Liquidity and Control within Organizations

Giuseppe Dari-Mattiacci*

January 17, 2019: do not cite or distribute

University of Amsterdam and Columbia Law School JSD Program

Abstract

The commitment of financial resources to a project is essential for long-term investment but brings about both a loss of control and a loss of liquidity for investors. Therefore, investors are ordinarily given an exit option. In this paper, I contrast three common ways to exit: tradability of one's equity position, liquidation rights and redemption rights. I show that they balance liquidity and control very differently. Large safe projects are better associated with tradability, because the risk of inefficient continuation is low and the market provides enough liquidity. Small risky projects are better associated with redemption rights, because they can sort inefficient liquidations from inefficient continuations. Liquidation rights are desirable when redemption rights fail because of high costs of capital or the risk of runs on the company's cash.

Keywords: liquidity, control, redemption, tradability, exit.
JEL codes: G30, K22.

*I would like to thank... for many constructive comments on earlier drafts.

Contents

1 Introduction

To capture the benefits of long-term investment, investors may elect to commit their capital to a project for an analogously long term. Commitment, however, comes at a cost, as it deprives an individual investor of the option to pursue an alternative opportunity along the way. Moreover, this liquidity cost is accompanied by a loss-of-control cost, as the possibility to pull out is a very valuable safeguard against managerial opportunism (Sahlman, 1990). The rules governing business organizations restore liquidity in a variety of ways, essentially disciplining an investor's exit from the organization. Different exit provisions, however, affect control in different ways.[1]

At one extreme, individual investors can be allowed to exit by forcing the liquidation of the company. Traditional legal principles dating back to the Roman law allowed partners to dissolve a partnership at will. The same principle of exit at will governed the joint ownership of assets (tenancy in common). Although time commitments are enforceable under some conditions, liquidation rights have been a typical feature of partnerships for centuries (Hansmann, Kraakman, and Squire, 2006, 1393). Two salient examples of successful partnerships are the Bardi, Peruzzi and Medici banks in 14^{th}- and 15^{th}-century Florence and the companies that made the Industrial Revolution in 19^{th}-century England (Hunt and Murray, 1999; Harris, 2000). Liquidation rights make investment for the long term dependent on the continual agreement of all the investors, which in turn is more easily manageable in small-size, close-kin groups. While giving investors full control over the continuation of the project—and hence guaranteeing that a project is efficiently liquidated if an investor discovers that the project is unprofitable—liquidation rights run the risk of inefficient liquidations of profitable projects triggered by investors with liquidity needs.

At the other extreme, investors can be allowed to exit by trading their shares. Tradability is possibly the most fundamental feature of public corporations. When investors exit by trading their shares on the secondary market, their capital remains invested in the company. The first modern corporation was the Dutch East India Company (VOC), chartered in 1602 in Amsterdam. The VOC was both the first private company with fully committed capital and the first one with a liquid secondary market for shares. These two features are complementary: if capital is fully committed, tradability is necessary to restore liquidity. By contrast, the English East India Company (EIC, chartered in 1600) had formally tradable shares, but trade was initially rare and the secondary market illiquid, arguably because the EIC did not have committed capital until 1657 (Dari-Mattiacci et al., 2017). Allowing exit only through trade carries the risk of inefficient continuation of unprofitable projects. Since investors with

[1] It is important to note at the outset that the collection of investors (or a qualified majority of them) can always act to discontinue a project (Hansmann, Kraakman, and Squire, 2006, 1338). Nevertheless, coordination costs may preclude this option, making individual exit the only feasible solution. To zero in on the problems of interest, I ignore coordinated exit and focus on individual exit only. Moreover, exit through IPO or acquisition is a form collective exit that is not considered here. Finally, the focus is on equity, not on debt.

private knowledge of poor profitability can exit through trade, their private information does not directly result in the liquidation of unprofitable projects (Coffee, 1991; Bhide, 1993). Sales may depress share price, but price is a noisy signal of profitability because also investors with liquidity needs and no private information are on the market.

To emphasize: in a stereotypical corporation capital is locked in for the long term and exit is possible only through trade, while in a stereotypical partnership capital is uncommited and exit is possible only by forcing the liquidation of the company.[2] In between these two extreme exit options, redemption rights allow investors to force the company to repurchase their shares for a predetermined redemption price, which is generally equal to the purchase price plus accrued but unpaid dividends. Redemption rights are commonly included in venture capital (VC) financings (Kaplan and Stromberg, 2003, 291) and considered an important safeguard against "walking dead" companies, which barely stay alive without being particularly profitable.[3] Redemption rights, however, may be regarded as a catch, as investors may want to redeem precisely when the company is unprofitable and hence has no cash to pay for redemption.[4]

However, as I will show in the following, the exercise of redemption rights may sort projects, leading to liquidation with high probability if the project is unprofitable—thus, over-performing tradability—and with low probability if the project is profitable—thus over-performing liquidation rights. The intuition is simple. Investors motivated by liquidity needs will redeem their shares independently of the profitability of the project. In contrast, investors motivated by private information—that is, those who know the project's profitability—will redeem only if the project is unprofitable. As a result, the number of redeeming investors—which will be a stochastic variable in the model presented below—will tend to be larger if the project is unprofitable; hence, the company will be pushed into insolvency and consequent liquidation relatively more often when liquidation is efficient because the project is unprofitable.

