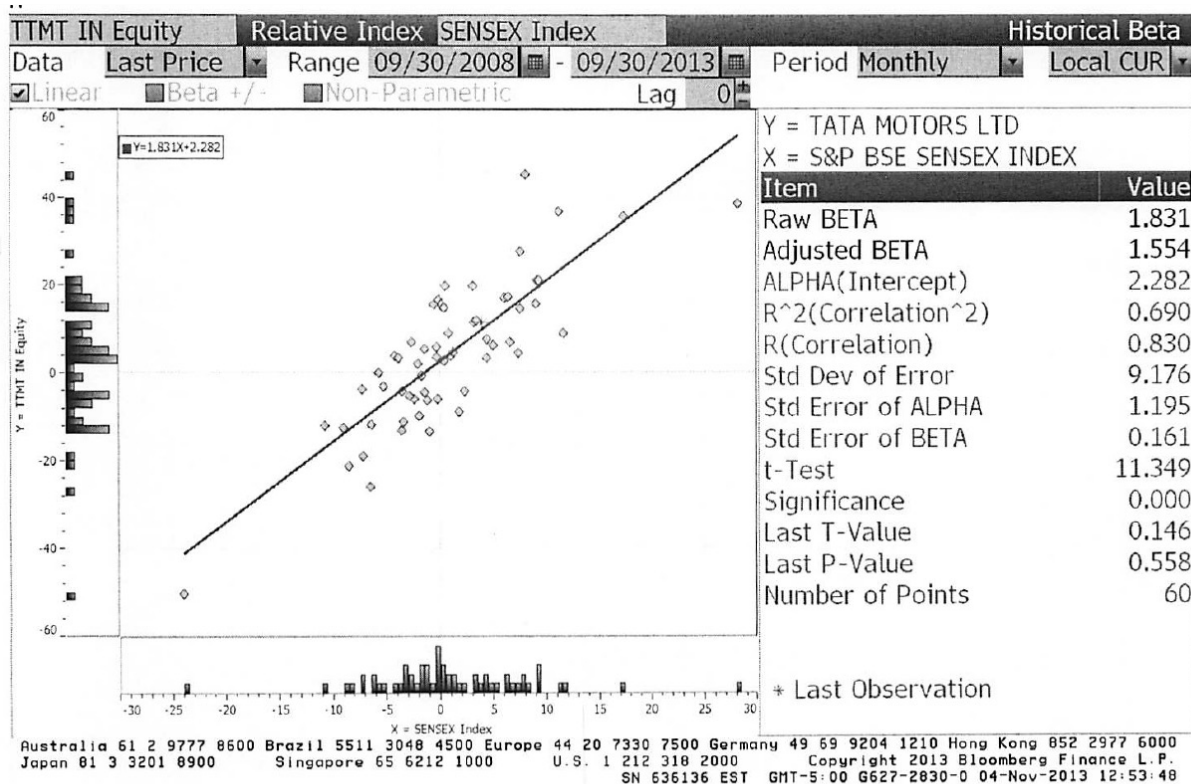


# Regression Diagnostics for Tata Motors



Beta = 1.83  
67% range  
1.67-1.99

69% market risk  
31% firm specific

Jensen's  $\alpha$   
 $= 2.28\% - 4\%/12 (1-1.83) = 2.56\%$   
 Annualized  $= (1-.0256)^{12}-1 = 35.42\%$   
 Average riskfree rate (2008-13) = 4%

Expected Return (in Rupees)  
 $= \text{Riskfree Rate} + \text{Beta} * \text{Risk premium}$   
 $= 6.57\% + 1.83 (7.19\%) = 19.73\%$

# Application Test: Analyzing the Risk Regression

- Using your Bloomberg risk and return print out, answer the following questions:
  - How well or badly did your stock do, relative to the market, during the period of the regression?
  - $\text{Intercept} - (\text{Riskfree Rate}/n) (1 - \text{Beta}) = \text{Jensen's Alpha}$   
where  $n$  is the number of return periods in a year (12 if monthly; 52 if weekly)
  - What proportion of the risk in your stock is attributable to the market? What proportion is firm-specific?
  - What is the historical estimate of beta for your stock? What is the range on this estimate with 67% probability? With 95% probability?
  - Based upon this beta, what is your estimate of the required return on this stock?

