Simple Agreements for Future Equity – not so simple?*

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Abstract

Y-Combinator's SAFE (Simple Agreement for Future Equity) notes are a form of contract used in financing of early stage ventures, that promise to convert an investor's money into shares at a price to be determined at a later date, when an equity round establishes a valuation of the company. Although these contracts may at first appear to precisely specify the number of shares to be issued, in practice, several different approaches are used to calculate this number, that lead to divergent consequences. We argue that contracts of this type introduce a contradiction into a set of equations that usually govern equity financing rounds, the resolution of which requires that a strict subset of these equations be treated as valid. We show that different choices for this subset lead naturally to the different approaches for calculating the number of shares issued. In the case of SAFE notes, their definition moreover has a circular nature that places some constraints on the equity round. We also consider game theoretic aspects of the way conversion is handled in the context of an equity round. The players in the associated game are the company, the SAFE note investor, and the investor in the equity round. We discuss strategies for each of these players when faced with different choices of contract and approaches to their execution.

1 Introduction

Financing of early stage ventures is increasingly using forms of investment contracts in which a seed investor provides a startup company with funds in exchange for a promise of shares to be issued in future, with the number of shares received determined according to conditions dependent on future events. These contracts provide the investor with an instrument that operates as a mix of debt and equity. They have a debt-like aspect in that they provide downside

*Version 2 - This version adds material on gaming the two stage process in Section 10.

protection that aims to guarantee that the investor gets their money back (possibly, with interest) in case the company does not appreciate in value, but also have an equity-like aspect that yields greater returns if the company enjoys a significant increase in value.

Besides the downside protection, one of the motivations for these contracts is that at its early stages, it can be difficult to meaningfully assign a valuation to a company on the basis of which to determine the shareholding received by the investor in exchange for their money. The Y Combinator [18] SAFE note is a particular instance of this class of contracts, specifically motivated to address this problem. The approach taken is to condition the number of shares issued on the valuation and share price of a later equity round in which the contract converts into a shareholding. Some history of the development of this contract has been described by Coyle and Green [4].

The shares to be issued in conversion of the SAFE note are preferred shares, with terms (except for price) identical to those of the preferred shares issued in the equity round. SAFE notes therefore also have the attraction to an investor that they will receive these advantageous terms. Both the SAFE investor and the founders benefit from the fact that the transaction is expedited, since they do not need to engage in complicated negotiations on these terms at a time when the company is still immature and the investment highly speculative, but for a modest amount of money.

In practice, SAFE notes introduce a number of complexities that have made their consequences difficult to understand, despite the intent for the SAFE to be simple and "layperson-friendly" [4]. There exist many web pages intended to explain SAFE and other convertible instruments to founders and investors, but they are generally cast in terms of concrete numerical examples that do not elucidate the general principles governing these contracts, and may obscure some of their peculiarities.

Our objective in this paper is to understand these complexities, and to clarify their consequences in practice in a precise mathematical formulation that elucidates the fundamental principles in play. Our original motivation for the work was to develop a precise enough understanding of the contract that it could be represented as a computer code in the form of a "smart contract" running on a blockchain platform. To do so requires much greater formality and precision than is common in natural language legal contracts. The formal analysis of the present paper stands on its own, however, and our work on smart contract implementations of SAFEs will be presented elsewhere [10, 11].

For one thing, a SAFE note could be understood to be a form of liability of the company, but unlike other types of contract, it cannot be independently valued, since it depends on the valuation of the company as a whole. This makes SAFE contracts *circular* in a way that raises questions about their soundness.

For another, one of the consequences of SAFE notes and other convertible instruments is that they dilute the value of shares issued in the equity round in a way that may be unacceptable to the new investors, particularly if they apply an understanding from a standard equity round that does not involve convertible instruments. We call an issuance of shares to an investor *conservative* if (ignoring transaction costs) immediately after the issuance, the investor holds shares of value at least equal to the money invested. Depending on the conversion method applied, equity rounds involving SAFE instruments may have the property that they are not conservative for the new investor.

Various approaches are used in practice in an attempt to mitigate this undesirable consequence. We argue that the diversity of these approaches can be explained as a response to a “paradox” that applies to convertible instruments in general: the existence of such instruments causes a set of equations that usually applies to equity rounds to become inconsistent. Resolving this inconsistency requires selecting a strict subset of the set of equations as valid. Different choices of the applicable set of equations lead to different ways to operate the convertible instrument, explaining the diversity of approaches used in practice.

We further argue that application of an accounting viewpoint is helpful to understand the “paradox”: from this perspective, the convertible instruments can be understood either as liabilities or as represented on the capitalization table of the company. Each of these views determines a consistent subset of equations for the equity round, but invalidates the others. Moreover, it can be argued that the two views yield essentially the same proportional shareholdings. They do, however, imply that there are two distinct interpretations of the term “Pre-Money Valuation” as used in term sheets for equity rounds. Some of the perceived difficulties of equity rounds involving convertible instruments appear to derive from confusions concerning these interpretations and/or a lack of clarity concerning what is being valued.

We illustrate the resulting understanding in the case of SAFE notes. We focus on a scenario in which the company has issued a single SAFE. (A companion paper [12] applies some of the key insights from the present work to an analysis of scenarios in which multiple SAFEs have been issued.) We derive the proportional shareholding resulting from each approach for each of the three parties: the company founders, the SAFE note investor, and the new investor. SAFE notes come in a number of different versions, depending on the inclusion of a valuation cap and/or discount. We focus on one case: the SAFE with valuation cap but no discount. The bulk of the paper concerns the original (Pre-Money) version of this particular contract [14].

We discuss several distinct approaches to the conversion of the SAFE in the context of an equity round. The first of these, the “Standard” method, appears to be the method intended by Y Combinator. As we show, this method is not conservative for the new investor. The “Discounted Valuation” and the equivalent “Percent-Ownership” method address this by conducting the equity round at a reduced valuation that results in a conservative result for the new investor. However, this comes at a cost to the founders, whose stake is reduced in this method, compared to the the Standard method. The “Dollars-Invested” method is a compromise that appears to be used in practice to resolve the resulting tension between founders and new investor. In addition to these methods, we also consider a “Zero-Round” approach to ensuring conservatism for the new investor by first conducting an artificial equity round (with a low, or, in the limit, zero amount of new money invested), simply in order to force conversion of the SAFE. A second equity round is then used to issue shares to the new investor.

Y Combinator in 2018 released a revision of its original Pre-Money SAFE called the "Post-Money SAFE", which changes the key clause that is our focus in this paper. We also analyze this new contract.

Our analysis leads to the identification of a number of weaknesses in the design of the Pre-Money SAFE with cap and no discount. One is that the contract lacks clarity about the relationship between "Pre-Money Valuation" and "Price", and this results in a further proliferation of conversion methods, one of which has the undesirable consequence that not all prices are feasible, and is moreover legally questionable. (The issue has been resolved in the Post-Money SAFE.) For some of the conversion methods (the conservative "Discounted Valuation" method of Section 7), the contract also has the deficiency that there exist valuations at which it cannot be converted.

After deriving closed form solutions for the distribution of shareholdings of the parties after the equity round on various conversion methods, we investigate equity rounds involving a SAFE note from a game theoretic perspective.[1] The players of the game are the company founders, the SAFE investor, and the new (equity round) investor. These parties may collude in various coalitions, against the interests of the excluded party.

In one of the forms of collusion we consider, the founders and the new investor "game" the SAFE by splitting the new investor's money across two distinct equity rounds, whose pre-money valuations are deliberately selected in order to minimize the resulting shareholding of the SAFE investor. We derive the optimal way for this collusion to proceed. While the legal SAFE contract contains language that could form the basis for a legal challenge to this form of collusion, but this analysis is relevant to situations where the costs of a legal challenge are likely to be prohibitive, or where legal challenge is impossible, such as smart contract implementations of the SAFE on open blockchain platforms.

A second analysis considers a game that consists of a number of stages. In the first stage, the founders and SAFE investor negotiate terms for the SAFE investor's investment. In the second stage, the founders and new investor negotiate the terms of the equity round in which a SAFE contract converts to equity, as well as the method for its conversion. We argue that if all the players are fully rational, then the range of conversion methods and instruments collapses to one main case and a fallback to cover a scenario where the SAFE cannot be converted. In particular, as far as the resulting shareholdings are concerned, a single Pre-Money SAFE with Cap and no Discount is equivalent to a Post-Money SAFE with Cap and No Discount (with different parameters).

However, there is evidence that in practice, players are not fully rational, and may settle a "Pre-Money Valuation" before having agreed on a conversion method. We also consider a version of the game that models this order of events and show that it leads to a rather complex negotiation scenario.

[1]There are also game theoretic questions that arise in liquidity events when SAFE notes have been issued. These are considered in another work [9].

The structure of the paper is as follows. Section 2 introduces the convertible instrument that provides the focus of most of the paper: the (Pre-money) SAFE with cap and no discount. For purposes of comparison, Section 3 considers standard equity rounds not involving convertible instruments, and identifies a number of equations governing such rounds. Section 4 argues that the presence of convertible instruments implies that these equations cannot all hold, so that a consistent subset needs to be selected. An accounting view on the situation is discussed in Section 5, where it is argued that two distinct ways in which the convertible instrument could be represented lead to the selection of particular consistent subsets of these equations. The following sections then apply the resulting understanding to a number of distinct methods used in practice to operate equity rounds involving a SAFE note: the Standard Method (Section 6), the Percent-Ownership method, which is argued to be closely related to a "Discounted Valuation" method (Section 7), the Dollars-Invested method, which is used as a compromise between the previous two (Section 8), as well as the Zero-Round approach in which the SAFE contract is discharged before new money is added in a standard round (Section 9). The optimal way for the founders and SAFE holders to collude agains the SAFE holder by constructing two equity rounds is discussed in Section 10. Section 11 considers the new "Post-money SAFE" with cap and no discount. We compare the outcomes of all these approaches and consider the associated game in Section 12. Section 13 concludes with some remarks on the weakness we identify in the Pre-Money SAFE in the course of the analysis. An appendix contains proof details for some of the game theoretic analysis of the paper.

2 SAFE note with cap and no discount

In this section we introduce a version of the SAFE contracts that were used by Y Combinator as its "standard deal" up until November 2018. These SAFEs may be called *pre-money SAFEs* in contradistinction with the *post-money SAFEs* introduced by Y Combinator as its "new standard deal" after that date. Y-Combinator's contracts have been adapted by other investors and incubator organisations, so there are now many different versions of these contracts extant. We focus in this paper on just one form of the Y Combinator SAFE, which offers a cap on the valuation at which the SAFE note is converted to shares, but has no discount on the conversion price [14]. (The other forms make different choices about which of these parameters apply. Many of the general points we make in the paper will apply equally to these variants, but the formulas we derive will require some modification.)

The SAFE note is a 6 page document comprised of a number of clauses, which define the parties to the contract, its purchase price, define a number of terms (Capital Stock, Change of Control, Company Capitalization, Distribution, Dissolution Event, Equity Financing, Initial Public Offering, Liquidity Capitalization, Liquidity Event, Liquidity Price, Pro Rata Rights Agreement, Safe, and Safe Preferred Stock), lists events of relevance to the execution of the contract (Equity Financing, Liquidity Event, Dissolution Event and Termination), and describes the consequences of each, asserts representations made by the company and the investor that underpin their capacity to enter into the contract, and describes various process issues relevant to the operation of the contract (e.g., rules concerning service of notices) that delimit the effect of revisions and specify legal jurisdiction.

We concentrate in this paper on just one key aspect of the contract, the Equity Financing clause, whereby the SAFE note specifies the number of shares received by the SAFE note holder as a result of the SAFE note converting to shares. The contract says the following:

> **Equity Financing.** If there is an Equity Financing before the expiration or termination of this instrument, the Company will automatically issue to the Investor either: (1) a number of shares of Standard Preferred Stock equal to the Purchase Amount divided by the price per share of the Standard Preferred Stock, if the pre-money valuation is less than or equal to the Valuation Cap; or (2) a number of shares of Safe Preferred Stock equal to the Purchase Amount divided by the Safe Price, if the pre-money valuation is greater than the Valuation Cap.

The definitions section tells us:

> **"Equity Financing"** means a bona fide transaction or sequence of transactions with the principal purpose of raising capital, pursuant to which the Company issues and sells Preferred Stock at a fixed pre-money valuation.
>
> **"Safe Price"** means the price per share equal to the Valuation Cap divided by the Company Capitalization.
>
> **"Company Capitalization"** means the sum, as of immediately prior to the Equity Financing, of: (1) all shares of Capital Stock (on an as-converted basis) issued and outstanding, assuming exercise or conversion of all outstanding vested and unvested options, warrants and other convertible securities, but excluding (A) this instrument, (B) all other Safes, and (C) convertible promissory notes; and (2) all shares of Common Stock reserved and available for future grant under any equity incentive or similar plan of the Company, and/or any equity incentive or similar plan to be created or increased in connection with the Equity Financing.[2]

To express this clause in a formal way, and calculate its ramifications when an equity round occurs, we introduce a number of variables, listed in Figure 1. All these values can be presumed positive, since negative or zero values are unrealistic.

[2]Notice that Company Capitalization in the SAFE, and throughout this paper, is the total number of shares, and not the value of those shares.

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 SAFE note m_{safe}, and the Valuation Cap c. The variable p_{safe} 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. We model a simple scenario in which the company has issued a single SAFE note, and no other forms of convertible promissory note. The variable s_f represents the number of shares held by the founders before (and after) the equity round. We assume there are no other shareholders. The variables s_{safe} represents the number of shares issued to the SAFE note holder 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 issued after the equity round is denoted S_{post} (if there were stock options, these would be accounted for here.) We will also denote the proportional post-money ownership of party i (either founders f, SAFE investor *safe*, or new equity investor *new*) by o_i, defined to be s_i/S_{post}.

In practice, shares received by different parties may have different rights (e.g., in case of a liquidation), but as a simplification, we ignore the differences between share types. To avoid adding complexity to our formulas that is not pertinent to the main points we wish to make, we furthermore simplify the setting by assuming that there are no stock options, either already issued or authorized, or to be newly authorized for future issuance as part of the equity round.

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 their 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}.

Using the above variables, we can write a formal representation of the key clauses of the SAFE contract described above. First, the **"Safe Price"** definition states that

$$p_{safe} = \frac{c}{S_{pre}} \tag{1}$$

In our concrete scenario, the company capitalization S_{pre} is s_f. Hence we get a Safe Price of

$$p_{safe} = \frac{c}{s_f} \ .$$

As will become clearer from the discussion of Section 3, we can think of this as the price the SAFE investor would have paid had they purchased shares in a standard equity raise in which the company had a pre-money valuation equal to the cap c.

- c = valuation cap of SAFE note
- m_{new} = dollar amount of new money raised
- m_{safe} = purchase amount of SAFE note
- s_f = the number of founders' shares
- s_{new} = number of shares issued for new money
- s_{safe} = number of shares issued to the SAFE note holder in conversion of the SAFE note
- S_{post} = the total number of shares issued (or authorized) after the equity financing
- S_{pre} = the total number of shares immediately prior to equity financing
- o_f = the proportion of shares owned by the founders after the equity raise
- o_{new} = the proportion of shares owned by the equity investor after the equity raise
- o_{safe} = the proportion of shares owned by the SAFE holder after the equity raise
- p_{new} = the price of new shares for the equity investor
- p_{safe} = 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_{safe} = valuation of the SAFE note

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

Secondly, we can write the Equity Financing clause as follows:

1. If $v_{pre} \leq c$, then $s_{safe} = m_{safe}/p_{new}$.
2. If $v_{pre} > c$, then $s_{safe} = m_{safe}/p_{safe}$.

These clauses seem clear enough, so one might expect that, in practice, it is straightforward for the company to comply with the terms of this contract. We will see below that they have some consequences which mean that things are not as simple as they might appear to be.

3 Standard equity raise

For purposes of comparison with what follows, we first consider the calculations for an equity raise with no SAFE note in place. We use the same variable names as above, except that those relating to the SAFE note are not relevant in this section.

Suppose that the company, with outstanding shares $S_{pre} = s_f$ raises extra capital m_{new} at a pre-money valuation of v_{pre}. Let p_{new} be the price of the newly issued shares, and s_{new} the number of newly issued shares. The new money, price per share paid and number of new shares issued are related by the equation

$$m_{new} = s_{new} p_{new} \ . \tag{msp_{new}}$$

One issue for the new investor is to determine the price per share that they are prepared to pay. There are multiple ways this price might be determined in practice, e.g., by negotiation with the company, taking into the account the price last paid by other investors, and the investor's estimates of their expected returns, given their investment horizon. Another way is for the company and the investor to agree upon the pre-money valuation of the company. From this we can determine a value per share for the existing shares in the company. Reasoning that the price of the newly issued shares should be the same as the value per share of the existing shares, at the pre-money valuation, we get that the transaction implies the following equation relating the pre-money valuation, outstanding shares, and the price per share[3]

$$v_{pre} = s_f p_{new} \ . \tag{vsp_{pre}}$$

Having determined a price per share p_{new} using this equation, we get, using equation (msp_{new}) that

$$s_{new} = m_{new}/p_{new} = m_{new} s_f / v_{pre} \ . \tag{2}$$

One can take several views on the valuation of the company after the equity round. One is to value the company based on the revised number of outstanding

[3]In mnemonics for the following equations, we use subscripts *pre* and *post* to indicate whether the variables (other than p_{new} and m_{new}) refer to the pre-money and/or the post-money state.

shares, each share valued at the price per share paid in the equity round. This leads to a post-money valuation v_{post} given by the equation

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

An alternate view 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

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

The number of post-money shares is $S_{post} = s_f + s_{new}$, so we get that the amount of this post-money value per share after the raise is

$$\begin{aligned} v_{post}/S_{post} &= (v_{pre} + m_{new})/(s_f + s_{new}) && \text{by } (vm_{pre,post}) \\ &= (v_{pre} + m_{new})/(s_f + m_{new} s_f / v_{pre}) && \text{by } (2) \\ &= v_{pre}/s_f \\ &= p_{new} && \text{by } (vsp_{pre}) \end{aligned}$$

i.e., the same as the pre-money value and price per share, as expected.[4] Note that equation (vsp_{post}) also gives $v_{post}/S_{post} = p_{new}$, so the two distinct ways of obtaining a post-money valuation expressed in equations (vsp_{post}) and $(vm_{pre,post})$ are consistent.

