Valuing Equity Options issued by firms... The Dilution Problem

Option pricing models can be used to value employee options with four caveats –

- Employee options are long term, making the assumptions about constant variance and constant dividend yields much shakier,
- Employee options result in stock dilution, and
- Employee options are often exercised before expiration, making it dangerous to use European option pricing models.
- Employee options cannot be exercised until the employee is vested.

These problems can be partially alleviated by using an option pricing model, allowing for shifts in variance and early exercise, and factoring in the dilution effect. The resulting value can be adjusted for the probability that the employee will not be vested.

Aswath Damodaran
Valuing Employee Options

To value employee options, you need the following inputs into the option valuation model:

- Stock Price = $10, Adjusted for dilution = $9.58
- Strike Price = $10
- Maturity = 10 years (Can reduce to reflect early exercise)
- Standard deviation in stock price = 40%
- Riskless Rate = 4%

Using a dilution-adjusted Black Scholes model, we arrive at the following inputs:

- \( N(d_1) = 0.8199 \)
- \( N(d_2) = 0.3624 \)
- Value per call = $9.58 (0.8199) - $10 e^{-0.04(10)(0.3624)} = $5.42
Using the value per call of $5.42, we can now estimate the value of equity per share after the option grant:

Value of firm = 100 / (.08-.03) = 2000
Debt = 1000
Equity = 1000
Value of options granted = $ 54.2
Value of Equity in stock = $945.8
\[ \text{Value per share} = \frac{\text{Value of Equity}}{\text{Number of shares outstanding}} \]
\[ = \frac{\$945.8}{100} = \$ 9.46 \]

Note that this approach yields a higher value than the diluted share count approach (which ignores exercise proceeds) and a lower value than the treasury stock approach (which ignores the time premium on the options).
To tax adjust or not to tax adjust...

- In the example above, we have assumed that the options do not provide any tax advantages. To the extent that the exercise of the options creates tax advantages, the actual cost of the options will be lower by the tax savings.

- One simple adjustment is to multiply the value of the options by \((1 - \text{tax rate})\) to get an after-tax option cost.
Option grants in the future...

- Assume now that this firm intends to continue granting options each year to its top management as part of compensation. These expected option grants will also affect value.

- The simplest mechanism for bringing in future option grants into the analysis is to do the following:
  - Estimate the value of options granted each year over the last few years as a percent of revenues.
  - Forecast out the value of option grants as a percent of revenues into future years, allowing for the fact that as revenues get larger, option grants as a percent of revenues will become smaller.
  - Consider this line item as part of operating expenses each year. This will reduce the operating margin and cashflow each year.

Aswath Damodaran
When options affect equity value per share the most...

- Option grants affect value more
  - The lower the strike price is set relative to the stock price
  - The longer the term to maturity of the option
  - The more volatile the stock price

- The effect on value will be magnified if companies are allowed to revisit option grants and reset the exercise price if the stock price moves down.
NARRATIVE AND NUMBERS: VALUATION AS A BRIDGE

Tell me a story..
Valuation as a bridge

**Number Crunchers**

- **Favored Tools**
  - Accounting statements
  - Excel spreadsheets
  - Statistical Measures
  - Pricing Data

- **Illusions/Delusions**
  1. Precision: Data is precise
  2. Objectivity: Data has no bias
  3. Control: Data can control reality

**Story Tellers**

- **Favored Tools**
  - Anecdotes
  - Experience (own or others)
  - Behavioral evidence

- **Illusions/Delusions**
  1. Creativity cannot be quantified
  2. If the story is good, the investment will be.
  3. Experience is the best teacher

A Good Valuation

The Numbers People

The Narrative People
Step 1: Survey the landscape

- Every valuation starts with a narrative, a story that you see unfolding for your company in the future.
- In developing this narrative, you will be making assessments of
  - Your company (its products, its management and its history.
  - The market or markets that you see it growing in.
  - The competition it faces and will face.
  - The macro environment in which it operates.
Higher income for drivers, relative to traditional taxis.

The drivers
Anyone with a car in one of Uber's covered cities can apply to be a Uber driver. If you pass the Uber screens, you are given a Uber iPhone and are in the system.

