Conducting Performance Attribution Analysis in the Classroom using Real Market Data

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Abstract: W*e demonstrate how Performance Attribution Analysis (PAA, thereafter) can be integrated into an existing portfolio simulation exercise that most students in an investments or portfolio analysis course already complete. Using the* STOCKTRAK© *Portfolio Simulation, we walk the reader through the entire PAA process. We first discuss the development of an appropriate benchmark portfolio. Then, we illustrate how to use* STOCKTRAK© *account statements to calculate weights and returns for each asset class. We also show how the Morningstar X-Ray function can be used to calculate the sector weights. We provide a template that concisely contains both the inputs and outputs required to perform performance attribution analysis. We show how to interpret the PAA results using a portfolio built by students. Finally, we extend our framework to a multi-period Performance Attribution Analysis.*

1. Introduction

Evaluating the performance of an investment portfolio is an increasingly important, but somewhat complicated task. Students in the typical investments or portfolio management course have traditionally been taught to evaluate portfolio performance using standard measures such as the Sharpe, Jensen, and Treynor indices. In the professional investment community, however, where many of our students hope to find employment, more sophisticated analytical techniques are increasingly being used to evaluate a portfolio manager's performance**.** One such technique, PAA, diagnoses the specific contributions of allocation and selection decisions to a portfolio's total excess return. As stated by Thompson (2002), performance attribution analysis is a significant improvement over standard measures because it allows one "to assess the value of each significant decision point within the investment process that ultimately determines the sources of relative performance of the portfolios under management."

Because of its obvious benefits, PAA is becoming a widely used performance tool in the investment community. For example, Koch (1998) suggests that "more and more pension plans are conducting performance attribution on their managers – identifying and weighting the factors underlying a manager's performance to gauge its effectiveness more accurately." The author further adds that "performance attribution is now amongst the most important management information at the CIO's disposal."

In addition to being used as an evaluative tool, Thompson (2002) suggests that results obtained from PAA are being used as marketing tools by portfolio managers to "provide demonstrable evidence of process to clients, prospects, and consultants." Pension fund overseers are using the latest performance analytics such as PAA to monitor a manager's compliance with his/her fund's stated investment strategy (Cakebread, 2003). Regulatory bodies are also embracing performance attribution analysis. For instance, the CFA Institute formed a Benchmarks and Performance Attribution Subcommittee which published guidelines on the criteria for benchmarks used in performance attribution (CFA Institute Subcommittee Report, 1998). The European Investment Performance Committee has also provided Performance Attribution Analysis guidelines to the international investment community to help insure complete and consistent disclosure of results (EIPC, 2004).

Given the increasing importance and widespread use of this sophisticated performance appraisal technique in the financial community, it is imperative that students understand how to conduct PAA using actual portfolios, and to meaningfully interpret the more complex, but more informative, outputs generated by this process. The concept of

PAA is very well explained in seminal textbooks such as Reilly and Brown (2002) and Bodie, Kane, and Marcus (2003). However, students rarely get the hands-on experience of applying performance attribution analysis to a realistic portfolio of actual securities. At most, students work through a hypothetical exercise where asset class weights and returns are already provided.

In this paper, we show how students can use resources freely available on the internet to implement a PAA on a portfolio created using the STOCKTRAK© portfolio simulation. We provide a methodology to integrate PAA into the typical portfolio simulation exercise, which consists of (1) calculating asset weights and money-weighted returns using periodic STOCKTRAK© account statements, (2) performing a periodic PAA and reporting findings at the end of the trading game, and (3) analyzing each component of the PAA and identifying strengths and weaknesses of the portfolio strategy.

2. PAA in the classroom – An example

In most investments classes, professors require students to participate in a simulation game such as the STOCKTRAK© Portfolio Simulation, where they build and manage a portfolio. Students, individually or in groups, first establish an investment policy, and then design an investment strategy**.** The strategy is implemented by creating a portfolio of stocks, bonds and cash[1] that reflects their predefined objectives, risk tolerances and constraints. Students usually prepare an accompanying report resembling a mutual fund

prospectus, in which the investment policy is defined, the strategy outlined, and the portfolio performance reported.

As a complement to Sharpe, Treynor and Jensen measures, PAA is particularly useful for investigating the specific sources of excess returns achieved by an active investment strategy, and for pinpointing the strengths and weaknesses in investment strategies. For instance, PAA allows students to break down excess (abnormal) portfolio returns along three attributes: (i) asset allocation skills, (ii) sector selection skills and (iii) security selection skills**.** At the end of the trading period, students can retrace the performance of their portfolios and easily highlight strengths and weaknesses of their investment strategies, as well as the effects of changes in allocation and/or selection strategy.

To understand how PAA works, let's start with a simple example. We will then expand to a more general setting. Take, for instance, an actively managed portfolio that is designed to time the market by deviating from a benchmark portfolio. The benchmark has an allocation of 60% stocks, 30% bonds, and 10% cash (assumed to be invested in a money market instrument). The managed portfolio has a one-period allocation of 70% invested in stocks, 20% in bonds and 10% in cash. Now, suppose that during the period the equity benchmark returned 10%, the bond benchmark returned –5% and the money market returned 1%. Furthermore, the one-period return is 4.6% for the benchmark and 7.1% for the managed portfolio. Obviously, the portfolio has an excess return of 2.5% compared to the benchmark. PAA can be used to determine whether this excess return comes from asset allocation and/or sector/security selection. In our example, the managed portfolio has a one period excess return due to a superior allocation decision in the equity

class of 1% (10% equity benchmark return x 10% excess equity weighting), as well as an excess return due to superior allocation in the bond class of 0.5%[2] (-5% bond benchmark return x –10% excess bond weighting.) Therefore, the total contribution to excess return due to the allocation decisions is 1.5%. Accordingly, the contribution due to selection decisions must be 1% (2.5%-1.5%).

Following a framework suggested by Bodie, Kane and Markus (2004, p.693), we extend this very simple example to a real portfolio that students construct using STOCKTRAK©. Essentially, we show how to apply PAA to a portfolio with an allocation choice among three asset classes, a sector selection decision among 12 equity sector components and 3 bond types, and a security selection decision which ultimately determines the individual stocks and bonds purchased/sold short for the portfolio. Consequently, PAA analyzes five levels of decision making: (1) the asset allocation decision, (2) the equity sector selection decision, (3) the bond type selection decision, (4) the individual stock selection decision and (5) the individual bond selection decision. Mathematically, the five components of PAA are related as follows**:**

$$
\begin{aligned}
&R_p - R_b = && \text{<--Portfolio excess return}\\
&(w_{p,E} - w_{b,E}) \times R_{b,E} + (w_{p,B} - w_{b,B}) \times R_{b,B} + (w_{p,C} - w_{b,C}) \times R_C && \text{<--Contribution to asset allocation}\\
&+ w_{p,E} \times \sum_{i=1}^{i=12} (w_{p,i,S} - w_{b,i,S}) \times R_{b,i,S} && \text{<--Contribution to sector selection}\\
&+ w_{p,B} \times \sum_{i=1}^{i=3} (w_{p,i,B} - w_{b,i,B}) \times R_{b,i,B} && \text{<--Contribution to bond sector selection}\\
&+ w_{p,E} \times \left[(R_{p,E} - R_{b,E}) - \sum_{i=1}^{i=12} (w_{p,i,S} - w_{b,i,S}) \times R_{b,i,S} \right] && \text{<--Contribution to stock selection}\\
&+ w_{p,B} \times \left[(R_{p,B} - R_{b,B}) - \sum_{i=1}^{i=3} (w_{p,i,B} - w_{b,i,B}) \times R_{b,i,B} \right] && \text{<--Contribution to bond selection}
\end{aligned}
\qquad (1)
$$

Where,

R_p is the return of the managed portfolio,

R_b is the return of the benchmark,

$R_{b,i,S}$ is the return of each of the 12 sectors in the benchmark (i=1 to 12),

$R_{b,i,B}$ is the return in each of the 3 bond sectors in the benchmark (i=1 to 3),

$R_{b,E}$ is the return of the equity class in the benchmark,

$R_{p,E}$ is the return of the equity class in the portfolio,

$R_{b,B}$ is the return of the bond class in the benchmark,

$R_{p,B}$ is the return of the bond class in the portfolio,

R_C is the return on the cash portion (we are assuming that the return of the cash portion in the benchmark and portfolio are the same),

$w_{p,E}$ is the portfolio equity weight,

$w_{b,E}$ is the benchmark weight in equity,

$w_{p,B}$ is the portfolio weight in bonds,

$w_{b,B}$ is the benchmark weight in bonds,

$w_{p,C}$ is the portfolio weight in cash,

$w_{b,C}$ is the benchmark weight in cash,

$w_{p,i,S}$ is the portfolio weight in each of the 12 sectors (i= 1 to 12),

$w_{b,i,S}$ is the benchmark weight in each of the 12 sectors (i=1 to 12),

$w_{p,i,B}$ is the portfolio weight in each of the 3 bond sectors (i=1 to 3),

$w_{b,i,B}$ is the benchmark weight in each of the 3 bond families (i=1 to 3).

