NBER WORKING PAPER SERIES

THE CORPORATION IN FINANCE

Raghuram Rajan

Working Paper 17760
http://www.nber.org/papers/w17760

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2012

Presidential address to the American Finance Association, Chicago, January 2012. This paper draws from many conversations I have had with my co-authors over the years, in particular, Viral Acharya, Douglas Diamond, Stewart Myers, Mitch Petersen, Henri Servaes, Jeremy Stein, Julie Wulf, and Luigi Zingales. I thank Douglas Baird, Effi Benmelech, Steve Kaplan, Lubos Pastor, Amit Seru, Ram Shivakumar,and Rob Vishny for valuable comments on this draft and Maryam Farboodi for very helpful research assistance. I bear responsibility for all errors. This research was funded in part by the Initiative on Global Markets and the Fama Miller Center at the University of Chicago Booth School of Business. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

The Corporation in Finance
Raghuram Rajan
NBER Working Paper No. 17760
January 2012, Revised March 2012
JEL No. G32,L22,L26

ABSTRACT

The nature of the firm and its financing are closely interlinked. To produce significant net present value, an entrepreneur has to transform her enterprise into one that is differentiated from the ordinary. To achieve the control that will allow her to execute this strategy, she needs to have substantial ownership, and thus financing. But it is hard to raise finance against differentiated assets. So an entrepreneur has to commit to undertake a second transformation, standardization, that will make the human capital in the firm, including her own, replaceable, so that outside financiers obtain control rights that will allow them to be repaid. I argue that the availability of a vibrant stock market helps the entrepreneur commit to these two transformations in a way that a debt market would not. This helps explain why the nature of firms and the extent of innovation differ so much in different financing environments.

Raghuram Rajan
Booth School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637
and NBER
raghuram.rajan@ChicagoBooth.edu

One of the cornerstones of modern corporate finance is the Modigliani Miller Theorem, which essentially says that in a world where investors can borrow and lend as easily as corporations, the value of a firm is determined by the present discounted value of its expected cash flows, and not by how these cash flows are allocated to various claimholders. A firm's capital structure is therefore irrelevant to its value, or taken literally, much of what corporate finance spends its time on is second order.

Corporate finance researchers have spent the years since then trying to prove the value of their field by challenging one assumption after another of the near-perfect world that Miller and Modigliani postulated. Miller and Modigliani themselves acknowledged the tax deductability of interest, which would imply that firm value should increase with leverage. Seminal contributions by Jensen and Meckling (1976) and Myers (1977) showed that capital structure choices affected the firm's investment decisions. These were followed by Myers and Majluf (1984), who suggested that information asymmetries between management and investors also influenced the choice of securities that are issued, and hence corporate investment, and by Jensen (1986), who proposed that debt disciplines managerial waste. Corporate finance thus responded well to the challenge posed by Miller and Modigliani, and instead of witnessing its extinction, we have seen a tremendous flourishing of the field.[2]

Today, behavioral theories of capital structure and financing choice (see Baker and Wurgler (2011) for a comprehensive survey) duke it out with asymmetric information and agency explanations to provide a veritable cornucopia of theories of corporate financing choices. Theories have linked capital structure decisions to everything from consumer fears (Titman (1984)) or predation (Bolton and Scharfstein (1990)) to wage negotiations (Perotti and Spier (1993)) or the early life experiences of today's CEO (Schoar and Zuo (2011)). If anything, corporate finance has an excess of models, with many explanations for the well-documented regularities in the data. Fortunately, empirical corporate finance too has joined the fray, with researchers uncovering interesting new patterns in firm financing behavior to

[2] Two excellent surveys of the field are Harris and Raviv (1991) and Shleifer and Vishny (1997), while a thoughtful paper about future research challenges that I draw on is Zingales (2000). Tirole (2006) offers a comprehensive integration and overview of research in corporate finance.

serve as grist for the theoretical mill, even while paying much more attention to issues like causality, which earlier researchers had neglected. Hopefully, in the future we will be better able to tell our students the empirical importance of each of the theories of corporate financing choice that we present to them, without laying them out as an un-weighted stream of consciousness.

In all this, though, one of the most important assumptions of the Modigliani Miller Theorem has gone unchallenged by researchers in corporate finance; the assumption is the existence of the corporation. In the largely perfect world envisioned by Miller and Modigliani, it is not clear what, if anything, determines the existence of the corporation with clear boundaries. As researchers on the theory of the firm such as Ronald Coase, Oliver Hart, and Oliver Williamson have suggested, firms with well-defined boundaries emerge in worlds with transactions costs stemming from difficulties in contracting. But these costs are unimportant in the Modigliani Miller world. So is the Modigliani Miller theorem doubly irrelevant – it postulates the irrelevance of corporate capital structure in a world where corporations are irrelevant?

The substantial point I want to make is that a more general approach to corporate finance would ask if the imperfections that lead to the boundaries of the firm being meaningful also lead to implications for corporate capital structure, and vice versa. No doubt, many of the seminal papers in corporate finance (see Myers (1977), for example) are based on the premise that the asset side and liability side of a firm's balance sheet are jointly determined, and much of the literature since links asset side frictions such as illiquidity (see Diamond (1991) or Shleifer and Vishny (1992), for example) to the nature of financing.

But with a few exceptions (see, for example, Fama and Jensen (1983 a & b), or Zingales (2000)), the firm in finance consists of a set of projects with a pattern of investments, cash flows, and liquidation values, with little explanation as to why the projects or the people running them should be part of the same firm. Similarly, with notable exceptions (for example, Williamson (1988) and Hart and Moore

(1990) read with Hart and Moore (1994)), those working on the theory of the firm have largely ignored the issue of how the firm is financed.

Presidential addresses are occasions when you lament a misspent youth, and point to issues that you wish you (and by implication, the profession) had spent more time on. Since the work of Fama and Miller (1973) and Jensen and Meckling (1976), the firm in corporate finance has invariably been a single person entity. The question of where the boundaries of the firm should lie is largely uninteresting in such a setting, so the primary focus of analysis has been on the agency problem between the manager and investors. But when one considers the firm's activities as potentially involving many collaborators, with their identity changing over time, the question of where the firm's boundaries are drawn to promote efficiency becomes an interesting one. It is equally fruitful to see how the factors that compel a certain structure for the efficient operation of the enterprise also affect its need for, as well as its ability to, obtain finance.

I would like to use my time at the podium to attempt such a synthesis, I will focus on the very early stages of the firm where the links between the nature of the entity being financed and the availability of financing are perhaps most clear. Clearly, my work is informed by a burgeoning empirical literature in the area of entrepreneurship and venture capital, which more than any other area of corporate finance has recognized the links between the corporation and financing (see, for example, Bhide (2000, 2008), Hellmann and Puri (2000, 2002), Kaplan and Stromberg (2002), Kaplan, Sensoy, and Stromberg (2009), and Lerner and Malmendier (2010)).

I will argue that the typical innovative firm undergoes two important transformations over its early life: The first transformation entails *differentiation*, whereby the entrepreneur brings a group of people and the assets they work with together to create an organization, which she leads to produce distinctive goods and services.[3] The differentiated nature of the enterprise's activities is critical to its

[3] This resembles the Fundamental Transformation that Williamson (1985, 2002) refers to, but I emphasize the need for the entrepreneur's collaborators to coordinate with the entrepreneur rather than undertake asset-specific

being able to generate value, but the associated risk makes it hard for the entrepreneur to get collaborators to coordinate in enterprise-building activities. I argue that the initial structure of the firm, with the entrepreneur having significant ownership of assets, and thus control, is intended precisely to enable her to differentiate substantially even while giving collaborators the incentive to follow.

But a differentiated unique enterprise is also hard for outsiders to finance. And for an entrepreneur who is not independently wealthy, finance is critical to purchasing the assets she needs to encourage enterprise building. This is why the firm needs a second transformation, whereby the firm's operations are standardized so as to make the firm's key human capital more replaceable and liquid, even while it continues to produce the differentiated product or service. In this way, outsiders obtain more control over the going concern, and value can be committed to them to repay their earlier financing. Equity is the appropriate instrument to finance such a transformation because equity relies on going concern value. Equity markets play an important role by rewarding the entrepreneur for standardizing the firm, and thus providing powerful incentives for the second transformation.

Because the cycle of up front financing followed by the two transformations is hard to commit to, path-breaking innovation, enterprise creation, and the generation of positive NPV, are all difficult. The availability of finance does alter the nature of firms that are created and explains why corporate finance is so central to innovation, firm growth, and economic development. Of course, mature firms are more capable of financing projects themselves, but the standardization many of them have undertaken to repay past finance typically renders them less capable of innovation. Analyzing the firm and its financing in this way gives us insights into who should own the firm, what the form of financing should be, and what kinds of innovation and enterprises are possible when the financial system is underdeveloped.

My broader message, of course, is that a very rewarding area of research in the years to come will be to open up the black box of the corporation so as to link its inner functioning to its financing needs. It

---

investment. The subtle distinction is that differentiation sets a direction for the entire enterprise, while asset-specific investment ties specific groups of assets together.

is doubly exciting in these times of great technological, economic, and political change. I will devote the last part of the paper to speculation on how innovation and finance might be altered in the years to come.

I. The Creation of Distinctive Capabilities

The structure of a firm encompasses the people who work for it, the way their work is organized and compensated, the assets it owns, the nature of ownership and control of the firm, the firm's relationship with suppliers and buyers, etc. And when we think about its financing, we refer to the variety of claims it has issued, the division between inside and outside financing, and the power outside claimants have over the firm's operational and strategic decisions, as well as over its cash flows. The firm's structure and its financing center around one common problem: how to create net present value – that is, value net of the opportunity costs of the inputs -- and then how to allocate this back to agents in the economy in a way that maximizes value creation.[4]

An entrepreneur cannot create net present value simply by mimicking others unless she happens to be extraordinarily lucky or the market extraordinarily uncompetitive– very few of the myriad laundry shops or small restaurants that open (and close) every day repay anything more than the normal expected returns for the factors that are employed. To create net present value, the entrepreneur has to go out on a limb, distinguishing herself from the rest of the herd of potential competitors, and thus potentially earning sustainable profits (provide the limb is narrow enough, the firm's capabilities distinctive enough, or its innovation continuous enough that others cannot follow). Thus, the process of creating positive net present value invariably implies differentiation – whether in creating new products or product varieties

[4] The firm and its financing structures need not arise only from conscious optimization. They also emerge from political and social compromises, sometimes resulting from historical happenstance (see, for example, Roy (1997)). Hysteresis plays an important role in economic development. Institutions developed for one purpose can be used for another -- the comfort that U.S. investors developed with government war bonds during the First World War may have eased the way for corporations to issue bonds after the war (Peach (1942)). However, while we should not be Panglossian in believing that every structure exists because it is efficient, we should not also dismiss the economic forces that push towards efficient structures.

that nobody else manufactures, in developing production methods that are more efficient than that of the competition, or in targeting customer populations or needs that have hitherto been overlooked.

However, the entrepreneur faces a critical challenge. She needs to persuade others to join her in enterprise-building activities, which is hard if the entrepreneurial venture is a significant departure from the ordinary, and is therefore both risky as well as uncertain (in the Knightian sense of entailing unknown unknowns). Clearly, one option would be to contract to buy inputs and hire services in the spot market. The entrepreneur would then be a contractor who sets up a *nexus of contracts* (see Alchian and Demsetz (1972) and Jensen and Meckling (1976)) with other *independent* contractors – collaborators who have full independence of actions, as well as full ownership of the critical assets they use, bound only by the need to make contracted deliveries at the stipulated time. This is typically the way undifferentiated products are put together. But differentiated products often require producers to acquire special skills that have little outside market value, place facilities in locations where there are few other uses, and put together machinery in new ways that make them not just hard to sell but also hard to replace. Independent contractors may worry about the likely decline in the outside value of their human capital and their assets if they tie their fates to the venture, even as they also doubt the chances of the proposed venture. When contracts are incomplete, the entrepreneur will find it hard to ensure through contract alone that independent contractors coordinate and specialize to the desired extent.

An example may be useful to fix ideas. It is well known that car manufacturer Henry Ford perfected progressive assembly or more colloquially, the moving assembly line, whereby men stayed put and the parts and work flowed wherever they were needed. But Ford also implemented a second innovation that was key to the success of the first (see, for example, Raff (1995)), the "American-system" production of parts – that is the production of parts finished to such high tolerances that they were for all practical purposes interchangeable. With it, the assembly line no longer needed artisans who could rework poorly finished parts, it could manage with moderately skilled workers. Moreover, the assembly line was not subject to delays as parts were re-jigged to fit each car. So the high tolerance of parts was essential to

the low cost and high efficiency of the assembly line. But since no other car manufacturer required such high tolerances, and since Ford in his early years was known for his failures rather than his successes, it would have been hard for him to persuade suppliers to produce the tolerances he needed.[5]

Indeed, it is far more attractive for the skeptical independent contractor to stay closer to the mainstream and provide a more conventional intermediate product that will have a market if the entrepreneur fails; the contractor's downside is protected by the deep market for the conventional intermediate product; he can obtain scale economies by producing for that larger market; he can also get more of the surplus generated by the entrepreneur if she is successful, because he retains a credible outside option. Matters are even worse in the "Prisoner's Dilemma" situation where no independent contractor wants to specialize to the business of the entrepreneur if they believe other key contractors will not specialize.

Moreover, even when the independent contractor is convinced that the entrepreneur's venture will work, he can manoeuver to grab a greater share of the prospective surplus instead of working to enhance it.[6] More generally, if the venture shows initial signs of success, the presence of multiple irreplaceable independent contractors who will each up their demands as the entrepreneur tries to get them to continue, will greatly diminish the rewards to entrepreneurship, and potentially reduce the life of the enterprise.[7]

In sum, similar to the process emphasized in Williamson (1985,2002), the entrepreneur needs a first transformation whereby some out of a large number of initially interchangeable people and assets collaborate, coordinate, and build inter-relationships to create a well-honed organizational structure that has a small number of mutually specialized and largely irreplaceable people and assets with a common

[5] There is some debate on what Ford's key innovations were, and whether in fact they were original to him. See Baird (2009) for an alternative view.

[6] For example, he can strengthen his bargaining position (as well as monetize future rents) by issuing significant amounts of short term debt that he would be unable to repay unless he gets a greater share of the surplus. He can also strive to expropriate the entrepreneur's critical resources and set up as competition, with a head start because of the resources he controls (see Rajan and Zingales (2001)).

[7] Bolton and Scharfstein (1996) make a similar point in the context of multiple debt holders. See Baird and Casey (2011) for a discussion of the costs and benefits of allocating property rights in complementary assets to different creditors.

purpose. However, because of risk as well as uncertainty, it is hard to shape the transformation through ex ante contracts – not only are the necessary enterprise-building actions difficult to specify contractually in a complete state-contingent way, myriad enterprise-destroying actions are hard to rule out without more control over the actions of collaborators.[8] So how does the entrepreneur gain enough control to shape the transformation?

