Advanced Algorithmic Trading and Portfolio Management
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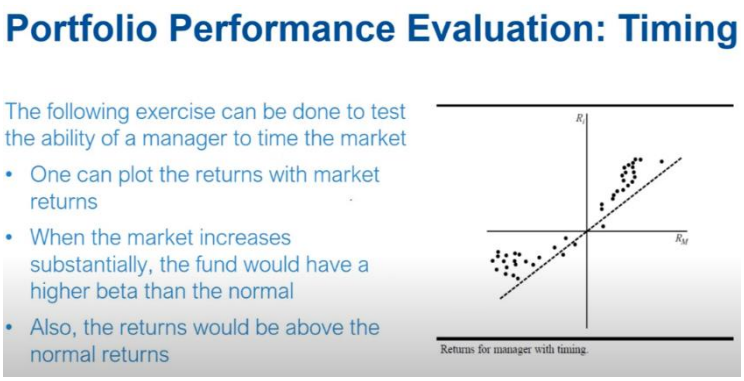
Lecture- 14

In this lesson, we will discuss portfolio performance evaluation with measures of timing and security selection. We will start the discussion by examining the statistical significance of portfolio performance. Subsequently, we will discuss the holding measures of timing and security selection. We will also understand the application of these measures in the fund management industry with the help of numerical examples. Portfolio Performance Evaluation – Timing In this video, we will discuss a very important aspect of portfolio performance which is timing of the portfolio manager. Timing involves changing the sensitivity of the portfolio to one or more systematic influences in anticipation of future market movements.

For example, if you believe that market is going to go up or down, accordingly you adjust the sensitivity or beta of your portfolio to that particular factor like market. Let us say you believe that market is going to go up and you want to exploit this, then you can buy high beta stocks and sell low beta stocks that will increase the sensitivity of your portfolio to

the market. So it rises more when market rises. Similarly, you can buy equity because equity is more sensitive to market and sell debt which is less sensitive to market.

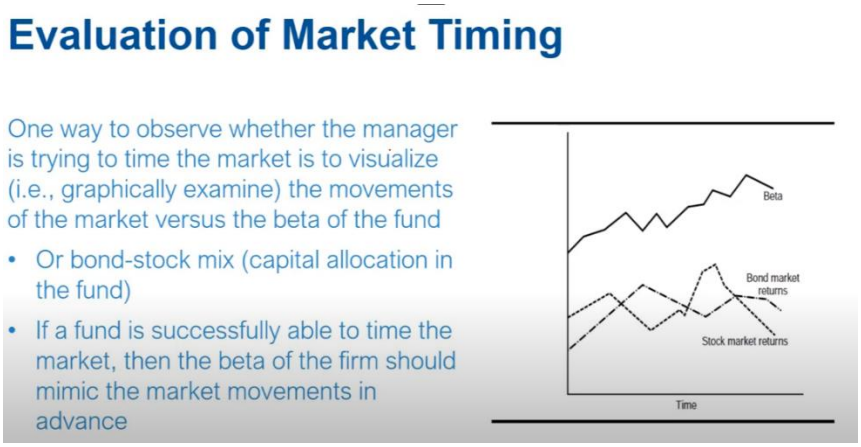


Another less costly method is to buy and sell stock index futures. Let us have a look at simple test to examine whether a manager has the ability to time the market. Let us plot the return of the stock or security RI along with the market returns. When the market rises, that means on upside movements, if manager is able to increase the beta, then the increase in return of that manager or portfolio will be higher than the market and therefore the points, the scatter points corresponding to the returns of the security will be above this line. This is a 45 degree line where RI equal to RM.

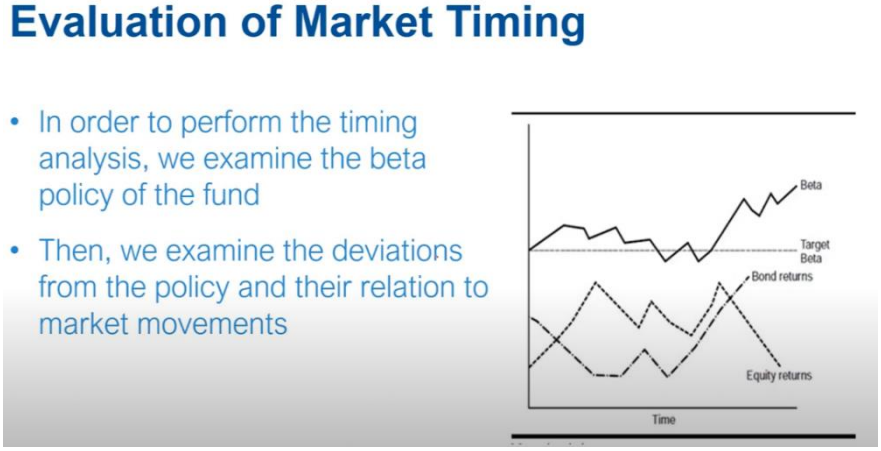
And therefore, since the beta is higher more than 1, RI will be greater than RM and the points will lie like this. Conversely, when there is a fall in market, in that case that manager would be able to reduce the beta, make his beta less than 1 and therefore the returns, the fall in returns of his portfolio would be lower than market and therefore they will still lie above the market returns. That means above this 45 degree line, they will be above it. This kind of graph where either on downside or upside, the returns are scattered, the portfolio or security returns are scattered above the market return would suggest that manager is successfully able to time the market and maintain his beta higher or lower depending upon how he anticipates the market in a successful manner. To summarize, in this video, we introduced a very important concept of portfolio performance evaluationwhich is timing of manager.