A recent Delaware case illustrates both the virtues and the problems with redemption rights. In ODN Holding[5] a VC and the company board allegedly colluded to cause the company to engage in growth-reducing, cash-generating transactions, the only purpose of which was to make redemption by the VC possible to the detriment of common stockholders.

If the company is doing so poorly that the VC wants to redeem its shares, it is in the interest of all investors that the company be liquidated. The beneficial

[2]A partnership with tradable shares is an uninteresting hybrid for our purposes, as our results would remain largely unchanged if we considered this possibility.

[3]Redemption usually needs to be requested by a qualified percentage of holders. Yet, an investor can opt out and refuse to redeem. In the model I will abstract from these complications and look at redemption as an individual decision. The key mechanisms behind my results would remain the same in a more complex model.

[4]Venture capital financings have many defining characteristics that are not examined here, see for instance Black and Gilson (1998); Gilson and Schizer (2003); Smith (2005); Cumming (2005, 2008).

[5]The Frederick Hsu Living Trust v. ODN Holding Corporation, C.A. No. 12108-VCL, 2017 WL 1437308 (Del Ch. Apr. 25, 2017). See Reder (2017).

sorting of projects under redemption rights, however, comes with two types of costs. The first cost is due to the need for the company to hold (or generate) cash in order to be able to satisfy a certain number of redemption requests. The second cost is due to the possibility of runs on the company's cash, which in turn is due to the fact that the redemption price is generally larger than the liquidation value of the company and hence informed redeemers may be able to create a negative externality for other investors, as ODN Holding nicely illustrates. As we will see, a necessary condition to avoid runs is that the company holds enough cash. These costs may weigh against the use of redemption rights for more than a selected class of shareholders.

Although they are commonly combined, I will analyze tradability, liquidation rights and redemption rights in isolation in order to characterize them as sharply as possible. These different exit options impact control and liquidity in very different ways. On the one hand, liquidation rights overshoot when exit is motivated by a liquidity need because they imply the liquidation of the company irrespective of the investor's motive. In a sense, they give investors too much control (as in Burkart, Gromb, and Panunzi, 1997). On the other hand, tradability is at the opposite end of the spectrum, because it never leads to the liquidation of the company, giving investors too little control on continuation (as in Bhide, 1993). Somewhat in between, redemption rights may lead to liquidation only if the number of redemption requests exceeds a certain threshold (above which the company is insolvent), which has a beneficial sorting effect.

Which exit modality is more efficient depends on factors such as the number of investors, the incidence of liquidity shocks and the riskiness of the projects. Large safe projects are better associated with tradability, because the risk of inefficient liquidation is low and the market provides enough liquidity. Small risky projects are better associated with redemption rights, because they can sort inefficient liquidations from inefficient continuations. Liquidation rights are desirable when redemption rights fail because of high costs of capital or the risk of runs on the company's cash.

These results are broadly consistent with the empirical literature documenting the more frequent use of redemption rights and other control rights on the continuation decision when the potential conflict of interest between the entrepreneur and the shareholders is more severe (Cumming, 2008). Since this particular conflict of interest arises when the project is unprofitable, risky projects are more likely to be associated with stronger control rights. Accordingly, Winton and Yerramilli (2008) find that risky projects are more likely to be financed through venture capital financing, which is characterized by more intense monitoring of the continuation decision, rather than with bank financing, characterized by laxer monitoring.[6]

The theoretical analysis that is most closely related to the model presented below is the one by Aghion, Bolton, and Tirole (2004), which focuses on trade as

[6]Note, however, as emphasized below, that the literature on venture capital focuses on redemption rights held by a single investor (the venture capital firm). In contrast, a crucial element of my model is that fact that multiple investors may exercise their redemption rights independently of each other.

an exit option while I also consider liquidation and redemption. There is a large related literature on private versus public ownership (see Röell, 1996, for an overview). This literature, however, generally assumes fully committed capital, while here the degree of commitment is an important factor in the analysis. Commitment can effectively be limited by staged-investment agreements. The literature focusing on venture capital stage financing (Tian, 2011) examines the relationship between a single venture capitalist and the entrepreneur. In contrast, the presence of several investors is a crucial factor in my analysis.

While focused on business organizations, the approach developed here could provide insights as to why and under what circumstances commercial parties may deliberately enter into low-commitment relational contracts as opposed to more detailed—and more easily enforceable—agreements (Goetz and Scott, 1981; Scott, 2003, 2006).

2 Model

2.1 Entrepreneur and production technology

We consider a project p, which yields a return qR per unit of capital invested, where $q = 1$ with probability p and $q = 0$ with the complementary probability $1 - p$, so that p is the probability that the project is profitable and npR is the expected return from the investment of n units of capital. If the project is liquidated early, assets can be sold at a reduced price equal to $L < 1$ per unit of capital initially invested; hence, nL is the liquidation value of the company. I assume that to run the project, an amount of investment n is needed. Think of a project requiring the purchase of a single machine which costs n, is expected to generate npR if the project runs to the end and can be resold at $nL < n$ if the project is discontinued early. To assure that investment is in principle optimal, let the expected profit be larger than the investment, that is, $pR > 1$.