Uber App

The customers
Uber subscribers download its app to their phones and when they need a ride, use the app. They can track the car as it approaches them on their devices.

Convenience, comfort and/or cost savings, relative to traditional cab

Pricing & payment
Uber set the prices for rides, with premium prices for rides during peak demand times. Customers pay Uber for the rides, using their credit cards and don't pay Uber drivers.

Safety & Secure transactions

Splitting the proceeds
Uber splits the ride receipts with the driver, keeping a percentage of the receipts for itself (revenues to Uber). While this percentage has historically been 20%, Uber had reduced it in some cities, when faced with competition from Lyft and Hailo.

Stronger competition from Lyft, Hailo & others will reduce Uber's split

From revenues to profits
From these revenues, Uber covers its expenses. These include R&D, technology development, customer acquisition costs (including rebates to new customers), marketing and the employees/infrastructure it needs in each of the cities that it operates in.

Regulatory & legal issues with offering service will increase costs.

Reinvest to grow
While Uber does not own the cars that its drivers operate, it still has to invest in technology (R&D) and acquisitions to grow. That reinvestment is likely to be modest initially, but will scale up as the company grows.

Local companies may need to be acquired to gain foothold in some markets

Fare quotes, based on distance, car type & demand period

Even with Uber's 20% cut, drivers make more than they do from status quo.

Uber has a low-cost model that should allow it to keep a large percent of its revenues as profits.

Should be kept low because Uber does not invest in cars or other expensive infrastructure.
Step 2: Create a narrative for the future

- Every valuation starts with a narrative, a story that you see unfolding for your company in the future.
- In developing this narrative, you will be making assessments of your company (its products, its management), the market or markets that you see it growing in, the competition it faces and will face and the macro environment in which it operates.
  - Rule 1: Keep it simple.
  - Rule 2: Keep it focused.
  - Rule 3: Stay grounded in reality.
In June 2014, my initial narrative for Uber was that it would be

1. **An urban car service business**: I saw Uber primarily as a force in urban areas and only in the car service business.

2. **Which would expand the business moderately** (about 40% over ten years) by bringing in new users.

3. **With local networking benefits**: If Uber becomes large enough in any city, it will quickly become larger, but that will be of little help when it enters a new city.

4. **Maintain its revenue sharing (20%) system due to strong competitive advantages** (from being a first mover).

5. **And its existing low-capital business model**, with drivers as contractors and very little investment in infrastructure.
Step 3: Check the narrative against history, economic first principles & common sense

- **"IT" IS POSSIBLE**: This could happen, but you are not sure what "this" is, when it will happen and what it will look like when it does.

  - **Gauge market potential & test products**

- **"IT" IS PLAUSIBLE**: This is something that you can make a reasoned argument could happen, though you have no tangible evidence for it happening (yet).

  - **Product success & Financial results**

- **IT IS PROBABLE**: This is something that you expect to happen, with some basis or evidence for that expectation. There can be substantial uncertainty in your expectations.

  - **Show in base year numbers and expected cash flows, adjusting for risk in your expected return.**

  - **Show as expected growth, adjusting for risk in your expected return.**

  - **Value as an option, with the value increasing with the size of the possible market and the exclusivity of your firm’s access to that market.**

Aswath Damodaran
The Impossible, The Implausible and the Improbable

**The Impossible**
- Bigger than the economy
  - Assuming growth rate for company in perpetuity > growth rate for economy
- Bigger than the total market
  - Allowing a company's revenues to grow so much that it has more than a 100% market share of whatever business it is in.
- Profit margin > 100%
  - Assuming earnings growth will exceed revenue growth for a long enough period, and pushing margins above 100%
- Depreciation without cap ex
  - Assuming that depreciation will exceed cap ex in perpetuity.

**The Improbable**
- Growth without reinvestment
  - Assuming growth forever without reinvestment.
- Profits without competition
  - Assuming that your company will grow and earn higher profits, with no competition.
- Returns without risk
  - Assuming that you can generate high returns in a business with no risk.