The key is for the entrepreneur to have employees, who typically have fewer degrees of freedom than independent contractors. Employees, unlike independent contractors, usually do not own the assets they work with -- instead, someone else owns the irreplaceable assets that are key to the enterprise. For now, it will be convenient to assume the entrepreneur owns all assets, but what is essential is that control over their use be largely delegated to the entrepreneur. The ability to allow (or deny) access to the assets, both initially and over time, is central to the entrepreneur's ability to encourage coordination. I now show this in a simple model before explaining why this implies a role for financing.

1.1. Differentiation, Enterprise-Building, and Ownership

Consider a two date economy with risk neutral participants. Let date 0 be today and date 1 represent the future, after uncertainty is revealed. Consider an entrepreneur who has an idea and related assets (experience, patents, a committed core team, critical pieces of land or natural resources, etc.). For now, I assume that the idea and the related assets (henceforth, collectively termed the entrepreneur's idea to distinguish it from the critical asset I will describe shortly) cannot be appropriated by others when they are given access to it. I will discuss "ideas" and "assets" in more detail after laying out the basic model.

Let δ be the degree of differentiation chosen by the entrepreneur coming in to date 0, where $\delta \geq 0$ and $\delta = 0$ means the entrepreneur chooses to be with the mainstream, which is normalized to 0. The entrepreneur's project will be successful with probability $p(\delta)$. After choosing the degree of

[8] The terms "ex ante" and "ex post" in the literature are with respect to the timing of the specific investment or transforming action.

differentiation, the entrepreneur picks a collaborator from the available set of independent contractors. In doing so, the entrepreneur essentially decides to share access to her idea with the collaborator, giving him the ability to coordinate.[9] The remaining independent contractors who are not given access have no ability to coordinate.

I assume the existence of a critical asset – a machine, a patent, or a piece of property – without which the project is not feasible. Nothing hinges on who owns the asset up front, though the rationale for financing, which I discuss later, will stem from the entrepreneur's need to buy or create it.

Having chosen the collaborator, the entrepreneur and the collaborator settle who will own the asset going forward, and any negotiated side payments are made. The collaborator then chooses the degree of coordination η, the key enterprise-building activity the entrepreneur seeks to foster. I assume that η is not contractible and intricate incentive contracts to force the optimal η are not possible.[10] Coordination may involve building specific human capital (learning specific software and technology, understanding the firm's culture, building friendship and trust, developing complementary skills, creating a bank of favors) or specializing assets (locating plants in the most appropriate places, linking and calibrating machines to one another, specializing equipment to the main product).

If the project is successful, it produces an NPV of $V(\delta,\eta)$ if the entrepreneur and the collaborator work together with the asset – I assume the entrepreneur cannot work with anyone else at that point. If it fails, the NPV produced by the project is zero. The collaborator can go back to being an independent contractor if he has use of the asset, producing an NPV of $v(\eta)$ without the entrepreneur. I assume (subscripts will denote derivatives):

[9] See Rajan and Zingales (1998, 2001) for an elaboration of how selective access can allow the entrepreneur to shape firm-specific investment. Access gives those who enjoy it the ability to acquire power conditional on making the required investment.

[10] See Baker, Gibbons and Murphy (2008) for similar assumptions. For a contrary viewpoint, see Maskin and Tirole (1999).

Assumption 1

(i) The greater the differentiation, the lower the probability of project success so $p_\delta < 0$.

(ii) The expected value of the project first increases then decreases in differentiation so that

$\frac{d}{d\delta}\left(p(\delta)V(\delta,\eta)\right) > 0$ at $\delta = 0$, $\frac{d}{d\delta}\left(p(\delta)V(\delta,\eta)\right) < 0$ at $\delta = \infty$, and

$\frac{d^2}{d\delta^2}\left(p(\delta)V(\delta,\eta)\right) < 0$. The value of the successful project is increasing and concave in differentiation so $V_\delta > 0, \quad V_{\delta\delta} < 0$.

(iii) The NPV of the successful project is maximized when $\eta = \delta$.

$V_\eta > 0 \quad if \quad \eta < \delta,$
$V_\eta < 0 \quad if \quad \eta > \delta,$
$V_{\eta\eta} < 0$

(iv) The expected value of the collaborator's outside option of working again as an independent contractor, $v(\eta)$, decreases with η at an increasing rate so that $v_\eta < 0, \quad v_{\eta\eta} < 0$.

(v) $V_{\eta\delta}$ and $p_{\delta\delta}$ are small.

The assumptions are straight forward. More differentiation takes the entrepreneur into more unknown territory and thus reduces the probability of project success, but it can enhance expected NPV over a range. The collaborator coordinates best when he sets $\eta = \delta$, however, the higher he sets η, the further he reduces his outside option of rejoining the mainstream if the project fails. The assumption that the entrepreneur cannot produce with anyone else once she chooses a collaborator, and that the collaborator's outside option falls in value as he coordinates, reflect the first transformation. Finally, plausible arguments can be made for $V_{\eta\delta}$ or $p_{\delta\delta}$ having either sign, so I assume they are small.

Given that contracts are incomplete, I have to propose some way surplus is allocated ex post. Throughout this paper, I will assume surplus is split according to Nash Bargaining with outside options;

Each person gets their outside option plus half the surplus over and above the sum of values of outside options. None of this is to say that there is actual bargaining when surplus has to be divided. Instead, recognizing each player's bargaining power, the system should gravitate towards dividing surplus automatically according to the prospective equilibrium.

1.2. First Best

The first best is to set δ and η to maximize the joint surplus $pV(\delta,\eta)+(1-p)v(\eta)$.[11] The first order conditions are

$$p_\delta V + pV_\delta - p_\delta v = 0 \qquad (1)$$

$$pV_\eta + (1-p)v_\eta = 0 \qquad (2)$$

(1) suggests that the first best degree of differentiation δ^{FB} will be set higher than δ^0, the level that ensures expected project NPV is maximized. Because the asset can be redeployed if the project fails, the optimal strategy is to increase differentiation even further, till the marginal reduction in the expected value of the project equals the marginal gain in the expected value of the redeployment option. In a sense, the surplus from redeployment is a form of insurance if the project fails, and its availability enhances the optimal amount of differentiation (effectively risk taking). The first best degree of coordination, η^{FB}, as (2) indicates, sets the marginal expected increase in project value equal to the marginal expected loss in the redeployment option. Thus $\eta^{FB} < \delta^{FB}$, implying that even in the first best, the collaborator should not coordinate fully with the entrepreneur.[12]

[11] Rather than assume $V(\delta,0) > v(0)$, which would ensure $V(\delta,\eta) > v(\eta)\ \forall\ \eta$, it is sufficient that the latter inequality holds for the values of η we are interested in.

[12] V is increasing and concave in η for $\eta < \delta$, and $V_\eta = 0$ when $\eta = \delta$, hence (2) implies $\eta^{FB} < \delta^{FB}$

1.3. Coordination and Differentiation if the Collaborator Owns the Critical Assets

Now consider what happens when the collaborator owns the key asset and therefore works as an independent contractor for the entrepreneur. As in the Property Rights view, the owner of the asset decides how an asset will be used. If the project succeeds, the collaborator will get his redeployment option plus half the surplus , which equals $v + \frac{V - v}{2} = \frac{V + v}{2}$. The entrepreneur gets $\frac{V - v}{2}$. If the project fails, the collaborator will simply redeploy the asset and get v. So he maximizes $p\left(\frac{V + v}{2}\right) + (1 - p)v$ w.r.t. η. The first order condition is $pV_\eta + (2 - p)v_\eta = 0$. Comparing with (2), and because $v_\eta < 0$, it follows that the level of coordination if the collaborator owns the asset, η^{CO}, is less than first best, η^{FB}. Intuitively, the collaborator benefits from owning the asset and having the option to redeploy it outside the relationship with the entrepreneur, both because it increases his bargaining power over the surplus if the project succeeds, and because it cushions him if the project fails. As a result, he is reluctant to jeopardize the value of his redeployment option, and undersupplies coordination relative to the first best.

Totally differentiating the first order condition, and using Assumption 1 that $V_{\eta\delta}$ is small, I get

$$\frac{d\eta}{d\delta} = -\frac{\frac{\partial}{\partial\delta}\left[pV_\eta + (2 - p)v_\eta\right]}{\frac{\partial}{\partial\eta}\left[pV_\eta + (2 - p)v_\eta\right]} = -\frac{p_\delta\left(V_\eta - v_\eta\right) + pV_{\eta\delta}}{pV_{\eta\eta} + (2 - p)v_{\eta\eta}} < 0 \qquad (3)$$

Intuitively, the higher the entrepreneur sets the degree of differentiation, the lower the probability of project success, and lower the value to the collaborator of coordinating instead of maintaining the value of his redeployment option.

Now consider the entrepreneur's problem. She sets the degree of differentiation to maximize $\frac{p}{2}(V-v)$. Recognizing that her choice will affect the collaborator's choice of coordination, her first order condition is $\frac{d}{d\delta}\left[p(V-v)\right]+\frac{d}{d\eta}\left[p(V-v)\right].\frac{d\eta}{d\delta}=0$, which gives us on simplifying and substituting from the collaborator's first order condition

$$p_\delta V + pV_\delta - p_\delta v = 2v_\eta \frac{d\eta}{d\delta} \qquad (4)$$

From (3), we can see the right hand side of (4) is positive. Comparing with (1), it is immediate that under collaborator ownership, the entrepreneur chooses a level of differentiation, δ^{CO}, that is less than the first best. Intuitively, the entrepreneur does not see the "insurance" from redeployment if the project fails, which accrues entirely to the collaborator when the collaborator owns the asset. Moreover, the collaborator will reduce his level of coordination as the entrepreneur differentiates more. For both these reasons, the entrepreneur will differentiate less than the first best. We have

Proposition 1: *Under collaborator ownership, the entrepreneur sets the degree of differentiation less than the first best, and the collaborator coordinates less than the first best.*

By settling on a potential collaborator and giving them access, the entrepreneur exposes herself to the collaborator's future non-contractible actions. Knowing that he has a right to the joint surplus, the collaborator focuses to a greater extent than he should on extracting a share of that surplus, rather than enhancing it. Asset ownership expands his outside options, and the incentive to nurture these diverts him from enterprise building activities.

1.4. Coordination and Differentiation if the Entrepreneur Owns the Critical Assets

If the entrepreneur owns the asset, she and the collaborator will share the surplus equally if the project is successful, because the collaborator does not have a credible threat to exercise his redeployment option. If the project fails, both the entrepreneur (who owns) and the collaborator (who is needed to operate the asset when it is redeployed) are essential to redeployment. As a result, they share the surplus from redeployment equally – the entrepreneur now obtains a stake in redeployment, which realigns her incentives also. Thus, both the entrepreneur and the collaborator maximize $\frac{p}{2}V + \frac{(1-p)}{2}v$, which is half the overall expected surplus. The collaborator's first order condition in setting coordination is just the first best condition (2). The entrepreneur sets differentiation so that $\frac{d}{d\delta}\left[\frac{p}{2}V + \frac{(1-p)}{2}v\right] + \frac{d}{d\eta}\left[\frac{p}{2}V + \frac{(1-p)}{2}v\right].\frac{d\eta}{d\delta} = 0$. The second term is zero because its first part is simply the collaborator's first order condition. So the entrepreneur's first order condition also reduces to the first best condition (1). We have

Proposition 2: *Under entrepreneur ownership, the entrepreneur sets the level of differentiation at the first best level and the collaborator also sets the level of coordination at the first best level.*

Example: Let $p(\delta) = 0.8e^{-0.8\delta}$, $v(\eta) = 5 - 1.5e^{0.05\eta}$,

$V(\delta,\eta) = 1 - e^{-(\delta - 0.8\eta)} + 4\left[1 - e^{-(1-0.8)\eta}\right] + 1 - 1.5e^{-\delta} + 2$. We then have

$\delta^{FB} = 1.72, \eta^{FB} = 1.06, V^{FB} = 4.17 > v^{FB} = 3.42$
and $\delta^{CO} = 1.43, \eta^{CO} = 0.27, \quad V^{CO} = 3.67 > v^{CO} = 3.47$

Both differentiation and coordination are lower under collaborator ownership. It is easily checked that taking probabilities into account, entrepreneur ownership is better than collaborator ownership.

1.5. Discussion

An entrepreneur who sets up a laundry shop or a run-of-the-mill restaurant generates very little surplus over the cost of factors employed. The high rate of failure of such enterprises is not because the entrepreneur ventures into the unknown but because their profit margins are so thin. There is little need for enforcing coordination in such enterprises because their activities are not distinctive and the enterprise could well be described as nexus of contracts.

The entrepreneur I focus on is instead the heroic leader found in Schumpeter (1911) and Knight (1921), who "incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one."[13] She must be willing to strike out, largely on the basis of intuition, on courses of action in direct opposition to the established settled patterns, she must have "the drive and the will to found a private kingdom", the desire to create new things even at the expense of destroying old patterns of thought and action.[14] Such an entrepreneur should own the critical asset so as to enhance differentiation, coordination, and project value. Implicit in this is the assessment that the entrepreneur will choose the right direction, and is committed to it – that she will lead well.[15] This is precisely the assessment that collaborators and the financier make ex ante.

Entrepreneur ownership does not just curtail the collaborator's outside options (see also Rajan and Zingales (1998), Holmstrom (1999), or Van den Steen (2010)), it also gives the entrepreneur more of a stake in her collaborators' redeployment possibilities (rather than in the project alone). While the model is specialized and the result that the first best is achieved under entrepreneur ownership is sensitive to bargaining assumptions, the broader point is that when the entrepreneur does not own, she may have too little concern for the outside options of her collaborators while single-mindedly focused on the project. At the same time, independent collaborators may be focused too much on their outside options. Ownership

[13] Joseph Schumpeter, *Capitalism, Socialism, and Democracy*, page 83, 1942, Harper Brothers
[14] John Elliott in the introduction to *The Theory of Economic Development* by Joseph Schumpeter, 1934, Harvard University Press, Cambridge MA
[15] For a model where the CEO may not be trusted, see Landier, Sraer, and Thesmar (2009).

by the entrepreneur shifts everyone's incentives in the right way, allowing her to focus on creating the next Google rather than limiting her aspirations to a laundry shop.

1.6. The Nature of Assets and Ideas

Let me now discuss the implicit assumptions I have made about the nature of assets that the collaborator works with. First, the asset is capable of being owned, and if the asset is not already possessed or owned by the entrepreneur, ownership can be transferred. So it is not a human capital asset possessed by the collaborator such as management capabilities or industry experience. Second, the asset is critical in that without it, neither the project nor the redeployment option generate value. Third, the asset is hard to replicate.

The collaborator's asset may be hard for him to replicate simply because he is specialized to it – for example, a favored tool or instrument. More generally, though, an asset may be hard to replicate because it occupies a strategic location (a port in recent times, or a fort in ancient times). It may enjoy property right protection, as with a brand name or a trade mark, or equivalently, regulatory protection as with a license or barriers on further entry. Some assets may enjoy multiple characteristics – a cluster of patents situated strategically may make it hard for competitors to innovate around them. An asset may be hard to replicate because doing so takes time, and by the time the competition has succeeded, the frontier could have moved. Assets may also have the characteristics of a natural monopoly with large up-front fixed costs, so that competitors will hesitate replicating the asset for fear of the ruinous competition that would subsequently ensue.