To better understand equation (1)**,** we translate it into a spreadsheet format where each component is appropriately positioned—see Table 1. Notice that we use Morningstar's "12 sector" equity classification scheme and also assume that the bond portion can only be broken down into corporate, government and mortgage-backed securities (these are the main types of bonds available to trade on STOCKTRAK©).

<Insert Table 1 about here>

PAA requires that the students establish a benchmark level of performance against which the performance of their portfolio will be compared. In this passive benchmark portfolio, asset class weights are fixed, and within each asset class an indexed portfolio is held - such as the S&P 500 index for the equity class, and the Lehman Brothers Aggregate Bond Index for the bond class. Whether students create their own "buy and hold" portfolio[3] or choose to use an index (or ETF) that reflects their investment policy and strategy, they will have to find weights and returns for each asset class composing the benchmark. These benchmark weights are fixed and will be determined by the risk tolerance level described in the policy statement.

Let's assume that students decide to adopt an investment policy with capital appreciation as a primary goal and income as a secondary goal. Let's further assume that a conservative growth strategy best reflects their objectives. The resulting allocation plan for the benchmark consists of 60% equity, 30% bonds, and 10% cash equivalents. The

team sets the equity portion to mimic the S&P500, and the bond portion to follow a composite bond index with approximately 50 percent in corporate bonds, 25 percent in government securities, and 25 percent in mortgage-backed securities. The cash portion returns a repo rate of 3 percent per annum--this is the rate used in STOCKTRAK© during the investment period.

By the end of the first week, students will allocate their initial investment capital ($1,000,000 in our example) to the asset classes and specific securities that reflect their investment policies and strategies. During the course of the 13-week investment simulation, they make decisions on buying or selling securities, and reallocate capital according to their expectations of relative returns among all investment options. At the end of the exercise, students analyze their performance utilizing the final STOCKTRAK© statement.

3. Understanding STOCKTRAK© Statements

STOCKTRAK© provides weekly statements to professors via emails, and students may get information about their accounts at the STOCKTRAK© website.[4] At the end of the 13-week trading period, students receive a statement the Monday following the last day of the trading period. In our example, the team's transaction summary and holdings over a 13-week period are depicted in Table 2.

<Insert Table 2 about here>

The top section of the statement provides a line-by-line description of each transaction. The middle section provides details about all open positions, including the total market value of each position, and the bottom section provides summary

information about the portfolio. The ending cash balance equals the initial cash balance plus interest earned on the money market account, less the net purchases. The net purchases consist of (1) the sum of all stock and bond purchases that either establish a long position or close out a short position (indicated by a "BO" or a "BC" in the transaction (TRANS) column), minus (2) the sum of all stock and bond sales that either close out a long position or establish a short position ("SC" or "SS" in the TRANS column), minus (3) all cash dividend payments and accrued coupons[5]. STOCKTRAK© also reports the current values of open long and short positions, and the value of accrued coupons on bond holdings. The current value of open long (short) positions is simply the sum of the market values of each long (short) position in the individual securities listed in the center section of the statement. The total value of the portfolio ($1,073,939) is computed by adding the cash position, the market value of long positions, the amount of accrued coupons and subtracting the market value of open short positions.

4. Converting STOCK-TRAK© Statements into a Returns-Weights Matrix

Cash contributions (net purchases) to each asset class need to be determined for the 13-week trading period so that weights and returns can be calculated. A cash contribution to equity consists of the cost of all stocks purchased minus the proceeds from selling stocks minus cash dividend receipts. A cash contribution to bonds consists of the cost of all bonds purchased minus the proceeds from selling bonds minus cash received from accrued coupons.[6]

The portfolio asset weights are then computed based on the market value of each asset class at the end of the trading period. The rationale is that the ending weights best reflect

the portfolio allocation strategy during the trading period. The center portion of Table 2 shows the individual securities held at the end of week 13. If we sum them by asset class, we find that the equity portion is worth $ 571,145 and the bond portion is worth $ 477,578. The cash portion is equal to the ending cash balance in STOCKTRAK© statement plus the accrued coupons earned. Accordingly, at the end of week 13, the portfolio is worth $1,073,939 ($571,145 in equity plus $477,578 in bonds and $25,216 in cash) and we can verify our result by comparing it to the portfolio value in the STOCKTRAK© statement (Table 2). The corresponding asset weights are therefore 53.18% invested in equity, 44.47% in bonds and 2.35% in cash.

Periodic returns for each asset class are computed using a Money Weighted Return approach (MWR, thereafter). MWR is a performance statistic reflecting how much money was earned by an investor during the measurement period. Specifically, we use the Modified Dietz Return (MDR, thereafter), a simple interest estimate of MWR, to take into consideration discretionary inflows and outflows over the investment period (Feibel, 2002). The MDR allows us to take into account the impact of cash flow timing into equity and bonds during the investment period using a timing correction factor. MDR is expressed as follows,

$$R_{p,E} = \frac{Ending\ market\ value\ of\ equity - Beginning\ market\ value\ of\ equity - Cash\ contributions\ to\ equity}{Beginning\ market\ value\ of\ equity + Cash\ contributions\ to\ equity \times (1 - \frac{average\ week\ of\ the\ contributions}{13\ weeks})} \quad (2)$$

and,

$$R_{p,B} = \frac{Ending\ market\ value\ of\ bonds - Beginning\ market\ value\ of\ bonds - Cash\ contributions\ to\ bonds}{Beginning\ market\ value\ of\ bonds + Cash\ contributions\ to\ bonds \times (1 - \frac{average\ week\ of\ the\ contributions}{13\ weeks})} \quad (3)$$

The average week of the contributions is approximately the same for bonds and equity and is equal to 2.8 weeks. Thus, the timing correction factor is equal to 0.785—i.e., 1-[2.8 / 13] = 0.785. Accordingly, the return on the equity and bond portions are 21.04% and –2.29%, respectively—i.e., [$ 571,145 – 0 - $ 490,165]/[0 + $ 490,165 x 0.785] for equity and [$ 477,578 - 0 - $ 486,311]/[0 + $ 486,311x 0.785] for bonds. For the cash portion, we use the STOCKTRAK© repo rate of 0.7% per quarter.

5. Finding sector and bond weights and returns for the portfolio and the benchmark

Next, sector weights need to be computed for both the managed and benchmark portfolios. This task can be accomplished quickly and easily using Morningstar's "X-Ray" function[7]. As shown in Figure 1, all stock tickers and dollars invested (the values of the securities held at the end of the trading period) in the equity portion the portfolio are inserted in the "X-ray" matrix.

<Insert figures 1 and 2 about here>

By clicking on "Show Instant X-Ray", the equity asset weights are displayed in the sector allocation section (Figure 2). Notice that the second column of the sector allocation table always gives the sectors' weight in the S&P500. This is one of the benefits of choosing the S&P500 Index as our equity benchmark.[8]

The last inputs necessary to start performing a PAA are the benchmark returns. The Morningstar website gives the 3-month returns for the individual sectors. Figure 3 provides an example of the equity sector returns[9], and Figure 4 shows the equity class and bond class and sectors return as reported by Morningstar.[10] For this example, we use the 3-month S&P 500 return as our equity benchmark return, and the Lehman Brothers

Government and Mortgage-Backed Indices returns as inputs into the PAA spreadsheet. Notice that we are missing one piece of the puzzle — the return on the corporate bond index. Since no such index is provided in the Morningstar database, we will calculate our own corporate bond return using an AMEX traded ETF that specializes on corporate bonds— the iShares Goldman Sachs Corporate Bond Fund. The ticker for this ETF is LQD. We download the daily time series (weekly and monthly data is also available) for LQD on yahoo[11] and then compute the historical 3-month return.

