The Influence of University Investment Education on Asset Allocation

Steven D. Dolvin, John S. Gonas, and Mark K. Pyles[1]

ABSTRACT

Using survey data from students at three universities, we examine the influence of an Investments Analysis course on student perception of the ideal asset allocation for a retirement portfolio. Consistent with previous studies that examine financial education in the workplace, a critical outcome of university investment education is the apparent alleviation of a conservative bias that is typically prevalent among uninformed investors. This change results in an increasing willingness to take larger stock positions, which produces higher expected returns and larger portfolio betas. Most importantly, however, the net effect is more efficient portfolios, particularly for those students who begin with the most inefficient starting portfolios.

Introduction

One of the most important financial decisions an individual makes is determining the asset allocation of his/her retirement portfolio. In the past, the predominant method of funding retirement was some variation of a defined benefit plan (i.e., pension), which essentially eliminated the individual's responsibility in making the asset allocation decision. However, there has been a distinct trend in recent years towards defined contribution plans (i.e., 401(k) or equivalent), which forces individuals to take responsibility for managing their own retirement portfolios.

Given this increased accountability, it becomes imperative that employees understand the ramifications of their investing behavior. Unfortunately, previous studies (e.g., Bernheim, 1998; Hilgert and Hogarth, 2002; Mandell, 2004; and Volpe, Chen, and Liu, 2006) indicate that many, if not most, employees lack sufficient financial literacy to make rational saving and investment decisions. Further, Bodie and Treussard (2007) suggest that some individuals simply find the task of retirement planning unpleasant or too time consuming and therefore avoid the process. In either case, the result is less than optimal retirement portfolios.

Many recent studies have examined the effect of financial education on retirement planning. As expected given the broad financial illiteracy described above, the majority of these studies document a positive impact associated with financial education. For example, Bernheim and Garrett (2003), Clark et al (2006), and Dolvin and Templeton (2006) find financial education results in an efficient reallocation of retirement funds by employees. In addition, Muller (2003) and McCarthy and Turner (2000) find that a large percentage of employees have a distinct conservative bias and that financial education reduces this inefficient predisposition.

Although we similarly examine the effect of financial education on retirement planning, we take a moderately different approach from most existing studies. Specifically, rather than focusing on educational programs implemented by employers (which are generally optional), we choose to study a more organized and established method of financial education, i.e., a pure academic setting. Using a sample of students from three universities over multiple semesters, we examine changes in stated asset allocation choices from the beginning to the end of a standard semester course in investments analysis. Our goal is to determine

[1] Steven D. Dolvin, Assistant Professor of Finance, Butler University, Indianapolis, IN 46208; John S. Gonas, Assistant Professor of Finance, Belmont University, Nashville, TN 37212; Mark K. Pyles, Assistant Professor of Finance, College of Charleston, Charleston, SC 29401.

whether the benefits of financial education in an academic setting are similar to those documented in the workplace.

Like most studies (with the exception of Dolvin and Templeton, 2006), we survey intended allocation choices, in that participants are not immediately required to put their stated plan into action. Although the extent of the education we examine, in terms of depth and complexity, is likely superior to that offered in a workplace setting, student interest level in the topic, and therefore motivation, is likely lower than for those individuals actively dealing with real dollar retirement funds (see Mandell and Klein, 2007). Thus, the net effect is a question of interest.

Our results are generally consistent with the findings of existing studies that examine the effect of financial education on portfolio allocations in a workplace setting. Specifically, we find that investment education results in improved diversification, higher expected returns, and, most importantly, more efficient portfolios. We also find that the largest improvements are concentrated among students who either (1) rate themselves as conservative prior to the class and/or (2) have little previous experience with financial markets and transactions in general, both of which may be indicative of limited investment understanding. Thus, we interpret the results to suggest financial education, particularly in an academic setting, does indeed improve overall retirement planning, especially for those with the most inefficient starting positions.

Background

In recent times, there has been a notable shift in retirement planning, with companies moving from defined benefit to defined contribution plans. In addition, the trend towards contribution-based retirement shows little sign of slowing. For example, in the past few years there has been a significant push by the United States government to create a reformed Social Security System that includes a self-directed investment component. Moreover, this movement to employee-directed pension plans is not specific to the United States, as several members of the European Union also have variations of contribution plans in place.

Although these changes generate a significant increase in flexibility for participants, they also transfer responsibility, particularly related to asset allocation, from employers (or governments) to employees. At first, presumably to ease the transition from defined benefit plans to contribution plans, participants were generally given only a select few alternatives for investments. For example, a participant might have been asked to allocate funds among a stock fund, a bond fund, and a money market fund. Now, however, there are many more choices available, with each having different financial characteristics that participants must evaluate (see Bernartzi and Thaler, 2002).