Riskless Rate + Beta \* Risk Premium

B Beta Page  
PB Page 23-26

# The problem with regression betas

- They are backward looking: By definition, a regression beta is backward looking because it is computed based upon past returns. Consequently, if a company's business mix or financial leverage has changed during the regression period, the regression beta (even if well estimated) is no longer operational.
- They are subject to manipulation: Changing the market index used, the time period of the regression or even the return intervals (daily, weekly, monthly) can yield very different regression output.
- They are noisy: A regression slope (which is what we use as a beta) comes with a standard error, and if you regress a stock against a broad enough index, the regression beta should have a high standard error (it is a feature, not a bug)>

# Beta: Exploring Fundamentals

Beta > 2	Bulgari: 2.45
Beta between 1 and 2	Qwest Communications: 1.85 Microsoft: 1.25 GE: 1.15
Beta < 1	Exxon Mobil: 0.70 Altria (Philip Morris): 0.60
Beta < 0	Harmony Gold Mining: -0.15

# Determinant 1: Product Type

- Industry Effects: The beta value for a firm depends upon the sensitivity of the demand for its products and services and of its costs to macroeconomic factors that affect the overall market.
  - ▣ Cyclical companies have higher betas than non-cyclical firms
  - ▣ Firms which sell more discretionary products will have higher betas than firms that sell less discretionary products

## Determinant 2: Operating Leverage Effects

- Operating leverage refers to the proportion of the total costs of the firm that are fixed.
- Other things remaining equal, higher operating leverage results in greater earnings variability which in turn results in higher betas.

# Measuring Disney's Operating Leverage: 1987- 2013

Year	Net Sales	% Change in Sales	EBIT	% Change in EBIT	
1987	\$2,877		\$756		
1988	\$3,438	19.50%	\$848	12.17%	
1989	\$4,594	33.62%	\$1,177	38.80%	
1990	\$5,844	27.21%	\$1,368	16.23%	
1991	\$6,182	5.78%	\$1,124	-17.84%	
1992	\$7,504	21.38%	\$1,287	14.50%	
1993	\$8,529	13.66%	\$1,560	21.21%	
1994	\$10,055	17.89%	\$1,804	15.64%	
1995	\$12,112	20.46%	\$2,262	25.39%	
1996	\$18,739	54.71%	\$3,024	33.69%	
1997	\$22,473	19.93%	\$3,945	30.46%	
1998	\$22,976	2.24%	\$3,843	-2.59%	
1999	\$23,435	2.00%	\$3,580	-6.84%	
2000	\$25,418	8.46%	\$2,525	-29.47%	
2001	\$25,172	-0.97%	\$2,832	12.16%	
2002	\$25,329	0.62%	\$2,384	-15.82%	
2003	\$27,061	6.84%	\$2,713	13.80%	
2004	\$30,752	13.64%	\$4,048	49.21%	
2005	\$31,944	3.88%	\$4,107	1.46%	
2006	\$33,747	5.64%	\$5,355	30.39%	
2007	\$35,510	5.22%	\$6,829	27.53%	
2008	\$37,843	6.57%	\$7,404	8.42%	
2009	\$36,149	-4.48%	\$5,697	-23.06%	
2010	\$38,063	5.29%	\$6,726	18.06%	
2011	\$40,893	7.44%	\$7,781	15.69%	
2012	\$42,278	3.39%	\$8,863	13.91%	
2013	\$45,041	6.54%	\$9,450	6.62%	
<b>Average: 87-13</b>		<b>11.79%</b>		<b>11.91%</b>	<b>11.91/11.79 = 1.01</b>
<b>Average: 96-13</b>		<b>8.16%</b>		<b>10.20%</b>	<b>10.20/8.16 = 1.25</b>

Average across entertainment companies = 1.35

Given Disney's operating leverage measures (1.01 or 1.25), would you expect Disney to have a higher or a lower beta than other entertainment companies?