An entrepreneur is endowed with a project p but has no funds and hence needs external capital. The entrepreneur may decide to discontinue the project at an early stage if it turns out that the project is unprofitable—that is, if she discovers $q = 0$. To stress the potential conflict of interests between the entrepreneur and the investors, I assume that the entrepreneur derives private benefits from running the project until the end and hence will have no incentives to discontinue an unprofitable project early, while investors would like to do so because, if liquidated early, the project yields L per unit of capital even if unprofitable, while it yields 0 if continued to the later date. Different exit modalities give investors different degrees of control over the continuation decision, as I will illustrate momentarily.

2.2 Inside and outside investors

(Inside) investors invest, for simplicity, 1 unit of capital each and only care about final returns or, if they experience a liquidity shock, about interim returns.[7] Investors can elect to monitor the entrepreneur at a (random) cost. Monitoring is speculative: if an investor monitors, he learns the profitability q of the project. Investors are also subject to a random liquidity shock which makes them value later returns at zero. Therefore, there are two possible reasons for investors to exit: a liquidity reason—that is, the realization of a liquidity shock—and a strategic reason—that is, private knowledge that the project is unprofitable. Since both the liquidity shock and the monitoring costs are privately known, outsiders cannot distinguish between these two exit motives when they observe an exit decision.[8]

Inside investors operate on the primary market only. An infinite number of outside investors operate on a competitive secondary market and will buy shares at their expected value given the information publicly available on the market (if trade is allowed).

2.3 Exit options

The model focuses on three stylized ways in which investors can exit: trade, liquidation and redemption. With trade, exit is allowed only by selling shares on the secondary market. With liquidation, exit is allowed only by liquidating the project, which occurs at the request of any individual investor. With redemption, exit is allowed by making a redemption request to the entrepreneur. If the entrepreneur holds enough cash, all redemption requests will be honored and the project will continue. If the entrepreneur does not hold enough cash, the company becomes insolvent and is liquidated prematurely. Those who posted a redemption request have priority on the available cash plus the liquidation value of the company. All other investors then share the residual liquidation value, if anything is left. Effectively, a redemption request turns a stockholder into a creditor with priority over (other) stockholders. Although extreme, this characterization captures the main problem with redemption, that is, the fact that it may generate an advantage over other (non-redeeming) stockholders. (Note that exit through liquidation corresponds to the case of redemption when the entrepreneur holds no cash but a liquidation request does not give priority over other investors.)

Although redemption ordinarily needs to be requested by a (majority of) a class of investors, dissenting investors are usually allowed to opt out. To capture this aspect of the problem, I model redemption as an individual decision. Since the project does not produce any value in the interim period, I assume that redemption yields the restitution of the initial investment, which is equal to 1

[7] Endogenizing the amount of capital invested by each investors is an interesting extension of the model but one that is unlikely to alter the main message of the analysis.

[8] The presence of some informed outside investors would not alter the results provided that there are enough uninformed outside investors.

(the redemption price). Redemption is thus more valuable than liquidation but less valuable than the expected value of the project. Absent a liquidity shock or private information, it is therefore inefficient to redeem.

2.4 Timing and setup

An entrepreneur with no funds is endowed with a project p at date 0. To run the project, the entrepreneur needs funds equal to n. Since investors invest 1 unit of capital each, the entrepreneur needs to raise capital from n investors on the primary market. The entrepreneur may also collect additional capital to hold as cash. We denote retained cash as $\hat{\nu}$; thus, in total the entrepreneur raises $n+\hat{\nu}$ units of capital from an many investors. Note that, given a redemption price equal to 1, $\hat{\nu}$ is also the number of redemption requests that the entrepreneur can satisfy without becoming insolvent.

At date 1, each investor draws a random monitoring costs: this cost is equal to 0 with probability μ and is prohibitively high ($C > R$) with the complementary probability $1-\mu$. If the cost is 0, the investor monitors the entrepreneur. Monitoring is speculative (as in Aghion, Bolton, and Tirole, 2004). By monitoring, the investor learns the value of q at date 2 so that, if $q = 0$, the investor knows that the project is unprofitable and may decide to exit. At date 2, the investor may also experience a random liquidity shock with probability λ. If the investor experiences a liquidity shock, the value of money in the future becomes 0 and the investor needs to cash out now on the investment (an in Diamond and Dybvig, 1983).

Both investors who have experienced a liquidity shock and investors who have monitored and discovered that the project is unprofitable value the final project returns qR at 0; hence, they prefer to exit at date 2 rather than to wait until date 4. (We allow also all other investors to exit; we will examine when they will elect to do so momentarily.)

At date 3, depending on the exit modality, the date-2 exit decisions may have different consequences for the organization. Exit through trade does not affect the organization, the capital remains locked in and the project continues with probability 1. Exit through liquidation discontinues the project with probability 1 at the request of a single investor. Finally, exit through redemption may or may not result in liquidation.