Unfortunately, there is substantial evidence that individuals do not possess a sufficient level of financial knowledge to make the best possible choices for retirement, particularly when faced with a broad array of alternatives. Bernheim (1995) and Bernheim (1998) were among the first to document this lack of financial literacy, which is even noticeable at a relatively early age, as Mandell (2004) and Mandell and Klein (2007) find that high school students fare poorly when asked questions pertaining to personal finance (such as credit management), as well as stocks and bonds. Moreover, this financial illiteracy is not constrained simply to high school students, as Chen and Volpe (1998) find a general level of financial ignorance among a broad sample of college students, both business and non-business majors. Given the results, Chen and Volpe suggest that higher education should take steps to implement financial education into general curricula. Our study builds on this recommendation by examining the potential effectiveness of such a class.

Hilgert and Hogarth (2002) examine a larger data set from the University of Michigan's 2001 Survey of Consumers and find a low level of financial understanding of mutual funds and securities markets. For example, only half of respondents could correctly identify the stock market as having a higher return over the long-run relative to fixed income securities. In addition, Hilgert and Hogarth find the low level of financial literacy is especially pronounced in single, uneducated, low income, minority, and either young or old (i.e., not middle aged) respondents. While no study can find a concentrated sample group consistently meeting this defined set of age and socio-economic characteristics, we feel our sample comes closer than many. For example, most college students are single, are still working on their education, and have a relatively low income and age level. Thus, we would expect financial education to be particular useful to this group.

A general lack of financial literacy has potentially serious implications. For example, Lusardi and Mitchell (2007a) find that, even after accounting for personal characteristics such as education level and gender, financial literacy still plays a role in determining the subset of the population that have simply planned for retirement. Consistent with this finding, Calvet, Campbell, and Sodini (2007) suggest that financially knowledgeable households are more likely to invest in risky assets (i.e., are less conservative) and have more efficient portfolio selections. This is consistent with the positive correlation between financial understanding and sound investment behavior documented by Kimball and Shumway (2006) and Hilgerth, Hogarth, and Beverly (2003).

The potentially negative consequences associated with a lack of financial knowledge provide evidence for the necessity (and potential benefit) of financial education (see Lusardi and Mitchell, 2007b). Thus, as would be expected, studies have found education to be useful in many areas, including risk adjustment and portfolio efficiency. In fact, Bernheim and Garrett (2003) find the mere availability of employer-sponsored education programs increases savings (particularly in 401(k) plans) and motivates more successful retirement planning.

While these programs can take many forms, McCarthy and Turner (2000), consistent with Muller (2003), find even basic educational materials supplied by the employer can be beneficial in alleviating the conservative bias through increasing the proportion of equities in retirement portfolios. In addition, Ameriks (2001) and Clark et al (2006) find approximately 30% of participants who take advantage of educational tools provided by TIAA-CREF are more likely to adjust their retirement portfolios than those who do not.

Similar to the approach we employ, most studies examine the influence of financial education on participants' surveyed intentions. A notable exception is Dolvin and Templeton (2006), who examine actual asset allocations following an optional employer-sponsored education program. They find seminar participants hold a greater number of funds (i.e., are more diversified) and have more efficient portfolios, as evidenced by larger Sharpe Ratios. They also conclude that financial education induces participants to allocate their investments in ways more consistent with their actual risk tolerance.

Data Collection

Data were collected from 206 students via a surveying method at three universities: Butler University is a private university located in Indianapolis, IN; The College of Charleston is a public university located in Charleston, SC; and Belmont University is a private university located in Nashville, TN. The surveys were administered at both the beginning and end of an introductory level Investments Analysis course at each university. The sample period was Fall 2005 through Spring 2007. While the specific nature of the courses may have differed slightly, all three were generally consistent in terms of material covered and the characteristics of the students in the class.

The beginning survey is presented in Appendix A, and it contains two basic types of questions: (1) personal characteristics and (2) desired portfolio characteristics. Summary statistics for each item are presented in Table 1. Students were first asked to judge their level of risk tolerance, given four choices. From Panel A, it appears approximately 11 percent of the respondents classified themselves as aggressive (*AGG*) investors, while the majority (60 percent) classified themselves as moderately aggressive (*ModAgg*). The remaining 29 percent was split between moderately conservative (*ModCons*, 10 percent) and conservative (*Cons*, 19 percent). To consolidate the rankings, we create the variable *Aversion*, which is a numerical representation of the risk tolerance selection, ranging from 1 (conservative) to 4 (aggressive). The average value of 2.63 reflects the skew towards aggressive investing behavior. Our results closely resemble those reported by Dolvin and Templeton (2006) in a workplace setting.

To measure the students' previous experience with financial markets, we also investigate their experience with checking accounts, as well as bond (*Bonds*) and stock (*Stocks*) trading. Unsurprisingly, almost all the respondents have (or have had) a checking account. A little over half of the students have invested in stocks, while only 40 percent have invested in bonds. Thus, a large percentage of the sample has little to no experience with investing, providing us with a fertile sample to examine the potential benefits that could result from financial education.