We also discussed how to visualize the performance of a successful timing manager on

graph. Application of market timing. In this video, we will discuss how to examine visually the timing ability of a fund manager. A very simple way to examine whether a fund manager is trying to time the market is to either visualize the movement of market, these are the beta fund or similarly bond stock mix that is capital location of the fund simply because bonds have in general low beta while stocks have higher beta. If fund is successfully able to time the market, then beta of the firm should mimic the market movements in advance.



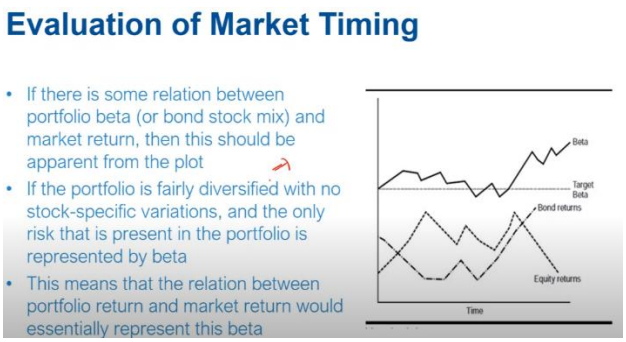
That means the movement of beta should reflect the market movements or capture the market movements before they happen. Let us say a particular manager claims that they do not try to time the market but follow a consistent stable policy over long horizons and they have a target beta which they try to follow. However, if you examine the beta of the portfolio and you find that it is not exactly in sync with that target beta and there are deviations and these deviations are systematically related to market movements. For example, when market is going up in advance, the beta of the fund is also going up and vice versa when market is going down, the beta of fund is going down, then you can say



that there are deviations from the stated policy and actually the fund manager is trying to time the market. Or in other words, if there is a change in composition of bond and equity

returns, that is bond stock mix is changing systematically with the market, then also you can say that he is trying to time the market.

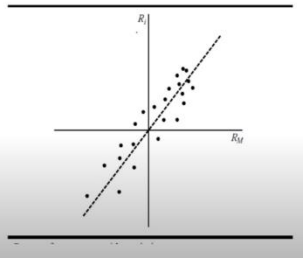
The simple assumption here is that the entire risk of the portfolio is diversified and therefore there is no idiosyncratic or non-systematic risk. The entire risk of the portfolio is driven by this beta and therefore the sensitivity of this portfolio is represented by beta. This means that the relationship between the return and market, which is this beta, is the only risk associated with that portfolio and if at all there is any idiosyncratic risk, that is very small. The same thing is captured with the bond stock mix as well. So you compare the movement of your beta over time or bond and equity returns in the market and also the target beta that is created by the fund manager and see if there are any deviations.



Let us go back to our example that we discussed in the previous video. On this chart, we can see when we plot the return from that security or fund along with the market return, we find that the returns are scattered around a straight line, 45 degree straight line, which suggests that this fund manager has no special timing ability as the returns are scattered up as well as down and therefore he has no timing ability. He is simply following the market and also these deviations, whether up or down, these represent the idiosyncratic components or non-diversifiable components in small quantities and no timing strategy per se. Contrast this to another manager who is successfully trying to time the market. For him, the scattered nature of points will always be above this line, beta line.

Evaluation of Market Timing

- In the figure, we can see that, on average, the market return and fund (portfolio) return are in the form of a straight line
- This means that no timing strategy
- The scattered nature of points around the line indicates the presence of diversifiable risk in small quantities

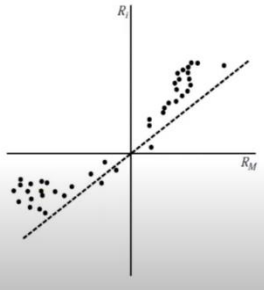


That means whenever market is rising, he will increase the beta of the stock. So his stocks move higher as compared to market when it is moving up and when the market is going down, he will decrease his beta less than one. So the decrease in his stock prices or negative returns are less as compared to market. So again, his returns or scattered points here on this line will be above this line. So this kind of scattered nature of points, which is above the RIRM straight line which reflects the slope beta, that reflects some kind of timing strategy.

