On Conversion of Multiple SAFE Contracts

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1 Introduction

SAFE notes, originally developed by the Silicon Valley seed fund Y Combinator, are contracts used in early stage venture financing, in which a company promises in exchange for money invested that shares will be issued to the investor in a future equity round, with the number of shares issued dependent on the valuation of the company at that time. Equity financing rounds, in which investors buy newly issued shares in a company, are usually *conservative* in the sense that the investor receives shares of value at least equal to their investment. This is not the case in equity financing events when a company has issued convertible instruments such as SAFEs, since the issuance of shares to the SAFE investor triggered by the financing event immediately dilutes the investors purchasing shares.

A previous work [vdMM21], has formalised a "Discounted Valuation" conversion method, that shows that proper accounting, and appropriate discounting of the valuation, ensures that the issuance to the new investor is conservative. SAFEs come in multiple versions. The original "Pre-Money" SAFEs [Y C], depend on which of two parameters called the "Cap" and the "Discount" are included in the contract, giving four versions. Subsequently, Y Combinator issued a revised set of four "Post-Money" versions [Lev18], which change the way that the number of shares issued in conversion of the contract is calculated. (One of these four appears to have been withdrawn.) The paper [vdMM21] considers a scenario in which the company has issued *only one* SAFE (either a Pre-Money SAFE with Cap and no Discount [Y C16], or a Post-Money SAFE with Cap and no Discount [Y C18]) by the time of the equity round.

In the present paper, we describe how the Discounted Valuation method works in equity rounds where the company has issued *multiple* convertible instruments. In particular, we consider the application of the method when the company has issued SAFEs of the same two types (either uniformly Pre-Money SAFEs with Cap and no Discount, or uniformly Post-Money SAFEs with Cap and no Discount)[1]. We also consider the relationship between these two types

[1]We believe that our analytic techniques apply to other forms of SAFE, with only minimal

of SAFE when converted using the Discounted Valuation method.

The main conclusions of this paper are that:

- The Discounted Valuation method extends to the case where multiple SAFEs have been issued, and remains conservative for both the new investors and the SAFE investors.
- Like the single SAFE case, there is a company valuation below which multiple Pre-Money SAFEs cannot be converted using the Discounted Valuation method. For Post-Money SAFEs, there are also valuations at which the SAFEs are not convertible using this method. However, the situation is significantly more complex for Post-Money SAFEs. The inability to convert occurs at higher valuations, and whereas the Discounted Valuation method is not applicable to Pre-Money SAFEs for valuations in a single interval, there may be multiple intervals over which Post-Money SAFEs are not convertible.
- To address the problem that the Post-Money SAFEs are sometimes not convertible using the Discounted Valuation method while the Pre-Money SAFEs are, we propose alternate conversion formulas for SAFE contracts that capture the intuitions underlying the Post-Money SAFEs, but which allow for conversion in all cases in which Pre-Money SAFEs are convertible using the Discounted Valuation method. Indeed, these formulas obviate the need to apply the Discounted Valuation method, since they guarantee conservatism for both the new investor and the SAFE investors.
- In the situation where the company has issued a single SAFE contract, [vdMM21] showed that a correspondence between Pre-Money and Post-Money SAFEs, in the sense that for each Pre-Money SAFE, there is a Post-Money SAFE which, when converted using the Discounted Valuation method, yields the same share distribution as the Post-Money SAFE. In general, this correspondence does not hold with multiple SAFEs. However, we show that in scenarios where all Pre-Money SAFEs have been issued at the same Cap, there exists a scenario in which the company has issued instead a set of Post-Money SAFEs, with the same share distribution resulting under the Discounted Valuation method in these two scenarios. (There is, however, a limitation to this result in that the correspondence applies only at the level of the entire scenario, and not at the level of the individual SAFEs.)

The structure of the paper is as follows. Section 2 recalls a set of equations governing equity financing rounds, and gives a formal description of the conversion provisions in two types of SAFE contracts, the Pre-Money SAFE with Cap and no Discount, and the Post-Money SAFE with Cap and no Discount. A general description of the Discounted Valuation method is given in Section 3. The result of applying this method for conversion of multiple Pre-Money SAFEs

changes to the resulting formulas.

with Cap and no Discount is developed in Section 4. Conversion for multiple Post-Money SAFEs with Cap and no Discount using the Discounted Valuation method is explained in Section 5. The two results from the application of the Discounted Valuation method for these two types of SAFE are compared in Section 6. In Section 7, we propose alternate SAFE conversion formulas that capture the Post-Money SAFE intuitions but allow for convertibility in a larger set of circumstances. Section 8 makes some remarks in conclusion.

2 SAFE Conversion in Equity Rounds

SAFE contracts were designed by Y Combinator to simplify early stage investments into startup ventures by eliminating the need for complex negotiations between investors and founders. In particular, early stage ventures are difficult to value for purposes of determining a share price for the investment, making this a sticking point in the negotiation. The legal complexities and costs of establishing preferred share structures are also daunting for an early stage venture. SAFEs finesse negotiations on these issues by deferring them to a later time. Instead of shares, the investor is given a contract that promises that their investment will be converted to shares at the first priced equity round for the company, according to a formula that gives both downside protection in case the company performs poorly, as well as, in the case the company performs well, a discount on the equity round price to recognize the early timing of the investment.

SAFE contracts recognize several types of events in which the investor receives a return: Equity Financing events (typically, a priced round with venture capital firms), Liquidity events (e.g., an acquisition or Initial Public Offering) and Dissolution events (winding up of the company). Our focus in the present work is exclusively on Equity Financing events. (See [vdM21] for a formal treatment of game theoretic issues in Liquidity events.)

SAFEs come in several versions, depending on which of two parameters, the Cap and the Discount, are selected for inclusion in the conversion formula (yielding four different contracts). In the original SAFEs, the conversion formula was based on the company's Pre-Money Valuation at the time of the equity round, but Y Combinator in 2018 revised its SAFE documents to be based on a Post-Money Valuation instead. In the present work, we consider both Pre-Money and Post-Money versions, but focus on cases where the Cap is the only parameter included.

We give a simplified presentation of the Equity Financing conversion formula that ignores issues such as warrants issued by the company, and its employee incentive pool before and after the equity round. We treat the shares outstanding at the time of the equity round as a single block, which we think of as the "founder" shares. With these simplifications, in both cases, the conversion formula involves the numerical variables in Figure 1, where we assume that the company has issued a set of SAFE notes parameterized by $i = 1 \ldots n$. All these values can be presumed positive, since negative or zero values are unrealistic.

- c_i = valuation cap of SAFE note i
- m_i = purchase amount of SAFE note i
- m_{new} = dollar amount of new money raised
- s_f = the number of founders' shares
- s_{new} = number of shares issued for new money
- s_i = number of shares issued to the holder of the SAFE note i in conversion of the SAFE note
- S_{post} = the total number of shares issued (or authorized) after the equity round
- S_{pre} = the total number of shares immediately prior to the equity round
- o_f = the proportion of shares owned by the founders after the equity round
- o_{new} = the proportion of shares owned by the equity investor after the equity round
- o_i = the proportion of shares owned by SAFE investor i after the equity round
- p_{new} = the price of new shares for the equity investor
- p_i = the price of shares for the SAFE note holder
- v_{post} = the post-money valuation of the company
- v_{pre} = the pre-money valuation of the company
- v_i = valuation of SAFE note i

Figure 1: Notation for variables related to SAFEs. Each variables can take only positive values.

