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### **Institutions and Incentives to Innovate: Economic Growth and Optimal Regulation**

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**CROATIAN NATIONAL BANK**

# **Institutions and Incentives to Innovate: *Economic Growth and Optimal Regulation***

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## ***ABSTRACT***

How do institutions in place affect the incentives to innovate and take risk? The global financial crisis has generated extensive debate on the reforms of financial regulation around the world. How restrictive should regulation be? In a broader context in which innovation in the private sector imposes positive and negative externalities, the social impact of private firms and financial institutions depends on the sharing rule between their owners and the society at large. This sharing rule is governed by laws, regulations, and institutions in place. We propose a framework where the social planner puts in place a system of laws, organizational forms, and taxation within which firms optimize without invasive regulation. Since the legal regime affects the extent to which the owners of firms are held responsible for the negative externalities they impose, unlimited liability may discourage innovation in strong legal regimes. Limited liability, however, might be accompanied by excessive innovation. In this framework we consider an optimally designed structure of taxation, a menu of organizational forms, and the legal system. In this structure, firms choose their organizational forms and level of innovation consistent with private optimality, and we show that these private choices are aligned with social optimality. One implication of such equilibrium is that the corporate tax rates are a decreasing function of legal effectiveness in the embedding economy. Finally, we explore the policy implications of our results for emerging and transition economies, e.g., the effectiveness of the mechanisms used in the bailout of distressed institutions and the pace of economic growth.

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# **Institutions and Incentives to Innovate:** *Economic Growth and Optimal Regulation*

## **I. Introduction**

The global financial crisis has generated extensive debate on the reforms of financial regulation around the world. At the center of the debate has been how tight financial regulation should be. In fact, a sweeping financial regulation has recently been enacted in the US (the Dodd-Frank Act, 2010) which has sharpened this debate. The financial crisis has also drawn widespread public attention to the negative (and positive) externalities imposed on the society at large by the activities of private firms (corporations and financial institutions). Industrial accidents, such as those by the British Petroleum oil spill, have highlighted the importance of these externalities in a much broader context.

A recognition of the large impact of these firms on the society-at-large, including non-financial claimholders of these firms, have led to renewed calls for stricter regulation of their activities by policy-makers and the government. Examples of such non-financial claimholders include customers, employees, suppliers, warranty holders, insurance holders, legal claimants and others in the society-at-large who may hold existing or potential claims against the firms and financial institutions.<sup>1</sup> Passionate anti-corporation groups have painted a picture of corporations (and banks) as amoral profit maximizing institutions.<sup>2</sup> Meanwhile, in mainstream corporate finance, shareholder wealth maximization remains a central paradigm, and corporate governance mechanisms are typically geared toward this private objective. While some have argued that a failure of corporate governance mechanisms have been behind the incentive problems that led to the financial crisis, most analyses now blame the reality that the objectives of private firms

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<sup>1</sup> Thus, nonfinancial claimholders are defined broadly to include potential awardees of legal settlements resulting from future industrial accidents as well as current holders of jury claims in product liability suits.

<sup>2</sup> See for example, *The Corporation: The Pathological Pursuit of Profit and Power* by Joel Bakan or *Gangs of America: The Rise of Corporate Power and the Disabling of Democracy* by Ted Nace.

(banks and corporations) differ significantly from that of society-at-large. Even if the corporate governance mechanisms are functioning well for the capital claimants (both equity holders and debt holders), the firms may have undertaken levels of innovations and risks well above what is optimal for society at large.

In this paper we argue that the above-mentioned misalignment of objectives and the resulting deviation of private firms' risk-taking and innovation from the socially optimal levels will depend on several factors; importantly, the legal structure in place, as well as other institutions such as the extent of liability implied by the organizational form of business and the taxation of the enterprise.<sup>3</sup> For example, a corporation's concern for non-financial claimholders that have been injured by a firm is likely to depend on the ability of these claimholders to access courts and sue the corporation. In the United States, where legal structure is well developed, examples of large potential claims held by non-financial claimholders are pervasive. Product liability suits, such as those against Manville Corporation - the asbestos manufacturer; A.H. Robins; maker of the Dalkon Shield contraceptive device; and Dow Corning - maker of silicone breast implants, can potentially generate legal claims against the corporation exceeding the value of its assets and force corporations into bankruptcy.<sup>4</sup>

We propose a framework where the social planner puts in place a system of laws, a menu of organizational forms, and taxation within which private firms optimize without invasive regulation. More generally, the interests of the corporation and the society depend on the sharing rule used between the financial claimants and the non-financial claimants. In addition to the legal structure, the sharing rule between financial and non-financial claimants is critically affected by the choice of organization form - limited or unlimited liability corporation. In fact, offering limited liability rights to corporations is often cited as a landmark ruling that empowered the corporation

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<sup>3</sup> See Coase (1967) for an analysis of how transaction costs prevent the efficient outcome in such scenarios with externalities. In what follows, we assume the 'Coase Theorem' does not hold because of such transaction costs.