Turning next to the entrepreneur's "idea", it could consist similarly of hard-to-replicate assets. But because the entrepreneur is committed to the project and has no need to sell her idea, it could also consist of personal assets like experience, a devoted team, industry relationships, management capabilities, trade secrets, and plain charisma.

1.7. Ownership, Ex Ante Access, and Appropriability.

If financing is limited and there are many critical collaborator assets, what assets should the entrepreneur own? The model suggests that, ceteris paribus, a collaborator's incentives to coordinate are most reduced by ownership when v_η (which is negative) is large in magnitude. The entrepreneur's incentive to differentiate is also reduced by more when v_η is large in magnitude. Thus assets whose use value outside the relationship fall most with coordination ought to be owned by the entrepreneur.[16] Clearly, ownership of assets that are neither hard to replace nor critical to the firm's activities will not help the entrepreneur control her collaborators' outside options. Such assets should not be owned by the entrepreneur.

In the model, I have ignored the possibility that asset ownership offers the entrepreneur additional tools to limit the collaborator's freedom ex ante and foster coordination. In practice, when the assets are on the entrepreneur's premises, she also has a greater ability to direct the efforts of her collaborator, which is an additional advantage of ownership. Essentially, the collaborator would be subject to an employment agreement that specifies the employee will obey reasonable commands, in return for reasonable pay and working conditions – in a sense, the entrepreneur obtains the residual control rights associated with having an employee.[17] By requiring regular attendance at the workplace, the entrepreneur could effectively rule out frequent contact between the collaborator and the competition, which would be essential for the collaborator to preserve his outside options. The entrepreneur can also prohibit certain activities by the chosen collaborator, such as practicing old skills, or taking on debt (that could serve as a mechanism to extract rents from the entrepreneur). Conversely, an independent contractor would only be

[16] A full treatment of optimal ownership when there are multiple collaborators and assets would, of course, require a constrained maximization problem.

[17] By the "residual rights of ownership", Grossman and Hart (1986) refer to rights conferred by ownership that cannot be, or are not habitually determined by, explicit contracts. In a similar vein, Masten (1988, p187) argues, "In addition to obedience, an employer has the right to expect loyalty, respect, and faithfulness from his employees and that each will "conduct himself with such decency and propriety of deportment as not to work injury to the business of his employer." There is a legal basis for the employment relationship that makes it different from a contractual relationship with an independent contractor, and the employment relationship offers both sides some rights that could be termed "residual" in the Grossman and Hart (1986) terminology.

responsible for the final output, could keep the entrepreneur off his premises, and have greater freedom to maintain outside options or choose financial structure.

All this presumes that the entrepreneur's idea (and related assets) cannot be appropriated by the collaborator ex post. If the collaborator could expropriate the entrepreneur after getting access to her idea, the entrepreneur has the problem of retaining a share of the surplus in addition to incentivizing coordination. This would suggest an additional reason for entrepreneur ownership than in the model we have studied so far: By owning the irreplaceable collaborator assets, the entrepreneur prevents the collaborator from expropriating her ex post. For instance, by owning iTunes music purchase and management software, a key complementary asset to the iPod player, Apple ensures that competitors cannot match it simply by replicating the hardware. Ownership by the entrepreneur of key irreplaceable assets is thus not just a way to foster coordination but also to protect the entrepreneur's idea ex post (see Teece (1986), Pisano and Teece (2007)) and ensure continuity of the enterprise.

1.8. Discussion: Enterprise Building, Ownership and the Firm's Boundaries

There is, obviously, a long history of viewing the firm as a governance structure that exercises fiat to control misbehavior instead of eliciting cooperation through contract.[18] My view of the entrepreneurial firm is one where the entrepreneur limits employee freedoms through the power she gets from ownership in order to lead a cohesive enterprise. There is a parallel to theories of government here: Much as the government has a monopoly over violence so as to ensure civil order, the entrepreneur has a monopoly over ownership so as to coordinate organizational movement in the chosen direction.

Theories of firm boundaries start, of course, with Coase (1937), who argues that a firm's boundaries are located where the costs of doing transactions within a firm exceed the costs of doing them in the market (see Gibbons (2005) or Holmstrom and Roberts (1998) for excellent surveys). Transaction costs

[18] Coase (1937) cites D.H. Robertson in *Control of Industry* (p85) describing firms as "islands of conscious power in this ocean of unconscious co-operation like lumps of butter coagulating in a pail of buttermilk". Williamson (1985,2002) focuses on the firm as a governance system, while Grossman and Hart (1986) see owners as having the right to exercise the "residual" control rights associated with ownership.

economics, which owes much to the work of Williamson (1975, 1985, 2002), takes this insight much further. Williamson (2002, p 174) argues that "if human actors are not only confronted with needs to adapt to the unforeseen (by reason of bounded rationality), but are also given to strategic behavior (by reason of opportunism), then costly contractual breakdowns (refusal of cooperation, maladaptation, demands for renegotiation) may be posed. In that event…efforts to devise supportive governance structures, thereby to mitigate contractual impasse and breakdowns, have merit." Thus Williamson, as also Klein et al. (1978), emphasize ex post haggling costs over the quasi-rents created when parties are tied through specific investments. Ownership allows the owner to settle disputes by fiat, reducing haggling costs.

My basic model does not have ex post "haggling" costs, but I can incorporate them as outlined earlier. If the entrepreneur's idea can be expropriated in the future by the collaborator, ownership of other critical complementary assets by the entrepreneur can prevent the collaborator from running away with the idea on his own (thus obviating the need for costly security measures such as restricting collaborator access– the equivalent of "haggling costs" in my model). Moreover, because the collaborator anticipates he will not be successful in expropriating the entrepreneur when the entrepreneur owns, he has incentives to undertake enterprise-building activities that complement the entrepreneur's skills (instead of undertaking activities that attempt to substitute for them). The key difference in my model is, however, the focus on ex ante incentives for coordination rather than ex-post opportunism.

My work is closer in many ways to the Property Rights View of Grossman and Hart (1986) and Hart and Moore (1990), henceforth GHM. Ownership for GHM consists of a bundle of revenue and control rights, including rights that are hard to contract that they term the "residual rights of control". Ownership attaches the assets to the owner, and can be useful in enhancing the owner's incentive to invest. Specifically, when the required ex ante investment by the owner is in her human capital and is asset specific (e.g., learning to use a particular machine), it is plausible to think that an increase in investment increases the value of both the owner's contribution to the enterprise and her value with the asset in

alternative ventures. The owner's threat to use her asset in alternative ventures when bargaining over ex post surplus then enhances her share of the surplus. Because her threat point is directly increased by her ex ante investment, ownership enhances her ex ante incentive to invest. As Holmstrom (1999) argues, ownership is a way of bringing in market incentives embedded in the increase in asset values resulting from investment to reinforce any pre-existing investment incentives.

Unlike Transactions Costs Economics, the Property Rights view assumes ex post efficiency. Thus the owner never actually exercises her right to use the asset differently; it is just a bargaining ploy. My paper relies heavily on the special nature of ownership suggested by the Property Rights view – that ownership bundles a variety of rights, many of which are hard to contract. However, I depart from it when considering the channel through which ownership "works". In GHM, ownership goes to the agent whose ex ante incentives to invest are most enhanced by the surplus he can extract by threatening to use the greater outside options available with ownership. In contrast, ownership in my model works by closing down the outside options of all except the entrepreneur, who is the only one trusted to lead. By owning the key assets, the entrepreneur in my model actually takes the enterprise in the direction she chooses, while having greater assurance that the collaborator will follow. It is precisely by eliminating the market options of the collaborator that ownership "works" in my framework.

Put differently, I argue that the more important, and also necessarily more specific, activity in new ventures is not asset-specific investment but enterprise-specific activities like learning to coordinate with other people and other machines, which make the agent an integral part of a team.[19] This coordination tends to be irreversible in part, which is why it reduces the value of the owner's outside options. The freedom provided by ownership detracts from, rather than enhances, enterprise building activities (see Rajan and Zingales (1998) for an early exposition of the detrimental effects of ownership). This is why common ownership by one who can be entrusted to set the enterprise's direction and stay the

[19] The importance of coordination in an enterprise is also explored elsewhere, with recent examples including Baird (2010), Baker, Gibbons, and Murphy (2008), Dessin and Santos (2006) and Hart and Holmstrom (2010).

course is typically more efficient (unlike in Grossman and Hart, the entrepreneur in my model does not have a credible threat to use the asset in alternative ways – she is wedded to the project unless it fails), and significant ownership by those who could prefer to exercise outside options is not. Indeed, because ownership is not primarily about the owner's investment incentives but about her control over firm direction, ownership by unrelated third parties who delegate control to the entrepreneur can improve upon ownership by the collaborator. This is unlike in Hart and Moore (1990) where ownership by unrelated third parties is a waste of the incentives embedded in ownership.[20]

1.9. Enterprise Direction, Indivisibility and Continuity

The firm is a separate legal personality defined and protected by law. Therefore, if there are (un-modeled) benefits to legal boundaries, the Property Rights view would suggest firms could well be associations of different independent contractors, each owning the assets they work with. In other words, the legal boundary of the firm would be drawn around assets with different ownership, with ownership allocated to maximize investment incentives, and the boundary drawn to minimize other transaction costs. Assets would be owned together only to the extent that they are worthless in enhancing investment incentives when owned separately (see Hart and Moore (1990)). But as Holmstrom (1999) argues, nothing else in the Property Rights theory requires the legal boundary of the firm to be drawn around commonly owned assets (other than tautologically).

Yet the legal concept of a firm emphasizes keeping assets together under common ownership for a long duration, and most firms (as distinct from loosely coupled co-operatives) have this structure. A separate *indivisible legal personality* for the corporation ensures it has a life of its own, and does not have to be broken up (and reconstituted) if any of its owners or employees die or leave. Divisions within the firm cannot depart at will and have no separate legal identity or standing. Furthermore, entity shielding

[20] The point that the incentives provided by ownership can detract from enterprise-building parallels the multi-tasking literature (see Holmstrom and Milgrom (1991, 1994)). However, instead of primarily giving the collaborator higher powered incentives to undertake some actions that cause him to neglect other poorly-measured ones, ownership in my model enables him to go in directions the firm wants to discourage.

(see Hansmann, Kraakman, and Squire (2006)) ensures that the personal creditors of owners or employees, or minority owners, cannot lay claim to the corporation's assets – the assets are held together in the firm, and will be sold only if the firm's owners collectively vote to do so, or if the firm defaults on its debts and its creditors seize assets. A number of legal scholars (for example, Blair (2003), Guinane, Harris, Lamoreaux, and Rosenthal (2007), or Hansmann, Kraakman, and Squire (2006)) see the separate indivisible legal personality of the firm and the "entity shielding" permitted by law as key features of the modern corporation.

My model offers support for these views. Common ownership implies common authority and control – the entrepreneur can set direction and the employees have an incentive to coordinate.[21] The enterprise survives regardless of the entrepreneur's own continued association with the firm or that of any of her collaborators (in contrast to, say, a partnership which could be dissolved when any partner wants to quit). The indefinite life of the enterprise promotes ex ante enterprise-building actions (who would give up outside options if they knew the enterprise would be dependent on the financial and physical health of each of the contracting parties) while dis-incentivizing costly ex ante jockeying for position and other fissiparous tendencies that would emerge if players saw a chance of the enterprise's demise. Entity shielding ensures that none of the collaborators can jeopardize the enterprise through injudicious personal borrowing so, once again, other collaborators can focus on enterprise-building rather than preserving outside options.

Finally, as the entrepreneur fosters enterprise-building activities, the effectiveness of the enterprise as well as her authority grows – it is no longer just the assets she owns that give her power but also the new direction she gives through differentiation, the employees tethered to that direction because of their coordination, and the employees tethered to those employees... The firm, as Rajan and Zingales

[21] Holmstrom (1999) argues that common ownership allows the firm to better tailor incentives. I would modify this slightly to say that common ownership itself is the primary source of the improved incentive.

(2001) argue, has a time dimension, a history that makes it more effective than strangers coming together via contract.

1.10. Debt Finance and Financing Frenzies

In order for the entrepreneur to buy the asset from the collaborator (or from outsiders) she will need financing if she is not independently wealthy. Even if the capital requirements needed for innovation are not high (products like new search engines or social networking sites do not need much capital at the innovation stage), finance is necessary for the entrepreneur to create the organization that will roll out the innovation. I now turn to how the enterprise should be financed and the additional issues that financing raises.

Before exploring the difficulties in financing in the next section, let us start by assuming financing is easily available. Consider first (again a stripped down version of) risky debt finance, and its effect on incentives. Assume debt is promised a fixed amount *D* sufficient for the lender to break even, and the creditors' bargaining power conditional on project success is high enough that the payment can be enforced (I will revisit this assumption shortly). Creditors acquire ownership of the assets if the project fails (that is, the required face value of payment on debt D is higher than the value of the redeployment option v). In this case, creditors will take over the assets and split the redeployment surplus with the collaborator. The entrepreneur therefore maximizes $\frac{p}{2}(V-D)$ while the collaborator maximizes $\frac{p}{2}(V-D)+\frac{(1-p)}{2}v$. Note that the collaborator's first order condition is still (2), so if he sees the entrepreneur set the degree of differentiation at the first best level, the collaborator will set the level of coordination at the first best level also.

The entrepreneur's first order condition is easily shown to be $p_\delta V + pV_\delta - p_\delta D + pV_\eta \frac{d\eta}{d\delta} = 0$

where $\frac{d\eta}{d\delta}$ can be shown to be negative as before. The higher the face value of debt, the greater the incentive of the entrepreneur to differentiate the project – this is akin to standard risk shifting incentives in finance where the entrepreneur gets the upside if the project succeeds while debt bears the downside if it fails. However, the entrepreneur's incentive to differentiate is also muted because the collaborator reduces coordination as the entrepreneur increases differentiation. By inspection and comparison to (1), there is a face value of debt D^{FB} $(= v + \frac{p}{p_\delta} V_\eta \frac{d\eta}{d\delta}$, with all values calculated at $\eta = \eta^{FB}$ and $\delta = \delta^{FB})$ such that the first best is achieved if $D = D^{FB}$. However, there is no reason to believe that the face value that would allow a creditor to break even would be precisely at this level, and in general, financing will introduce distortions in differentiation (and hence coordination).

Distortions notwithstanding, the above discussion points to an important effect of external debt finance. Because the creditor takes the critical asset away from the entrepreneur in case the project fails and shares the surplus from its redeployment with the collaborator, he limits the extent to which the collaborator coordinates (and hence the extent to which the entrepreneur differentiates). Now consider a financial frenzy where a disproportionate number of overoptimistic entrepreneurs, who think the probability of success is high and who do not recognize failure even if it stares them in the face, are financed (alternatively, entrepreneurs want to hide failure so as to avoid stigma). In the midst of the frenzy, financiers also think the probability of success is high – they forecast *p* close to 1 and unaffected by δ. So they accept "pay-in-kind" bonds and "lite" covenants up front, implying they cannot effect a change in control or redeployment when they see the project fail.