A number of these variables are explicit parameters of the SAFE contract, and their values are written into the contract when it is instantiated and signed: the Purchase Amount of the i-th SAFE note m_i, and its Valuation Cap c_i. The variable p_i represents the Safe Price, the effective price at which the SAFE holder's money is converted into shares: it is defined in the Safe Price clause of the contract.

Others relate to the state of the company before and after the equity financing. The variable s_f represents the number of founder shares before (and after) the equity round. The variable s_i represents the number of shares issued to the SAFE note holder i in conversion of the SAFE note. We write s_{new} for the number of shares purchased by the new investor(s) in the equity round, and S_{pre} for the total number of shares before the equity round. The total number of shares after the equity round is denoted S_{post}. We will also denote the proportional post-money ownership of party j (either founders f, SAFE investor i, or new equity investor *new*) by o_j, defined to be s_j/S_{post}.

A final set of variables gives the details of the equity round. The new investor pays money m_{new}, paying a price of p_{new} per share, and receiving in exchange s_{new} newly issued shares in the company. The price per share may have been determined based on a *pre-money* valuation v_{pre} of the company, an assessment of its total value prior to the equity round. After the transaction, the company holds a larger amount of cash, so has a different valuation, the *post-money* valuation, which we denote by v_{post}.

Convertible instruments in general, and SAFE notes in particular, cause changes in the state of the company that raise issues for the interpretation of the terms "pre-money valuation" and "post-money valuation", which depend on questions concerning the accounting treatment of the SAFE notes. We refer to [vdMM21] for an extended discussion of this issue. In what follows, we treat v_{pre} as an uninterpreted input to the SAFE conversion formula itself, although we discuss a specific conversion method by which a value for this input can be determined.

2.1 Equity Round Equations

Before describing the specific terms in SAFE contracts that describe how the SAFE converts into a shareholding in the course of an equity round, we recall a number of equations that one expects to hold in equity rounds. See [vdMM21] for a longer discussion of these equations.

For a company that has shares S_{pre} outstanding, and has valuation v_{pre}, we can determine a price per share p_{new} according to equation

$$v_{pre} = S_{pre} p_{new} \ . \qquad (vsp_{pre})$$

Using the price p_{new} to issue shares to the new equity round investor, who is investing new money m_{new}, the number of shares s_{new} that they receive is determined by equation

$$m_{new} = s_{new} p_{new} \ . \qquad (msp_{new})$$

After the equity round, the company will have issued a total number of shares S_{post}. There is a number of ways that we can understand the post-money valuation v_{post} of the company, that is, the valuation after the equity round is complete. One is to take the view that the equity round itself does not change the share price, so that we have

$$v_{post} = S_{post} p_{new} \ . \qquad (vsp_{post})$$

Another is to consider the way that the transaction changes the company's assets and liabilities. All that has changed is that the company now has an additional amount m_{new} of money in the bank; all its other assets and liabilities, valued at v_{pre}, are unchanged. On this view, the pre-money valuation and post-money valuation are related by the equation

$$v_{post} = v_{pre} + m_{new} \ . \qquad (vm_{pre,post})$$

In standard equity rounds, when the company has issued no convertible instruments, these equations are consistent, In this situation, we have $S_{post} = S_{pre} + s_{new}$, and we obtain a price per share after the equity round of

$$\begin{aligned} v_{post}/S_{post} &= (v_{pre} + m_{new})/(S_{pre} + s_{new}) && \text{by } (vm_{pre,post}) \\ &= (v_{pre} + m_{new})/(S_{pre} + m_{new} S_{pre}/v_{pre}) && \text{by } (vsp_{pre}, msp_{new}) \\ &= v_{pre}/S_{pre} \\ &= p_{new} && \text{by } (vsp_{pre}) \end{aligned}$$

This derives equation (vsp_{post}) and justifies the assumption above that the equity round itself does not change the share price. It also follows from this that the value of the new investor's shareholding after the equity round is

$$\frac{s_{new}}{S_{post}} v_{post} = s_{new} p_{new} = m_{new}$$

by equation (msp_{new}).

We say that an equity round is *conservative* for an investor when (relative to some valuation of the company) the value of their shareholding after the equity round is at least equal to the money that they invested. If the value of the shares are exactly equal to the money invested, we say that the round is *minimally conservative* for the investor. In particular, we have from the above that a standard equity round is minimally conservative for the equity round investor.

However, in the case that there are convertible instruments such as SAFEs outstanding before the equity round, which convert into new shares s during the equity round, we have instead that

$$S_{post} = S_{pre} + s + s_{new} \ . \qquad (vm_{pre,post})$$

The new shares s have the effect of *diluting* the new shareholder. This makes the above equations inconsistent, and results in the equity round not being conservative for the new investor. See [vdMM21] for an extended discussion of this issue, in the case where a single SAFE has been issued, as well as an analysis of a number of approaches to addressing this deficiency. The solutions to the apparent contradiction developed there rely on a consideration of the accounting status of the convertible instruments. One can either treat these as liabilities of the company, or as obligations to issues shares on the cap table of the company.

Consider first the case that we treat the convertible instruments C as liabilities, valued at v_C. That is, we have that the pre-money valuation v_{pre} equals $v_A - v_L - v_C$, where v_A is the valuation of all assets and v_L the valuation of all other liabilities. In determining the post-money valuation of the company, we need to take into account that the convertible instruments C are discharged as a result of the equity round, and and the liabilities converted into a shareholding, so that the post-money valuation is $v_A - v_L + m_{new}$. This means that instead of equation $(vm_{pre,post})$, we have

$$v_{post} = v_{pre} + v_C + m_{new} \ . \qquad (vmC_{pre,post})$$

Note that we now have terms corresponding to each of the shareholders. With an appropriate choice of valuation of v_C, it can be guaranteed that the equity round is conservative for the new investor.

The alternative is to treat the convertible instruments as entries on the cap table. This requires that when we determine a share price, we treat S_{pre}, for purposes of determining the share price, as including not only the shares *already* issued, but also the share that *will* be issued as a result of converting the convertible instruments into a shareholding.

In the case of a single SAFE, [vdMM21] shows that there is in fact an equivalence between the two accounting treatments: with the correct selection of equations and understanding of valuation, they lead to the same conclusions about the value of the shareholdings of the parties after the equity round. In Section 3, we extend this analysis for a single SAFE to the situation where the company has issued multiple SAFEs. We first describe the terms of two distinct types of SAFEs in the following subsections.

2.2 Pre-Money SAFE with Cap Only

In terms of the above variables, the Equity Financing clause of the Pre-Money SAFE with Cap Only [Y C16] defines the number of shares s_i to be issued in conversion of the SAFE as follows:

1. If $v_{pre} \leq c_i$, then $s_i = m_i/p_{new}$.
2. If $v_{pre} > c_i$, then $s_i = m_i/p_i$.

where p_i is defined in the Safe Price clause by

$$p_i = \frac{c_i}{S_{pre}} \ .$$

We remark that the variable v_{pre} here corresponds to the term "Pre-Money Valuation" in the natural language text of the contract. As we discuss below, some subtleties arise concerning the interpretation of this term in the context of the Discounted Valuation method.