<Insert figures 3 and 4 about here>

Now, all required data have been retrieved and inputted into the PAA template in Table 1.b. Table 3 depicts all return and weight inputs for the portfolio and the benchmark; the lower left portion presents the outputs needed to perform the actual portfolio performance attribution analysis.

<Insert Table 3 about here>

6. Interpretation of the One-Period PAA

For the 13-week period, the student team's portfolio earned a 10.19% total return, while the benchmark portfolio returned 7.33% over the same period. The managed portfolio's excess return over the benchmark is 2.86% which is equal to its actual return less the return of the benchmark—i.e., 10.19% – 7.33% = 2.86%. PAA allows us to determine the source of the excess return.

Any departure of the students' portfolio excess return from the passive benchmark must be due to either asset allocation decisions (departures from the neutral allocation

across markets) or sector/security selection decisions (departures from the passive index within each asset class).

To isolate the abnormal return earned due to the asset allocation choice, we consider the return of a hypothetical portfolio that would have been invested in the indexes for each market with weights equal to the managed portfolio, (roughly) 53/44/2. This return measures the effect of the shift away from the benchmark 60/30/10 weights, without allowing for any effects attributable to active management of the securities selected within each market. Superior performance relative to the benchmark is achieved by over-weighting investments in markets that turn out to perform well and by under- weighting investments in poorly performing markets. The contribution of asset allocation to superior performance equals the sum over all three asset markets of the differential weighting (w_p - w_b) in each market multiplied by the return of the market index. In our example, asset allocation contributed to a loss of 35 basis points in the portfolio's overall excess return of 286 basis points. The major factor contributing to inferior performance in this quarter is the heavier weighting in the bond market.

If -35 basis points of the excess performance is due to poor asset allocation, the remaining 321 basis needed to achieve a total excess return of 2.86% must be attributable to selections within each market. The equity component of the portfolio returns 21.04%, versus a return of 10.61% for the S&P 500. The fixed-income return is –2.29%, versus 2.97% for the bond benchmark. The superior performance in equity markets and inferior performance in fixed-income markets weighted by the respective portfolio proportions invested in each market must sum to a 3.21% attribution to selection decisions.

Contribution to sector selection measures the extent to which excess return was due to the portfolio sector weighting scheme departure from the benchmark sector weights. To isolate the effect of the sector selection choice, the performance of a hypothetical portfolio that would have been invested in the indexes for each sector with the portfolio sector weights is measured. This return measures the effect of the shift away from the benchmark sector weights without allowing for any effects attributable to active management of the securities selected within each sector. To be more precise, contribution to sector selection derives from over-weighting over-performing sectors, as well as under-weighting under-performing sectors. The contribution of sector selection to superior performance equals the product of the portfolio equity weight and the sum of the excess weight in each sector times the return of the sector index. As indicated in Table 3, sector selection contributed -13 basis points to the portfolio's overall excess return of 286 basis points. This is due to under-weighting in such sectors as energy, consumer services, media, telecommunication and hardware, which performed particularly well during the trading period.

At this point, it is quite easy to imply the contribution due to individual stock selection. The equity component of the portfolio outperformed the S&P500 by 10.43% (21.04%-10.6%); this is 5.54% if scaled with the portfolio equity weight (53% x 10.43%). We've already determined that 0.13% was lost from sector selection decisions; therefore, the effect of stock selection within sectors must have contributed an additional 5.67% [5.54%- (-0.13%)].

The process to decompose the contribution due to bond selection is quite similar. Contribution to bond type (sector) selection measures the extent to which excess return had to do with the student portfolio's departure from the benchmark bond weighting scheme of 50% corporate, 25% Treasury, and 25% mortgage-backed securities. The contribution from the bond selection decisions was determined by superior or inferior bond selection within each of the 3 bond categories. The abnormal return due to bond type selection is equal to the product of the portfolio bond weight and the sum of the excess weight in each bond category times the return of each bond type benchmark. In our example, bond type selection contributed -3 basis points to the portfolio's overall excess return of 286 basis points.

Then, the contribution due to individual bond selection can be inferred in the same manner as the contribution to stock selection. The bond component of the portfolio underperformed the bond benchmark return by 5.26% (-2.29%- 2.97%); that is –2.31% if scaled by the portfolio's bond weight (44% x –5.26%). We already know that -0.03% of it comes from bond type selection; therefore, the effect of bond selection within bond types must have contributed an additional –2.30% (-2.31%-[-0.03%]).

To sum up, the student team therefore excelled at picking individual stocks, which more than offset their inability to forecast the relative performance of the three asset classes, the various investment sectors, or the individual bonds.

7. Extending the Exercise to a Multi-Period Performance Attribution Analysis

So far, we have shown how to use PAA in a one period portfolio measurement scheme. One major drawback of PAA is that it is biased against market timing

behaviors—i.e., the more active the portfolio manager, the less accurate the weights and returns measurements. For that reason, ideally, one should measure portfolio return and weights as often as possible. Technically, these should be measured each time a cash contribution is made to an asset class—i.e., on a daily basis. Obviously, it is not feasible to ask students to measure weights and returns on a daily basis. However, once exposed to the one-period PAA in an investments course, students in a portfolio management or advanced investments course can measure weights and returns on a weekly basis. At the same time, students can perform a weekly PAA and compile the findings of thirteen weekly PAAs by the end of the semester. We have found several advantages to this exercise: (1) it forces students to monitor their portfolio regularly; (2) as a result of each weekly PAA analysis, students are more prone to address their weaknesses and justify their strategies in a final report; and (3) final reports are generally more consistent and pertinent.

The process of measuring weekly PAAs is pretty much the same as for a 13-week period, though some minor differences do exist. Take for instance, the sample portfolio presented in the 13-week period analysis. Each Monday, students can access their portfolio summary on STOCK-TRAK©. We show "week 1" and "week 2" portfolio summaries in Table 4.

<Insert table 4 about here>

The process of computing the portfolio value for each week has already been explained and the contributions and market values for "week 1" are computed the same way as for the 13-week period. Now, some minor manipulations are necessary to

compute the contributions during "week 2." Indeed, the cash contributions from week 1 to week 2 must include (i) all transactions performed during week 2 (all transaction under "week 2"); (ii) the incremental interest earned on cash during week 2 (the difference between interest reported in the "week 2" statement and the interest reported in the "week 1" statement); and (iii) the incremental accrued coupons received from week 1 to week 2 (the difference between accrued coupons reported in week 2 statement and the accrued coupons reported in week 1 statement).

Once cash contributions have been computed, a weights-return matrix can be built. Students then use the Morningstar X-RAY and the 5-day indexes/sectors performance summary to tabulate sector weights and returns. Bond type weights are computed directly from STOCKTRAK© statements and benchmark returns are obtained using corresponding ETF 5-day returns. The resulting PAA is calculated and interpreted in exactly the same manner as explained earlier. At this point, the process becomes mechanical for the remaining 11 weeks. For example, we show returns-weights matrix and PAA for "week 1" and "week 2" each week in table 5.

<Insert table 5 about here>

At the beginning of "week 1" the allocation is 0/0/100 and at the end of "week 1" it is 65/21/13. During that first week, the PAA shows that the portfolio lost value because of poor equity sector and bond selection skills. During the second week, asset weights were dramatically shifted from 65/21/13 at the beginning of "week 2" to 38/30/32 by the end of "week 2." During that second week, the portfolio gained in value due to superior stock selection skills. At this point, students realize that they are stronger in stock selection than

sector selection. So, for instance, we could expect the team to start investigating and applying a sector rotation strategy to overcome their sector selection deficiency.