The vast majority of the sample is undergraduate students, the only exception being two MBA classes (one each at Belmont and Butler). Approximately 70 percent of the sample is male, which is unsurprising in

Finance classes where the majority is generally male. Finally, approximately 70 percent of students in the sample are Finance majors.[2]

Table 1: Summary Statistics

Panel A: Personal Characteristics

	Average	Std.Dev
Agg	.11	.31
ModAgg	.60	.49
ModCons	.10	.30
Cons	.19	.39
Aversion	2.63	.91
Checking	.99	.07
Bonds	.40	.49
Stocks	.57	.50
Undergrad	.89	.32
Male	.71	.45
Finance	.70	.46

Panel B: Desired Portfolio Characteristics

	Average	Std.Dev
Cash	18.34	16.19
Gov	12.32	10.51
Corp	14.36	.945
Large	24.47	13.08
Small	18.40	12.99
Intl	12.03	8.88
Funds	5.31	1.03
PercentST	54.90	22.86
RiskAccurate	.54	.50
Return	9.50	2.07
Beta	.61	.25
Treynor	7.01	1.46

Notes: This table presents descriptive statistics for the entire sample of 206 students surveyed over the academic years 2005-2007. Panel A presents personal characteristics as obtained via the survey given at the beginning of each course (see Appendix A).

Students were also asked to identify their ideal retirement portfolio allocations among six choices, which follow categories commonly reported in finance textbooks, as well as those typically used in general investment style boxes. These results are presented in Panel B. The respondents choose the largest percentage of their desired portfolio to be invested in large company (*Large*) stocks (approximately 25 percent), followed by small company (*Small*) stocks (approximately 18.4 percent) and cash (approximately 18.3 percent). The remaining desired portfolio is split among corporate (*Corp*) bonds (14.4 percent), government (*Gov*) bonds (12.3 percent), and international (*Intl*) stocks (12 percent).

To more cohesively examine the chosen allocations, we create six additional variables. *Funds* is the number of different investment categories the respondents chose in their desired portfolio. The average number of categories chosen was approximately 5.3, indicating a large portion of students used all six categories in their portfolio. This finding is consistent with the "1/n" phenomenon documented by Bernartzi and Thaler (2001), who suggest many investors follow a simple and naïve strategy of dividing their contributions (almost equally) among all available investment alternatives, even if it is not in their best interest to do so.

---

[2] The College of Charleston does not have a Finance major. Instead, CofC has a Finance concentration attached to a Business Administration major. We treat them interchangeably; however, for robustness, we repeat all analyses at each school separately and find the results qualitatively unchanged.

The percentage of stocks in a student's hypothetical portfolio (*PercentST*, which is the sum of small stock, large stock, and international stock allocations) averaged approximately 55 percent. While this is the majority, the average risk aversion leans heavily towards moderately aggressive. Thus, this percentage of stocks appears a bit low relative to stated risk tolerance. To illustrate this potential discrepancy, we create *RiskAccurate*, which is a dummy variable equal to one if the student's percentage stock allocation is considered theoretically consistent with their chosen risk tolerance.

To determine whether an allocation is consistent with stated risk tolerance, we consulted multiple brokerage websites and material to estimate reasonable ranges of stock holdings at each risk level. Once consolidated, we used the following overlapping ranges to determine accuracy:

Risk Category	Percent Stock
Conservative	0 – 60%
Moderately Conservative	50-70%
Moderately Aggressive	60-85%
Aggressive	75-100%

So, if a student classifies her/himself as moderately aggressive, for example, and allocates 60-85% of funds to stocks (large, small, or international), s/he is viewed as accurate (i.e., *RiskAccurate* =1). Any allocation outside of this range, either above or below, is classified as inaccurate (i.e., *RiskAccurate* = 0).[3] As documented in Table 1, only 54 percent of students chose a portfolio consistent with their risk tolerance, which may be a signal of limited investment understanding.

The last three variables in Table 1 are calculated based upon historical returns in each asset class. Using data (as presented in Ibbotsons) over the years 1926 to 2004, we calculate the expected return for each student's chosen portfolio. In addition, we calculate a portfolio beta using the same data, where we treat large capitalization stocks as our index for calculation purposes. Using these estimates, we find that the average student has a portfolio expected return of 9.5% and a portfolio beta of .61. Finally, we calculate the Treynor ratio (portfolio risk premium relative to beta) for each student's portfolio using the estimated expected return and beta, as well as an assumed risk-free rate of 5 percent. The average Treynor ratio for the sample is 7.01.

Taken as a whole, it appears students feel they have a preference towards aggressive investing; however, their actual investment allocation is often more on the conservative side. Thus, it appears that students may significantly benefit from investment education, if not simply by increasing their understanding of risk. Prior to making any conclusions, however, some additional analysis is needed. Specifically, some of the variables we identify may be related to particular characteristic of subsets of the sample. For example, it is widely documented that females exhibit a stronger conservative bias, which may be of importance given the demographics of our sample (see Dolvin and Templeton, 2006). Therefore, we consider the possibility of particular subsets influencing our results.

In Table 2, we examine summary statistics for the total sample, segmented by student characteristics. Specifically, we examine the student's major (Panel A), gender (Panel B), previous stock experience (Panel C), risk tolerance (Panel D), and academic classification (Panel E). Examining Panel A, there does not appear to be any significant differences between Finance majors and all other majors. This perhaps indicates that general finance coursework is insufficient to prepare students for retirement planning and that more targeted coursework (such as the Investments Analysis course) is needed.

