

# Stat 107: Introduction to Business and Financial Statistics

## Homework 6: Due Wednesday, November 9th

### Homework policy

Homework is due by 8am EST of the assigned date. Homework is to be handed in electronically via the Canvas system. Late homework will not be accepted.

You are encouraged to discuss homework problems with other students (and with the instructor and TFs, of course), but you must write your final answer in your own words. Solutions prepared “in committee” or by copying someone else’s paper are not acceptable. **Please review the course’s Academic Honesty and Collaboration policy on the class website to know what is considered appropriate conduct. Everyone must submit their own homework assignment consisting of their individual effort.**

- 1) For this problem, we will perform style analysis on three mutual funds. This is more for educational purposes than a definitive style analysis, since much care should be taken to determine the style factors. This exercise could be easily expanded into a course project for anyone interested.

The scope of the exercise is based on two papers that can be found on the website. As discussed in class (and the above two papers), style analysis uses a set of style factors  $f_1, f_2, \dots, f_6$  (say-it could be any number of factors) to try to explain an assets return ( $r_t$ ).

More specifically, we want to find style weights  $f_1, f_2, \dots, f_6$  that do the following:

$$\begin{aligned} \min \sum_t |r_t - (b_1 f_{1t} + b_2 f_{2t} + b_3 f_{3t} + b_4 f_{4t} + b_5 f_{5t} + b_6 f_{6t})| \\ \text{subject to} \\ b_i \geq 0 \\ \sum b_i = 1 \end{aligned}$$

Note that there are several criterion functions one could use to find the factor weights; one paper defines tracking error differently than we do. I have put an example Excel file for you to work with, but you will **have to update the data**.

The style factors we use will be as follows:

- ☐ JKD : Large Core Index Fund
- ☐ JKG : Mid Cap Core Index Fund
- ☐ JKJ : Small Cap Core Index Fund
- ☐ EFA : International Index Fund
- ☐ AGG : Aggregate Bond Fund
- ☐ SHY: Short Term Bond Fund

- a) Perform style analysis on the Dodge and Cox Balanced Fund (DODBX), the Fidelity New Millenium Fund (FMILX) and the Fidelity Short Term Bond Fund (FSHBX) using three years of monthly returns (starting at 2013-09-01).

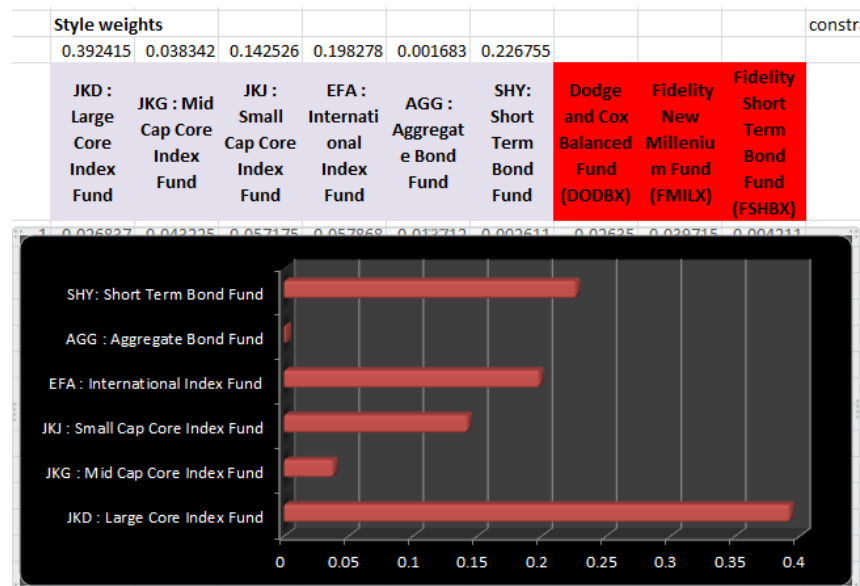
This is easiest done in Excel as shown in the example Excel file on the website, BUT you need to put the data into Excel. You do this by getting all the necessary return data, for example jkdret, jkgret, etc.. then write it all to a csv file as follows:  
`write.csv(cbind(jkdret, jkgret, ...), whateverfilenameyouwant)`

Your deliverable for this part will be the style weights for each, and a discussion for each fund of whether or not the style weights agree with each funds description found at [finance.yaho0.com](http://finance.yahoo0.com).

