

## Valuing Warrants Underlying an IPO Issued Stock – A Case Demonstration for Entrepreneurs

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### ABSTRACT

Prior to issuing an IPO, a private company normally issues warrants as an incentive to investors to make capital contributions before it gets publicly listed in the exchanges. However, the company's IPO price estimated from conventional models, usually ignores the existence of warrants associated with the issue. To correct this common error, this case demonstrates a four-step approach to account for the value of warrants and their dilutive effect in estimating the IPO price of the stock. During this process, an initial value of the IPO price is adjusted for the dilution effect of the value of warrants using the "Black-Scholes" option-pricing model. Furthermore, the final estimated IPO price is adjusted downwards to account for the value of warrants which should also be reflected on company's balance sheet. Accordingly, the price and number of shares sold to each angel investor and the founder's gain in equity should also be estimated. The analysis of this case enhances the valuation skills that upper-level finance majors or MBA students should have in evaluating an IPO issued with accompanying warrants in the fields of entrepreneurial finance and investment banking.

Keywords: warrant valuation, IPO valuation, Black-Scholes option pricing

## INTRODUCTION: CONCEPTS AND STEPS

Warrants, according to Leach and Melicher (2015, p. 513), “are call options issued by the company and typically involve the issue of new shares rather than the purchase of existing ones. Warrants involving the creation of new (dilutive) shares are worth less than options on existing shares;” They are normally bundled with the shares purchased by business angels as sweeteners or pacifiers for disgruntled investors. Sometimes, these warrants are issued to resolve the disputes among founders.

While estimating the company’s IPO price, the dilutive effect of warrants should be taken into account to allow for an accurate reflection of the structure of owners’ equity in the balance sheet. To do so, this case demonstrates the following four-step approach:

The first step, is to estimate the exit value of the company at the time when the planned IPO occurs. This step requires knowledge of the terminal value, accumulated surplus cash and the total amount of capital injected by investors up to the planned timing of the IPO. The second step involves the calculation of the initial IPO price assuming no warrants are issued. For this second step, the total number of shares issued should be estimated first. To project this number, the future values of invested capital and the percentage of exit value to reward the company’s executives, are utilized for this calculation. Dividing the exit value from step one by the total number of shares computed in the second step gives us the initial IPO price without warrants. The third step applies the Black-Scholes option-pricing formula to account for the dilution factor to estimate the value of the warrant. In the fourth and final step, the estimate for the initial IPO price from step two is adjusted downward to yield a final projected IPO price. Additionally, the number of shares and the projected price (per share) sold to each business angel investor and founder’s reward in term of equity gain could be projected.

The questions listed in this case are designed to follow the above four steps. In order to enhance students understanding of the materials discussed in the case, utilizing at least three-hours of class instruction time is suggested

## BODY OF THIS CASE

Tipfy, an assumed name for a private company, has experienced a great deal of success in selling mattresses online backed by its a sizable investment in its R&D. As a result, Tipfy is able to develop two lines of high-quality foam mattresses which could be packaged and delivered in a box. Powered by its effective marketing strategies including promoting its mattresses as “America’s most comfortable mattress”, advertising customers’ testimonials on YouTube and providing free shipping gave Tipfy a competitive advantage over its rivals. Because of its sustained growth trajectory, the company plans to issue an IPO four years from now. “Sleep Well”, Tipfy’s closest peer listed in the exchange market, has generated a required return of 18% for its investors. Tipfy’s investment banker, Mr. Scott White, recommends this number to be used as an appropriate discount rate benchmark for Tipfy once it becomes a public company. However, since Tipfy is currently a private corporation operating its business at a higher risk than its publicly-listed peer, its investors currently demand a minimum required rate of return of 25%. This rate is what should be applied before the time of its IPO. Mr White also projected an annual growth rate of 6% after the company issues its IPO.

Based on the Tipfy’s financial statements (referenced below), Mr. White also estimates the amount of its surplus cash in its balance sheet four years from now to be \$378,897 and the

dividend (D5) to be declared five years from now to be \$63,465.