Given that the financier cannot force the continuation-minded entrepreneur to ever redeploy assets, a rational collaborator has the incentive to set $\eta = \delta$. Knowing that the collaborator will not hold

back on setting η, the entrepreneur has an incentive to differentiate more. This means that even though the high δ makes the true probability of success small, if it succeeds the project could be a spectacular innovation, both because it is so differentiated, and because collaborators coordinate so well.

In other words, financial frenzies typically lead to spectacular crashes, in part because the extent of project differentiation, and hence riskiness, is endogenously high. The lack of financial controls and the low likelihood of redeployment incentivizes collaborators to coordinate in a single minded way, and removes any constraints on the differentiation entrepreneurs choose. However, the few projects that are successful could be extraordinarily valuable precisely because they are so innovative as well as coordinated. Crashes and disruptive product innovation may have common roots – in optimism and excessively lax finance (see Perez (2002) for a discussion of the links between technological revolutions and financial crashes).[22]

In drawing out the above point, I have assumed that creditors are willing to finance the enterprise – I assumed away the financing problem. But given the enterprise has been differentiated, this will not be the norm. The very uniqueness of the enterprise and its assets could make it hard for the financier to obtain repayment. I now turn to examining this is more detail.

II. Financing the Innovative Enterprise

The difficulty in starting an innovative differentiated organization has as much to do with the availability of financing as it has to do with willing collaborators. The entrepreneur needs financing to assemble the critical assets the enterprise needs, with the problem being particularly acute if the scale at which she needs to start is large. But the financier needs to be assured of an adequate return.

[22] Pastor and Veronesi (2006) suggest an alternative rational explanation for the link between projects with high uncertainty about growth (the differentiated project in my model) and high ex ante stock prices. Essentially, the Gordon valuation model suggests that firm value is convex in growth, so expected firm value increases in uncertainty about growth. Of course, if the low growth scenario is realized, the stock price crashes.

2.1. Liquidation Values

Even if the differentiated enterprise succeeds, the entrepreneur and the employees will appropriate much of the going concern value because their irreplaceable human capital gives them bargaining power. The debt contract described earlier, whereby the creditor can lay claim to the firm's assets in case it does not make contracted payments, gives the creditor the ability to force repayment if the redeployment value of the assets or the break-up value is high. But this will typically not be the case in the differentiated firm; Critical irreplaceable assets will either be intrinsically special or will have been specialized during the first transformation (for example, by moving them to a remote area or by altering them to better coordinate with other firm assets), which reduces alternative uses. This is why I have assumed that the more the collaborator coordinates, the lower the value of the redeployment option. Moreover, the financier has to share some of the redeployment surplus with the collaborator, diminishing his own recovery in redeployment.

In some industries (which use general purpose machinery, buildings, or untransformed real estate), certain assets may retain substantial break-up value despite the first transformation. But such assets are unlikely to be the source of the entrepreneur's power because they are unlikely to be irreplaceable. Irreplaceable assets such as patents and brands may not find as good a use or user on sale, and may therefore fetch only fire sale prices. Also, certain past investments, such as those in employee training or in building organizational capital, will intrinsically have little realizable break-up value.

When liquidation values (the higher of redeployment or break-up values) are low, the entrepreneur has two options, neither particularly attractive, for obtaining outside debt finance. First, she could "harden" debt claims by making them shorter term and dispersing them amongst many claimholders (see Berglof and Von Thadden (1994), Bolton and Scharfstein (1996), Calomiris and Kahn (1991), Diamond and Rajan (2001)). The threat of a destructive run coupled with the difficulty of renegotiating with dispersed claimants would give her the incentive to repay whenever she can. She

would not default "strategically" for fear of getting tied up in costly bargaining, or losing the irreplaceable assets because of inefficiencies in bargaining, and becoming unable to produce any output. The anticipation of ex post inefficient debt renegotiation can thus allow her to credibly promise more than the (low) liquidation value of assets. To the extent, however, that she genuinely does not have the ability to pay, such a financing structure is unforgiving, and would lead to excessive liquidation. Moreover, to the extent that there is substantial noise about the true prospects of a firm that is trying innovative strategies, misinformed destructive runs on the firm could occur with high probability.

A second option is for the entrepreneur to differentiate less. By choosing this route, the entrepreneur reduces the risk for the financier – not only will the project succeed with higher probability, but the financier's ability to extract more of the admittedly lower surplus if the project succeeds will be higher, as will be his ability to recover value from liquidating assets if the project fails. The difficulty with this option is, first, that the expected surplus is much diminished and, second, that the entrepreneur has strong incentives, having obtained the financing, to push for a riskier strategy of greater differentiation, which has the added advantage of specializing assets and reducing the financier's ability to collect. Unless the financier has a very good ability to monitor and prevent such actions, he is unlikely to want to finance.

2.2. Appropriating Going Concern Value

So how then can the entrepreneur obtain financing that will permit her to innovate to the extent she desires? Given that the first transformation increases the firm's going-concern value while reducing alternative use values, the challenge is to increase the power of outside financiers over going-concern surplus. Instead of relying on the liquidation value of assets, the financier should improve his threat of replacing the firm's human capital by making it more "liquid", that is, replaceable, especially at the top of the hierarchy where key decisions and surplus gravitate.

After undergoing the first transformation of differentiation, the firm must therefore undergo a second transformation – *standardization* -- that gives the financier more effective rights over going-

concern surplus.[23] The tension between generating NPV, which requires innovation and differentiation of the firm's assets and human capital, and offering financiers credible repayment, which requires reducing the extent to which the firm's employees are irreplaceable, has to be lowered by bringing every task done by the enterprise closer to the mainstream (while ensuring that the tasks, taken together, produce the differentiated product). Finance requires successful start-ups to grow up and standardize what they do well, and the entrepreneur has an incentive to make this happen precisely because the firm will be run by others over time. I now propose a simple model describing standardization. It could be appended to the previous model at the cost of obscuring the simple mechanisms at work, so I present it as a stand-alone model.

2.3. Standardization and Outside Control

Consider a two period three date world. Assume the entrepreneur has created the coordinated enterprise I described in the last section. She has an employee (who could be the collaborator and stands in for all collaborators and employees). At date 0, the entrepreneur picks the degree γ to which she standardizes the enterprise, where $\gamma \leq 1$.

For instance, an entrepreneur who has been handling product development, marketing, personnel, and finance in the early stages of the firm might hive the activities off into four separate functions, each of which could be more easily managed by professionals recruited from outside. She might restructure the enterprise to create organizational sub-units that resemble sub-units elsewhere in the industry. She might formalize implicit agreements between employees and herself by putting in place a human resource

[23] An early attempt at formalizing this is in Myers, Rajan, and Zingales (2005). An alternative to making the human capital replaceable by an outsider or subordinate is to have redundant insiders (see Stole and Zwiebol (1996)). This is arguably easier at lower levels in the hierarchy, where redundant workers are less costly, and no single worker feels directly threatened by the presence of redundant workers. Not only is a redundant CEO extremely costly for a firm to carry, it is unlikely that she would stay in the shadow and not interfere in management decisions. In turn, the incumbent could engage in costly influence activities. Rather than ensuring redundancy at every level, it may make more sense to make internal replacement possible through promotion. This is what I examine.

department.[24] She might introduce strategic planning and management information systems so that the information a CEO needs to make decisions is easily available. She might put in place rules for capital budgeting and procurement so that there is some discipline on employee spending without every decision being elevated to her. Finally, she might secure patents for innovations that were protected only by being kept secret by her. Standardization therefore reduces the idiosyncratic and personalized aspects of the entrepreneur's role, allowing her job to resemble that of a typical CEO, and making it easier for an employee or outsider to replace her as CEO. It also implies greater control over, and routinization of, work down the hierarchy. Of course, this could result in an (unmodeled) loss of organizational flexibility, which I discuss later.

After the entrepreneur sets the degree of standardization at date 0, the employee exercises effort μ in learning by doing (or innovation) at a personal cost μ. At the end of the period, the entrepreneur can produce $V^E(\mu)$ along with the employee and the firm's assets at date 1, with $V^E_\mu > 0$. Before production, the entrepreneur can be replaced by the employee, who can generate γV^E with the assets at date 1. Thus more standardization increases the amount the employee can produce if he replaces the entrepreneur, while more learning by doing increases the amount each can produce.

The entrepreneur becomes old and retires after date 1 (if she is not replaced earlier). Standardization increases *external* replaceability even as it increases *internal* replaceability; The probability that an outside CEO comes in to lead the firm in period 2 is $q(\gamma, \mu)$, while the probability the current employee will succeed the entrepreneur is $(1-q)$, where $q_\gamma > 0$ and $q_\mu < 0$; greater standardization increases the probability of being able to find an outside CEO to replace the entrepreneur, while more learning effort by the current employee reduces the probability that the succession will be

[24] For implicit contracts, see Shleifer and Summers (1988) or Novaes and Zingales (1993), for formalization, see Hellman and Puri (2002).

external. Finally, greater standardization increases the importance of the employee's effort for his chance of succeeding the entrepreneur as CEO, so $q_{\gamma\mu} < 0$.

Regardless of whether the next CEO is internal or external, he can produce V^C at date 2 with the enterprise's assets, and he can be replaced by an (un-modeled) future employee who can generate γV^C. Everyone is risk neutral, the common discount rate for date-2 revenues is $(1+r)$, and I assume well-behaved functions so that the maximization problem is well defined: $q_{\mu\mu} > 0, \quad q_{\gamma\gamma} < 0, \quad V^E_{\mu\mu} < 0$.

2.4. Financing The Going Concern Value

I assume the entrepreneur raised financing before date 0 from a venture capitalist to undertake the initial asset purchases described earlier. The venture capitalist is essentially a large investor who can push to improve the value of his claims. I will assume that the financing instrument issued is equity (I will discuss why later), which is an instrument with perpetual life, where each share has identical cash flow and voting rights, and where the controlling equity interest (or a board that works on behalf of dispersed equity) has the right at any time to replace the firm's incumbent CEO (in the first period, this is the entrepreneur). So the CEO serves at the pleasure of the controlling equity. I assume the entrepreneur is left with share α of the equity of the firm after financing, and the venture capitalist's share $(1-\alpha)$ gives him a controlling interest.

The controlling interest bargains (implicitly or explicitly) with the CEO over the surplus generated at the end of the each period. He can threaten to fire the incumbent before production and replace her with an insider – that constitutes controlling equity's outside option. Following Nash bargaining, the entrepreneur/CEO gets $\frac{(V-\gamma V)}{2}$ while outside equity gets $\frac{(V+\gamma V)}{2}$.[25] Each period, the

[25] This follows the formulation in Diamond and Rajan (2000). Controlling equity is assumed to be able to extract all the surplus from any replacement CEO. This can be plausibly modified without a qualitative change in the results.

current employee gets a normalized wage of zero – I want to focus on the long term returns to effort and learning, where the rewards to employees consists of promotion and rents over a career in the firm, which dwarf short term annual compensation.

At the end of the first period, after surplus is produced and the entrepreneur replaced, the firm is taken public, and the entrepreneur and the venture capitalist sell their stake in the initial public offering. Outside equity is now represented by a board or a controlling interest that will bargain (implicitly or explicitly) with the new CEO over the surplus. At date 2 the surplus produced is shared according to prior agreement.

The time line is

Date 0				**Date 1**			**Date 2**
Entrepreneur issues equity to buy assets, retaining stake α.	Entrepreneur chooses the level of standardization γ.	Employee chooses effort μ.	Entrepreneur bargains with venture capitalist over split of surplus.	Surplus produced and shared according to agreement. Entrepreneur replaced by outside CEO with probability q and insider with probability (1-q).	Initial public offering	CEO bargains with outside equity over split of surplus.	Surplus produced and shared according to agreement.

2.5. Solving the Model: Effort Choice and Standardization

The first best is for the employee to exert effort such that $V_{\mu}^{E} = 1$. The level of standardization only affects transfers between insiders and outside claimants, and has no direct effect on output. However, the employee is rewarded for his learning effort only indirectly, through the prospect of future promotion possibilities, and a future share of the surplus. By affecting both the employee's promotion prospects and his share of surplus, standardization does affect output. I now show this.

All that is important is that standardization increases the threat of replacing the incumbent CEO. Implicit in the formulation of the problem is that no one can make multi-period commitments.

In choosing effort, the employee maximizes $(1-q(\gamma,\mu))\frac{V^C(1-\gamma)}{2(1+r)^2}-\mu$, where the first term is his expected direct claim on the surplus as CEO at the end of the second period, and the second term is his cost of effort. His first order condition is $-q_\mu V^C(1-\gamma)=2(1+r)^2$. Totally differentiating w.r.t. γ and rearranging, I get

$$\frac{d\mu}{d\gamma}=\frac{q_\mu-q_{\mu\gamma}(1-\gamma)}{q_{\mu\mu}(1-\gamma)} \qquad (5)$$

The denominator in (5) is positive. So the effect of the change in standardization on the employee's effort depends on the numerator. The first term there is negative; more standardization directly reduces the future CEO's expected surplus (more is extracted by outside equity), and thus reduces the employee's incentive to exert effort to attain that position. The second term is positive reflecting the fact that greater standardization increases competition for the top position and makes the role of effort in increasing the employee's chances of succession more important. The net effect of greater standardization on employee effort depends on whether the adverse incentive effect of lower future *surplus* outweighs the positive *competitive* effect.

Turn finally to the entrepreneur's first order condition. In choosing γ, the entrepreneur maximizes $\frac{V^E(\mu)(1-\gamma)}{2}+\alpha\left[\frac{V^E(\mu)(1+\gamma)}{2}+\frac{V^C(1+\gamma)}{2(1+r)}\right]$. The first term is her direct share of the surplus generated under her tenure, while the second term is the present discounted value of her equity stake. Clearly, the entrepreneur's incentive to standardize departs from those of the venture capitalist because of the presence of the first term, that is, the entrepreneur's direct share of the surplus. Note also that the entrepreneur does not really care about who succeeds but does very much care that her employee is motivated by his future prospects to exert effort today, because greater effort enhances today's surplus.

Differentiating w.r.t. γ, I get the entrepreneur's first order condition to be

$-V^E + \alpha(V^E + \frac{V^C}{(1+r)}) + (1-\gamma+\alpha(1+\gamma))V_\mu^E \frac{d\mu}{d\gamma} = 0$. The first term is the reduction in her personal share of the surplus as she becomes more replaceable. Of course, this surplus goes to equity, and there is an immediate offsetting increase in value of her own share of equity holdings, though only by α of what she loses. In addition, the enhanced control right from standardization allows equity to extract greater surplus in the future also, from future CEOs. This gives the entrepreneur an additional incentive to standardize today (unlike in models where the entrepreneur is infinitely lived and this incentive absent). Finally, standardization may enhance or reduce the employee's incentive to exert effort (depending on whether the surplus or incentive effect prevails in determining the sign of $\frac{d\mu}{d\gamma}$), which will affect the surplus from date 1 production that flows back to the entrepreneur directly, and via equity. Note that the entrepreneur may set a positive level of standardization even if she owns no equity, so as to provide more ex post competition for her employee in the succession battle, and thus spur more current effort.