<sup>4</sup> The actual social costs resulting from the corporation's activities can often far outstrip the legal claims of the society against the corporation. For example, the Price-Anderson Act (Public Law 85-256) limits liability from nuclear accidents such that in some cases the legal claims against the corporation may be only a fraction of the full value of the actual social costs. Also note that negative externalities or social costs of significant magnitude are not limited to cataclysmic events, such as Chernobyl, Bhopal, and the Love Canal. Consider, for instance, the continuous and gradual release of pollution into the environment or the introduction of a new potentially toxic product (or byproduct). For various reasons, there are difficulties in the measurement,

to its “pathological pursuit of profits”.<sup>5</sup> Quite early, it had been well recognized that limited liability was a mixed blessing and the implications of limited liability - the feature that the owners are not liable for any claims greater than the value of the corporation - were widely debated (see, for example, Hunt (1937)).<sup>6</sup>

In this paper, we show how the legal structure and the organizational structure together alter the sharing rule between the owners of a corporation and the non-financial claimants and hence alter the costs (and benefits) affecting society at large. Within this framework of analyzing sharing rules between the corporate owners and the non-financial claimants, we then highlight the importance of the government owing to its claim on corporation cash flows through the tax channel. Finally, we analyze equilibrium social costs imposed by corporations when corporations choose their organizational form.

To focus on the importance of organization form, we first analyze how limited liability alters incentives of corporate owners to invest in a strong legal system that internalizes all negative externalities. Limited liability specifies a sharing rule between the non-financial claimholders and the set of all financial claimholders. This in turn affects the private incentives to innovate. In the absence of limited liability, many socially beneficial innovations might be passed up due to the threat of lawsuits while, in the presence of limited liability, the corporation might take innovation to levels that are socially undesirable. In other words, corporate limited liability may induce a degree of innovation which deviates from the socially optimal one.<sup>7</sup>

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verification, and assignment of liabilities to the corporation for chemical injuries, environmental impairment, etc. See Katzman (1986) for further discussion.

<sup>5</sup> See for example the op-ed piece “Reward but no risk” in New York Times, May 10, 2003

<sup>6</sup> In this debate, the concern for society is evident from the following observation in Hunt (1937): “There was a corporation and widespread conviction that unlimited liability was not only some safeguard against speculation, but also that general limitation, by allowing men to indulge in their spirit of adventure without endangering their fortunes would produce a sudden convulsion, a rush into all sorts of schemes [and society will be exposed to] the evils of inconsiderate enterprise and reckless speculation”.

<sup>7</sup> The existing corporate finance literature has focused on the conflict of interest among various classes of capital contributors to the corporation. The incentive effects of outstanding risky debt and the distortions in investment choices have been studied extensively. Modeling the scale or the riskiness of investment as “private” choices made by corporate insiders, it has been shown that risky debt induces underinvestment (compared to value-maximizing levels) and risk-shifting (shifting into high-risk projects even at the expense of corporation-value). See Jensen and Meckling (1976) and Myers (1977). However, even in the absence of any conflicts among holders of external financial claims, say in the case of an all-equity corporation, corporate limited liability induces conflict of interest between equity holders and non financial claimholders (and more generally society-at-large).