	Actions	Private information (everything else is common knowledge)
Date 0 (Investment)		
A	The entrepreneur is endowed with a project p The entrepreneur chooses the exit modality	
B	The entrepreneur chooses how much cash $\hat{\nu}$ to retain $n+\hat{\nu}$ investors invest 1 each	
Date 1 (Monitoring)		
A	Nature draws the monitoring costs $c_i \in \{0, C\}$	Only investor i observes his c_i
B	Each investor i decide whether to monitor	
Date 2 (Exit)		
A	Nature draws the liquidity shocks $l_i \sim \mathrm{B}(1, \lambda)$ and the firm's profitability $q \sim \mathrm{B}(1, p)$	Only investor i observes his l_i Only monitoring investors observe q
B	Investors may opt for exit (trade, liquidation or redemption)	
Date 3 (Liquidation versus continuation)		
A	The firm may be forced to liquidate depending on the exit modality	
B	The payoff from liquidation (L) is realized or the project is continued	
Date 4 (Project payoff)		
	Continued projects yield qR	

Table 1: Timing, actions and information

If at date 1 the entrepreneur has acquired enough cash to satisfy all outstanding redemption requests, the project continues. This is the case if the number ν of redemption requests is less than or equal to $\hat{\nu}$. If instead the redemption requests exceed the available cash, the project is liquidated; this happens when $\nu > \hat{\nu}$. Redemption requests are posted simultaneously by investors. Continued projects yield qR at date 4. Table 1 summarizes this setup.

3 Exit

3.1 Demand for exit and its information value

An important factor in the analysis is the number of investors who genuinely prefer exit at date 2. Those are investors who either experience a liquidity shock (a "liquidity exit" with probability λ) or those who, without liquidity shock, monitor and discover that the project is unprofitable, that is, they learn $q = 0$ (a "strategic exit" with probability $(1-\lambda)(1-p)\mu$). We will examine momentarily the possibility for runs on the company's cash by investors who neither experienced a liquidity shock nor monitored (those who monitored and discovered $q = 1$ clearly have no incentive to exit). For now, we focus on genuine exit decisions.

Since both liquidity exits and strategic exits are random variables, the number of investors who desire to exit is also a random variable, which we denote by ν. There are two states of the world. If the project is profitable ($q = 1$), then ν has a binomial distribution $\Pr[\nu \mid n, q = 1] = \mathrm{B}(n, \lambda)$ because the only investors who desire to exit are those with a liquidity shock. If the project is unprofitable ($q = 0$), then ν has a binomial distribution $\Pr[\nu \mid n, q = 0] = \mathrm{B}(n, \lambda + (1-\lambda)\mu)$, which is analogously intuitive. Now those who want to exit are the investors with a liquidity shock and the investors without a liquidity shocks who have monitored. It is easy to see that $\Pr[\nu \mid n, q = 0]$ has a greater success rate and hence leads to a larger demand for exit. This means that the number of investors who elect to exit can serve as a noisy signal of the probability of success for the project: if only few investors elect to exit, the project is more likely to be profitable than when many investors decide to do so.

Aggregating the previous conditional probabilities, we have that the unconditional number of investors electing to exit is randomly distributed according to

$$\begin{aligned}\Pr[\nu \mid n] &= p\Pr[\nu \mid n, q = 1] + (1-p)\Pr[\nu \mid n, q = 0] \\ &= \binom{n}{\nu}\left[p\lambda^{\nu} + (1-p)(\lambda + (1-\lambda)\mu)^{\nu}(1-\mu)^{n-\nu}\right](1-\lambda)^{n-\nu}\end{aligned}$$

The conditional probability of success given the number of exit demands is:

$$\begin{aligned}\Pr[q = 1 \mid n, \nu] &= \tfrac{\Pr[\nu|n,q=1]\Pr[q=1]}{\Pr[\nu|n]} \\ &= \tfrac{p\lambda^{\nu}}{p\lambda^{\nu}+(1-p)(\lambda+(1-\lambda)\mu)^{\nu}(1-\mu)^{n-\nu}}\end{aligned} \tag{1}$$

which is decreasing in ν (see Dari-Mattiacci, 2017, for the derivation of both formulas). The more people elect to exit the lower the posterior probability of success for the project. This suggests that seeing many exit demands is bad news. This relationship will be an important element of the analysis.

3.2 Price on the secondary market

When exit is only possible through trade, investors may offer their shares for sale on the secondary market. To eliminate the possibility for multiple equilibria, I assume that, if indifferent, the investor holds on to his share. The number of shares offered for sale is equal to the number of investors who elect to exit, ν. I assume that ν is common knowledge, that is, that a competitive market maker sees the flow of offers ν and determines the highest price that uninformed outside investors are willing to pay for one share. The market price is hence equal to the expected value of the shares, which in turn equal to R times the conditional probability that the project is profitable given ν. That is:

$$P(\nu, n) = \frac{p\lambda^{\nu+1}}{p\lambda^{\nu+1}+(1-p)(\lambda+(1-\lambda)\mu)^{\nu+1}(1-\mu)^{n-\nu}}R$$

It is easy to see that other investors have no incentive to offer their shares for sale. Since shares are traded for their expected value given publicly available information, uninformed investors are indifferent between selling and holding their shares and we assumed that they always elect to hold. Informed investors (the strategic sellers) earn information rents on the market, since they are selling shares in a project they know is worth 0 but they obtain a positive price.

Liquidity sellers make a loss, due to the fact that, in expectation, the price is less than the expected value of a project of unknown profitability, pR. This happens because liquidity sellers sell projects irrespective of their profitability, hence they sell shares of value pR, but outside investors discount the fact that strategic sellers adversely select the projects they put on the market and hence price shares at less than pR in expectation. Adverse selection by strategic sellers causes liquidity sellers to bear a trading cost $pR - \mathrm{E}_{\nu>0}[P(\nu, n)] > 0$ (see Dari-Mattiacci, 2017).