The Pre-Money SAFE contracts define the "Company Capitalization" S_{pre} so as to exclude shares to be issued to the SAFE investors. Under our simplifying assumptions, this means that

$$S_{pre} = s_f \tag{1}$$

Therefore, we also have

$$p_i = \frac{c_i}{s_f}$$

We note that this contract has the following property with respect to the value of the shares received by the SAFE investor in an Equity Financing:

Proposition 1 *Suppose that the equity round is conducted at a valuation v_{pre}, with a share price p_{new} for the new investor's shares determined using equation (vsp_{pre}), and that the value of the shares after the equity round remains equal to p_{new}, that is, satisfies equation (vsp_{post}). Then the number shares issued to SAFE investor i satisfies*

$$s_i = \frac{m_i}{\min(p_{new}, p_i)}$$

and the value of these shares after the equity round is at least the money m_i that they invested.

Proof:

Note that if equation (vsp_{pre}) holds, then we have $v_{pre} \leq c_i$ iff

$$p_{new} = \frac{v_{pre}}{S_{pre}} \leq \frac{c_i}{S_{pre}} = p_i \ .$$

If $v_{pre} \leq c_i$, then

$$s_i = \frac{m_i}{p_{new}} = \frac{m_i}{\min(p_{new}, p_i)}$$

and the value of the shares is

$$s_i p_{new} = \frac{m_i}{p_{new}} \cdot p_{new} = m_i \ .$$

If $v_{pre} > c_i$, then

$$s_i = \frac{m_i}{p_i} = \frac{m_i}{\min(p_{new}, p_i)}$$

and the value of the shares is

$$\begin{aligned} s_i p_{new} &= \frac{m_i}{p_i} \cdot p_{new} \\ &= \frac{m_i S_{pre}}{c_i} \cdot \frac{v_{pre}}{S_{pre}} && \text{by } (vsp_{pre}) \\ &= m_i \cdot \frac{v_{pre}}{c_i} \\ &> m_i && \text{by the case assumption.} \end{aligned}$$

In either case, the claim holds. □

This result states that, under the assumptions, the equity round is conservative for the SAFE investors.

2.3 Post-Money SAFE with Cap Only

One of the differences between the Pre-Money SAFEs and the Post-Money SAFEs is that the latter allows that new equity round investors do not all pay the same price for their shares: there is an explicit reference to "the lowest price per share of the Standard Preferred Stock". It is unclear whether equity rounds with varying prices for new investors are much used in practice. In our analysis, we will for comparative purposes make the simplifying assumption that all new investors pay the same price p_{new}.

Rather than state an explicit conversion formula, the Post-Money SAFEs state a set of constraints that need to be solved in order to determine the number of shares issued to the SAFE investor. Whereas the number of shares issued for a Pre-Money SAFE is independent of other SAFEs issued, in the case of Post-Money SAFEs, these constraints include other SAFEs. In effect, the Post-Money SAFE conversion constraints view SAFEs as corresponding to a number of shares existing on the cap table at the time of the equity round.

With respect to our simplifying assumptions, the Company Capitalization S_{pre} is defined by the Post-Money SAFE not by equation (1) as in the Pre-Money SAFE, but by equation

$$S_{pre} = s_f + \sum_{i=1}^{k} s_i \tag{2}$$

where s_i is the number of shares that will be issued to SAFE investor i.

The Post-Money SAFE Equity Financing clause states that the number s_i of shares issued to the SAFE investor i satisfies

$$s_i = \max\{m_i/p_{new}, m_i/p_i\} \tag{3}$$

where p_{new} is the (minimum) price at which Standard Preferred shares are issued in the round and the SAFE Price p_i is defined as

$$p_i = c_i/S_{pre} \ . \tag{4}$$

Note that since s_i depends on the SAFE Price p_i, which depends on S_{pre}, which in turn depends on s_i, these definitions are circular. To resolve the circularity, we need to take these equations as simultaneous constraints on these values, to be solved. We give the details of the solution in Section 5.

The Post-Money SAFE does not specify exactly how the price p_{new} should be determined from a valuation of the company. Indeed, its text deliberately leaves this question open, by stating that

> "Equity Financing" means a bona fide transaction or series of transactions with the principal purpose of raising capital, pursuant to which the Company issues and sells Preferred Stock at a fixed valuation, including but not limited to, a pre-money or post-money valuation.

The Discounted Valuation method we discuss in this paper gives a particular way to derive a valuation and determine a corresponding share price, that takes into account the fact that SAFE contracts have been issued by the company, in order to ensure that the equity round is conservative for the new investor.

3 Discounted Valuation Method

Before investigating the specific consequences of the SAFE conversion formulas, it is helpful to consider the Discounted Valuation method for setting a share price in equity rounds involving a general notion of convertible contract.

Suppose that the company has issued a set of k contracts which convert to shareholdings as a result of the equity round, with the holder of contract i receiving s_i shares in conversion. In the case of SAFE contracts, the s_i depend on the valuation of the company - we discuss the consequences of this in the following sections, but in the present section, we leave such dependencies implicit. We also assume that the existing shareholders (as a simplification, we call these, collectively, the "founders") hold $S_{pre} = s_f$ shares.

The Discounted Valuation method can be understood as a response to the fact that issuance of shares s_i is dilutive for the new investor, which means that the round is not conservative. To compensate, this method artificially adjusts the pre-money valuation v_{pre} used to determine a share price to a value v_{pre}^- calculated to ensure that, immediately after the equity round, the new investor holds shares of value equal to the money they paid.

The assumption that the share price is determined from v_{pre}^- rather than v_{pre} is captured by equation

$$p_{new} = \frac{v_{pre}^-}{s_f} \tag{5}$$

Since shares are issued to the new investor at this price, we have equation (msp_{new}) with respect to v_{pre}^-. To obtain that the round is minimally conservative, we need to have that the value per share after the equity round is equal to the share price paid by the new investor.

After the equity round, the capitalization of the company is $s_f + s_{new} + \sum_i s_i$. Moreover, assuming that the share price immediately after the equity round is equal to the share price before the equity round (as is the case for an equity round not involving convertible instruments), and that the post-money valuation is $v_{pre} + m_{new}$, we have

$$p_{new} = \frac{v_{pre} + m_{new}}{s_f + s_{new} + \sum_i s_i} \tag{6}$$

Reorganising, this gives that

$$p_{new}s_f + p_{new}s_{new} + \sum_i p_{new}s_i = v_{pre} + m_{new}$$

so using equation (msp_{new}), we obtain

$$p_{new}s_f + \sum_i p_{new}s_i = v_{pre} \tag{7}$$

We can take two views of this equation. First, using equation (5), we can derive

$$v^-_{pre} = v_{pre} - \sum_i p_{new}s_i$$

Intuitively, each term $p_{new}s_i$ here can be understood as the valuation of the i-th convertible instrument, as determined from the number of shares s_i issued in exchange and the price per share p_{new}. Thus, we can understand v^-_{pre} as the result of discounting the pre-money valuation v_{pre} by the valuation of the convertible instruments. In effect, v^-_{pre} is the valuation of the company when the convertible instruments are accounted for as liabilities, assuming that v_{pre} is a valuation of all other assets and liabilities of the company (but excluding the convertible instruments). Note that, on this view, since these liabilities are discharged in the course the equity round, the valuation increases by an equivalent amount, so that the post-money valuation of the company is

$$v^-_{pre} + m_{new} + \sum_i p_{new}s_i = v_{pre} + m_{new}$$

exactly as expected. We also have that equation ($vmC_{pre,post}$) is satisfied, but with v^-_{pre} in place of v_{pre}.