We may also conclude from the fact that the post-money value per share is p_{new} that the new investor's share of the post-money valuation is $s_{new} p_{new} = m_{new}$. Thus, we also see that the investor neither gains nor loses by engaging in the transaction, they merely convert the form of their holding from cash to shares. In a similar sense, the founders also do not lose from the transaction: the value of their shares after the equity round is $s_f p_{new} = s_f (v_{pre}/s_f) = v_{pre}$, i.e., the pre-money valuation.

More generally, we will say that a transaction in which shares are issued for money is *conservative* for the investor if (ignoring transaction costs), immediately after the transaction, the value of the shares issued is at least equal to the money invested. The previous paragraph then shows that a standard equity round is conservative for the investor.

Stated in terms of monetary value, the effect of the equity round on the proportional shareholdings in the company is that after the raise, the founder holds a fraction

$$\frac{s_f}{s_f + s_{new}} = \frac{s_f}{s_f + m_{new} s_f / v_{pre}} = \frac{v_{pre}}{v_{pre} + m_{new}}$$

[4] It would be reasonable to take the view that the post-money value per share should be higher on the grounds that the new money enables the company to proceed with its development plans whereas, without the new money, it may have to be liquidated for a lower return. However, if one takes the view that the pre-money valuation is based on the assumption that the equity round will proceed, the conclusion that the equity round should not change the value per share is reasonable.

of the company, and the new investor holds

$$\frac{m_{new}}{v_{pre} + m_{new}} .$$

For purposes of later comparison with the effects of SAFE notes, we note the effect of a sequence of two standard equity rounds (neither with convertible instruments in place), the first to an early investor for money m_{safe} at valuation c, and the second to a new investor for money m_{new} at valuation v_{pre}. Repeating the calculations of the present section, we obtain proportional shareholdings for the founders, early investor and new investor, respectively, of

$$\frac{c}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}} . \tag{3}$$

For the new investor this shareholding is worth m_{new}, as above, and the remaining value v_{pre} after the second round is divided between the founders and the early investor in the proportions

$$\frac{c}{c + m_{safe}}, \quad \frac{m_{safe}}{c + m_{safe}}$$

that result from the first equity round.

4 An Inconsistency

When convertible instruments, such as the SAFE contract, or other forms of convertible bond, are in place at the time of an equity round, they cause some fundamental changes to the properties of the round. Individually, each of the equations (msp_{new}), (vsp_{pre}), (vsp_{post}) and ($vm_{pre,post}$) governing a standard equity round is reasonable. However, taken together, they lead to an inconsistency when one of the consequences of the equity round is that convertible instruments convert into equity. In these situations, after the equity round, new shares have been issued not just to the new investor, but also to the holder(s) of the convertible instruments, but no additional money is paid for these shares. (Money was paid for the convertible instruments at an earlier time, but it may have already been spent by the time of the equity round.) This leads to a contradiction between the above equations, stated in the following proposition.

Proposition 1 *Consider an equity round in which the pre-money state of the company consists of the founders holding shares s_f, and in which the company has issued a convertible instrument to an early investor. Suppose that after the equity round, there are three shareholders, the founders, the early investor*[5]

[5] For convenience of later discussion, we subscript variables relating to the early investor here by "*safe*", as if they were a SAFE note holder. However, the proof makes use of no information about the details of the SAFE contract, so the result applies more broadly to any equity round in which a convertible instrument converts to equity without yielding new money for the company.

and the new investor, each holding a nonzero number of shares s_f, s_{safe} and s_{new}, respectively, and new shares are issued in the round to the new investor at a non-zero price p_{new} and at no cost to the early investor. Then equations (msp_{new}), (vsp_{pre}), (vsp_{post}), ($vm_{pre,post}$) are inconsistent.

Proof: From the assumption about the three post-money shareholders, we get $S_{post} = s_f + s_{safe} + s_{new}$. Thus, using ($vsp_{post}$), we have

$$v_{post} = p_{new}s_f + p_{new}s_{safe} + p_{new}s_{new} \ .$$

By ($vm_{pre,post}$), the left-hand side of this equation equals $v_{pre} + m_{new}$, by (vsp_{pre}), the first term on the right equals v_{pre}, and by (msp_{new}), the rightmost term equals m_{new}. Thus, we have

$$v_{pre} + m_{new} = v_{pre} + p_{new}s_{safe} + m_{new} \ ,$$

which is equivalent to $p_{new}s_{safe} = 0$. Since both p_{new} and s_{safe} have been assumed to be non-zero, this is a contradiction. $\square$

It follows that any attempt to make sense of such a situation needs, for consistency, to clarify which of the above equations is abandoned in understanding the equity round. As we will see, various approaches exist which resolve this issue by making different choices about which equation to abandon.

A related issue is that after the equity round, according to equation ($vm_{pre,post}$), the post-money value per share is $(v_{pre}+m_{new})/(s_f+s_{safe}+s_{new})$, which is less than the amount $(v_{pre} + m_{new})/(s_f + s_{new})$ it would be in the standard equity raise. If the new investor receives the same number of shares for their money, as in a standard equity round, this means that the new investor's shares are worth not m_{new}, as in a standard equity round, but a lesser amount. Whereas a standard equity round preserves value for the new investor, issuance of shares to the early investor *dilutes* the value of the new investor's shares, so that the new investor is left holding an immediate unrealised loss!

On the other hand, equation (vsp_{post}) can be understood as stating that the post-money value per share is exactly equal to the price paid by the new investor, and it then follows by equation (msp_{new}) that the post-money value of the new investor's shares is m_{new}. This directly contradicts the conclusion from the previous paragraph.

The following sections consider the ramifications of these issues with respect to the SAFE contract with cap and no discount, which adds some further complexity because of its recursive nature.

5 Two Accounting Views

The previous section indicates that when convertible instruments are involved in an equity round, the usual equations concerning the notions of pre-money and post-money valuation may be in conflict. This suggests that these notions are not well-defined in such a situation, and additional information may be required to determine which characterization best captures the situation. One way to do so is to consider the accounting status of the convertible instrument. There are two ways that the convertible instrument might be accounted for in the pre-money state. One is to view it as akin to a loan, which makes it a liability. Another is to account for it on the capitalisation table of the company, as an obligation to issue shares. In what follows, we consider these alternatives from first principles. (In practice, accounting standards contain complicated rules about the treatment of convertible instruments for purposes of standardised financial reporting, that remain subject to revisions [5]. IRS treatment of SAFEs is also ambiguous [1], relying on circumstances beyond the actual SAFE document.)

5.1 Liability View

We consider first the consequences of an accounting model where the instrument C being converted is treated as a liability. Suppose the initial state of the company consists of assets A, and liabilities L and C, and the cap table consists of shares s_{pre}. Let the valuation of the assets and liabilities be v_A, v_L and v_C, respectively. (If C is a loan then it is easily valued: v_C is the outstanding principal and interest due. We will see below that the recursive nature of SAFE notes adds some complexities to the question of their valuation.) Thus, prior to the transaction, the company has a valuation $v_{pre} = v_A - v_L - v_C$.

Consider an equity round where C is converted to shares at value equal to v_C and a new investor buys new shares for money m_{new}. The current share price is $p_{new} = v_{pre}/s_{pre}$, and the number of new shares issued for the convertible instrument would therefore be $s_C = v_C/p_{new} = v_C s_{pre}/v_{pre}$. (We emphasize that here v_C represents the value of the shares received by the convertible instrument holder at price p_{new}. This may be different from the value and price used for the actual conversion; case 2 of the Equity financing clause of the SAFE note is an example of this.) The number of shares issued to the new investor is given by equation (msp_{new}). The state of the company after the transaction consists of assets A plus new money m_{new}, liabilities L, and the cap table contains s_{pre}, together with newly issued shares s_C and s_{new}. Valuing the assets and liabilities, we have $v_{post} = v_A + m_{new} - v_L$. Thus, we have that

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

Note that the price per share after the transaction is therefore

$$\frac{v_{post}}{s_{pre} + s_C + s_{new}} = \frac{v_{pre} + v_C + m_{new}}{s_{pre} + (v_C s_{pre}/v_{pre}) + (m_{new} s_{pre}/v_{pre})} = \frac{v_{pre}}{s_{pre}}$$

which is identical to the price before the transaction. In terms of assets and liabilities, the share price is $(v_A - v_L - v_C)/s_{pre}$. This analysis shows that equation $(vm_{pre,post})$ does not correctly state the relationship between the pre-money and post-money valuation of the company when the convertible instrument is treated as a liability. Instead, equation ($vmC_{pre,post}$) captures this relationship. However, we do have $v_{post} = v_{pre} + v_C + m_{new} = p_{new} s_{pre} + p_{new} s_C + p_{new} s_{new} = p_{new} S_{post}$, so equation ($vsp_{post}$) does hold.

5.2 Cap Table View

However, particularly when C is not debt, but a hybrid instrument like the SAFE note, there is another way to do the accounting: we could consider the instrument C that will be converted to shares as already existing on the cap table of the company, rather than treated as a liability. On this view, the initial state of the company is given by assets A, liabilities L and cap table consisting of s_{pre} and C. The state after the equity round that converts C to an actual number of shares consists of assets A plus new money m_{new}, liabilities L and cap table comprised of shares s_{pre}, s_C and s_{new}. Thus, by contrast with the situation above, we have, from an accounting point of view, that $v_{pre} = v_A - v_L$ and $v_{post} = v_A - v_L + m_{new} = v_{pre} + m_{new}$, so equation ($vm_{pre,post}$) *does* hold on this view.

It remains to determine a share price. Note that if we take the price to be v_{pre}/s_{pre}, as in a standard equity round, and also assume that the transaction does not change the share price, we obtain the contradiction that the entirety of the final valuation $v_{post} = v_{pre} + m_{new}$ corresponds to the holder(s) of shares s_{pre} and s_{new}, leaving no part of the valuation for the shares s_C. To escape this contradiction, we need to either assume that the share price decreases as a result of the transaction, or start with a different share price. A decrease in share price would imply that the transaction is unsatisfactory for the new investor, since it is not conservative. The price v_{pre}/s_{pre} also does not take into account that we have recorded C on the cap table. We therefore consider just a different way to determine the share price.

To compute a share price that avoids the above paradox, we calculate this as if the shares s_C to be issued in conversion have already been issued. Thus, we have a share price

$$p_{new} = \frac{v_{pre}}{s_{pre} + s_C} \ . \qquad (vsCp_{pre})$$

Take the price p_{new} at which shares are issued to the new investor to satisfy equation ($vsCp_{pre}$). As usual, the number of shares issued to the new investor, by equation (msp_{new}), satisfies $p_{new} s_{new} = m_{new}$. Thus

$$p_{new} S_{post} = p_{new}(s_{pre} + s_C) + p_{new} s_{new} = v_{pre} + m_{new} = v_{post} \ ,$$

so equation (vsp_{post}) holds. We can write this as

$$p_{new} = \frac{v_{post}}{S_{post}} \ ,$$

that is, the share price at which the transaction is conducted is equal to the value per share after the transaction.

5.3 Cap Table View (Alternate)

Indeed, we can invert this reasoning, to show the following: under the assumptions that the values per share before and after the equity round are identical, that equation $(vm_{pre,post})$ captures the relation between pre- and post-money valuations, and that (msp_{new}) describes the number of shares issued to the new investor, equation $(vsCp_{pre})$ captures the share price at which the equity round should be conducted.

Treating v_C as the value of the shares s_C received in exchange for C, at price p_{new}, the number s_C satisfies

$$s_C = \frac{v_C}{p_{new}} = \frac{v_C}{v_{pre}} \cdot (s_{pre} + s_C) \ .$$

We can solve this equation for s_C to get

$$s_C = \frac{v_C s_{pre}}{v_{pre} - v_C} \ .$$

Thus, we get the following further characterizations of the price per share:

$$p_{new} = \frac{v_{pre}}{s_{pre} + s_C} = \frac{v_{pre}}{s_{pre} + v_C s_{pre}/(v_{pre} - v_C)} = \frac{v_{pre} - v_C}{s_{pre}}$$

From the last of these, we see that the value of shares s_{pre} at price p_{new} is $v_{pre} - v_C$, where the value of shares s_C at this price is v_C. Thus, this conversion price gives a coherent account of the impact of the conversion. The conclusion from this accounting view is that it is incorrect, pre-transaction, to view the valuation v_{pre} of the company as the value of the shares s_{pre}. Instead, the valuation v_{pre} should be discounted by the value v_C to get the valuation of these shares. This discounted valuation is then preserved by the transaction, and the holder of C receives shares worth v_C.

5.4 Accounting Views: Conclusions

It is worth noting that on the "cap table" accounting views, the share price is

$$(v_{pre} - v_C)/s_{pre} = (v_A - v_L - v_C)/s_{pre} \ , \tag{4}$$

which is exactly the same as the share price calculated for the liability view above. Although the two views disagree on the meaning of the term "pre-money valuation", they agree on the share price and yield the same number of shares issued. This suggests that share price is a more robust notion than "pre-money valuation". On both views, we obtained $v_{post} = v_A - v_L + m_{new}$, so "post-money valuation" is also a robust notion.

These considerations suggest that there are two distinct coherent interpretations of the terms "pre-money valuation" in an equity round in which shares are issued to a new investor for money m_{new}, and the instrument C is converted to shares. If we view C as a liability, then we can calculate a share price using

View	Equations Used	Equations Derivable	Equations False
Liability	msp_{new}, vsp_{pre}	vsp_{post}, $vmC_{pre,post}$	$vm_{pre,post}$
Cap Table	msp_{new}, $vsCp_{pre}$	vsp_{post}, $vm_{pre,post}$	vsp_{pre}, $vmC_{pre,post}$
Cap Table (alternate)	msp_{new}, vsp_{post}, $vm_{pre,post}$	$vsCp_{pre}$	vsp_{pre}, $vmC_{pre,post}$

Table 1: Accounting Views related to equity round equations

equation (vsp_{pre}), but ($vm_{pre,post}$) is false and instead the correct relationship is given by $v_{post} = v_{pre} + v_C + m_{new}$. On the other hand, if we view C not as a liability, but as already represented on the cap table, then it is reasonable that ($vm_{pre,post}$) holds, but this view requires that rather than using equation (vsp_{pre}), the pre-money valuation should be discounted when determining a share price. The discount can be represented either using equation ($vsCp_{pre}$) or equation (4). Whichever view is adopted, the determination of valuation should bear in mind *what* is being valued. In the case of the Liability view, the valuation should include a deduction for the value of C, whereas in the Cap Table view, the valuation should ignore C or treat it as if already discharged. Table 1 summarizes these relationships.

In the following sections, we apply the general model developed in the present section to the specific case of the SAFE note with cap and no discount. In practice, a number of approaches are used in the operation of convertible instruments. We relate these to the two accounting views of this section.

6 Pre-money SAFE: Standard Interpretation

We begin with an analysis of a literal interpretation of the SAFE contract, with the terms of the contract interpreted exactly as they would be in a standard equity round. We assume that the founders and the new investors agree upon a pre-money valuation v_{pre} for the company, use this and equation (vsp_{pre}) to derive a price per share paid by the new investor, and use equation (msp_{new}) to determine the number of shares received by the new investor. Using the Equity Financing clause, we can calculate the share-holding of the SAFE investor.

The use of equations (vsp_{pre}) and (msp_{new}) appears to be the method assumed by Y Combinator. For example, Example 1 in the Safe Primer [15] states the following (the numbers are approximate)[6]:

- Investor has purchased a safe for \$100,000. The Valuation Cap is \$5,000,000.
- The company negotiates with investors to sell \$1,000,000 worth of Series A Preferred Stock at a \$10,000,000 pre-money valuation. The company's fully-diluted outstanding capital stock

[6]The example contains a share option pool, which we have omitted in our formulation - the reader may treat the option pool shares as counted within founder shares in our formulation.

> immediately prior to the financing, including a 1,000,000 share option pool to be adopted in connection with the financing, is 11,000,000 shares.
>
> The company will issue and sell 1,100,110 shares of Series A Preferred at \$0.909 per share to the new investors. The company will issue and sell 220,022 shares of Series A-1 Preferred to the safe holder, at \$0.4545 per share.

We now derive the proportional shareholdings of the parties, and their *values*. To avoid the contradiction from Section 4, we need to make a choice between equations ($vm_{pre,post}$) and (vsp_{post}). It appears from Colla [3] that that investors frequently have the expectation that in setting a term sheet with pre-money valuation v_{pre} and new money m_{new}, they are purchasing a proportion $m_{new}/(v_{pre} + m_{new})$ of the company. For a standard equity round, this does follow, using ($vm_{pre,post}$). In fact, as already noted, the conversion of SAFE shares dilutes the new investor, so that they hold less than this amount. We will argue that, moreover, if one adopts equation ($vm_{pre,post}$), the SAFE contract has some further unexpected consequences, and that the rationale for its design is not completely clear. However, this mode of operation is more coherent with respect to equations (vsp_{post}) and ($vmC_{pre,post}$), corresponding to the Liability accounting view.

For the analysis, we consider each of the cases of the pre-money valuation v_{pre}. We begin by calculating the proportional shareholding for each of the parties. We express this as a fraction of amounts of money, since this is informative for understanding the value of each shareholding. Note that from (vsp_{pre}) and (msp_{new}) we have $p_{new} = v_{pre}/s_f$ and $s_{new} = m_{new}s_f/v_{pre}$, as we would in a standard equity round.

Case $v_{pre} \leq c$**:** In this case we have $s_{safe} = m_{safe}/p_{new} = m_{safe}s_f/v_{pre}$. Thus,

$$\begin{aligned} S_{post} &= s_f + s_{safe} + s_{new} \\ &= s_f + (m_{safe}s_f/v_{pre}) + (m_{new}s_f/v_{pre}) \\ &= s_f(v_{pre} + m_{safe} + m_{new})/v_{pre} \end{aligned}$$

We get that the proportional shareholding o_i for $i = f, \mathit{safe}, new$, of the founders, SAFE investor and new investor, respectively, can be expressed in the forms

$$\frac{v_{pre}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{safe}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{safe} + m_{new}}$$

after multiplying numerator and denominator by v_{pre}/s_f. Interestingly, these are precisely the same proportions of the company that they would hold had they raised both the SAFE investor's and the new investor's money at valuation v_{pre} in a single standard equity round.