Evaluation of Market Timing

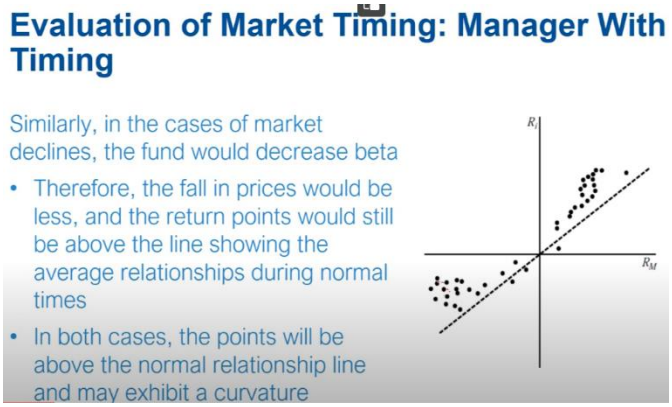
If the fund is successfully following the timing strategy by changing the beta of the fund, then if it anticipates a rising market, the fund would exhibit a higher beta in advance and tend to do well as compared to normal conditions

- This would cause the return points to be above the line that shows the average relationship between the fund and market during normal times

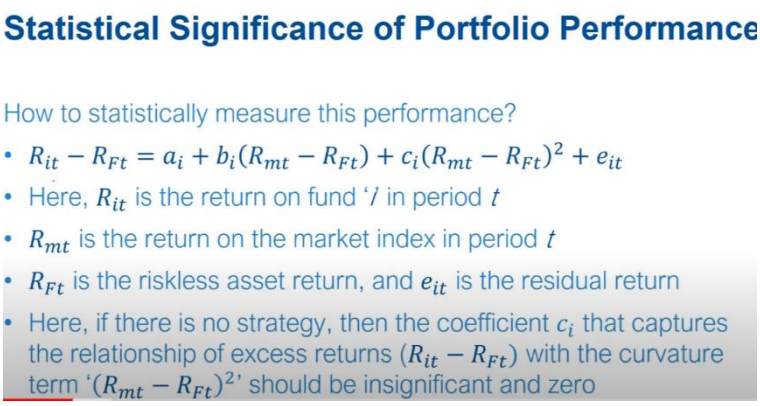


To summarize, in this video, we saw how to visually examine whether a manager is trying to time the market and also whether he is successfully able to time the market. For example, if he is successful, the scatter points of his returns would lie above this 45-degree line between RIRM and RIRM. If the points are scattered above and below in not a systematic manner, but randomly, in that case, we would say that manager is not able to time the market and those errors on positive or negative side would represent non-systematic or idiosyncratic risk in small quantities. Statistical Significance of Portfolio Performance In this video, we will examine how to measure the statistical significance of a fund manager with a special focus on timing the management. Consider this simple model where RIT-

RFT is equal to alpha i plus bi into RMT-RFT plus ci into RMT-RFT raised to the power 2 plus ci t, where EIT is the residual term, RIT is the return on fund i for period t, RMT is the return on market index in period t, and RFT is the riskless return and EIT is the residual term.

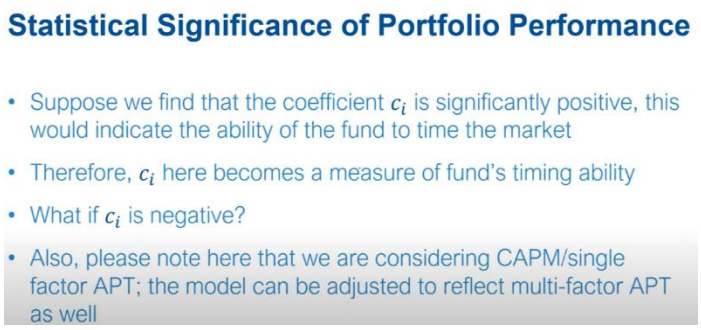


If you remember our discussion in previous two videos, we said that if a manager is successfully timing the market, his returns on RI vs RM plot will appear above this in the form of these scattered points above this straight line. And therefore, if I run this kind of model, and please note, assumption here is that single factor or CAPM kind of model where there is only one market factor, that kind of model holds, this kind of relationship, this straight line relationship, as we can see here, is captured by this model, RI-RF equal to alpha i plus bi into RM-RF. This kind of straight line relationship captures the straight line. However, if we believe that points are scattered like this, that means there is a sort of curvature in the performance or in the actual returns with the market returns, there is a nonlinear curvature which is represented by this term. In order to capture that nonlinearity, we have this square term, RMT-RFT2, which captures that nonlinear aspect.



$$R_{it} - R_{Ft} = a_i + b_i(R_{mt} - R_{Ft}) + c_i(R_{mt} - R_{Ft})^2 + e_{it}$$

Now, suppose that in this model, if you indeed find that this curvature, this term which is curvature term is indeed there and Ci is significant, that means if Ci is in the regression estimates turns out to be significant, then that means indeed there is a curvature effect. And therefore, if this Ci is significantly positive, that would indicate the ability of fund manager to time the market, that means his returns will scatter like this above this Ri versus RM straight line. So, above the straight line, there will be a nonlinearity sort of curvature here. This would be captured by the significance of that Ci term. So in a sense, this Ci becomes the ability of fund manager's timing.



In case this Ci is negative, that would have a positive effect, that means if it is negative, then that curvature would be something like this and that would indicate a very poor performance of that fund manager in terms of its timing. Please note here is a very key assumption or underlying fundamental assumption that we are considering CAPM or single factor APT where that factor is market factor RM is to be the true depiction of reality. However, there is nothing that stops us from adjusting this model to reflect the more realistic multi-factor APT model as well. To summarize, in this video, we discussed how to statistically measure the timing ability of fund manager. We noted that if a manager

is able to time the market, then his performance would be captured by this nonlinear curvature over this straight line RM-RF and the coefficient Ci which is the coefficient of this nonlinear term, the nonlinear term being RM-RF base to the power 2.