Finally, the venture capitalist gets $(1-\alpha)\left[\frac{V^E(\mu)(1+\gamma)}{2} + \frac{V^C(1+\gamma)}{2(1+r)}\right]$. His value is maximized when $(V^E + \frac{V^C}{(1+r)}) + (1+\gamma)V_\mu^E \frac{d\mu}{d\gamma} = 0$. For this to have an interior solution, it is necessary that $\frac{d\mu}{d\gamma} < 0$, else the venture capitalist wants maximum standardization. Assuming the venture capitalist's maximization problem is concave in γ, we have

Proposition 3:

The entrepreneur will set a lower level of standardization, γ, than the venture capitalist would desire her to. The higher the entrepreneur's equity stake, α, the greater the degree of standardization the entrepreneur will set.

Proof: See appendix.

The entrepreneur standardizes to a lesser extent than desired by the venture capitalist because she loses personal rents doing so. Clearly, the venture capitalist has to leave the entrepreneur enough of a stake, not just for her to have the incentive to bring the project to fruition, but also for her to forego personal rents and standardize the firm in order to make it amenable to outside control. That the entrepreneur plans to turn over managerial control is necessary for standardization to occur – it is the prospect of capturing rents from future CEOs, which will be reflected in the elevated price of her shares at the IPO, that makes her forego her own direct rents today.

2.6. VC Financing and Optimal Equity Holding

The venture capitalist is willing to finance the entrepreneur in the early stages of the enterprise if he knows that the entrepreneur has sufficent incentive to standardize later on, and if the expected market value of the venture capitalist's equity claim compensates for the risk he takes up front in financing the venture. Consider now an example.

Let $V^E(\mu) = K\mu^\beta$ where $0 < \beta \leq 1$, and $q(\mu,\gamma) = \frac{1}{1+\zeta}\gamma^\zeta e^{-\mu}$ where $0 < \zeta \leq 1$. Let K=1, $V^C = 10$, r=0.05, $\beta = 0.7, \zeta = 0.3.$ The first best level of μ is easily checked to be 0.89.

I plot the equilibrium values of μ and γ for different values of the entrepreneur's stake, α in Figure 1. The standardization picked by the entrepreneur, γ, increases with α as expected – the more equity the entrepreneur owns, the greater her incentive to standardize. The employee's effort does not depend directly on α, but depends on standardization, and hence indirectly on α. At low levels of standardization, the competitive effect dominates, and effort increases with standardization, while at higher levels of standardization, the incentive effect dominates, and effort decreases.

I plot in figure 2 the amount of outside equity raised at date 0 for different values of the entrepreneur share, α, and we see it reaches a maximum of 6.45, when $\alpha = 0.19$ and the corresponding standardization $\gamma = 0.632$, and effort $\mu = 0.636$. I also plot the present value obtained by the entrepreneur (including her direct rents, her equity stake, and her take from selling equity initially to the venture capitalist) and we see that it reaches its maximum value when $\alpha = 1$. This is straightforward – when the entrepreneur sells some of the equity up front, she does not take this equity into account while setting standardization, and therefore obtains lower overall value than if she retained everything. So in choosing the amount of equity to sell at date 0, the entrepreneur will retain the maximum stake α that will allow her to finance asset purchases. So if asset purchases require an amount I^A in Figure 2, she will retain α^A rather than a lower amount, even if it is possible to raise more outside funds with a lower holding.

An aside: while standardization makes the firm easier to finance, it also has a potential downside to it. Too much standardization eliminates future rents for the firm's employees. To the extent that these rents are a form of long term compensation that depend on firm performance and survival in a way that ordinary long term compensation may not (rents are less susceptible, for example, to manipulation of performance metrics, and the prospect of future rents could foster actions with long term payoffs such as innovation), total elimination of these rents may not be desirable because that can undermine employee, and firm, performance. Indeed, in Acharya, Myers, and Rajan (2011), the desire to obtain these rents makes employees interested in firm survival, and allows them to check the otherwise rapacious behavior of the CEO. I will come back to this shortly when I discuss innovation.

2.7. The Role of the Venture Capitalist

Thus far, the venture capitalist simply plays the role that any concentrated equity holder would. But there are two key additional un-modeled tasks that he performs. First, I have assumed that the entrepreneur knows how to standardize the firm. In practice, the venture capitalist provides help here,

using his past experience of standardizing other firms to advise the entrepreneur, and using his network of contacts to bring in the right personnel.

Second, I have assumed that the entrepreneur can standardize only at date 0. However, unless her equity stake is substantial and current surplus small, the entrepreneur has an incentive to delay standardization, so as to appropriate more of the surplus directly, standardizing only near the end of her term. Postponing standardization could also be a way to entrench herself and to prolong her tenure. The venture capitalist (VC) may be useful again here. He can utilize the fact that some key standardization milestones are contractible – for example, hiring a chief operating officer or making an operating unit an independent division. The venture capitalist can tie further disbursements to them. Failure to meet standardization milestones can be met with the loss of cash flow rights as well as control rights (see Kaplan and Stromberg (2002)). Thus the venture capitalist can monitor progress on contractible elements of standardization, even while the entrepreneur has an incentive through her equity stake to deliver on the non-contractible elements.

The analysis also points to the kinds of firms the venture capitalist will back. While standardization makes top management replaceable, it is critical that the collective assets be irreplaceable, so that top management cannot simply walk out with the employees and set up a new venture in competition, leaving a shell of a company behind. This suggests that the typical VC backed firm should have either a strong proprietary underlying technology, or have developed complementary proprietary assets such as brand names, that would be hard to replicate (also see Bhide (2000, 2008)). In contrast, firms that rely primarily on the idiosyncratic talents and energies of the entrepreneur are unlikely to find VC backing at all.

Also, given the substantial amount of effort the venture capitalist has to devote to monitoring and aiding standardization, the enterprise has to have sufficient promise of scale to be of interest. We will shortly survey some evidence on the differences between VC backed firms and non-VC backed firms.

2.8. The Equity Claim

Unlike the entrepreneur, the shareholder post-IPO has no passionate a priori commitment to a direction for the firm. Instead, the shareholder's neutrality amongst the various interested operating factions in the firm is his greatest strength (see Hansmann (1996) and Rajan and Zingales (1998)). He cares about maximizing his own share value and will (through the board) appoint a CEO who will take the firm in a direction to achieve that.

From the shareholder's perspective, standardization has multiple effects that could be explored in greater detail in future research. Standardization in the lower rungs of the corporate hierarchy strengthens the CEO's operational control, and allows her to draw the firm's surplus to the top of the hierarchy. Standardization at the top of the hierarchy strengthens outside control, and allows the equity holder to draw the surplus out. The CEO, post standardization, thus resembles a tax farmer, who is delegated authority so long as equity holders approve his strategic direction and he comes up with the requisite "taxes" for them. The pro-rata nature of equity payouts serves to align the interests of the entrepreneur with that of the equity holders (in influencing standardization), and the board with the equity holders (in extracting and sharing future payouts).

2.9. Debt vs Equity

Equity seems the natural claim with which to finance when the entrepreneur's intent is to commit to share future going concern value, since equity supports payouts with the threat of replacing management even while maintaining the firm as a going concern. Why cannot debt threaten to do this (instead of threatening to liquidate assets) and extract repayment? Why is equity the favored instrument for raising finance in many start-ups? Clearly, the high degree of uncertainty associated with start-ups and the low initial cash flows militate against fixed payments. But there is another reason for preferring equity that my model makes salient – the contingent nature of the control rights associated with debt makes

standardization less attractive for the entrepreneur, and allows her to capture less of firm value in a public issuance.

To see this, note that outside equity (in the form of the venture capitalist early on and the public market shareholder later) has ownership but delegates control, with the right to take it back (that is, replace the entrepreneur/CEO) at any time. The right to intervene unconditionally in firm management is a key distinguishing feature of equity. With debt finance, the creditor obtains ownership and control only if the firm cannot pay the pre-determined debt payments.

Suppose then that the entrepreneur has financed initially by issuing debt to the venture capitalist instead of equity. And assume that the proposed public offering will be of debt rather than equity. Unless the proposed debt issue is extremely large the entrepreneur will typically have a lower incentive to standardize than if she proposed to issue equity. The reason is that standardization cannot increase debt value beyond its face value, while an increase in standardization will always increase equity value.[26]

Of course, debt of infinite face value is effectively equivalent to equity in the future, since the creditors get control under all future circumstances. While we can appeal to costs of default and renegotiation to explain why very high levels of debt are not issued, there is another reason why the entrepreneur would prefer equity over debt. Controlling equity can intervene to force the pace of standardization (as we have seen) or to prevent standardization being reversed. By contrast, debt cannot intervene unless there is a default.

To see this last point, note that the entrepreneur wants to standardize primarily because by doing so she can enable equity holders to extract surplus from future generations of firm managers. But what

---

[26] The entrepreneur will never want to set standardization higher than $\gamma^D = \frac{2D}{V^C} - 1$ where D is the total debt outstanding after the public debt issue at date 1. Of course, if the initial debt issued is low, higher standardization will not hurt the personal rents of the entrepreneur. A full exploration of the incentives to standardize when the firm issues debt is left to future research, but may offer interesting insights. For instance, a leveraged buyout could be seen as an attempt to take the mature firm private in order to give management the incentive to standardize it once again to more exacting standards.

ensures that a future CEO who owns little equity will not entrench himself (see, for example, Shleifer and Vishny (1989)) by firing key subordinates, by restructuring the organization and its task allocations, and by reversing past standardization? In other words, what ensures the persistence of standardization after the public offering?

Clearly, a later CEO who wants make himself more central and indispensable will have to dis-empower strong constituencies – for example, those who were allocated critical functions the CEO used to carry out. Taking back power will be more difficult than giving it away. Importantly, any aggrieved party can appeal to outside equity. Since reversing standardization is against the interests of outside equity, it has the incentive to step in and countermand the CEO's changes. Thus the ability of equity to intervene unconditionally in the enterprise ex ante allows it to maintain the standardization in place. Debt holders, in contrast, would find it much harder to protect an existing level of standardization, because they would not be able to intervene until the borrower defaulted. By then, it might be too late. Outside equity's ability to intervene to prevent a reversal in the capacity of outsiders to control the firm makes equity an even more powerful means of financing young firms.

2.10. Life Cycle of Financing

The preceding might suggest that equity is always the preferred financing instrument. This is probably true only when the firm is being standardized.[27] Once the firm is standardized, the split of surplus between equity and management is determined. If standardization is not high, equity gets only a moderate fraction of the surplus generated by an investment. If this investment is financed with an equity

[27] What if the entrepreneur issued debt first, then intends to issue equity in the initial public offering? Standardization helps strengthen the ability of controlling investors to replace management. However, if the entrepreneur has issued debt up front, she will not have strong incentives to put in place standardization measures that strengthen investor control in bad times – for example, effective accounting systems that allow an incoming CEO to cut costs quickly. This is because the benefits accrue primarily to existing outstanding debt at the likely expense of the entrepreneur. So again, standardization may be lower than optimal.

issuance, it is possible that old equity is "diluted" by issuance, because the share of additional surplus going to equity is outweighed by the significantly larger number of shareholders post-issue.

To see this, consider an investment opportunity at date 1, with required investment i^P and net revenues from the project of v^P. Recall V^C is the surplus from existing projects. If the project is financed using equity, equity holders get a present value of $\frac{(1+\gamma)}{2(1+r)}(V^C + v^P)$ at date 1, of which new equity holders gets i^P. So old equity is "diluted" if $\frac{(1+\gamma)}{2(1+r)}v^P - i^P < 0$, with the extent of dilution increasing as standardization falls. In a sense, management does not bear the cost of investment, but gets some of the gain, so investment financed by equity issues could be "dilutive" for existing equity even if it is positive NPV for the firm as a whole. Equity holders will therefore demand a higher hurdle rate for projects when standardization is low, if they are to be financed with equity – we have an underinvestment problem because of the overhang of managerial rents.

Matters are unchanged if the firm finances with debt, d^P, when d^P or the level of outstanding prior debt D are low (I assume debt is "hard" implying it cannot be renegotiated, and all debt is paid before equity at date 2). So long as $\gamma(V^C + v^P) \geq D + d^P$, management contributes an incremental surplus of $(1-\gamma)(V^C + v^P)$ relative to its replacement, so the present value of incremental management rents are unaffected by the form of financing. Debt is "paid for" by old equity, which is effectively the residual claimant.[28] The underinvestment problem is unchanged.

[28] To see this, note that if the equity exercises its "outside option" of replacing management, it gets $\gamma(V^C + v^P)$ but has to pay $D + d^P$. So its outside option is worth $\gamma(V^C + v^P) - (D + d^P)$ at date 2, to which it adds half the surplus contributed by retaining management. Thus the present value of its claim is
$\frac{(1+\gamma)}{2(1+r)}(V^C + v^P) - (D + d^P)$

However, if debt issued or outstanding is high enough that $\gamma(V^C + v^P) < D + d^P$, equity's outside option to replace management yields it zero, since the surplus then generated is insufficient to pay off debt. Interestingly, managerial rents now go down with debt financing because the surplus management contributes (relative to its replacement) is now only $(V^C + v^P) - (D + d^P)$.[29] Put differently, the issuance of a hard claim forces management to co-invest in the project by foregoing some rents, reducing the underinvestment problem relative to when the project is financed with equity. We have

Proposition 4: *(i) Old equity is strictly better off when the firm finances with debt rather than with equity if* $D + d^P > \gamma(V^C + v^P)$ *and indifferent otherwise. (ii) Ceteris paribus, the extent of value gain to old equity from financing the new project with debt increases as D increases.*

Proof: See appendix.

Interestingly, as the proposition indicates and I show in the appendix, the higher the pre-existing level of debt, the greater the benefit of financing with new debt, even though debt is not risky in my model. Thus leverage begets more leverage. We also have another explanation of the well-documented difference in effects on a firm's stock price between the announcement of a seasoned equity issuance (negative) and a debt issuance (neutral to positive) -- see, for example, Asquith and Mullins (1986). However, we neither need risky debt (Myers (1977)) or asymmetric information (Myers and Majluf (1984)) to explain the phenomenon. Of course, we have to rely on alert outside equity or a takeover market (e.g., Zwiebel (1996)) to explain why in practice management might want to forego its own rents and favor old outside equity by financing with debt rather than equity.

All this then suggests a life cycle of firm financing, with firms financing with equity early on so as to enhance incentives for standardization, and financing later with debt so as to avoid diluting equity. It also suggests that a firm's early need to raise public equity finance, and the standardization efforts it had

[29] See Diamond and Rajan (2000).

to undertake to obtain it, should affect the subsequent frequency of its seasoned equity issues and the magnitude of their announcement effect.