If we were to assume that, as in the case of a standard equity raise, the price per share is the same immediately after the raise as the price at which the newly issued shares were sold, then, from the SAFE note investor's point of view, the value of the shares they receive is $s_{safe}p_{new} = m_{safe}$. On this reasoning, the SAFE investor would be guaranteed in this case that, at the time of the equity round, they have not lost money on their investment. This calculation appears to be the motivation for the definition of this case. The assumption that the pre-money and post-money share price are the same underlies the characterization of post-money valuation given by equation (vsp_{post}), which gives $v_{post} = p_{new}S_{post} = v_{pre} + m_{safe} + m_{new}$ by the above calculations. On this view, the founders', SAFE investor's, and new investor's shares are worth $v_{pre}, m_{safe}, m_{new}$, respectively. This is a satisfactory outcome for each of the parties. It is conservative for both the SAFE investor and the new investor, and the founders retain the value v_{pre} that they have created.

However, the actual situation is more complex for the other (apparently more common [3]) characterization of post-money valuation. According to ($vm_{pre,post}$), the post-money valuation is $v_{pre} + m_{new}$. This means that the value of the holding of the SAFE investor after the round is

$$o_{safe}(v_{pre} + m_{new}) = m_{safe} \cdot \frac{v_{pre} + m_{new}}{v_{pre} + m_{safe} + m_{new}} < m_{safe} \ .$$

Thus, in fact, the SAFE investor does not get quite their money back in this case. Similarly, the value of the new investor's shares on this view of the post-money valuation is

$$o_{new}(v_{pre} + m_{new}) = m_{new} \cdot \frac{v_{pre} + m_{new}}{v_{pre} + m_{safe} + m_{new}} < m_{new} \ .$$

This is in agreement with the remarks in Section 4 concerning dilution of the new investor, since o_{new} is less than the proportion $m_{new}/(v_{pre}+m_{new})$ that the new investor would hold after a standard equity round. On this understanding, the Standard method is conservative for neither the SAFE investor nor the new investor.

Case $v_{pre} > c$: In this case $p_{safe} = c/s_f < v_{pre}/s_f = p_{new}$, and the number of shares held by the founders, SAFE investor and new investor after the equity round are, respectively,

$$s_f, \quad \frac{m_{safe}s_f}{c}, \quad \frac{m_{new}s_f}{v_{pre}} \ .$$

This implies that the proportional holdings can be written in terms of monetary value in the form

$$\frac{v_{pre}}{v_{pre} + \frac{v_{pre}m_{safe}}{c} + m_{new}}, \quad \frac{\frac{m_{safe}v_{pre}}{c}}{v_{pre} + \frac{v_{pre}m_{safe}}{c} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + \frac{v_{pre}m_{safe}}{c} + m_{new}} \ .$$

As already noted above, and also in this Case, the new investor may receive shares of lesser post-money value than they paid for, if one takes equation ($vm_{pre,post}$)

to describe the post-money valuation. On this understanding, the value of the SAFE holder's shares after the raise is

$$
\begin{aligned}
s_{safe}\frac{v_{pre}+m_{new}}{s_f+s_{safe}+s_{new}} &= \frac{m_{safe}}{p_{safe}}\cdot\frac{v_{pre}+m_{new}}{s_f+s_{safe}+s_{new}} \\
&= m_{safe}\cdot\frac{v_{pre}+m_{new}}{s_f p_{safe}+s_{safe}p_{safe}+s_{new}p_{safe}} \\
&= m_{safe}\cdot\frac{v_{pre}+m_{new}}{c+m_{safe}+(cm_{new}/v_{pre})}
\end{aligned}
$$

where the last step uses, respectively, the definition of p_{safe} in the SAFE contract, the definition of s_{safe} in the second case of the Equity Financing clause of the SAFE contract, and equation (vsp_{pre}). This means the SAFE investor makes an (unrealised) profit on the investment m_{safe} provided $v_{pre}+m_{new} > c+m_{safe}+(cm_{new}/v_{pre})$. This is a quadratic constraint on v_{pre}. Taking into account that we are in a case where $v_{pre} \geq c$, this constraint can be shown[7] to hold just when

$$
v_{pre} \geq \frac{c+m_{safe}-m_{new}+\sqrt{(m_{new}-c-m_{safe})^2+4m_{new}c}}{2} \; .
$$

This condition does not seem to have a strong rationale, particularly as it depends on the amount m_{new} of new money, whereas one might have expected a condition that depends just on the terms of the SAFE contract. A sufficient condition for this that does make some sense is $v_{pre} \geq c+m_{safe}$. (In a scenario where the SAFE investor had made their investment of m_{safe} in a standard round at valuation c, this would say that the company has not lost value from its post-money valuation $c+m_{safe}$ by the time of the new equity round at valuation v_{pre}.)

However, if we take the post-money valuation to be given by equation (vsp_{post}), we have that

$$
\begin{aligned}
v_{post} &= p_{new}S_{post} \\
&= p_{new}s_f+p_{new}s_{safe}+p_{new}s_{new} \\
&= v_{pre}+(v_{pre}m_{safe}/c)+m_{new}
\end{aligned}
$$

[7]The polynomial has zeros at

$$
v_{pre} = \frac{c+m_{safe}-m_{new}\pm\sqrt{(m_{new}-c-m_{safe})^2+4m_{new}c}}{2} \; . \tag{5}
$$

Prima facie, there may be two regions where the constraint is satisfied, to the left and right of these roots, but we have the further constraint that $v_{pre} \geq c$. It is therefore convenient to work with a translation: write $v_{pre} = c+x$, where $x \geq 0$. The constraint then becomes

$$
x+\frac{x\cdot m_{new}}{c+x} > m_{safe} \; .
$$

Note that in the case $x = 0$ this amounts to the practical absurdity $0 > m_{safe}$, so cannot be a solution. The value $x = 0$ therefore sits in the region where the polynomial is negative, and there is in fact only a single region satisfying both constraints, that to the right of the rightmost root.

and $v_{post}o_{safe} = (v_{pre} + (v_{pre}m_{safe}/c) + m_{new})o_{safe} = m_{safe}(v_{pre}/c)$. Since $v_{pre} > c$ in this case, this is always a gain on the SAFE investor's original investment. Additionally, $v_{post}o_{new} = m_{new}$, and $v_{post}o_f = v_{pre}$. On this understanding, therefore, the Standard method is conservative for both the SAFE investor and the new investor.

In summary, in both cases of the SAFE note, we see that literal interpretation of the SAFE note using (vsp_{pre}) and (msp_{new}) produces conservative outcomes for the parties under the assumption that the post-money valuation is given by (vsp_{post}), but is problematic when the post-money valuation is given by $(vm_{pre,post})$. This conclusion is consistent with the conclusions of Section 5: use of (vsp_{pre}) corresponds to the Liability View of the SAFE note, which implies that (vsp_{post}) and $(vmC_{pre,post})$ describe the post-money valuation. From the above calculations, we see that the implied valuation v_{safe} of the SAFE note is

$$v_{safe} = \begin{cases} m_{safe} & \text{if } v_{pre} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c} & \text{if } v_{pre} > c \end{cases}$$

on the Liability View.

7 Percent-Ownership and Discounted Valuation Methods

Notwithstanding the analysis of the previous section, on which the SAFE note is coherent with respect to the Liability View of accounting, it appears from Colla [3], that equity round investors are interpreting term sheets stating pre-money valuation v_{pre} and new money m_{new} with the expectation (valid for standard equity rounds) that this delivers them a proportional shareholding of $m_{new}/(v_{pre} + m_{new})$. As shown above, for both cases of the SAFE note, the actual proportional shareholding is less than this when the Standard method is applied.

One of the approaches used in response to this perceived dilution suffered by a new investor as a consequence of shares issued in conversion of a convertible note is called the *percent-ownership* method [3]. The idea is to construct the equity round so as to guarantee to the new investor an agreed upon share of the company on completion of the round. Having agreed upon this share, the other variables are calculated so as to deliver this outcome. This approach resolves the inconsistency of Section 4 by dropping equation (vsp_{pre}) as a way to calculate p_{new} given v_{pre}, and instead calculates the value of p_{new} using equations (vsp_{post}) and $(vm_{pre,post})$. We describe the working of this method for a SAFE in Section 7.1, and show that it is essentially equivalent to a another method that works with a discounted valuation, in Section 7.2.

7.1 Percent-Ownership Method

In our scenario, this works in two steps, as follows.

Step 1: We fix the post-money proportional ownership o_{new} of the new investor to the agreed upon value. To deliver this outcome, we need

$$o_{new} = \frac{m_{new}}{v_{post}} \qquad (omv_{post})$$

in terms of monetary value, so using equation $(vm_{pre,post})$, we get

$$o_{new}(v_{pre} + m_{new}) = m_{new} \ . \qquad (6)$$

We can then calculate the pre-money valuation as $v_{pre} = m_{new}(1 - o_{new})/o_{new}$. We remark that, having determined v_{pre}, the remainder of the calculation does not need to treat o_{new} as an input, but can rederive it using equations (omv_{post}) and $(vm_{pre,post})$. Thus, an equivalent starting point for Step 2 would be the assumption that m_{new} and v_{pre} are given, and that we seek to determine a price per share that yields a percentage ownership o_{new} whose post-money value is m_{new}.

Step 2: An alternate way to express the post-money proportional ownership attained for the new investors is to formulate it in terms of number of shares:

$$o_{new} = \frac{s_{new}}{s_f + s_{safe} + s_{new}} \ . \qquad (os_{new})$$

Combining this with (omv_{post}) and $(vm_{pre,post})$, we get

$$\frac{s_{new}}{s_f + s_{safe} + s_{new}} = \frac{m_{new}}{v_{pre} + m_{new}} \ . \qquad (7)$$

From this, we derive

$$s_{new} = \frac{m_{new}}{v_{pre}}(s_f + s_{safe}) \ . \qquad (8)$$

It is worth noting that this formula effectively states that the new shares are issued at a price

$$p_{new} = v_{pre}/(s_f + s_{safe})$$

which suggests that the SAFE holder's shares s_{safe} have already been issued prior to the equity round at v_{pre}. This corresponds precisely to the Cap Table accounting view, with the SAFE note represented on the cap table as an obligation to issue shares. Equation (vsp_{pre}) fails on this method, but it is consistent to use $(vm_{pre,post})$ to determine the relationship between pre- and post-money valuations: since the SAFE note is not represented as a liability, all that changes with respect to valuation is to add m_{new} to the assets of the company.

While equation (vsp_{pre}) does not express the relationship between p_{new} and v_{pre}, we note that we could use this equation to determine a valuation v^*_{pre} that does satisfy this equation, namely,

$$v^*_{pre} = p_{new}s_f = \frac{v_{pre}s_f}{s_f + s_{safe}} = v_{pre} - \frac{v_{pre}s_{safe}}{s_f + s_{safe}} = v_{pre} - p_{new}s_{safe} \ .$$

The term $v_S = p_{new}s_{safe}$ can be understood as the valuation of the SAFE contract, so we have $v_{post} = v_{pre} + m_{new} = v^*_{pre} + v_S + m_{new}$. Thus, the relationship between v^*_{pre} and v_{post} is precisely what we would expect on the Liability View accounting model, where the SAFE note is represented as a liability that converts to shares in the course of the transaction at price p_{new}. Note moreover that

$$v_{post} = v^*_{pre} + v_S + m_{new} = p_{new}(s_f + s_{safe} + s_{new}) = p_{new} S_{post}$$

by equation (msp_{new}) and the definitions above, so that equation (vsp_{post}) is derivable.

However, since we have not yet determined s_{safe}, which, according to the SAFE note, depends on p_{new}, we cannot yet calculate p_{new}. Instead, we apply the definitions from the SAFE contract as additional constraints that together with equation (8) determine a value for p_{new}. The calculation is different in the two cases of the SAFE note.

Case $v_{pre} \leq c$: In this case the SAFE note requires that $s_{safe} = m_{safe}/p_{new}$. Since $s_{new} = m_{new}/p_{new}$, by ($msp_{new}$), we get from (8) that

$$\frac{m_{new}}{p_{new}} = \frac{m_{new}}{v_{pre}}(s_f + \frac{m_{safe}}{p_{new}}) \ .$$

We solve this for p_{new} to get

$$p_{new} = \frac{v_{pre} - m_{safe}}{s_f} \ .$$

(Obviously, this price makes sense only if $m_{safe} < v_{pre}$, so this case actually can occur only under the stronger condition $m_{safe} < v_{pre} \leq c$.) This gives $s_{safe} = m_{safe} s_f/(v_{pre} - m_{safe})$. Since we have guaranteed that the post-money value per share is p_{new}, the SAFE holder's shares are worth $p_{new} s_{safe} = m_{safe}$, so the SAFE holder is guaranteed not to lose money. The proportional holding for the SAFE holder, expressed in terms of money, is

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

We already have o_{new} as given by equation (6), so the resulting founder share is

$$\begin{aligned} o_f &= 1 - o_{safe} - o_{new} \\ &= \frac{v_{pre} - m_{safe}}{v_{pre} + m_{new}} \end{aligned}$$

According to the formulation ($vm_{pre,post}$) of post-money value that we have used in this derivation, the post-money value of the founder, SAFE investor and new investor's shares are, respectively, $v_{pre} - m_{safe}, m_{safe}$ and m_{new}. This case is therefore conservative for the SAFE investor and the new investor. Note also that the sum of these post-money amounts is $v_{pre} + m_{new}$, so they satisfy ($vm_{pre,post}$).

Case $v_{pre} > c$**:** Here we have $s_{safe} = m_{safe}/p_{safe} = m_{safe}s_f/c$, and we get from (8) that

$$s_{new} = \frac{m_{new}}{v_{pre}}(s_f + \frac{m_{safe}s_f}{c}) = m_{new}\frac{s_f}{v_{pre}}\frac{c + m_{safe}}{c} \ .$$

Thus, the new investor pays a share price

$$p_{new} = \frac{v_{pre}}{s_f}\frac{c}{c + m_{safe}}$$

rather than the expected v_{pre}/s_f. The SAFE holder's share of the company in this case is

$$\begin{aligned} o_{safe} &= \frac{\frac{m_{safe}s_f}{c}}{s_f + \frac{m_{safe}s_f}{c} + m_{new}\frac{s_f}{v_{pre}}\frac{c+m_{safe}}{c}} \\ &= \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}} \end{aligned}$$

and the founder share is the balance

$$o_f = \frac{c}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}} \ .$$

Comparing this outcome with (3), we see that this case operates in the same way as two equity rounds, in the first of which the SAFE holder purchases shares at pre-money valuation c, and in the second of which the new investor purchases shares at pre-money valuation v_{pre}.

7.2 Discounted Valuation Method

It is worth remarking that there is an alternate viewpoint that leads to essentially the same conclusions as just derived. One way that the new investor might respond to their perceived dilution is to "game" the situation, by conducting the equity round at a "discounted" pre-money valuation that differs from their actual valuation of the company, and which is designed to deliver an equity holding that better accords with this actual valuation, once the consequences of the SAFE are taking into account. (We emphasize that the discount we refer to here is for the *new* investor, and different from the discount on the conversion price provided to the SAFE investor in some versions of the SAFE — we are still concerned with the SAFE with cap and no discount.)

Suppose that the new investor's actual pre-money valuation of the company (ignoring the existence of a SAFE contract) is v_{pre}. We write v^-_{pre} to denote the pre-money valuation at which the equity round is actually conducted – this variable is taken as an unknown, with its value to be derived. As in a standard equity round, we apply equation (vsp_{pre}) to determine a price per share from v^-_{pre} , and then determine the number of shares issued to the new investor using (msp_{new}) based on this price per share. For purposes of selecting the applicable case of the SAFE contract, we use v^-_{pre} rather than v_{pre}. We first use v^-_{pre} to calculate the number of shares issued to the SAFE investor and the new investor, but then calculate the value of those shares using v_{pre} and characterization ($vm_{pre,post}$) of the post-money valuation. Assuming that the post-money valuation of the new investor's shares should equal m_{new} gives a constraint on v^-_{pre} that we then use to derive a value for v^-_{pre}.

Since the equity round is conducted at valuation v^-_{pre}, based on existing shares s_f, we have $p_{new}s_f = v^-_{pre}$ by equation (vsp_{pre}) and $p_{new}s_{new} = m_{new}$ by equation (msp_{new}). After the equity round, using the actual valuation v_{pre} and equation ($vm_{pre,post}$), the post-money valuation is $v_{pre} + m_{new}$. Thus, the post-money price per share is

$$\frac{v_{pre} + m_{new}}{s_f + s_{safe} + s_{new}} \, .$$

In order for the new investor's shares to still be valued at m_{new} in the post-money state, since we have $p_{new}s_{new} = m_{new}$, this post-money price per share must equal p_{new}. Hence, we need

$$\frac{v_{pre} + m_{new}}{s_f + s_{safe} + s_{new}} = \frac{m_{new}}{s_{new}} \tag{9}$$

from which we obtain

$$\begin{aligned} v_{pre} + m_{new} &= p_{new}(s_f + s_{safe} + s_{new}) \\ &= p_{new}s_f + p_{new}s_{safe} + p_{new}s_{new} \\ &= v^-_{pre} + p_{new}s_{safe} + m_{new} \end{aligned}$$

where we use equation (vsp_{pre}) for the first term and equation (msp_{new}) for the third term on the right. Thus, we conclude that $v^-_{pre} = v_{pre} - s_{safe}p_{new}$ is a valuation that guarantees that the post-money valuation of the new investor's shares will be m_{new}. Note also that the left and right hand sides of (first line of) the above equation are just the two formulations of v_{post} of equations ($vm_{pre,post}$) and (vsp_{post}), so this approach will guarantee that these formulations are equivalent. Additionally, note that equation (9) is equivalent to equation (7), so we have reached the same constraint as above from a different perspective.

As above, we do not yet have actual values for v^-_{pre}, s_{safe} or p_{new}, but we can obtain these by noting that the details of the SAFE contract provide additional constraints, and use these to derive the values of these variables. We obtain the same formulas for share price and proportional shareholding as above, and discounted valuations $v^-_{pre} = v_{pre} - m_{safe}$ when $v^-_{pre} \leq c$ and

$$v^-_{pre} = v_{pre} \cdot \frac{c}{c + m_{safe}}$$

otherwise.

The present perspective, of an equity round at the lower valuation v^-_{pre}, does result in one difference, however. Since the SAFE contract is invoked at valuation v^-_{pre} rather than v_{pre}, the conditions under which the cases of the SAFE contract apply are different. Instead of the conditions $v_{pre} \leq c$ and $v_{pre} > c$ for the cases given above, we have conditions $v^-_{pre} \leq c$ and $v^-_{pre} > c$, or equivalently, $v_{pre} - m_{safe} \leq c$ and $v_{pre} - m_{safe} > c$.