Alternately, note that equation (7) can be written as

$$p_{new} = \frac{v_{pre}}{s_f + \sum_i s_i} \tag{8}$$

This view can be understood as determining the share price on the understanding that the convertible instruments are represented not as liabilities, but as entries on the cap table of the company. That is, we calculate a share price from v_{pre} as if the shares s_i to be issued in conversion of the convertible instrument have already been issued before the equity round is conducted.

There is a further viewpoint (called the "Percent Ownership Method" [Col]) that again yields the same equations, based on the consideration that the new investor expects to receive for their money the same proportional shareholding in the company as they would in an equity round not involving convertible instruments. After the equity round, the new investor's actual share of the company is

$$o_{new} = \frac{s_{new}}{s_f + s_{new} + \sum_i s_i}$$

Multiplying numerator and denominator by p_{new}, we have

$$o_{new} = \frac{s_{new}p_{new}}{s_f p_{new} + s_{new}p_{new} + \sum_i s_i p_{new}}$$

$$= \frac{m_{new}}{s_f p_{new} + m_{new} + \sum_i s_i p_{new}} \qquad \text{by } (msp_{new})$$

Had the equity round been a standard equity round in which convertible instruments are not present, the new investor would have received a share

$$o_{new} = \frac{m_{new}}{v_{pre} + m_{new}}$$

of the company. Note that this share, plus the assumption that the post-money valuation of the company is $v_{pre} + m_{new}$, yields that the value of the shareholding is m_{new}, so that the round is minimally conservative for the new investor. Equating these two formulations of o_{new}, we again derive equation (7).

Thus, in fact, formula (7) underpins three different ways to understand the equity round:

- Decreasing the valuation used to determine the price of shares in the equity round so as to guarantee that the round is minimally conservative for the new investor. (Equivalently, treating the convertible instruments as liabilities of the company (with valuation of these liabilities derived from the price at which shares are issued and the number of shares issued in conversion).
- Determining a price by treating the shares that will be issued in the equity round as already represented on the cap table.
- Setting the valuation of the company so as to ensure that the new investor receives an expected share of the company.

Ignoring any extraneous financial implications from these different viewpoints (e.g., from differing tax treatment), each yields that the round is minimally conservative for the new investor.

We note that, depending on the specifics of the convertible instruments, our characterizations of the discounted pre-money valuation v_{pre}^{-} and price p_{new} above may be insufficient to directly determine the values of these variables. The problem is that the numbers s_i of shares issued in conversion may be defined in terms of the pre-money valuation and price. This circular dependency does in fact apply to the specific case of SAFE contracts, requiring further analysis. We take this up for the two types of SAFEs we consider in the following sections.

4 Discounted Valuation Method: Pre-Money SAFEs

We consider the application of the Discounted Valuation method to a scenario where multiple Pre-Money SAFEs have been issued. Our discussion in this section generalizes the treatment in [vdMM21] for equity rounds in the case where the company has issued a single SAFE.

We suppose that k Pre-Money SAFEs with Cap and no Discount have been issued, with the i-th having cap c_i and price m_i. We suppose that the new investor's inherent pre-money valuation of the company (ignoring the existence of SAFE contracts) is v_{pre}.

The Discounted Valuation method is (minimally) conservative for the new investor by design, and also ensures that share price before the equity round is equal to the share price after the equity round. It follows using Proposition 1 that the equity round is also conservative for the SAFE investors.

We have not yet determined an actual value for v^-_{pre}. There is a circularity in the equation $v^-_{pre} = v_{pre} - \sum_i s_i p_{new}$, because , for the Pre-Money SAFE, the term $s_i p_{new}$ depends on the "Pre-Money Valuation" at which the equity round is conducted. We resolve this circularity by showing that the SAFE contract imposes additional constraints on these variables, that lead to a unique solution.

We note that, when using the Discounted Valuation method with Pre-Money SAFEs, a question arises concerning the term "Pre-Money Valuation" in this contract: should we interpret it as v^-_{pre} or as v_{pre}? In some cases, this choice leads to different values of s_i. See [vdMM21] for arguments leading to the conclusion that the Pre-Money SAFE is more coherent with the interpretation v^-_{pre}. (Briefly, use of v_{pre} results in the unexpected conclusion that there are share prices at which the equity round cannot consistently be conducted.) We therefore use the interpretation v^-_{pre} in the following analysis.

Using the interpretation v^-_{pre} of "Pre-Money Valuation", the conversion formula gives, using Proposition 1 and the definition of the Pre-Money SAFE[2],

$$s_i p_{new} = \frac{m_i}{min(p_{new}, p_i)} \cdot \frac{v^-_{pre}}{s_f} = \frac{m_i}{min(v^-_{pre}, c_i)} \cdot v^-_{pre} \ . \tag{9}$$

Thus, we need to solve

$$v_{pre} = v^-_{pre} + \sum_{i: v^-_{pre} < c_i} m_i + \sum_{i: v^-_{pre} \geq c_i} \frac{m_i}{c_i} \cdot v^-_{pre} \tag{10}$$

for v^-_{pre}.

Since we need $v^-_{pre} > 0$ (else we get a zero or negative price per share) and $(m_i/c_i) \cdot v^-_{pre} \geq m_i$ when $v^-_{pre} \geq c_i$, we must have $v_{pre} > \sum_i m_i$ in order for this to be solvable. Conversely, we now show that we can solve for $v^-_{pre} > 0$ when $v_{pre} > \sum_i m_i$.

Note that the right hand side of equation (10) is continuous, piecewise linear and increasing in v^-_{pre}, since $m_i = \frac{m_i}{c_i} \cdot v^-_{pre}$ when $v^-_{pre} = c_i$. Hence, in case $v_{pre} > \sum_i m_i$, we get a unique solution for v^-_{pre} in terms of v_{pre}. To express this, order the distinct SAFE caps amongst the c_i as $c'_1 < c'_2 < \ldots < c'_k$, and let

[2]Note that if we used interpretation v_{pre} for "Pre-Money Valuation, but priced that round using equation (5), then Proposition 1 would not apply, because different values are being used for v_{pre} in the SAFE conversion conditions and the price calculation.