Panel B suggests males have a higher level of stated risk tolerance than females, which is consistent with the higher percentage of stocks held in their ideal portfolios. Males also tend to be more accurate with their portfolio selections. Specifically, in unreported results we find that even those females that rated themselves more aggressive still selected a lower allocation to stocks. The increased stock percentage held by males leads to an increased expected return and higher risk level (i.e., portfolio beta). Most importantly, the net effect of these differences is a higher Treynor ratio, which is indicative of a more efficient portfolio. Students with previous experience investing in stocks are associated with higher risk tolerance, a larger stock allocation (meaning higher return and risk), and a superior Treynor ratio. Individuals, either in an academic or workplace setting, who are new to investing are likely to be more reluctant to assume risk,

---

[3] Although it is not a purely objective set of criteria, the results are consistent across relatively modest changes in the ranges. Moreover, for those considered inaccurate, they are generally well outside the stated range. For example, there are multiple students who classify themselves as moderately aggressive, yet state a target stock allocation of less than 10 percent.

even though it is often in their best interest to do so. It is possible that an investments course could level the playing field in this regard by proxying for previous experience.[4]

Table 2: Summary Stats Segmented by Student Characteristics

Panel A: Major (Finance vs. Non-Finance)

	Finance Major	Non-Finance Major	*t*-stat
N	145	61	
Funds	5.34	5.25	.58
Aversion	2.68	2.51	1.16
PercentST	56.00	52.28	1.11
RiskAccurate	.56	.51	.66
Return	9.61	9.25	1.18
Beta	.62	.58	1.16
Treynor	7.00	7.03	-.16

Panel B: Gender (Male vs. Female)

	Male	Female	*t*-stat
N	147	59	
Funds	5.32	5.29	.20
Aversion	2.73	2.36	2.80
PercentST	56.61	43.15	5.06
RiskAccurate	.61	.37	3.18
Return	9.91	8.48	4.85
Beta	.66	.49	4.95
Treynor	7.16	6.64	2.09

Panel C: Previous Experience (*Stocks*=1)

	Stock Experience	No Stock Expericence	*t*-stat
N	117	89	
Funds	5.29	5.34	-.32
Aversion	2.84	2.35	3.83
PercentST	60.98	46.90	4.64
RiskAccurate	.53	.56	-.45
Return	10.01	8.84	4.24
Beta	.67	.53	4.41
Treynor	7.22	6.73	2.28

Panel D: Risk Tolerance (Aggressive vs. Conservative)

	Aggressive	Conservative	*t*-stat
N	146	60	
Funds	5.27	5.40	-.82
Aversion	3.15	1.35	26.16
PercentST	61.92	37.82	8.46
RiskAccurate	.47	.73	-3.77
Return	10.10	8.06	7.68
Beta	.69	.43	8.04
Treynor	7.26	6.38	3.12

---

[4] We also examine previous experience with a checking account and bond trading. However, the lack of variation in *Checking* makes meaningful analysis impossible, and previous experience in bond trading has a similar impact as stocks. Thus, for brevity, we exclude those from the primary analyses.

Panel E: Classification (Undergraduate vs. Graduate)

	Undergraduate	Graduate	*t*-stat
N	183	23	
Funds	5.39	4.70	2.48
Aversion	2.56	3.17	-3.76
PercentST	51.96	78.26	-6.88
RiskAccurate	.52	.74	-2.19
Return	9.26	11.43	-5.68
Beta	.58	.85	-6.17
Treynor	6.95	7.48	-3.93

Notes: This table presents summary statistics for the entire sample, segmented by various student characteristics. Specifically, the sample is segmented by major (Panel A), gender (Panel B), previous stock investing experience (Panel C), risk tolerance (Panel D), and classification (Panel E). We collapse *ModAgg* and *Agg* to create a subsample of aggressive students for Panel D. All other variables are as defined in Table 1. *T*-stats from difference tests between averages for the reported categories are calculated assuming unequal variances.

We also examine the differences between characteristics of students that classify themselves as conservative and those that classify themselves as aggressive. For conciseness, we collapse the four risk tolerance categories into two. Thus, moderately aggressive and aggressive students are classified as aggressive, while moderately conservative and conservative are classified as conservative.[5] Interestingly, while students who classify themselves as aggressive do hold more stocks in their ideal portfolio, they are less accurate with their choices. This suggests they do not hold enough equity given their risk tolerance designation.

Lastly, graduate students are more aggressive, which naturally leads to higher expected returns and higher betas. Further, the combination also results in larger Treynor ratios. This is likely due to previous stock experience, as 90 percent of graduate students had previously traded stock, compared to only 50 percent of undergraduate students.

Results

At the completion of every semester, each participant filled out an ending survey (see Appendix B), which again questioned his/her risk tolerance and ideal retirement portfolio allocation. We compiled the results of the ending survey, subsequently examining the ending values in relation to the beginning levels. We report the results of this analysis in Table 3. We also include a column representing the percentage difference between the beginning and ending values of each variable, except for *RiskAccurate*, which, due to its binary definition, does not lend itself to conversion to percentage change form.