It is possible for these case conditions to be different in the two approaches of this section because, while the SAFE contract refers to both a pre-money valuation and a share price, it does not explicitly state how these should be related. One could take the view that it is an assumption of the contract that these variables are related to outstanding shares by equation (vsp_{pre}). The first approach of this section, uses a price which, by equation (vsp_{pre}), corresponds to the same discounted valuation $v_{pre} - s_{safe}p_{new}$ as just derived. Thus, there is a reasonable argument that the case conditions used in the first approach should be the same as those used in the second approach of this section, making the two approaches completely equivalent.

If either $v_{pre} \leq c$ (implying $v_{pre} - m_{safe} \leq c$) or $v_{pre} - m_{safe} > c$ (implying $v_{pre} > c$), then the two approaches agree with respect to selection of the SAFE case. However, when $c < v_{pre} \leq c + m_{safe}$, the first and second approaches yield for the SAFE investor proportional shareholdings of

$$\frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}} = \frac{m_{safe}}{v_{pre} + m_{new}} \cdot \frac{v_{pre}}{c + m_{safe}} \quad \text{and} \quad \frac{m_{safe}}{v_{pre} + m_{new}}$$

respectively. Under the condition $v_{pre} < c + m_{safe}$, the latter is the larger holding, so preferable to the SAFE investor. There is therefore a risk that, when $c < v_{pre} < c + m_{safe}$, the SAFE holder may legally challenge the first approach on the grounds that it does not satisfy equation (vsp_{pre}), and that this should be considered part of the implicit legal context of the SAFE contract, even if it is not explicitly stated. From the point of view of legal certainty, it may therefore be preferable to use the second approach. (It is a weakness of the SAFE contract that it allows uncertainty on this point.)

A further reason to prefer the second, Discounted Valuation, approach is that, intuitively, one expects that the market should be able to set any price for the company's shares, but the first approach does not support this. On the first approach, in case $v_{pre} \leq c$, and $v_{pre} > m_{safe}$, we have that the price $p_{new} = (v_{pre} - m_{safe})/s_f$ takes on any value in the interval $(0,\ (c - m_{safe})/s_f]$. In case $v_{pre} > c$, the price $p_{new} = v_{pre}\, c/s_f(c + m_{safe})$ takes on any value in the interval $(c^2/s_f(c + m_{safe}),\ \infty)$. This leaves prices in the interval

$$((c - m_{safe})/s_f,\ c^2/s_f(c + m_{safe})]$$

unattainable.[8] On the other hand, under the second approach, where the conditions for the two cases are $v_{pre} - m_{safe} \leq c$ and $v_{pre} - m_{safe} > c$, we obtain prices in the intervals $(0,\ c/s_f]$ and $(c/s_f,\ \infty)$, so all non-zero prices are attainable.

[8]Note that the statement that the left value is less than the right value is equivalent to $c^2 - m^2_{safe} < c^2$, which holds provided $m_{safe} > 0$ – we can safely assume that this is the case, else the SAFE note is inconsequential.

From an accounting perspective, since we have used equation ($vm_{pre,post}$), we should think of v_{pre} as a valuation of the company that does not include the SAFE note as a liability. Consistent with this, as already noted, equation (8) effectively states that the price for the new investor is determined assuming that the SAFE shares are already represented on the cap table. However, the post-money valuation can also be written as $v^-_{pre} + p_{new}s_{safe} + m_{new}$. Taking $v_{safe} = p_{new}s_{safe}$ to be the valuation of the SAFE note, we see that v^-_{pre} can be thought of as a valuation of the company on the assumption that the SAFE note is accounted for as a liability, which is discharged in the course of the equity round, so that the correct equation relating this interpretation of the pre-money valuation to the post-money valuation is $v_{post} = v^-_{pre} + v_{safe} + m_{new}$. The analysis in this section is therefore consistent with both accounting methods. Using the conditions from the second (discounted valuation) method, we obtain a valuation of the SAFE note given by

$$\begin{aligned} v_{safe} &= \begin{cases} m_{safe} & \text{if } v_{pre} - m_{safe} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c+m_{safe}} & \text{if } v_{pre} - m_{safe} > c \end{cases} \\ &= \begin{cases} m_{safe} & \text{if } v^-_{pre} \leq c \\ m_{safe} \cdot \frac{v^-_{pre}}{c} & \text{if } v^-_{pre} > c \end{cases} \end{aligned}$$

Note that the second formulation, with case conditions expressed in terms of v^-_{pre}, corresponds directly to the valuation obtained from the Standard method with respect to the Liability View in Section 6.

8 Dollars Invested Method

Another approach that has been used in practice to deal with dilution of the new investor resulting from convertible bond conversion is the *Dollars Invested* method. According to Colla [3], this method is used to allay founder objections to the fact that the percent-ownership method results in them being diluted more than they expected when setting a term sheet with the new investors. As a compromise, the agreed pre-money valuation is used, but the post-money valuation is set to be equal to the pre-money valuation plus the new-money, plus the principal (and interest, if any) of the convertible bond. Based on this post-money valuation, a share price is calculated that results in the agreed ownership percentage for the new investor. That is, instead of equation ($vm_{pre,post}$), we use the following:

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

For the SAFE contract with cap and no discount, this might work as follows. In order to determine the price paid by the new investor, we equate the revised post-money valuation from equation ($vmi_{pre,post}$) with the product of the price and the number of post-money shares, as per equation (vsp_{post}), giving

$$v_{pre}+m_{safe}+m_{new} = p_{new}(s_f+s_{safe}+s_{new}) = p_{new}s_f+p_{new}s_{safe}+m_{new} \ . \quad (10)$$

where we use equation (msp_{new}) to get the rightmost term. There are two cases for s_{safe}, depending on v_{pre}, the pre-money valuation.[9]

Case $v_{pre} \leq c$: In this case $s_{safe}p_{new} = m_{safe}$, so the equation (10) becomes $v_{pre} = p_{new}s_f$, and we deduce $p_{new} = v_{pre}/s_f$. (It is interesting to note that here we have *derived* rather than assumed equation (vsp_{pre}). However, it holds only in this case, and fails in the other case.) Dividing both sides of equation (10) by the left-hand side, we obtain the proportional shareholdings of the founders, SAFE investor and new investor, respectively, as

$$\frac{v_{pre}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{safe}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{safe} + m_{new}} .$$

This shareholding is the same as would have been produced had the SAFE holder and the new investor used their money to participate in a single equity round together, at pre-money valuation v_{pre}.

Case $v_{pre} > c$: In this case, we have $s_{safe} = m_{safe}s_f/c$. Thus equation (10) becomes

$$v_{pre} + m_{safe} = p_{new}s_f + p_{new}\frac{m_{safe}s_f}{c}$$

and we obtain

$$p_{new} = \frac{c}{c + m_{safe}} \frac{v_{pre} + m_{safe}}{s_f} .$$

Dividing both sides of equation (10) by the left-hand side, we obtain the proportional shareholdings of the founders, SAFE investor and new investor, respectively, as

$$\frac{c}{c + m_{safe}} \cdot \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{safe} + m_{new}} .$$

Comparing with (3), this is exactly the same outcome as would have been obtained in two equity rounds, in the first of which the SAFE holder purchased shares at valuation c, and in the second of which the new investor purchased shares at valuation $v_{pre} + m_{safe}$.

The coherence of this method depends on the view one takes of the "actual" post-money valuation, and the assumptions on which the pre-money valuation v_{pre} was determined. If v_{pre} was calculated on the assumption that the SAFE note is not a liability, then the actual post-money valuation is $v_{pre} + m_{new}$, and the new investor suffers a dilution, as they do in the standard method, though to a smaller extent.

[9] We remark that a question arises as to whether we should use the value v_{pre} agreed in the term sheet, or $v_{pre} + m_{safe}$, i.e., the post-money valuation being used in the calculation, minus the new money. The fact that we have $p_{new} = v_{pre}/s_f$, exactly as in a standard equity round suggests the former, but the SAFE holder may possibly have a legal case to argue for the latter. The latter approach would yield the same formulas for the two cases, but shift the intervals over which they hold, so we do not treat this as a separate method.

From an accounting perspective, perhaps the best rationale that can be given for this method is by viewing the transaction as a two-stage process. Suppose the new investor starts by valuing the company on the basis that the SAFE note is represented as a liability with value m_{safe}, determining v_{pre} as the valuation on this assumption. In the first stage, the liability is transferred to an obligation on the cap table, increasing the valuation to $v_{pre} + m_{safe}$. The price per share p_{new} is then calculated on the assumption that the existing shares are s_f, plus the obligation to issue shares s_{safe}. This viewpoint yields the equation $v_{pre} + m_{safe} = p_{new}(s_f + s_{safe})$, which is equivalent to the equation (10) used above, and supports the assumption that the post-money valuation is $v_{pre} + m_{safe} + m_{new}$. However, this method disagrees with the discounted valuation method on the proper valuation of the SAFE note. The discounted valuation method takes this to be equal to $s_{safe}p_{new}$, which is equal to m_{safe} in case $v_{pre} \leq c + m_{safe}$, but which equals the larger amount

$$m_{safe} \cdot \frac{v_{pre}}{c + m_{safe}}$$

when $v_{pre} > c + m_{safe}$. Thus, the Dollars Invested method arguably undervalues the SAFE note.

9 Two Stage (Zero-Round) Approach

Some investors may respond to the perceived dilution they would suffer from the Standard method, with post-money defined by equation ($vm_{pre,post}$), by simply refusing to invest until the SAFE note is extinguished by some means. One way this could be achieved is to structure the transaction in two stages. In the first stage, an artificial equity round is executed in which a minimal amount of new money is invested, simply in order to force conversion of the SAFE note into shares. In the second stage, the new investor purchases shares at valuation v_{pre} for money m_{new}, exactly as in a standard equity round. This purchase is free from dilution by the issuance of SAFE shares, so, by the argument of Section 3, the new investor receives a share $m_{new}/(v_{pre} + m_{new})$, as expected.

Although it may not be legally feasible, in the limit, the "minimal amount" of new money invested in the first round is zero, so we assume for purposes of the analysis that no new money is invested in the first stage round. Consequently, we refer to this approach as the *Zero-Round* approach.

The SAFE investor may have legal grounds to challenge such an approach as being artificially constructed and prohibited by the terms of the SAFE. The text of the SAFE defines "Equity Financing" as a

> a bona fide transaction or series of transactions with the principal purpose of raising capital, ...

and the SAFE investor might claim that the two stages constitute a single equity financing, that the first round does not have the principal purpose of raising capital, or that the transactions are not "bona fide"[10]. Nevertheless, this approach provides an interesting comparison with those already discussed.

We assume that the new investor is prepared to invest in stage 2 at valuation v_{pre}, and that this fact is known when constructing stage 1. In order to focus on the value of the SAFE investor's original investment, we will assume here that the SAFE investor does not take up, at additional cost, any pro-rata rights that they might have in this second stage. The consequences of this two-stage approach depend on how the first stage is negotiated. There are two possibilities for the first stage, considered in the following subsections.

9.1 Zero-Round (Discounted Valuation Method)

The new investor could allow the conversion terms to be agreed between the company and the SAFE investor. Whereas usually, the SAFE investor does not have rights to set the terms of the equity round, the negotiation between the company and SAFE investor in this situation gives some power to the SAFE investor to set terms for the conversion. They are likely to insist on avoidance of any loss, where possible. One way to achieve this is to use the Discounted method. Using the results of Section 7 with $m_{new} = 0$, we get the proportional shareholdings for the founders and SAFE investor after stage 1 of

$$\frac{v_{pre} - m_{safe}}{v_{pre}}, \quad \frac{m_{safe}}{v_{pre}}$$

respectively, in case $m_{safe} < v_{pre} \leq c + m_{safe}$, and

$$\frac{c}{c + m_{safe}}, \quad \frac{m_{safe}}{c + m_{safe}}$$

in case $v_{pre} > c + m_{safe}$. In either case, with the company valued at v_{pre}, the value of the SAFE investor's shares is at least m_{safe}, so this step is conservative for the SAFE investor.

In stage 2, these holdings are diluted by the new money in the same way that the founders are diluted in a standard equity round as discussed in Section 3. Thus, the proportional holdings become, for the founders, SAFE investor and new investor, respectively:

1. In case $m_{safe} < v_{pre} \leq c + m_{safe}$:

$$\frac{v_{pre} - m_{safe}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}} .$$

2. In case $v_{pre} > c + m_{safe}$:

$$\frac{c}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}} .$$

[10] This definition also poses challenges to implementing SAFE contracts on a blockchain as a smart contract [11].

Since we have used the Discounted Valuation method in the first round, the same remarks concerning accounting model appropriate to the method apply as in Section 7. The first round is consistent with both the treatment of the SAFE note as represented on the cap table, or (with respect to discounted valuation $v_{pre} - v_{safe}$) with the treatment of the SAFE note as a liability valued at v_{safe}. The second round does not involve convertible instruments. Thus, at the post-money valuation $v_{pre} + m_{new}$, this method is always conservative for both the SAFE investor and the new investor.

9.2 Zero-Round (Standard Method)

The Discounted Valuation method results in a lower proportional shareholding for the founders. In the interests of maximizing founder incentives, the new investor may prefer to ensure that the founders retain a larger share. Clearly, the founders would prefer a better deal, and, arguably, the SAFE investor does not have bargaining rights in the construction of the equity round in which the SAFE note converts. The first stage could therefore be constructed using the Standard method from Section 6, which delivers the founders a higher proportional shareholding.

In principle, there is the option for a more general type of collusion between the new investor and the founders, in which they conduct either of the two rounds at a valuation other than the new investor's actual valuation v_{pre}, and split the new investor's money across the two rounds, in such a way as to yield a desired result. We analyze this possibility in the following section, but assume here that both rounds are conducted at valuation v_{pre}. In general, the founders get a greater benefit from a higher valuation (from the perspective of the share of the company that they retain, the implied value of their share, and their negotiation position with respect to future rounds), so they may be averse to rounds at valuations less than v_{pre}. Moreover, it could be argued that the new investor, to the extent that they are involved in the first stage, does not have an interest in this being conducted at a valuation greater than v_{pre}, since that may create a precedent for the founders to argue that the second round should also be conducted at such a higher valuation. We therefore conduct the analysis assuming that both the first round and second round are conducted at valuation v_{pre}.

Using the approach and results of Section 6 with $m_{new} = 0$, conducting the first round at valuation v_{pre} leads to the following consequences after stage 1.

1. If $v_{pre} \leq c$, then the founder and SAFE investor proportional shareholdings are
$$\frac{v_{pre}}{v_{pre} + m_{safe}}, \quad \frac{m_{safe}}{v_{pre} + m_{safe}}$$
respectively.

2. If $v_{pre} > c$, then the founder and SAFE holder proportional shareholdings are
$$\frac{c}{c + m_{safe}}, \quad \frac{m_{safe}}{c + m_{safe}}$$

respectively. The SAFE investor receives a fixed share of the company in this case, equivalent to having purchased their shares at valuation c in a standard equity round. They have made an unrealised gain in case this share of the valuation v_{pre} is greater than m_{safe}, which holds if $v_{pre} > c + m_{safe}$.

In stage 2, these holdings are diluted by the new money in the same way that the founders are diluted in a standard equity round as discussed in Section 3. Thus, the proportional holdings become, for the founders, SAFE investor and new investor, respectively:

1. In case $v_{pre} < c$:

$$\frac{v_{pre}}{v_{pre} + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{v_{pre} + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}} .$$

2. In case $v_{pre} \geq c$:

$$\frac{c}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}} .$$

One expects that the appropriate accounting approach for this method is the same as for the Standard method applied in stage 1, namely, the Liability view. However, we note that this would yield a post-money valuation after stage 1 of $v_{pre} + v_{safe}$, which is greater than the pre-money valuation v_{pre} used for stage 2. In effect, the compromise that has been made in the interest of the founders is to conduct the first stage at a higher pre-money valuation than would be warranted by Liability accounting of the SAFE. This overvaluation is then corrected in a “down-round” in stage 2. This method is therefore not fully consistent with Liability accounting.

At post-money valuation $v_{pre} + m_{new}$, this method is always conservative for the new investor, and conservative for the SAFE investor in case $v_{pre} \geq c$, but is not conservative for the SAFE investor in case $v_{pre} < c$, since it yields the SAFE investor shares of value $m_{safe} \cdot \frac{v_{pre}}{v_{pre}+m_{safe}} < m_{safe}$.

As already noted above, the SAFE investor may have have grounds to argue that the Zero-Round approach is prohibited by the terms of the SAFE contract. The legal risk in this approach is higher if the first round applies the Standard Method, since the SAFE investor has a case that they were disadvantaged as a result of the artificial construction used, compared to the application of the Discounted Valuation Method.

10 Gaming the Two Stage Process

As noted, inasmuch as the SAFE contract does not explicitly grant the SAFE investor negotiation rights, it leaves the terms of the conversion round open to negotiation between the founders and the new investor. This has the risk that they will collude against the interests of the SAFE investor. In the two-stage Zero-Round processes of the previous section, we assumed that the first round is artificial in that zero new money is invested, and that the new investor invests all their money m_{new} in the second round at valuation v_{pre}, in order to obtain their desired share $m_{new}/(v_{pre} + m_{new})$ in the company, exactly as they would in a standard equity round. However, it is possible to generalize the two-stage process to allow more flexibility in the choice of valuation used in the two rounds, as well as to split the new investor's money across the two rounds.

We now conduct an analysis of a process in which the SAFE investor and the new investor collude as follows: they first negotiate on the proportion of shares to be owned by the new investor after the two-round process is complete. This negotiation fixes a proportion o_{new} of shares for the new investor (which typically, would equal $m_{new}/(v_{pre} + m_{new})$). The two rounds are then constructed so as to deliver this proportion of shares to the new investor, while maximizing the proportion of the company going to the founders (and therefore minimizing the proportion going to the SAFE holder). The new investor splits their money into two portions m and $m_{new} - m$, with $0 \leq m \leq m_{new}$. In the first round, the new investor purchases shares for money m at pre-money valuation v_1, discharging the SAFE contract using the standard method. In the second round, the new investor purchases shares for money $m_{new} - m$ at pre-money valuation v_2. We seek constraints on these parameters that achieve a proportional shareholding of o_{new} for the new investor while optimizing the proportional shareholding of the founders. We note that this is equivalent to maximizing the ratio between the founders' share o_f and the SAFE investor's share o_{safe}. We again assume that the SAFE investor does not take up any pro rata rights that they may have in the second round.