3.3 Liquidation and project profitability

The probability of liquidation depends on the exit modality. If exit is through trade, the project is never liquidated and hence the probability of liquidation is equal to 0. If exit is only through liquidation, the probability of liquidation is equal to the probability that at least one investor elects to exit:

$$\begin{aligned}\Pr[\nu > 0 \mid n] &= 1 - \Pr[\nu = 0 \mid n] \\ &= 1 - (1-\lambda)^n [p + (1-p)(1-\mu)^n]\end{aligned}$$

It is easy to see that other investors—those not experiencing a liquidity shock and those with no private knowledge that the project is unprofitable—do not have any incentive to demand the liquidation of the company. If $\nu > 0$ the company will be forced to liquidate by somebody else. If $\nu = 0$, there is no investor who has discovered that the project is unprofitable (or ν would not be zero) and hence, using (1), the conditional probability of success for the project is

$$\Pr[q = 1 \mid n, \nu = 0] = \frac{p}{p+(1-p)(1-\mu)^n} > p$$

Thus, the project's expected returns are larger than $pR > L$ and hence it is never optimal to liquidate the project early. This shows that, as in the case of exit through trade, also when exit is through liquidation there are no runs—that is, no demand for exit—by those investors who do not have liquidity or strategic motives to exit.

Things are more complex with redemption rights. Given a redemption price equal to 1, the number of redemption requests motivated by liquidity or strategic considerations is equal to the number of investors who want out, ν. If $\nu > \hat{\nu}$, the company cannot pay the redemption amounts out of current cash, becomes insolvent and is therefore liquidated. The probability of liquidation is thus $\Pr[\nu > \hat{\nu} \mid n + \hat{\nu}]$.

Since $\Pr[q = 1 \mid n + \hat{\nu}, \nu]$ decreases in ν, redemption sorts projects. Those continued are characterized by $\nu \leq \hat{\nu}$ and have a higher conditional probability to succeed than those liquidated, which are characterized by $\nu > \hat{\nu}$. That is:

$$\Pr[q = 1 \mid n + \hat{\nu}, \nu \leq \hat{\nu}] > \Pr[q = 1 \mid n + \hat{\nu}, \nu > \hat{\nu}] \text{ for all } \hat{\nu} \text{ and } n$$

On the one hand, uninformed inside investors can leverage on the sorting effect of redemptions by holding on to their shares. If the project is not liquidated they will know that the project has a relatively high chance of success. If instead the project is liquidated, it is relatively unlikely to succeed. This suggests that uninformed inside investors should refrain from redeeming their shares; by holding they can free-ride on information held by others. On the other hand, conditional on liquidation, redeeming investors share in the company's cash and the liquidation value, while all other investors only receive the residual liquidation value, which could generate a run on the company. For the moment, we assume away the problem of runs. We return to it in Section 5, where we show that runs can occur if the entrepreneur does not hold enough cash.

4 Liquidity versus control

In this section, I will unpack the effect of the different exit modalities on liquidity and control within the organization.

4.1 Liquidity provision within the organization

Table 2 below summarizes the expected "price" that investors facing a liquidity shock can obtain for their shares under different exit modalities. It is important to recall that an investor with liquidity needs elects to exit irrespective of the profitability of the project. With tradability, exiting investors obtain an expected market price which is less than the expected project value because of adverse selection by informed investors (Dari-Mattiacci, 2017).[9] This cost of trade decreases as the number of investors increases, that is, the market becomes

[9]The expectation is calculated over all possible realizations of ν.

more liquid when the number of investors goes up. When the exit modality is liquidation, the exit price is simply the liquidation value of the shares, which, by hypothesis, is less than the initial investment.

If the exit modality is redemption, the exit price depends on the number of redeeming investors as follows. If they are less than the available cash ($\nu \leq \hat{\nu}$), redemption does not lead to liquidation and the redeeming investors obtain the predetermined redemption price, 1. When $\nu > \hat{\nu}$, the available cash is not enough to satisfy all redemption requests and the company is forced to liquidate. However, since, by assumption, redeemers have priority over other investors, as long as cash plus the total liquidation value are enough to satisfy the redemption requests—that is, if $\nu \leq \hat{\nu} + nL$—redeeming investors obtain the full redemption price of 1. When this is not the case, the available resources are shared pro rata among the redeeming investors (with all other investors obtaining nothing from liquidation). The expected exit price with redemption is larger than the liquidation value L, because investors share in assets of per-share value equal to L plus some cash with unitary per-share value, which is larger than L. In addition, the expected exit price with redemption is less than 1 for the same reason (if the company only held cash and no assets, the exit price would be 1).

	Price of early exit
Tradability	$\mathrm{E}_{\nu \geq 1}\left[P\left(\nu, n\right)\right] < pR$
Liquidation	$L < 1$
Redemption	$L < \sum_{1 \leq \nu \leq \hat{\nu}+nL}\left[\Pr\left[\nu \mid n+\hat{\nu}\right]\right] + \sum_{\nu > \hat{\nu}+nL}\left[\Pr\left[\nu \mid n+\hat{\nu}\right]\frac{\hat{\nu}+nL}{\nu}\right] < 1$

Table 2: Liquidity

Exit through redemption provides therefore better liquidity than exit through liquidation. The intuition is straightforward: the company is holding cash—which retains its value over time—in addition to assets—which are productive in expectation over the long term but lose value in the interim period. Tradability may or may not outperform redemption depending on the parameters. The exit price through redemption is bounded above by 1. In contrast, with tradability, the exit price could become very close to $pR > 1$ if n is particularly large, but could also be depressed below 1 when the cost of trade is large due to a small n. Therefore, liquidity is highest with redemption if n is small and with trade if n is large.

