The Mathematically-Correct Way of Calculating the Early-Stage Start-Up Valuations

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Executive Summary

The objective reality of the technology Angel investing is that a tiny minority of Angel investments produce huge returns, while the vast majority end up as flops.

Most Angels appear to have convinced themselves that if they just (1) **diversify** their Angel Investments portfolio sufficiently, and (2) insist on the industry-standard "**risk premium**" from the founders when negotiating the equity %, then their portfolios will have sufficiently high statistical probability of ending up being profitable within a few years.

The objective statistical analysis does not support such optimism, because a portfolio containing a relatively small number of companies (around 10 or even less) in many cases will have less than 10% probability of not losing most of the money eventually.

The key to successful Angel & VC investing lies *not* in portfolio diversification, but in focusing on the single-minded pursuit of the very small number of companies (the "diamonds") that can become overwhelmingly valuable based on their own unique fundamentals.

In order to be able to implement the above strategy, the investors need to have the *ability* to detect those "diamonds" during the pre-investment evaluation and due diligence stages.

The techniques currently employed by the investors (esp. in cases of early-stage start-ups) are poorly-suited for detecting those "diamonds", because, in part, the valuation techniques used in those situations are essentially just a set of "rules of thumb" that give Angels a false sense of comfort that they are "*managing their figures sensibly*", while in reality these methods: (1) lack the mathematical validity, and (2) are not designed to detect the "diamonds" (because their design is based on the implicit assumption that all companies are basically similar, hence "diamonds can't exist").

Specifically, the 3 most popular methods for valuating early-stage pre-revenue start-ups are: Scorecard, Berkus, and the Venture Capital Method, but all three have serious deficiencies as far as their fitness for the above purpose is concerned:

- The **Scorecard** and **Berkus** methods are essentially ***qualitative checklists*** for assessing the most important risk factors, with more-or-less randomly-chosen numerical values assigned to each checkbox by their authors.
- **The VC method** is considerably more valid quantitatively than the first two, but still poorly-suited for the tasks of: (1) calculating the *pre-revenue* start-up valuations, and (2) detecting the high-potential start-up companies.

The *mathematically-correct* way of calculating valuations is the **Dividend Discount Model** (hereafter DDM, a.k.a. Discounted Cash Flow Method), according to which, "*company's valuation is equal to the sum of all of its future dividend payments, discounted back to their present value*".

The reason why currently **DDM** is not being used for valuating the **early-stage start-ups**, is because in its currently-known form DDM does not have the built-in ability to handle *more than one* future scenario, while in cases of early-stage start-ups ***at least two*** **radically different future scenarios** *must always* be considered: (1) the "complete failure", and (2) the "run-away success" (as well as possibly one or more of the "moderate success" scenarios). So, absent the ability to use DDM in such situations, the early-stage investment industry has defaulted into using the *qualitative* techniques like Berkus and Scorecard – which make a *very poor* substitution from the quantitative point of view.

This DDM's deficiency can be easily fixed by applying the techniques for calculating the *statistical mean* of the multi-scenario event outcomes, in which case the Valuation definition becomes "***scenario-weighted statistical mean*** *of future dividend payments, discounted back to their present value*".

The resultant ***Multi-Scenario*** **Dividend Discount Model** (M-DDM) is *the most general* embodiment of the Dividend Discount Model, and it is *universally applicable:* from the earliest-stage pre-revenue start- ups (including even idea stage), all the way to most mature companies; and it turns the valuation of early-stage start-ups from a "**form of art**" into an "**objective science**".

The easiest-to-understand form of M-DDM is:

$$V_0 = \sum_{S=1}^{M} P_S V_{0S} = P_1 V_{01} + P_2 V_{02} + \cdots + P_M V_{0M}$$

where:

- V_{0S} is "what the *current* **DDM valuation** of the company would be if we were certain that scenario ***S*** was *definitely* going to unfold in the future"; and
- P_S is the currently-assessed **probability** of scenario ***S*** unfolding in the future.

Under this model, all of the risks associated with the company's future uncertainty (including and especially the Default Risk Premium, which is the dominant factor affecting the valuation of the early-stage companies) are moved into the "*scenario probabilities*" parameters P_S and out of the Required Rate of Return parameter ***r*** (which now encapsulates *only* the desired ROI target).

This *immensely* simplifies the task of numerically evaluating the risks' influence on the companies' valuations, because under this model, if the project's success depends on the list of N objectives, *each* of which must be achieved successfully for the project to succeed (e.g. all are a part of the *critical path*), then the probability of the project's overall success will be simply a product of the probabilities of successfully achieving each of those objectives:

$$P_{project} = P_{sub_1} \cdot P_{sub_2} \cdot P_{sub_3} \cdots P_{sub_N} = \prod_{i=1}^{N} P_{sub\_i}$$

where P_{sub_i} are the sub-projects within the project.

There is more than one valid way of calculating $P_{project}$ because there is more than one way of subdividing the critical path into the *complete set* of critical objectives; and in fact it's probably a good idea to calculate $P_{project}$ by calculating it using several of these methods, and then averaging the results.

In case of **technology start-ups** (i.e. in cases where the two most important future scenarios are "maximum achievable success" and "complete failure"), the general Valuation formula can be approximated into:

$$V_0 \approx P_{max} V_{max} \langle d_{max} \rangle \approx P_{max} \frac{\$_{max} f_{max} m_{max}}{r_{min}} (1 + \langle r \rangle)^{-yY}$$

where:

- P_{max} is the probability of the "maximum achievable success" scenario (basically defined as "*fully capturing the relevant market worldwide within a reasonable time period (of 5-10 years)*"). The most common factors that can prevent a company from achieving this success, are:
    a. Lack of interest in the market;
    b. Actions of the competitors;
    c. Company's management's inability to execute the business plan well enough.
- V_{max} is the valuation of a company once it's achieved the maximum achievable success.
- $\langle d_{max} \rangle$ is the "average" future discounting factor.
- $\$_{max}$ is the total annual market size (which is equal to either the Total Addressable Market (TAM) or the Total Addressable Problem (TAP)).

- f_{max} is the fraction of TAM or TAP that under the best case scenario a company would convert into revenue.
- m_{max} is the best-case-scenario profit margin in the steady-state stage. This factor depends on the constraints of the business model, and how efficiently the company will be run.
- r_{min} is the *mature company* rate of return in that company's industry. In the *technology* sector, $r_{min} \approx 15\%$.
- $\langle r \rangle \approx 25\%$ is the "average time-discounting ***r***".
- Y = the number of years it's expected for a company to take before it comes close to reaching its plateau; and
- $y \approx 0.75$ is the "averaging factor".

As detailed in sections 5 and (especially) 6, what has emerged during this inquiry, is the **new paradigm** that can revolutionise the way Angels and Founders negotiate and work together, and make the operations of the start-up investment industry much **more *systemically sound*** (compared to the "lottery" that investors are currently playing (and many of them *losing*)):

- By shifting the focus away from the fairly-subjective "singular valuation figure" and into its two most important constituent factors (V_{max} and P_{max}), this methodology provides a better framework governing the Founder-Angel relationships, esp. in the early stages of that relationship: from negotiating the investment agreement's terms, to maximising the value that Angels can bring into the start-up once they start working together after the agreement has been reached, because when deployed, this methodology seamlessly becomes a valuable business strategy and coaching tool that draws the participants' focus into the necessary topical areas and degree of detail.
- Investors will have significantly better tools for assessing the start-ups' valuation potential and probability of success, which will put them into considerably better informed position when making investment and asset allocation choices (which start-ups to invest to, and what investment amounts would maximise the probabilities of their success).

How to extract the most value from reading this document

The primary target audience for this document are the start-up investors (esp. early-stage), but major parts of this document will also be of great relevance to the start-up founders, business analysts, and business coaches.

The primary objective of this document is to provide a comprehensive strategic picture to those who want to understand well the topics of (1) vetting the prospective start-up investments, and (2) calculating the start-up valuations.

This document is composed of a number of fairly-autonomous topics, all related to the general theme of start-up investing (with a particular focus on *early-stage* start-ups). This means that, depending on the reader's area of focus, some sections will be very relevant, while other sections can be safely skipped without losing out on the relevant-to-*them* learning.

The quick guide to the contents of the sections:

- Section **1. Why this is important** (pp. 7-11) gives an overview of what are the current major deficiencies in the way the investment industry (esp. Angel) is operating that are hurting them greatly (and they don't even realise why). Some of the details are truly shocking.
- Section **2. Currently-used early stage start-up valuation methods**:
    - pp. 11-13 gives a brief overview of the 3 most popular methods currently used for calculating pre-revenue start-up valuations (Berkus, Scorecard and Venture Capital); and
    - pp. 14-15 provides the analysis and critique of these methods.
- Section **3. The Simplified Valuation Formula**:
    - pp. 16-18 gives a convenient (brief but comprehensive) overview of the Discounted Cash Flow Model for calculating company valuations (which is the *mathematically correct* way of calculating valuations, but in its current form impossible to apply to the *pre-revenue* start-up situations);
    - Sub-section **3.5.3. Difficulty in factoring the risks in complex multi-scenario situations** (pp. 19-21) (a) identifies the specific obstacle that's preventing the Discounted Cash Flow Model from being used on the pre-revenue start-ups; and (b) reveals the solution to that problem, which leads to the version of the Discounted Cash Flow Model-based formula that is ***universally*** applicable to *all* stages of companies' development (including early pre-revenue).
- Sections **4. The practical method for calculating start-ups' valuation** (pp. 22-23) and **5. Start-up valuation evolution** (pp. 24-27) derive the much-simplified formula *designed specifically* for quickly and easily calculating the valuations of the early-stage (including pre-revenue) tech start-ups.
- Sections **5.3. An important insight** (pp. 27-28) and **6. How this framework can be used to revolutionise the way Angels and Founders negotiate and work together for the maximum mutual benefit** (pp. 28-30) present the picture how this new information could modify the way the investors and the founders interact with each other in order to create *much more effective* win-win outcomes, compared to what's now. Section 6 is currently far from complete.