<Insert figure 5 about here>

A useful way to present a class's performance during the 13-week trading period is with a boxplot analyzing weekly performance, illustrated in Figure 5. In this boxplot, the horizontal axis depicts all five sources of contribution to excess return and the vertical axis measures excess returns. For each source of contribution to excess return, the boxplot indicates the 13-week median return, the high and low weekly returns, and the overall 13-week excess return. Drawing on Figure 5, the students' portfolio showed strengths in the area of stock selection and weaknesses in asset allocation and bond selection. Currently, the team has progressively overcome its weaknesses in sector selection noted during the first two weeks.

The final word for this exercise has to come from the instructor. We usually ask our students to submit their 13-week boxplots by the end of the semester, right before reports are due. In exchange, we provide each team with a peer group performance comparison. This peer group comparison is also in a boxplot format and compares the individual group median weekly contributions to the class median, high and low weekly contributions. For instance, we show an illustrative peer group performance comparison in Figure 6 for the team in our example. Figure 6 reveals that the class showed homogenous results across contributions, with higher marks in sector and stock selection. It also indicates that our student team performed in the top tier in their area of strength (stock selection) and in the bottom tier in all other areas.

<Insert figure 6 about here>

9. Summary and Conclusion

Performance attribution analysis is growing in importance and popularity among practitioners in the investment community. Therefore, it is crucial that our students be able to perform PAA in a realistic setting. In this paper we demonstrate how this sophisticated portfolio evaluation technique can be integrated into the existing portfolio simulation exercise.

We first discuss the development of an appropriate benchmark portfolio. Then, we illustrate how to use the STOCKTRAK© account statements to calculate the weights and returns for the asset classes. We also show how the Morningstar X-Ray function can be used to calculate the sector weights. We provide a template that concisely contains both the inputs and outputs required to perform performance attribution analysis. We show how to interpret the PAA results using a portfolio built by students. Finally, we extend the one-period example to a multi-period setting.

Endnotes:

[1] PAA can also be easily applied to analyze allocation and selection decisions for global equity, global fixed income, commodity, real estate, and currency portfolios.

[2] There is, of course, no excess return related to the cash class since the benchmark and managed portfolios have the same allocated weight of 10% cash.

[3] STOCK-TRAK© provides this option for an additional fee.

[4] www.stocktrak.com.

[5] In effect, we assume that at the end of the simulation, all positions are liquidated, and accrued coupons are turned into cash. This cash serves to reduce the cash contribution for the bond portion. See also fn. 6.

[6] It is assumed that the cash flows from dividends and bond interest received are reinvested in their respective asset classes, which, in effect, reduces the cash contributions needed to purchase the assets.

[7] http://portfolio.morningstar.com/InstantXray/InstantxrayDEntry.asp?t0=VTSMX&d0=8000.00&t1=AEPGX&d1=2000.00&entryNum=20&page=/demoxray.html

[8] If an indexed mutual fund had been selected as a benchmark, the ticker for the mutual fund can simply be input into the ticker field, and the sector weights for the fund will be returned.

[9] http://news.morningstar.com/stockReturns/CapWtdSectorReturns.html?msection=SectorReturns

[10] http://screen.morningstar.com/index/indexReturns.html?msection=IdxReturns Note: this exhibit is for illustrative purposes only; the returns in this Figure will not correspond with those used in the PAA example.

[11] http://finance.yahoo.com/

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Table 1: Excel Template to Compute PAA

	A	B	C	D	E
1		Weights		Returns	
2		Portfolio Weights	Benchmark Weights	Portfolio Returns	Benchmark Returns
3	EQUITY				
4	Utility (1)				
5	Telecommunication (2)				
6	Software (3)				
7	Media (4)				
8	Industrial Material (5)				
9	Healthcare (6)				
10	Hardware (7)				
11	Financial Services (8)				
12	Energy (9)				
13	Consumer Services (10)				
14	Consumer Goods (11)				
15	Business Services (12)				
16	BONDS				
17	Corporate (1)				
18	Government (2)				
19	Morgaged backed (3)				
20	CASH (Money Market)				
21	Weighted Average			=C5*B5+C18*B18+C22*B22	=E5*D5+E18*D18+E22*D22
22	Performance Attribution Analysis	Excess Return			
23	Total Excess Return	=D21-E21			
24	Contribution from Allocation Decisions	=(B3-C3)*E3+(B16-C16)*E16+(B20-C20)*E20			
25	Contribution from Sector Selection Decisions	=B3*((B4-C4)*E4+(B5-C5)*E5+(B6-C6)*E6+(B7-C7)*E7+(B8-C8)*E8+(B9-C9)*E9+(B10-C10)*E10 +(B11-C11)*E11+(B12-C12)*E12+(B13-C13)*E13+(B14-C14)*E14+(B15-C15)*E15)			
26	Contribution from Bond Type Selection Decisions	=B16*((B17-C17)*E17+(B18-C18)*E18+(B19-C19)*E19)			
27	Contribution from Stock Selection Decisions	=B3*(D3-E3)-B25			
28	Contribution from Bond Selection Decisions	=B16*(D16-E16)-B26			

Table 2: Sample of STOCKTRAK© Statement for a 13-Week Investment Period

All Transactions						
DATE	TRANS	SHARES	TICKER	PRICE	COMMISSION	AMOUNT
Week1	BO (Buy to Open)	1000	TYC	30.15	25	$ (30,175.00)
Week1	BO	1000	MAT	18	25	$ (18,025.00)
Week1	BO	1000	AIR	11.55	25	$ (11,575.00)
Week1	BO	1000	INKP	5	25	$ (5,025.00)
Week1	BO	1000	MAPS	9.3	25	$ (9,325.00)
Week1	BO	1000	EGOV	5	25	$ (5,025.00)
Week1	BO	1000	ECPG	19.25	25	$ (19,275.00)
Week1	BO	1000	CTHR	7.92	25	$ (7,945.00)
Week1	BO	10000	QQQ	36.36	25	$ (363,625.00)
Week1	BO	1000	ING	26.19	25	$ (26,215.00)
Week1	BO	1000	MRK	34.27	25	$ (34,295.00)
Week1	BO	1000	WMT	53.56	25	$ (53,585.00)
Week1	BO	1000	RMBS	16.29	25	$ (16,315.00)
Week1	BO	1000	NUCO	21	25	$ (21,025.00)
Week1	BO	1000	DTSI	17.99	25	$ (18,015.00)
Week1	BO	1500	MSFT	29.81	25	$ (44,740.00)
Week1	BO	1000	HAS	18.32	25	$ (18,345.00)
Week1	SC (Sell to Close)	1000	HAS	20.21	25	$ 20,235.00
Week1	BO	99	B-FN07	1187.5	370	$ (117,932.50)
Week1	BO	99	B-GN09	1085.31	462	$ (107,907.69)
Week1		1500	MSFT-DIV	3	0	$ 4,500.00
Week1	SS (Sell Short)	1000	PFE	31.05	25	$ 31,075.00
Week 2	BO	1000	INKP	6.25	25	$ (6,275.00)
Week 2	BO	1000	MAPS	9.84	25	$ (9,865.00)
Week 2	BO	1000	EGOV	5.06	25	$ (5,085.00)
Week 2	BO	1000	ECPG	19.86	25	$ (19,885.00)
Week 2	BC (Buy to Close)	1000	PFE	29.05	25	$ (29,075.00)
Week 2	SC (Sell to Close)	10000	QQQ	38.29	25	$ 382,875.00
Week 2	BO	99	B-BOL	1000	128	$ (99,128.00)
Week 2	BO	99	B-UAL	41.23	188	$ (4,269.77)
Week 3	SC (Sell to Close)	1000	ING	29.84	25	$ 29,815.00
Week 3	SC (Sell to Close)	1000	MRK	37.59	25	$ 37,565.00
Week 3	SC (Sell to Close)	1000	WMT	56.32	25	$ 56,295.00
Week 3	SC (Sell to Close)	1000	RMBS	19.84	25	$ 19,815.00
Week 3	SC (Sell to Close)	1000	NUCO	22.05	25	$ 22,025.00
Week 3	BO	50	B-BLS	1070	99	$ (53,599.00)
Week 3	BO	50	B-TWX	1083.75	100	$ (54,287.50)
Week 4	BO	1000	AZZ	14.07	25	$ (14,095.00)
Week 4	BO	1000	BLKB	10.25	25	$ (10,275.00)
Week 4	BO	1000	TLP	93.75	25	$ (93,775.00)
Week 6	BO	1000	ABAX	13.51	25	$ (13,535.00)
Week 6	BO	1000	KERX	11.1	25	$ (11,125.00)
Week 6	BO	1000	ITT	78.03	25	$ (78,055.00)
Week 9	BO	1000	OXM	40.25	25	$ (40,275.00)
Week 9	BO	1000	ORBZ	27.19	25	$ (27,215.00)
Week 9	BO	1000	SNMX	9.05	25	$ (9,075.00)
Week 9	BO	1000	SBNY	24.2	25	$ (24,225.00)
Week 9	BO	50	B-LLY	1140	175	$ (57,175.00)