- a. Higher
- b. Lower
- c. No effect

# Determinant 3: Financial Leverage

- As firms borrow, they create fixed costs (interest payments) that make their earnings to equity investors more volatile.
- This increased earnings volatility which increases the equity beta.
- The beta of equity alone can be written as a function of the unlevered beta and the debt-equity ratio
- $\beta_L = \beta_U (1 + ((1-t)D/E))$   
where
  - $\beta_L$  = Levered or Equity Beta      $D/E$  = Market value Debt to equity ratio
  - $\beta_U$  = Unlevered or Asset Beta      $t$  = Marginal tax rate
- Earlier, we estimated the beta for Disney from a regression. Was that beta a levered or unlevered beta?
  - a. Levered
  - b. Unlevered



# Effects of leverage on betas: Disney

- The regression beta for Disney is 1.25. This beta is a levered beta (because it is based on stock prices, which reflect leverage) and the leverage implicit in the beta estimate is the average market debt equity ratio during the period of the regression (2008 to 2013)
- The average debt equity ratio during this period was 19.44%.
- The unlevered beta for Disney can then be estimated (using a marginal tax rate of 36.1%)  
= Current Beta / (1 + (1 - tax rate) (Average Debt/Equity))  
= 1.25 / (1 + (1 - 0.361)(0.1944))= 1.1119

# Disney : Beta and Financial Leverage

<i>Debt to Capital</i>	<i>Debt/Equity Ratio</i>	<i>Beta</i>	<i>Effect of Leverage</i>
0.00%	0.00%	1.11	0.00
10.00%	11.11%	1.1908	0.08
20.00%	25.00%	1.29	0.18
30.00%	42.86%	1.42	0.30
40.00%	66.67%	1.59	0.47
50.00%	100.00%	1.82	0.71
60.00%	150.00%	2.18	1.07
70.00%	233.33%	2.77	1.66
80.00%	400.00%	3.95	2.84
90.00%	900.00%	7.51	6.39

# Betas are weighted Averages

- The beta of a portfolio is always the market-value weighted average of the betas of the individual investments in that portfolio.
- Thus,
  - the beta of a mutual fund is the weighted average of the betas of the stocks and other investment in that portfolio
  - the beta of a firm after a merger is the market-value weighted average of the betas of the companies involved in the merger.

# Bottom-up versus Top-down Beta

- The top-down beta for a firm comes from a regression
- The bottom up beta can be estimated by doing the following:
  - ▣ Find out the businesses that a firm operates in
  - ▣ Find the unlevered betas of other firms in these businesses
  - ▣ Take a weighted (by sales or operating income) average of these unlevered betas
  - ▣ Lever up using the firm's debt/equity ratio
- The bottom up beta is a better estimate than the top down beta for the following reasons
  - ▣ The standard error of the beta estimate will be much lower
  - ▣ The betas can reflect the current (and even expected future) mix of businesses that the firm is in rather than the historical mix

# Disney's businesses: The financial breakdown (from 2013 annual report)

<i>Business</i>	<i>Revenues</i>	<i>Operating Income</i>	<i>D&amp;A</i>	<i>EBITDA</i>	<i>S, G &amp; A Costs</i>	<i>Cap Ex</i>	<i>Identifiable Assets</i>
Media Networks	\$20,356	\$6,818	\$251	\$7,069	\$2,768	\$263	\$28,627
Parks & Resorts	\$14,087	\$2,220	\$1,370	\$3,590	\$1,960	\$2,110	\$22,056
Studio Entertainment	\$5,979	\$661	\$161	\$822	\$2,145	\$78	\$14,750
Consumer Products	\$3,555	\$1,112	\$146	\$1,258	\$731	\$45	\$7,506
Interactive	\$1,064	-\$87	\$44	-\$43	\$449	\$13	\$2,311

# Unlevered Betas for businesses

$$\frac{\text{Unlevered Beta}}{(1 - \text{Cash/ Firm Value})}$$

<i>Business</i>	<i>Comparable firms</i>	<i>Sample size</i>	<i>Median Beta</i>	<i>Median D/E</i>	<i>Median Tax rate</i>	<i>Company Unlevered Beta</i>	<i>Median Cash/ Firm Value</i>	<i>Business Unlevered Beta</i>
Media Networks	US firms in broadcasting business	26	1.43	71.09%	40.00%	1.0024	2.80%	1.0313
Parks & Resorts	Global firms in amusement park business	20	0.87	46.76%	35.67%	0.6677	4.95%	0.7024
Studio Entertainment	US movie firms	10	1.24	27.06%	40.00%	1.0668	2.96%	1.0993
Consumer Products	Global firms in toys/games production & retail	44	0.74	29.53%	25.00%	0.6034	10.64%	0.6752
Interactive	Global computer gaming firms	33	1.03	3.26%	34.55%	1.0085	17.25%	1.2187