- b) Perform the same style analysis as above now using data from 2010-09-01 to 2013-09-01 and discuss if the weights have changed greatly or not for each fund.

a)

### Dodge and Cox Balanced Fund (DODBX) 2013-09-01 to 2016-09-01



The Return-Based Style Analysis reveals that, DDBX Fund's benchmark portfolio allocates 39.24% on large cap stocks, 3.83% on mid cap stocks, 14.25% on small cap stocks, 19.83% on international index fund(equity market performance in developed and emerging markets, excluding US), almost none (0.17%) on aggregated bond fund (including government securities, mortgage-backed securities, asset-backed securities and corporate securities), and 22.68% on short term bonds.

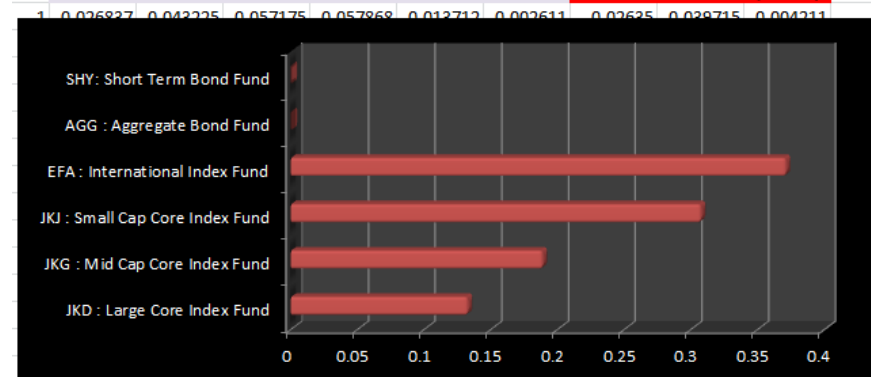
#### Overall Portfolio Composition (%)

Cash	0.68%
Stocks	68.06%
Bonds	30.65%
Others	0.12%
Preferred	0.49%
Convertible	0.00%

The portfolio composition reported on finance.yahoo.com differs with the RBSA results, some degree but not a lot. In terms of stocks, RBSA: 77.15% vs Yahoo: 68.06%; in terms of bonds, RBSA: 22.85% vs Yahoo: 30.65%. RBSA suggests higher stocks and lower bonds.

## Fidelity New Millenium Fund (FMILX)

Style weights										constra
0.132617	0.188726	0.30745	0.371148	0	5.95E-05					
JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : Internati onal Index Fund	AGG : Aggregat e Bond Fund	SHY: Short Term Bond Fund	Dodge and Cox Balanced Fund (DDBX)	Fidelity New Milleniu m Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)		



The Return-Based Style Analysis reveals that, DDBX Fund's benchmark portfolio allocates 13.26% on large cap stocks, 18.87% on mid cap stocks, 30.75% on small cap stocks, 37.11% on international index fund, none on aggregated bond fund, and almost none (<0.01%) on short term bonds.