The quick "**which sections to read vs. can skip**" guidelines for some of the most-relevant reader profiles:

If you are an investor (Angel or VC) who primarily wants to learn how to *use* the right tools, but is not that much concerned about understanding the finer points of how these tools were created (esp. the math), then:

- The most important sections to read will be:
    - Section **1. Why this is important**
    - Section **2.4. Summary & Critique of the 3 methods**
    - Look *only* at the Eq.(11) (in section **3.5.3. Difficulty in factoring the risks in complex multi-scenario situations**) which is really the key conclusion, presented in the most intuitively-possible way.

- Eq.(15) in section **4. The practical method for calculating technology start-ups' valuation**
- Section **5. Start-up valuation evolution**
- Section **6. How this framework can be used to revolutionise the way Angels and Founders negotiate and work together for the maximum mutual benefit**

- Can safely skip the rest of the math-heavy section **3. The Mathematically-Correct Valuation Methodologies**

If you are an analyst (or someone who likes math in general and likes to understand the fine points of the analysis methods and models), then:

- Can skip sections **3.1-3.5.2** if you are already well-versed in how the *mainstream* Discounted Cash Flow Model works.
- Read:
  - Section **1. Why this is important**
  - Section **2.4. Summary & Critique of the 3 methods**
  - Sections **3.5.3** and **3.6**
  - Section **4. The practical method for calculating technology start-ups' valuation**
  - Section **5. Start-up valuation evolution**

If you are a technology company founder, then the most important parts to read would probably be:

- Section **2.4. Summary & Critique of the 3 methods**
- Look *only* at the Eq.(11) (in section **3.5.3. Difficulty in factoring the risks in complex multi-scenario situations**) which is really the key conclusion, presented in the most intuitively-possible way.
- Eq.(15) in section **4. The practical method for calculating technology start-ups' valuation**
- Section **5. Start-up valuation evolution**
- Section **6. How this framework can be used to revolutionise the way Angels and Founders negotiate and work together for the maximum mutual benefit**

- Can skip the rest of the math-heavy section **3. The Mathematically-Correct Valuation Methodologies**

If you are a business coach, then the most important parts to read would probably be:

- Eq.(11) (in section **3.5.3. Difficulty in factoring the risks in complex multi-scenario situations**) which is really the key conclusion, presented in the most intuitively-possible way.
- Eq.(15) in section **4. The practical method for calculating technology start-ups' valuation**
- Section **6. How this framework can be used to revolutionise the way Angels and Founders negotiate and work together for the maximum mutual benefit**

Glossary

"**Diamonds**" = start-ups that have the potential to succeed at vast scale based on their unique fundamentals (esp. the features of their offer to the market (and the size of the Total Addressable Market associated with it), but also the business strategy and the people involved).

"**Glass beads**" = start-ups that appear to present a good Angel investment potential, but investments in which will eventually produce losses.

Introduction

The fit-for-purpose start-up assessing tool should be able to do well 2 things:

1. Make it possible to identify diamonds in the pile of glass beads; and
2. Assess the valuations of those companies properly.

Why *both* of them are important?

1. Why this is important

1.1. Why finding diamonds is so important

As far as the importance of "finding diamonds in the pile of glass beads" is concerned, the objective reality of the technology Angel investing is such that a tiny minority of Angel investments produce huge returns, while the vast majority end up as flops:

According to Jason Calacanis (who is considered to be one of the most successful Silicon Valley Angel investors), a good Angel investor would invest on average in 1 start-up founder for every 50 he speaks to, which means the he would make ~200 bets after reviewing over 10,000 start-ups (which can take about a decade to do). And then out of those 200 investments, 190+ will flop, a few will produce unimpressive returns, and one of those 200 investments will make 99.9%+ of the overall returns (by returning ~5,000X the original investment).

Some Angels (especially those who possess insights, skills and connections that are a *particularly good* fit to the industry niche they had chosen to operate in) will be capable of achieving notably higher success rates than above, but the majority of Angels will probably achieve even lower success rates.

The Calacanis statistics implies that competent Angel's probability of ending up investing in one of those "diamonds" is ~0.5%, which has very important implications:

Most Angels appear to have convinced themselves that if they just (1) diversify their Angel Investments portfolio sufficiently, and (2) insist on the industry-standard "risk premium" from the founders when negotiating the equity %, then their portfolios will have high statistical probability of ending up being profitable within a few years.

The objective statistical analysis does not support the above optimism:

If the probability of investing in one of the "diamonds" is only 0.5%, then the statistical probability that *any given* company in a portfolio will be a flop, is $P_{flop} = 100\% - 0.5\% = 99.5\% = 0.995$; and the statistical probability that a given investment portfolio, containing n investments, will have *at least one* of the "diamonds" is:

$$P_{diamond} = 1 - P_{flop}^{n} \quad (1)$$

In reality, reportedly most Angel investors don't hold more than 5 or 6 investments across their portfolio, which means that the statistical probability that a portfolio, composed of 6 investments, contains *at least one* "diamond", is just 3% (in other words, there is a 97% probability that such portfolio contains *nothing but flops*).

All of the above clearly demonstrates that "typical" diversification (*especially* when the portfolio contains a relatively small number of investments) *does not* provide *anywhere near* statistically-adequate downside protection; and what usually "makes or breaks" an investment portfolio (or a VC fund), is having vs. *not* having *at least one* of those "diamonds" in the portfolio (while the deal terms (e.g. early-stage valuation) matters relatively little, because the wins are so disproportionate when they *do* happen).

As a direct consequence of the above statistical situation in the Angel industry, what happens is as follows:

- The majority of Angels (i.e. those whose investment portfolios never contained a "diamond") will lose most or all of the money invested;
- Some Angels will achieve modest returns;
- A small minority of Angels (i.e. those whose investment portfolios had contained *at least one* "diamond") will do *exceptionally* well; and
- The stories about the successes of the latter group keep many people motivated to join this game (or to remain in it).

And if the Angels were to insist that the required rate of return should be commensurate with the 0.5% investment success rate, then *just to break even* statistically, their required rate of return would have to be close to 400% (designed to produce the 200X multiple over the 5-year period) – which would lead to the early-stage valuations 5-10x lower than they currently are (which in many cases is *already* much too low). If this were to happen, nearly all start-ups would instantly become unfundable, because even modest investment amounts would require the founders to give away 100% of their companies in the first round.

Worse yet, the above methodology of the downside protection would *only* be statistically viable in cases where the investment portfolio contains a large number (at least a few hundred) companies, otherwise it becomes simply a stochastic lottery, where chances of winning = 0.5% * [the number of companies in the portfolio].

All of the above means that in order for the investors to build high-success-probability portfolios, they need to be able to do 2 things:

1. **Increase the success probabilities** of the start-ups they are investing in to considerably above the (current) 0.5%, by:
    a. Having a much more effective way of ***filtering*** through their deal flow; and
    b. Getting access to a ***better deal flow*** if possible.
2. **Increase the number of companies** in the portfolio to the point where the statistical probability of having *at least one* "diamond" in it becomes considerably closer to 100% than to 0%.

For example:

- If the probability of investing in one of the "diamonds" *remains* at 0.5% but the portfolio contains 200 companies instead of 6, then the statistical probability that this portfolio contains *at least one* "diamond" increases from 3% to 63% – still quite far from 100%, but *much* better than 3%.
- If the probability of investing in one of the "diamonds" were to be increased from 0.5% to 5% (which is doable, as will be detailed later in this article), then a 6-company portfolio will have a 26.5% probability of containing at least one "diamond"; and a 50-company portfolio: 92.3% probability.

In case of VCs, the things are somewhat better: instead of 0.5% of investments producing 99.9%+ of overall returns, in the Silicon Valley VC scene 5% of the deals produce 95% of the venture capital returns.

And as far as the public listed companies are concerned, the situation is not that much different either:

- According to the 2017 Arizona State University study of the performance of over 26,000 stocks across nine decades from 1926 to 2016, all the gains in that 90 year period were down to just 4% of all those listed stocks; and 60% of stocks offered returns no better than cash in all the time that they were listed on that public stock market.
- According to the recently-released new report covering 60,000 stocks for the 28 years from 1990 to 2018, again 60% of the stocks surveyed failed to provide a better return than cash; and worse yet, just 1.3% of listed companies accounted for all the market gains across nearly three decades; and if we consider only the listed companies *outside* America (hence take out of the consideration companies like Alphabet, Amazon, Apple, Facebook, Microsoft, etc.), then this figure declines to just 1%.

The above are the manifestations of the more general phenomenon that the billionaire PayPal co-founder Peter Thiel described in his book's "***Zero to One: Notes on Start Ups, or How to Build the Future***" chapter 7 "Follow the Money" (where he discusses the success factors as they apply to operating the most successful VC funds): that one of the major rules in life is that it is the small minorities that achieve the disproportionate results. The "Pareto principle" (more commonly known as the 80-20 rule) is one of the more-widely-known embodiments of this phenomenon, except that in start-up investing the figures are much more extreme than 80-20.