4.2 Control within the organization

Within the model, the issue of control is essentially a question of continuation versus liquidation at date 3. In the first best, continuation is efficient if $q = 1$, while liquidation is efficient if $q = 0$. No exit modality achieves the first best; inefficient continuation needs to be balanced against inefficient liquidation. The loss with inefficient continuation is L (because the project yields zero if continued) while the loss with inefficient liquidation is $R-L$ (because the project would yield R if continued but is liquidated instead).

With tradability, all $q = 1$ projects are continued (there are no inefficient liquidations), but also all $q = 0$ projects are, which is inefficient. If the exit modality is liquidation, projects may be liquidated in both states of the world. Good projects may be inefficiently liquidated due to an investor's liquidity shock. This eventuality becomes more likely when the number of investors n increases. Intuitively, since *any* investor can liquidate the company, the more investors the larger the risk that this occurs inefficiently. Bad project may be inefficiently continued if no investor monitors and no investor experiences a liquidity shock. As n increases, the probability that a bad project continues goes to zero. In the extreme, with very large n, liquidation rights result in inefficient liquidation with probability close to 1 and in inefficient continuation with probability close to 0. This suggests that, with large n, tradability and liquidation rights suffer from diametrically opposite problems. While trade results in inefficient continuation of unprofitable projects, liquidation rights result in inefficient liquidation of profitable ones.

If the exit modality is redemption, projects are sorted. If the project is profitable ($q = 1$), redemption allows the company to absorb some exit demands without liquidating. This is an improvement over liquidation rights, which result in liquidation at the request of *any* investor. In contrast redemption rights result in liquidation only if the redeeming investors are more than $\hat{\nu}$. Therefore, the probability of inefficient liquidation is lower than with liquidation rights, although it is higher than with trade.

If the project is unprofitable, the opposite reasoning applies. Redemptions result in more projects being continued than with liquidation rights and in less projects being continued if compared with tradability.

	Probability of inefficient continuation (given $q = 0$)	Probability of inefficient liquidation (given $q = 1$)
Tradability	1	0
Liquidation	$(1-\lambda)^n (1-\mu)^n$	$1-(1-\lambda)^n$
Redemption	$\Pr[\nu \leq \hat{\nu} \mid n+\hat{\nu}, q=0]$	$\Pr[\nu > \hat{\nu} \mid n+\hat{\nu}, q=1]$

Table 3: Control

To sum up, with respect to inefficient continuation, trade has the worst performance, liquidation is the best, redemption is somewhere in between. Instead, with respect to inefficient liquidation, trade performs the best, liquidation the worst, redemption is again somewhere in between. The sorting effect of redemption yields intermediate values of both type-I and type-II errors.

Comparing the performance of the different exit modalities is straightforward. It is easy to see that it is always possible to choose $\hat{\nu}$ so that redemption rights perform better than liquidation rights. At least, if $\hat{\nu} = 0$, the two modalities are identical. Therefore, redemption is always to be preferred over liquidation.

The choice between redemption and trade depends on the parameters of the game and, in particular, on the riskiness of the project, which is captured by the probability of success, p, and on the prevalence of liquidity shocks, λ, which could in turn be a proxy for the efficiency of the credit market.

With low p—these are high-risk, high-yield projects—trade performs very poorly because inefficient continuations weigh heavily on the balance. With high-p projects, instead, trade performs well. We would therefore expect that risky projects be associated with redemption rights and safe projects be associated with tradability.

Similarly, the likelihood of a liquidity shock, λ, only negatively affects the performance of redemption rights. Therefore, if λ is large, trade performs better and if λ is small redemption performs better. This result could be interpreted as suggesting that in settings where liquidity needs can be satisfied elsewhere—for instance, through an efficient credit market—redemption rights are more likely to emerge.

The ex ante project value net of investment is accounted for in the next table. It is easy to see that, keeping pR constant, the project value under liquidation rights is larger when n, p and λ are small. Since redemption rights can be engineered to perform better than liquidation rights, this observation proves the claims above.

	Net project value
Tradability	$pR - 1$
Liquidation	$p\left[(1-\lambda)^n R + \left[1-(1-\lambda)^n\right] L\right]$ $+ (1-p)\left[1-(1-\lambda)^n (1-\mu)^n\right] L - 1$
Redemption	$\frac{n}{n+\hat{\nu}} p \left(\Pr\left[\nu \leq \hat{\nu}, n+\hat{\nu} \mid q=1\right] R + \Pr\left[\nu > \hat{\nu}, n+\hat{\nu} \mid q=1\right] L\right)$ $+ \frac{n}{n+\hat{\nu}} (1-p) \Pr\left[\nu > \hat{\nu}, n+\hat{\nu} \mid q=0\right] L$ $+ \frac{\hat{\nu}}{n+\hat{\nu}} - 1$

Table 4: Project value net of investment

4.3 Summary

The previous analysis suggests that tradability will be associated with projects characterized by large initial investments (large n), relatively safe but possibly moderate returns (large p relative to R) and inefficient credit markets (large λ). Vice versa, redemption rights will be associated with projects characterized by small initial investments (small n), relatively risky but possibly high returns (small p relative to R) and efficient credit markets (small λ). In the next section, we will examine the costs associated with redemption rights, which in turn will define the scope for liquidation rights.