**Value Narrative**
- Growth
- High Growth and Low Risk
- Low Risk and High Reinvestment
- Reinvestment
Uber: Possible, Plausible and Probable

Possible
Car ownership market
Option value

Plausible
Suburban car service & rental market
Higher growth rate

Probable
Urban taxi market
In Total Market size, Revenues & Earnings
The Runaway Story: When you want a story to be true...

- With a runaway business story, you usually have three ingredients:
  1. Charismatic, likeable Narrator: The narrator of the business story is someone that you want to see succeed, either because you like the narrator or because he/she will be a good role model.
  2. Telling a story about disrupting a much business, where you dislike the status quo: The status quo in the business that the story is disrupting is dissatisfying (to everyone involved).
  3. With a societal benefit as bonus: And if the story holds, society and humanity will benefit.

- Since you want this story to work out, you stop asking questions, because the answers may put the story at risk.
The Impossible: The Runaway Story

The Story

Money

Companies valued at $1 billion or more by venture-capital firms

125 COMPANIES

Valuations as of October 2015

Theranos valued at $9 billion

Select companies from the chart or table for more detail.

The Checks (?)

<table>
<thead>
<tr>
<th>Board Member</th>
<th>Designation</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henry Kissinger</td>
<td>Former Secretary of State</td>
<td>92</td>
</tr>
<tr>
<td>Bill Perry</td>
<td>Former Secretary of Defense</td>
<td>88</td>
</tr>
<tr>
<td>George Schultz</td>
<td>Former Secretary of State</td>
<td>94</td>
</tr>
<tr>
<td>Bill Frist</td>
<td>Former Senate Majority Leader</td>
<td>63</td>
</tr>
<tr>
<td>Sam Nunn</td>
<td>Former Senator</td>
<td>77</td>
</tr>
<tr>
<td>Gary Roughead</td>
<td>Former Navy Admiral</td>
<td>64</td>
</tr>
<tr>
<td>James Mattis</td>
<td>Former Marine Corps General</td>
<td>65</td>
</tr>
<tr>
<td>Dick Kovrovich</td>
<td>Former CEO of Wells Fargo</td>
<td>72</td>
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<tr>
<td>Riley Bechtel</td>
<td>Former CEO of Bechtel</td>
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<tr>
<td>William Fege</td>
<td>Epidemiologist</td>
<td>79</td>
</tr>
<tr>
<td>Elizabeth Holmes</td>
<td>Founder &amp; CEO, Theranos</td>
<td>31</td>
</tr>
<tr>
<td>Sunny Balwani</td>
<td>President &amp; COO, Theranos</td>
<td>NA</td>
</tr>
</tbody>
</table>
When runaway stories melt down..

The Meltdown Story

**UntrustworthyStoryteller**
A narrator, who through his/her words or actions has become untrustworthy.

**Story at war with numbers**
The company's narrative conflicts with its own actions and/or with the actual results/numbers reported by the company.

**Bad Business Model**
The business model has a fundamental flaw that can affect either future profitability or survival, but the management is either in denial about the flaw or opaque in how it plans to deal with it.

**Meltdown Story**
Investors, lenders and observers question story, unwilling to accept the company's spin on number, pushing pricing down.
The Implausible: The Big Market Delusion