Market value of open positions at the end of week 13						
Date	Position	SHARES	TICKER	PRICE		Market Value
Week 13	BO	1000	TYC	32.05		$ 32,050.00
Week 13	BO	1000	AIR	11.23		$ 11,230.00
Week 13	BO	2000	INKP	6.95		$ 13,900.00
Week 13	BO	2000	MAPS	12.31		$ 24,620.00
Week 13	BO	2000	EGOV	7.03		$ 14,060.00
Week 13	BO	2000	ECPG	20.98		$ 41,960.00
Week 13	BO	1000	CTHR	9.91		$ 9,910.00
Week 13	BO	1000	DTSI	19.25		$ 19,250.00
Week 13	BO	1000	MAT	23.25		$ 23,250.00
Week 13	BO	1000	AZZ	12.91		$ 12,910.00
Week 13	BO	1000	BLKB	14.05		$ 14,050.00
Week 13	BO	1000	TLP	93.3		$ 93,300.00
Week 13	BO	1000	ABAX	13.03		$ 13,030.00
Week 13	BO	1000	KERX	13.8		$ 13,800.00
Week 13	BO	1000	ITT	86.2		$ 86,200.00
Week 13	BO	1000	OXM	38.65		$ 38,650.00
Week 13	BO	1000	ORBZ	27.51		$ 27,510.00
Week 13	BO	1000	SNMX	9.3		$ 9,300.00
Week 13	BO	1000	SBNY	29.7		$ 29,700.00
Week 13	BO	1500	MSFT	28.31		$ 42,465.00
Week 13	BO	50	B-LLY	1130		$ 56,500.00
Week 13	BO	50	B-BLS	1060		$ 53,000.00
Week 13	BO	50	B-TWX	1024.0625		$ 51,203.13
Week 13	BO	99	B-BOL	1000		$ 99,000.00
Week 13	BO	99	B-UAL	41.23		$ 4,081.77
Week 13	BO	99	B-FN07	1105.21		$ 109,415.79
Week 13	BO	99	B-GN09	1054.32		$ 104,377.68

SUMMARY OF TRANSACTIONS		
Net purchases during the 13 weeks	$	(984,464)
Interest Earned during the 13 weeks	$	1,692
Beginning Cash	$	1,000,000
Ending Cash	$	17,228
Market value of long positions	$	1,048,723
Market value of short positions	$	-
Accrued coupons	$	7,988
Portfolio value	$	1,073,939

Table 3: An Example of Single Period PAA

SUMMARY OF TRANSACTIONS					
Net purchases during the 13 weeks		$ (984,464)			
Interest Earned during the 13 weeks		$ 1,692			
Beginning Cash		$ 1,000,000			
Ending Cash		$ 17,227.54			
Market value of long positions		$ 1,048,723			
Market value of short positions		$ -			
Accrued coupons		$ 7,988			
Portfolio value		$ 1,073,939			
Asset Class	**Initial**	**Total Contributions**	**Week 13**	**Portfolio Weigths**	**Periodic Return**
EQUITY	$ -	$ 490,165.00	$ 571,145.00	53%	21.0%
BONDS	$ -	$ 486,311.46	$ 477,578.37	44%	-2.3%
Cash (Money Market)	$ 1,000,000.00	$ (976,476)	$ 25,216	2%	0.7%
Total	$ 1,000,000.00	$ -	$ 1,073,938.91	100%	10.2%
	Portfolio Weights	**Benchmark Weights**	**Portfolio Returns**	**Benchmark Returns**	
EQUITY	**53%**	**60%**	**21.04%**	**10.61%**	
Software	15.85%	4.48%		16.74%	
Hardware	0.00%	9.55%		14.28%	
Media	0.00%	3.68%		11.84%	
Telecommunication	0.00%	3.69%		13.06%	
Healthcare	9.73%	12.94%		1.24%	
Consumer Services	0.00%	8.90%		12.79%	
Business Services	6.69%	3.92%		13.28%	
Financial Services	9.99%	20.68%		8.84%	
Consumer Goods	21.63%	9.31%		5.34%	
Industrial Materials	36.11%	12.61%		12.93%	
Energy	0.00%	7.35%		18.52%	
Utilities	0.00%	2.88%		15.40%	
BONDS	**44%**	**30%**	**-2.29%**	**2.97%**	
Corporate	55%	50%		3.19%	
Treasury	0%	25%		2.97%	
Mortgaged Backed	45%	25%		2.52%	
Cash (Money Market)	**2%**	**10%**	**0.70%**	**0.70%**	
Weighted Average			**10.19%**	**7.33%**	
Performance Attribution Analysis	**Excess Return**				
Total excess return	2.86%				
Contribution from Allocation Decisions	-0.35%				
Contribution from Sector Selection Decisions	-0.13%				
Contribution from Bond Type Selection Decisions	-0.03%				
Contribution from Stock Selection Decisions	5.67%				
Contribution from Bond Selection Decisions	-2.30%				

Table 4: Sample of STOCKTRAK© Statements for Weeks 1 and 2

Transactions during week 1

DATE	TRANS	SHARES	TICKER	PRICE	COMMISSION	AMOUNT
Week1	BO (Buy to Open)	1000	TYC	30.15	25	$ (30,175.00)
Week1	BO	1000	MAT	18	25	$ (18,025.00)
Week1	BO	1000	AIR	11.55	25	$ (11,575.00)
Week1	BO	1000	INKP	5	25	$ (5,025.00)
Week1	BO	1000	MAPS	9.3	25	$ (9,325.00)
Week1	BO	1000	EGOV	5	25	$ (5,025.00)
Week1	BO	1000	ECPG	19.25	25	$ (19,275.00)
Week1	BO	1000	CTHR	7.92	25	$ (7,945.00)
Week1	BO	10000	QQQ	36.36	25	$ (363,625.00)
Week1	BO	1000	ING	26.19	25	$ (26,215.00)
Week1	BO	1000	MRK	34.27	25	$ (34,295.00)
Week1	BO	1000	WMT	53.56	25	$ (53,585.00)
Week1	BO	1000	RMBS	16.29	25	$ (16,315.00)
Week1	BO	1000	NUCO	21	25	$ (21,025.00)
Week1	BO	1000	DTSI	17.99	25	$ (18,015.00)
Week1	BO	1500	MSFT	29.81	25	$ (44,740.00)
Week1	BO	1000	HAS	18.32	25	$ (18,345.00)
Week1	SC (Sell to Close)	1000	HAS	20.21	25	$ 20,235.00
Week1	BO	99	B-FN07	1187.5	370	$ (117,932.50)
Week1	BO	99	B-GN09	1085.31	462	$ (107,907.69)
Week1	BO	1500	MSFT-DIV	3	0	$ 4,500.00
Week1	SS (Sell Short)	1000	PFE	31.05	25	$ 31,075.00