5 The costs of cash

There are two costs associated with the use of redemption rights. On the one hand, to be effective redemption rights require companies to hold some cash. The amount of cash held determines the likelihood that redemption requests will result in the liquidation of the company. In the model, the need to hold cash requires the entrepreneur to rise more initial capital than she would otherwise do if exit were allowed either through trade or through liquidation. In turn, this may have direct or indirect costs for the entrepreneur, such as a higher cost of capital or the risk of not being able to find a large enough number of investors.

On the other hand, as we have suggested above, tradability and liquidation rights are immune from runs. The intuition is that trade is a purely individual decision with no consequence for other investors and takes place at a price that reflects available information on the secondary market. Hence, uninformed investors with no liquidity needs derive no benefits from trading. Conversely, liquidation rights perfectly internalize negative information: if the project is unprofitable, investors with private information will force the liquidation of the company to exit—because no other exit option is available. Therefore, uninformed investors with no liquidity needs have again no incentives to demand liquidation.

Redemption rights lie somewhat in between. The decision to redeem is private but has possibly negative effects for other investors. The reason is that a redeemer's claim has priority over other investor's claims on the company's cash and assets. Although somewhat extreme, this feature captures the idea that redemption rights allow a redeemer to exit for a convenient price, which is possibly higher than the liquidation value of the project. This generates the potential for runs, that is, creates incentives for investors with no private information or liquidity needs to redeem their shares. To show that this is a possibility, it is enough to focus on the outcome in which all and only the investors with either a liquidity shock or private knowledge that the project is unprofitable request redemption, while all other investors hold their shares. We need to show that this outcome may not be an equilibrium.

Since redemptions are placed simultaneously, we look for pure-strategy Nash equilibria and focus on a representative uninformed inside investor with no liquidity needs. We are interested in establishing whether the situation in which only the ν investors with liquidity or strategic reasons to redeem do so and all other investors hold to their shares (including monitors who learn that the project is good) is an equilibrium. If this is not the case, there can be a "run on the company's cash" equilibrium where (some) uninformed investors with no liquidity needs redeem their shares.

We focus therefore on the payoff of a representative investor who does not experience a liquidity shock and does not monitor. Recall that the entrepreneur has collected funds equal to $n + \hat{\nu}$ at date 0. Only a portion n of these funds are productive, while the remaining funds, $\hat{\nu}$, are held as cash and they do not yield or lose value as time passes. In total, the company's return at date 4 is $nqR + \hat{\nu}$ and the company's liquidation value at date 3 is $nL + \hat{\nu}$.

If only ν investors request redemption, then the investor under analysis expects to receive the following payoff if he holds his share

$$\begin{aligned}\Pi^H \quad \equiv \quad & \textstyle\sum_{\nu=0}^{\nu=\hat{\nu}} \left(\Pr\left[\nu \mid n+\hat{\nu}\right] \left[\frac{\hat{\nu}-\nu}{n+\hat{\nu}-\nu} + \frac{n}{n+\hat{\nu}-\nu} \Pr\left[q=1 \mid n+\hat{\nu},\nu\right] R \right] \right) \\ & + \textstyle\sum_{\nu=\hat{\nu}+1}^{\nu=\hat{\nu}+nL} \Pr\left[\nu \mid n+\hat{\nu}\right] \frac{nL+\hat{\nu}-\nu}{n}\end{aligned}$$

where the first summation captures the case in which there is enough cash to satisfy the (genuine) redemption demands and the project is continued and, with some probability, is successful. In this case, the payoff at date 4 is equal to the residual cash $(\hat{\nu}-\nu)$ plus the conditional expectation to receive R. Both residual cash and returns are shared among the $n+\hat{\nu}-\nu$ non-redeeming investors. The second summation captures the eventuality that the redemption demands exceed the available cash and the firm is liquidated. In this case, the non-redeeming investors only share in the residual liquidation value of the company, after the redeeming investors are paid. If $\nu > \hat{\nu}+nL$ the available cash and the liquidation value are not enough to satisfy redeeming investors and there are no assets left to share among non-redeeming investors.

If instead the investor redeems, then he earns

$$\Pi^R \equiv \frac{1}{\Pr\left[\nu>0 \mid n+\hat{\nu}\right]} \left(\sum_{\nu=1}^{\nu=\hat{\nu}+nL} \Pr\left[\nu \mid n+\hat{\nu}\right] + \sum_{\nu=\hat{\nu}+nL+1}^{\nu=\hat{\nu}+n} \Pr\left[\nu \mid n+\hat{\nu}\right] \frac{\hat{\nu}+nL}{\nu} \right)$$

where the summation now starts at $\nu=1$ because the present (uninformed) investor is redeeming. The first summation refers to the case where redemption requests are honored; in which case the investor receives the redemption price of 1. The second summation refers to the case in which the redemption requests cannot be honored, in which case the investor receives his share of the available cash plus a pro-rata share of the liquidation value. The condition for the no-run situation to be an equilibrium is $\Pi^H \geq \Pi^R$.