We then proceed to examine the role of corporate taxation in altering the sharing rule between financial owners and non-financial claimants, and thus mitigating the conflict between the corporate owners and non-financial claimants that limited liability enjoins. Corporate taxation affects a corporation's incentive to innovate through a reduction of its cash flows from a successful innovation. A lower profit in the successful state reduces the incentives of owners to innovate. Therefore, corporate taxation can be viewed as the price that corporations have to pay for limited liability, and it plays an important role in aligning the interests of non-financial claimholders and the owners of a corporation. The view that taxation can be used to control a corporation's power to abuse stakeholders was, in fact, a primary motive to introduce taxation (see, for example, Kornhauser (1990)).<sup>8</sup> Actually in President's Taft's message justifying the introduction of the corporate tax, the principal reason was that it enabled the federal government to exercise some degree of supervision, primarily by obtaining information about the business affairs of corporations, and more broadly by serving a regulatory function.<sup>9</sup>

*"While the faculty of assuming a corporate form has been of the utmost utility in the business world, it is also true that substantially all of the abuses and all of the evils which have aroused the public to the necessity of reform were made possible by the use of this very faculty".*

In the framework analyzed here, corporate taxation, in a spirit similar to President Taft's message, prevents excessive innovative activity that is socially undesirable.<sup>10</sup> The role of taxation can be thought of in the same vein as that of the government taking claims in the private firms in the bailout of failed institutions in the current financial crisis. In fact, in exchange for bailing out failing financial institutions stemming from the current crisis, the government is known to

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<sup>8</sup> See Desai, Dyck and Zingales (2007) on how this role aligned shareholders and government interests vis-a-vis the managers. In contrast, the role for taxation here exists even when managers and shareholders are perfectly aligned and is instead used to curb externalities imposed by the corporation on the society at large.

<sup>9</sup> See Avi-Yonah, 2004 for a historical discussion of corporate taxation. It is useful to note that this regulatory role of taxation was initially viewed as an information gathering role, as is evident from the low tax rate employed. We however point to a second regulatory role that taxes play through their claim on firm profits. With different accounting books - that reduce the accuracy of information gathered - and a substantially higher tax rate - that increases the government's share of profits - this second role is only likely to have become more important

<sup>10</sup> A similar point of the use of taxation to constrain managerial power has been made, more recently, by Avi-Yonah (2004) who argues that taxation reduces managerial power by (1) limiting wealth accumulation which is viewed as the foundation of managerial power and (2) the threat of tax penalties if the corporation's activities are not used for the betterment of society. In contrast, we focus on the *ex ante* effect taxation has on the investment policy that does not hinge on any threat (or attraction) of future change in tax rates.

have taken equity-like claims, such as preferred stock and warrants, as a mechanism for repaying the tax payer. However, in our framework corporate taxation and equity-like claims play a role in the prevention of future crisis by aligning the *ex ante* incentives of the private corporations with the goals of the government. We will formalize this later in our model.

We then highlight the importance of the legal regimes when corporations choose their organization form. In this analysis, we focus on the role of law in the design of corporate tax and the equilibrium social impact of corporations by endogenizing a corporations' choice of organizational form. This enables us to generate cross country comparisons in tax rates and the social costs imposed by corporations. We show that low corporate tax rates prevail in environments with strong legal protection, whereas countries with poor legal structures, on an average, have higher corporate tax rates. The intuition for the result follows from noting that taxes address residual conflicts left over from the legal system, and hence tax and legal strength are substitutes. However, whether this intuition is robust to a firm's choice of organizational form is not obvious.

To see this, note that the benefits to corporations from limited liability arise from not being liable to the legal claims that are greater than corporation value. As the legal structure gets weaker, the benefits of limited liability reduce and the corporation is willing to only pay a smaller cost. Consequently, corporations will not be willing to pay a high tax rate in poor legal structures. We find that that in all regions, where limited liability plays a role in solving the under-investment problem, the optimal tax rate is indeed feasible. We also analyze the equilibrium social costs on society by comparing this feasible tax rate with the 'first-best' tax that would align the interests of the financial and the non-financial claimants and find that the social costs imposed by corporations increases as the legal system weakens.

Finally, we provide some extensions and generalizations of the tax structure and liability structure for the firms. We exploit the substitute relationship between the firm's liability for the social costs and corporate taxes to derive additional insights. We also provide some stylized facts from cross-country data relating to indicators of judicial efficiency and the incremental tax disadvantage associated with the limited liability corporate form of organization. Consistent with our framework, the stylized facts suggest a negative relationship between this tax disadvantage

and legal strength.

This paper makes several contributions. *First*, the paper is one of the first that analyzes the sharing rule between financial claimholders and non-financial claimholders, highlighting the role of organization form, corporate taxation and legal regimes; and the interaction between these institutional features. This allows us to characterize equilibrium social costs (and benefits) imposed by corporations on society.