The outcome of the first round is a proportional shareholding for the founders, SAFE holder, and new investor, respectively, of

$$\frac{v_1}{v_1 + m_{safe} + m}, \quad \frac{m_{safe}}{v_1 + m_{safe} + m}, \quad \frac{m}{v_1 + m_{safe} + m}$$

in case $v_1 \leq c$, and

$$\frac{v_1}{v_1 + m_{safe}\frac{v_1}{c} + m}, \quad \frac{m_{safe}\frac{v_1}{c}}{v_1 + m_{safe}\frac{v_1}{c} + m}, \quad \frac{m}{v_1 + m_{safe}\frac{v_1}{c} + m}$$

in case $v_1 > c$.

Determining the proportional shareholdings for the founders, SAFE investor and new investor after the second round, we obtain proportions (respectively):

$$o_f = \frac{v_1}{v_1 + m_{safe} + m} \cdot \frac{v_2}{v_2 + m_{new} - m}$$

$$o_{safe} = \frac{m_{safe}}{v_1 + m_{safe} + m} \cdot \frac{v_2}{v_2 + m_{new} - m}$$

$$o_{new} = \frac{m}{v_1 + m_{safe} + m} \cdot \frac{v_2}{v_2 + m_{new} - m} + \frac{m_{new} - m}{v_2 + m_{new} - m}$$

in case $v_1 \leq c$, and

$$o_f = \frac{v_1}{v_1 + m_{safe}\frac{v_1}{c} + m} \cdot \frac{v_2}{v_2 + m_{new} - m}$$

$$o_{safe} = \frac{m_{safe}\frac{v_1}{c}}{v_1 + m_{safe}\frac{v_1}{c} + m} \cdot \frac{v_2}{v_2 + m_{new} - m}$$

$$o_{new} = \frac{m}{v_1 + m_{safe}\frac{v_1}{c} + m} \cdot \frac{v_2}{v_2 + m_{new} - m} + \frac{m_{new} - m}{v_2 + m_{new} - m}$$

in case $v_1 > c$.

We conduct the analysis for the two cases, to determine the values of v_1, v_2 and m that give the optimal outcome for the founders, given that the new investor gets a share o_{new} at the end of the process.

Case 1: $v_1 \leq c$. In this case, the ratio between the founders' share and the SAFE investor's share, is, from the above, $\frac{o_f}{o_{safe}} = \frac{v_1}{m_{safe}}$. Plainly this takes a maximum at $v_1 = c$. Noting that $o_f + o_{safe} + o_{new} = 1$ and substituting the value $o_{safe} = o_f m_{safe}/c$ obtained at the maximum, we derive that

$$o_f = \frac{c}{c + m_{safe}} \cdot (1 - o_{new}) \text{ and } o_{safe} = \frac{m_{safe}}{c + m_{safe}} \cdot (1 - o_{new}) \ .$$

As this result was obtained without consideration of m or v_2, it remains to verify that the result can be obtained with feasible values for these variables. These variables are related because, when $v_1 = c$, the new investor proportion after the two rounds is

$$o_{new} = \frac{m}{c + m_{safe} + m} \cdot \frac{v_2}{v_2 + m_{new} - m} + \frac{m_{new} - m}{v_2 + m_{new} - m}$$

Solving for v_2, we get

$$v_2 = \frac{(m_{new} - m)(1 - o_{new})(c + m_{safe} + m)}{o_{new}(c + m_{safe} + m) - m} \ .$$

Note that all terms in the numerator are non-negative, so we have a feasible value $v_2 \geq 0$ satisfying the conditions for this case when $o_{new}(c + m_{safe} + m) - m > 0$, i.e., when

$$\frac{o_{new}(c + m_{safe})}{1 - o_{new}} > m \ .$$

This can always be satisfied by choosing m to be sufficiently small. (We note, however, that for the round to be considered *bona fide*, larger values are more credible).

Case 2: $v_1 > c$. In this case, note that the ratio between the founder share and the SAFE investor share is, from the above, $\frac{o_f}{o_{safe}} = \frac{c}{m_{safe}}$. This amount is independent of the choice of v_1, v_2 and m. Thus, after fixing the proportion going to the new investor after two rounds at o_{new}, this case does not provide any opportunity to manipulate the outcome by choosing parameters of the two-stage process.

As above, we derive that the corresponding founder share is

$$o_f = \frac{c}{c + m_{safe}} \cdot (1 - o_{new})$$

holding not just at the maximum, but *always*. This is identical to the *optimal* solution from Case 1, but this is to be expected, given that Case 2 gives a constant result and its definition is continuous with Case 1 at the boundary between the two cases, where the optimum of Case 1 occurs.

Again, we need to consider feasibility of the values for v_2 and m. Similarly to the above calculation, we get

$$v_2 = \frac{(m_{new} - m)(1 - o_{new})(v_1 + m_{safe}\frac{v_1}{c} + m)}{o_{new}(v_1 + m_{safe}\frac{v_1}{c} + m) - m} \ .$$

so that we require for feasibility that

$$o_{new}(v_1 + m_{safe}\frac{v_1}{c} + m) - m > 0$$

that is,

$$\frac{o_{new}(v_1 + m_{safe}\frac{v_1}{c})}{1 - o_{new}} > m \ .$$

Again, this is always possible by choosing m to be sufficiently small.

We conclude that the optimal share for the founders obtainable from the two round process, given that the new investors receive share o_{new}, is always $c(1-o_{new})/(c+m_{safe})$. There may be multiple choices of v_1, v_2 and m that yield this outcome. The following example illustrates the extent of the advantage that can be obtained for the new investor and founders from this two stage process in case $v_{pre} < c$.

Example 1 *Consider a company whose founders have 1,000 shares, and suppose an investor, Saffron, buys a Pre-Money SAFE with a valuation cap of $1,000,000 and no discount, for principal $10,000.*

We suppose that later, a new investor Neville has $1,500 to invest, and that the development of the company has gone poorly, so that its valuation has dropped significantly to around $3,000, or $3 per share. If this investment were made using an equity round that discharges the SAFE according to the Standard method, the numbers of shares after the equity round would be Founders: 1,000, Saffron:3,333, Neville: 500, and proportional shareholdings, roughly, Founders:21%, Saffron:69% and Neville:10%. Saffron would have control of the company in this situation.

To avoid this outcome, Neville and the company collude to limit the influence of Saffron after an equity financing, by structuring Neville's investment into two rounds rather than one. It is agreed to structure the two rounds so as to give

Neville a 1/3 stake at the end of the two stages. (Note that this is equivalent to the stake Neville would obtain if the SAFE were not present.)

Specifically, in spite of the low valuation, in the first round, Neville provides equity financing of \$1,000 at a Pre-Money Valuation of \$1,000,000 and hence a price of \$1,000 per share. (Not that the valuation in this first round is equal to the cap. It was shown above that this gives the optimal share to the founders.) After this financing, the founders have 1,000 shares, Saffron has 10, and Neville has 1, so the proportional shareholdings are, roughly, founders: 99%, Saffron: 0.99%, and Neville: 0.01%. The SAFE is terminated in this round. Saffron might well be satisfied with the deal since it implies a valuation of her shares roughly equal to her original investment, so she avoids a paper loss.

Later, in a second round of equity financing, Neville uses the remaining \$500 to buy 504 shares at a price \$0.99206 (a valuation of \$1,002.976). The SAFE has terminated, so Saffron receives no shares in this round. The capitalization is now 1,511 shares, of which the founders have 1,000, Saffron has 10, and Neville has 505, or proportions of 66%, 0.7% and 33.3%.

Thus, overall, rather than a 10% stake, Neville has obtained his desired 1/3 stake for the same money, and with a significantly different outcome for the founders and Saffron. The founders retain almost all of the controlling stake that Saffron would have obtained in a Standard SAFE round. If Neville had paid this price in a single round, Saffron would have received 3,334 shares and become the majority shareholder.

If Saffron has a pro rata *rights agreement with the company then she can obtain some shares at the same price as Neville, but that simply maintains her shareholding at about 1%. She still has arguably been defrauded of a majority share in the company.*

It is of interest to compare this to an "honest" one-round process that guarantees a particular share to the new investor, namely, the Percent Ownership method. Recall from Section 7 that this involves a round conducted at valuation $v_{pre} = m_{new}\frac{1-o_{new}}{o_{new}}$ and yields founder share

$$\begin{aligned} \frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}} &= \frac{\frac{c(1-o_{new})}{c+m_{safe}}-m_{safe}}{\frac{c(1-o_{new})}{c+m_{safe}}+m_{safe}} \\ &= \frac{m_{new}-o_{new}(m_{new}+m_{safe})}{m_{new}} \end{aligned}$$

in case $v_{pre} \leq c$ and

$$\begin{aligned} \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} &= \frac{c}{c+m_{safe}} \cdot \frac{m_{new}\frac{1-o_{new}}{o_{new}}}{m_{new}\frac{1-o_{new}}{o_{new}}+m_{new}} \\ &= \frac{c(1-o_{new})}{c+m_{safe}} \end{aligned}$$

in case $v_{pre} > c$. The latter is identical to the optimum attainable from the two round process, showing that the two round process gives the founders no advantage in this case.

In case $v_{pre} \leq c$, the two round process gives an (optimal) advantage to the founders if

$$\frac{c(1 - o_{new})}{c + m_{safe}} > \frac{m_{new} - o_{new}(m_{new} + m_{safe})}{m_{new}}$$

or, equivalently,

$$o_{new} > \frac{m_{new}}{c + m_{safe} + m_{new}} \ .$$

For this case to apply we need $v_{pre} = \frac{m_{new}(1-o_{new})}{o_{new}} \leq c$, that is, $o_{new} \geq \frac{m_{new}}{m_{new}+c}$. Hence, we need

$$o_{new} > \max(\frac{m_{new}}{m_{new} + c}, \frac{m_{new}}{c + m_{safe} + m_{new}}) = \frac{m_{new}}{m_{new} + c}$$

in order for the founders to obtain an advantage from the two-round process, compared to the Percent Ownership method. With $v_{pre} \leq c$ and $o_{new} = v_{pre}/(v_{pre} + m_{new})$, the new investor's share after investing m_{new} at valuation v_{pre} in a standard equity round, this always holds.

The amount of advantage to the founders, compared to the percent ownership method, is that they obtain an additional share of

$$\frac{m_{safe}}{c + m_{safe}} \cdot \frac{m_{new} + o_{new}(c + m_{safe} + m_{new})}{m_{new}}$$

of the company. The share of the SAFE investor decreases by a corresponding amount.

As in the previous section, we have ignored the possibility that this loss causes the SAFE investor to litigate on the basis of the claim that the first round was not *bona fide*. It is likely that "gaming" of the SAFE along the lines contemplated in the present section is even less legally defensible than the use of a Zero-Round. For example, the SAFE investor may introduce an independent valuation of the company to argue that there has been a breach of contract. They may also argue that the intention of the contract was to provide them with downside protection in the event of a low de-facto valuation, and that they have been deprived of this protection by the artificial construction of the two rounds. It is not clear whether such arguments would be upheld, but the risk of costly litigation and the desire to keep the SAFE investor on good terms may inhibit the type of manipulation considered in the present section.

Nevertheless, the possibility of such "attacks" on the contract are worth considering in contexts such as SAFEs implemented as smart contracts on open distributed ledger systems, where a "Code is Law" attitude and lack of clear legal jurisdiction could make it more difficult for the SAFE investor to obtain legal redress.

11 Post-money SAFE

Thus far in the paper, we have been focused on an original version of the SAFE (with cap and no discount). Y Combinator introduced a "post-money SAFE" as its new standard deal in late 2018 [8], supplanting the previous SAFE versions. Like the previous "pre-money" SAFE, there are four distinct versions of this new contract, allowing a choice to be made on whether to include a cap and/or a discount. There are differences from the original in several key regards, including the equity financing clause that is our focus in this paper. In this section we compare the post-money (with cap and no discount [17]) SAFE's handling of Equity Financing with that of the pre-money SAFE, and analyse the post-money SAFE with respect to the same scenario as treated above, in which a single SAFE note has been issued.

In essence, the post-money SAFE is more explicit with respect to the method of its operation[11]. Like the pre-money SAFE, it has a Purchase Amount and a cap, which is called the "Post-Money Cap". The Equity Financing clause of the post-money SAFE states the following:

> **Equity Financing.** If there is an Equity Financing before the termination of this Safe, on the initial closing of such Equity Financing, this Safe will automatically convert into the greater of: (1) the number of shares of Standard Preferred Stock equal to the Purchase Amount divided by the lowest price per share of the Standard Preferred Stock; or (2) the number of shares of Safe Preferred Stock equal to the Purchase Amount divided by the Safe Price.

One apparent difference is that whereas the Equity Financing clause in the pre-money SAFE makes explicit reference to both pre-money valuation and price, this clause refers only to price. Thus, the issue we raised above, whether equation (vsp_{pre}) governs the relationship between pre-money valuation and price for purposes of the Equity Financing clause, has been obviated. The clauses defining "Safe Price" also contain modifications. First of all, we have

> "**Safe Price**" means the price per share equal to the Post-Money Valuation Cap divided by the Company Capitalization.

which is similar to the corresponding clause of the pre-money SAFE except that it uses the term "Post-money Valuation Cap" for the cap. More significant is that "Company Capitalization" is defined by

> "**Company Capitalization**" is calculated as of immediately prior to the Equity Financing and (without double-counting):
>
> - Includes all shares of Capital Stock issued and outstanding;
> - Includes all Converting Securities;
> - Includes all (i) issued and outstanding Options and (ii) Promised Options;
> - Includes the Unissued Option Pool; and

[11] Y Combinator summarize the changes in Appendix III of [16].

- Excludes, notwithstanding the foregoing, any increases to the Unissued Option Pool (except to the extent necessary to cover Promised Options that exceed the Unissued Option Pool) in connection with the Equity Financing.

Whereas, in the pre-money SAFE, company capitalization was defined to exclude the SAFE note, the new definition explicitly includes it, amongst "Converting Securities", defined by

> "**Converting Securities**" includes this Safe and other convertible securities issued by the Company, including but not limited to: (i) other Safes; (ii) convertible promissory notes and other convertible debt instruments; and (iii) convertible securities that have the right to convert into shares of Capital Stock.

We may note the resemblance of this definition to a particular stance on the accounting status of the SAFE note - that the SAFE note is not a liability, but is represented on the cap table. We argue below that this view yields the more felicitous interpretation of the post-money SAFE.

In the case of the pre-money SAFE, we argued that the contract implicitly introduces a circularity into the definition of pre-money valuation. There is similarly a circularity in the post-money SAFE: in case (2), the number of SAFE shares issued depends on the Safe Price, which depends on the Company capitalization, which in turn depends on the number of SAFE shares issued.[12] Some have consequently questioned the mathematical soundness of the post-money SAFE [2]. We show here that the recursion can be resolved for our simple scenario in which a single post-money SAFE has been issued. (The situation is somewhat more complex in situations where multiple SAFEs have been issued, where the SAFEs place more complex constraints on the conditions under which an equity round can be conducted. We discuss the more general case in [12].)

We first characterize the outcomes of the Post-Money SAFE in terms of price, and consider their relation to valuation below. We use the same variable names as above. The post-money SAFE note directly specifies the Purchase Amount of the SAFE note m_{safe}, and the Post-money Valuation Cap c. The number of founder shares s_f is also fixed. At the time of the equity round, the new money raised m_{new}, and the price per share p_{new} are given. As usual, we assume that equation (msp_{new}) is used to determine the number of shares s_{new} received by the new investor.

As above, we assume that Common Stock, Safe Preferred Stock and Standard Preferred Stock are essentially the same, but in fact there are differences (liquidation preference, anti-dilution protection, dividend rights) that would need to be addressed in a more detailed analysis. We also assume a single equity investor, so that the "lowest price per share of the Standard Preferred Stock" unambiguously refers to p_{new}.

[12] Given their name, perhaps it is not surprising that Y Combinator has a tendency to recursive contracts. "Y combinator" is a term from lambda calculus, concerned with recursion.

By the Equity Financing clause, we have that the number s_{safe} of shares issued to the SAFE investor satisfies

$$s_{safe} = \max\{m_{safe}/p_{new}, m_{safe}/p_{safe}\} \ .$$

By the definition of Safe Price,

$$p_{safe} = c/S_{pre}$$

where S_{pre} is the Company Capitalization. Since this has been defined to include all shares of capital stock and all SAFE notes, in our simple scenario, we have

$$S_{pre} = s_f + s_{safe} \ .$$

Substituting, we get the equation

$$s_{safe} = \max\{m_{safe}/p_{new}, m_{safe}(s_f + s_{safe})/c\}$$

which explicitly displays that the SAFE gives a circular definition of s_{safe}. We have two cases, depending on which argument of the maximum is greater. (We include the case where the two terms are equal in order to check consistency of the solutions in this case.)

Case 1: $m_{safe}/p_{new} \geq m_{safe}(s_f + s_{safe})/c$. Equivalently, $s_{safe} \leq \frac{c}{p_{new}} - s_f$. In this case $s_{safe} = m_{safe}/p_{new}$. Consequently, the condition for this case is equivalent to

$$0 \ < \ p_{new} \ \leq \ \frac{c - m_{safe}}{s_f} \ .$$

Case 2: $m_{safe}/p_{new} \leq m_{safe}(s_f + s_{safe})/c$. In this case, s_{safe} is defined by the recursive equation $s_{safe} = m_{safe}(s_f + s_{safe})/c$. Solving for s_{safe}, we get

$$s_{safe} = \frac{m_{safe} s_f}{c - m_{safe}} \ .$$

Obviously, we need the constraint $m_{safe} < c$ for this solution to make sense, else we have an undefined or negative number of shares. This constraint is reasonable, if we treat the cap c as analogous to a post-money valuation for the SAFE investor's investment. (We will see below, when discussing the proportional shareholding outcomes, that this analogy makes sense.) Substituting for s_{safe} in the inequality and reorganising, we get the following formulation of the condition for this case:

$$p_{new} \ \geq \ \frac{c - m_{safe}}{s_f} \ .$$

Note that this is the complement of the condition for Case 1.