In the business world, this is manifested by the monopoly businesses capturing more value than millions of their undifferentiated competitors; and in Angel and Venture Capital investment situations, a small handful of companies radically outperform all others, and attain exponentially greater value than the rest put together.

Peter Thiel's own Founders Fund illustrates this skewed pattern: Facebook, the best investment in their 2005 fund, returned more than all the others combined. Palantir, the second-best investment, is set to return more than the sum of every other investment aside from Facebook; and this highly uneven pattern is seen in all of their other funds as well.

"*The biggest secret in venture capital is that the best investment in a successful fund equals or outperforms the entire rest of the fund combined*".

Not surprisingly therefore, even the broadly diversified (with the hope that winners will counterbalance losers – or as Peter Thiel calls it "*the 'spray and pray' approach*") portfolios of investee companies "*usually produce an entire portfolio of flops, with no hits at all*"; and when those fail, most funds fail with them.

The relevant VC industry statistics supports the above statements: in the revealing 2012 report titled "***We Have Met the Enemy …and He Is Us***", Diane Mulcahy:

- Calculated that since 1997, less cash has been returned to VC investors than they have invested;
- The truth is that most VCs subsist entirely on fees, which they compound by raising a new fund every three years. Returns are kept hidden by nondisclosure agreements, and so VCs routinely overstate them, both to encourage investment and to attract entrepreneurs;
- VCs oftentimes "logo shop" by buying into late rounds of hot companies at high prices so they can list them on their portfolio page;
- The bottom three-quarters of VC firms didn't beat the Nasdaq for the prior five years, but as one L.P.'s remarked sardonically, "*You can't find a venture fund anywhere that's not in the top quartile*".

And when it comes to the Angel investing, as already detailed earlier, the statistics is *even more* skewed against investors achieving profitable outcomes (which has given birth to saying "*If you want to make a small fortune as a business Angel, you have to start with a big fortune*").

According to Peter Thiel:

- *"Even seasoned investors understand this phenomenon only superficially: they know companies are different, but they underestimate the degree of difference; and if they focus on diversification instead of* ***single-minded pursuit of the very few companies that can become overwhelmingly valuable****, they miss those rare companies in the first place".*
- *"Of course, no one can know with certainty ex ante which companies will succeed, so even the best VC firms have a portfolio. However,* ***every single company in a good venture portfolio must have the potential to succeed at vast scale****. At Founders Fund, we focus on five to seven companies in a fund, each of which we think could become a multibillion-dollar business* ***based on its unique fundamentals****".*
- *"Whenever you shift from the substance of a business to the financial question of whether or not it fits into a diversified hedging strategy, venture investing starts to look a lot like buying lottery tickets. And once you think that you're playing the lottery, you've already psychologically prepared yourself to lose".*

All of the above means that:

1. The "*spray and pray*" approach of investing in a broadly diversified portfolio of start-ups constitutes basically "playing a lottery" that in the majority of instances results in investment losses; and
2. The key to the Angel (and VC) investment success lies in focusing on the single-minded pursuit of the very small number of companies that can become overwhelmingly valuable based on their unique fundamentals, which can be achieved by:
    a. Being able to detect and recognise the "diamonds" in their deal flow (and which also requires having access to the ***diamond-rich*** deal flows);
    b. Making sure to invest in those "diamonds" (while at the same time doing your best to *avoid* investing in the "glass beads"); and afterwards:
    c. Focusing on doing *whatever is necessary* to help that small handful of "diamond" companies succeed.

1.2. Why being able to calculate Valuation correctly is important

Being able to calculate start-up's Valuation correctly is important for several reasons:

A "diamond detection" tool:

A properly-designed Valuation calculation methodology will *have* to contain a "sub-process" for appropriately estimating the company's future valuation potential. This makes it much easier to detect the "diamonds" in the investor's deal flow.

Fairness for both sides:

If *both* sides (Founders and Angels) have the ability to correctly calculate the company's future valuation potential and the current value, then this significantly increases the likelihood that *neither* party will get "short-changed" in the funding deal – which leads to greater fairness, transparency, fewer downstream problems, and also more *objectively rational* investor asset allocation.

A business development tool:

A properly-designed Valuation calculation methodology will *not only* enable the users to calculate more reliably the company's current and future valuations, but during the process of calculations it will *also* bring up valuable insights into: (1) how the company's future potential could be increased, and/or (2) how the progress towards it could be accelerated.

It would *also* reveal or highlight the flaws in the company's product, business strategy or the personnel composition, which would:

- Cause the necessary improvements to be made (that otherwise would be done later in the process and at a higher cost, or maybe even never or when it's too late); or
- Make everybody realise that the uncovered problems are *so* serious, that the whole project is not worth pursuing – thus saving everybody (Angels, but also Founders) a lot of wasted money, effort and future grief.

Project viability:

Most investors are naturally (and justifiably) concerned about not overpaying – which also includes the scenario where the eventually-achievable company's valuation will be too low to justify the amount of investment being considered (on the grounds that even if the company were to become successful, its valuation at that point will not even be able to *fully* refund the investment).

On the other hand, there will be situations where having the valuation estimate much too low (which on the surface might *appear* to benefit the investors, because this would lead to them getting a substantially higher equity % in a start-up) can actually be catastrophically harmful to *all* parties involved.

This can happen, for example, if for it to succeed, a high-potential start-up were to require an upfront investment that *exceeds* its current valuation.

If the current valuation estimate is much too low (which can happen if e.g. for whatever reasons the future valuation potential ends up being grossly underestimated), then this can make the whole project appear "unfundable" (what do you do if the required investment amount is greater than the current valuation? Does it make sense for the investor to invest? And how many founders would agree to give away *all* of the equity to get such investment?). This can kill some of the best investment opportunities (i.e. "diamonds") at their point of inception. A correct valuation calculation methodology, on the other hand, would prevent such scenarios from occurring by adjusting the valuation figure up to the levels where investing makes business sense for all parties.

A "diamond rescue" tool:

While many start-ups fail because their fundamentals were such, that their chances of success were low or even non-existent from the outset, there are also instances where the potential "diamonds" failed because they didn't get from the Angels the resources and/or support necessary for achieving the *possible* success; and this happened because their Angels had been distracted and/or had spread themselves too thin by devoting too much of their attention and resources to the start-ups that had little or no chance of a large-scale success; hence they neglected the investees who had the potential of becoming huge success *if adequately supported*.

By identifying the likely "diamonds" and the "glass beads", a good Valuation methodology will enable and motivate the Angels to direct their attention and resources into the projects *most worthy* of their attention, thus reducing the rate of *avoidable* failures of high-potential companies; and resultantly making *both* the Angels and the Founders of high-potential companies much better off.

Metaphorically, a good valuation calculation methodology is like a good map of the area: it saves a lot of grief and wastage if you have it, compared to if you *don't* have it.

2. Currently-used early stage start-up valuation methods

The current prevailing opinion is that valuing a start-up (esp. pre-revenue) is very different from valuing an established company.

This has in large part to do with the fact that quantitative analysis and financial projections (which are the *extrapolations* of the past financial performance of the company) don't work when there is no data of the company's past financial performance to extrapolate from – which is frequently the case with the early-stage start-ups.

For this reason, Angel investors tend to lean towards using *qualitative* (rather than proper quantitative) tools and checklists for judging the quality and valuation of pre-revenue start-ups.

Below I briefly explain the 3 *most commonly* used early-stage start-up valuation methods.

2.1. Scorecard Valuation Method

The **Scorecard Valuation Method** is one of the most preferred methodologies used by Angels. This method compares the start-up (raising angel investment) to other funded start-ups, modifying the average valuation based on factors such as region, market and stage.

The valuation process starts by assuming that the pre-money valuations of all pre-revenue start-ups hovers around $1.5m (with relatively minor regional variations).

Then, correcting factors are applied by comparing the start-up to the perception of other start-ups within the same region, using factors such as:

1. Strength of the Management Team (0–30%)
2. Size of the Opportunity (0–25%)
3. Product/Technology (0–15%)
4. Competitive Environment (0–10%)
5. Marketing/Sales Channels/Partnerships (0–10%)
6. Need for Additional Investment (0–5%)
7. Other factors (0–5%)

Here is an example of how this method is used, where it is assumed that the team is strong (125% comparison) with a huge market opportunity (150% comparison), but the start-up is playing in a highly competitive environment (75%).

COMPARISON FACTOR	RANGE	TARGET COMPANY	FACTOR
Strength of Entrepreneur and Team	30% max	125%	0.3750
Size of the Opportunity	25% max	150%	0.3750
Product/Technology	15% max	100%	0.1500
Competitive Environment	10% max	75%	0.0750
Marketing/Sales/Partnerships	10% max	80%	0.0800
Need for Additional Investment	5% max	100%	0.0500
Other factors (great early customer feedback)	5% max	100%	0.0500
Sum			1.0750

By multiplying the sum factor (1.0750) by the average pre-money valuation ($1.5M), they arrive at a pre-money valuation of roughly $1.6M for the target start-up.

2.2. Berkus Method

The **Berkus Method** assigns a number (a financial valuation) to each major element of *risk* faced by all young companies — after crediting the entrepreneur some basic value for the quality and potential of the idea itself.