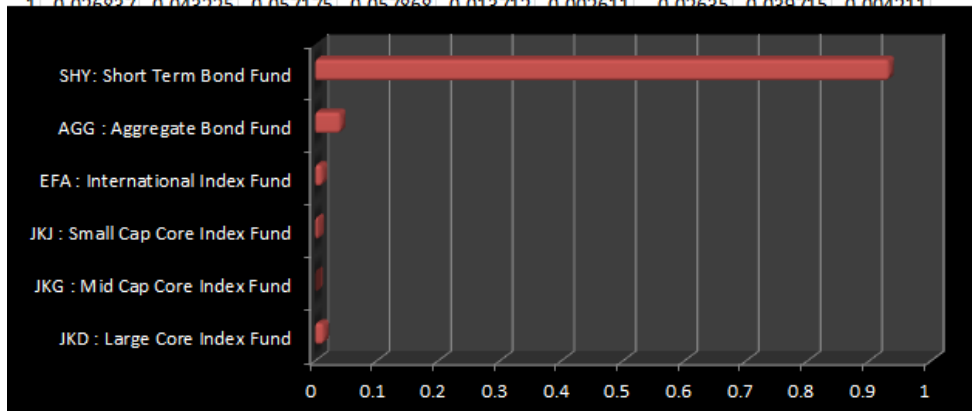
### Overall Portfolio Composition (%)

Cash	2.30%
Stocks	94.86%
Bonds	0.13%
Others	2.71%
Preferred	0.00%
Convertible	0.00%

The portfolio composition reported on finance.yahoo.com mostly agrees with the RBSA results. In terms of stocks, RBSA: 99.99% vs Yahoo: 94.86%; in terms of bonds, RBSA: <0.01% vs Yahoo: 0.13%. RBSA suggests slightly higher stocks and slightly lower bonds.

## Fidelity Short Term Bond Fund (FSHBX)

Style weights									const
0.013321	0	0.004107	0.010654	0.040472	0.931446				
JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : International Index Fund	AGG : Aggregate Bond Fund	SHY : Short Term Bond Fund	Dodge and Cox Balanced Fund (DODBX)	Fidelity New Millenium Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)	
1	0.026827	0.042225	0.057175	0.057868	0.012712	0.002611	0.02625	0.028715	0.004211



The Return-Based Style Analysis reveals that, DDBX Fund's benchmark portfolio allocates 1.33% on large cap stocks, 0% on mid cap stocks, 0.41% on small cap stocks, 1.07% on international index fund, 4.05% on aggregated bond fund, and 93.14% on short term bonds.

### Overall Portfolio Composition (%)

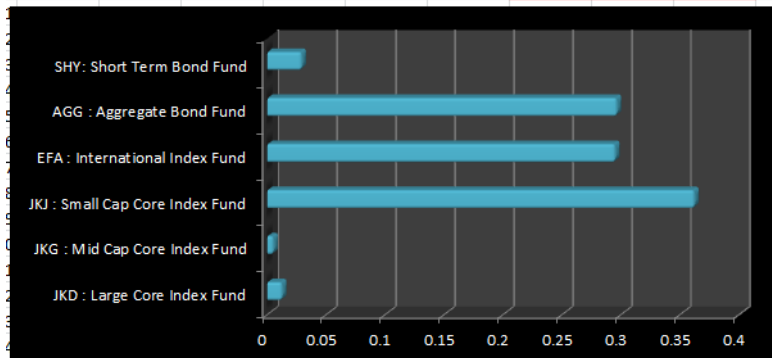
Cash	2.43%
Stocks	0.00%
Bonds	97.57%
Others	0.00%
Preferred	0.00%
Convertible	0.00%

The portfolio composition reported on finance.yahoo.com is almost the same as the RBSA results. In terms of stocks, RBSA: 2.81% vs Yahoo: 0%; in terms of bonds, RBSA: 97.17% vs Yahoo: 97.57%. RBSA suggests slightly higher stocks and slightly lower bonds.

b)