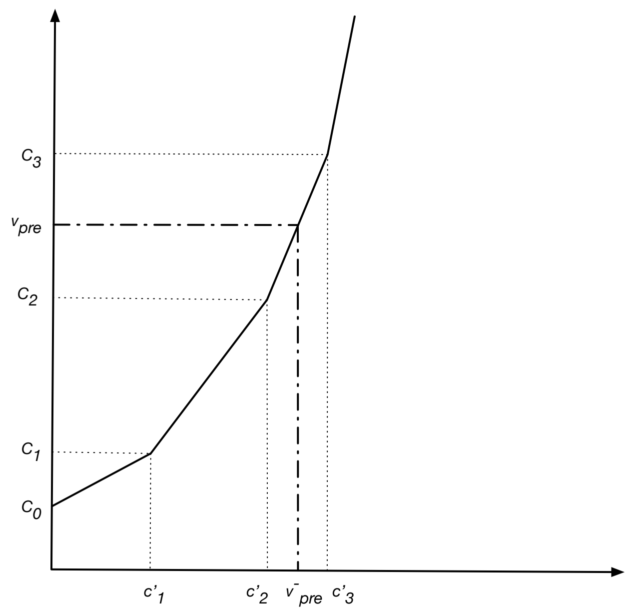

Figure 2: Mapping from v^-_{pre} to v_{pre}

$c'_0 = 0$. The values $c'_0, \ldots c'_k$ on the v^-_{pre} axis correspond to the points $C_0, \ldots, C_k$ on the v_{pre} axis, defined by

$$C_j = c'_j + \sum_{i:c'_j < c_i} m_i + \sum_{i:c'_j \geq c_i} \frac{m_i}{c_i} \cdot c'_j \ .$$

(See Figure 2.) Note $C_0 = \sum_i m_i$.

For $i = 1 \ldots k$ let $f(i)$ be the index such that $c_i = c'_{f(i)}$. Then $v^-_{pre} < c_i$ iff $v^-_{pre} < c'_{f(i)}$ iff $v_{pre} < C_{f(i)}$. Hence

$$v^-_{pre} = \frac{v_{pre} - \sum_{i:v_{pre} < C_{f(i)}} m_i}{1 + \sum_{i:v_{pre} \geq C_{f(i)}} \frac{m_i}{c_i}} \tag{11}$$

Note that we need

$$v_{pre} > \sum_{i:v_{pre} < C_{f(i)}} m_i$$

for this solution to yield $v^-_{pre} > 0$, but this holds when $v_{pre} > \sum_i m_i$.

We can now determine the number of shares issued in exchange for the i-th

SAFE as

$$
\begin{aligned}
s_i &= \frac{m_i s_f}{\min(v_{pre}^-, c_i)} \\
&= \begin{cases} \frac{m_i s_f}{v_{pre}^-} & \text{if } v_{pre}^- < c_i \\ \frac{m_i s_f}{c_i} & \text{if } v_{pre}^- \geq c_i \end{cases} \\
&= \begin{cases} \frac{m_i s_f \cdot \left(1 + \sum_{\ell : v_{pre} \geq C_{f(\ell)}} \frac{m_\ell}{c_\ell}\right)}{v_{pre} \cdot \left(1 - \sum_{\ell : v_{pre} < C_{f(\ell)}} m_\ell\right)} & \text{if } v_{pre} < C_{f(i)} \\ \frac{m_i s_f}{c_i} & \text{if } v_{pre} \geq C_{f(i)} \end{cases}
\end{aligned}
$$

The founder value after the equity round is

$$
v_{pre} - \sum_i s_i p_{new} = v_{pre} - \left(\sum_{i : v_{pre}^- < c_i} m_i \right) - \left(\sum_{i : v_{pre}^- \geq c_i} m_i \frac{v_{pre}^-}{c_i} \right) \tag{12}
$$

5 Discounted Valuation Method: Post-Money SAFEs

As already noted, the Post-Money SAFE uses a calculation of the Safe Price from the Safe Cap in the case that $v_{pre} \geq c$, that is similar to that used in the Discounted Valuation method to obtain a discounted price for the equity round (equation (8)). However, it remains the case that the issuance of SAFE shares is dilutive for the new investor, irrespective of how the number of SAFE shares is calculated. It is therefore appropriate to determine the price of the round using the Discounted Valuation method to counteract this effect. We suppose that the company has issued Post-money SAFEs to k investors, with investor $i = 1 \ldots k$ purchasing a SAFE for price m_i at post-money cap c_i.

The Company Capitalization, as defined by the Post-Money SAFE (pre the equity round, and inclusive of the SAFE shares), is

$$
S_{pre} = s_f + \sum_{i=1}^{k} s_i
$$

where s_i is the number of shares that will be issued to SAFE investor i. The Post-Money SAFE states that the number of shares issued to SAFE investor i in the equity round is given by

$$
s_i = \max\left(\frac{m_i}{p_{new}}, \frac{m_i}{p_i}\right)
$$

where p_i is the Safe Price, defined as $p_i = c_i / S_{pre}$.

To apply the Discounted Valuation method, we use a price p_{new} determined from the discounted valuation v_{pre}^{-} derived from v_{pre}. We have several equivalent formulations of this price (equations (5) and (8)). In the present context, it is more convenient to use the formulation $p_{new} = v_{pre}/S_{pre}$ of equation (8), which yields that

$$s_i = \max(\frac{m_i S_{pre}}{v_{pre}}, \frac{m_i S_{pre}}{c_i}) = \frac{m_i S_{pre}}{\min(v_{pre}, c_i)} \tag{13}$$

The valuation of these shares is given by

$$s_i p_{new} = \frac{m_i S_{pre}}{\min(v_{pre}, c_i)} \cdot \frac{v_{pre}}{S_{pre}} = \frac{v_{pre} m_i}{\min(v_{pre}, c_i)}$$

from which we see that the round is conservative for the SAFE investors.

We also obtain the discounted valuation

$$\begin{aligned} v_{pre}^{-} &= v_{pre} - \sum_i p_{new} s_i && (14) \\ &= v_{pre} - \sum_i \frac{v_{pre} m_i}{\min(v_{pre}, c_i)} && (15) \\ &= v_{pre} \left(1 - \sum_i \frac{m_i}{\min(v_{pre}, c_i)}\right) && (16) \end{aligned}$$

Of course, S_{pre} depends on s_i, so equation (13) does not give a closed form solution for the number of shares s_i. To obtain a closed form solution, we first solve for S_{pre}. Substituting the value for the number of SAFE shares s_i for each investor into the equation for S_{pre}, we get

$$S_{pre} = s_f + \sum_{i=1}^{k} \frac{m_i S_{pre}}{\min(v_{pre}, c_i)}$$

This equation has a unique solution for S_{pre} as

$$S_{pre} = \frac{s_f}{1 - \sum_{i=1}^{k} \frac{m_i}{\min(v_{pre}, c_i)}}$$

using which we can also solve uniquely for the number of shares for each SAFE investor as

$$s_i = \frac{m_i s_f}{\min(v_{pre}, c_i)(1 - \sum_{j=1}^{k} \frac{m_j}{\min(v_{pre}, c_j)})} .$$

Note that in order for these expressions for v_{pre}^{-} and s_i to be finite and positive, we need that

$$1 > \sum_{i=1}^{k} \frac{m_i}{\min(v_{pre}, c_i)} . \tag{17}$$

This can be understood by noting that the proportion of the company that SAFE investor i receives, before the dilution by the new investor's money, is, by equation (13),

$$\frac{s_i}{S_{pre}} = \frac{m_i}{\min(v_{pre}, c_i)} \; . \tag{18}$$

Hence inequality (17) says that the total share of the company controlled by the SAFE investors before the new investor's money should be less than 100%. (Some amount needs to be left over to account for the founder shares s_f.)