Tipfy has two business angel investors and each one is committed to invest \$50,000 into the company. The first business angel, Dr. Jones, will put his \$50,000 today, while the other, Mrs Huang, will invest her portion three years from now. As mentioned earlier, Dr. Jones and Mrs Huang both require 25% annual return. In addition, Tipfy's founder, and the sole owner of the company, Mr. David Fuller, plans to give 6% of the exit value of the company as an incentive compensation to his employees and staff members at the time of the IPO. The only class of equity for the company is common stock and currently has 200,000 shares outstanding. Equity accounts for \$181,585 in its current balance sheet.

To facilitate the IPO process and attain a successful outcome, Mr. White suggests to issue 13,213 warrants two years from now as sweeteners or pacifiers to various parties including disgruntled investors and its staff. These warrants are designed with an exercise price of \$3 with two years of maturity. Based on the forecast for a two-year US Treasury note, the implied risk-free rate of interest estimated at 2.81% which corresponds to the maturity of the warrant. In addition, the stock price of "Sleep Well", Tipfy's peer in public market, is observed to have an annual stock volatility of 30%. This volatility is used as a proxy for the stock fluctuation of Tipfy stock price as if it were operating in a public market.

You are the assistant for Mr. White, who are new on the job to undertake an IPO analysis. Based on the above information, he would like you to develop a valuation report for Tipfy's IPO. To help you accomplish this task, he has identified the following questions that need to be addressed in to analyze this case.

## QUESTIONS 1 TO 6

You are required follow the order in which the questions are presented and provide your recommended solutions.

1. Identify and briefly explain the exit value for Tipfy (Step 1).
2. Assume no warrant is planned to be issued: What is the projected number of the total common stocks Tipfy should issue at the time of the IPO? What is Tipfy's price per share for its IPO under this setup (Step 2)?
3. Assume Tipfy will issue 13,213 warrants two years from now: What is the estimated value of each warrant? What is the adjusted value for Tipfy's total common equity (IPO value) after issuing these warrants (Step 3)?
4. With the existence of warrants, what is the adjusted total number of common stocks that should be issued for Tipfy's IPO? What is the adjusted projection for its IPO price (Step 4)?
5. How many shares should Tipfy sell to its investors and at what prices (Step 4)?
6. What is the projected value of founder's equity at the time of the IPO? Based on this projection, what are Mr. Fuller's periodic and annual returns for the period from now to its planned IPO (Step 4)?

## INSTRUCTOR'S NOTES

### Answer 1:

For this case, Tipfy's exit value is also called its IPO value. It is the total value of

common equity in the balance sheet at the time of the IPO. It could be estimated by the sum of three parameters given in this case. These three parameters are (1) surplus cash, (2) total injection of capital by investors and (3) terminal value of this company. All three data are estimated at the time when the IPO takes place four years from now. Among these three data, (1) surplus cash of \$378,897 and (2) total injection of capital by two business angel investors with each committing \$50,000 ( $=\$50,000 + \$50,000 = \$100,000$ ) are provided in the case in the case. However, to come up with the estimated terminal value four years from now of \$528,878, the formula:  $[D5 / (\text{discount rate} - \text{constant growth rate})]$  is applied, where D5 is \$63,465, an 18% discount rate and a 6% constant growth rate. The exit value is thus projected to be \$1,007,775 (Table 1).

### Answer 2:

To address the first part of the question, i.e., what is the total number of common stocks to be issued under the assumption specified in question two, Mr. Fuller's percentage of ownership at the time of Tiptfy's IPO should be projected first. Dividing Mr. Fuller's 200,000 shares by this ownership percentage will provide the solution to this part of the question.

To project Fuller's ownership percentage, two business angle investors, Dr. Jones and Mrs Huang, should be decided first. Their ownership percentages are determined based on the amount and timing of their respective capital injections (\$50,000 by Dr. Jones today and another \$50,000 by Mrs Huang three years from now) contributed to Tiptfy's exit value. Therefore, based on the capital they provide and a minimum required return of 25%, the contributions of these capitals are presented in terms of their future values at the time of Tiptfy's IPO. These ownership percentages are calculated as follows:

The future value of Dr Jones's \$50,000 investment =  $\$50,000 * (1+25\%)^4 = \$122,070$

The future value of Mrs Huang's \$50,000 investment =  $\$50,000 * (1+25\%) = \$62,500$

The Dr. Jones's ownership % =  $\$122,070 / \$1,007,775 = 12.11\%$

The Mrs Huang ownership % =  $\$62,500 / \$1,007,775 = 6.20\%$

With a 6% as incentive payoff to Tiptfy's employees and staff, the residual ownership of 75.69% ( $=100\% - 12.11\% - 6.20\% - 6\%$ ) belongs to Mr. Fuller. Dividing Mr. Fuller's 200,000 shares by 75.69%, the total numbers of common stocks issued for the Tiptfy's IPO is projected to be 264,252.