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Cap</th>
<th>Enterprise Value</th>
<th>Current Revenues</th>
<th>Breakeven Revenues (2025)</th>
<th>% from Online Advertising</th>
<th>Imputed Online Ad Revenue (2025)</th>
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<tbody>
<tr>
<td>Google</td>
<td>$441,572.00</td>
<td>$386,954.00</td>
<td>$69,611.00</td>
<td>$224,923.20</td>
<td>89.50%</td>
<td>$201,306.26</td>
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<td>Facebook</td>
<td>$245,662.00</td>
<td>$234,656.00</td>
<td>$14,640.00</td>
<td>$129,375.54</td>
<td>92.20%</td>
<td>$119,284.25</td>
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<tr>
<td>Yahoo</td>
<td>$30,614.00</td>
<td>$23,836.10</td>
<td>$4,871.00</td>
<td>$25,413.13</td>
<td>100.00%</td>
<td>$25,413.13</td>
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<td>LinkedIn</td>
<td>$23,265.00</td>
<td>$20,904.00</td>
<td>$2,561.00</td>
<td>$22,371.44</td>
<td>80.30%</td>
<td>$17,964.26</td>
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<td>Twitter</td>
<td>$16,927.90</td>
<td>$14,912.90</td>
<td>$1,779.00</td>
<td>$23,128.68</td>
<td>89.50%</td>
<td>$20,700.17</td>
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<td>Pandora</td>
<td>$3,643.00</td>
<td>$3,271.00</td>
<td>$1,024.00</td>
<td>$2,915.67</td>
<td>79.50%</td>
<td>$2,317.96</td>
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<td>Yelp</td>
<td>$1,765.00</td>
<td>$0.00</td>
<td>$465.00</td>
<td>$1,144.26</td>
<td>93.60%</td>
<td>$1,071.02</td>
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<td>Zillow</td>
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<td>$4,101.00</td>
<td>$480.00</td>
<td>$4,156.21</td>
<td>18.00%</td>
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<td>Zynga</td>
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<td>$752.00</td>
<td>$757.86</td>
<td>22.10%</td>
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<td>Alibaba</td>
<td>$184,362.00</td>
<td>$173,871.00</td>
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<td>Tencent</td>
<td>$154,366.00</td>
<td>$151,534.00</td>
<td>$13,969.00</td>
<td>$63,730.36</td>
<td>10.50%</td>
<td>$6,691.69</td>
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<td>Baidu</td>
<td>$49,991.00</td>
<td>$44,864.00</td>
<td>$9,172.00</td>
<td>$30,999.49</td>
<td>98.90%</td>
<td>$30,558.50</td>
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<td>Sohoo.com</td>
<td>$18,240.00</td>
<td>$17,411.00</td>
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<td>$16,973.01</td>
<td>53.70%</td>
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<td>Naver</td>
<td>$13,699.00</td>
<td>$12,686.00</td>
<td>$2,755.00</td>
<td>$12,139.34</td>
<td>76.60%</td>
<td>$9,298.74</td>
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<td>Yandex</td>
<td>$3,454.00</td>
<td>$3,449.00</td>
<td>$972.00</td>
<td>$2,082.52</td>
<td>98.80%</td>
<td>$2,057.52</td>
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<td>Yahoo Japan</td>
<td>$23,188.00</td>
<td>$18,988.00</td>
<td>$3,591.00</td>
<td>$5,707.61</td>
<td>69.40%</td>
<td>$3,961.08</td>
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<td>Sina</td>
<td>$2,113.00</td>
<td>$746.00</td>
<td>$808.00</td>
<td>$505.09</td>
<td>48.90%</td>
<td>$246.99</td>
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<tr>
<td>NetEase</td>
<td>$14,566.00</td>
<td>$11,257.00</td>
<td>$2,388.00</td>
<td>$840.00</td>
<td>11.90%</td>
<td>$3,013.71</td>
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<tr>
<td>Mail.ru</td>
<td>$3,492.00</td>
<td>$3,768.00</td>
<td>$636.00</td>
<td>$1,676.47</td>
<td>35.00%</td>
<td>$586.76</td>
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<tr>
<td>Mixi</td>