The coefficient of this term Ci if it is statistically significant that means the manager is successfully able to time the market. Holding measure of timing In this video, we will discuss another variant of timing measure which is based on security holdings of a portfolio. In contrast to directly examine the relationship between fund returns and market returns, holding measures rely on portfolio holdings. We already know that beta for a security of portfolio is estimated as weighted average of betas of all the securities that comprise the portfolio. This requires estimation of beta for each security individually that is part of portfolio.

Holding Measure of Timing

In contrast to examining the relationship between the fund returns and market returns, holding measures rely on the portfolio holdings

- Beta is estimated as the weighted average beta of securities that comprise the portfolio
- This requires beta estimation of each security in the portfolio
- Then, using holdings data, one can compute the security proportions in the fund, and thereby estimate portfolio beta

And once we have the beta of each security using the holdings data, we can compute the beta of the portfolio by using security proportions and individual security beta. So thus we estimate the portfolio betas. This method is in contrast to estimating beta directly by relationship between portfolio movement and market movement. A very simple and intuitive measure of timing which is holdings measure of timing is Elton-Grubber-Blaige

Holding Measure of Timing

One holding measure of performance evaluation is discussed as follows [Elton, Gruber, Blage: EGB measure]

- Timing = $\sum_{t=1}^{T} \frac{(\beta_t^* - \beta_{At}) R_{pt}}{T}$
- Here, β_t^* is the target beta and β_{At} is the actual beta for the beginning of the period
- T is the number of time-periods and R_{pt} is the return in the period
- The measure captures whether the fund deviated from the target beta in the same direction as the return on the index deviated from its normal pattern

measure or EGB measure. The formula is simple summation t equal to 1 to t beta t square minus beta t star minus beta AT into RPT upon t.

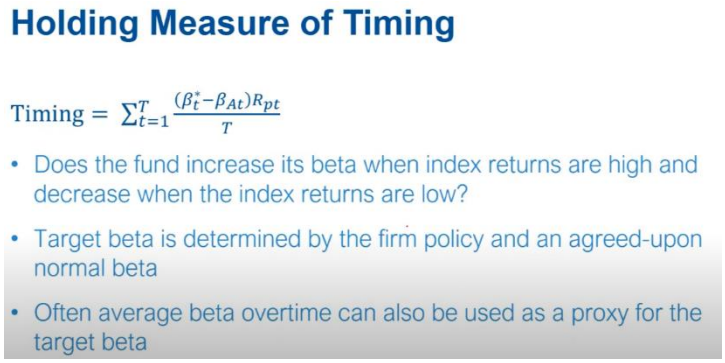
$$Timings = \sum_{t=1}^{T} \frac{(\beta_t - \beta_{At})R_{pt}}{T}$$

Here beta t star is the target beta, beta AT is the actual beta at the beginning of the period and t are the number of time periods and RPT is the return for the period t. Now this measure captures whether the fund deviated from its target beta in the same direction as the return on market, some kind of market index deviated from its normal pattern. Now the idea is that we want to examine whether fund, a particular given fund increases its beta when the market returns are high and decrease when market or index returns are low. Generally, this target beta, BT star is determined by the firm policy and some kind of agreed normal beta which is agreed upon based on the firm policy. Sometimes often long term average betas are also employed as the proxy for target beta.

It may be also noted that certain aspects of market and security prices are forecasted withsome given attributes. For example, dividend price ratio can be employed to forecast prices and therefore such forecasting or such prediction, a manager should not get any credit for such prediction where the price changes can be forecasted with metrics like dividend price ratio or price warning ratio and therefore the beta, forecasted beta using such attributes or parameters can also be employed as some kind of target beta. So when we have these attributes, we can forecast beta and that forecasted beta can also be employed as target beta. The idea in summary, the idea behind this kind of measure is that if there are moments in beta or deviations from target beta, are these deviations reflect the future movement of market and therefore indication of some kind of timing by manager. To summarize in this video, we discussed a very important measure of timing which is holding measure of timing.

Here, we do not estimate the beta of a fund directly with its sensitivity towards market movement, but we estimate beta of individual security constituents of that portfolio. Then we use holdings data to estimate the proportionate weights of the securities and compute the portfolio beta by using the betas of individual security constituents. Once we have that portfolio beta based on holdings measure, holdings of securities, we estimate some kind of holding measure of timing like this EGB measure of timing where we see whether the beta of the portfolio is deviating from its target or agreed upon beta or policy beta or some kind of long term target beta and these deviations follow or anticipate future market

movements and try to benefit from it. Holding measure of security selection. In this video, we will discuss a very important measure of portfolio performance which is holdings measure of security selection.