2.11. Venture Capital, Equity Markets, and Innovation

Let me turn to evidence now. There is substantial evidence suggesting, first, that venture capitalists tend to focus on the more innovative (aka differentiated) firms and, second, they help standardize such firms. Hellmann and Puri (2000) find in a sample of hi-tech start-ups that firms they classify as innovators are more likely to obtain venture capital than firms they classify as imitators. Kaplan, Sensoy, and Stromberg (2009, p 77) conclude on reading the business plans of 50 venture capital financed firms that "almost uniformly, firms claim that they are differentiated by a unique product, technology, or service at the stage we examine".

Standardization should result in a substantial reduction in the importance of specific human capital. Indeed, Kaplan, Sensoy, and Stromberg (2009) document that over time, from early business plan to IPO and after, most self-reported differentiating characteristics of a VC-financed firm remain stable, *except* for management or employee expertise. This is claimed as a differentiating characteristic by 46 percent of firms at the time of the business plan, but is claimed by only 16 percent of the firms at the IPO stage or after. That human capital is less of a differentiator is consistent with standardization. They also find that 46 percent of firms have patent rights at the business plan stage, going up to 60 percent at the time of the IPO and 66 percent soon after. Thus more of the intellectual property of the firm is embedded in formal patents over time. Hellmann and Puri (2002) find that VC financed firms are more likely to put in place formal human resource policies than firms financed otherwise, making VC financed firms less dependent on implicit contracts between the founding team and employees. They also show that VC financed firms are more likely to hire a VP of sales and marketing.

Consisting with increasing standardization over time, Kaplan, Sensoy, and Stromberg (2009) find that only 43 percent of the firms they follow list a Chief Financial Officer (CFO) as one of the top five

executives at the time of the business plan, while 77 percent list a Chief Technology Officer (CTO). By the time of the first annual report after the IPO, 81 percent list a CFO, while only 46 percent list a CTO. This suggests that firms move from emphasizing areas of differentiation (technology) to areas of commonality (finance, sales and marketing).

Standardization should mean a greater ability to replace the founder. Hellmann and Puri (2002) find that VC backed firms tend to be faster and more likely to replace founders than non-VC-backed firms in the hi-tech industries. Kaplan, Sensoy, and Stromberg (2009) find that the involvement of founders declines steadily over time in their sample of VC-financed firms. At the business plan stage, 66 percent of firms have a founder CEO (and 77 percent of firms with a CEO have a founder CEO). By the first annual report after the IPO, this has fallen to 38 percent. They conclude that "over time, founders move from operating positions to board positions to no involvement".

VC financing and innovation are tightly linked. Kortum and Lerner (2000) examine the influence of venture capital on patented inventions across 20 industries in the United States, and find that while it accounted for less than 3 percent of the share of R&D, it accounted for over 8 percent of the share of patents over the period 1983 to 1992. My model would suggest two explanations for the greater role of venture capital in patenting. First, venture capital is associated with more differentiated, innovative companies that promise greater rewards but also need more standardization effort, and hence help from venture capitalists. Second, patenting is a form of standardization, so it is again not surprising to see it associated with venture capital.

Differentiated innovative firms that obtain venture capital financing are different in a number of ways from firms that start out with more run-of-the-mill technology. Bhide (2000) examines a set of 500 firms that appear in *Inc.* magazine's annual list of the fastest growing companies. These companies are less innovative – indeed they typically start out with an entrepreneur who "borrows" an idea from her old employer. Only 12 percent of the founders of *Inc.* 500 firms examined by Bhide (2000) attributed success

to an exceptional idea. Instead, the firms appear to be successful because they adapt to exploit niches in the marketplace. Because the idea is not distinctive enough early on to merit VC financing, *Inc.* 500 firms typically are funded by the entrepreneur's own savings, her family and friends, or by credit card debt. Given the paucity of capital, Bhide argues *Inc.* 500 firms typically find it hard to attract quality personnel or collaborators, and take longer to grow than VC backed firms. Finally, unlike VC-financed firms that have substantial turnover of top personnel, Bhide (2000, p305) finds that in all but one of the companies from the *Inc.* 500 cohort of 1985 that had crossed $ 500 million in revenue by 1995, the same CEO was still involved in management.

Thus innovation, standardization, and finance seem to be linked, with venture capital backed firms starting out with more innovative, distinctive ideas, getting more initial finance, in return for greater standardization and greater possible replacement of the managerial team down the line as compared to Bhide's sample of *Inc.* 500 firms. This is not to say that firms in Bhide's sample are doing the wrong thing. Their strategy typically relies on finding the right new niche for methods or products that have worked elsewhere. They need to be flexible to be opportunistic, which makes it harder for them to standardize to attract finance, especially because their capabilities are so centered on the human capital of the founder. They are doomed to be financially constrained until they hit upon their niche, at which point they can standardize and obtain easier financing.

2.12. Stock Markets, Venture Capital, and Innovation

My model also suggests a reason why stock markets are so critical to the development of innovation and venture capital. Brown, Martinsson, and Petersen (2011) find in a large sample of firms across 32 countries that better access to stock market financing is associated with high levels of R&D investment, particularly in small firms, but is unimportant for firm investment in fixed capital. Similarly, Black and Gilson (1998) note the relative paucity of venture capital financing in Germany relative to the United States, and suggest that it is primarily because exit through an IPO is largely unavailable in

Germany (the predominant form of exit in their sample is through a buyback by the company of the venture capitalist's stake).

Black and Gilson (1998) argue that the reason the IPO is so important is that it allows the entrepreneur to reacquire control (they note that the venture capitalist typically gives up many of his control rights and his controlling stake at the time of the IPO). Yet this explanation does not sit well with the evidence I refer to in the previous sub-section, which suggests a significant number of entrepreneurs in the United States tend to leave under venture capitalist tutelage. My model suggests an alternative explanation. The role of the venture capitalist is to use his control rights to help standardize the firm, and ready it for public control by more dispersed equity. Once standardization is achieved, the firm can be taken public, and the venture capitalist no longer needs control rights. The role of the vibrant stock market is not so much to reduce the burden on the entrepreneur of VC oversight, but to reward both for making the firm "controllable". The entrepreneur's incentives are aligned with the venture capitalist because her equity stake tends to benefit tremendously from standardization. My model suggests the reason venture capital is less popular or effective in Germany at the time Black and Gilson write is because the majority of the "exits" are entrepreneurs buying back their own stake from the venture capitalist, which gives them little ability to capture the future rents of the enterprise, and hence little reward from VC financing.[30]

III. Discussion

I now discuss the links between differentiation and standardization – bringing the two aspects of the entrepreneur's role together. This will also help us see where in the spectrum of innovations small start-ups may have an advantage over more mature firms, and vice versa. I then want to turn briefly to changes in the environment that are affecting the nature of the corporation and its financing. I will conclude with a discussion of the political environment and how that might impact the financing of innovation.

[30] The entrepreneur could sell the firm to her managers (see Acharya, Myers, and Rajan (2011) or Kreps (1999)). However, the amount she can raise will be limited by the financing capacity of those managers, which in turn will be constrained by the availability of finance. She could allow her firm to be acquired, but the principle issues there resemble the ones we have already explored with a public equity offering.

3.1. Differentiation and Standardization

The fundamental tension running through this paper is between the two transformations, between differentiation and standardization, or put differently, the extent of innovation and the availability of finance. Because of the difficulties in financing, start-ups are likely to stay away from capital intensive fundamental innovation where the commercialization possibilities are uncertain.

But what of more mature firms who have the internal cash flows to finance innovation? To the extent that central headquarters is remote, both in physical distance as well as in technical expertise, from the research and development unit of the corporation, it is not clear that headquarters has better knowledge to finance effectively than would an outside financier (though see Gertner, Scharfstein, and Stein (1994)). Indeed, because of internal politics (see Rajan, Servaes, and Zingales (2000) or Scharfstein and Stein (2000)), innovative but disruptive projects may have less chance of being financed internally. Xerox's Palo Alto Research Center, set up to create new technologies, played a key role in inventing laser printing, the Ethernet, the graphical user interface, and personal distributed computing. Xerox's management based in Rochester, New York, skeptical of the maverick California-based group, discouraged development, and many of these inventions were commercialized elsewhere (see Seru (forthcoming) for evidence on the decline in a target's innovation following diversifying acquisitions).

There are other reasons why a mature firm may be less innovative. An entrepreneur in a small stand-alone start-up tends to experience high costs of failure. The scarcity of funds and the knowledge of the fall that awaits her if the enterprise does not succeed give the entrepreneur focus. By contrast, the manager of an incubator in a mature firm overflowing with cash flows can rely on the typically soft budget constraint in large organizations to experiment endlessly. Neither the downside nor the upside he faces is large enough, nor is his budget constraint tight enough, to induce urgency.

Furthermore, the very process of standardization, of disciplining the workforce, makes it difficult for anyone in the more mature firm to think or act outside the box, to differentiate the firm significantly

once again. For instance, while the technologists in a start-up can order a piece of equipment quickly when needed, those in a mature firm have to go through the procurement office, with extensive delays as contracts are bid out. Rules and procedures bring order, efficiency, and ease of control to large scale operations but tend to suffocate innovation, which is typically spontaneous and unplanned. If rules and compensation structures differ for the mainstream division and for the innovation incubator, it will tend to breed resentment and internal conflict, while if the firm puts in place common rules and compensation structures, they will tend to be tailored for the mature businesses rather than for the incubator (see Kanter (1989)).

So both the greater tolerance of failure and standardization make it harder for a mature public firm's employees to innovate radically and successfully. This is not to say that mature firms have no advantages. Apart from their ability to deploy more resources, their previous cluster of patents allows them to defend an innovation, while their existing organization and their network of collaborators and customers allows them to commercialize it quickly. To the extent that top management is still entrepreneurial in spirit, and is close to the technologies being developed, they may have the ability and willingness to take big, radical risks. Mature corporations may also focus on buying out small innovators and commercializing their products rather than innovating on their own.

3.2. Mature Firms and the Matrix

Much of my analysis has focused on the early stages of the firm. This may well be when the most dramatic changes in the structure of a firm and its capital structure take place. Of course, much of the existing capital structure literature focuses on more mature firms, where capital structure choices may already be largely pre-determined by earlier decisions. The problems for mature firms are different – for instance, the agency costs associated with dispersed equity, which has occupied center stage ever since Berle and Means (1932) – though as I have hinted earlier, some of the issues I examine will carry over.

While I leave detailed analysis to future work, it is useful to lay out in Figure 3 the array of possibilities for firms and financing when we consider both standardization and differentiation. A laundry shop is low on both differentiation and standardization. A utility is low on differentiation but high on standardization, hence it is easy to finance. A wealthy family enterprise can be high on differentiation and relatively low on standardization – it can differentiate more (though families may be undiversified and risk averse, which will eventually limit differentiation) without standardizing because it has little need to cater to financial markets. Finally, a mature firm with entrepreneurial roots such as Microsoft scores high on both differentiation as well as standardization. The central forces governing the structure of the laundry shop or the small grocer are different from those governing the entrepreneurial high technology firm, and a tremendous source of confusion in the literature has been to try and understand the latter by examining the former.

3.3. Changes in the environment

My essential point has been that ownership improves coordination when key assets are irreplaceable and coordination is costly. Recent changes in the environment have been making a variety of assets more easily replicable, even while bringing down the costs of coordination. These clearly have had effects on the nature of the firm and its financing.

In recent decades in industrial countries, there has been substantial deregulation and liberalization of domestic product markets, of cross-border trade and capital flows, and of the financial sector. Taken together, these changes have tended to increase the ease of replication, and thus have reduced the criticality, of physical assets and of assets whose uniqueness is only protected by regulation. For instance, when regulations limited entry, when the few domestic intermediate goods producers were locked into contracts with the incumbent, and when financing was scarce, collaborators could not quit an enterprise and set up easily in competition. The organization man (Whyte (1956)) was not just a product of the cultural environment in the United States in the 1950s, he was evidence of the hold corporations had over

employees. Today, with few regulatory barriers to entry, a host of competing domestic and cross-border producers of intermediate goods, and financing more available, it is easier for a collaborator to quit, contract with suppliers, and buy the necessary assets to compete, which reduces the power of the incumbent owner.

Even as physical-asset-based power has diminished, the costs of coordination have also fallen. Machines today tend to be far more flexible, reprogrammable in an instant at low cost. They can make small lots at much the same cost that they would take to make large lots. It makes far more sense for a contract manufacturer to have multi-purpose programmable machines, which he uses to supply a variety of downstream firms than for each firm to have a dedicated manufacturing base. In case a downstream venture fails, the contract manufacturer can quickly redeploy his machines at low cost to someone else's order. The lower redeployment costs as a result of greater flexibility diminish the need for the downstream firm to own the upstream firm in order to improve incentives to coordinate.

The greater availability of information and the ease of exchanging it add to the attractiveness of contracting out because the cost of keeping in close touch, no matter what the distance separating collaborators, is smaller. At the design stage, various collaborators in a project can share the same designs electronically, so that each part fits perfectly. Designs can be shipped instantaneously to a distant contract manufacturer, whose progress can be monitored in real time. Communications technology ensures that everyone can be in close touch without ever being physically proximate. Given the ease of monitoring at a distance, there is less need to bring a collaborator in as an employee who comes to the premises every day to work.

Finally, detailed industry standards ensure that firms can be confident that others will coordinate without any formal agreement. So long as a firm's product adheres to the standard, it knows that it will be inter-operable with a host of other products.

3.4. Effects on the Firm

Consider now the effects of the diminished power from certain kinds of assets as well as the lower cost of coordination on the structure of firms:

Changes in the method of coordination: As the physical-asset-based authority of the entrepreneur diminishes, any coordination will have to occur more by persuasion rather than by fiat. This means more direct contact between the top and bottom of hierarchies – flatter hierarchies, more meetings, more people-friendly management. The lower cost of communication does make it possible to reduce managerial layers (see the arguments in Malone (2003) and the evidence in Rajan and Wulf (2006)). Effective CEOs will earn power by creating bonds with key subordinates, building a strong and cohesive management team. This reduction in asset-based authority extends to the financier also. Even if the financier makes every single member of the management team replaceable, he is still exposed to the risk that the entire management team walks out, taking the firm's value with it. To the extent that the CEO has made herself central to the team, more value will have to be paid to her than when she obtained power only through delegated ownership of physical assets. One implication is that relative increases in CEO compensation across countries should be viewed in the context of these regulatory and financial market developments rather than narrowly through the lens of corporate governance.

Changes in critical assets: As physical and regulatory assets become less central to power, protected intellectual property such as brand names and patents increasingly become the critical assets around which firms are built. Moreover, because these assets have to be constantly refreshed through human creativity and innovation, it is harder for firms to standardize, at least to the extent that was possible in the past. More firm value will have to go to the firm's innovators and creative personnel, partly as rents as controls are more lax, partly as incentive. More equity based compensation may be necessary across the flatter hierarchy (rather than just at the top) to align incentives of creative employees with equity holders.

Changes in need for ownership: The lower cost of coordination can have complex effects on the size of enterprises and their commonly owned assets. On the one hand, it can result in loosely coupled global enterprises, tied together by common ownership of brand names, clients, and databases, but without the close hierarchical control that characterized firms of the past. Global accounting, consulting, and law firms are an example.