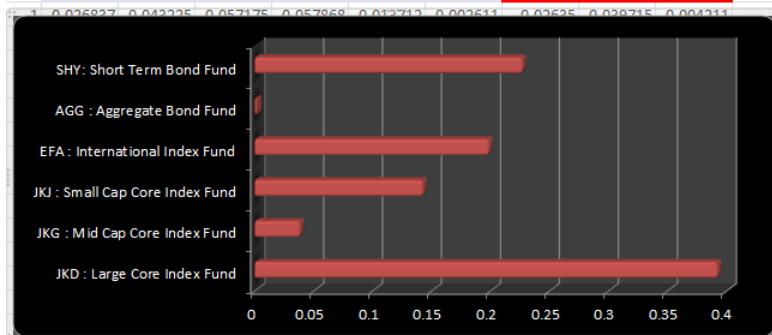
### Dodge and Cox Balanced Fund (DODBX) 2010-09-01 to 2013-09-01

Style weights									cor
0.012527	0.005163	0.36205	0.294903	0.296307	0.029051				
JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : International Index Fund	AGG : Aggregate Bond Fund	SHY : Short Term Bond Fund	Dodge and Cox Balanced Fund (DODBX)	Fidelity New Millenium Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)	



### Dodge and Cox Balanced Fund (DODBX) 2013-09-01 to 2016-09-01

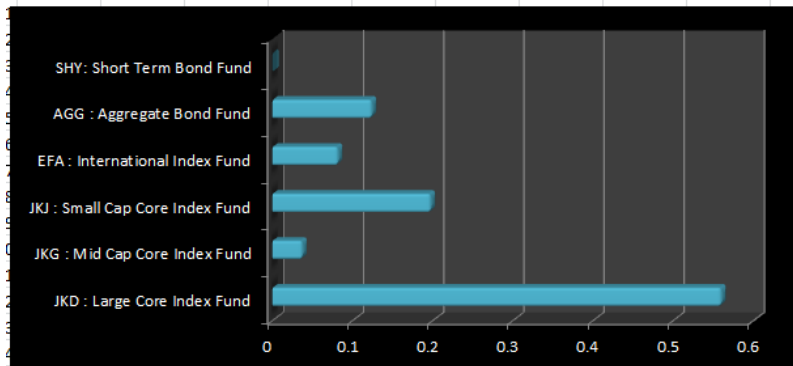
Style weights									constr
0.392415	0.038342	0.142526	0.198278	0.001683	0.226755				
JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : International Index Fund	AGG : Aggregate Bond Fund	SHY : Short Term Bond Fund	Dodge and Cox Balanced Fund (DODBX)	Fidelity New Millenium Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)	



Compare the two periods, we see a large shift from AGG, EFA, and JKL to SHY and JKD, it might suggest a shift to US large cap company investment strategy after 2013, while before more investment on bonds, international equity, and small cap company.

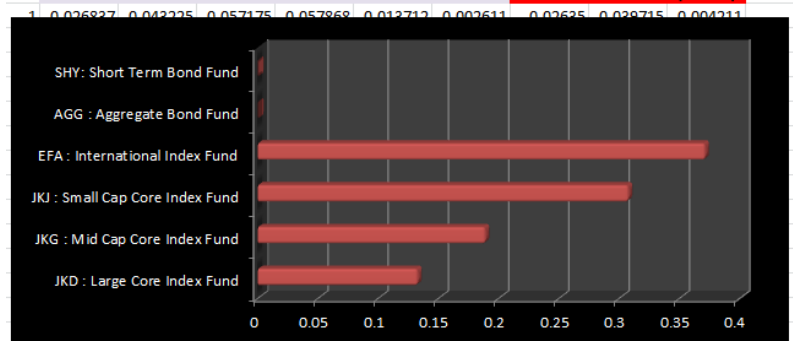
## Fidelity New Millenium Fund (FMILX) 2010-09-01 to 2013-09-01

Style weights										con
0.559859	0.037263	0.197336	0.081668	0.123873	0					
JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : International Index Fund	AGG : Aggregate Bond Fund	SHY: Short Term Bond Fund	Dodge and Cox Balanced Fund (DODBX)	Fidelity New Millenium Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)		