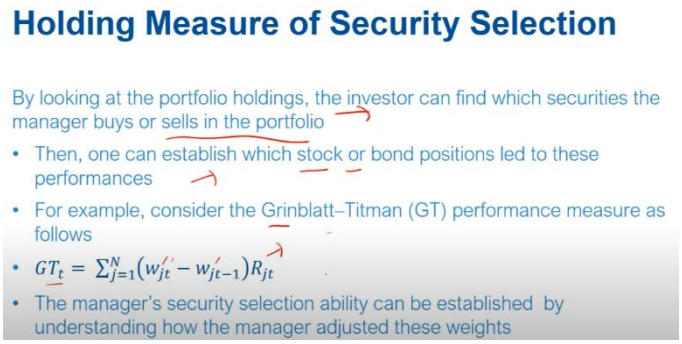
$$Timings = \sum_{t=1}^{T} \frac{(\beta_t - \beta_{At})R_{pt}}{T}$$

By examining portfolio holdings for investor or an analyst, it is easy to see which securities have been bought or sold by a fund manager in the portfolio. And using this data, one can establish whether a particular entry or exit or liquidation of a particular stock or bond led to this up or down performances. For example, one such measure, Greenblatt and Tittman performance measure is computed as follows. RjT for a period T is summation j equal to one to n, wjT minus wjT minus one into RjT wherewjT is the weight of security j at time T and wjT minus one is the weight of security j at time T minus one and RjT is its return. This measure can be examined to see the security selection ability of a manager by understanding how manager adjusted weight between these periods, let's say T minus one to T.

$$GT_t = \sum_{j=1}^{N} (w_{jt} - w_{jt-1})R_{jt}$$

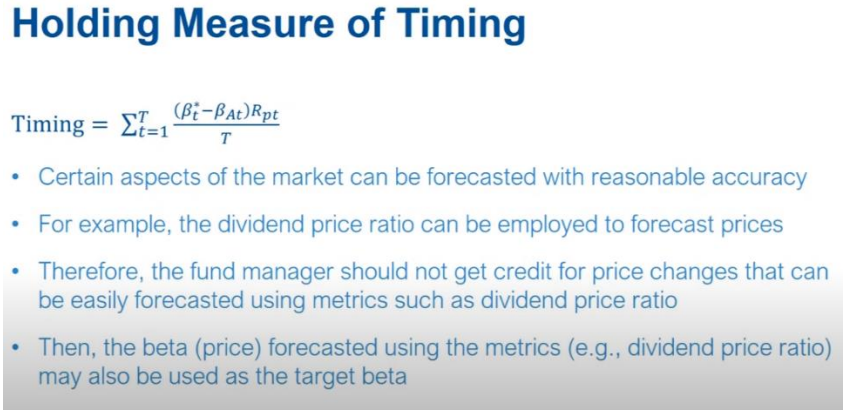
In this formula wjT minus wjT minus one indicates the change in weights for security j between period T and T minus one while RjT is the return on security j for period T that is from T to T plus one. And therefore, a series of GTs are averaged over a period to get the combined measure which is summation GT over time T divided by T. This average GT is an indicator of the quality of manager's decision making. How? This formula

examines whether a manager is successfully able to change the weight in the previous period from T minus one to T in anticipating the performance of security from period T to T plus one. If manager is successful in security selection, if a manager is successful in security selection, he should be able to find those securities that are undervalued that means if this manager is able to successfully anticipate whether security is undervalued or overvalued, he will buy undervalued securities and increase their weight from T minus one to time T and if it is overvalued then sell these securities by decreasing their weight from T minus one to T.

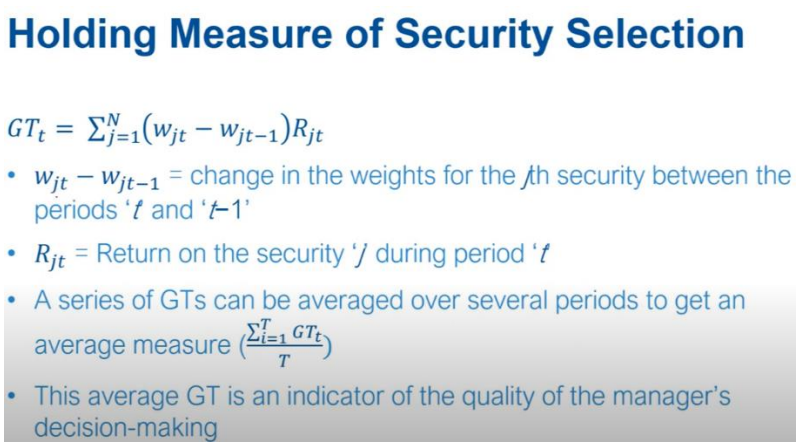


$$GT_t = \sum_{j=1}^{N}(w_{jt} - w_{jt-1})R_{jt}$$

And if in subsequent periods the security performs accordingly thereby benefiting the portfolio, his performance will be reflected in this GT measure. This GT measure will be able to capture the performance whether the movement in WJT weights from WJT minus one to WJT is systematically linked to RGT. If it indicates successful performance that is positive which indicates he has security selection ability, a negative measure would indicate poor security selection ability. To summarize, in this video we discussed holding



measure of security selection. We noted that using holdings data and changes in period on period changes in this data, we can examine whether a manager is successfully able to select those securities that are undervalued or overvalued and thereby benefiting the portfolio in terms of superior performance in future. Holding measure of security selection. In this video, we will try to understand the holding measure of security selection with the help of a simple example. In this example, we will try to compare the performance of two portfolios or fund managers. One is a passive fund and other is a more active fund manager. Here in Panel A, we have stock price data



provided for five stocks.

$$GT_t = \sum_{j=1}^{N}(w_{jt} - w_{jt-1})R_{jt}$$

These five stocks form part of portfolio of both of these active and passive fund managers as we will see shortly. Their prices for today's date next period, next to next period, third, fourth period and one period earlier are shown. These are prices at the beginning of the period. The corresponding return computation are shown in the table below for all the five stocks. For example, for period 1, the return is computed using rupees 10 at the beginning at period 0 and next period or period 1 beginning price of 14, we have computed return here.