*Second*, the paper characterizes certain benefits and costs of corporate limited liability and shows how corporate taxation can be used to mitigate, or even eliminate, the social cost of limited liability. As a corollary, the paper provides a justification for taxing corporations. Although the corporate tax can be viewed as a tax on the corporate form of organization, in addition to a tax on personal income received by corporate claimants, it has troubled financial and public economists. Indeed, as Stiglitz (1988, p.586) notes, “most economists cannot see any strong argument for the differential tax treatment.” In our paper, corporate taxation is designed to align the incentives of limited liability corporations such that the degree to which they innovate is consistent with social optimality. In other words, corporate tax is the price that corporations pay for the benefits of limited liability.<sup>11</sup> We, therefore, provide a rationale for corporate tax as well as double taxation of dividends paid by limited liability corporations.

*Third*, the paper generates implications on how corporate taxation is related to limited liability organizations across different legal structures. In addition to generating cross-country implications, this allows us to analyze the equilibrium social costs imposed by corporations on society across different legal regimes. The implications of these results are only likely to become more important as countries, some with poor legal protection, lower corporate taxes to attract investment.

*Fourth*, our results have implications for the mechanisms that are used in the bailout of failed institutions in the current financial crisis. In many cases, the government has effectively taken ownership interests in the form of equity-like claims, and it turns out that the tax scheme that we use in the paper is isomorphic to the payoff structure of the government claims. Our analysis shows that

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<sup>11</sup> Though there has been recognition in the literature that corporate taxation may reflect the price of incorporation (Pechman(1987)), this insight has not been explored in detail.

these claims held by the government not only reduce the taxpayer's cost of the bailout *ex post* but also sets in place *ex ante* private incentives that are consistent with social optimality.

The rest of the paper is organized as follows. In section II we present the innovation policy choice of a private firm in the basic model. In section III, we analyze the investment policy under different organizational forms in the simple case of an ideally strong legal system. In section IV, we investigate the role of law. In section V, we analyze the link between law and taxes. Section VI addresses some extensions, and Section VII provides highlights some stylized facts from cross-country data. The conclusion follows.

## II. The Model

The essential aspects of how the choice of organizational form and corporate taxation interact can be captured in the following simple model.

### *A. To Innovate or Not to Innovate*

We use a two-date, single period model with  $t=0$  denoting the initial date and  $t=1$  the final date. The representative private firm in our economy invests  $I$  at date  $t=0$  in its project. At this point the firm can choose two alternative methods of implementing the project. It can use the old and tried method or the “innovative” method. The old and tried method generates normal profits with probability 1. For simplicity this normal profit is standardized to zero. On the other hand, the innovative project generates a random cash flow at  $t=1$ . When the innovation succeeds, which happens with a probability  $p$ , the resulting cash flow is high and is equal to  $H$ . When the innovation fails, which happens with a probability  $(1 - p)$ , the cash flow is low, and is equal to  $L$ . The probability of the success of innovation,  $p$ , is uniformly distributed on  $[0, 1]$  and is common knowledge at  $t=0$ . However, the realized value of  $p$  is privately observed by the firm's insider/manager at  $t=1$  before she decides whether to innovate or not.<sup>12</sup> The value of  $p$  is

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<sup>12</sup> We abstract from any agency issues between managers and the shareholders of the corporation, and the role of incentive features of managerial compensation in addressing the public-private conflict (see, for instance, John, Saunders, Senbet, 2000).

assumed to be not verifiable.<sup>13</sup> It is assumed that risk neutral valuation is appropriate for our economy.<sup>14</sup>

### ***B. Non-Financial Claimants***

While the total payoffs to the financial claimants (capital suppliers) when the innovation succeeds and fails are respectively  $H$  and  $L$ , the society at large bears externalities from the innovation. Let us assume that the costs that the society bears in the failure state are  $C_L$  and in the success state is  $C_H$ . In other words, in the bad state the non-financial claimholders bear cost  $C_L$  while in the good state, the non-financial claimholders bear a cost  $C_H$ . The innovation also has positive externalities. For simplicity, we assume that these positive externalities take the form of benefits to society-at-large, say to non-financial claimants, equal to  $B_H$  in the success state and  $B_L$  (standardized to zero) in the failure state.<sup>15</sup> Examples of positive externalities could be employment, innovation, infrastructure development etc. Importantly,  $B_H$  cannot be monetized by the private firm (the part of the benefits that can be monetized is already included in  $H$ , the cash flows in the success state).  $B_H$  represents the value as assessed by the society of the benefits from the firm innovations that cannot be monetized. The decision makers in the firm would ignore these non-monetizable benefits  $B_H$  in their decision whether or not to innovate since these are not part of the profits of the firm.