# A closer look at the process...

## Studio Entertainment Betas

Company Name	Levered Beta	Market Cap	Total Debt	Firm Value	Cash	Cash/Firm Value	Enterprise Value	Marginal tax rate	Gross D/E ratio	Unlevered Beta	Pure play beta	EV/Sales
SFX Entertainment	1.12	738.80	\$98.89	\$837.69	\$143.60	17.14%	\$694.09	40.00%	13.39%	1.04	1.25	11.20
Mass Hysteria Entertainment	1.19	0.24	\$1.13	\$1.37	\$0.00	0.00%	\$1.37	40.00%	477.94%	0.31	0.31	12.45
Medient Studios	0.93	3.21	\$3.18	\$6.39	\$0.05	0.81%	\$6.34	40.00%	99.07%	0.58	0.59	1.21
POW! Entertainment	0.94	3.97	\$0.34	\$4.31	\$0.43	9.85%	\$3.89	40.00%	8.65%	0.89	0.99	1.92
MGM Holdings	1.29	3631.70	\$142.16	\$3,773.86	\$140.70	3.73%	\$3,633.16	40.00%	3.91%	1.26	1.31	1.92
Lions Gate Entertainment	1.20	4719.60	\$1,283.20	\$6,002.80	\$67.20	1.12%	\$5,935.60	40.00%	27.19%	1.03	1.04	2.28
DreamWorks Animation	1.32	2730.00	\$348.30	\$3,078.30	\$156.40	5.08%	\$2,921.90	40.00%	12.76%	1.23	1.29	3.81
Twenty-First Century Fox	1.28	77743.50	\$20,943.00	\$98,686.50	\$6,681.00	6.77%	\$92,005.50	40.00%	26.94%	1.10	1.18	3.20
Independent Film Development	1.61	1.32	\$0.96	\$2.28	\$0.05	2.20%	\$2.23	40.00%	72.35%	1.12	1.15	3.37
Odyssey Pictures Corp	2.60	0.30	\$1.64	\$1.94	\$0.00	0.10%	\$1.94	40.00%	551.12%	0.60	0.60	2.90
<b>Average</b>	<b>1.35</b>					<b>4.68%</b>		<b>40.00%</b>	<b>129.33%</b>	<b>0.92</b>	<b>0.97</b>	<b>4.43</b>
<b>Aggregate</b>	<b>1.35</b>	<b>\$89,572.64</b>	<b>\$22,822.82</b>	<b>\$112,395.45</b>	<b>\$7,189.43</b>	<b>6.40%</b>	<b>\$105,206.02</b>	<b>40.00%</b>	<b>25.48%</b>	<b>1.17</b>	<b>1.25</b>	<b>3.09</b>
<b>Median</b>	<b>1.24</b>					<b>2.96%</b>		<b>40.00%</b>	<b>27.06%</b>	<b>1.03</b>	<b>1.10</b>	<b>3.05</b>

# Backing into a pure play beta: Studio Entertainment

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## The Median Movie Company

Movie Business	97.04	Beta (movies) = 1.0093	Debt	21.30	Beta (debt) = 0
Cash Business	2.96	Beta (cash) = 0.0000	Equity	78.70	Beta (equity) = 1.24
Movie Company	100.0	Beta (company) = 1.0668			

1. Start with the median regression beta (equity beta) of 1.24
2. Unlever the beta, using the median gross D/E ratio of 27.06%  
 Gross D/E ratio =  $21.30/78.70 = 27.06\%$   
 Unlevered beta =  $1.24 / (1 + (1-.4) (.2706)) = 1.0668$
3. Take out the cash effect, using the median cash/value of 2.96%  
 $(.0296) (0) + (1-.0296) (\text{Beta of movie business}) = 1.0668$   
 Beta of movie business =  $1.0668 / (1-.0296) = 1.0993$

**Alternatively, you could have used the net debt to equity ratio**

$$\text{Net D/E ratio} = (21.30 - 2.96) / 78.70 = 23.30\%$$

$$\text{Aswath Damodaran} \quad \text{Unlevered beta for movies} = 1.24 / (1 + (1-.4)(.233)) = 1.0879$$