The Berkus Method uses both qualitative and (rudimentary) quantitative factors to calculate a valuation based on five elements:

1. Sound Idea (basic value);
2. Prototype (reduces technology risk);
3. Quality Management Team (reduces execution risk);
4. Strategic Relationships (reduces market risk);
5. Product Rollout or Sales (reduces production risk).

Each of these 5 factors is allowed to contribute the maximum of $500K towards the start-up's pre-money valuation (which means that under this method, *by definition* the valuation can *never* exceed $2.5M).

Lastly, Berkus sets the hurdle number at $20M (in fifth year in business) to "provide some opportunity for the investment to achieve a 10X increase in value over its life."

Here is an assessment of a fictitious pre-revenue start-up illustrating the general rules of the Berkus Method:

Berkus Method		
Value Driver	**Add to Pre-Money Valuation**	**Assigned Value**
1. Sound Idea (basic value, product risk)	$0-$500,000	$ 275,000
2. Prototype (reduces technology risk)	$0-$500,000	$ 300,000
3. Quality Management Team (reduces execution risk)	$0-$500,000	$ 350,000
4. Strategic Relationships (reduces market risk and competitive risk)	$0-$500,000	$ 150,000
5. Product Rollout or Sales (reduces financial or production risk)	$0-$500,000	$ 75,000
	PRE-MONEY VALUATION	**$ 1,150,000**

2.3. Venture Capital (VC) Method

Venture Capital (VC) Method is based on the rudimentary application of the **Dividend Discount Model** onto the statistical data sourced from the industry sector in which the start-up aims to operate.

The method in a nutshell:

Pre-money valuation = [Post-money valuation] - [Investment]

Post-money valuation = [Terminal value] ÷ [Expected Return on Investment (ROI)]

As for the **Expected Return on Investment (ROI)**, Angel investors typically target 10x-30x ROI on each individual investment.

The **Terminal value** = the anticipated value of the company at exit date (typically 4-7 years in the future).

The **Terminal value** under this method can be calculated in one of the two ways:

Approach 1:

Terminal value = [Anticipated future revenue at exit date] x 2

The [**Anticipated future revenue at exit date**] is estimated by researching the average sales of established companies within the same industry.

Approach 2:

Terminal value = [Anticipated future after-tax earnings at exit date] x [P/E ratio of similar public start-ups in that industry]

Anticipated future after-tax earnings = [Anticipated future revenue] x [Anticipated future after-tax profit margin]

Under this model, investors would typically calculate both multiples and take the average of the two. And if future rounds of funding are expected (which would create dilution), this further reduces the current pre-money valuation. The valuation will also be reflective of the type of investor.

2.4. Summary & Critique of the 3 methods

2.4.1. Scorecard and Berkus methods

In a nutshell, the Scorecard and Berkus methods are quite closely related to each other, in that they *both*:

1. Start with the assumption that at exit date a company will be worth in the ballpark of $20M.
2. This future value then:
    a. Gets discounted into the present value; and
    b. Adjusted for:
        i. Risks, and
        ii. Size of the Opportunity.

The biggest shortcomings of these 2 valuation methods are:

First, the "dynamic range" of the risk and the size of opportunity adjustment factors are restricted to *such* a ridiculous extent, that it:

- Causes the *unviable* start-ups to appear viable because they are discounted to a much lesser degree than they should have been (which induces the Angels into making investments that are *nearly certain* to lose them money); and
- *By design* "hides" the start-ups with exceptionally-high potential (the earlier-mentioned "diamonds" that would make the Angel investors rich) in the metaphorical "pile of glass beads" by adjusting their valuation (and esp. their valuation potential) well below their true value.

If we consider the earlier-presented example of the Scorecard method use, they assigned:

- 150% score to the value-enhancing factor "a huge market opportunity";
- 75% score to the increased risk factor "the start-up is playing in a highly competitive environment"; and
- 125% score to the risk-reducing factor "the team is strong".

Given that (1) the maximum-achievable Terminal Value is directly proportional to (and is fundamentally restricted by) the size of the Total Addressable Market (TAM), and (2) depending on the market niche, TAM can vary by many orders of magnitude (in principle, from zero to $ trillions per year), then it's *wholly inadequate* to increase the start-up's valuation (hence by implication its Terminal Value) by just 12.5% (= 25% of 50% increase) to reflect the possibly 10,000%-100,000% (100x-1000x) greater Terminal Value potential.

Furthermore, if the company's offer to the market can be characterised as "sound but unexceptional" (which is what I would surmise from the "Product/technology =100%" assessment), then that would *dramatically* reduce the start-up's chances of getting a secure foothold in the market. Therefore again, to adjust the start-up's valuation down by *only* 2.5% (=10% of 25% reduction) is *pure insanity!*

And as for the team quality, enhancing the company's valuation by only 7.5% (= 30% of 25% increase) when the team is strong, should also be seen as significantly underestimating the importance of the team's value.

Second, both of these methods fail to make a meaningful distinction between factors that are largely under the *control* of the players (i.e. the factors to which the companies and/or Angels have the power to make major changes if they choose to) vs. factors that can't really be affected in a materially significant way. After all, Angels are usually *expected* to contribute their business skills and connections (and not just their money)!

For example, if (1) the company's offer to the market is unexceptional, and (2) that market niche is already full of competitors, then the company will have no choice but adopt the "red ocean" strategy of trying to increase its market share through "the battle of attrition". Under these circumstances, the probability of this company eventually becoming well-established and one of the major players is low; and there is normally not a great deal that either the founders or the Angels could do to change that.

On a similar note, if the company's TAM is small for fundamental reasons (and there is no practical way of adapting the company's offer to other (and bigger) market niches), then that puts a fundamental upper limit onto the magnitude of the valuation that this company could *ever* manage to achieve; and there might be little that founders or Angels could do to change that.

On the other hand, if the business idea (i.e. technology + business strategy) is strong, but the team lacks some core competencies, this kind of problem oftentimes can be eminently fixable if:

- The founder(s) have the right mind-set (i.e. have the right amount of perseverance and motivation, as well as the attitude whereby they accept and welcome outside help); and
- The missing set(s) of skills are common enough to be obtainable in the job marketplace.

On the other hand, if the founder(s) have the type of personality that would cause them to *resist* "all attempts of outside interference", then this problem might indeed be unfixable.

In conclusion, all of the abovementioned factors make Scoreboard and Berkus valuation methods basically *qualitative* tools/checklists for judging the quality of start-ups, with a pseudo-scientific "quantitative" veneer affixed to their surface to give the Angels a comforting illusion that "they know what they are doing" quantitatively. But these are *not* quantitatively-valid valuation tools!

2.4.2. The VC method

The VC Method is quantitatively superior to the Scorecard & Berkus methods, because it drops the artificial assumption that all companies have basically the same valuation ($1-2M in the pre-revenue stage; and in the ballpark of $20 once well-established) *regardless* of their industry or any other details, and instead:

- Is derived from the scientifically solid **Dividend Discount Model**; and
- Uses the statistical data sourced from the *directly-relevant* industry sectors.

However, even though the VC Method has been derived from the scientifically-solid first principles, it's crafting got "botched" along the way, making it much less fit for the *primary* intended purpose (of making Angels' (and also VCs') investment activities profitable): as mentioned at the beginning of this article, the fit-for-purpose start-up assessing tool should be able to do well 2 things:

1. Make it possible to identify diamonds in the pile of glass beads; and
2. Assess the valuations of those companies properly.

The biggest problem with the VC method (which makes it a completely inadequate tool for achieving the above 2 operational objectives) is that it's been designed to answer the question "*What is the likely fair market value of an average company in industry X?*" rather than "*How likely is this particular start-up to be one of those potential "diamonds" that I should make sure to be investing in?*"

The VC method fails at the latter because:

- It ignores the issues related to the *probability* of the company's eventual success (which can vary *dramatically* depending on factors like the quality of the business idea, the competitiveness inside the sector, the quality of the team, etc. In fact, this method contains the built-in assumption that the success rate is *at least* 3.3%-10% – which is on the "optimistic" side for the VC sector (where the success rates tend to be in the ballpark of 5%), and "unrealistically optimistic" for the Angel sector (where the success rates tend to be in the ballpark of 0.5%)); and
- It's completely unsuited for detecting the diamonds, because *by design* it automatically assumes that the future performance of *all* start-ups will be *average* for their respective industry sector (how *possibly* can a technique detect diamonds if it is *fundamentally* based on the assumption that diamonds *don't* exist?).

To put it another way:

- The Scorecard and Berkus methods correctly identify the most relevant success factors, but then make a ***complete mess*** at *quantifying* them; while

- The VC method:
  - Uses considerably more valid quantification techniques for the factors that it *does* choose to quantify, but it ***completely ignores*** some of the most important factors; and
  - Is specifically designed ***not*** to detect diamonds by *explicitly assuming* that *all* companies will be nothing but "average".

As a result, *all three* of the most commonly used valuation methods are ***not fit*** for the tasks they are currently being used for.

3. The Mathematically-Correct Valuation Methodologies

One of the most widely used equity analysis and valuation tools is the **Dividend Discount Model** (DDM) (also known as the Gordon Growth Model, or Discounted Cash Flow Model), which is based on the theory that company's stock is worth the sum of all of its future dividend payments, discounted back to their present value.

The Dividend Discount Model is a universal concept that allows investors to calculate the value of a share of stock exclusive of current market conditions, which makes it possible to make apples-to-apples comparisons among the companies in different industries.