We document significant "improvement" in almost all variables. For example, individual risk tolerance increases, which is illustrated by a significantly higher value of *Aversion*. This suggests that students are able to overcome a preexisting conservative bias. In addition, the respondents are more accurate in their portfolio allocations, at least in relation to their newly stated level of risk tolerance. As would be predicted, expected returns increase with the higher percentage of stocks held in the respondents' ideal portfolios. Naturally, this leads to an increase in the portfolio beta as well. This increased risk (i.e., higher beta) is more than offset by the increased return, however, as evidenced by a positive increase in the portfolio Treynor ratio.

To further illustrate an important element of this study, in unreported results we create *Tolup*, a dummy variable equal to one if the student identified him/herself as having an increased risk tolerance at the end of the course relative to the beginning. We find that over 25 percent of students increase their stated risk tolerance, with less than 15 percent reducing their tolerance. This difference is highly significant, again evidencing the potential effectiveness of financial education in reducing preconceived biases.

The only area in which an "improvement" is not documented is a decrease in the number of investment types used in the ending portfolio allocation relative to the beginning. While this conflicts with our expectations, it is most likely due to the fact that many students chose to hold less (or no) cash in the

---

[5] For robustness, we examine all four categories separately and find the new classification does not alter the qualitative results of the paper in any way.

ending portfolio. While there are always extenuating circumstances, this is generally consistent with the finding of increased risk tolerance. And, in fact, it suggests an overcoming of the "1/n" bias.

Table 3: Before and After Analysis

	Before	After	*DiffPer* (%)	*t-stat*
N	206	206		
Funds	5.31	5.05	-2.19	-3.11
Aversion	2.63	2.83	23.62	2.89
PercentST	54.90	73.64	63.82	13.09
RiskAccurate	.54	.66	na	2.29
Return	9.50	11.17	21.80	12.62
Beta	.61	.81	73.44	13.05
Treynor	7.01	7.52	3.16	4.99

Notes: This table presents summary statistics for both the pre-course survey and the post-course survey. We also provide *t*-statistics for the difference between the pre and post values. *DiffPer* is the average percentage difference in each of the variables from pre-survey to post-survey. All variables are as defined in Table 1. *t*-stats from difference tests between averages for the reported categories are calculated assuming unequal variances.

As before, we reexamine the sample after segmenting by student characteristics, and we report these results in Table 4. However, in this analysis, we examine revised variables that represent the percentage difference between the beginning and ending values (i.e., similar to those in column 3 of Table 3), thereby measuring the impact of the investments education. For example, *FundsDiff* represents the percentage difference in the number of investment types selected in the pre-survey and the number chosen in the post-survey. Specifically, finance majors reduced the number of funds held, on average, by 4.6%; whereas, non-finance majors increased the number of categories held by 3.52%. This difference is moderately significant.

We considered examining the raw numerical difference in each of the variables (i.e., not percentages); however, this approach created problematic interpretations due to the preexisting framework. For example, those students coming in rating themselves conservative have a potential increase of three levels (i.e., from conservative to aggressive) in risk tolerance; whereas, a moderately aggressive investor only has one level of potential increase in risk tolerance. Thus, we would expect conservative to be significantly related to change in aversion. The same is true for many of the other relations.

Thus, to mitigate this issue we redefined six of the eight variables by measuring the percentage change for each participant from the beginning to ending surveys. Although analyzing percentage changes does not completely eliminate the framework problem, it does moderate the effect. The remaining two variables, *RiskAccurate* and *Tolup*, are binary by nature, thus we retain the raw values for those model specifications. Again, we find little difference between Finance and non-Finance majors, indicating that all majors can potentially benefit from financial education. The only exception, as mentioned above, is that finance majors have changed (reduced) the number of investment types they hold more so than non-Finance majors. This difference appears to be a result of Finance majors replacing cash in their portfolio with another asset type.

Females appear to overcome their conservative bias more so than males, as evidenced by a larger increase in the percentage of stocks in their portfolios. Further, this change leads to a greater increase in both expected return and betas. Interestingly, though, there is no stated difference in changes in risk aversion. This combination suggests that females primarily benefit from an increased understanding of risk. Also, while the difference in the percentage increase in the Treynor ratio is statistically insignificant, it is economically large, indicating the portfolios of females do experience a greater improvement in efficiency, which suggests education does appear to have the greatest positive impact on females. Overall, however, at the conclusion of the semester females continue to hold fewer stocks than males, indicating education may not completely overcome inherent risk preferences in the genders.

We also find that those students without previous experience increase their holdings in stock-based assets more so than those with previous experience. This is related to a larger increase in risk tolerance, as well as to the increase in funds held, as those without experience were more likely to avoid equity in their original allocations. Further, those students without previous stock investing experience appear to have benefited more from the education, as evidenced by the economically larger change in the Treynor ratio, although statistically this difference is small.