When both cases apply, we have $p_{new} = (c - m_{safe})/s_f$. The two cases agree on the value of s_{safe}. However, the SAFE note does not specify whether the SAFE investor receives Standard or Safe Preferred Stock, and it is also not made explicit that the investor has a choice. As the apparent intent of the clause is to deliver the maximum benefit to the SAFE investor, one expects that this question would be resolved in case of a legal dispute by the SAFE investor receiving whichever class of shares gives the greatest benefit. The details of the shareholder rights with respect to Liquidity, Dissolution and Dividend events need to be taken into account to make a determination on this point. For uniformity with the pre-money SAFE, and because preferred stock has priority over common stock in case of a Liquidity or Dissolution event, we assume that SAFE preferred stock is preferable, so that the conditions for the two cases are $p_{new} \leq (c - m_{safe})/s_f$ and $p_{new} > (c - m_{safe})/s_f$.

Assuming that the transaction does not change the share price, we can deduce monetary values for the resulting shareholdings of the founders, SAFE investor and new investor, respectively, by multiplying these by p_{new}, resulting in the following:

Case 1:

$$s_f p_{new}, \quad m_{safe}, \quad m_{new}$$

Case 2:

$$s_f p_{new}, \quad m_{safe} \frac{s_f p_{new}}{c - m_{safe}}, \quad m_{new}$$

On this assumption the new investor is guaranteed a shareholding equivalent in value to their investment, as is the SAFE investor in case 1. In case 2, since we have $p_{new} > (c - m_{safe})/s_f$, the monetary value of the SAFE investor's shares is greater than m_{safe}. Thus, the contract guarantees that the SAFE investor does not suffer a loss, on this view.

We now characterize these outcomes in terms of valuation. The pre- and post-money valuations are not defined in the Post-Money SAFE. Indeed, the text contains the following definition:

> "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.

This suggests that, although the Safe Price is calculated using the Discounted method, the document has been deliberately designed to be ambiguous with respect to the conversion method.[13] We therefore analyze the equity round transaction from the point of view of the two accounting methods, corresponding to different ways to relate price and valuation.

[13] On the other hand, in the context of a discussion of tax treatment of the SAFE, the Post-Money SAFE Users Guide [16] states "we've always intended and believed the safe (original safe or new safe) to be an equity security." A contract can of course be treated differently for valuation and taxation purposes, but consistency would therefore indicate treatment of the SAFE on the cap table for valuation purposes also.

Cap Table Accounting: Note that the definition of Safe Price as $c/(s_f+s_{safe})$ suggests that in case this price is applied, the SAFE note is being converted at valuation c using cap table accounting, so it is reasonable to treat the new investor's money in the same way (though at a different valuation). Let the pre-money valuation of the company on Cap Table accounting be v_{pre}, so $v_{pre} = p_{new}(s_f + s_{safe})$. In Case 1, we have

$$v_{pre} = (s_f + s_{safe})p_{new} = (s_f + m_{safe}/p_{new})p_{new} = s_f p_{new} + m_{safe}$$

so we can characterize p_{new} in terms of v_{pre} as $p_{new} = (v_{pre} - m_{safe})/s_f$. In Case 2,

$$v_{pre} = (s_f + s_{safe})p_{new} = (s_f + \frac{m_{safe}s_f}{c - m_{safe}})p_{new} = \frac{c}{c - m_{safe}} \cdot s_f p_{new}$$

so

$$p_{new} = \frac{(c - m_{safe})}{c} \cdot \frac{v_{pre}}{s_f} \ .$$

In both cases, $p_{new} \leq (c - m_{safe})/s_f$ exactly when $v_{pre} \leq c$, so the conditions for the two cases are $v_{pre} \leq c$ and $v_{pre} > c$.

On cap table accounting, the post-money valuation is $v_{pre} + m_{new}$, so the proportional shareholdings of the founders, SAFE investor and new investor, respectively, in the two cases are as follows.

Case 1: $(v_{pre} \leq c)$

$$\frac{v_{pre} - m_{safe}}{v_{pre}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{v_{pre}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}}$$

Case 2: $(v_{pre} > c)$

$$\frac{c - m_{safe}}{c} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{safe}}{c} \cdot \frac{v_{pre}}{v_{pre} + m_{new}}, \quad \frac{m_{new}}{v_{pre} + m_{new}}$$

Intuitively, in both cases, the new investor is guaranteed a shareholding equivalent to their money. Case 1 is equivalent to a two stage process in which the SAFE investor first purchase shares worth m_{safe} in a standard equity round at valuation $v_{pre} - m_{safe}$, followed by the new investor buying shares worth m_{new} at valuation v_{pre}. The outcome of Case 2 is equivalent to that of a two stage process in which the SAFE investor first buys shares worth m_{safe} at valuation $c - m_{safe}$ in a standard equity round, followed by the new investor buying shares worth m_{new} at valuation v_{pre}. (As suggested above, on this view, c is analogous to the post-money valuation at which the SAFE investor's investment is made.)

We remark that the first stage of this process is always less advantageous to the founders, and more favourable to the SAFE investor, than a first stage investment of m_{safe} at pre-money valuation c, as was essentially involved in several cases of the analysis of the pre-money SAFE above.

Liability Accounting: If the Post-money SAFE is treated as a Liability, then we relate the price and pre-money valuation by equation (vsp_{pre}), i.e., $p_{new} = v_{pre}/s_f$. In this case we have $v_{post} = v_{pre} + v_{safe} + m_{new}$. The cases of the SAFE note are determined by the condition $p_{new} = v_{pre}/s_f \leq (c - m_{safe})/s_f$, which is equivalent to $v_{pre} \leq c - m_{safe}$. The post-money values of the shareholdings of the founders, SAFE holder and new investor are

Case 1. ($v_{pre} \leq c - m_{safe}$)

$$v_{pre}, \quad m_{safe}, \quad m_{new}$$

Case 2. ($v_{pre} > c - m_{safe}$)

$$v_{pre}, \quad \frac{v_{pre}}{c - m_{safe}} m_{safe}, \quad m_{new}$$

Thus, we derive that the valuation of the SAFE note is

$$v_{safe} = \begin{cases} m_{safe} & v_{pre} \leq c - m_{safe} \\ \frac{v_{pre}}{c - m_{safe}} m_{safe} & v_{pre} > c - m_{safe} \end{cases}$$

The proportional shareholdings are the above monetary values divided by $v_{pre} + v_{safe} + m_{new}$. With respect to a view (fitting Liability accounting of the SAFE) that equations (vsp_{post}) and ($vmC_{pre,post}$) describe the post-money valuation, this implies that neither the SAFE investor nor the new investor loses value as a result of the transaction.

12 Comparison

In the previous sections, we have discussed a variety of methods by which two forms of SAFE contract may be converted to shares at the time of the equity round. Factors distinguishing these methods are two distinct interpretations of the term "Pre-money Valuation", as well as the accounting stance that one takes. Table 2 summarises our conclusions, showing for each method an accounting stance on which it makes sense. Some of the methods have some limitations that makes their rationality questionable; we refer to the relevant sections for an explanation of the issues mentioned in the "Limitations" column.

We now compare the outcomes of these contracts and conversion methods to determine which is more favourable to each of the players. There are two ways that one can undertake such an analysis.

1. **Conservative Methods:** One can suppose that the founders, SAFE investor and new investors start with clarity about the interpretation of "Pre-money Valuation". In this case, only conversion methods appropriate to that interpretation should be considered, and the negotiation of a value for v_{pre} can take into account the selected meaning. A rational new investor will not accept an immediate loss, so only conservative methods are considered in this case.

SAFE Operation Method	Section	Consistent Accounting View	Limitations
Standard	3	Liability (wrt v_{pre})	
Percent Ownership	7.1	Cap Table (wrt v_{pre})	price gap, case justification
Discounted Valuation Method	7.2	Cap Table (wrt v_{pre}) converted to Liability (wrt v_{pre}^{-})	
Dollars Invested	8	Liability (wrt v_{pre}) converted to Cap Table (wrt $v_{pre} + m_{safe}$)	undervalues SAFE
Zero-Round (discounted)	9.1	Cap Table (wrt v_{pre}) converted to Liability (wrt v_{pre}^{-}) then standard round (wrt v_{pre})	
Zero-Round (standard)	9.2	Liability (wrt v_{pre}) then standard round (wrt v_{pre})	down-round
Post-Money	11	Cap Table (wrt v_{pre}) = Liability (wrt v_{pre}^{-})	

Table 2: Accounting Methods Consistent with SAFE Operation Methods

2. **Deferred Interpretation:** One can suppose that the new investors, SAFE investors and the founders failed to distinguish between the two interpretations of "pre-money valuation". In particular, the interpretation had not been decided at the time the founders negotiated with the new investors a term sheet stating a pre-money valuation. (This seems to be not infrequently the case, according to [3]!) In such a situation v_{pre} is fixed, but the parties may still select a method for calculating p_{new}. All the methods should be compared in this case.

There is a game theoretic dimension to the situation, in the form of a two-round game. In round 1, the founder and SAFE investor negotiate and choose a form for the SAFE investor's investment: either a standard equity round (to be followed later by a standard round with the new investor), a pre-money SAFE contract, or a post-money SAFE contract. In the second round, the founders and the new investor negotiate and choose a method to conduct the equity round. We analyze this game to determine the optimal strategy for the players.

12.1 Conservative Methods

We consider first the cases where the participants have started with clarity about the interpretation of pre-money valuation and the accounting method, and use one of the conservative conversion methods that the analysis above shows to be appropriate for that interpretation. The game in this case proceeds in the following steps:

1. The founders and SAFE investor choose a form of contract: standard round for money m_{safe} at valuation c, Pre-Money SAFE for money m_{safe} and cap c, or Post-Money SAFE for money m_{safe} and cap c.

2. The new investor chooses an inherent valuation of the company, i.e., a valuation $v_I = v_A - v_L$ where v_A and v_L are the valuations of the company assets A and liabilities L, excluding the SAFE contract.

3. The founders and new investor negotiate a conversion method and an associated interpretation and value of the pre-money valuation v_{pre}. The choices are the following: Standard method with Liability View, Discounted Valuation Method with Cap Table View, Zero-Round (Standard) method with Liability View, Zero-Round (Discounted Valuation) method with Cap Table View, and the Post-Money SAFE with either Liability or Cap Table View.[14]

[14] We omit the Dollars Invested method here because it is a non-conservative, less clearly rational compromise, and arguably motivated by the confusion concerning the meaning of "Pre-Money Valuation". As we will see, this motivation disappears as a result of the analysis that follows. The Percent Ownership method differs from the Discounted Valuation method only in the case conditions. It also is omitted, since it has a price gap: we assume that the Discounted Valuation method is the correct implementation of the Percent Ownership conversion idea.

We first determine a valuation v_{safe} for the SAFE contract at the time of the equity round for each of the conversion methods considered. Using this, we will later derive a value for v_{pre} for each method and compute the resulting distribution of shareholdings of the parties.

In case of the Standard method with the Liability View, we have the following valuation of the SAFE:

$$v_{safe} = \begin{cases} m_{safe} & v_{pre} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c} & v_{pre} > c \end{cases}$$

On the Liability view, the SAFE is a liability that has not yet been accounted for in the inherent valuation v_I, so we have that the correct pre-money valuation is $v_{pre} = v_I - v_{safe}$. Thus, the above analysis has not yet escaped from the circularity of the SAFE. However, we may solve the equations resulting from the two cases to get

$$v_{safe} = \begin{cases} m_{safe} & v_I - m_{safe} \leq c \\ m_{safe} \cdot \frac{v_I}{c+m_{safe}} & v_I - m_{safe} > c \end{cases} \tag{11}$$

which gives a formulation of the valuation of the SAFE in terms of the inherent valuation v_I of the company.[15]

The two-stage Zero-Round (Discounted Valuation) method, interpreted with respect to the Cap Table View, gives

$$v_{safe} = \begin{cases} m_{safe} & v_{pre} - m_{safe} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c+m_{safe}} & v_{pre} - m_{safe} > c \end{cases}$$

The Discounted Valuation method, with Cap Table View, gives precisely the same formulation of v_{safe}. Under the Cap Table View, we have $v_{pre} = v_I$, and after substituting, we obtain exactly equation (11). Thus, these two methods also give the same result as the Standard method.

In case of the two stage Zero-Round (Standard) method, interpreted using the Liability view, we have

$$v_{safe} = \begin{cases} m_{safe} \cdot \frac{v_{pre}}{v_{pre}+m_{safe}} & v_{pre} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c+m_{safe}} & v_{pre} > c \end{cases}$$

which *prima facie* seems different from the above case. However, we should note that in the two stage methods, regardless of the approach used in the first stage, v_{pre} represents the valuation of the company at which the new investor is prepared to invest, *once the SAFE liability has been discharged*. Thus,

[15] Note that the case condition for the second case $v_{pre} = v_I - v_{safe} > c$ is

$$v_I - m_{safe} \cdot \frac{v_I}{c + m_{safe}} > c \ ,$$

which is equivalent to $v_I - m_{safe} > c$.

the appropriate value for v_{pre} in this case is the inherent valuation $v_{pre} = v_I$. Substituting, we obtain

$$v_{safe} = \begin{cases} m_{safe} \cdot \frac{v_I}{v_I + m_{safe}} & v_I \leq c \\ m_{safe} \cdot \frac{v_I}{c + m_{safe}} & v_I > c \end{cases} \tag{12}$$

which is the same as equation (11) in case $v_I \geq c + m_{safe}$, but differs otherwise.

For the Post-Money SAFE, with Liability View, the SAFE is valued at

$$v_{safe} = \begin{cases} m_{safe} & v_{pre} \leq c - m_{safe} \\ m_{safe} \cdot \frac{v_{pre}}{c - m_{safe}} & v_{pre} > c - m_{safe} \end{cases}$$

Again, we have a circularity, so substituting $v_{pre} = v_I - v_{safe}$ and solving for v_{safe}, we get

$$v_{safe} = \begin{cases} m_{safe} & v_I \leq c \\ m_{safe} \cdot \frac{v_I}{c} & v_I > c \end{cases} \tag{13}$$

This has the same case conditions as the Zero-Round (Standard) method interpreted using the Liability View, but in the second case, the divisor is the smaller number c rather than $c + m_{safe}$. Thus, this method gives a higher valuation to the SAFE in this case.

The Post-Money SAFE, with Cap Table View, gives

$$v_{safe} = \begin{cases} m_{safe} & v_{pre} \leq c \\ m_{safe} \cdot \frac{v_{pre}}{c} & v_{pre} > c \end{cases}$$

Substituting $v_{pre} = v_I$ as is appropriate to the Cap Table View, we get exactly equation (13), so this method gives the same valuation to the SAFE as the Post-Money SAFE, with Liability View.

Using the above derivations of the values of v_{safe} we obtain solutions for v_{pre} in terms of the inherent company valuation v_I for each approach (for the Cap Table View approaches, this is simply v_I). Substituting into the corresponding characterizations of proportional shareholdings for each of the methods, and noting that in all cases we have post-money valuation equal to $v_I + m_{new}$, we get the post-money values, in terms of v_I for each of the shareholders given in Table 3. (Dividing by $v_I + m_{new}$ gives the proportional holdings.) The table uses the following abbreviations for the approaches: 2R is two standard equity rounds, the first for money m_{safe} at valuation c, the second for money m_{new} at valuation v_I; S(L) is the Standard method with Liability View; D(C) is the Discounted Valuation method with Cap Table View, ZR(D,C) is the two-stage Zero-Round (Discounted Valuation) method with Cap Table View; and ZR(S,L) is the two stage Zero-Round (Standard) method with Liability View. As just noted, the Post-Money SAFE produces the same results for both the Liability and Cap Table views.

From the point of view of the new investor, the outcome of each of these methods is the same. Any choice between these methods is therefore only of concern to the founders and the SAFE investor. We consider the ordering

$Approach$	$Condition$	$Founders$	$SAFE$	New
$2R$	$True$	$\frac{c}{c+m_{safe}} \cdot (v_I)$	$\frac{m_{safe}}{c+m_{safe}} \cdot (v_I)$	m_{new}
$ZR(S,L)$	$v_I \leq c$	$\frac{v_I}{v_I+m_{safe}} \cdot (v_I)$	$\frac{m_{safe}}{v_I+m_{safe}} \cdot (v_I)$	m_{new}
	$v_I > c$	$\frac{c}{c+m_{safe}} \cdot (v_I)$	$\frac{m_{safe}}{c+m_{safe}} \cdot (v_I)$	m_{new}
$S(L), D(C),$	$v_I - m_{safe} \leq c$	$v_I - m_{safe}$	m_{safe}	m_{new}
$ZR(D,C)$	$v_I - m_{safe} > c$	$\frac{c}{c+m_{safe}} \cdot (v_I)$	$\frac{m_{safe}}{c+m_{safe}} \cdot (v_I)$	m_{new}
$Post - Money$	$v_I \leq c$	$v_I - m_{safe}$	m_{safe}	m_{new}
$(C\ or\ L)$	$v_I > c$	$\frac{c-m_{safe}}{c} \cdot (v_I)$	$\frac{m_{safe}}{c} \cdot (v_I)$	m_{new}

Table 3: Value of shareholdings from standard equity rounds and conservative SAFE approaches (ordered by increasing preference for SAFE holder and decreasing preference for founders)

between the post-money values for the SAFE investor - since the total post-money valuation is the same in all cases, this is the inverse of the ordering for the founders.

In case $v_I \geq c + m_{safe}$, all the Pre-Money SAFE methods also produce exactly the same result as the Two-Round (2R) method. Note that the condition $v_I \geq c + m_{safe}$ essentially says that the inherent valuation of the company has not fallen below the post-money valuation of a standard round for money m_{safe} at valuation c. Thus, the differences between the Pre-Money SAFE approaches emerge only in case the equity round for the new investor's money is effectively a "down-round" from this post-money valuation.

The comparison between 2R and ZR(S,L) is straightforward. In case $v_I \leq c$, the ZR(S,L) value for the SAFE investor is larger because the term in the denominator is larger in case of 2R. Thus the SAFE investor always prefers ZR(S,L) over 2R.