Essentially, the Dividend Discount Model emulates the scenario where a passive investor, who wants to achieve a rate of return ***r***, buys 100% of the company by paying its valuation $\boldsymbol{V_0}$ with the expectation that:

- Company's operating profits will be paid out as dividends for as long as the company continues to exist; and
- The resulting cash flow will be such that it will produce the average annual returns ***r*** on the investment amount V_0.

Therefore, in its simplest embodiment, the Dividend Discount Model can be expressed by the following formula:

$$V_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{2}$$

where:

- V_0 = company's present valuation;
- $\boldsymbol{D_t}$ = the expected total dividends at the end of the future time period ***t***; and
- ***r*** = the required (by the investor) rate of return per time period (per year, per quarter, etc.).

3.1. Constant growth scenario

Under the scenario where the dividends will grow at the constant rate ***g*** in perpetuity, eq. (2) transforms into the more famous version of the **Gordon Growth** formula:

$$V_0 = D_0 \frac{1+g}{r-g} \tag{3}$$

where D_0 = the value of *this* year's dividends.

3.2. Mature steady-state scenario

Lastly, let's consider the steady-state scenario (where $g = 0$ and $D_t = D_{max}$).

This can happen if:

- The company becomes a huge success and ends up *completely* monopolising their market segment (which is the objective that the most ambitious companies should aspire to); and
- That market segment size and the profit margins remain static (hence (1) further growth no longer possible, and (2) the monopoly position remains in effect).

Under this scenario the **Gordon Growth** formula turns into:

$$V_0 = \frac{D_{max}}{r} \tag{4}$$

In other words, eq. (4) represents the ***maximum achievable valuation*** if a company:

- Completely and permanently monopolises their target market sector; and
- Does not venture (successfully) outside of that sector.

3.3. Resale value

Furthermore, eq. (2) can be re-written as:

$$V_0 = \sum_{t=1}^{N} \frac{D_t}{(1+r)^t} + \sum_{t=N+1}^{\infty} \frac{D_t}{(1+r)^t} = \sum_{t=1}^{N} \frac{D_t}{(1+r)^t} + \frac{1}{(1+r)^N} \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} \tag{5}$$

where:

- the 1st term represents the time-discounted sum of dividends paid out during the first *N* time periods; and
- the 2nd term represents the time-discounted company's valuation *right after* the N^{th} dividend has been paid out.

Or in other words:

$$V_0 = \sum_{t=1}^{N} \frac{D_t}{(1+r)^t} + \frac{1}{(1+r)^N} V_N \tag{6}$$

This elegantly reflects the fact that (assuming the adequate market liquidity) during *any* time period *N* investors would have 2 choices:

1. To sell it to other investor(s) for a lump sum equal to the *contemporaneous* fair market value V_N; or
2. To continue holding it (in anticipation of future capital gains + collecting more dividends).

3.4. Required rate of return

Generally speaking, the Investor's Required Rate of Return ***r*** comprises 5 separate components:

1. The Risk-Free Interest Rate. Currently, in the UK it is ~1.48%; and in the US ~2.87%.
2. An Inflation Premium = the rate that is added to an investment to adjust it for the market's expectation of future inflation.
3. A Liquidity Premium that is applied to the thinly-traded investments where there is a very real possibility that they will not be able to dump the stock or bond in a short period of time because buyers are scarce. This is expected to compensate them for that potential loss. The size of the liquidity premium is dependent on an investor's perception of how active a particular market is.
4. Default Risk Premium, applied in the situations where investors believe that there is high likelihood that a company will default on its obligations or go bankrupt.

5. Maturity Premium (that applies only to bonds) is designed to compensate for the risk of the future bond interest rates going up (which would cause the bond prices to go down, because bond interest rates have the inverse relationship with the bond prices). The further in the future the maturity of a company's bonds, the greater the risk and the greater the maturity premium.

One of the most popular ways of calculating the value of ***r*** for *listed* stocks is the Capital Asset Pricing Model (CAPM):

$$r = r_f + B(r_m - r_f) \quad (7)$$

where:

- r_f = the rate of return on risk-free securities (typically Treasuries);
- r_m = the market's overall expected rate of return. Its long-term estimates tend to fall in the range of 4-7%.
- *B* = the beta of the investment in question. It's determined by analysing how much its return fluctuates in relation to the overall market return. A stock with a beta of 1.0 will tend to move higher and lower in lockstep with the overall market. Stocks with a beta greater than 1.0 tend to be more volatile than the market, and those with betas below 1.0 tend to be less volatile than the underlying index. Stocks with betas of zero generally move independently of the broader market. And stocks with negative betas tend to move in the opposite direction relative to the broader market.

As far as investments in the predominantly IP/IA-driven firms is concerned (i.e. intellectual property ("IP") or other intangible assets ("IA") – which includes most tech (esp. software) companies), the typical required annual rate of return values for the different investor profiles are:

- Angel: 60-70%
- Venture Capital: 30-35%
- Private Equity: 20+%
- Public Company: 12-20%

The above are the "typically used" ***r*** values, but as I will detail in another section of this document, there are major issues with how ***r*** is being currently calculated in cases involving early-stage start-ups (especially Angel stage, but also Venture Capital stage).

3.5. Potential issues with DMM

While the *concept* of the Dividend Discount Model is mathematically solid, there are several potential problems with it (and especially with eqs. (2) and (3)):

3.5.1. Dividend distribution

The Dividend Discount Model appears to have a limitation in that it requires that a company distributes dividends, while it's not uncommon for stocks (esp. high-growth tech stocks) *not* to pay dividends.

This issue is easily resolved by modifying the definition of $\boldsymbol{D_t}$ from "dividends that *will* be paid" to "dividends that he company *would be able* to pay if its shareholders were to vote to distribute all company's operating profits as dividends instead of reinvesting them back into the company". This is because for the profitable companies *not* to be paying out dividends is a matter of *choice* rather than *ability*; and therefore somebody who owns 100% of the company, has *complete control* over whether the dividends are paid out or not.

3.5.2. Non-dividend factors

Equations (2) and (3) appear *not* to take into account non-dividend (but value-enhancing) factors like exceptional brand names, customer loyalty, unique intellectual property, etc., which can lead to stocks in those companies to end up being undervalued by a significant factor.

The answer to *this* particular issue lies in the fact that the abovementioned value-enhancing factors do indeed increase the company's valuation by *implicitly* (1) increasing the present and future $\boldsymbol{D_t}$ values, and (2) reducing ***r*** value, because they make the profit margins more sustainable longer-term by making the company more immune to the competition.

In other words, *in the presence* of those factors the current and future profitability of a company will likely be higher than *in their absence*; and the probability of a company declining or going out of business in the future will be lower (and this diminished risk of failure reduces the value of ***r*** by attracting *more risk-averse* investors who are content with lower rates of return).

The only difficulty lies in quantifying their effect on the company's resistance to the future competition – but that's part of a *general* "difficulty in accurately predicting the future" problem that will be a major factor no matter which valuation methodology one would choose to use.

3.5.3. Difficulty in factoring the risks in complex multi-scenario situations

One of the biggest issues with eq. (2) is that it's *not* designed to take into account the *multi-scenario* situations (whereby a company's future can feasibly take several distinctly different paths, each of those paths producing dramatically different outcomes and their associated valuations).

This is not a big problem in cases of *well-established* companies that are most likely to continue on their already-well-established gradual evolution path, in which case their future financial performance can be extrapolated with a reasonable degree of accuracy.

But this is a *huge* problem in cases of early-stage start-ups, where *at least two* (and oftentimes more) major future paths are possible, ranging from a fantastic runaway success (if everything goes right) in one extreme, all the way to the "complete failure to launch" and subsequent bankruptcy (if enough goes wrong) in the other extreme, and a few possible scenarios in-between. Then, depending on the scenario assumed, the valuation can vary *anywhere* between "close to zero" and "billions", because *both* the values of D_t's and ***r*** can vary by orders of magnitude, depending on the scenario.

This means that in order to be able to use eq. (2) for calculating V_0 of an early-stage start-up, one would need to be able to figure out the "average" D_t's and ***r*** for a *collection* of several very-widely-differing scenarios.

While calculating reasonable D_t averages *might* be feasible in a number of situations, ***r*** is an *entirely different* story, because there appears to be a significant degree of confusion regarding how the value of ***r*** should be *correctly* calculated in cases or high-risk illiquid investments: no sources that I could find on internet detail the "universal" methodology for calculating ***r***; and in fact some of the websites that delve into this subject, *explicitly* admit that "*no one really knows for certain the appropriate expected rate of return to use*".

As a consequence, what we basically see is the situation where ***r*** can be estimated quite reliably *only* in the "low investment risk" situations (e.g. in cases of *listed* companies), but everything *outside* of that (e.g. Venture Capital, and especially Angel situations) appear to operate *purely* on the basis of "*rule of thumb*" or "*these are the **r** values that others in this part of the industry are using*" which, under a bit more scrutiny (as detailed in section 1.1), reveal themselves *not* to be statistically sound, hence provide *significantly less* downside protection for the investors than they believe to be the case.

The main source of difficulty regarding figuring out the correct value of "average" ***r*** is the fact that ***r*** incorporates inside of it two *independent* (from each other) factors: the actually-desired ROI target and whole-portfolio risk mitigation; and when you combine that with the fact that nobody seems to know what the formula for calculating the value of ***r*** is in high-risk start-up situations (and in fact it's quite possible that such formula might not even exist), then it's clear that a different approach is needed for calculating V_0 in these kinds of situations.