<td>$3,095.00</td>
<td>$2,661.00</td>
<td>$1,229.00</td>
<td>$777.02</td>
<td>96.00%</td>
<td>$745.94</td>
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<td>Kakaku</td>
<td>$3,565.00</td>
<td>$3,358.00</td>
<td>$404.00</td>
<td>$1,650.49</td>
<td>11.60%</td>
<td>$191.46</td>
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<tr>
<td>Total non-US</td>
<td>$474,131.00</td>
<td>$444,613.00</td>
<td>$50,379.00</td>
<td>$248,495.46</td>
<td></td>
<td>$133,415.32</td>
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<tr>
<td>Global Total</td>
<td>$1,244,316.90</td>
<td>$1,134,430.00</td>
<td>$146,562.00</td>
<td>$682,681.44</td>
<td></td>
<td>$522,387.98</td>
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<td>----------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Unit Volume</td>
<td>24,298</td>
<td>36,883</td>
<td>64,684</td>
<td>86,713</td>
<td>149,869</td>
<td>214,841</td>
</tr>
<tr>
<td>% Growth</td>
<td>52%</td>
<td>73%</td>
<td>73%</td>
<td>73%</td>
<td>43%</td>
<td>36%</td>
</tr>
<tr>
<td>Automotive Revenue Per Unit ($)</td>
<td>93,403</td>
<td>85,342</td>
<td>83,432</td>
<td>78,932</td>
<td>65,465</td>
<td>58,258</td>
</tr>
<tr>
<td>% Growth</td>
<td>-9%</td>
<td>-2%</td>
<td>-5%</td>
<td>-5%</td>
<td>-17%</td>
<td>-3%</td>
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<tr>
<td>Automotive Sales</td>
<td>2,462</td>
<td>3,321</td>
<td>5,613</td>
<td>7,051</td>
<td>10,025</td>
<td>12,720</td>
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<tr>
<td>Development Service Sales</td>
<td>16</td>
<td>40</td>
<td>42</td>
<td>44</td>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>Total Sales</td>
<td>2,478</td>
<td>3,361</td>
<td>5,655</td>
<td>7,059</td>
<td>10,072</td>
<td>12,760</td>
</tr>
<tr>
<td>% Growth</td>
<td>36%</td>
<td>68%</td>
<td>25%</td>
<td>42%</td>
<td>27%</td>
<td>31%</td>
</tr>
<tr>
<td>EBITDA</td>
<td>148</td>
<td>417</td>
<td>920</td>
<td>1,042</td>
<td>1,586</td>
<td>2,150</td>
</tr>
<tr>
<td>% Margin</td>
<td>6.0%</td>
<td>12.4%</td>
<td>16.3%</td>
<td>14.7%</td>
<td>15.7%</td>
<td>16.8%</td>
</tr>
<tr>
<td>D&amp;A</td>
<td>103</td>
<td>158</td>
<td>172</td>
<td>203</td>
<td>230</td>
<td>314</td>
</tr>
<tr>
<td>% of CapEx</td>
<td>41%</td>
<td>79%</td>
<td>59%</td>
<td>65%</td>
<td>69%</td>
<td>69%</td>
</tr>
<tr>
<td>EBIT</td>
<td>45</td>
<td>259</td>
<td>748</td>
<td>839</td>
<td>1,285</td>
<td>1,749</td>
</tr>
<tr>
<td>% Margin</td>
<td>1.8%</td>
<td>7.7%</td>
<td>13.2%</td>
<td>11.8%</td>
<td>12.9%</td>
<td>14.1%</td>
</tr>
<tr>
<td>Net Interest Income (Expenses)</td>
<td>(27)</td>
<td>(1)</td>
<td>9</td>
<td>33</td>
<td>47</td>
<td>90</td>
</tr>
<tr>
<td>Other Income</td>
<td>28</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pretax Income</td>
<td>46</td>
<td>256</td>
<td>758</td>
<td>872</td>
<td>1,332</td>
<td>1,886</td>
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<tr>
<td>Income Taxes</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>34</td>
<td>86</td>
<td>262</td>
</tr>
<tr>
<td>% Effective Rate</td>
<td>6%</td>
<td>1%</td>
<td>2%</td>
<td>4%</td>
<td>6%</td>
<td>14%</td>
</tr>
<tr>
<td>Net Income</td>
<td>44</td>
<td>256</td>
<td>744</td>
<td>839</td>
<td>1,246</td>
<td>1,624</td>
</tr>
</tbody>
</table>

**Plus**
- After-tax Interest Expense (Income)
  - 27
- Depreciation of PP&E
  - 103
- Other
  - 0

**Less**
- Change in Working Capital
  - (155)
- % of Change in Sales
  - -2%
- Capital Expenditures
  - 250
- % of Sales
  - 10%
- Other
  - 0

Unlevered Free Cash Flow
- 78
- 229
- 750
- 863
- 1,186
- 1,702
- 2,343
- 2,884
- 3,314
- 4,113
- 4,472
- 4,959
- 5,466
- 6,597
- 7,315
- 8,005

EBITDA: 12,099
Sales: 68,059
Net Debt (Cash): (260)
Tesla Diluted Shares: 142