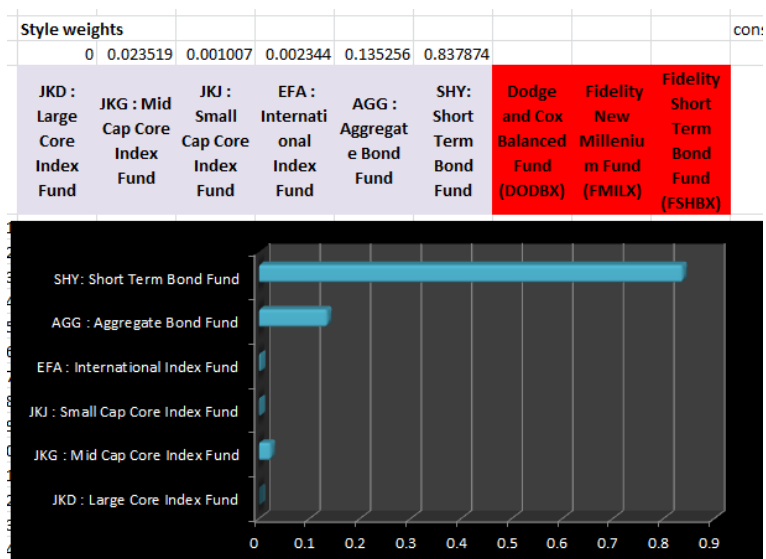
## Fidelity New Millenium Fund (FMILX) 2013-09-01 to 2016-09-01

Style weights										constr
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JKD : Large Core Index Fund	JKG : Mid Cap Core Index Fund	JKJ : Small Cap Core Index Fund	EFA : International Index Fund	AGG : Aggregate Bond Fund	SHY: Short Term Bond Fund	Dodge and Cox Balanced Fund (DODBX)	Fidelity New Millenium Fund (FMILX)	Fidelity Short Term Bond Fund (FSHBX)		

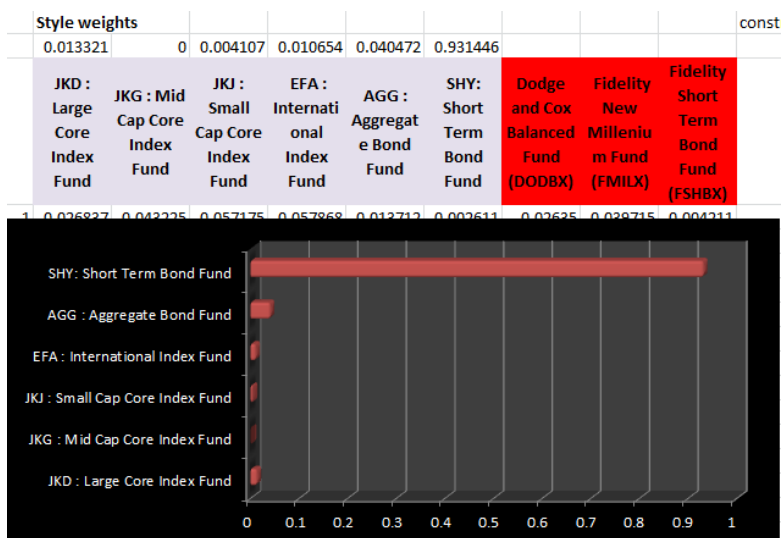


Compare the two periods, we see a large shift from JKD to EFA, JKJ and JKD, it might suggest a shift to emerging market equity, US small and mid cap company investment strategy after 2013, while before more investment on US large cap company.

## Fidelity Short Term Bond Fund (FSHBX) 2010-09-01 to 2013-09-01



## Fidelity Short Term Bond Fund (FSHBX) 2013-09-01 to 2016-09-01



Compare the two periods, we see a quite consistent investment strategy, which is mostly on bonds, almost none on stocks. Exactly what the name of the fund suggests.