### ***C. Legal System***

The non-financial claimants can resort to the legal system to claim compensation for the social costs  $C_H$  and  $C_L$  imposed on society by the firms.. To capture this in a simple manner, we denote the strength of the legal system by  $\lambda$ ,  $0 < \lambda < 1$ . This is the fraction of the social costs ( $C_L$  or  $C_H$ ) that the corporation is held accountable for such that it is a liability of the corporation. Thus,  $\lambda C_i$  ( $i = L, H$ ) is the maximum compensation that the non-financial claimants are able to recover

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<sup>13</sup>This rules out the possibility that contracts on innovation policy stating their probability of success are not possible. Incomplete contracting is a crucial feature of our model that captures the fact that writing and enforcing contracts that specify probability of success of innovations are not feasible.

<sup>14</sup> Without any loss of generality, the riskfree rate is normalized to 0.

<sup>15</sup> More generally, let the social costs and the non-monetizable benefits in each state be  $C_i$  and  $B_i$ , where  $i$  denotes the state.

from the corporate owners through the legal channel. In an “ideal” legal regime,  $\lambda = 1$ , and the firm is held responsible for the total costs,  $C_H$  and  $C_L$ , imposed on society. However, in an extremely poor legal regime ( $\lambda = 0$ ), the corporation is not held liable for any of the social costs, and the non-financial claimants bear the entire cost of the corporation’s activities. In a given legal system  $\lambda$  that is in place, the extent to which the firm is actually made to pay up its liability  $\lambda C_i$  ( $i = L, H$ ), may further depend on its organizational form and the availability of assets and cash in the firm. A firm that is organized as a limited liability will have its legal liability limited to the extent of cash flows available in the firm. In the success state, the firm is liable for the entire liability,  $\lambda C_H$ , since  $H > \lambda C_H$ . However, in the failure state its legal liability is limited to  $L$ , the available cash flows.

### III. Organizational Form and Corporate Taxation

We now consider how the firm’s organizational form affects the innovation policy it chooses to pursue. In this section, we assume that the legal system is “ideally strong”, that is  $\lambda = 1$ . In section III, when we analyze the impact of law in the design of taxation and the corporations’ choice of organizational form, we consider the general case of legal systems of varying strengths. The case of an “ideal” legal system ensures that the non-financial claimants have recourse to the legal system to hold the firm liable for all the social costs,  $C_L$  or  $C_H$ . To focus our analysis to the interesting scenario, we will make the following assumptions.

**Assumption 1:** (a)  $C_L > L$ , and (b)  $C_H < H$ .

The assumption **1(a)**, central to our paper, states that the cash flows  $L$  in the low state are insufficient to meet the social costs  $C_L$  that the non-financial claimants have to bear. This assumption captures scenarios in which the social costs of particular products and the legal liability resulting from them exceed the value of corporate assets in the states of the world in which the innovation fails. Examples include product liability suits mentioned earlier (e.g., ADT, etc.) where the legal claims exceeded corporation value. The assumption also subsumes scenarios of industrial accidents where both the corporation and the society bear large losses. Examples include large oil spills (e.g., the British Petroleum) and large chemical accidents (e.g., the Union Carbide Bhopal accident).

The assumption **1(b)** states that social cost  $C_H$  imposed in the high state is lower than corporation value,  $H$ . In other words, the corporation has sufficient assets in place to pay out liability claims in the high state. This ensures that the corporate owners have an incentive to undertake projects with a high probability of success. For simplicity, we set  $L = 0$  in the remaining analysis. This would imply that when the innovation fails, a limited liability corporation would not be required to pay any of its legal liability  $C_L$  since its available cash flows  $L$  happen to be zero. We now characterize the socially optimal innovation policy and compare it to those of an unlimited liability firm and that of a limited liability firm.