All Transactions: Week 1 and Week 2

DATE	TRANS	SHARES	TICKER	PRICE	COMMISSION	AMOUNT
Week1	BO (Buy to Open)	1000	TYC	30.15	25	$ (30,175.00)
Week1	BO	1000	MAT	18	25	$ (18,025.00)
Week1	BO	1000	AIR	11.55	25	$ (11,575.00)
Week1	BO	1000	INKP	5	25	$ (5,025.00)
Week1	BO	1000	MAPS	9.3	25	$ (9,325.00)
Week1	BO	1000	EGOV	5	25	$ (5,025.00)
Week1	BO	1000	ECPG	19.25	25	$ (19,275.00)
Week1	BO	1000	CTHR	7.92	25	$ (7,945.00)
Week1	BO	10000	QQQ	36.36	25	$ (363,625.00)
Week1	BO	1000	ING	26.19	25	$ (26,215.00)
Week1	BO	1000	MRK	34.27	25	$ (34,295.00)
Week1	BO	1000	WMT	53.56	25	$ (53,585.00)
Week1	BO	1000	RMBS	16.29	25	$ (16,315.00)
Week1	BO	1000	NUCO	21	25	$ (21,025.00)
Week1	BO	1000	DTSI	17.99	25	$ (18,015.00)
Week1	BO	1500	MSFT	29.81	25	$ (44,740.00)
Week1	BO	1000	HAS	18.32	25	$ (18,345.00)
Week1	SC (Sell to Close)	1000	HAS	20.21	25	$ 20,235.00
Week1	BO	99	B-FN07	1187.5	370	$ (117,932.50)
Week1	BO	99	B-GN09	1085.31	462	$ (107,907.69)
Week1	BO	1500	MSFT-DIV	3	0	$ 4,500.00
Week1	SS (Sell Short)	1000	PFE	31.05	25	$ 31,075.00
Week 2	BO	1000	INKP	6.25	25	$ (6,275.00)
Week 2	BO	1000	MAPS	9.84	25	$ (9,865.00)
Week 2	BO	1000	EGOV	5.06	25	$ (5,085.00)
Week 2	BO	1000	ECPG	19.86	25	$ (19,885.00)
Week 2	BC (Buy to Close)	1000	PFE	29.05	25	$ (29,075.00)
Week 2	SC (Sell to Close)	10000	QQQ	38.29	25	$ 382,875.00
Week 2	BO	99	B-BOL	1000	128	$ (99,128.00)
Week 2	BO	99	B-UAL	41.23	188	$ (4,269.77)

Market value of open positions at the beginning of week 2

Date	Position	SHARES	TICKER	PRICE	Market Value
Week 2	BO	1000	TYC	31.25	$ 31,250.00
Week 2	BO	1000	AIR	11.55	$ 11,550.00
Week 2	BO	1000	INKP	6.02	$ 6,020.00
Week 2	BO	10000	QQQ	35.5	$ 355,000.00
Week 2	BO	1000	ING	27.81	$ 27,810.00
Week 2	BO	1000	MRK	35.24	$ 35,240.00
Week 2	BO	1000	WMT	55.52	$ 55,520.00
Week 2	BO	1000	RMBS	17.25	$ 17,250.00
Week 2	BO	1000	NUCO	22	$ 22,000.00
Week 2	BO	1000	MAPS	10.65	$ 10,650.00
Week 2	BO	1000	EGOV	7.21	$ 7,210.00
Week 2	BO	1000	ECPG	20.15	$ 20,150.00
Week 2	BO	1000	CTHR	8.25	$ 8,250.00
Week 2	BO	1000	DTSI	17.03	$ 17,030.00
Week 2	BO	1000	MAT	19.25	$ 19,250.00
Week 2	BO	1500	MSFT	28.51	$ 42,765.00
Week 2	SS	1000	PFE	36.21	$ (36,210.00)
Week 2	BO	99	B-FN07	1102.21	$ 109,118.79
Week 2	BO	99	B-GN09	1054.32	$ 104,377.68

Net purchases	$ (872,560.19)
Interest Earned	$ 523
Beginning Cash	$ 1,000,000
Ending Cash	$ 127,962.81
Market value of long positions	$ 900,441.47
Market value of short positions	$ (36,210.00)
Accrued coupons	$ 1,418.00
Portfolio value	$ 993,612.28

Market value of open positions at the beginning of week 3

Date	Position	SHARES	TICKER	PRICE	Market Value
Week 3	BO	1000	TYC	32.05	$ 32,050.00
Week 3	BO	1000	AIR	11.23	$ 11,230.00
Week 3	BO	2000	INKP	6.95	$ 13,900.00
Week 3	BO	1000	ING	29.84	$ 29,840.00
Week 3	BO	1000	MRK	37.59	$ 37,590.00
Week 3	BO	1000	WMT	56.32	$ 56,320.00
Week 3	BO	1000	RMBS	19.84	$ 19,840.00
Week 3	BO	1000	NUCO	22.05	$ 22,050.00
Week 3	BO	2000	MAPS	12.31	$ 24,620.00
Week 3	BO	2000	EGOV	7.03	$ 14,060.00
Week 3	BO	2000	ECPG	20.98	$ 41,960.00
Week 3	BO	1000	CTHR	9.91	$ 9,910.00
Week 3	BO	1000	DTSI	19.25	$ 19,250.00
Week 3	BO	1000	MAT	23.25	$ 23,250.00
Week 3	BO	1500	MSFT	28.31	$ 42,465.00
Week 3	BO	99	B-BOL	1000	$ 99,000.00
Week 3	BO	99	B-UAL	41.23	$ 4,081.77
Week 3	BO	99	B-FN07	1095.21	$ 108,425.79
Week 3	BO	99	B-GN09	1054.32	$ 104,377.68

Net purchases	$ (663,268)
Interest Earned	$ 1,265
Beginning Cash	$ 1,000,000
Ending Cash	$ 337,997
Market value of long positions	$ 714,220
Market value of short positions	$ -
Accrued coupons	$ 1,918
Portfolio value	$ 1,054,135

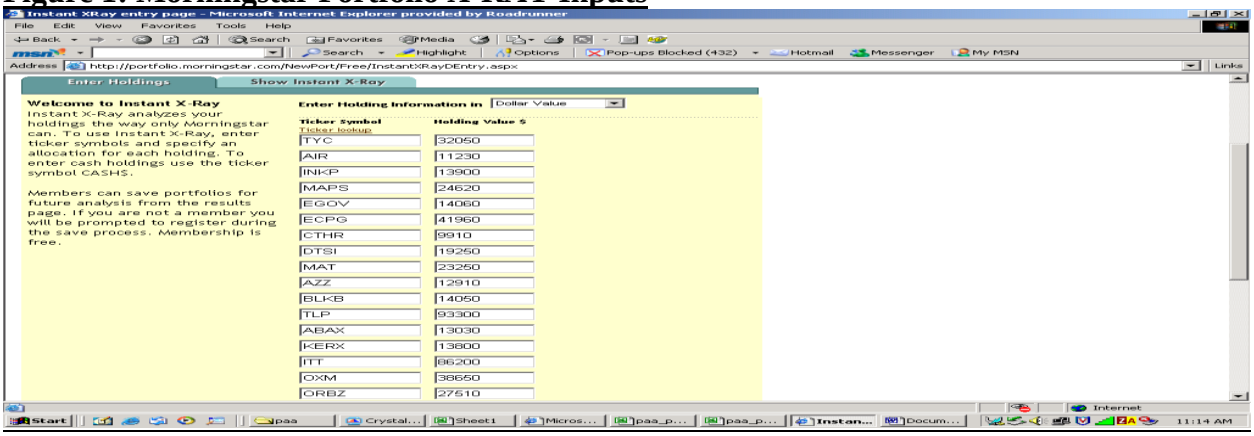
Table 5: An Example of Multi-Period PAA

	WEEK1					WEEK 2				
Asset Class	Beginning Week 1	Contributions	End Week 1	Portfolio Weigths	Periodic Return	Beginning Week 2	Contribution	End Week 2	Portfolio Weigths	Periodic Return
EQUITY	$ -	$ 646,720.00	$ 650,735.00	65%	0.78%	$ 650,735.00	$ (312,690.00)	$ 398,335.00	38%	15.1%
BONDS	$ -	$ 224,422.19	$ 213,496.47	21%	-6.09%	$ 213,496.47	$ 102,897.77	$ 315,885.24	30%	-0.2%
Cash (Money Market)	$ 1,000,000.00	$ (871,142)	$ 129,380.81	13%	0.05%	$ 129,380.81	$ 209,792	$ 339,915.04	32%	0.05%
Total	$ 1,000,000.00	$ -	$ 993,612.28	100%	-0.792%	$ 993,612.28	$ -	$ 1,054,135.28	100.00%	5.653%