Table 4: Before and After Analysis of Student Characteristics

Panel A: Major (Finance vs. Non-Finance)

	Finance Major	Non-Finance Major	*t*-stat
N	145	61	
FundsDiff	-4.60	3.52	-1.60
AversionDiff	25.80	18.44	.71
PercentSTDiff	60.21	72.27	-.54
RiskAccurateDiff	.10	.15	-.48
ReturnDiff	22.25	20.73	.36
BetaDiff	78.33	61.81	.70
TreynorDiff	.22	10.14	-1.02
Tolup	.31	.23	1.21

Panel B: Gender (Male vs. Female)

	Male	Female	*t*-stat
N	147	59	
FundsDiff	-4.67	3.98	-1.65
AversionDiff	25.85	18.08	.78
PercentSTDiff	51.36	95.16	-2.06
RiskAccurateDiff	.05	.25	-1.80
ReturnDiff	18.31	30.50	-2.51
BetaDiff	56.59	115.44	-1.60
TreynorDiff	1.33	7.72	-.56
Tolup	.31	.22	1.39

Panel C: Previous Experience (*Stocks*=1)

	Stock Experience	No Stock Experience	*t*-stat
N	117	89	
FundsDiff	-7.93	5.36	-3.23
AversionDiff	14.25	35.96	-2.10
PercentSTDiff	43.62	90.97	-2.38
RiskAccurateDiff	.09	.13	-.42
ReturnDiff	18.18	26.57	-2.00
BetaDiff	41.79	115.05	-2.39
TreynorDiff	.78	6.29	-.39
Tolup	.27	.30	-.47

Panel D: Risk Tolerance (Aggressive vs. Conservative)

	Aggressive	Conservative	*t*-stat
N	146	60	
FundsDiff	-3.62	1.28	-1.15
AversionDiff	-3.65	90.00	-7.48
PercentSTDiff	36.81	131.80	-3.70
RiskAccurateDiff	.21	-.12	2.99
ReturnDiff	14.92	38.54	-4.60
BetaDiff	34.65	167.83	-3.09
TreynorDiff	1.24	7.84	-.32
Tolup	.15	.60	-6.42

Panel E: Classification (Undergraduate vs. Graduate)

	Undergraduate	Graduate	*t*-stat
N	183	23	
FundsDiff	-.68	-14.20	2.47
AversionDiff	24.73	14.86	.87
PercentSTDiff	69.57	18.55	4.58
RiskAccurateDiff	.14	-.13	2.17
ReturnDiff	22.85	13.49	2.15
BetaDiff	79.93	21.83	3.56
TreynorDiff	3.19	2.89	.04
Tolup	.30	.22	.82

Notes: This table presents descriptive statistics of the differences between the pre- and post-course surveys. Each variable (except *Tolup and RiskAccurateDiff*) represents the percentage difference between the beginning and ending survey values in each category. All variables are as defined in Tables 1 and 3. *T*-stats from difference tests between averages for the reported categories are calculated assuming unequal variances.

We also find that those students without previous experience increase their holdings in stock-based assets more so than those with previous experience. This is related to a larger increase in risk tolerance, as well as to the increase in funds held, as those without experience were more likely to avoid equity in their original allocations. Further, those students without previous stock investing experience appear to have benefited more from the education, as evidenced by the economically larger change in the Treynor ratio, although statistically this difference is small.

Students classifying themselves as conservative experience a much larger increase in stock allocation in their portfolios, which is to be expected as they started with significantly less. Accordingly, their expected returns and betas increase by more than their aggressive counterparts. Graduate students improve their portfolio less than undergraduates (i.e., lower increase in stocks and a smaller increase in tolerance). This is likely due, however, to their superior starting position. This result, combined with the results relating to gender, previous experience, and starting risk tolerance, suggests financial education benefits everyone, but particularly those individuals who have the most inefficient starting position. Therefore, taken as a whole, financial education appears to put everyone in a more equal situation.

To control for potential overlap in the effects documented in Table 4 and to more closely examine the relation between student characteristics and portfolio improvement, we examine the following OLS regression model:

$$VarDiff = B_0 + B_1 Conservative + B_2 Stocks + B_3 Undergrad + B_4 Male + B_5 Finance + B_6 RiskAccurate + \varepsilon \qquad (1)$$

where *VarDiff* is one of the eight variables examined in Table 4. Results from this analysis are presented in Table 5.

Rather than discussing results for each equation separately, we choose to examine the influence of each independent variable across the equations. We feel this approach leads to a richer understanding of the type of student (i.e., particular preexisting characteristics) that tends to receive the greatest benefit from the education in investments.

Those students that enter the class rating themselves as conservative experience a larger increase in risk tolerance, as seen in *AversionDiff* and *Tolup*. Further, these students increase their allocation to stocks, resulting in higher expected returns and betas. Although the adjustment does not necessarily result in a larger change in efficiency (i.e., Treynor ratio), the modification, given a moderate time to maturity, should result in a larger portfolio ending value.