Holding Measure of Security Selection: Example

Different portfolio performances are shown

- Panel A shows the share prices of all the five (5) stocks available for investment
- These are shown for six different dates relative to the current date 0. For these stocks, the returns are computed and are shown

A. Stock Market Data

	Share Price ($):					
Stock	Date −1	Date 0	Date 1	Date 2	Date 3	Date 4
A	10	10	14	13	13	14
B	10	10	8	8	8	6
C	10	10	8	8	7	6
D	10	10	10	11	12	12
E	10	10	10	10	10	10

A. Stock Market Data

	Return (%):			
Stock	Period 1	Period 2	Period 3	Period 4
A	14/10 − 1 = 40%	−7.14	0	7.69
B	−20	0	0	−25
C	−20	0	−12.5	−14.29
D	0	10	9.09	0

Similarly, for all the other 8, 10, 10, these being the closing prices and 10, 10, 10 being the opening prices for the period 0 to 1, the returns are computed. Similarly, for period 2, 3 and 4, we have returns. In Panel B, we have the data for a value weighted index, holdings data are provided. For all the five stocks for different dates 0, 1, 2, 3, different dates we have holding data provided. Coincidentally for all the dates, we have 200 shares for these stocks for all the dates.

Holding Measure of Security Selection: Example

Panel B shows the shares outstanding at the beginning dates for each of the periods. The index weights are also shown at the beginning of the periods.

- The index weights (28% for A at the beginning of 2) are computed by multiplying the stock price (14 for A Date 1) with the number of stocks (200 for A Date 1) for the numerator
- Denominator = 200 × (14 + 8 + 8 + 10 + 10) = 10000
- This is a value-weighted passive portfolio

B. Value-Weighted Index Holding Data

	Shares Outstanding On:				
Stock	Date −1	Date 0	Date 1	Date 2	Date 3
A	200	200	200	200	200
B	200	200	200	200	200
C	200	200	200	200	200
D	200	200	200	200	200
E	200	200	200	200	200

B. Value-Weighted Index Holding Data

		Index Weight (w_{jt}) at Beginning Of:			
Stock	Period 0	Period 1	Period 2	Period 3	Period 4
A	0.2	0.2	0.28	0.26	0.26
B	0.2	0.2	0.16	0.16	0.16
C	0.2	0.2	0.16	0.16	0.14
D	0.2	0.2	0.2	0.22	0.24
E	0.2	0.2	0.2	0.2	0.2

In the table below, we have index weight data, the holding weights in the value weighted index is provided. These index weights are very easily computed. For example, look at the weight of security A in period 2 that is at the beginning of period 2 which is 28 percent. It is very easily computed by multiplying the price of A at the closing of date 1 which is 14, multiplying it with the number of stocks 200 as a numerator. So, we have 14 which is this price of the security multiplied by the holdings 200, the numerator and denominator

is, denominator is complete portfolio composition which is 200 into price of security A which is 14, then 200 into price of security B which is 28 and so on 14, 8, 8, 10, 10.

So similarly, we have 200 into 14 plus 8 plus 8, 10 plus 10 and so on. So, this is 10,000 is my denominator. So, dividing this 2800 divide by 10,000.

Holding Measure of Security Selection: Example

Panel C shows the holdings of the active manager at the beginning dates for each of the periods

- The portfolio weights (33.3% for A at the beginning of 2) are computed by multiplying the stock price (14 for A Date 1) with the portfolio holdings (10 for A Date 1) for the numerator
- Denominator is = 14 × 10 + 8 × 5 + 8 × 5 + 10 × 10 + 10 × 10 = 420

C. Active Manager Holding Data

	Shares Held On:				
Stock	Date –1	Date 0	Date 1	Date 2	Date 3
A	0	10	10	10	10
B	10	5	5	0	0
C	10	5	5	10	10
D	10	10	10	10	10
E	10	10	10	10	10

C. Active Manager Holding Data

	Portfolio Weight (w_{it}) at Beginning Of:				
Stock	Period 0	Period 1	Period 2	Period 3	Period 4
A	0	0.25	0.333	0.31	0.31
B	0.25	0.125	0.095	0	0
C	0.25	0.125	0.095	0.19	0.167
D	0.25	0.25	0.238	0.262	0.286
E	0.25	0.25	0.238	0.238	0.238

So, dividing this 2800 by 10,000, we get 0.28. This is my weight of index weight for stock A. Similarly, we can compute for stock B, C, and D and E. So, we have respective portfolio weights or in a way proportionate amount invested in stock A, B, C, and D and E in this value weighted index. So, this is sort of value weighted portfolio. As we will see, it is a passive portfolio because there is not much active buying and selling of stocks A and B and C.