For $\hat{\nu}$ small enough this condition is violated. To see how, consider $\hat{\nu}=0$. Then we have:

$$\Pi^H = \sum_{\nu=1}^{\nu=nL} \Pr\left[\nu \mid n\right] \frac{nL-\nu}{n}$$

and

$$\Pi^R > \sum_{\nu=1}^{\nu=nL} \Pr\left[\nu \mid n\right] + \sum_{\nu=nL+1}^{\nu=n} \Pr\left[\nu \mid n\right] \frac{nL}{\nu}$$

which clearly results in $\Pi^H < \Pi^R$. If the company does not hold enough cash, redemption rights may result in runs.

6 Conclusion

I have presented a simple model of exit from a company. Exit modalities balance the need to commit capital to a project for the long term—which may generate the risk of inefficient continuation of unprofitable projects due to managerial entrenchment—and the need to provide liquidity and control to investors—which in turn may result in too many liquidations of profitable projects. The analysis has contrasted three exit modalities: trade, liquidation rights and redemption rights.

I have shown that redemption rights are optimal when projects are risky, require moderate amounts of initial investments (and the involvement of relatively small groups of investors) and occur in an environment with relatively well-developed credit markets (which can absorb most liquidity needs). In the opposite scenario, tradability is the optimal exit modality. This also suggests that companies will abandon exit through redemption and move to tradability as they move away from the initial, risky phase of investment and mature into larger, more profitable and less risky endeavors.

Liquidation rights are, in general, suboptimal choices because of the risk of inefficient liquidation associated with them but may be preferred when the cost of holding cash is too high. This may be the case when the risk of runs makes redemption rights impractical.

References

Aghion, P., P. Bolton, and J. Tirole. 2004. "Exit Options in Corporate Finance: Liquidity versus Incentives." *Review of Finance* 8 (3):327–353.

Bhide, Amar. 1993. "The hidden costs of stock market liquidity." *Journal of Financial Economics* 34 (1):31–51.

Black, Bernard S and Ronald J Gilson. 1998. "Venture Capital and the Structure of Capital Markets: Banks versus Stock Markets." *Journal of Financial Economics* 47 (3):243–277.

Burkart, Mike, Denis Gromb, and Fausto Panunzi. 1997. "Large Shareholders, Monitoring and the Value of the Firm." *Quarterly Journal of Economics* 112 (3):693–728.

Coffee, John C. Jr. 1991. "Liquidity versus Control: The Institutional Investor as a Corporate Monitor." *Columbia Law Review* 91 (6):1277–1368.

Cumming, Douglas. 2008. "Contracts and Exits in Venture Capital Finance." *Review of Financial Studies* 21 (5):1947–1982.

Cumming, Douglas J. 2005. "Capital Structure in Venture Finance." *Journal of Corporate Finance* 11 (3):550–585.

Dari-Mattiacci, Giuseppe. 2017. "Capital Lock-in, Liquidity, and the Separation of Ownership and Control." *Working Paper, Columbia University School of Law* .

Dari-Mattiacci, Giuseppe, Oscar Gelderblom, Joost Jonker, and Enrico C. Perotti. 2017. "The Emergence of the Corporate Form." *Journal of Law, Economics & Organization* 33 (2):193–236.

Diamond, Douglas W. and Philip H. Dybvig. 1983. "Bank Run, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91 (3):401–419.

Gilson, Ronald J. and David M. Schizer. 2003. "Understanding Venture Capital Structure: A Tax Explanation for Convertible Preferred Stock." *Harvard Law Review* 116 (3):874.

Goetz, Charles J and Robert E Scott. 1981. "Principles of Relational Contracts." *Virginia Law Review* 67 (6):1089–1150.

Hansmann, Henry, Reinier Kraakman, and Richard Squire. 2006. "Law and the Rise of the Firm." *Harvard Law Review* 119 (5):1333–1403.

Harris, Ron. 2000. *Industrializing English Law: Entrepreneurship and Business Organization, 1720-1844*. Cambridge: Cambridge University Press.

Hunt, Edwin S. and James Murray. 1999. *A History of Business in Medieval Europe, 1200- 1550.* Cambridge: Cambridge University Press.

Kaplan, Steven N. and Per Stromberg. 2003. "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts." *Review of Economic Studies* 70 (2):281–315.

Reder, Robert S. 2017. "Delaware Court Refuses to Dismiss Common Stockholder's Challenge to Redemption of Preferred Stock Owned by Controlling Stockholder." *Vanderbilt Law Review En Banc* 70:235–248.

Röell, Ailsa. 1996. "The Decision to Go Public: An Overview." *European Economic Review* 40 (3):1071–1081.

Sahlman, William A. 1990. "The structure and governance of venture-capital organizations." *Journal of Financial Economics* 27 (2):473–521.

Scott, Robert E. 2003. "A Theory of Self-Enforcing Indefinite Agreements." *Columbia Law Review* 103 (7):1641–1699.

———. 2006. "The Law and Economics of Incomplete Contracts." *Annual Review of Law and Social Science* 2 (1):279–297.

Smith, D. Gordon. 2005. "The Exit Structure of Venture Capital." *UCLA Law Review* 53:315–356.

Tian, Xuan. 2011. "The Causes and Consequences of Venture Capital Stage Financing." *Journal of Financial Economics* 101 (1):132–159.

Winton, Andrew and Vijay Yerramilli. 2008. "Entrepreneurial Finance: Banks versus Venture Capital." *Journal of Financial Economics* 88 (1):51–79.