The solution to this "Gordian knot" lies in:

- Going back to the first principles of the fundamental definition of the V_0 (= "the sum of all of its future dividend payments, discounted back to their present value"); and
- Applying to it the techniques for calculating the *statistical mean* of the multi-scenario event outcomes.

In this case V_0 definition becomes "*scenario-weighted statistical mean* of future dividend payments, discounted back to their present value"; and the **Dividend Discount Model** (DDM) becomes "***Scenario-weighted* Dividend Discount Model**" (SWDDM).

Other possible names (that have the advantage of easier pronounceability) for this model are:

- "***Multi-Scenario* Dividend Discount Model**" (MS-DDM or M-DDM); and
- "***Probabilistic* Dividend Discount Model**" (P-DDM).

Under this scheme, ***r*** contains *only* the desired ROI target (incorporating the earlier-mentioned components like the Risk-Free Interest Rate, the Inflation Premium and the Liquidity Premium); while the risks associated with the future uncertainty (including the Default Risk Premium) are moved into the "*scenario probabilities*" parameters that are *considerably easier* to deal with than trying to estimate the "average ***r***". Furthermore, for the reasons that will be detailed a bit later, the value of ***r*** would be different for *each* time period under *each* scenario.

After taking all of the above into consideration, the *universal* formula for calculating the valuation becomes:

$$V_0 = \sum_{S=1}^{M} \sum_{T=1}^{\infty} D_{TS} P_{TS} \prod_{t=1}^{T} \frac{1}{1 + r_{tS}} \tag{8}$$

where:

- D_{TS} = the expected total dividends at the end of the future time period ***T*** under the scenario ***S***;
- P_{TS} = the probability of scenario ***S*** playing out during the time period ***T***;
- r_{tS} = the "de-risked" required rate of return during the time period ***t*** under the scenario ***S*** (i.e. the actually-desired ROI target); and
- M = the number of possible future scenarios being considered. In case of start-ups, M cannot be less than 2 (so that *both* the (1) complete success and (2) complete failure future scenarios are taken into account).

The most important advantage of eq. (8) is that it is ***the most general* embodiment of the Dividend Discount Model**, therefore it can be applied to *any* situation: from the earliest-stage start-ups (even including the "idea" stage), all the way to the most mature companies.

This model is universal because:

- The **Dividend Discount Model** is *the only* quantitatively-correct concept for calculating companies' valuations, because it's derived from *the first principles* of the fundamental concept of investing; and
- *All* companies are *always* facing *more than one* possible future; and ***M-DDM*** can accommodate an *unlimited* number of future scenarios.

Equation (8) might appear to be bewildering and intimidating, but in reality it's quite simple, and most importantly, it's very easy to program into an easy-to-use spreadsheet.

To make its meaning easier to grasp, eq. (8) can be re-written as:

$$V_0 = \sum_{S=1}^{M} \sum_{T=1}^{\infty} D_{TS} P_{TS} d_{TS} \tag{9}$$

where d_{TS} is the future value discount factor for the time period T under scenario S:

$$d_{TS} = \frac{1}{1+r_{1S}} \cdot \frac{1}{1+r_{2S}} \cdot \frac{1}{1+r_{3S}} \cdots \frac{1}{1+r_{TS}} = \prod_{t=1}^{T} \frac{1}{1+r_{tS}} \tag{10}$$

In other words, d_{TS} is the *generalised* form of the $\frac{1}{(1+r)^T}$ "future cash flow discount factor" from eq. (2).

And probably the easiest-to-understand form of eq. (8) is:

$$V_0 = \sum_{S=1}^{M} P_S V_{0S} = P_1 V_{01} + P_2 V_{02} + \cdots + P_M V_{0M} \tag{11}$$

where:

- V_{0S} is "what the *current* **valuation** of the company would be if we were certain that scenario ***S*** was *definitely* going to unfold in the future"; and
- P_S is the currently-assessed **probability** of scenario ***S*** unfolding in the future.

Example 1:

If a (well-established) company is launching a major new product that is estimated to have:

- Probability P_1 of becoming a major success producing a series of future dividends D_{t1} (a.k.a. "future scenario 1") and the corresponding valuation V_{01};
- Probability P_2 of being a flop, producing a series of future dividends D_{t2} (a.k.a. "future scenario 2") and the corresponding valuation V_{02}; and
- r_{tS} is expected to stay nearly constant within the extent of this simulation (i.e. $r_{tS} = r$ for all values of ***t*** and ***S***),

THEN:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_{t1}P_1 + D_{t2}P_2}{(1+r)^t} = P_1 V_{01} + P_2 V_{02}$$

3.6. Required rates of return & scenario probabilities

It is important to highlight the fact that in ***general*** case (eqs. (8)-(10)) the r_{tS} and P_{TS} values will be *individually different* for *each* combination of time period ***T*** and scenario ***S***, because a company's valuation (i.e. resale value) at *any* given moment in time will be "*what the potential buyers at that time (given the contemporaneously-available information) would be willing to pay for it*" – which potentially can differ by many orders of magnitude; and would be *implicitly* determined by r_{tS} and P_{TS}:

- P_{TS} = the perceived probability of more-favourable or less-favourable scenarios playing out in the future; and
- r_{tS} – by virtue of attracting *different groups* of potential investors with differing rate of return preferences.

Specifically:

1. IF a company is doing well (and/or its future prospects look solid), then:
    a. In the prospective buyers' minds there is a *greater* probability P_{TS} of the future scenario involving *larger* D_{TS}; and

b. The lower degree of investment risk will attract *more conservative* investors who are content with *lower* rates of return (hence lowering r_{tS}).

2. IF a company is doing poorly (and/or its future prospects look dim), then:
   a. In the prospective buyers' minds there is a *lower* probability P_{TS} of the future scenario involving larger D_{TS}; and
   b. The higher degree of investment risk will *scare away* the more conservative investors, hence only *more-risk-tolerant* potential buyers would remain in the picture; and they would require *higher* rates of return (hence raising r_{tS}).

To do the valuation calculations *properly*, information about *all* major foreseeable scenarios must be inputted. In the case of start-ups, *at least two* distinct scenarios must be incorporated into the valuation calculations: "maximum achievable success" and "complete failure".

It's also important to note that the range of possible r_{tS} values (if eq. (8) is used) is going to be *considerably narrower* than the range of possible r values (when eq. (2) is used), because r incorporates the Default Risk Premium (which can vary *widely* depending on the situation, esp. in cases of start-ups), while the scope of r_{tS} is mainly confined to the investors' sentiment "*what kinds of returns would I realistically find acceptable once the downside has been covered?*" – which falls into the considerably narrower range than r in eq. (2).

4. The practical method for calculating technology start-ups' valuation

Here is an easy-to-use method for calculating the early-stage technology start-ups' valuations:

In its *simplest* form, only the following 2 scenarios are to be considered:

1. Scenario 1 (S=1) with probability P_1: "Maximum achievable success" whereby the company eventually gets to dominate their market segment; and
2. Scenario 2 (S=2) with probability P_2: "Complete failure" whereby the company never becomes profitable and eventually goes bankrupt. Under this scenario $D_{T2} = 0$ (for *all T*).

In that case, the current valuation would be:

$$V_0 = P_1 \sum_{T=1}^{\infty} D_{T1} \prod_{t=1}^{T} \frac{1}{1 + r_{t1}} \tag{12}$$

where:

- D_{T1} should be increasing at an aggressive growth rate (after all, this is the "maximum success" scenario!) until levelling off at the value D_{max} that it would achieve if it were to get to *completely* dominate its target market segment; and
- r_{11} should start probably in the 30% neighbourhood; and as ***t*** increases, r_{t1} should gradually settle to the r_{min} value (in the ~15% neighbourhood) – because successful companies attract conservative investors whose required rate of return is modest.

The maximum-achievable valuation V_{max} (when the company reaches the steady-state stage of complete market segment domination), according to eq. (4) would be:

$$V_{max} = \frac{D_{max}}{r_{min}} \tag{13}$$

where

$$D_{max} = \$_{max} f_{max} m_{max} \tag{14}$$

Hence

$$V_{max} = \frac{\$_{max} f_{max} m_{max}}{r_{min}} \quad (15)$$

where:

- $\$_{max}$ is the total annual market size (which is equal to either the Total Addressable Market (TAM) or the Total Addressable Problem (TAP);
- $f_{max}$is the fraction of TAM or TAP that under the best case scenario a company would capture;
- m_{max} is the best-case-scenario profit margin in the steady-state stage.

The difference between **TAM** and **TAP** can be considerable:

The **Total Addressable Market (TAM)** should be used for the valuation calculations in cases where there are *already* products or services in the market that do basically the same thing and at a comparable price point as this company's offer – which means that:

- The overall size of the market segment is likely *not* to change by much; and
- The key to the company's success lies in taking the market share away from the competition. This is also known as "The Red Ocean Strategy".

The **Total Addressable Problem (TAP)** should be used for the valuation calculations in cases where the company's offer is *so much* superior to what's currently available in the market, that:

- The size of that market will expand considerably; and
- All this newly-created business will end up in the hands of this company. In this case the key to the company's success lies in creating this new market and then quickly monopolising it *unopposed*. This is known as "The Blue Ocean Strategy".

"The Blue Ocean Strategy" scenario is possible under the following circumstances:

- When the price and/or features of the new offer are so attractive, that they create new demand that wasn't there before; or
- The new offer is able to fulfil the pent-up demand that the current market players aren't able to fulfil for various reasons (e.g. not possible technologically or economically under the existing model).