### *A. Social Optimality*

The social planner seeks to maximize the welfare of all claimants, including the nonfinancial ones, in determining whether an innovation should be implemented. If an innovation has been implemented, and in the state it succeeds, the social planner adds up the following: the cash flows from the project (the benefits that can be monetized) equal to  $H$ , social costs  $C_H$ , and non-monetizable benefits  $B_H$ .<sup>16</sup> If an innovation has been implemented, and in the state it fails, the social planner considers the following: the cash flow from the project equal 0 and the social costs equal  $C_L$ . Therefore, the social planner, who considers all social costs and benefits, as well as all cash flows to the firm, would choose the innovation if and only if its probability of success,  $p > p_s$ . The cut-off point probability  $p_s$  is given by the following equality:

$$p_s (H - C_H + B_H) - (1 - p_s) C_L = I$$

$$p_s = \frac{(I + C_L)}{(H - C_H + B_H + C_L)} \quad (1)$$

Equation (1) characterizes the cut-off probability  $p_s$  such that the innovation should be implemented whenever  $p > p_s$ , where  $p$  is the probability that the innovation succeeds. From now on we will denote the cut-off probability  $p_s$  as the socially optimal innovation policy. Private firms may deviate from this innovation policy if they are focused on the cash flow claims of the financial claimants and do not place adequate weight on the social costs  $C_H$  or

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<sup>16</sup> In this state, the firm absorbs all the costs it imposes.

$C_L$  or the non-monetizable benefits  $B_H$ . It should be recognized that the social optimality condition is independent of the institutional structures in place: legal structure, tax structure, and organization structure. However, the relative weights that a firm may place on its after-tax cash flows, and the social costs will depend on the tax and legal regimes in place, as well as the organizational adopted by the private firm and its liability structure. In the next subsections, we examine the innovation policy that would be implemented by the private firm as a function of its organization form characterized by unlimited liability and limited liability.

### ***B. Unlimited Liability***

The owners of an unlimited liability corporation receive the cash flow  $H$  if the innovation succeeds (and have to compensate the social costs of  $C_H$ ) which happens with probability  $p$  but also face the prospect of losing  $C_L$ , the value of legal claims in the low state. This assumes that the corporation owner is personally responsible for the full extent of the legal claims.<sup>17</sup> Since the owners are liable, they choose to invest if  $p(H - C_H) - (1 - p)C_L > I$ . Therefore, the unlimited liability corporation will innovate only when its success probability

$p > p_N$ , where

$$p_N = \frac{(I + C_L)}{(H - C_H + C_L)} \quad (2)$$

Comparing  $p_N$ , the cut-off probability for the unlimited liability firm in equation (2) with  $p_s$ , the socially optimal cut-off probability in equation (1) we find that  $p_N > p_s$ , since the denominator in equation (2) is smaller. Consequently, relative to the socially optimal innovation policy an unlimited liability firm innovates too little. The reason that the unlimited liability corporation is cautious is because it accounts for the potential liability claims via the legal system but does not account for (or internalize) the non-monetizable benefits  $B_H$  to society that its innovation generates.

### ***C. Limited Liability***

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<sup>17</sup> Thus, here we assume that the aggregate personal wealth of the owners of the firm is sufficient to meet these legal claims. See section 6 for a discussion of the case where this assumption is relaxed.

We now consider the innovation policy of a corporation with limited liability. Similar to the case of unlimited liability corporations, the owners of a limited liability corporation receive the cash flow  $H$  in case of a successful innovation (and have to compensate the social costs of  $C_H$ ) with probability  $p$ . However, unlike in an unlimited liability corporation, the owners of a limited liability corporation can walk away from the legal claims  $C_L$  by non-financial claimants in case of a failure of an implemented innovation. Therefore, the limited liability firm chooses to innovate if  $p(H - C_H) > I$ . Equivalently, the limited liability corporation innovates whenever the success probability of its innovation  $p$  is such that  $p > p_L$ , where

$$p_L = \frac{I}{(H - C_H)} \quad (3)$$

Comparing  $p_L$  with  $p_N$ , the cutoff probability for the unlimited liability firm, we find that the limited liability corporation innovates more often than the unlimited liability corporation. This is because the limited liability corporation does not consider the costs  $C_L$  it imposes on society in case of a failure of its innovation. Both the unlimited liability firm and the limited liability corporation fails to consider the positive externalities (the non-monetizable benefits)  $B_H$  on society. To see the social desirability of this innovation policy, we compare the expressions for  $p_s$  in equation (1) and that for  $p_L$  in equation (3). We find that the limited liability corporation innovates too often relative to the socially desirable level if the private benefit-cost ratio exceeds the social benefit-cost ratio as characterized by the following condition.

$$\frac{(H - C_H - I)}{I} > \frac{B_H}{C_L}$$

The condition states that the gain-to-loss ratio of financial claimholders should be greater than the benefit-cost of the nonfinancial claimholders. We will adopt the above condition as a maintained assumption for the rest of the paper.<sup>18</sup> That is,

**Assumption 2:**  $\frac{(H - C_H - I)}{I} > \frac{B_H}{C_L}$

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<sup>18</sup> The gain to loss ratio can also be balanced through an appropriate design of limited liability, particularly through limitation on liability or partial liability. This approach is analyzed in section V.