A significant point here is that there are several ways in which this constraint can be violated. We consider a number of cases:

Case 1: The company issues a set of SAFE notes with

$$\sum_{i=1}^{k} \frac{m_i}{c_i} \geq 1 \; .$$

Since always $\min(v_{pre}, c_i) \leq c_i$, this would imply that inequality (17) is violated. There is therefore an implicit obligation on the company not to issue excess SAFE notes in this way: doing so would render the company unable to meet its explicit obligations to the SAFE holders in the event of an Equity Financing.

Case 2: We have

$$\sum_{i=1}^{k} \frac{m_i}{c_i} < 1$$

and $v_{pre} \geq c_i$ for all $i = 1 \ldots k$. Then for any valuation v_{pre} greater than or equal to the largest cap of any of the SAFE notes, we have $\min(v_{pre}, c_i) = c_i$ for all i, so inequality (17) is satisfied and the numbers s_i are well defined.

Case 3: We have

$$\sum_{i=1}^{k} \frac{m_i}{c_i} < 1$$

and $\min(c_1, \ldots, c_k) \leq v_{pre} < c_i$ for some $i = 1 \ldots k$.

Let the SAFE caps be ordered as $c_1 \leq \ldots \leq c_k$, and suppose that $c_{j-1} \leq v_{pre} < c_j$. Then we have $\min(v_{pre}, c_i) = c_i$ for $i < j$ and $\min(v_{pre}, c_i) = v_{pre}$ for $i \geq j$, so inequality (17) amounts to

$$1 > \sum_{i=1}^{j-1} \frac{m_i}{c_i} \; + \; \sum_{i=j}^{k} \frac{m_i}{v_{pre}}$$

which requires that

$$v_{pre} > \frac{\sum_{i=j}^{k} m_i}{1 - \sum_{i=1}^{j-1} \frac{m_i}{c_i}} \; . \tag{19}$$

SAFE Parameters:
$(m_1, c_1) = (1, 3),$
$(m_2, c_2) = (1, 5),$
$(m_3, c_3) = (2, 20),$
$v_{pre} = 4.4$

j	1	2	3
RHS (19)	4	4.5	4.8
(19) holds	T	F	T

SAFE Parameters:
$(m_1, c_1) = (1, 3),$
$(m_2, c_2) = (1, 4),$
$(m_3, c_3) = (2, 20),$
$v_{pre} = 4.4$

j	1	2	3
RHS (19)	4	4.5	4.286
(19) holds	T	F	F

Figure 3: Numerical examples of Post-Money SAFE convertibility with v_{pre} in cap intervals $[c_{j-1}, c_j)$.

Depending on the values of the SAFE caps c_i and prices m_i, this may not be possible for all values of v_{pre} in the interval $[c_{j-1}, c_j)$. Thus, even if the company has taken care not to exceed granting over a 100% share to the SAFE investors, as calculated using the SAFE caps, there may yet be pre-money valuations at which the SAFE contracts can never be converted. Note that both the numerator and denominator in the expression on the right hand side of the inequality (19) increase as j descends from k to 1 (i.e., as v_{pre} decreases through the range of SAFE cap values). The value of this expression behaves non-monotonically, so the set of intervals within which the SAFE cannot be converted is complex. Some numerical values to illustrate this are given in Figure 3.

Case 4: The pre-money valuation satisfies $\sum_{1=1}^{k} m_i < v_{pre} \leq \min(c_1, \dots c_k)$. In this case, inequality (17) amounts to

$$1 > \sum_{i=1}^{k} \frac{m_i}{v_{pre}}$$

which is necessarily satisfied in this case. Hence the SAFEs are always convertible in this case.

Case 5: The pre-money valuation satisfies $v_{pre} \leq \min(\sum_{1=1}^{k} m_i, c_1, \dots c_k)$. In this case, we again have inequality (17) amounts to

$$1 > \sum_{i=1}^{k} \frac{m_i}{v_{pre}}$$

but this is false because $v_{pre} \leq \sum_{1=1}^{k} m_i$. Hence the SAFES are never convertible in this case.

6 Comparison

One way to compare Pre-Money SAFEs and Post-Money SAFEs is to consider contracts with identically valued parameters. In one scenario, suppose the company has issued k Pre-Money SAFEs with the i-th having Purchase Amount m_i and Cap c_i. Similarly, in a second scenario, suppose the company has issued k Post-Money SAFEs with the i-th having Purchase Amount m_i and Cap c_i. By equation (9) and equation (16), we see that in the first scenario, SAFE investor i receives share valued at $\frac{v^-_{pre} m_i}{\min(v^-_{pre}, c_i)}$, and in the second scenario, $\frac{v_{pre} m_i}{\min(v_{pre}, c_i)}$. The value v^-_{pre} here is that calculated for Pre-Money SAFEs in Section 4, and satisfies $v^-_{pre} < v_{pre}$. (Note that a potentially different value for v^-_{pre} is calculated for the Post-Money SAFEs in Section 5.) Thus, the SAFE investor, in case $v_{pre} < c_i$, receives shares of a larger value (and therefore a larger share of the company) in the case of Post-Money SAFEs than they do in the case of Post-Money SAFEs.

However, knowing this, one expects that the company and the SAFE investor will negotiate on the value of the parameters, specifically, on the Cap amount. It is reasonable to consider the parameter settings that might result from such a negotiation. The following result shows that, provided that the Caps of different contracts are identical in each of the scenarios, an effectively equivalent set of contracts can be obtained in the Pre-Money and the Post- Money scenarios.

Proposition 2 *Consider the following scenarios, where $m_1, \ldots, m_k, c > 0$:*

1. **Scenario 1:** *The company issues a set of Pre-Money SAFEs $i = 1 \ldots k$, all with cap c, for Purchase Amounts $m_1, \ldots, m_k$, respectively.*

2. **Scenario 2:** *The company issues a set of Post-Money SAFEs $i = 1 \ldots k$, all with cap $c + \sum_{i=1}^k m_i$, for Purchase Amounts $m_1, \ldots, m_k$, respectively.*

Then

- *All contracts are convertible by the Discounted Valuation method in Scenario 1 iff all contracts are convertible by the Discounted Valuation method in Scenario 2 iff the pre-money valuation v_{pre} satisfies $v_{pre} \geq \sum_i m_i$.*

- *For all pre-money valuations $v_{pre} \geq \sum_i m_i$, and all $i = 1 \ldots k$, the post-money value of shares received by SAFE investor i in Scenario 1 converted using the Discounted Valuation method is the same as the the post-money value of shares received by SAFE investor i in Scenario 2, converted using the Discounted Valuation method.*

Proof: We first consider the conditions under which the SAFE contracts are convertible in the two scenarios. In the Pre-Money Scenario 1, the contracts are convertible by the Discounted Valuation method iff $v_{pre} > \sum_i m_i$, as shown in Section 4. In the Post-Money Scenario 2, the contracts are convertible iff condition (17) holds, with $c_i = c + \sum_j m_j$ for all $i = 1 \ldots k$. There are two cases.