Furthermore, given that expanding into a "new territory" unopposed is usually much easier and quicker than to gain the territory through the battle of attrition, this means that the probability P_1 of the "rapid and huge success" scenario is likely to be considerably greater in the "Blue Ocean" cases where the company's offer is such, that **TAP** is much greater than **TAM**.

According to the Harvard Business Review article "***GROWTH STRATEGY: The Mindset Your Company Needs to Grow Organically***":

> "… successful founders focus on the Total Addressable Problem (TAP). Instead of looking at how much market share they can get for products that already exist, they look at how much market they can create by solving problems that already exist.
>
> Managers focus on maximizing one's share of the market for existing products. Founders focus on finding new markets to solve existing but underserved problems."

Finally, the formula for calculating the "best case scenario ROI" or the "maximum valuation increase multiple" X_0 (i.e. by what factor the value of the original investment would increase under the best case scenario), is:

$$X_0 = \frac{V_{max}}{V_0} \quad (16)$$

5. Start-up valuation evolution

As we can see from eq. (8), the increase in ***V*** can achieved through the combination of:

1. Maximising D_{ts};
2. Increasing D_{ts} sooner (through faster growth);
3. Maximising P_{ts} for the scenario(s) under which D_{ts} are the largest and r_{ts} are the smallest; and
4. Minimising r_{ts}.

Let's now take a closer look at the likely evolution (and the changes in relative importance) of the 3 parameters (D_{ts}, P_{ts} and r_{ts}) as a company evolves through its developmental stages from the early start-up and into the mature market domination (if things go well); and see which parameters play the most important roles in determining the company's valuation at each of those different stages; hence improving on which should be prioritised (and when and how).

5.1. Early stages

In the earliest stages of the company's development, by far the most dominant factor depressing the technology start-up's valuation is the suppressed probability that it will achieve "huge success".

The Angel industry success rates statistics (according to Jason Calacanis, who is considered to be one of the most successful Silicon Valley Angel investors) is that a good Angel investor would invest on average in 1 start-up founder for every 50 he speaks to, which means the he would make ~200 bets after reviewing over 10,000 start-ups (which can take about a decade to do). And then out of those 200 investments, 190+ will flop, a few will produce unimpressive returns, and one of those 200 investments will make 99.9%+ of the overall returns (by returning ~5,000X the original investment).

Some Angels (especially the ones that are able to significantly increase their chosen start-ups' P_1 because of their relevant specialist skills and connections) are able to achieve a notably higher success rate than above, but the majority will probably achieve even lower success rates.

If for the purposes of the Angel-stage start-ups' valuation calculations we were to consider 3 scenarios:

1. "Huge success" (S = 1) that returns $X_1 = 5{,}000$ times the original investment;
2. "Unimpressive returns" (S = 2) that returns X_2 (= a few hundred %?) the original investment; and
3. "Total loss" (S = 3) that produces complete loss of the original investment (i.e. $X_3 = 0$);

Then the abovementioned Calacanis' statistics implies that the associated scenario probabilities would be:

1. $P_1 \approx 0.5\%$
2. $P_2 \approx 2.5\%$
3. $P_3 \approx 97\%$

In that case, as per eq. (11), the current valuation will be:

$$V_0 = P_1 V_{01} + P_2 V_{02} \approx P_1 V_{01} \qquad \text{(because } P_1 V_{01} \gg P_2 V_{02}\text{)} \tag{17}$$

and where V_{01} is the valuation under the scenario that eventually ends up with the company worth V_{max} (i.e. $V_{01} =$ appropriately "time-discounted" V_{max}).

The "proper" way of calculating V_0 is by plugging the "best case scenario" figures for D_{t1} and r_{t1} into eq. (12), but given that in the majority of cases the biggest source of inaccuracy will come from the uncertainty in the value of P_1rather than from the future discounting factor, then in those cases eq. (17) becomes:

$$V_0 \approx P_1\langle d_1\rangle V_{max} = P_1\langle d_1\rangle \frac{\$_{max} f_{max} m_{max}}{r_{min}} \tag{18}$$

where $\langle d_1\rangle$ is the "average" future discounting factor.

As we can see from the last equation:

- The factors like the **quality of the business idea and product** (including the size of the target market) are *mainly* contained within V_{max};
- The **quality of execution** (including the quality of the team and the quality of the business development plan) is contained primarily in P_1; and
- The anticipated **speed of progress** – in the time discount factor $\langle d_1\rangle$.

Under the assumption that D_{t1} will grow rapidly year-after-year and will approach D_{max} after Y years, the time-discounting process can be approximated to the scenario where D_{t1} were 0 during the first $y \approx 75\%$ of Y, and then became D_{max} afterwards, in which case eq. (6) leads us to the $\langle d_1\rangle$ estimate of:

$$\langle d_1\rangle \approx (1 + \langle r\rangle)^{-yY} \tag{19}$$

Where the "average ***r***" can be assumed to be $\langle r\rangle \approx 25\%$.

In that case, under the hypothetical scenario where a company would reach its full potential 7 years from now, $\langle d_1\rangle \approx 0.3$.

So to summarise all of the above, the **valuation formula for a high-potential technology start-up** is:

$$V_0 \approx P_1 \frac{\$_{max} f_{max} m_{max}}{r_{min}} (1 + \langle r\rangle)^{-yY} \tag{20}$$

where:

- P_1 is the probability of the "huge success" scenario, basically defined as "*fully capturing the relevant market worldwide within a reasonable time period (of 5-10 years)*". The most common factors that can prevent a company from achieving this success, are:
    d. Lack of interest in the market;
    e. Actions of the competitors;
    f. Company's management's inability to execute the business plan well enough.
- $\$_{max}$ is the total annual market size (which is equal to either the Total Addressable Market (TAM) or the Total Addressable Problem (TAP)).
- f_{max} is the fraction of TAM or TAP that under the best case scenario a company would convert into revenue.
- m_{max} is the best-case-scenario profit margin in the steady-state stage. This factor depends on the constraints of the business model, and how efficiently the company will be run.
- r_{min} is the *mature company* rate of return in that company's industry. In the *technology* sector, $r_{min} \approx 15\%$.
- $\langle r\rangle \approx 25\%$ is the "average time-discounting ***r***".
- Y = the number of years it's expected for a company to take before it comes close to reaching its plateau; and
- $y \approx 0.75$ is the "averaging factor".

Then:

$$X_0 = \frac{V_{max}}{V_0} = \frac{1}{P_1\langle d_1\rangle} = \frac{(1 + \langle r\rangle)^{yY}}{P_1} \tag{21}$$

Example 2:

Let's consider a hypothetical example of a technology start-up that's aiming to monopolise the $100 million/year industry niche; at which point it's expected to be operating at a 20% profit margin; and if things go well (the probability of which is estimated to be 1%), then the company expects to reach that stage in 5 years.

In that case:

- $\$_{max} = £100m$
- $f_{max} = 100\%$
- $m_{max} = 20\%$
- $P_1 = 1\%$
- $Y = 5$

which yields:

- Current valuation $V_0 = \$577{,}000$
- Maximum achievable valuation $V_{max} = \$133\ million$
- The multiple $X_0 = 231$

(this is assuming that the company *does not* expand into other niches, which *could* increase its valuation considerably if the new target market is much bigger than the original one)

Given that the 2 most important factors in the early-stage technology start-ups are D_{max} and P_1, this means that the primary job of Angels and Advisors is to add value to a company by using their money, skills, insights & connections in order to increase those two factors (or at least one of them); and to achieve that as quickly as possible.

D_{max} can be increased by using everybody's expertise and insights to:

- Find ways how to get to dominate the niche (and how to achieve this faster);
- Identify more or bigger TAMs and/or TAPs (i.e. increase $\$_{max}$); and
- Find ways to increase f_{max} and m_{max}.

P_1 can be increased primarily through:

- Identifying more effective business development strategies;
- Identify the likely ways and reasons that could cause the project to fail and proactively address them; and
- Making sure the team is sufficiently resourced in all important aspects (money, personnel, talents, etc.).

If the project's success depends on the list of objectives, *each* of which must be completed successfully for the project to succeed (e.g. all are a part of the *critical path*), then the probability of the project's overall success will be:

$$P_{project} = P_{sub_1} \cdot P_{sub_2} \cdot P_{sub_3} \cdots P_{sub_N} = \prod_{i=1}^{N} P_{sub\_i} \tag{22}$$

where P_{sub_i} are the sub-projects within the project.

By looking at the above equation, one can see that:

- If *each* sub-project has a high probability of success, then the whole project has a high probability of success; but
- If *just one* sub-project has a low or zero probability of success, then the whole project has low or zero probability of success.

The major "sub-projects", probabilities of which should be *explicitly* considered, are:

1. P_{pf} ("*product feasibility*") = the probability that the promised product is technically and financially feasible (i.e. there are no technical reasons why a competent production team would not be able to create it, and do it at an acceptably-low cost);
2. P_{ptc} ("*product team competence*") = the probability that either the current team is competent enough to create the product, or such team can be created;
3. P_{ma} ("*market appeal*") = the probability that the market will like (and buy!) that product once it's been made aware of it;
4. P_{mc} ("*marketing campaign*") = the probability that the proposed marketing campaign will be successful (or alternatively, that a successful marketing campaign can be designed);
5. P_{dtc} ("*delivery team competence*") = the probability that the sales team, delivery team and customer support team will be capable of doing what's required of them (or alternatively, that such teams can be successfully assembled);
6. P_{mtc} ("*management team competence*") = the probability that the management team will be able to cope well at each stage of the process;
7. P_{nma} ("*no major adverse*") = the probability that there won't be some kind of a major adverse event that would sabotage the success under the scenario where the above factors have worked out well.