Thus, while the limited liability corporation innovates more than the overly cautious unlimited liability corporation, it can innovate to an excessive degree imposing large social costs. Comparing equations (1), (2), and (3), we obtain the following result.

**Proposition 1**

*For  $B_H > 0$ , the unlimited liability corporation innovates less relative to the socially optimal level. For  $C_L > 0$ , the limited liability corporation innovates more than the unlimited liability firm. Under Assumption 2, i.e., for  $\frac{H - C_H - I}{I} > \frac{B_H}{C_L}$ , the limited liability corporation innovates more relative to the socially optimal level*

*Proof: See Appendix.*

The difference in the innovation policy of the unlimited liability firm compared to the socially optimal innovation policy arises from the fact that the private unlimited liability firm fails to take into account the positive externalities (the non-monetizable benefits)  $B_H$  on society. This leads to less innovation on the part of the unlimited liability firm with respect to the benchmark of social optimality. The limited liability firm also fails to take into account the positive externalities (the non-monetizable benefits)  $B_H$  on society. In addition, the limited liability firm ignores the costs  $C_L$  it imposes on society in case of failure. The trade-off of  $B_H$  versus  $C_L$  will determine whether the limited liability firm will innovate less or more compared to the socially optimal benchmark.

Under Assumption 2, for  $\frac{H - C_H - I}{I} > \frac{B_H}{C_L}$ , the effect of  $C_L$  dominates that of  $B_H$  and the limited liability firm innovates more than the socially optimal benchmark.

So far our analysis has focused on the effects of the organizational structure on the innovation policy choices by private firms. We now consider how these policies are impacted by the two institutional structures, namely the tax system and the legal structure.

***D. The Role of Corporate Taxation***

In this section, we highlight the role of corporate taxation in mitigating the conflict between the corporate owners and non-financial claimants that limited liability enjoins. We show that corporate taxation affects a corporations' incentive to innovate by reducing its cash flows from a successful innovation.<sup>19</sup> Therefore, corporate taxation can be viewed as the price that corporations have to be pay for limited liability.

Corporate taxation introduces an additional claimholder (the government) to the corporations' cash flows and hence alters the sharing rule between the corporate owners and the non-financial claimholders. Let the corporate tax rate be  $T$ . When the innovation succeeds, the corporate owners now only receive  $(H - C_H)(1 - T)$ . In the failure state, the owners of the limited liability corporation can walk away from any claims exceeding cash flows by non-financial claimants and do not pay any taxes.

Therefore, in the presence of taxation, the limited liability corporation chooses to invest if

$$p(H - C_H)(1 - T) > I$$

With corporate taxation, the limited liability corporation implements innovations whenever its success probability  $p > p_T$ , where

$$p_T = \frac{I}{(H - C_H)(1 - T)} \tag{4}$$

Comparing equation (3) with equation (4)), it can be seen that  $p_T$  is greater than  $p_L$  for any positive corporate tax rate  $T$ , since the denominator in equation (4) is smaller than that in equation (3). In other words, for any  $T > 0$ , the firm innovates less relative to the taxless scenario. This incentive to reduce innovation now can now counterbalance the incentive to increase innovation due to corporate limited liability. The tax rate,  $T$ , can then be chosen such that  $p_T$  is equal to  $p_s$ , the socially optimal innovation level. Proposition 2 characterizes such an optimal tax rate  $T^*$ . When Assumption 2 holds, there is a wedge between the private benefit-cost ratio of the financial claimholders and the social benefit-cost ratio of the non-financial claimholders. Define this wedge

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<sup>19</sup> If debt is tax deductible, taxation also increases the tax advantages of risky debt. A higher debt in the capital structure may also reduce incentives of owners to invest in risky innovative projects. This is explored further in Section VI.

as  $\Phi$ , where  $\Phi$  is:

$$\Phi = \frac{(H - C_H - I)}{I} - \frac{B_H}{C_L}$$

Assumption 2 implies that  $\Phi > 0$ . For any positive tax rate  $T$ , this wedge narrows since

$$\Phi(T) = \frac{(H - C_H)(1 - T) - I}{I} - \frac{B_H}{C_L}$$

will be smaller. A tax rate  $T^*$  such that  $\Phi(T^*) = 0$  would induce an innovation policy by the limited liability corporation that coincides with the socially optimal innovation policy. Such a tax rate  $T^*$  has a simple characterization.