The only change, the reason for change in these portfolio stocks is because of change in their prices. The quantities or shares held for these stocks remains same at 200. Next, in Panel C, we have holding data for active manager and the holdings are provided at the dates, beginning dates 10, 5, 5, 10, 10. Now using these dates and the prices as we saw earlier here, these prices, we can compute the proportionate amount invested for this particular portfolio. For example, for period 2, beginning, beginning of period 2, we can simply compute the proportionate weight for security A as 10 into 14 as numerator divided by 14 into 10, then 8 into 5, 8 into 5 and then again this 10 into 10, 10 into 10, so we get 420.

So, this is our denominator and numerator is 10 into 14, so 140 upon 420, we get 0.33 as the proportionate amount invested in security A. Similarly, we can compute the proportionate amount invested in security B, C, D and E. So, these are respective weights of securities invested in the active fund manager's portfolio. Now, let us compute the GT measure for these value weighted index portfolio and active fund manager portfolio.

Holding Measure of Security Selection: Example

Now, let us compute the GT measure

Value-Weighted Index				
Stock	$(w_1 - w_0) \times R_1$	$(w_2 - w_1) \times R_2$	$(w_3 - w_2) \times R_3$	$(w_4 - w_3) \times R_4$
A	0	−0.57	0	0
B	0	0	0	0
C	0	0	0	0.29
D	0	0	0.18	0
E	0	0	0	0
GT	0.00%	−0.57%	0.18%	0.29%

Active Manager				
Stock	$(w_1 - w_0) \times R_1$	$(w_2 - w_1) \times R_2$	$(w_3 - w_2) \times R_3$	$(w_4 - w_3) \times R_4$
A	10	−0.59	0	0
B	2.5	0	0	0
C	2.5	0	−1.19	0.34
D	0	−0.12	0.22	0
E	0	0	0	0
GT	15.00%	−0.71%	−0.97%	0.34%

The formula is W1 minus W0 into R1 for period 1, W2 minus W1 into R2 for period 2 and so on. Here, we are taking the difference between the weights, for example, in the case of value weighted index, we have the return number R1, return for period 1. So for example, here we have return for period 1, which is 40% and the change in portfolio weights from period 1, which is the change in portfolio weight at period 1, which is here 0.

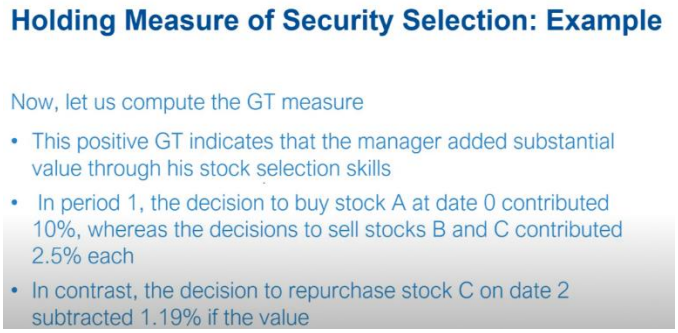
Holding Measure of Security Selection: Example

Now, let us compute the GT measure

- Average GT for VWA index= (0.00 – 0.57 + 0.18 + 0.29)/5 = 0.02%
- Average GT for the active manager = (15.00 – 0.71 + 0.97 + 0.34)/5 = 3.12%
- For the index, the average GT across the investments is close to zero (–0.02%)
- This is expected for the passive buy-and-hold portfolio
- In contrast, the average GT for an active portfolio should be positive (3.41% in this case) or negative when he has not done well

2 minus 0.2, which is 0, so we have a number of 0. So this is change in weight into return.

Similarly, if you look at stock A for this value W1 minus W0 into R1, so again the return for stock A in period 1, let us look at that number. So the return for stock A in period 1 is 40% multiplied by change in weight, the change in weight for active fund manager is 0.25 minus 0, which is again 0.



25, so the resulting number is 10%. So 40% into 0.25, which is 10%, so 10% is this number. Similarly, this is computed for all the periods, period 1, 2, 3 and 4 and using corresponding weights W1 minus W0, W2 minus W1 and so on. This gives us GT measure, the summation of all these numbers gives us the GT measure for all individual periods, here we can see the numbers. For example, 15% here, which is summation of these, all these five numbers for active manager and 0 for period 1 for value weighted index, which is 0% or for example here, minus 0.

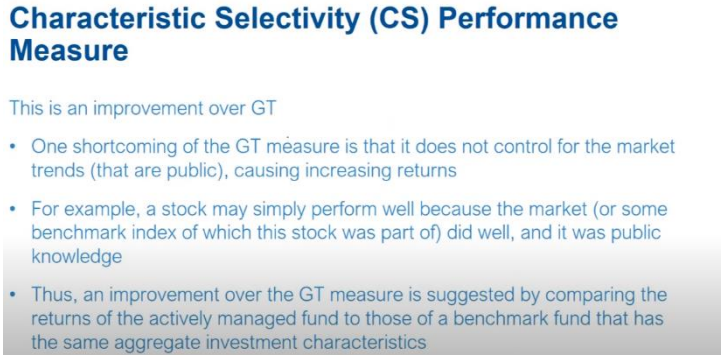
7 and others are 0, so minus 0.57%, which is the GT number for value weighted index. Now we will summarize the GT measure for all of them, so for example for volume weighted index, the GT measure is average of all these five and for active manager, the GT measure is the average of all these four figures, as we can see here, the average of these figures and average of these figures. So for value weighted index, which is a passive fund, this figure works out to 0.