On the other hand, with physical assets providing less power, and with a lower need for coordination, we would expect ownership of physical assets to be less important for business. Stories of "virtual" businesses with a handful of employees generating hundreds of millions of dollars in sales are legion today. However, these very factors make differentiation even more necessary to achieve a sustainable advantage. When everyone uses the same contract manufacturer in Taiwan, the entrepreneur has to make her idea or design attractively different because the quality of the manufacturing is the same.

Changes in organizations: Ownership was especially important when the entrepreneur knew the direction she wanted to take the firm in, and had to enforce it. With greater need for differentiation, innovation is more open-ended, and no one may know the precise direction that the enterprise has to go in ex ante – unlike in my model where the entrepreneur knows where to take the firm. This may explain why firms increasingly choose to innovate through alliances or consortiums with collaborators that have important necessary capabilities (see, for example, Baker, Gibbons, and Murphy (2008) for the variety of alliance structures). Alliances spread risk, bring the right capabilities together, and are more useful when no one knows which way to proceed. They also become more viable when the costs of coordination are low.

None of this is to say that the fundamental forces I have pointed to earlier in the paper have ceased to be important. The seemingly high rate of break-up of alliances is consistent with the lower commitment in those ventures that my model would predict. Boeing's attempt to create the Boeing 787 Dreamliner by coordinating suppliers across the world came in very late and way over-budget, and ended

with Boeing having to buy some of its suppliers.[31] Equally, the tension between the firm's structure and its financing are still extremely important. Even though the need for common asset ownership and hence financing may be lower in a world where coordination across firms is easier, the entrepreneur has to differentiate more, and because human capital is more critical, has a lower ability to promise the financier an adequate return. On net, it is not obvious that the entrepreneurial problem of effecting the twin transformations has become any easier.

Conclusion

Though presidential addresses are supposed to be timeless, it would be remiss of me to ignore the political environment we are in. Finance is in some disrepute because of the near-death experience of Wall Street in 2008, and the continuing travails of European banks. The crisis that started in 2007 is still with us, and has severely damaged the real economy around the world. At times like these, there is a strong tendency for critics to claim that finance is a zero, or even negative, sum game, adding risk to economic activity without contributing real value. No doubt, a number of practices of the financial sector ought to be re-examined, and regulation improved to reduce the financial sector's ability to make one way bets at the expense of the rest of the economy.

At the same time, we should not succumb to the rhetoric that financial innovation and creativity are simply ways for the clever to part the innocent of their money. Such rhetoric does get louder after a crisis, and makes it easier for governments to suppress finance (see Rajan and Zingales (2003 a, b)). What I have tried to show in this paper is the very real potential cost if financiers are unable to play midwife to innovative new firms, and if equity markets are not vibrant enough to reward entrepreneurial activity. The broader point is that attempts to separate Main Street from Wall Street, real activity from "merely" finance, are not useful. The two are intimately linked, both in theory and in practice.

[31] See "Boeing's Woes: Nightmareliner", *The Economist*, September 1st 2011.

References

Acharya, Viral, Stewart Myers, and Raghuram Rajan, 2011, "The Internal Governance of Firms", Journal of Finance, Volume: 66 Issue: 3 Pages: 689-720: Jun 2011

Alchian, A. and H. Demsetz (1972), "Production, Information Costs and Economic Organization", American Economic Review, 777-705.

Alchian, A, Crawford and B.Klein (1978), "Vertical Integration, Appropriable Rents and the Competitive Contracting Process", Journal of Law and Economics, Vol. 21, No. 2, 297-326.

Asquith, Paul, and David Mullins, 1986, Equity issues and offering dilution, Journal of Financial Economics 15, 61-89.

Baird, Douglas, 2009, "In Coase's Footsteps", mimeo, University of Chicago.

Baird, Douglas and Anthony Casey, 2011, "No exit: Withdrawal Rights in Chapter 11, mimeo, University of Chicago.

Baker, George, Robert Gibbons and Kevin Murphy (2008), "Strategic Alliances: Bridges Between "Islands of Conscious Power", mimeo, M.I.T.

Baker, Malcolm and Jeffrey Wurgler (2011), "Behavioral Corporate Finance: An Updated Survey", NBER Working paper 17333.

Berglof, Erik and Ernst-Ludwig von Thadden [1994], Short-Term versus Long-Term Interests: Capital Structure with Multiple Investors, *Quarterly Journal of Economics* 109, 1055-1084.

Berle, Adolf, and Gardiner Means, *Modern corporation and private property,* 1933, New York : Macmillan Company.

Bhide. Amar (2000) *The Origin and Evolution of New Businesses,* New York : Oxford University Press.

Bhide, Amar (2008) *The Venturesome Economy: How innovation sustains prosperity in a more inter-connected world* Princeton University Press, New Jersey.

Blair, Margaret, 2003, "Locking in Capital: What Corporate Law Achieved for Business Organizers in the Nineteenth Century", Working Paper no 495984, Georgetown University Law Center.

Black, Bernard and Ronald Gilson, 1998, "Venture Capital and the Structure of Capital Markets: Banks versus Stock Markets", *Journal of Financial Economics,* 47, 243-277.

Bolton, Patrick and Mathias Dewatripont. 2005. Contract Theory. Cambridge, MA: MIT Press.

Bolton, Patrick and David Scharfstein (1990) "A Theory of Predation Based on Agency Problems in Financial Contracting," AER, 80, 93-106

Bolton, Patrick and David Scharfstein (1996) “Optimal Debt Structure and the Number of Creditors,” JPE, 104, 1-25

Brown, James, Gustav Martinsson, and Bruce Petersen (2011), “Law, Stock Markets, and Innovation”, working paper, Iowa State University.

Brynjolfsson, Eric and Lorin and Hitt, 2003, “Beyond Computation: Information Technology, Organizational Transformation, and Business Performance, in *Inventing the Organizations of the 21st Century*, Thomas Malone, Robert Laubacher, and Michael Scott Morton ed., M.I.T. Press, Cambridge, MA.

Calomiris, Charles W. and Charles M. Kahn [1991], “The Role of Demandable Debt in Structuring Optimal Banking Arrangements” *The American Economic Review*, Vol. 81, No. 3. (Jun., 1991), pp. 497-513.

Coase, R. (1937), “The Nature of the Firm", Economica, 386-405.

Dessein, Wouter and Tano Santos. 2006. “Adaptive Organizations.” Journal of Political Economy 114: 956-95.

Diamond, Douglas, 1991, Debt Maturity Structure and Liquidity Risk, Quarterly Journal of Economics, August 1991.

Diamond, Douglas and Raghuram Rajan (2000) "A Theory of Bank Capital", Journal of Finance, vol 55, no 6, 2431-2465.

Diamond, Douglas and Raghuram Rajan (2001) “Liquidity Risk, Liquidity Creation and Financial Fragility: A Theory of Banking”, 2001, Journal of Political Economy , vol 109, 2, 287-327.

Fama, E. and M. Jensen (1983a) Separation of Ownership and Control, Journal of Law and Economics, pp. 301-325

Fama, E. and M. Jensen (1983b) Agency Problems and Residual Claims, Journal of Law and Economics, pp. 327-349

Gertner, Robert, David Scharfstein, and Jeremy Stein. "Internal versus External Capital Markets." Quarterly Journal of Economics 109, no. 4 (November 1994): 1211-1230.

Gibbons, Robert, 2005, “Four formal(izable) theories of the firm?, Journal of Economic Behavior and Organization”, vol 58, 200-245.

Gompers, Paul, Anna Kovner, Josh Lerner, David Scharfstein, 2009, “Performance persistence in entrepreneurship”, Journal of Financial Economics 96 (2010) 18–32

Guinane, Timothy, Ron Harris, Naomi Lamoreaux, and Jean-Laurent Rosenthal, 2007, “Putting the Corporation in its Place”, NBER Working Paper, 13109.

Hansmann, Henry, Reinier Kraakman, and Richard Squire, 2006, “Law and the Rise of the

Firm", Harvard Law Review, vol 119, no 5, pp 1333-1403.

Harris, Milton and Artur Raviv (1991) "The Theory of Capital Structure," Journal of Finance, 46, 297-355

Hart, Oliver and Sanford Grossman, 1986, "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration" , Journal of Political Economy (August 1986).

Hart, Oliver and Bengt Holmstrom , 2010, "A Theory of Firm Scope, Quarterly Journal of Economics, 125 (2): (May 2010) 483-513.

Hart, Oliver and John Moore (1990) "Property Rights and the Nature of the Firm", The Journal of Political Economy, Vol. 98, No. 6., pp. 1119-1158.

Hart, Oliver and John Moore (1994) "A Theory of Debt Based on the Inalienability of Human Capital" (with J. Moore), Quarterly Journal of Economics, 109(4) (1994) 841-79.

Hellmann, Thomas and Manju Puri, 2000, "The interaction between product market and financing strategy: The role of venture capital," with Thomas Hellmann, Review of Financial Studies, 13(4), 959-984.

Hellmann, Thomas and Manju Puri (2002) "Venture capital and the professionalization of start-up firms: Empirical Evidence", Journal of Finance, 2002, 57 (1), 169-197.

Holmstrom, Bengt. 1999. "The Firm as a Subeconomy." Journal of Law Economics and Organizations 15: 74-102.

Holmstrom, Bengt and Paul Milgrom. 1991. "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design." Journal of Law, Economics and Organization 7: 24-52.

Holmstrom, Bengt and Paul Milgrom. 1994. "The Firm as an Incentive System." American Economic Review 84: 972-91.

Holmstrom, Bengt and John Roberts. 1998. "The Boundaries of the Firm Revisited." Journal of Economic Perspectives 12: 73-94.

Jensen, Michael C. and William H. Meckling (1976), "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics 3: 305-360.

Jensen (1986) "Agency Costs of Free Cash Flow, Corporate finance, and Takeovers," AER, 76, 323-329

Kaplan, Steven and Per Stromberg, 2002, "Financial Contracting Theory Meets the Real World: An Empirical Analysis of V ture Capital Contracts", *Review of Economic Studies*, 1-35.

Kaplan, Steven, Berk Sensoy, and Per Stromberg , 2009, "Should Investors Bet on the Jockey or the Horse? Evidence from the Evolution of Firms from Early Business Plans to Public

Companies", *Journal of Finance*, vol 64, 1, 75-114.

Knight, Frank (1921) Risk, Uncertainty and Profit, Boston ; New York : Houghton Mifflin Company, 1921

Kortum, Samuel, and Josh Lerner, 2000, "Assessing the Contribution of Venture Capital to Innovation" , Rand Journal of Economics, 31, 674-692.

Kreps, David, 1990, Corporate culture and economic theory, in James E. Alt and Kenneth A. Shepsle, editors, Rational Perspectives on Political Science, Cambridge University Press, New York.

LANDIER, Augustin DAVID SRAER and DAVID THESMAR, "Optimal Dissent in Organizations", *The Review of Economic Studies*, vol. 76, n. 2, March 2009, p. 761-794.

Lerner, Joshua and Ulrike Malmendier, 2010, "Contractibility and Contract Design in Strategic Alliances", American Economic Review, 100, 214–246.

Malone, Thomas, 2003, "Is Empowerment Just a Fad? Control, Decision Making, and IT" in *Inventing the Organizations of the 21st Century*, Thomas Malone, Robert Laubacher, and Michael Scott Morton ed., M.I.T. Press, Cambridge, MA.

Maskin, Eric and Jean Tirole (1999), "Unforseen Contingencies and Incomplete Contracts, Review of Economic Studies, vol 66, 83-114

Masten, Scott, 1988, A Legal Basis for the Firm, Journal of Law, Economics, & Organization, Vol. 4, No. 1 (Spring, 1988), pp. 181-198

Modigliani, Franco and Merton H. Miller, 1958, "The Cost of Capital, Corporation Finance, and the Theory of Investment," American Economic Review 48: 261-297.

Myers, Stewart, (1977) "Determinants of Corporate Borrowing" Journal of Financial Economics, 5, 147-175

Myers, Stewart and Nicholas Majluf (1984) "Corporate Financing and Investment Decisions when Firms Have Information That Investors Do Not Have," Journal of Financial Economics, 13, 187-222

Myers, Stewart, Raghuram Rajan, and Luigi Zingales, 2005, "Financing Organizations 1: Start-up", mimeo, University of Chicago.

Novaes, Walter and Luigi Zingales (1993), Financial Distress as a Collapse of Incentives, mimeo, University of Chicago.

Pastor, Lubos and Pietro Veronesi, 2006, "Was There a Nasdaq Bubble in the Late 1990s?", Journal of Financial Economics 81, 61–100.

Peach, W. Nelson, The Security Affiliates of National Banks, Baltimore: Johns Hopkins Press, 1941.

Perez, Carlota,2002, *Technological revolutions and financial capital : the dynamics of bubbles and golden ages*, Northampton, MA, USA : E. Elgar Pub

Perotti, Enrico C & Spier, Kathryn E, 1993. "Capital Structure as a Bargaining Tool: The Role of Leverage in Contract Renegotiation," American Economic Review, vol. 83(5), pages 1131-41, December.

Rajan, R. and J. Wulf, 2006, "The Flattening Firm: Evidence from Panel Data on the Changing Nature of Corporate Hierarchies", *Review of Economics and Statistics*, 2006, 88, (4), 759-773

Rajan, R. and L. Zingales, (1998), "Power in a Theory of the Firm", Quarterly Journal of Economics, vol 113, pp 387-432.

Rajan, R. and L. Zingales, 2000, "The Governance of the New Corporation", in Xavier Vives, ed. *Corporate Governance Theoretical and Empirical Perspectives*, Cambridge: Cambridge University Press.

Rajan, R. and L. Zingales, (2001), "The Firm as a Dedicated Hierarchy: A Theory of the Origins and Growth of Firms", *Quarterly Journal of Economics*, 116 (3): 805-851.

Rajan, R. and L. Zingales (2003a*),* Saving Capitalism from the Capitalists, Crown Business Division of Random House, New York, NY.

Rajan, R. and L. Zingales (2003b), "The Great Reversals: The Politics of Financial Development in the 20th Century", *Journal of Financial Economics*, vol69, 1, July 2003, 5-50.

Roy, William (1997), Socializing capital : the rise of the large industrial corporation in America, Princeton University Press, Princeto, NJ.

Scharfstein, David and Jeremy Stein, 2000, " The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment", The Journal of Finance, Vol. 55, No. 6, pp. 2537-2564

Schoar, Antoinette, and Luo Zuo, 2011, Shaped By Booms And Busts: How The Economy Impacts CEO Careers And Management Style, NBER working paper 17590

Schumpeter, Joseph, (1911) The theory of economic development; an inquiry into profits, capital, credit, interest, and the business cycle

Seru, Amit (forthcoming), "Firm Boundaries Matter: Evidence from Conglomerates and R&D Activity. *Journal of Financial Economics.*

Shleifer, Andrei and Lawrence Summers (1988), "Breach of Trust in Hostile Takeovers", in A. Auerbach ed: *Corporate Takeovers: Causes and Consequences* University of Chicago Press: Chicago.