As an answer to the second part of question two, i.e., what is the Tiptfy's initial IPO price for each share without the warrants, is thus estimated to be \$3.81 ( $=\$1,007,775 / 264,252$ ). This projection is calculated by dividing the exit value of \$1,007,775 by the total shares of 264,252 (Table 2).

### Answer 3:

In order to determine the value of Tiptfy's warrants, the Black-Sholes option-pricing formal is first employed to obtain the value for one call option. A dilution factor will then be applied to this option value to obtain the estimate for the value of one warrant. The Black-Sholes formula and its variables are listed in the following (Leach & Melicher, 2015, p. 532):

$$C_t = N(h) * S_t - \{N[h - \sigma * (\tau^{0.5})]\} * PV(K)$$

Where

$N(t)$  = Standard normal cumulative distribution function (mean =0, and Standard deviation =1),

$\sigma$  = Annual standard deviation (volatility) for the compounded rate of return of the stock, expressed as a decimal, not a percent,

$K$  = Exercise price,

$T$  = Today's date

$\tau$  = Time to maturity (in a portion of one year),

$PV(K)$  = Present value of the exercise price,  $K$ ,

$h = \{\log(S_t/K) + r\tau + (\sigma^2) * \tau/2\} / [\sigma * (\tau^{0.5})]$ , where  $r$  is the risk-free interest rate, expressed as a decimal. It is the annualized continuously compounded rate on a safe asset with the same maturity as the expiration date of the option.

Inputting these variables into the above formula (see Table 3) results an value of \$1.17 for the warrant. When you adjust this value by a dilution factor of 0.9524, a warrant value of \$1.12 is projected. This dilution factor is calculated as 264,252/ (264,252+13,213). It is the pre-exercise share outstanding of 264,252, divided by the sum of 264,252 and the number of warrants issued (13,213). With 13,213 warrants valued at \$1.12, expected to be included as part of equity in the balance sheet on the time of Tipfy's IPO, the value of common equity is thus reduced by the value of the warrant, \$14,768 (= \$1.12 \* 13,213) to \$993,007 (= \$1,007,775 - \$14,768).

#### Answer 4:

To find the answers for this question, the procedure outlined in Answer 2 is followed. However, the exit value is now replaced by \$ 993,007, to account for the value of warrants. This recalculation yields an estimated 265,206 total number of common stocks issued at \$3.74 per share for Tipfy's IPO (Table 4). As expected, this valuation of \$3.74 is lower than the initial projected price of \$3.81 adjusted the valuation of warrants.

#### Answer 5:

For Dr. Jones, since his ownership percentage is 12.29%, he will receive 32,602 shares (= 12.29% \* 265,206) at the price per share of \$1.53 (= \$50,000/32,602). The same method of calculation will be applied to Mrs. Huang as well. She will receive 16,692 (= 6.29% \* 265,206) shares of common stocks with each share sold for \$3.00 (= \$50,000/16,692) (Table 4).

#### Answer 6:

Mr. Fuller, the founder, at the time of IPO, is estimated to own 75.41% of common equity, which is equal to \$748,857 (= 75.41% \* \$993,007). With the value of equity currently recorded at \$181,585, he could foresee his periodical return from now on until the time of Tipfy's IPO to be 312% (= (\$748,857 - \$181,585)/\$181,585). This is amounted to the annual return of 43% (= (\$748,857/\$181,585)<sup>1/4</sup> - 1). These impressive returns thus create great incentives for Mr. Fuller to go along with the plan for Tipfy's IPO to harvest his great reward in building a profitable enterprise.

**REFERENCE:**

Leach, J. Chris., & Melicher, Ronald W. (2015), Entrepreneurial finance. Stamford: Cengage Learning.