02% and for active manager, this figure works out to 3.12%. This is intuitive also because the passive fund manager is expected to buy and hold portfolio with not much excess return and they are closer to their benchmark return, closer to 0. For active fund manager,

he is expected to bring something extra on the table and he is offering some positive returns of 3.41%. If these returns are negative, then he is not done well, he is not performing well.

In this particular case, these numbers are 3.41%, which suggests that he is able to generate some value for his investors. To summarize, the positive GT measure computed here indicates that the fund manager added substantial value because of the stock selection skills by changing weights over the periods. For example, if you look at for this active manager in period 1, he is able to contribute to 10% by adding stock A, 2.5% by adding stock B and 2.5% by adding stock C, but at the same time he is able to lose value, he is losing value of minus 1.

2% in period 2 because of C. So the decision to sell stocks in period 3 because he repurchased stock C on day 2, which subtracted 1.19%. While in the previous periods, his decision to sell stock B and C contributed to 2.5% each, as we can see here. In this video, we will discuss an interesting measure of portfolio performance, characteristics selectivityor CS measure, which is an improvement over the previous measures like GT measure.



This CS measure or characteristics selectivity measure is an improvement over the GT measure. One important shortcoming of GT measure was that it does not control for the market trends or performance due to a certain styles causing increasing returns. For example, a stock may simply perform well because the market gave us a certain style or some kind of benchmark which did well, which was public knowledge. One example of this kind of scenario is that it is well known that small stocks overperform large stocks usually and therefore a manager who is just playing on the strategy should not be rewarded for the simple fact. And therefore, a simple improvement over GT measure is to suggest or create by comparing the returns of an actively managed fund to those of a benchmark fund index.

This benchmark fund index should have on aggregate basis similar investment characteristics as this actively management fund, and therefore if this actively managed fund overperforms this benchmark fund, then ideally it should be said that it has been well and therefore manager has certain security selection abilities. The formula to compute this measure is simple. It is CS measure for time t is equal to WJT summation from j equal to 1 to n, RJT minus RBJT. Here, RBJT is the return to a passive portfolio which is the benchmark portfolio matched with our actively management portfolio on investment characteristics and styles at each period beginning t with each those of stock J. With this, the values of CST can be averaged over period to indicate his stock specific stock selection abilities.

Characteristic Selectivity (CS) Performance Measure

This measure is described as follows: $\mathrm{CS}_t = \sum_{j=1}^{N} w_{jt}(R_{jt} - R_{Bjt})$

- Here, R_{Bjt} is the return to a passive portfolio whose investment characteristics are matched at the beginning of period 't' with those of stock j
- With this, the values of CS_t can be averaged over a period to indicate the manager's ability to pick specific stocks
- Average CS = $\frac{\sum_{t=1}^{T} \mathrm{CS}}{T}$

$CS_t = \sum_{j=1}^{N} w_{jt} (R_{jt} - R_{B\ jt})$

Characteristic Selectivity (CS) Performance Measure

This measure credits the manager for selecting the stock that outperforms a style-matched index investment and penalizes when the opposite is true

- The argument is that why should an investor pay the management fee of actively managed stock when the investor can simply buy these indexes that suit certain investment styles
- Thus, the manager is rewarded only when his portfolio outperforms the passive portfolio matched in terms of investment style indices
- One challenge to this measure is the identification of risk and style characteristics of stocks that the active manager plans to hold

Essentially, this measure credits the manager for his selecting ability of stocks that outperform a particular style matched index and penalizes when a positive is true. So the given active fund is matched on its investment styles to the benchmark fund and only when this actively managed fund overperforms that style matched portfolio, then only he is rewarded. To summarize, in this video, we discussed characteristics selectivity performance measure. The idea or the argument here is that why should an investor pay management fee which is in excess of other expenses to actively managed fund where the investor can simply buy these indices that suit certain investment styles. And therefore, the manager should be only rewarded when his portfolio outperforms the passive portfolio or benchmark index which is matched in terms of investment styles when he is able to outperform this matched portfolio.

One challenge in this kind of characteristics selectivity measure or selecting the benchmark portfolio is what kind of risk or styles or how to identify the appropriate risk and styles and therefore the benchmark portfolio against which the performance is matched. To summarize this lesson, portfolio performance can be evaluated along two dimensions, timing and security selection. Timing involves changing the sensitivity of the portfolio to one or more systematic influences in anticipation of market movements. One can statistically measure the timing ability, whether the manager is successfully able to predict future market movements. Holding measures of timing involve estimating properties of the portfolio using holdings data.

Selection involves the ability of the manager to select securities with positive alphas. Similar to timing, one can also compute the holding measure of security selection. Some of the most useful performance measures we discussed included EGB measure of timing, GT measure of security selection and characteristic selectivity measure of performance. Thank you.