Shleifer, Andrei and Robert Vishny, 1989, "Managerial Entrenchment: The Case of Manager-Specific Investments" *Journal of Financial Economics*, November, 1989.

Shleifer, Andrei and Robert Vishny (1997) "A Survey of Corporate Governance," Journal of Finance, 52, 737-783.

Shleifer, Andrei and Robert Vishny, 1992, “Liquidation values and debt capacity: A market equilibrium approach”, Journal of Finance (1992) vol. 47 (4) pp. 1343-1366

Stole, Lars and Jeffrey Zwiebol, 1996, Organizational Design and Technology Choice under Intra-firm Bargaining," , American Economic Review, March 1996, 86(1):195-222.

Teece, David, 1986, “Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy”, Research Policy, Volume 15, Issue 6, Pages 285-305

Teece, David and Gary Pisano, 2007, “How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture” , *California Management Review*, 50th Anniversary Special Issue on Leading Through Innovation, 50:1 , 278-296.

Tirole, Jean, *The Theory of Corporate Finance*, 2006, Princeton University Press, Princeton.

Titman, Sheridan, 1984, “The effect of capital structure on a firm's liquidation decision”, Journal of Financial Economics, Volume 13, Issue 1, March 1984, Pages 137-151

Van den Steen, Eric. 2010. “Interpersonal Authority in a Theory of the Firm.” American Economic Review 100: 466-90.

Whyte, William, 1956, *The Organization Man*, Simon and Schuster, New York.

Williamson, Oliver 1975. Markets and Hierarchies: Analysis and Antitrust Implications. New York, NY: Free Press

Williamson, Oliver. 1985. The Economic Institutions of Capitalism. New York: The Free Press.

Williamson, Oliver, 1988, “Corporate Finance and Corporate Governance”, Journal of Finance, 43, 567-91.

Williamson, Oliver. 2002. “The Theory of the Firm as Governance Structure: From Choice to Contract.” Journal of Economic Perspectives 16: 171-95.

Zingales, Luigi (2000), “In Search of New Foundations”, Journal of Finance, vol 60, 4, 1623-1653.

Zwiebel, Jeffrey (1996), “Dynamic Capital Structure under Managerial Entrenchment” The American Economic Review, Vol. 86, No. 5 (Dec., 1996), pp. 1197-1215.

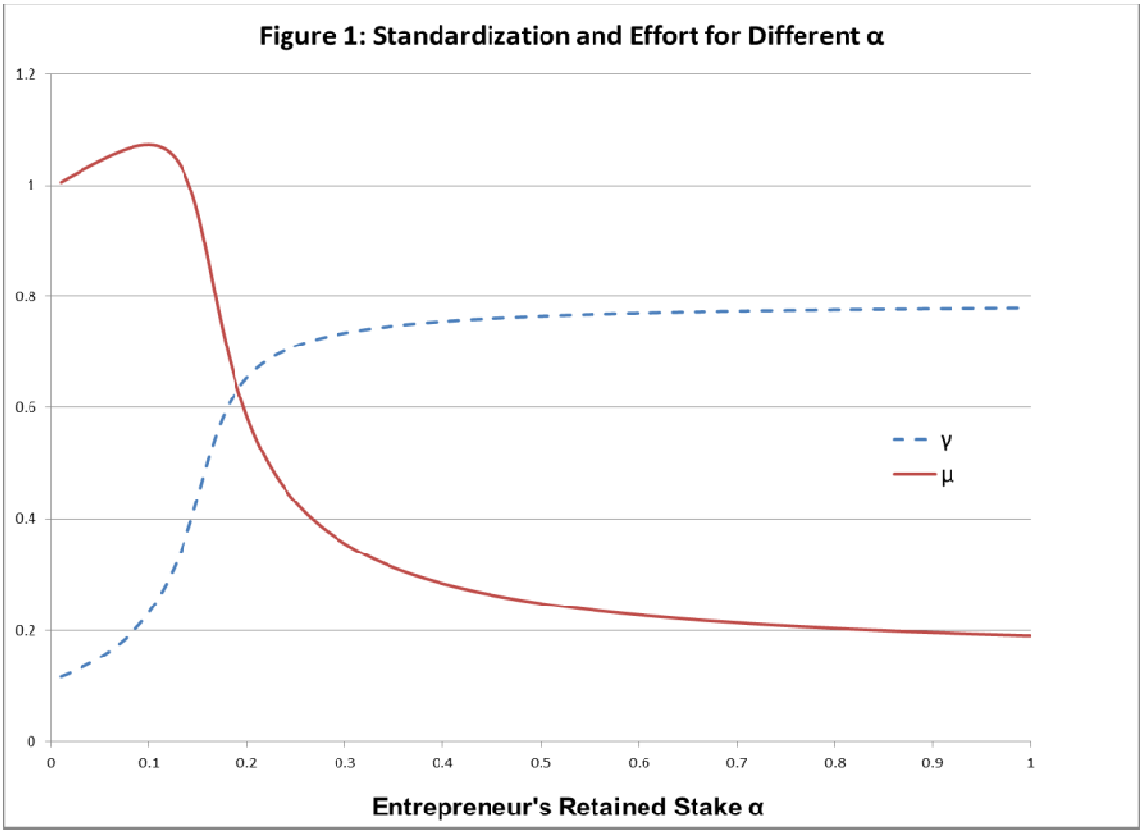
Figure 1: Standardization and Effort for Different α
1.2
1
0.8
0.5
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
γ
μ
Entrepreneur's Retained Stake α

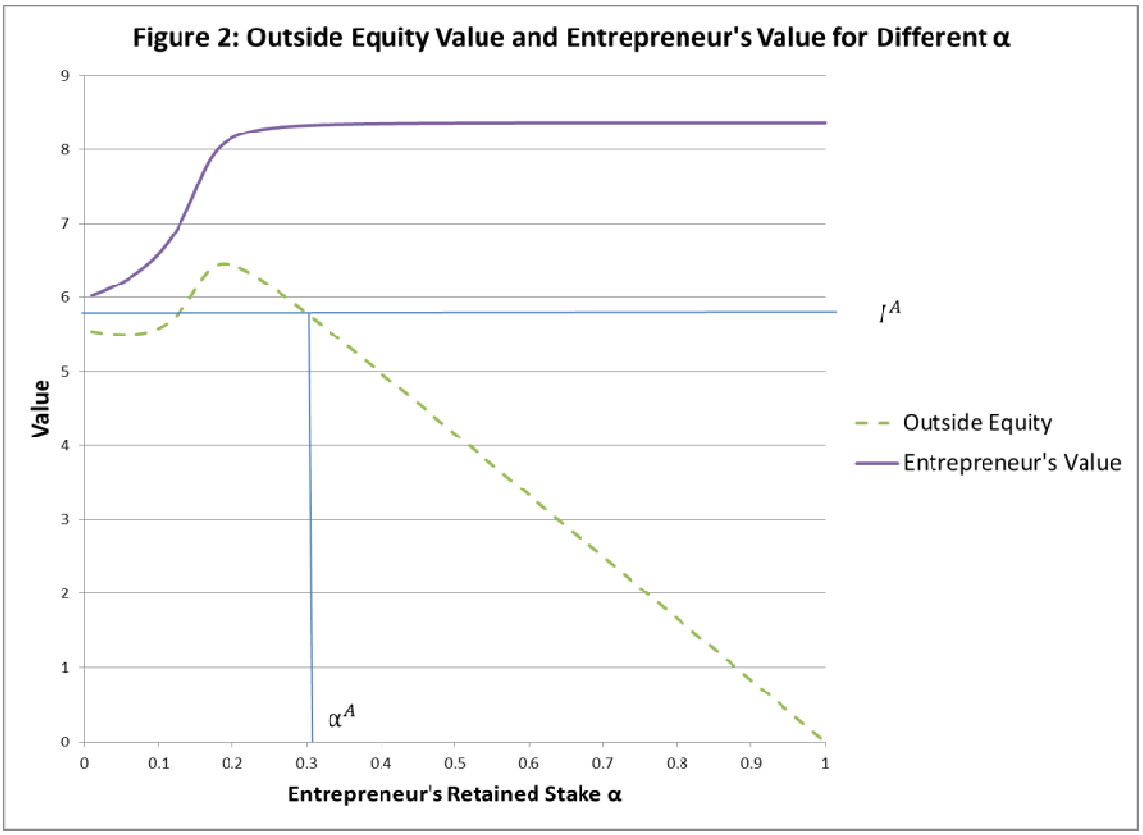
Figure 2: Outside Equity Value and Entrepreneur's Value for Different α
Value
Entrepreneur's Retained Stake α
I^A
α^A
Outside Equity
Entrepreneur's Value
0
1
2
3
4
5
6
7
8
9
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Figure 3: Differentiation and Standardization

	Low standardization	High standardization
Low differentiation	Laundry Shop	Utility
High differentiation	Family firm	High tech IPO

Appendix

Proof of Proposition 3

We know that if $\frac{d\mu}{d\gamma} \geq 0$, the VC wants to set standardization at its maximal level. Thus the theorem holds weakly, and strictly so long as the solution to the entrepreneur's maximization problem is interior.

Now let $\frac{d\mu}{d\gamma} < 0$. The entrepreneur's utility is $U^E = \frac{V^E(\mu)(1-\gamma)}{2} + \alpha\left[\frac{V^E(\mu)(1+\gamma)}{2} + \frac{V^C(1+\gamma)}{2(1+r)}\right]$

and the VC's utility is $U^{VC} = (1-\alpha)\left[\frac{V^E(\mu)(1+\gamma)}{2} + \frac{V^C(1+\gamma)}{2(1+r)}\right]$

Therefore, the entrepreneur's utility is $\frac{V^E(\mu)(1-\gamma)}{2} + \frac{\alpha}{1-\alpha}U^{VC}$. This implies the entrepreneur's first order condition is $-\frac{V^E}{2} + \frac{(1-\gamma)}{2}V^E_\mu \frac{d\mu}{d\gamma} + \frac{\alpha}{(1-\alpha)}\frac{dU^{VC}}{d\gamma} = 0$. The VC's utility is concave in γ and has an interior optimal γ^{VC}, where $\frac{dU^{VC}}{d\gamma} = 0$ at $\gamma = \gamma^{VC}$. This means that $\frac{dU^E}{d\gamma} < 0$ at $\gamma = \gamma^{VC}$. If U^E is concave, we are done. If not, we know that $\frac{dU^{VC}}{d\gamma}$ is decreasing in γ by concavity of U^{VC}. That means $\frac{dU^E}{d\gamma} < 0$ for $\gamma \geq \gamma^{VC}$. So the entrepreneur preferred choice of standardization is lower than the venture capitalist's. Finally, since the weight the entrepreneur puts on the venture capitalist's utility in his own maximization problem is $\frac{\alpha}{1-\alpha}$, it must be that the standardization chosen by the entrepreneur increases in α.

Proof of Proposition 4:

We have seen the basic underinvestment problem when the mature firm finances with a new equity issuance and $\frac{(1+\gamma)}{2(1+r)}v^P - i^P < 0$.

Now consider the multiple cases at different levels of legacy debt and new debt issuance, where $\frac{d^P}{1+r} = i^P$.

Case 1: $D \leq \gamma V^C$ and $(D + d^P) \leq \gamma\left(V^C + v^P\right)$.

Equity's outside option of replacing management, if the project is not undertaken, fetches $\gamma V^C - D$. The incremental surplus if it works with management is $(1-\gamma)V^C$. So its date-2 value from Nash bargaining is $\frac{(1+\gamma)}{2}V^C - D$. Similarly, if the project is undertaken, equity gets $\frac{(1+\gamma)}{2}\left(V^C + v^P\right) - (D + d^P)$. This means the incremental present value (at date 1) to old equity of undertaking the project, financing with debt, is $\frac{(1+\gamma)}{2(1+r)}v^P - \frac{d^P}{1+r} = \frac{(1+\gamma)}{2(1+r)}v^P - i^P$. This is no different from the present value of financing with equity explored in the text.

Case 2: $D \le \gamma V^C$ and $(D + d^P) > \gamma\left(V^C + v^P\right)$.

In this case, equity's outside option is unchanged if the project is not undertaken, but is zero if it is (since the surplus generated after replacement is insufficient to repay debt). Hence the date-2 value of old equity post investment is $\frac{\left(V^C + v^P\right) - (D + d^P)}{2}$. If the firm does not invest, its value is $\frac{(1+\gamma)}{2}V^C - D$. So on rearranging and substituting, the incremental date-1 present value to old equity from investment is $\frac{(1+\gamma)}{2(1+r)}v^P - i^P + \left[\frac{D + d^P - \gamma(V^C + v^P)}{2(1+r)}\right]$. The last term is the present value of rents foregone by management relative to all equity financing, and is positive. Thus equity's incentive to invest is greater with debt financing than with equity financing.

Case 3: $D > \gamma V^C$ and $\gamma\left(V^C + v^P\right) \ge (D + d^P)$. In this case, it is easily checked that old equity bears the full cost of debt financing, so there is no difference between financing with equity and financing with debt.

Case 4: $D > \gamma V^C$ and $(D + d^P) > \gamma\left(V^C + v^P\right) \ge D$.

When the firm finances with equity, the incremental value to equity is $\frac{1}{1+r}\left[(\frac{1+\gamma}{2})\left(V^C + v^P\right) - D - \frac{\left(V^C - D\right)}{2}\right] - i^P$. When the firm finances with debt, the incremental value to equity is $\frac{1}{1+r}\left[\frac{\left(V^C + v^P\right) - (D + d^P)}{2} - \frac{\left(V^C - D\right)}{2}\right]$. Comparing the two, and simplifying, the present value of equity at date 1 is higher financing with debt by the amount $\left[\frac{D + d^P - \gamma(V^C + v^P)}{2(1+r)}\right]$, which is the extent of loss of rents to management from debt financing.

Case 5: $D > \gamma V^C$ and $(D + d^P) > D \geq \gamma\left(V^C + v^P\right)$. When the firm finances with equity, the incremental value to equity is $\frac{1}{1+r}\left[\frac{\left(V^C + v^P\right) - D}{2} - \frac{\left(V^C - D\right)}{2}\right] - i^P$. When it finances with debt, the incremental value to equity is $\frac{1}{1+r}\left[\frac{\left(V^C + v^P\right) - (D + d^P)}{2} - \frac{\left(V^C - D\right)}{2}\right]$. Comparing the two, and simplifying, the present value of equity at date 1 is higher financing with debt by the amount $i^P - \frac{d^P}{2(1+r)} = \frac{i^P}{2}$.

Thus in all cases, the value of old equity when financing the new project with debt is weakly higher than when financing with equity, and strictly higher when $(D + d^P) > \gamma\left(V^C + v^P\right)$. Note also that, ceteris paribus, the incremental present value to equity from debt financing increases (weakly) with legacy debt D and reaches a maximal value of $\frac{i^P}{2}$ when $D \geq \gamma\left(V^C + v^P\right)$.