If $m_{safe} < v_I \leq c$, then the Pre-Money SAFE approaches S(L), D(C) and ZR(D,C) agree that the SAFE investor effectively gets their money m_{safe} back in the form of shares. Approach ZR(S,L) gives the SAFE investor a lesser value in this case, and the founders a correspondingly greater value. Thus, the SAFE investor always prefers S(L), D(C) and ZR(D,C) over ZR(S,L). As we noted above, ZR(S,L) might be selected by the new investor and founders in order to favour the founders, but if the SAFE investor holds the stronger bargaining position when in a negotiation with the founders concerning the conversion method, ZR(S,L) is not likely to be selected. However, we note that the S(L), D(C) and ZR(D,C) require that $m_{safe} < v_I$ in order to be applied. In case $v_I \leq m_{safe}$, approach ZR(S,L) might still be applied to resolve this impasse.

When comparing the Post-Money result with S(L), D(C) and ZR(D,C) we see both yield the SAFE investor value m_{safe} when $v_I \leq c$ (implying $v_I - m_{safe} \leq c$). In case $v_I - m_{safe} > c$ (implying $v_I > c$), the expression for S(L), D(C) and ZR(D,C) has the larger denominator, so the Post-money SAFE is preferable. When $v_I \in (c, c + m_{safe}]$, the Post-Money SAFE yields $\frac{m_{safe}}{c} \cdot (v_I)$ which is greater than the S(L), D(C) and ZR(D,C) yield m_{safe} because $v_I > c$ in this case. Thus the Post-money SAFE is always preferable for the SAFE investor.

In effect, as indicated by the name, the Post-Money SAFE treats c as analogous to a post-money valuation, rather than a pre-money valuation, as we see from the equivalence of the Pre-Money SAFE methods with the 2R method in case $v_I > c + m_{safe}$. Consider a Post-Money SAFE with cap $c' = c + m_{safe}$ and money m_{safe}. Substituting c' for c and simplifying, we get the value outcomes for the founders, SAFE investor and new investor respectively, of

$$v_I - m_{safe}, \quad m_{safe}, \quad m_{new}$$

in case $v_I \leq c + m_{safe}$, and

$$\frac{c}{c + m_{safe}} \cdot (v_I), \quad \frac{m_{safe}}{c + m_{safe}} \cdot (v_I), \quad m_{new}$$

in case $v_I > c + m_{safe}$. This is precisely the same outcome in all cases as the Pre-Money SAFE with methods S(L), D(C) or ZR(D,C). Thus (assuming only one SAFE will be issued) if the founders and SAFE investor are fully rational, we expect that a negotiation on the terms of a Pre-Money SAFE or a Post-Money SAFE will yield an instrument with the same effective consequences at the time of the equity round in either case.[16] From this point of view, there is not a reason to prefer one over the other.[17]

Both the Pre-Money SAFE (with method S(L), D(C) or ZR(D,C)) and the Post-Money SAFE, have the disadvantage of not being convertible when $v_I < m_{safe}$, however, since they imply a negative shareholding for the founders in this case. The Pre-Money SAFE has the fallback method of ZR(S,L) in this case, but it is less clear how the Post-Money SAFE should be handled. This issue becomes more complicated in the case the company has issued multiple Post-Money SAFEs, where there may be multiple valuation intervals in which the SAFE cannot be converted. We discus this more general case in [12].

In summary, it can be argued that when the Pre-Money SAFE and Post-Money SAFE are interpreted with clarity about the meaning of pre-money valuation, the values for c and m_{safe} that will be negotiated will be such that

[16] We ignore here other differences between the Pre-Money and Post-Money SAFEs, such as the ability to receive dividends in the Post-Money SAFE. Our comparison is only based on equity financing.

[17] We note, however, that our analysis concerns only a single SAFE note - the situation may be more complex when multiple SAFE notes are issued.

all conservative methods of execution, with an appropriate method of accounting, other than ZR(S,L), yield equivalent results. The latter is better for the founders but worse for the SAFE investor, and may be needed as a fallback to enable conversion in case of a low valuation that prevents the other methods being applied.

12.2 Deferred Interpretation

Next, we consider the situation when the interpretation of "Pre-Money Valuation" is deferred until after the term sheet has been signed. The game in this case is played as follows:

1. The founders and the SAFE investor negotiate a form of contract.
2. The new investor chooses v_{pre} and m_{new}.
3. The founders and new investor choose a conversion method.

The choices of contract forms are "Two-Rounds" (i.e., two equity rounds, in the first of which the SAFE investor purchases shares at valuation c, and in the second of which the new investor purchases shares at valuation v_{pre}), a Pre-Money SAFE (with cap c and money m_{safe}) and a Post-Money SAFE.

While this order of events may not be fully rational, it appears that this situation is not just theoretical. Feld [6] writes

> Most notes are ambiguous as to whether they convert on a pre-money or a post-money basis. This can be especially confusing, and ambiguous, when there are multiple price caps. There are also some law firms whose standard documents are purposefully ambiguous to give the entrepreneur theoretical negotiating flexibility in the first priced round.
>
> If the entrepreneur knows this and is using it proactively so they get a higher post-money valuation, that's fair game. But if they don't know this, and they are negotiating terms with a VC who is expecting the notes to convert in the pre-money, it can create a mess after the terms are agreed to somewhere between the term sheet stage and the final definitives. This mess is especially yucky if the lawyers don't focus on the final cap table and the capitalization opinion until the last few days of the process. And, it gets even messier when some of the angels start suggesting that the ambiguity should work a certain way and the entrepreneur feels boxed in by the demands of his convertible note angels on one side and priced round VC on the other.

An issue with respect to the Post-Money SAFE is the choice of parameters. We argued above that a single Post-Money SAFE with cap $c+m_{safe}$ and money m_{safe} is equivalent, with respect to equity financing, to the Pre-Money SAFE with cap c and money m_{safe} for fully rational players. Thus, to avoid an unfair comparison, we should choose these equivalent parameter values for the Post-Money SAFE. However, the outcomes for each conversion method would then give the same result as the Pre-Money SAFE, making it redundant to include the Post-Money SAFE as an option. We therefore consider just the Pre-Money version of the SAFE.

As above, for the Pre-Money SAFE the choices of conversion method are the Standard method, Discounted Valuation method, the Two Stage (Zero Round) method based on either Standard or Discounted method. We also include the Dollars Invested method since we are now not dealing with fully rational players.

Tables 4 and 5 summarise the relative shareholdings derived for each of the parties on the two forms of SAFE contracts and these models of their operation. In each case, each column gives the outcomes on the different approaches for one of the three parties. In the case of the Discounted Valuation method, we use the given pre-money valuation v_{pre} to state the relative shareholdings, but the case of the SAFE contract used is determined using the discounted valuation v_{pre}^{-}. Consequently, we need to split the analysis into three cases rather than two.

As well as the proportional shareholding, we indicate the preference order of the outcome for that party, with (1) indicating the most preferred outcome (i.e., the largest proportional holding). Working for the comparisons is given in Appendix A. Note that these rankings are valid only within each of the cases, they are not intended for comparisons across cases. In some cases (e.g., the case for the founders in the Two-Round method with $v_{pre} \leq c$) the preference order also depends on the value of m_{new}. Rather than further fragment the number of cases, we give a range of rankings in this case.

One immediate observation is that for the SAFE investor, the outcome for the Pre-Money SAFE is always at least as good as the outcome for the Two-Round method. The SAFE investor is likely to hold the stronger negotiating position than the founders, so the Pre-Money SAFE is likely to be the instrument selected in the first step of the game. We may therefore focus the analysis on the Pre-Money SAFE.

The three cases for v_{pre} give the following conclusions for the conversion method chosen at the final step of the game. In the analysis, we assume first that the final move is decided by negotiation between the founders and the new investor. The preferences of the founders and new investor turn out to be at odds in all cases, so we discuss two possible resolutions: (a) the founders yielding and accepting one of the new investor's first preferences but selecting one that is the founders' most preferred among that set, and (b) the new investors yielding to one of their next best preference and the founders again selecting their best preference amongst those. Strictly, the SAFE investor does not have legal standing in setting the terms of the equity round. However, we also consider the potential for them to form a coalition with one of the other players to strengthen their position in the negotiation.

1. ($v_{pre} \leq c$): Here the founders and new investor do not have a common best choice: the founders prefer the Standard or Dollars Invested method,

Proportional shareholdings, case of $v_{pre} \leq c$:

Approach	Founders	SAFE investor	New investor
Two-Rounds	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (1 − 4)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (4)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Standard	$\frac{v_{pre}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{new}}{v_{pre}+m_{safe}+m_{new}}$ (2)
Discounted	$\frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}}$ (5)	$\frac{m_{safe}}{v_{pre}+m_{new}}$ (1)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Dollars Invested	$\frac{v_{pre}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{new}}{v_{pre}+m_{safe}+m_{new}}$ (2)
ZR (Disc)	$\frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}}$ (5)	$\frac{m_{safe}}{v_{pre}+m_{new}}$ (1)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
ZR (Standard)	$\frac{v_{pre}}{v_{pre}+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{v_{pre}+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)

Table 4: Pre-Money SAFE ; Proportional shareholdings from different conversion methods.

Proportional shareholdings, case of $c < v_{pre} \leq c + m_{safe}$:

Approach	Founders	SAFE investor	New investor
Two-Rounds	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (6)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Standard	$\frac{v_{pre}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (1)	$\frac{\frac{m_{safe}v_{pre}}{c}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (2)	$\frac{m_{new}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (3)
Discounted	$\frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}}$ (4)	$\frac{m_{safe}}{v_{pre}+m_{new}}$ $(1-5)$	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Dollars Invested	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (4)	$\frac{m_{new}}{v_{pre}+m_{safe}+m_{new}}$ (2)
ZR (Disc)	$\frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}}$ (4)	$\frac{m_{safe}}{v_{pre}+m_{new}}$ $(1-5)$	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
ZR (Standard)	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (6)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)

Proportional shareholdings, case of $c + m_{safe} < v_{pre}$:

Approach	Founders	SAFE investor	New investor
Two-Rounds	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Standard	$\frac{v_{pre}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (1)	$\frac{\frac{m_{safe}v_{pre}}{c}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (1)	$\frac{m_{new}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$ (3)
Discounted	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
Dollars Invested	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$ (2)	$\frac{m_{new}}{v_{pre}+m_{safe}+m_{new}}$ (2)
ZR (Disc)	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)
ZR (Stand)	$\frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{safe}}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}$ (3)	$\frac{m_{new}}{v_{pre}+m_{new}}$ (1)

Table 5: Pre-Money SAFE ; Proportional shareholdings from different conversion methods.

and the new investor prefers any of the other options.

(a) If the new investor holds firm, the founders would select the Zero-Round(Standard) method, which is only their third preference. However, the Zero-Round methods do carry the risk of a legal dispute by the SAFE investor. To avoid this, the founders would select the Discounted method, which is their least preferred option.

(b) If the new investor is prepared to yield, their second best options are the Standard or Dollars Invested methods, which are precisely the preferred options of the founders. Thus, the outcome is this case is either the Standard or Dollars Invested method.

However, the SAFE investor would prefer, depending on m_{new}, either the Discounted or Zero-Round(Discounted) options, which are amongst the most preferred options of the new investor. So they have an incentive to form a coalition with the new investor to argue for one of these options, most likely the Discounted method, in view of the legal questionability of the Zero-Round options.

Thus, the outcome of this case depends on m_{new}, the negotiation strength of the parties, and their tolerance of legal risk, and could be any of the Standard, Discounted, Dollars Invested or Zero-Round(Standard) methods.

2. ($c < v_{pre} \leq c + m_{safe}$): Again there is no common best option for the founders and new investor. The founders prefer the Standard method, and the new investor prefers the Discounted, Zero-Round(Discounted) or Zero-Round (Standard) options.

   (a) If the new investor holds firm, the founders would select the Zero-Round(Standard) option again, or their least preferred Discounted option in case they are averse to legal risk.

   (b) If the new investor yields, their second preference is the Dollars Invested method, which is also the second preference of the founders.

   The stability of this case with respect to the SAFE investor is complex, since the SAFE investor's ranking is variable within this case. Depending on m_{new}, their interests may be aligned with the new investor by most preferring the Discounted or Zero-Round(Discounted) method, but their most preferred option may be also be aligned with the founders by preferring the Standard method. The Dollars Invested method is either the second or third preference of the SAFE investor.

   Thus, in this case, again the selection of either the Standard, Discounted, Dollars Invested or Zero-Round(Standard) methods is conceivable.

3. ($c + m_{safe} < v_{pre}$): In this case the rankings of the founders and new investor are once again in conflict, but the situation is somewhat simpler than the previous case. The founders and the SAFE investor both prefer

Case	New holds	New yields	SAFE Coalition
$v_{pre} \leq c$	ZR(Stand) or Disc	Stand or DI	Disc or ZR(Disc)
$c < v_{pre} \leq c + m_{safe}$	ZR(Stand) or Disc	DI	Disc or ZR(Disc) or Stand
$c + m_{safe} < v_{pre}$	Disc	DI	Stand

Table 6: Game Outcomes by assumptions about v_{pre} and negotiation position.

the Standard method, which is the third and lowest preference of the new investor. Conversely, the new investor prefers the Discounted and the two Zero-Round methods, which are all the third and lowest preference of the founders and SAFE investor.

(a) If the new investor holds firm, both the founders and the SAFE investor are indifferent amongst the new investor's first choices. The outcome is likely to be the Discounted method since it involves only a single equity round and is free from legal risk.

(b) If the new investor is prepared to compromise, the Dollars Invested method, which is the unique second preference of all parties, is a stable compromise position.

In case the SAFE investor and the founders together have the strongest bargaining position, they may be able to get the new investor to accept the Standard method, but this is their least preferred option, so the case for this would need to be very strong (e.g., the prospects for the company are perceived to be so strong that the new investor is prepared to accept a much weaker deal than they might otherwise.)

Thus, in this case, the Standard, Discounted or Dollars Invested methods, are conceivable selections,

In summary, as Feld suggests, the best answer to the question of what outcome can be expected for this version of the game is that "it's complicated". Depending on the parameters, negotiating strengths of the players, and attitude to legal risk, the ultimate selection of any of the conversions methods is conceivable. Table 6 summarises the outcomes for the three possible assumptions with respect to negotiating position: new investor holds, new investor yields, and SAFE forms a dominant coalition. (Since the new investor holds the money, we do not expect the founders to hold the strongest position on their own.) The complexity of the negotiation scenarios resulting from a deferred interpretation of "Pre-Money Valuation" suggests that it would be more rational for all parties to set a clear policy for conversion of the SAFE, based on a clearly stated accounting status of the SAFE.

We have not attempted to factor into the above analysis any assumptions about the probability of v_{pre} falling into the above cases, since it is unclear what the appropriate distribution should be. Some data on ability of companies to meet their SAFE caps by the time of an equity round could in principle be obtained. A factor in such empirical results may be that founders will prefer to defer an equity round (possibly by raising additional SAFE investments) until they are able to obtain a valuation that is to their benefit, given the SAFE issued. Some weighting of the distribution towards the case $v_{pre} > c$ therefore seems likely. Against this, the failure rate of startups is high, so many SAFEs will ultimately be resolved by dissolution or sale of the company rather than an equity round. We have not attempted in this paper to deal with the Dissolution and Liquidity clauses that cover such an eventuality.

13 Conclusion

We have started, in this paper, with a general analysis of equity rounds in which shares are issued to convertible instrument holders as well as new investors. The general analysis shows that a set of equations that hold in standard equity rounds, become contradictory in the presence of conversions, so that a subset needs to be selected. We have shown that alternative ways to do accounting for the convertible instruments, as Liabilities or on the Cap Table, helps to explain the possible alternative sets of equations that apply to the round. Related to the accounting viewpoints is an ambiguity in the term "Pre-Money Valuation" and its relationship to the share price at which the equity round should be conducted.

We then applied the general analysis to the specific case of Pre-Money and Post-Money forms of the SAFE note with cap and no discount. The ambiguities in the understanding of Pre-Money Valuation leaves open a variety of conversion methods at the time of the equity round, discussed in Sections 6-9 for the Pre-Money SAFE and in Section 11 for the Post-Money SAFE. We examined how these methods perform, under the two accounting viewpoints, with respect to the desideratum that an equity round should be conservative for both the new investor and the SAFE investor.

We have also considered a number of game theoretic aspects of SAFE conversion. In Section 10 we derived the optimal (but legally questionable) way for the founders and new investor to "game" the SAFE by structuring an investment into two rounds so as to minimize the share going to the SAFE investor. Our analysis in Section 12 compares the SAFE conversion methods of Sections 6-9 and Section 11 both for a scenario where the players are "fully rational", and for a scenario where they defer resolution of the conversion method until after a pre-money valuation has been fixed. The fully rational players correctly apply one of two accounting methods, Liability accounting and Cap Table accounting. This turns out to guarantee that the same distribution of shares will be reached in almost all cases in our simple scenario. From this perspective, the Dollars Invested method appears as a compromise made by players who are not fully rational. With an adjusted interpretation of the cap, in our scenario, the Post-Money SAFE can also be seen to be equivalent to the Pre-Money SAFE for fully rational players.

In either case, there is a circularity in the SAFE contracts that needs to be resolved in the process of conversion, because the value of the SAFE depends on the valuation of the company or the price of its shares. Cap Table accounting requires that the share price be calculated knowing the number of shares to be issued for the SAFE, which in turn depends on the company valuation and/or share price. Liability accounting requires that, in order to value the company to determine a share price, the SAFE be valued first, but this in turn requires a valuation for the company and/or the share price. In both cases, the circularity can be resolved by expressing it in equational form and solving.

The primary focus of our analysis was the (Pre-Money) SAFE note, with cap and no discount. In the course of the analysis, we identified a number of fine points concerning the terms of this contract, and weaknesses that should be taken into account in the design of future variants of contracts of this type.

This SAFE note uses Pre-Money Valuation v_{pre}, Price p_{new} and Company Capitalization (s_f, in the scenario we analyze) as input variables to define the number of shares issued in conversion, but it does not actually state that v_{pre} and p_{new} are related to s_f by equation (vsp_{pre}). This leaves it open for the equity round to be constructed so as to violate this equation. Our treatment of the Percent Ownership method in Section 7 in fact starts with values for v_{pre} and s_f and derives a price p_{new} that does not satisfy this equation. We argued, however, that for this reason, this method might be legally questionable. It is also economically questionable because it leaves open a price gap - a range of prices at which the SAFE is not convertible. Moreover, if one takes the point of view that the Equity Financing clause is intended to deliver the maximum number of shares to the SAFE investor, then we get the constraints between v_{pre} and p_{new} that

- $v_{pre} \leq c$ implies $p_{new} \leq c/s_f$, and
- $v_{pre} > c$ implies $p_{new} > c/s_f$.