5.2. Later stages

In later developmental stages (especially when P_1 comes sufficiently close to 100%) the *further* future valuation increase potential can come from the combination of:

- Finding further ways of increasing D_t (via entering new market sectors, increasing profit margins, etc.); and
- Lowering r (by attracting more conservative investors (esp. the large institutional investors) with lower rate of return requirements as the company evolves into a *much safer* investment).

5.3. An important insight

There is one important insight to be drawn from eq. (23):

Given that:

- The investment multiple $X_0 = \frac{1}{P_1\langle d_1\rangle}$;
- The inverse of the "average" future discounting factor (i.e. $1/\langle d_1\rangle$) in the majority of cases should not exceed ~3 (because most tech start-ups are expected to be showing serious signs of success within 5 years or so if they are *destined* to be a success); and
- If a business idea (the product + the business development plan) are good and well-thought-out, then they should have *significantly better* than 1% probability of success *even* from the early stages (or to put it another way: if the business plan, even with proper resources and support, has less than 1% chance of success, then that's a clear indication that there is something seriously wrong with this plan, which should make it uninvestable!);

This means that X_0 greater than 100 or so (which certainly includes X_0 that's 1000 or more) should not happen if things are done properly; and the fact that such events *do* happen, can *only* mean one of the two things:

1. The valuation figure used for the purposes of early-stage investment was a gross underestimate (by a factor of 10-100) – in which case the founders of that company got seriously short-changed; and/or
2. Something happened *after* that investment took place that increased the company's business potential by a factor of 10-100, compared to what it would have been based on the original business plan presented to the investors (e.g. the company discovered and pursued successfully a much bigger market than what was envisioned initially).

In other words, X_0 of 1000 or more should be seen as Angel investor's stroke of genius *only* in the sense that he or she were *smart* (or lucky?) to have decided to invest in a business venture that was going to make it big (while presumably *all other* investors were *too stupid* to have *passed* on this opportunity?).

But what is clear: if run *correctly*, the Angels' success should not be so vitally dependent on the rare (1 in 200?) windfall profits to offset and compensate for the losses on 95%+ of their investments, but should rely *instead* on significantly lower multiples (under 100) produced by a *significantly higher* percentage of successful investments.

One of the main jobs of a *properly-designed* investment opportunity vetting system (like the one detailed in this document) is to *prevent* a large percentage of investments (that are certain or likely to fail) from taking place, which would then make it possible to achieve the above objective.

Furthermore, a distinction should be made between the instances where (1) a start-up was going to fail because there was something *fundamentally wrong* with its business idea or product (in which case investments in them *should not* be made), and (2) the probability of start-up's success are suppressed because the founders *by themselves* don't have access to certain vital resources (money, expertise, connections) that appropriately-chosen investors could quite easily provide (which is really where the added value of Angel investors and advisors truly lies!).

6. How this framework can be used to revolutionise the way Angels and Founders negotiate and work together for the maximum mutual benefit

The above-detailed methodology provides a better framework governing the founder-Angel relationship, esp. in the early stages of that relationship: from negotiating the investment agreement's terms to maximising the value that Angels can bring into the start-up once they start working together after the agreement has been reached.

6.1. Negotiations stage

As far as the pre-investment talks (and negotiations) are concerned, the main objectives of these talks are:

- **For the investors**: to figure out if this start-up is something they *should* be investing in: if it makes sense for them financially and/or also emotionally; and especially whether this start-up is likely to become a success (and of the magnitude sufficient to make it worth their while).
- **For the founders**: to find out if the investor is a good fit: if, in addition to the money, they *also* can bring to the table *other* resources (skills, connections, etc.) the company needs to succeed. Also, if there is sufficient emotional compatibility.

If both sides decide that this relationship is worth pursuing, then the next major objective is to work out the terms of agreement that *both* sides would find acceptable; and here the issue of valuation is oftentimes one of the main objects of disagreement.

Currently, most people (*both* founders *and* investors) tend to utilise *subjective* techniques when trying to estimate companies' valuations:

- **Founders** tend to overestimate the value, because of their strong emotional involvement, wishful thinking and "*the success stories they'd heard*"; and
- **Investors**, while being more objective on the subject (and oftentimes having more experience) than founders, in the majority of cases operate from the frame of "*the rule of thumb*" and "*this situation looks similar to X*".

As a consequence of the above, the prospective investment negotiations typically start with the Founders having certain ideas or aspirations regarding how much their company is worth; and with prospective investors having *their own* ideas regarding the company's valuation (that are usually significantly lower than those of the founders).

The "name of the game" then becomes to see if the 2 sides are willing to move *enough* towards each other's positions to arrive at a valuation figure that *both* sides find acceptable.

This method might be *adequate enough* in routine situations, but can fail spectacularly in unusual situations; and we know now that start-ups that succeed *big*, are *indeed* highly unusual (1 in a few hundred); and the proper statistical analysis of such situation shows that in situations of this kind, the key to investing success lies *not* in "portfolio diversification", but in "*making sure not to miss out on those rare diamonds in the large pile of glass beads*".

The fact (as detailed in section 2) that the techniques currently used for estimating the start-ups' valuations are so *subjective*, can be harmful to *both* sides:

- The deserving founders can end up being "short-changed" by having to give up too much equity when more objective calculations should have warranted a notably higher valuation;
- Investors are more likely to miss out on those "rare diamonds" (that would put their investment portfolio "in the black") *just because* they did not invest in them because an agreement on the valuation figure could not be reached – which includes the situations (mentioned in section 1.2) where high-potential projects aren't able to secure the funding necessary for proper business plan execution *just because* "the math didn't work out" (the grossly underestimated valuation made the funding deal numerically impossible); and
- If the cap table gets screwed up too much because of the too low a valuation in the early stages, this can make the company uninvestable in the future rounds – in which case the interests of *both* the founders and the existing investors can be hurt in a major, sometimes even fatal, way.

By making the valuation calculations more *objective* and factual, the early-stage start-up valuation calculation methodology (detailed in section 5.1) can make a *significant positive difference* to the negotiation, and also in overall investment outcomes:

First, by making the valuation (and the eventual profit potential) more objective, this methodology can serve as a more effective tool for "separating diamonds from glass beads", thus *increasing* the probability of the investors:

- *Not* missing out on the *genuinely worthy* investment opportunities; and
- Detecting (and *avoiding*) *more* "false diamonds" (which previously looked like "the real thing").

Second, by narrowing down *significantly* the initial gap between the founders' and investors' valuation estimates, it creates a *more productive* starting point for the negotiations, leading to a higher probability of investment deals on the worthy projects being agreed (instead of the negotiations failing).

Also, the higher internal granularity of the valuation discussions will make it possible to narrow down the scope of the disagreements from "we disagree on the valuation figure *in general*" (which can oftentimes lead to an impasse) to disagreements on *specific factors* (which can be discussed in a *much more focused* manner, hence usually making it *easier* to arrive at an opinion that both sides agree).

Third, the higher internal granularity of the valuation discussions will have a major benefit of stimulating the process of "co-operative scrutinising" of the founders' business plans and visions by serving as a valuable "coaching tool" that naturally brings up to the surface and focuses the participants' (Angels' *and* founders') minds on important questions like:

- "This element appears to a weak/vulnerable part of the plan. What needs to happen for it to be significantly improved or strengthened?"
- "Events like Y would have a major influence on factor X (positive or negative). What can be done to affect this?"
- "What needs to happen for this scenario to become more (or less) likely during this time period?"

And if some of the factors needed for calculating Valuations are impossible to estimate from the information contained in the founders' proposals, then that's an indication that this business plan is "undercooked" and might be not investment-ready. Further work on it can either bring in the missing information, or reveal that no good business case can be made for this business idea.

Fourth, this model makes the value of *non-monetary* resources (e.g. skills and connections of *both* the Angels and other key personnel that might need to be brought into the company) more *quantifiable*, leading to better decisions regarding: (1) who and/or what should be hired or acquired, and (2) what price is justifiable vs. not.

So in a nutshell, under this framework, *rather than* the two sides starting the negotiations far apart (for *subjective* reasons) and then seeing if either side can find ways to "knock down" the other side's expectations, the parties *instead* should be spending most of their time on:

1. Focusing on scrutinising the soundness of the founders' business plans and vision;
2. Based on those, find out the numerical value of *which* factors (used in calculating V_0 and V_{max}) they agree on, and on which they disagree; and then:
3. Delve into the details as to *why* they might disagree on the numerical values of those factors;
4. What changes to the current business plans and/or to the currently-available resources would bring significant improvements to the factors that were found to be deficient;
5. What currently-lacking resources the Angel could bring to the table that would cause major improvements to the company's future prospects;
6. *And only* once all of the above have been figured out to a good degree of clarity and detail, the parties should proceed with valuation and equity distribution negotiations.

In other words, instead of starting the valuation negotiations by stating what each party thinks the correct *valuation figure* "should" be, the valuation conversation: (1) should start with discussions aimed at arriving at the consensus (or at least narrowing down the gap) re: the values of the constituent parameters used to calculate the valuation; and *only then* (2) proceed with calculating the actual valuation figures (i.e. once the range of those parameters has been narrowed down *considerably*).