STARE INTO THE ABYSS: FACING UP TO UNCERTAINTY!

Not looking at uncertainty won’t make it go away.
The Origins of Financial Analysis

- In both corporate finance and valuation, much of what we do is built around point estimates, made with the data that we have at the time of estimation.

- The reality is that what we are estimating are distributions, with an expected value (that should be the point estimate) but also a substantial possibility of error.

- Our defense for using point estimates was that we lacked the data to estimate probability distributions and/or that doing valuations with distributions would require machine power that we did not have access to (at a reasonable price).
In a simulation, you estimate probability distributions for each variable that goes into an analysis.

In each simulation, you draw an outcome from each of the distributions and estimate the end result with those outcomes. Since these outcomes can come from the low end or high end of the distributions, they will be different.

You run as many simulations as you can and come up with a distribution of the outcomes, which you then use for decision making.
Classifying uncertainties

1. Discrete or Continuous? Risks that either occur or do not are discrete risks; you are not exposed to them much of the time, but when they do happen, they can be catastrophic. Risks that you are exposed to all of the time, albeit often in small does, are continuous risks.

2. Symmetric or Asymmetric? If positive and negative outcomes are roughly equivalent in magnitude and probability, you have symmetric risks. If large positive (negative) outcomes are more likely, you have positively (negatively) skewed risks.

3. Extreme value likelihood, low or high? If outcomes that are very different from your expected value happen very infrequently, you have thin tailed distributions. If they occur often, you have fat tailed distributions.
Simulation in Valuation

Value Simulation: The Steps

1. Do a base case valuation, with expected values for inputs
2. Identify the key value drivers
3. Collect data on value drivers
4. Choose probability distributions & parameters for value drivers
5. Build in constraints and connections
6. Run Simulations
7. Value Percentiles
8. Value distribution
9. Investor fears & disagreements
10. Cross Sectional Data

Value Sensitivity "What ifs"
**Step 1: Base Case Valuation**

### Apple: Base Case Valuation (May 2016)

#### Most recent twelve months

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$227,535</td>
</tr>
<tr>
<td>Operating income</td>
<td>$66,864</td>
</tr>
<tr>
<td>Pre-tax Operating margin</td>
<td>-5.22%</td>
</tr>
<tr>
<td>Pre-tax operating margin decreases to 25% over time.</td>
<td></td>
</tr>
</tbody>
</table>

#### Revenue growth rate

<table>
<thead>
<tr>
<th>Year</th>
<th>1.50%</th>
<th>1.50%</th>
<th>1.50%</th>
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<th>1.50%</th>
<th>1.50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues (TY)</td>
<td>$230,948</td>
<td>$234,412</td>
<td>$237,928</td>
<td>$241,497</td>
<td>$245,120</td>
<td>$248,797</td>
<td>$252,529</td>
<td>$256,316</td>
</tr>
<tr>
<td>EBIT (Operating income)</td>
<td>$74,953</td>
<td>$74,136</td>
<td>$73,377</td>
<td>$72,614</td>
<td>$71,861</td>
<td>$71,123</td>
<td>$70,391</td>
<td>$69,673</td>
</tr>
<tr>
<td>Tax rate</td>
<td>26.49%</td>
<td>26.49%</td>
<td>26.49%</td>
<td>26.49%</td>
<td>28.19%</td>
<td>29.00%</td>
<td>30.60%</td>
<td>32.10%</td>
</tr>
<tr>
<td>EBIT (1-t)</td>
<td>$55,095</td>
<td>$54,495</td>
<td>$53,863</td>
<td>$53,201</td>
<td>$52,507</td>
<td>$51,862</td>
<td>$51,241</td>
<td>$50,636</td>
</tr>
<tr>
<td>Reinvestment</td>
<td>$2,133</td>
<td>$2,160</td>
<td>$2,186</td>
<td>$2,213</td>
<td>$2,240</td>
<td>$2,267</td>
<td>$2,294</td>
<td>$2,323</td>
</tr>
<tr>
<td>FCFF</td>
<td>$52,962</td>
<td>$52,330</td>
<td>$51,666</td>
<td>$50,971</td>
<td>$50,243</td>
<td>$49,571</td>
<td>$48,934</td>
<td>$48,325</td>
</tr>
</tbody>
</table>

#### Value of operating assets

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of operating assets</td>
<td>$552,748</td>
</tr>
<tr>
<td>Debt</td>
<td>$64,735</td>
</tr>
<tr>
<td>Cash</td>
<td>$204,928</td>
</tr>
<tr>
<td>Equity value</td>
<td>$692,941</td>
</tr>
<tr>
<td>Value of options</td>
<td>$8</td>
</tr>
<tr>
<td>Equity value in common stock</td>
<td>$692,852</td>
</tr>
<tr>
<td>Number of shares</td>
<td>5,478.45</td>
</tr>
<tr>
<td>Estimated value /share</td>
<td>$126.47</td>
</tr>
</tbody>
</table>

#### Revenue growth of 1.5% a year in perpetuity.

#### Pre-tax operating margin decreases to 25% over time.

#### Sales to capital ratio of 1.60

#### Terminal Value

\[
\text{Terminal Value} = \frac{38,110}{(0.08 - 0.015)} = $586,304
\]

#### Stable Growth

- **g = 1.5%:** Cost of capital = 8%
- **ROE = 12%:** Reinvestment Rate - 1.5%/12% = 16.67%

**In May 2016, Apple was trading at $93 a share.**

**My Apple Narrative:** A mature company that derives the bulk of its value from a franchise (iPhone) in a market where growth is slowing and competition is increasing.
Step 2: Identify value drivers
Step 3: Collect data
The iPhone Decade
Revenue Growth at Aging Tech Firms

- **26.2% of firms had negative growth rates**

**Revenue Growth Rate (CAGR over 10 years) - Tech firms older than 25 years**

- **Average**: 4.81%
- **25th percentile**: -0.56%
- **Median**: 4.63%
- **75th percentile**: 9.56%
Step 4: Probability Distributions - Choices
For Apple’s revenue growth & margin

Correlation between revenue growth & margin = 0.50
Step 5: Constraints, Correlations and Connections

- You can build in constraints that will affect the company's operations, and its value, that are either internally or externally imposed.
  - Internal constraints can include refusal to issue new stock, borrow money or pay dividends.
  - External constraints can include failure to make debt payments or meet regulatory capital requirements.

- You can also build in correlations between the variables that you are attaching probability distributions to.
Step 6: Run the Simulation

- **Crystal Ball:** [http://www.oracle.com/us/products/applications/crystalball/crystal-ball-product/overview/index.html](http://www.oracle.com/us/products/applications/crystalball/crystal-ball-product/overview/index.html)
The Value Distribution
Conclusion

- Not looking at what you are uncertain about does not make it go away.
- Ironically, taking a closer look at what you fear (being wrong) can make you less fearful.
- Look into the (uncertainty) abyss. It might not be as dark and dangerous as you think it is.