# Disney's unlevered beta: Operations & Entire Company

<i>Business</i>	<i>Revenues</i>	<i>EV/Sales</i>	<i>Value of Business</i>	<i>Proportion of Disney</i>	<i>Unlevered beta</i>	<i>Value</i>	<i>Proportion</i>
Media Networks	\$20,356	3.27	\$66,580	49.27%	1.03	\$66,579.81	49.27%
Parks & Resorts	\$14,087	3.24	\$45,683	33.81%	0.70	\$45,682.80	33.81%
Studio Entertainment	\$5,979	3.05	\$18,234	13.49%	1.10	\$18,234.27	13.49%
Consumer Products	\$3,555	0.83	\$2,952	2.18%	0.68	\$2,951.50	2.18%
Interactive	\$1,064	1.58	\$1,684	1.25%	1.22	\$1,683.72	1.25%
Disney Operations	\$45,041		\$135,132	100.00%	0.9239	\$135,132.11	

Disney has \$3.93 billion in cash, invested in close to riskless assets (with a beta of zero). You can compute an unlevered beta for Disney as a company (inclusive of cash):

$$\beta_{\text{Disney}} = \beta_{\text{Operating Assets}} \frac{\text{Value}_{\text{Operating Assets}}}{(\text{Value}_{\text{Operating Assets}} + \text{Value}_{\text{Cash}})} + \beta_{\text{Cash}} \frac{\text{Value}_{\text{Cash}}}{(\text{Value}_{\text{Operating Assets}} + \text{Value}_{\text{Cash}})}$$

$$= 0.9239 \left( \frac{135,132}{(135,132 + 3,931)} \right) + 0.00 \left( \frac{3,931}{(135,132 + 3,931)} \right) = 0.8978$$

# The levered beta: Disney and its divisions

- To estimate the debt ratios for division, we allocate Disney's total debt (\$15,961 million) to its divisions based on identifiable assets.

<i>Business</i>	<i>Identifiable assets (2013)</i>	<i>Proportion of debt</i>	<i>Value of business</i>	<i>Allocated debt</i>	<i>Estimated equity</i>	<i>D/E ratio</i>
Media Networks	\$28,627	38.04%	\$66,580	\$6,072	\$60,508	10.03%
Parks & Resorts	\$22,056	29.31%	\$45,683	\$4,678	\$41,005	11.41%
Studio Entertainment	\$14,750	19.60%	\$18,234	\$3,129	\$15,106	20.71%
Consumer Products	\$7,506	9.97%	\$2,952	\$1,592	\$1,359	117.11%
Interactive	\$2,311	3.07%	\$1,684	\$490	\$1,194	41.07%
Disney	\$75,250	100.00%		\$15,961	\$121,878	13.10%

- We use the allocated debt to compute D/E ratios and levered betas.

<i>Business</i>	<i>Unlevered beta</i>	<i>Value of business</i>	<i>D/E ratio</i>	<i>Levered beta</i>	<i>Cost of Equity</i>
Media Networks	1.0313	\$66,580	10.03%	1.0975	9.07%
Parks & Resorts	0.7024	\$45,683	11.41%	0.7537	7.09%
Studio Entertainment	1.0993	\$18,234	20.71%	1.2448	9.92%
Consumer Products	0.6752	\$2,952	117.11%	1.1805	9.55%
Interactive	1.2187	\$1,684	41.07%	1.5385	11.61%
Disney Operations	0.9239	\$135,132	13.10%	1.0012	8.52%

# Discussion Issue

- Assume now that you are the CFO of Disney. The head of the movie business has come to you with a new big budget movie that he would like you to fund. He claims that his analysis of the movie indicates that it will generate a return on equity of 9.5%. Would you fund it?
  - a. Yes. It is higher than the cost of equity for Disney as a company
  - b. No. It is lower than the cost of equity for the movie business.
- What are the broader implications of your choice?

