properly disentangling selection and performance even when they are spurious allows the investor to measure the net value added by a fund manager more precisely.

All these performance-evaluation methods assume that security returns have little predictability based on publicly available information. While the literature documenting predictable patterns in stock returns based on publicly available information has become rather large, the practical relevance of the findings is the subject of ongoing debate. In a world where risk premiums can be forecasted with publicly available information, there is a need for performance measures that distinguish between true timing ability and timing through the use of public information. Ferson and Schadt (1996) derive measures that allow us to isolate true skill.

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