- If $c + \sum_j m_j < v_{pre}$, then we require

$$\sum_i \frac{m_i}{c + \sum_j m_j} < 1 \tag{20}$$

  This is equivalent to $0 < c$, which always holds. Note that the condition $v_{pre} > \sum_i m_i$ for convertibility in Scenario 1 also always holds in this case.

- if $c + \sum_j m_j \geq v_{pre}$, then we require that

$$\sum_i \frac{m_i}{v_{pre}} < 1$$

  that is, $\sum_i m_i < v_{pre}$. This is equivalent to the condition under which we have convertibility in Scenario 1.

Thus, all contracts are convertible in Scenario 1 iff all contracts are convertible in Scenario 2 iff $v_{pre} > \sum_i m_i$.

In Scenario 1, using the analysis of Section 4, by equation (9), we have that

$$\begin{aligned} s_i p_{new} &= \frac{m_i}{min(v_{pre}^-, c_i)} \cdot v_{pre}^- \\ &= \begin{cases} m_i & v_{pre}^- \leq c \\ \frac{m_i v_{pre}^-}{c} & v_{pre}^- > c \end{cases} \end{aligned}$$

since $c_i = c$ for all $i = 1 \dots k$.[3] Also, we have that $c'_0 = 0$ and $c'_1 = c$ are the only distinct cap values to be considered, and we have

$$\begin{aligned} C_0 &= \sum_i m_i \\ C_1 &= c + \sum_{i:c'_1 < c_i} m_i + \sum_{i:c'_1 \geq c_i} \frac{m_i c'_1}{c_i} \\ &= c + \sum_i m_i \end{aligned}$$

since $c_i = c$ for all $i = 1 \dots k$. We have $f(i) = 1$ for all i, since $c = c_1$. Hence, by equation (11),

$$\begin{aligned} v_{pre}^- &= \frac{v_{pre} - \sum_{i:v_{pre} \leq C_{f(i)}} m_i}{1 + \sum_{i:v_{pre} > C_{f(i)}} \frac{m_i}{c_i}} \\ &= \frac{v_{pre} - \sum_{i:v_{pre} \leq C_1} m_i}{1 + \sum_{i:v_{pre} > C_1} \frac{m_i}{c}} \end{aligned}$$

[3] By continuity, we could include the case of $v_{pre}^- = c_i$ in either the first or second case. We have used to given form here to simplify the reasoning using the closed form solution of v_{pre}^- that follows.

In particular, in the case that $v^-_{pre} > c = c_1$, that is, $v_{pre} > C_1 = c + \sum_i m_i$, we have that

$$v^-_{pre} = \frac{v_{pre}}{1 + \sum_i \frac{m_i}{c}}$$

It follows that we can also characterize the valuation $s_i p_{new}$ as

$$s_i p_{new} = \begin{cases} m_i & v_{pre} \le c + \sum_i m_i \\ \frac{m_i v_{pre}}{c + \sum_i m_i} & v_{pre} > c + \sum_i m_i \end{cases}$$

In the Post-Money Scenario 2, we have, by the analysis of Section 5 (with $c_i = c + \sum_i m_i$ for all $i = 1 \dots k$), that

$$\begin{aligned} s_i p_{new} &= \frac{m_i v_{pre}}{\min(v_{pre}, c + \sum_i m_i)} \\ &= \begin{cases} m_i & v_{pre} \le c + \sum_i m_i \\ \frac{m_i v_{pre}}{c + \sum_i m_i} & v_{pre} > c + \sum_i m_i \end{cases} \end{aligned}$$

This is identical to the characterization of $s_i p_{new}$ in Scenario 1, so the value amounts of the shareholdings of the SAFE investors after the equity round are identical in the two scenarios. Since the Discounted Valuation method is always minimally conservative, it also follows that the new investor and the founders also have identically valued shareholdings after the equity round in the two scenarios. □

This result generalizes a result from [vdMM21], which states that, with respect to Equity Financing events, the situation where the company has issued a single Pre-Money SAFE for Purchase Amount m and Cap c is equivalent to the situation where the company has issued single Post-Money SAFE for Purchase Amount m and Cap $m + c$. (The contractual situations may still differ in other regards because of differences in other clauses of the two contract types. For example, Post-Money SAFEs differ from Pre-Money SAFEs in that investors may receive dividends prior to conversion.)

It is worth noting, however, that because the transformation in Proposition 2 from the Pre-Money scenario to the Post-Money scenario includes the term $\sum_i m_i$, it needs to made globally, at the level of the scenarios, with knowledge of the total amount of money that will be raised by the company using SAFE contracts, rather than at the level of each individual SAFE. It is not possible to determine what would be the Post-Money SAFE equivalent to a given Pre-Money SAFE if the contracts were being issued one at a time, with the total money to be raised from SAFEs before the equity round unknown.

7 Towards a Better SAFE

Equation (18) provides a particularly simple understanding of the promise made to the SAFE investor in scenarios where the multiple Post-Money SAFEs are issued, and converted using the Discounted Valuation method. In cases where $v_{pre} > c_i$, the Post-Money SAFE promises the SAFE investor shares valued at a proportion m_i/c_i of the inherent pre-money valuation v_{pre}. That is, in this case the Post-Money SAFE promises the investor a share m_i/c_i of the company immediately before being diluted in the equity round. In addition to this, there is downside protection: if $v_{pre} \leq c_i$, the SAFE investor is promised shares of value equal to the money m_i they invested.

We have shown that there are situations where these promises cannot be met for all investors, even when the condition $\sum_i m_i < v_{pre}$ for the applicability of the Discounted Valuation method to Pre-Money SAFEs holds. There are various approaches that one might take to address this deficiency of the Post-Money SAFE contract in such situations. One is to take all promises at face value, so that the value of the promises exceeds the amount of value v_{pre} that is to be distributed. In this view, the situation is akin to that studied in bankruptcy theory [Tho03], where we have we have a set of creditor claims $C_1, \ldots, C_n$ whose sum exceeds the value V of the estate to be distributed. The question raised by this is how to determine a "fair" distribution to the creditors. The literature provides a large number of alternative approaches, with some dating back as early as the Babylonian Talmud [AM85]. A diversity of justifications for the alternatives can be found, drawing on axiomatic characterizations of fairness, as well as game-theoretic methods. In principle, any of the approaches from the literature could be adopted, with the SAFE revised to explicitly state the fair distribution method applied in a situation of excess claims.

We note that the situation is actually richer than that studied in bankruptcy theory, since, in addition to the claims made by the investors on the basis of promises made in their investment contracts, there is an additional factor that could be taken into consideration in determining a distribution, namely the money m_i invested. This suggests that there is an even richer space of justifiable options available than in bankruptcy theory. For example, rather than base the distribution solely on the claims C_i, one could do a distribution based instead just on the individual investments m_i. Other schemes that take both the C_i and the m_i into account can also be envisaged.

There is also a further consideration, which can be seen in the distribution to investors defined by SAFEs for Liquidity Events. In such events, investors are promised an option to receive either *Cashout* and receive back their original investment m_i, or to *Convert* and receive a distribution based on a conversion of the SAFE to shares. The investors choosing to Cashout are treated with priority over those choosing to Convert, so that the value distributed to investors choosing Convert is based on an amount after the Cashout total has been subtracted from the valuation. (This creates a game theoretic scenario, that is analysed in more detail in [vdM21].) We may note that there is a correspondence between the Liquidity Event options and the two cases of the SAFE conversion formula. This suggests giving priority to investors receiving their money back over those receiving a proportional shareholding.

