What?

Investors care about financial ratios. However, implications and importance of financial ratios may be dependent on several factors. For instance, while a high debt-to-equity ratio may be detrimental during high cost of borrowing times, it may be quite positive during zero-borrowing-cost times. It is our job to figure out which financial ratio is important for investors and in what way.

Method

We will create two portfolios for a random financial ratio (i.e. P/E ratio). $Portfolio_{HIGH}$ will include companies with the highest P/E ratios in the market. $Portfolio_{LOW}$ will include companies with the lowest P/E ratios in the market. Then, we will compare these portfolios for different time periods. We hope to see if there are meaningful differences between these portfolios and if these differences are dependent on the time period.

Portfolios

The Stata code to download the daily prices is as follows:

```
net install http://researchata.com/stata/203/fetchyahooquotes.pkg, force
fetchyahooquotes ^GSPC CSCO NFLX AMZN AAPL JPM F, freq(d)  chg(ln) start(01jan2000)
```

The Stata code to create the portfolios is as follows:

```
gen P_high = (ln_CSCO + ln_NFLX + ln_AMZN) / 3
gen P_low = (ln_AAPL + ln_JPM + ln_F) / 3
```

Let's compare annual risk and return:

```
tabstat P_high, stat(sd sum) by(year) columns(stats)
tabstat P_low, stat(sd sum) by(year) columns(stats)
```

year	sd	sum
2000	.	0
2001	.	0
2002	.0355302	-.2320324
2003	.0230636	1.080773
2004	.0262221	-.3984287
2005	.0157026	.2425676
2006	.0164129	.0814438
2007	.0185533	.2909468
2008	.0320363	-.3276067
2009	.0215196	.653414
2010	.0189175	.4275565
2011	.0225398	-.3568935
2012	.0193016	.2569154
2013	.016865	.6661761
2014	.0143603	-.0263126
2015	.0167827	.5454241
2016	.0151774	.1079781
2017	.0097841	.3850329
2018	.0185134	.2829358
Total	.0205951	3.67989

(a) Portfolio High

year	sd	sum
2000	.0273884	-.453491
2001	.0228073	-.053617
2002	.0263034	-.4280176
2003	.0174598	.4844719
2004	.0125619	.378701
2005	.0127424	.0862365
2006	.0132825	.1330781
2007	.0154605	.2223347
2008	.0405895	-.7365043
2009	.0298341	.8910909
2010	.0166796	.322241
2011	.0194051	-.1464897
2012	.0132519	.2648298
2013	.0106696	.1973031
2014	.0095131	.1571513
2015	.0123772	-.0019144
2016	.0121636	.1036853
2017	.007507	.239245
2018	.0116862	.0144868
Total	.0193625	1.674821

(b) Portfolio Low

This simple comparison shows that P/E ratio is a significant determinant of risk and return. However, the level of risk and return change through years. For instance, the high P/E portfolio has 108% return for 2003. The low P/E portfolio has -42% return for 2003. However, for 2004, while low P/E portfolio has positive return high P/E portfolio has a negative return. This reversal of investor appetite is the reason why we need to evaluate price reaction to financial ratios.

Assumptions

- Portfolios must be constructed using highest P/E and lowest P/E companies (i.e. our example above is way too simplistic).
- There are obvious outliers with respect to each financial ratio.
- Certain industries have distinct characteristics.
- Multiple ratios may interact. For instance, high P/E for a large company may be perceived differently for a high P/E for a small company.

Statistical Example: Entire sample

The Stata code to compare the daily returns for both portfolios is as follows:

```
ttest P_high==P_low
```

We are simply testing whether the average daily return for the high P/E portfolio is statistically differ-

ent than the average daily return for the low P/E portfolio (i.e. $mean(P_{high} - P_{low}) = 0$).

```
Paired t test
```

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
P_high	4,138	.0008893	.0003202	.0205951	.0002616	.001517
P_low	4,138	.0005039	.0002878	.0185153	-.0000604	.0010682
diff	4,138	.0003854	.0002953	.0189966	-.0001936	.0009643

```
    mean(diff) = mean(P_high - P_low)                         t =   1.3049
Ho: mean(diff) = 0                         degrees of freedom =     4137

Ha: mean(diff) < 0           Ha: mean(diff) != 0           Ha: mean(diff) > 0
Pr(T < t) = 0.9040         Pr(|T| > |t|) = 0.1920          Pr(T > t) = 0.0960
```

We find that $mean(P_{high} - P_{low}) > 0$ at 9.60% statistical significance. This implies: $P_{high} > P_{low}$. High P/E portfolio average daily returns are higher than the average daily returns for the low P/E companies.
Please remember our assumptions.

Statistical Example: 2016

We are now repeating the prior average daily return comparison test for the year 2016 only. The Stata code to compare the daily returns for both portfolios for 2016 is as follows:

```
ttest P_high==P_low if year(date)==2016
```

```
Paired t test
```

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
P_high	252	.0004285	.0009561	.0151774	-.0014545	.0023115
P_low	252	.0004114	.0007662	.0121636	-.0010976	.0019205
diff	252	.000017	.000868	.0137795	-.0016925	.0017266

```
    mean(diff) = mean(P_high - P_low)                         t =   0.0196
Ho: mean(diff) = 0                         degrees of freedom =      251

Ha: mean(diff) < 0           Ha: mean(diff) != 0           Ha: mean(diff) > 0
Pr(T < t) = 0.5078         Pr(|T| > |t|) = 0.9844          Pr(T > t) = 0.4922
```

We find that average daily returns for both portfolios are statistically indifferent.
Please remember our assumptions.

Statistical Example: Beta 2017-2018

We will now focus on market risk (Beta) for each of the two portfolios. The Stata code to estimate the market model for the **high** P/E portfolio is as follows:

```
reg P_high ln__GSPC if year(date)>2016
```

Source	SS	df	MS	Number of obs	=	461
				F(1, 459)	=	570.57
Model	.052963277	1	.052963277	Prob > F	=	0.0000
Residual	.04260685	459	.000092825	R-squared	=	0.5542
				Adj R-squared	=	0.5532
Total	.095570127	460	.000207761	Root MSE	=	.00963

P_high	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln__GSPC	1.492023	.0624628	23.89	0.000	1.369274	1.614771
_cons	.0008637	.0004494	1.92	0.055	-.0000195	.0017468

The Stata code to estimate the market model for the **low** P/E portfolio is as follows:

```
reg P_low ln__GSPC if year(date)>2016
```

Source	SS	df	MS	Number of obs	=	461
				F(1, 459)	=	856.27
Model	.027811904	1	.027811904	Prob > F	=	0.0000
Residual	.014908538	459	.00003248	R-squared	=	0.6510
				Adj R-squared	=	0.6503
Total	.042720442	460	.000092871	Root MSE	=	.0057

P_low	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln__GSPC	1.081193	.0369487	29.26	0.000	1.008584	1.153803
_cons	.0001263	.0002658	0.47	0.635	-.0003961	.0006487

Notice that the market risk (Beta) for the high P/E portfolio is 1.49 and it is 1.08 for the low P/E portfolio. This is as expected.
Please remember our assumptions.