We find that students with previous stock experience have a significant reduction in the number of investment types they chose. Although this is associated with larger stock holdings, the percentage change is lower as compared to those without stock experience. This is consistent with the belief that those in better starting positions are in less need of a portfolio reallocation. Examining the other regressions, previous experience seems to have little relative impact.

Although academic level (i.e., undergraduate vs. MBA) seemed to influence the benefit of the education, once we control for other characteristics, this variable has no significance. Thus, investments courses seem to be equally beneficial no matter what the level of student.

Table 5: Multivariate Analyses

	FundsDiff		*AversionDiff*		*PercentSTDiff*		*RiskAccurateDiff*	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Intercept	.11	1.36	-.33	-2.14	.76	2.12	.68	4.65
Conservative	.00	.01	.89	9.99	.96	4.71	-.06	-.73
Stocks	-.10	-2.55	-.06	-.81	-.30	-1.71	-.08	-1.16
Undergrad	.07	1.10	-.08	-.62	.07	.26	.03	.25
Male	-.04	-.91	.24	2.74	-.09	-.44	.04	.51
Finance	-.09	-2.24	.12	1.51	-.02	-.10	-.00	-.05
RiskAccurate	-.09	-2.30	.28	3.55	-.39	-2.15	-1.02	-13.77
N	206		206		206		206	
Adj. R. Sq.	.0878		.4324		.1327		.5286	

	ReturnDiff		*BetaDiff*		*TreynorDiff*		*Tolup*	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Intercept	.21	2.79	.65	2.24	.26	1.27	-.17	-1.43
Conservative	.21	4.93	.80	4.85	-.08	-.66	.49	7.37
Stocks	-.02	-.64	-.22	-1.53	.00	.04	.05	.83
Undergrad	.01	.09	.05	.20	.00	.02	.02	.17
Male	-.04	-1.06	-.10	-.60	-.21	-1.87	.17	2.69
Finance	.02	.57	.02	.12	-.14	-1.36	.11	1.87
RiskAccurate	-.07	-1.73	-.31	-2.11	.03	.31	.13	2.14
N	206		206		206		206	
Adj. R. Sq.	.1288		.1357		-.0037		.2751	

The univariate results suggested that females stood to benefit the most from financial education; however, the results of the regressions do not provide strong support for this finding. Specifically, controlling for other factors, males increase their risk aversion more so than females (although more females increase than males as suggested by *Tolup*). There is no difference in the change in stock holdings. Taken together, these results are consistent with our earlier findings that suggest the real benefit to females is a richer understanding of risk and its definition. This result is supported by the finding that females actually improve their Treynor ratios by more than male students.

Finance majors reduce the number of categories held relative to non-finance majors, and they tend to increase their risk tolerance. However, none of these changes significantly affect differences in holdings or portfolio efficiency, suggesting that courses of this nature are beneficial for students beyond just finance majors.

Lastly, we examine *RiskAccurate*, which appears to be the most consistently significant variable. For example, those who are least accurate (i.e., *RiskAccurate*=0) in matching their identified risk tolerance to selected stock allocation reduce the funds they hold, while also increasing their relative stock holdings. They improve their ability to match stated risk tolerance with stock allocations, and they improve expected return, all without a loss in efficiency. We feel that the risk accuracy variable likely proxies for investment knowledge. If so, our results suggest that those with the least pre-existing knowledge benefit the most from the course.

Taken as a whole, our results suggest that the students who benefit the most from an investments course are those who have the least pre-existing experience and/or knowledge. Thus, consistent with the findings of previous studies that examine a workplace setting, our results suggest that education puts individuals on a more equal footing. Further, our findings suggest (see Mandell and Klein, 2007) that students in investments courses have sufficient motivation to capture the potential benefits of education. We attribute this result to the fact that most students are finance majors (and therefore inherently interested in the topic) or have elected to take the class. Both may be indicative of self-selection. Therefore, forcing all majors to take such a course may result in less significant outcomes.

Conclusion

We examine, via a survey technique, the influence of financial education on retirement planning. Numerous previous studies have illustrated a distinct lack of financial literacy, and the result is often an inefficient allocation in associated retirement portfolios. As such, many studies have shown financial education helps alleviate these inefficiencies.

We survey students who have enrolled in and completed an Investment Analysis course at one of three universities. After surveying students both before and after the class, we find financial education does indeed benefit participants in that they experience increased risk tolerance and choose more efficient portfolio allocations. Further, those students with the worst starting positions (i.e., the most conservative bias or the least amount of experience/knowledge) tend to benefit more so than those with better beginning allocations. Thus, our conclusions are consistent with those reported in a workplace setting and add to the existing literature supporting the benefits of financial education.

References

Benartzi, Shlomo & Richard H. Thaler. 2001. "Naïve Diversification Strategies in Defined Contribution Savings Plans." *American Economic Review*, 91, 79-98.

Benartzi, Shlomo & Richard H. Thaler. 2002. "How Much is Investor Autonomy Worth?" *Journal of Finance*, 57, 1593-1616.