There are many relationships between p_{new} and v_{pre} that satisfy this, but $p_{new} = v_{pre}/s_f$, i.e., equation (vsp_{pre}) is arguably the simplest one, so there is a case that the SAFE contract was designed with the intention that this constraint be satisfied. Examples in the Safe Primer [15] calculate price in this way (see also Section 6 for one of these examples). This argument would be supportive of any legal claim that the equity round should be conducted so as to satisfy equation (vsp_{pre}).

The SAFE contract could have avoided the issue of the previous point by writing the Equity Financing clause using only the price p_{new}, replacing v_{pre} by its value derivable using s_f by (vsp_{pre}). We have argued that price is a more stable notion than "Pre-money Valuation", so it is unclear why this was not done. Indeed, the Post-Money SAFE uses only p_{new}, although it also moves to what is effectively Cap Table accounting with respect to calculation of the "SAFE price" p_{safe}. (Nevertheless it still remains open to use either Cap Table or Liability accounting to determine p_{new}.)

On the other hand, the fact that the Pre-Money SAFE is constructed in a way that suggests use of equation (vsp_{pre}), which corresponds to Liability accounting, is not coherent with the statement in the SAFE primer [15] that

> A safe is not a debt instrument ... Debt instruments have requirements — including regulations, interest accrual, maturity dates, the threat of insolvency and in some cases, security interests and subordination agreements. These requirements can have unintended negative consequences ... an outstanding safe would be referenced on the company's cap table like any other convertible security (such as a warrant or an option)

The Post-Money SAFE seems more coherent from this point of view, by relying only on a price (but still leaving it open how this is determined).

Our analysis of game theoretic aspects of SAFE conversion strongly suggests that it is better for founders to start with a precise understanding of how the SAFE will be accounted for and the methodology that will be applied to its conversion, and to ensure that this understanding is shared with SAFE and equity round investors. This helps to avoid the complexities of the Deferred Interpretation analysis of Section 12.2, which shows that the outcome of the equity round will depend not just on valuation, but also on the formation of coalitions between the parties, which may depend on unpredictable social factors.

As shown in Section 10, there is the potential for the founders and new investor to collude against the interests of the SAFE investor by use of two equity rounds rather than one. The SAFE fails to make clear the rights of the SAFE investor in the construction of the equity round in which the SAFE converts, although the general principal that it be "bona fide" and may consist of a "series of transactions" gives grounds for a legal challenge against such collusion. It would be interesting to explore contract designs that protect against this form of collusion by financial mechanism rather than legal means, particularly if the contract is to be automated on a blockchain platform, where legal protections may be much weaker.

Our analysis in this paper is limited in a number of ways. The scenario we study is one in which only a single SAFE has been issued by the company; an extension to an analysis of multiple Pre-Money or Post-Money SAFEs converted using the Discounted Valuation method is developed in another paper [12]. We have considered only the SAFE with cap and no discount, which is just one of the four forms available for each of the Pre-Money SAFE and Post-Money SAFE. The issue concerning use of both v_{pre} and p_{new} does not arise for the other variants. The Pre-Money SAFE [13] without a valuation cap (discount only or MFN (most favoured nation) no cap, no discount and the SAFE with both a valuation cap *and* a discount convert at a price which depends on p_{new} but not on v_{pre}. The other Post-Money SAFEs [7] are also free from this issue. To that extent, they appear to be better constructed than the Pre-Money SAFE we have considered here.

We expect that analysis of these other instruments will yield similar general conclusions with respect to the other points we have raised. The diversity of convertible instruments, and the potential for multiple instances of such instruments with different parameters to be combined on a company's cap table, suggests that an automated analysis that takes as input a formal description of the contracts would be beneficial, and presents a direction that could be interesting to pursue in future work.

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References

[1] Joseph R Bell, Roger W Dorsey, and Jeffrey Hamm. The simple agreement for future equity: Advantages, disadvantages and tax treatment. *Taxes: The Tax Magazine*, 94, 2016.

[2] Clefru. Is the new post-money safe mathematically sound? *Clefru's Blog*, `http://clemens.endorphin.org/2018/11/is-new-post-money-safe-mathematically.html` 2018.

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

[4] John F. Coyle and Joseph M. Green. Contractual innovation in venture capital. *Hastings Law Journal*, 66(1):133 – 183, 2015.

[5] Financial Accounting Standards Board (FASB). Accounting Standards Update 2020-06, DebtDebt with Conversion and Other Options (Subtopic 470-20) and Derivatives and HedgingContracts in Entitys Own Equity (Subtopic 815-40): Accounting for Convertible Instruments and Contracts in an Entitys Own Equity. Available at `fasb.org`.

[6] Brad Feld. The pre-money vs. post-money confusion with convertible notes. Online `https://feld.com/archives/2015/06/pre-money-vs-post-money-confusion-convertible-notes.html` [Accessed Sep 5, 2019], 2015.

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

[8] Michael Seibel and Jason Kwon. *New Standard Deal.* Y Combinator, `https://blog.ycombinator.com/new-standard-deal/` 2018.

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

[10] R. van der Meyden and M. J. Maher. Architecture for smart SAFE contracts. In *3rd Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS)*, Sep 2021.

[11] R. van der Meyden and M. J. Maher. Can SAFE contracts be smart? manuscript, 2021.

[12] Ron van der Meyden. On conversion of multiple safe contracts. manuscript, `http://www.cse.unsw.edu.au/~meyden/research/multipleSAFEs.pdf`, 2023.

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

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

[15] Y Combinator. *SAFE Primer*, `https://web.archive.org/web/20180831020232/http://www.ycombinator.com/docs/SAFE_Primer.rtf` 2016.

[16] Y Combinator. *Post Money Safe User Guide*, `https://www.ycombinator.com/docs/Post\%20Money\%20Safe\%20User\%20Guide.pdf` 2018.

[17] 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.

[18] Y combinator, `https://www.ycombinator.com/` 2013.

A Working for Comparisons of Proportional Shareholding

In this appendix we justify the rankings of outcomes of proportional shareholdings for the three parties given in Section 12. We calculate the relationship between the outcomes for each party in each of the three cases. In each case, there are just two possible outcomes for the new investor, and it is easy to see that the standard SAFE calculation never gives them the best outcome. We use the following abbreviations: Two-Round = 2R, Standard = S, Discounted=D, Dollars Invested = DI, Zero-Round (Standard) = ZR(S), Zero-Round (Discounted) = ZR(D).

- **Assumption :** $v_{pre} < c$**.** Here, we have the following comparisons for the Founders:

  $2R$ versus S

  $$\begin{aligned}
  &\equiv \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} \text{ versus } \frac{v_{pre}}{v_{pre}+m_{safe}+m_{new}} \\
  &\equiv c \cdot (v_{pre}+m_{safe}+m_{new}) \text{ versus } (c+m_{safe}) \cdot (v_{pre}+m_{new}) \\
  &\equiv cv_{pre}+cm_{safe}+cm_{new} \text{ versus } cv_{pre}+cm_{new}+m_{safe}v_{pre}+m_{safe}m_{new} \\
  &\equiv cm_{safe} \text{ versus } +m_{safe}v_{pre}+m_{safe}m_{new} \\
  &\equiv c \text{ versus } v_{pre}+m_{new}
  \end{aligned}$$

  This may be in either order, depending on m_{new}.

  S versus $ZR(S)$

  $$\begin{aligned}
  &= \frac{v_{pre}}{v_{pre}+m_{safe}+m_{new}} \text{ versus } \frac{v_{pre}}{v_{pre}+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} \\
  &= (v_{pre}+m_{new})(v_{pre}+m_{safe}) \text{ versus } v_{pre}(v_{pre}+m_{safe}+m_{new}) \\
  &= m_{new}m_{safe} \text{ versus } 0
  \end{aligned}$$

  so S > ZR(S).

  $ZR(S)$ versus D

  $$\begin{aligned}
  &= \frac{v_{pre}}{v_{pre}+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} \text{ versus } \frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}} \\
  &= v_{pre}^2 \text{ versus } (v_{pre}+m_{safe})(v_{pre}-m_{safe}) \\
  &= v_{pre}^2 \text{ versus } v_{pre}^2-m_{safe}^2
  \end{aligned}$$

  so ZR(S) > D.

  $2R$ versus D

  $$\begin{aligned}
  &= \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} \text{ versus } \frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}} \\
  &= cv_{pre} \text{ versus } (v_{pre}-m_{safe})(c+m_{safe}) \\
  &= 0 \text{ versus } v_{pre}m_{safe}-m_{safe}c-m_{safe}^2 \\
  &= c+m_{safe} \text{ versus } v_{pre}
  \end{aligned}$$

  SO 2R > D since $v_{pre} < c$.

For 2R versus ZR(S), the rightmost terms are identical, so

$$\begin{aligned}
&2R \text{ versus } ZR(S)\\
&= \frac{c}{c+m_{safe}} \text{ versus } \frac{v_{pre}}{v_{pre}+m_{safe}}\\
&= cv_{pre} + cm_{safe} \text{ versus } cv_{pre} + v_{pre}m_{safe}\\
&= c \text{ versus } v_{pre}
\end{aligned}$$

So 2R > ZR(S) in this case.

In this case, D = ZR(D) and DI = S by inspection. So, for the founders, we have D = ZR(D) < ZR(S) < DI = S, and D < 2R but the relation of 2R to ZR(S) and S depends on m_{new} and m_{safe}.

In case of the SAFE investor, we have 2R < ZR(S) < D and DI = S < D by inspection.

$$\begin{aligned}
&S \text{ versus } ZR(S)\\
&= \frac{m_{safe}}{v_{pre}+m_{safe}+m_{new}} \text{ versus } \frac{m_{safe}}{v_{pre}+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}\\
&= (v_{pre}+m_{safe})(v_{pre}+m_{new}) \text{ versus } (v_{pre}+m_{safe}+m_{new})v_{pre}\\
&= v_{pre}^2 + v_{pre}m_{new} + v_{pre}m_{safe} + m_{safe}m_{new} \text{ versus } v_{pre}^2 + v_{pre}m_{safe} + v_{pre}m_{new}\\
&= m_{safe}m_{new} \text{ versus } 0
\end{aligned}$$

so S > ZR(S).

So the SAFE investor order on outcome values is 2R < ZR(S) < S = DI < D.

- **Assumption:** $c \le v_{pre} < c + m_{safe}$.

  For the founders: we have the following comparisons. By inspection 2R = ZR(S) and D= ZR(D).

$$\begin{aligned}
&D \text{ versus } 2R\\
&= \frac{v_{pre}-m_{safe}}{v_{pre}+m_{new}} \text{ versus } \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}}\\
&= (v_{pre}-m_{safe})(c+m_{safe}) \text{ versus } cv_{pre}\\
&= v_{pre}c + v_{pre}m_{safe} - m_{safe}c - m_{safe}^2 \text{ versus } cv_{pre}\\
&= v_{pre}m_{safe} \text{ versus } m_{safe}c + m_{safe}^2\\
&= v_{pre} \text{ versus } c + m_{safe}
\end{aligned}$$

  so we have D < $2R$ by the assumption.

$2R$ versus DI

$$= \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}}{v_{pre}+m_{new}} \text{ versus } \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$$
$$= \frac{v_{pre}}{v_{pre}+m_{new}} \text{ versus } \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}}$$
$$= v_{pre}(v_{pre}+m_{safe}+m_{new}) \text{ versus } (v_{pre}+m_{safe})(v_{pre}+m_{new})$$
$$= v_{pre}m_{new} \text{ versus } (v_{pre}+m_{safe})m_{new}$$
$$= 0 \text{ versus } m_{safe}m_{new}$$

so we have 2R < DI

DI versus S

$$= \frac{c}{c+m_{safe}} \cdot \frac{v_{pre}+m_{safe}}{v_{pre}+m_{safe}+m_{new}} \text{ versus } \frac{v_{pre}}{v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}}$$
$$= c(v_{pre}+m_{safe})(v_{pre}+\frac{v_{pre}m_{safe}}{c}+m_{new}) \text{ versus } v_{pre}(c+m_{safe})(v_{pre}+m_{safe}+m_{new})$$
$$= cv_{pre}^2 + v_{pre}^2 m_{safe} + cv_{pre}m_{new} + cm_{safe}v_{pre} + m_{safe}^2 v_{pre} + cm_{safe}m_{new}$$
$$\text{versus } v_{pre}^2 c + v_{pre}cm_{safe} + v_{pre}cm_{new} + v_{pre}^2 m_{safe} + v_{pre}m_{safe}^2 + v_{pre}m_{safe}m_{new}$$
$$= cm_{safe}m_{new} \text{ versus } v_{pre}m_{safe}m_{new}$$
$$= c \text{ versus } v_{pre}$$

Hence we have DI < S using assumption $c \leq v_{pre}$.

So, for the founders, we have D = ZR(D) < 2R = ZR(S) < DI < S in this case.

For the SAFE investor, we have 2R = ZR(S) and D = ZR(D).

The outcome for 2R can be written as

$$\frac{m_{safe}}{v_{pre}+m_{new}} \cdot \frac{v_{pre}}{c+m_{safe}}$$

which is the outcome for D times a number not larger than 1, by assumption. Hence 2R < D

The outcome for S can be written as

$$\frac{m_{safe}v_{pre}}{v_{pre}c+v_{pre}m_{safe}+m_{new}c}$$

which has the same numerator as 2R. The denominator of 2R multiplies out to the larger number $v_{pre}c + v_{pre}m_{safe} + m_{new}c + m_{new}m_{safe}$, so we have 2R < S.

To compare D with S, we mutiply the denominator and numerator of D by v_{pre}, so that we get

$$\begin{aligned}D \text{ versus } S &= v_{pre}c + v_{pre}m_{safe} + m_{new}c \text{ versus } v_{pre}^2 + v_{pre}m_{new} \\ &= v_{pre}(c + m_{safe}) \text{ versus } v_{pre}^2 + m_{new}(v_{pre} - c)\end{aligned}$$

Since, by assumption, we have $c \leq v_{pre} < c + m_{safe}$., we have $v_{pre}^2 < v_{pre}(c+m_{safe})$ and $0 \leq v_{pre} - c$. Hence the order between these expressions depends on m_{new}.

$ZR(S)$ versus DI

$$\begin{aligned}&= \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre}}{v_{pre} + m_{new}} \text{ versus } \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}} \\ &= \frac{v_{pre}}{v_{pre} + m_{new}} \text{ versus } \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}} \\ &= v_{pre}(v_{pre} + m_{safe} + m_{new}) \text{ versus } (v_{pre} + m_{new})(v_{pre} + m_{safe}) \\ &= v_{pre}^2 + v_{pre}m_{safe} + v_{pre}m_{new} \text{ versus } v_{pre}^2 + v_{pre}m_{safe} + m_{new}v_{pre} + m_{new}m_{safe} \\ &= 0 \text{ versus } m_{new}m_{safe}\end{aligned}$$

So ZR(S) < DI

DI versus D

$$\begin{aligned}&= \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}} \text{ versus } \frac{m_{safe}}{v_{pre} + m_{new}} \\ &= (v_{pre} + m_{new})(v_{pre} + m_{safe}) \text{ versus } (c + m_{safe})(v_{pre} + m_{safe} + m_{new}) \\ &= v_{pre}^2 + v_{pre}m_{safe} + m_{new}v_{pre} + m_{new}m_{safe} \\ &\quad \text{versus } c(v_{pre} + m_{safe} + m_{new}) + m_{safe}v_{pre} + m_{safe}^2 + m_{safe}m_{new} \\ &= v_{pre}^2 + m_{new}v_{pre} \text{ versus } c(v_{pre} + m_{safe} + m_{new}) + m_{safe}^2 \\ &= (v_{pre} - c)(v_{pre} + m_{new}) \text{ versus } (c + m_{safe})m_{safe}\end{aligned}$$

All terms on the last line are positive since we are in a case where $c \leq v_{pre}$. Choice of m_{safe} can result in either order, so these terms are not directly comparable without further information.

DI versus S

$$= \frac{m_{safe}}{c + m_{safe}} \cdot \frac{v_{pre} + m_{safe}}{v_{pre} + m_{safe} + m_{new}} \text{ versus } \frac{\frac{m_{safe} v_{pre}}{c}}{v_{pre} + \frac{v_{pre} m_{safe}}{c} + m_{new}}$$

$$= c(v_{pre} + m_{safe})(v_{pre} + \frac{v_{pre} m_{safe}}{c} + m_{new}) \text{ versus } v_{pre}(c + m_{safe})(v_{pre} + m_{safe} + m_{new})$$

$$= cv_{pre}^2 + m_{safe} v_{pre}^2 + cv_{pre} m_{new} + cv_{pre} m_{safe} + m_{safe}^2 v_{pre} + cm_{safe} m_{new}$$

$$\text{versus } cv_{pre}^2 + cv_{pre} m_{safe} + cv_{pre} m_{new} + v_{pre}^2 m_{safe} + v_{pre} m_{safe}^2 + v_{pre} m_{safe} m_{new}$$

$$= cm_{safe} m_{new} \text{ versus } v_{pre} m_{safe} m_{new}$$

$$= c \text{ versus } v_{pre}$$

Since we are in a case where $c \leq v_{pre}$ we have DI < S.

Thus, for the SAFE investor, we have 2R = ZR(S) < DI < S and 2R = ZR(S) < D=ZR(D). with the order between D=ZR(D) and each of DI and S possibly either way.

Since we are in a case where $c < v_{pre}$, we have $v_{pre} + m_{new} \leq v_{pre} + m_{safe} + m_{new} \leq v_{pre} + \frac{v_{pre} m_{safe}}{c} + m_{new}$ so the order for the new investor is straightforwardly 2R = D = ZR(D) = ZR(S) < DI < S.

- **Assumption $c + m_{safe} \leq v_{pre}$:** The table in this case differs from that for the case $c \leq v_{pre} < c + m_{safe}$ only in the rows for D and ZR(D), and the assumption $c \leq v_{pre}$ used in a number of the comparisons for that case continues to hold. Hence there is no change from the previous case in the ordering of any of the rows other than D, ZR(D). By inspection, we have 2R = D = ZR(D) = ZR(S) for all agents in this case. Thus, for the founders, the outcomes are ordered 2R = D = ZR(D) = ZR(S) < DI < S and for the SAFE investor the outcomes are ordered 2R = D = ZR(D) = ZR(S) < DI < S.