**APPENDIX****Table 1: Exit (IPO) Value Calculation, the End of Year 4**

	Today	Year 1	Year 2	Year 3	Year 4	Year 5
Valuation Date	7/31/Y0	7/31/Y1	7/31/Y2	7/31/Y3	7/31/Y4	7/31/Y5
						*Constant Growth Starts in the Beginning of Year 5
Surplus Cash		0	0	0	0	\$ 378,897
Capital Injection by Two Investors	\$ 50,000	0	0	\$ 50,000	\$ 100,000	
Terminal Value at Year 4 :					\$ 528,878	(=\$634,65/(18%-6%))
Dividend at Year 5						\$ 63,465
Discount Rate						18%
Constant Growth Rate						6%
<b>Exit Value (=IPO Value)</b>					<b>\$ 1,007,775</b>	

Note: The numbers in green cells are given in this case.

**Table 2: Initial IPO Valuation without Warrant: Ownership %, Total Numbers of Shares and Price per Share,**

Round 1 Investor (Dr. Jones) in Year 0	\$ 50,000	\$ 122,070	12.11%		
Round 2 Investor (Mrs. Huang) in Year 3	\$ 50,000	\$ 62,500	6.20%		
6% Incentive Compensation		\$ 60,467	6.00%		
Founder (Mr. Fuller)		\$ 762,739	75.69%	200,000	\$ 3.81
Total Shares		\$ 1,007,775	100.00%	<b>264,252</b>	(=Initial IPO price = \$1,007,775/264,252)
					(=200,000/(Founder's Ownership % of 75.69%))

**Notes:**

1. The future value of Round 1 investment =  $\$50,000 \times (1+25\%)^4 = \$122,070$
2. The future value of round 2 investment =  $\$50,000 \times (1+25\%) = \$62,500$
3. Value for the 6% incentive compensation =  $6\% \times \$1,007,775 = \$60,467$
4. Founder's portion on exit value =  $\$1,007,775 - \$122,070 - \$62,500 - \$60,467 = \$762,739$
5. The numbers in green cells are given in this case.

**Table 3: Warrant Valuation: Black-Sholes Option-Pricing Formula with Dilution Factor**

Tipfy: 13,213 warrants and 264,252 pre-exercise shares outstanding

K	Time to Expiration (t)	Annual Interest Rate (r)	Equity value per share (St)	Annual Stock Volatility ( $\sigma$ )	Present Value of K*
\$ 3.00	2	0.0281	\$ 3.81	0.3	\$ 2.84
h	N(h)	$N[h - \sigma^2(t/2)]$	Dilution Factor**= 264,252/(264,252 + 13,213)	BS Option Value	BS Warrant
0.910248	0.818654178	0.686510781	0.9524 \$	1.17 \$	1.12

Notes:

\* N = 2, is used for this present value calculation.

\*\* Dilution factor = pre-exercise shares outstanding / (pre-exercise shares outstanding + the number of warrants issued).

Numbers in green cells are given in this case.

**Table 4: Final IPO Valuation with Warrants: Ownership %, Total Numbers of Shares and Price per Share**

	A	B	C = B/\$993,007	D = C*265,206		
Round 1 Investor in Year 0	\$ 50,000	\$ 122,070	12.29%	32,602	\$ 1.53	(=investment/# shares) = \$50,000/32,602
Round 2 investor in Year 3	\$ 50,000	\$ 62,500	6.29%	16,692	\$ 3.00	(=investment/# shares) = \$50,000/16,692
6% Incentive Compensation		\$ 59,580	6.00%	15,912	\$ 3.74	
Founder		\$ 748,857	75.41%	200,000	\$ 3.74	(=IPO price = \$993,007/265,206)
Total shares		\$ 993,007	100.00%	265,206		(=200,000/(founder's ownership % of 75.41%))

Notes:

1. The future value of Round 1 investment =  $\$50,000 \times (1+25\%)^4 = \$122,070$ 2. The future value of round 2 investment =  $\$50,000 \times (1+25\%) = \$62,500$ 3. Value for the 6% incentive compensation =  $6\% \times \$993,007 = \$59,580$ 4. Founder's portion on exit value =  $\$993,007 - \$122,070 - \$62,500 - \$59,580 = \$748,857$ 

5. The numbers in green cells are given in this case.

**Table 5: Founder's Equity Positions and Returns**

Founder's Projected Equity Position	\$	748,857
Founder's Current Equity Position	\$	181,585
Period Return (%) from Now to the IPO		312%
Annual Return Rate (%)		43%

Note: The number in green cells is given in this case.