Bernheim, B. Douglas. 1995. "Do Households Appreciate Their Financial Vulnerabilities? An Analysis of Actions, Perceptions, and Public Policy." *Tax Policy and Economic Growth*, Washington, D.C. American Council for Capital Formation, 1-30.

Bernheim, B. Douglas. 1998. "Financial Illiteracy, Education, and Retirement Saving. In O.S. Mitchell & S.J. Schieber (Eds.), *Living with Defined Contribution Pensions*, Philadelphia, University of Pennsylvania Press, 38-68

Bernheim, B. Douglas. & Daniel M. Garrett. 2003. "The Effects of Financial Education in the Workplace: Evidence from a Survey of Households. *Journal of Public Economics*, 87, 1487, 1519.

Bodie, Zvi & Jonathan Treussard. 2007. "Making Investment Choices as Simple as Possible, but Not Simpler." *Financial Analysts Journal*, 63, 42-47.

Calvet, Laurent E., John Y. Campbell, & Paolo Sodini. 2007. "Down or Out: Assessing the Welfare Costs of Household Investment Mistakes." *Journal of Political Economy*, 115, 707-747.

Chen, Haiyang & Ronald P. Volpe. 1998. "An Analysis of Personal Financial Literacy Among College Students." *Financial Services Review,* 7, 107-128.

Clark, Robert L., Madeleine B. d'Amrbosio, Ann A. McDermed, & Kshama Sawant. 2006. "Retirement Plans and Savings Decisions: The Role of Information and Education." *Journal of Pension Economics*, 5, 45-67.

Dolvin, Steven .D. & William K. Templeton. 2006. "Financial Education and Asset Allocation." *Financial Services Review*, 15, 133-149.

Hilgert, Marianne A. & Jeanne M. Hogarth. 2002. "Financial Knowledge, Experience and Learning Preferences." Preliminary Results from a New Survey on Financial Literacy. *Consumer Interest Annual*, Vol. 48, 2002.

Lusardi, Annamaria & Olivia S. Mitchell. 2007a. "Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth." *Journal of Monetary Economic*s, 54, 205-224.

Lusardi, Annamaria & Olivia S. Mitchell. 2007b. "Financial Literacy and Retirement Preparedness: Evidence and Implications for Retirement Education." *Business Economics*, 42, 35-44.

Mandell, Lewis. 2004. "Financial Literacy: Are We Improving?" Washington, D.C.: Jump$tart Coalition for Personal Financial Literacy.

Mandell, Lewis & Linda Klein. 2007. "Motivation and Financial Literacy." *Financial Services Review*, 16, 105-116.

McCarthy, David D. & John A. Turner. 2000. "Pension Education: Does it Work? Does it Matter? *Pension Benefits*, 9, 6.

Muller, Leslie A. 2003. "Investment Choice in Defined Contribution Plans: The Effects of Retirement Education on Asset Allocation." *Benefits Quarterly*, 19, 76-94.

Volpe, Ronald P., Haiyang Chen, & Sheen Liu. 2006. "An Analysis of the Importance of Personal Finance Topics and the Level of Knowledge Possessed by Working Adults." *Financial Services Review,* 15, 81-99.

Appendix A

Retirement Investing Survey   Four Digit Identifier_____
(Pre-questionnaire)   Date_____

By completing this survey, you agree that the information provided may be used for purposes of an academic study. Completion is voluntary.

1. Please assess yourself (by checking **one** of the following) with regard to taking on risk:
      _____ Aggressive
      _____ Moderately Aggressive
      _____ Moderately Conservative
      _____ Conservative

2. Please check the type (all that apply) of accounts/investments you presently or have previously owned:
      _____ Checking, Savings, or Money Market
      _____ Bonds (individual or as part of mutual fund)
      _____ Stocks (individual or as part of mutual fund)

3. Please check the academic degree that you are currently pursuing:
      _____ Undergraduate
      _____ Graduate

4. Please indicate your gender:
      _____ Male
      _____ Female

5. Please identify your major/concentration:
      _____ Accounting
      _____ Economics
      _____ Business Administration
      _____ Finance
      _____ Management
      _____ Marketing
      _____ Other

6. Please indicate the percentage (%) of each of the following investment types that you would hold in an ideal retirement portfolio (percentages must add to 100%):
    _____ Money market (or savings account)
    _____ Government bonds
    _____ Corporate bonds
    _____ Large capitalization US Stocks
    _____ Small capitalization US Stocks
    _____ International Stocks

Appendix B

Retirement Investing Survey   Four Digit Identifier _____
(Post-questionnaire)   Date_____

By completing this survey, you agree that the information provided may be used for purposes of an academic study. Completion is voluntary.

1. Please assess yourself (by checking **one** of the following) with regard to taking on risk:
        _____ Aggressive
        _____ Moderately Aggressive
        _____ Moderately Conservative
        _____ Conservative

2. Please indicate the percentage (%) of each of the following investment types that you would hold in an ideal retirement portfolio (percentages must add to 100%):
    _____ Money market (or savings account)
    _____ Government bonds
    _____ Corporate bonds
    _____ Large capitalization US Stocks
    _____ Small capitalization US Stocks
    _____ International Stocks