	WEEK1				WEEK2			
	Portfolio Weights	Benchmark Weights	Portfolio Returns	Benchmark Returns	Portfolio Weights	Benchmark Weights	Portfolio Returns	Benchmark Returns
EQUITY	**65%**	**60%**	**0.78%**	**-0.18%**	**38%**	**60%**	**15.05%**	**0.79%**
Software	17.78%	4.49%		-0.52%	18.21%	4.32%		-0.36%
Hardware	20.62%	9.16%		0.51%	5.38%	9.61%		0.43%
Media	2.69%	3.84%		1.09%	0.00%	3.78%		1.21%
Telecommunication	1.55%	3.72%		1.35%	0.00%	3.77%		1.39%
Healthcare	18.39%	12.91%		-2.15%	13.97%	12.59%		-1.05%
Consumer Services	15.85%	8.95%		-2.03%	15.28%	8.88%		-0.21%
Business Services	3.11%	3.99%		0.81%	3.82%	3.97%		1.65%
Financial Services	2.90%	20.62%		0.01%	11.39%	20.77%		1.00%
Consumer Goods	6.40%	9.28%		-1.23%	14.22%	9.33%		0.23%
Industrial Materials	10.58%	12.72%		0.21%	17.73%	12.64%		1.23%
Energy	0.15%	7.50%		2.53%	0.00%	7.42%		3.90%
Utilities	0.00%	2.82%		1.02%	0.00%	2.92%		2.64%
BONDS	**21%**	**30%**	**-6.09%**	**0.23%**	**30%**	**30%**	**-0.17%**	**0.24%**
Corporate	66%	50%		0.31%	64%	50%		0.29%
Treasury	0%	25%		0.15%	0%	25%		0.18%
Mortgaged Backed	34%	25%		0.15%	36%	25%		0.18%
Cash (Money Market)	**13%**	**10%**	**0.70%**	**0.70%**	**32%**	**10%**	**0.70%**	**0.70%**
Weighted Average			**-0.71%**	**0.03%**			**5.86%**	**0.61%**

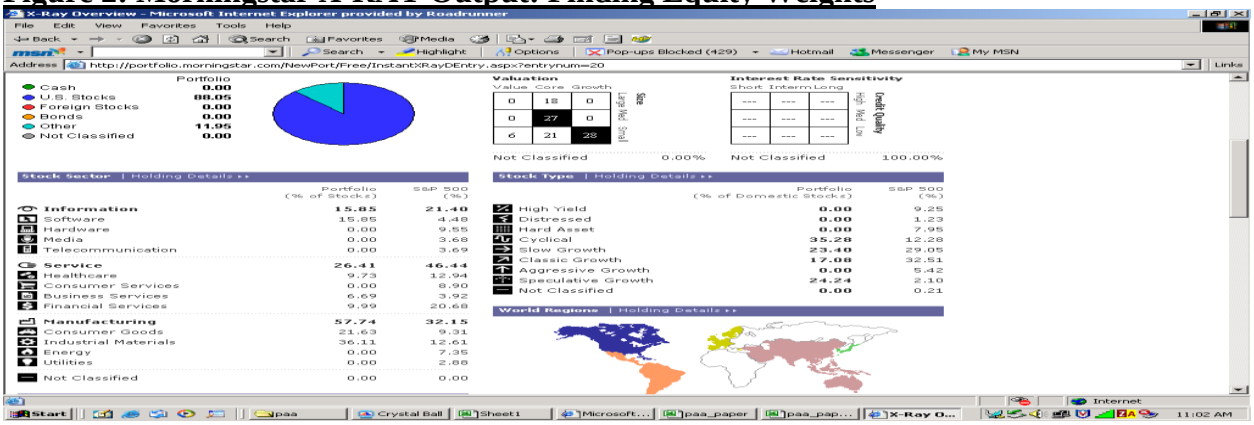
Performance Attribution Analysis	WEEK 1 Return	WEEK 2 Return
Total excess return	-0.74%	5.25%
Contribution from Allocation Decisions	-0.01%	-0.02%
Contribution from Sector Selection Decisions	-0.33%	-0.22%
Contribution from Bond Type Selection Decisions	0.01%	0.00%
Contribution from Stock Selection Decisions	0.95%	5.61%
Contribution from Bond Selection Decisions	-1.36%	-0.13%

Figure 1: Morningstar Portfolio X-RAY Inputs



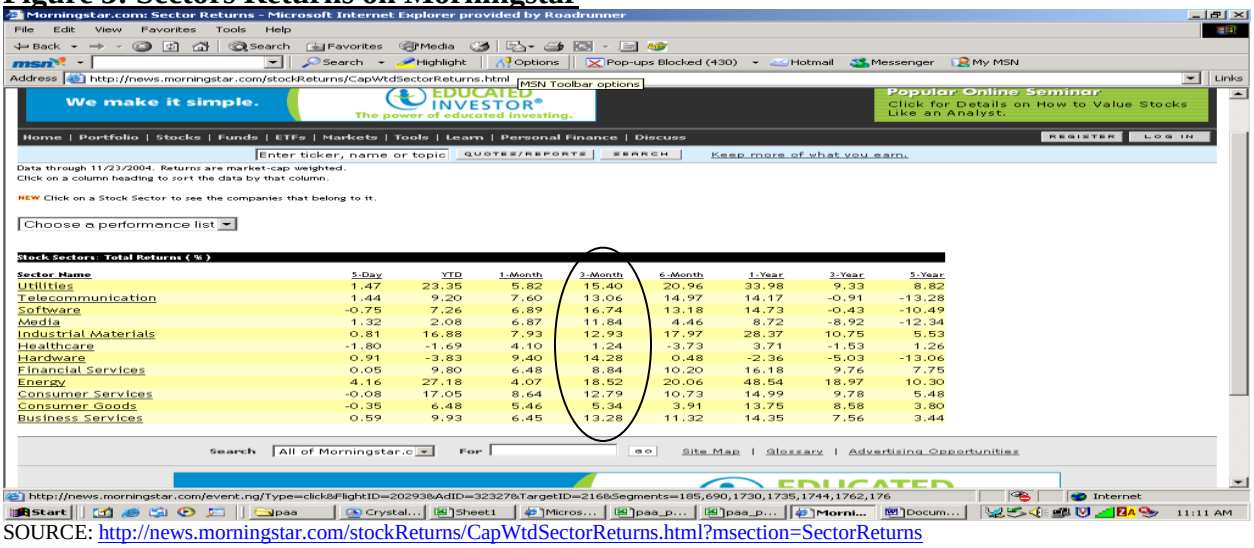
SOURCE:
http://portfolio.morningstar.com/NewPort/Free/InstantXRayDEntry.aspx?t0=VTSMX&d1=2000.00&d0=8000.00&t1=AEPGX&entryNum=20&dt=0.7055475