Motivated from this observation, we propose here one possible revision of the Equity Financing clauses of the SAFE, that allows for a simple and justifiable distribution formula for all situations where $v_{pre} > \sum_i m_i$. An assumption of this variation is that all convertible instruments issued by the company are of the same type - this may need to written into the terms of the contract.(The reason for this assumption is that it is less clear how to determine priorities to define conversion when there are other types of instruments in play, we leave this question for future work.) We define the share issuance to the SAFE investor in Equity Financing events by first defining the value v_i of the shares to be issued, by means of the formula

$$v_i = m_i + \frac{m_i}{c_i}(v_{pre} - \sum_j m_j)$$

where the summation is over all SAFE's that have been issued. The contract should state that here v_{pre} is the inherent valuation of the company, that is, its valuation ignoring the fact that SAFE contracts have been issued. The idea here is to first return value equal to the principal invested to all the SAFE investors, and then to distribute a proportion m_i/c_i of the remaining value $v_{pre} - \sum_j m_j$ to SAFE investor i. Plainly, provided $v_{pre} > \sum_j m_j$, we have $v_i > m_i$, so this instrument is conservative for the SAFE investor, unless the company fails to create value greater than the total amount of all SAFE investments.

The company is required to issue these SAFEs so as to ensure that

$$\sum_i \frac{m_i}{c_i} < 1 \ .$$

Note that we then have

$$\begin{aligned} \sum_i v_i &= \sum_i m_i + (\sum_i m_i/c_i \ )(v_{pre} - \sum_i m_i) \\ &< \sum_i m_i + (v_{pre} - \sum_i m_i) \\ &= v_{pre} \end{aligned}$$

so that the total amount of value distributed to SAFE investors is no more than v_{pre}. The pre-money value remaining for the founders is

$$v_f = (1 - \sum_i m_i/c_i) \cdot (v_{pre} - \sum_i m_i)$$

That is, after distributing to total principal amount of value $\sum_i m_i$ to all SAFE investors, and a proportion $\sum_i m_i/c_i$ of the remaining upside $v_{pre} - \sum_i v_i$ to the SAFE investors whose cap was met, the residual share of the remaining upside is held by the founders.

To determine the actual number of shares for each SAFE investor, we first solve $s_f p_{new} = v_f$ for the share price p_{new} and then determine $s_i = v_i/p_{new}$. The same price p_{new} can then be used to issue additional shares to the new investor. Since we have ensured that $v_f + \sum_i v_i = v_{pre}$, these formulas for the equity round will be conservative for the new investor, as well as for the SAFE investors. We note that SAFEs defined using these formulas for conversion do not require the use of the Discounted Valuation method to ensure conservatism for the new investor, since this is already guaranteed.

This approach leaves open the distribution in the case that $v_{pre} \leq \sum_i m_i$, but this is, in any case, a situation needing special treatment, since the SAFE investors cannot be guaranteed a return of their investment, because the company's valuation has fallen below the total of the SAFE investments. It may, indeed, be rare for an equity round to be conducted in such a situation, since the founders have failed to demonstrate a capacity to grow the value of the company. In principle, the SAFE investors have a claim to 100% of the pre-money value of the company, but this leaves nothing for the founders, who would then lack motivation to continue with the company. Dissolution of the company, or a negotiated restructuring of the cap table may be more in order in such situations. We suggest that one way to clarify the contract is to have it state in this situation that SAFE investor i receives a pro-rata share

$$v_i = \frac{m_i}{\sum_j m_j} \cdot v_{pre}$$

of value, based on the SAFE principal amounts, and that, post-equity round, it is up to the shareholders to decide upon a founder incentive package.

8 Conclusion

In this paper, we have presented a general formulation of the Discounted Valuation method for dealing with equity rounds in which the company has issued convertible instruments that convert to shareholdings in the course of the equity round, and developed the implications of this method in the case of two types of convertible instruments: Pre-Money SAFE contracts with Cap but no Discount, and Post-Money SAFE contracts with Cap but no Discount. We have also compared the outcomes and shown that there is an equivalence (with respect to Equity Financing events) between these contract types in certain situations. The analysis shows that the Post-Money SAFEs, although arguably easier for investors to understand, are convertible using the Discounted Valuation method in a smaller set of circumstances than the Pre-Money SAFEs. To address this deficiency, we have proposed an alternate definition of the conversion conditions for SAFEs that capture the intuitions underlying the Post-Money SAFEs, but are convertible in all situations where the Pre-Money SAFEs are convertible using the Discounted Valuation method, without requiring the application of that method to ensure conservatism.

SAFE contracts, both Pre- and Post-Money, come in three forms in addition to the versions that we have considered in this paper. We expect that our general techniques apply to these forms and yield similar results, but we have not verified the details of the calculations for these other versions to confirm this. We also note that we have not considered the effect of combining Pre- and

Post-Money SAFEs in the same equity round, though we do not expect that there will be any significant difficulties with the calculations in this case. (It is unclear if there will be any demand for such a mixing of contract types, but it seems feasible if different investors have different preferences with respect to contract type.)

Our focus in this paper has been on the clauses of SAFE contracts covering Equity Financing events. The impact of our contributions for the other events in the SAFE lifecycle (Liquidity and Dissolution events) should also be considered. We leave this for future work.

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References

[AM85] Robert J. Aumann and Michael Maschler. Game theoretic analysis of a bankruptcy problem from the Talmud. *Journal of Economic Theory*, 36:195–213, 1985.

[Col] Derek Colla. Calculating share price with outstanding convertible notes. `https://www.cooleygo.com/calculating-share-price-outstanding-convertible-notes/`. [Online, Accessed Sep 2019].

[Lev18] Carolynn Levy. Safe financing documents 2018. Online `https://www.ycombinator.com/documents/#safe`, Accessed Sep 2019, Sep 2018.

[Tho03] William Thomson. Axiomatic and game-theoretic analysis of bankruptcy and taxation problems: a survey. *Mathematical Social Sciences*, 45:249–297, 2003.

[vdM21] R. van der Meyden. A game theoretic analysis of liquidity events in convertible instruments. arXiv `https://arxiv.org/abs/2111.12237`, Nov 2021.

[vdMM21] Ron van der Meyden and Michael J. Maher. Simple agreements for future equity – not so simple? manuscript, `http://www.cse.unsw.edu.au/~meyden/research/SAFEnss.pdf`, 2021.

[Y C] Y Combinator. *Startup Documents 2016*.

[Y C16] Y Combinator. *Safe: Cap, no Discount*, `https://web.archive.org/web/20180831020232/http://www.ycombinator.com/docs/SAFE_Cap.rtf` 2016.

[Y C18] Y Combinator. *Safe: Valuation Cap, no Discount*, `https://web.archive.org/web/20190626002912/https:`

//www.ycombinator.com/docs/Postmoney\%20Safe\%20-\
%20Valuation\%20Cap\%20-\%20v1.0.docx 2018.