# Estimating Bottom Up Betas & Costs of Equity: Vale

<i>Business</i>	<i>Sample</i>	<i>Sample size</i>	<i>Unlevered beta of business</i>	<i>Revenues</i>	<i>Peer Group EV/Sales</i>	<i>Value of Business</i>	<i>Proportion of Vale</i>
Metals & Mining	Global firms in metals & mining, Market cap>\$1 billion	48	0.86	\$9,013	1.97	\$17,739	16.65%
Iron Ore	Global firms in iron ore	78	0.83	\$32,717	2.48	\$81,188	76.20%
Fertilizers	Global specialty chemical firms	693	0.99	\$3,777	1.52	\$5,741	5.39%
Logistics	Global transportation firms	223	0.75	\$1,644	1.14	\$1,874	1.76%
<i>Vale Operations</i>			<i>0.8440</i>	<i>\$47,151</i>		<i>\$106,543</i>	<i>100.00%</i>

Business	Unlevered beta	D/E ratio	Levered beta	Risk free rate	ERP	Cost of Equity
Metals & Mining	0.86	54.99%	1.1657	2.75%	7.38%	11.35%
Iron Ore	0.83	54.99%	1.1358	2.75%	7.38%	11.13%
Fertilizers	0.99	54.99%	1.3493	2.75%	7.38%	12.70%
Logistics	0.75	54.99%	1.0222	2.75%	7.38%	10.29%
Vale Operations	0.84	54.99%	1.1503	2.75%	7.38%	11.23%

# Vale: Cost of Equity Calculation – in nominal \$R

- To convert a discount rate in one currency to another, all you need are expected inflation rates in the two currencies.

$$(1 + \$ \text{ Cost of Equity}) \frac{(1 + \text{Inflation Rate}_{\text{Brazil}})}{(1 + \text{Inflation Rate}_{\text{US}})} - 1$$

- From US \$ to R\$: If we use 2% as the inflation rate in US dollars and 9% as the inflation ratio in Brazil, we can convert Vale's US dollar cost of equity of 11.23% to a \$R cost of equity:

$$\begin{aligned} \text{Cost of Equity}_{\text{Nominal R\$}} &= (1 + \text{Cost of Equity}_{\text{US \$}}) \frac{(1 + \text{Expected Inflation}_{\text{R\$}})}{(1 + \text{Expected Inflation}_{\text{US \$}})} - 1 \\ &= (1.1123) \frac{(1.09)}{(1.02)} - 1 = 18.87\% \end{aligned}$$

- Alternatively, you can compute a cost of equity, starting with the \$R riskfree rate of 10.18%.

$$\text{Cost of Equity in \$R} = 10.18\% + 1.15 (7.38\%) = 18.67\%$$

# Bottom up betas & Costs of Equity: Tata Motors & Baidu

- Tata Motors: We estimated an unlevered beta of 0.8601 across 76 publicly traded automotive companies (globally) and estimated a levered beta based on Tata Motor's D/E ratio of 41.41% and a marginal tax rate of 32.45% for India:

Levered Beta for Tata Motors =  $0.8601 (1 + (1 - .3245) (.4141)) = 1.1007$

Cost of equity (Rs) =  $6.57\% + 1.1007 (7.19\%) = 14.49\%$

- Baidu: To estimate its beta, we looked at 42 global companies that derive all or most of their revenues from online advertising and estimated an unlevered beta of 1.30 for the business. Incorporating Baidu's current market debt to equity ratio of 5.23% and the marginal tax rate for China of 25%, we estimate Baidu's current levered beta to be 1.3560.

Levered Beta for Baidu =  $1.30 (1 + (1 - .25) (.0523)) = 1.356$

Cost of Equity for Baidu (Renmimbi) =  $3.50\% + 1.356 (6.94\%) = 12.91\%$

# Bottom up Betas and Costs of Equity: Deutsche Bank

- We break Deutsche Bank down into two businesses – commercial and investment banking.

<i>Business</i>	<i>Sample used</i>	<i>Sample size</i>	<i>Median Levered Beta</i>	<i>Deutsche Net Revenues in 2012</i>	<i>Proportion</i>
Banking	European diversified banks	84	1.0665	19,019 mil €	54.86%
Investment Banking	Global investment banks	58	1.2550	15,648 mil €	45.14%
Deutsche Bank			1.1516	34,667 mil €	

- We do not unlever or relever betas, because estimating debt and equity for banks is an exercise in futility.

<i>Business</i>	<i>Beta</i>	<i>Cost of Equity</i>
Commercial banking	1.0665	$1.75\% + 1.0665(6.12\%) = 8.28\%$
Investment Banking	1.2550	$1.75\% + 1.2550(6.12\%) = 9.44\%$
Deutsche Bank	1.1516	$1.75\% + 1.1516(6.12\%) = 8.80\%$