Figure 2: Morningstar X-RAY Output: Finding Equity Weights



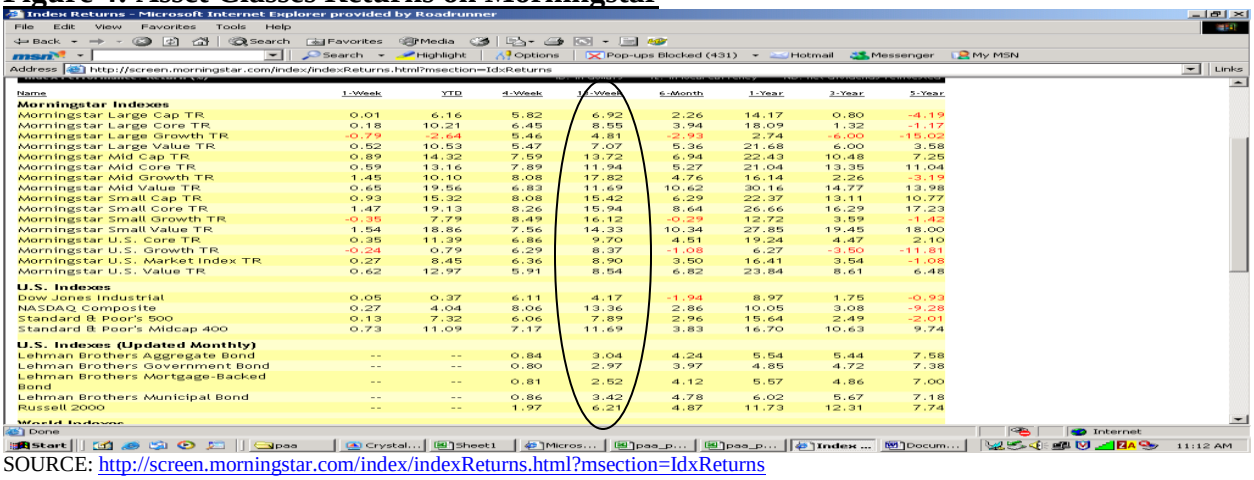
SOURCE:
http://portfolio.morningstar.com/NewPort/Free/InstantXRayDEntry.aspx?t0=VTSMX&d1=2000.00&d0=8000.00&t1=AEPGX&entryNum=20&dt=0.7055475

Figure 3: Sectors Returns on Morningstar



SOURCE: http://news.morningstar.com/stockReturns/CapWtdSectorReturns.html?msection=SectorReturns

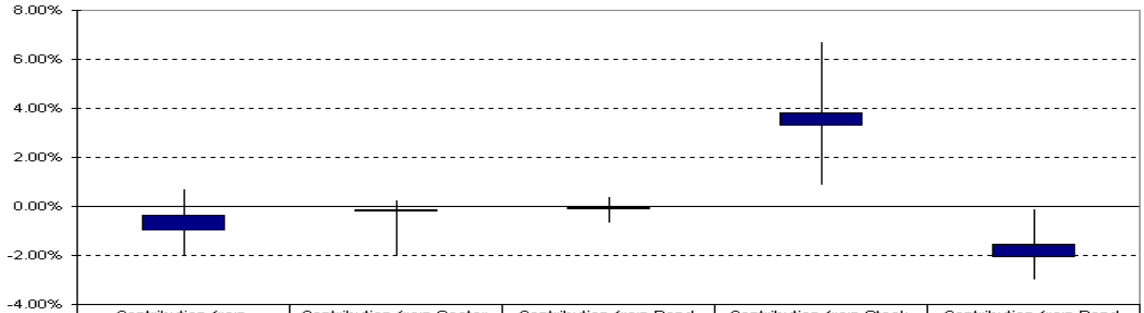
Figure 4: Asset Classes Returns on Morningstar



Name	1-Week	YTD	4-Week	13-Week	6-Month	1-Year	3-Year	5-Year
Morningstar Indexes								
Morningstar Large Cap TR	0.01	6.16	5.82	6.92	2.26	14.17	0.80	-4.19
Morningstar Large Core TR	0.18	10.21	6.45	8.55	3.94	18.09	1.32	-1.17
Morningstar Large Growth TR	-0.79	-2.64	5.46	4.81	-2.93	2.74	-6.00	-15.02
Morningstar Large Value TR	0.52	10.53	5.47	7.07	5.36	21.68	6.00	3.58
Morningstar Mid Cap TR	0.89	14.32	7.59	13.72	6.94	22.43	10.48	7.25
Morningstar Mid Core TR	0.59	13.16	7.89	11.94	5.27	21.04	13.35	11.04
Morningstar Mid Growth TR	1.45	10.10	8.08	17.82	4.76	16.14	2.26	-3.19
Morningstar Mid Value TR	0.65	19.56	6.83	11.69	10.62	30.16	14.77	13.98
Morningstar Small Cap TR	0.93	15.32	8.08	15.42	6.29	22.37	13.11	10.77
Morningstar Small Core TR	1.47	19.13	8.26	15.94	8.64	26.66	16.29	17.23
Morningstar Small Growth TR	-0.35	7.79	8.49	16.12	-0.29	12.72	3.59	-1.42
Morningstar Small Value TR	1.54	18.86	7.56	14.33	10.34	27.85	19.45	18.00
Morningstar U.S. Core TR	0.35	11.39	6.86	9.70	4.51	19.24	4.47	2.10
Morningstar U.S. Growth TR	-0.24	0.79	6.29	8.37	-1.08	6.27	-3.50	-11.81
Morningstar U.S. Market Index TR	0.27	8.45	6.36	8.90	3.50	16.41	3.54	-1.08
Morningstar U.S. Value TR	0.62	12.97	5.91	8.54	6.82	23.84	8.61	6.48
U.S. Indexes								
Dow Jones Industrial	0.05	0.37	6.11	4.17	-1.94	8.97	1.75	-0.93
NASDAQ Composite	0.27	4.04	8.06	13.36	2.86	10.05	3.08	-9.28
Standard & Poor's 500	0.13	7.32	6.06	7.89	2.96	15.64	2.49	-2.01
Standard & Poor's Midcap 400	0.73	11.09	7.17	11.69	3.83	16.70	10.63	9.74
U.S. Indexes (Updated Monthly)								
Lehman Brothers Aggregate Bond	--	--	0.84	3.04	4.24	5.54	5.44	7.58
Lehman Brothers Government Bond	--	--	0.80	2.97	3.97	4.85	4.72	7.38
Lehman Brothers Mortgage-Backed Bond	--	--	0.81	2.52	4.12	5.57	4.86	7.00
Lehman Brothers Municipal Bond	--	--	0.86	3.42	4.78	6.02	5.67	7.18
Russell 2000	--	--	1.97	6.21	4.87	11.73	12.31	7.74

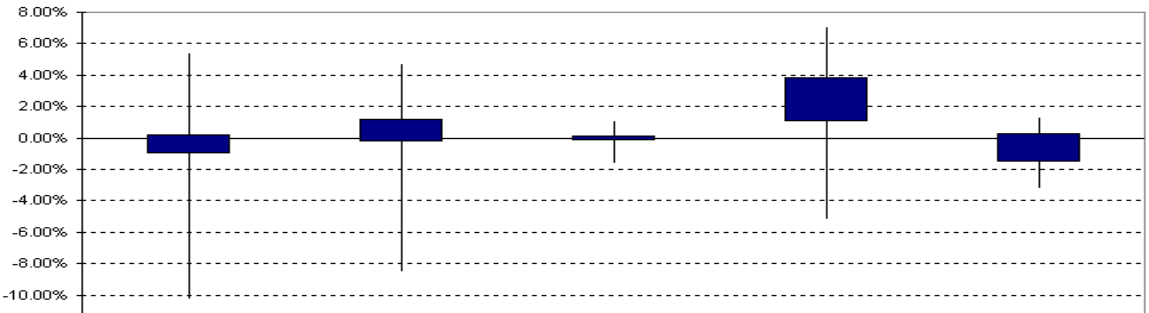
SOURCE: http://screen.morningstar.com/index/indexReturns.html?msection=IdxReturns

Figure 5: Multi-period PAA-Illustrative Week Performance Comparison



	Contribution from Allocation	Contribution from Sector Selection	Contribution from Bond Type Selection	Contribution from Stock Selection	Contribution from Bond Selection
Median Week	-0.98%	-0.22%	-0.15%	3.82%	-1.56%
Highest Week	0.69%	0.21%	0.35%	6.66%	-0.12%
Lowest Week	-2.03%	-2.05%	-0.68%	0.85%	-3.02%
Overall Period	-0.35%	-0.13%	-0.03%	3.27%	-2.08%

Figure 6: Instructor Multi-period Analysis Report



	Contribution from Allocation	Contribution from Sector Selection	Contribution from Bond Type Selection	Contribution from Stock Selection	Contribution from Bond Selection
Group Median	-0.98%	-0.22%	-0.15%	3.82%	-1.56%
Class Highest	5.32%	4.69%	1.01%	7.02%	1.23%
Class Lowest	-10.23%	-8.52%	-1.65%	-5.20%	-3.21%
Class Median	0.21%	1.20%	0.12%	1.02%	0.24%