### Proposition 2

For the tax rate of  $T^* = \left[ 1 - p_L \left( \frac{B_H}{C_L} + 1 \right) \right]$  the innovation policy of the corporation is identical to

the socially optimal innovation policy. This tax rate  $T^*$  is increasing in  $\Phi$  (the wedge between the private benefit-cost ratio of the financial claimholders and the social benefit-cost ratio of the non-financial claimholders) and  $C_L$ . This tax rate  $T^*$  is decreasing in  $p_L$  and  $B_H$ .

Proof: See Appendix.

**Policy remarks:** The optimal rate of taxation  $T^*$  applied to the profits in the successful state alters the *ex ante* innovation incentives of limited liability corporations to be in line with social optimality. The role of taxation can be viewed in the same manner as the government taking claims in the private firms in the current financial crisis. The government, in exchange for bailing out failing financial institutions, is known to have taken equity-like claims, such as preferred stock and warrants, as a mechanism for repaying the tax payer. In this respect, we wish to make two observations. First, taxation of profitable states works in a fashion similar to holding equity or warrants in the private firms in a setting of *ex post* resolution of crisis. Second, corporate taxation has *ex ante* incentive effects, since as we show, it can play a role in realigning the incentives of private firms with the goals of the government. Interestingly, taxation plays such a role even in good times, and unlike equity claims in the bailout schemes, it does not entail voting rights for the government. Thus, incentives are realigned in the right

way without mandating specific innovation levels through invasive regulation.

#### **IV. Law and Organizational Form**

In this section, we highlight the role of legal strength in altering the sharing rule between firm owners and other stakeholders. We assumed an “idealized legal system” ( $\lambda = 1$ ) in the previous section. We now analyze the general case of a legal system  $\lambda, 0 < \lambda < 1$ , in the embedding economy. In particular, we will characterize the corporate innovation policies and the optimal tax structure as a function of the legal system  $\lambda$ .

##### **A. Social Optimality**

Since the social planner seeks to maximize the welfare of all claimants, any payoffs that the non-financial claimants receive through the legal structure are simply transfers and do not affect the optimality of the social planner’s problem. The legal structure impacts the social planner’s problem only through the corporation’s innovation choices which in turn may be influenced by the payoffs to nonfinancial claimholders. Thus, the socially optimal innovation policy is the same as before and all projects with probability of success,  $p > p_s$ , should be accepted where  $p_s$  is given by the following equality.

$$p_s(H - C_H + B_H) - (1 - p_s)C_L = I$$

$$p_s = \frac{C_L + I}{H - C_H + B_H + C_L} \tag{5}$$

##### **B. Unlimited Liability**

The owners of an unlimited liability firm now face the prospect of gaining  $(H - C_H\lambda)$  in the case of a successful innovation but also face the prospect of losing  $C_L\lambda$ , the value of legal claims in the case of a failed innovation. Since the owners are liable, they choose to innovate whenever  $p(H - C_H\lambda) - (1 - p)C_L\lambda > I$ . Therefore, the unlimited liability firm implements all innovations that have a success probability  $p > p_N(\lambda)$ , where

$$p_N(\lambda) = \frac{\lambda C_L + I}{H - C_H \lambda + C_L \lambda} \quad (6)$$

From equation (2) of section III B,  $p_N > p_s$  for  $\lambda = 1$ . As  $\lambda$  increases,  $p_N$  increases and hence the corporation's innovation policy becomes more conservative. Similarly as  $\lambda$  decreases, the legal system weakens and the innovation incentives become more aggressive. Therefore, for a particular level of legal strength,  $\lambda = \lambda^*$ , the corporation's innovation policy is identical to the socially optimal innovation policy. This level of legal strength,  $\lambda^*$ , is given by

$$\frac{\lambda^* C_L + I}{H - \lambda^* (C_H - C_L)} = \frac{C_L + I}{H - C_H + B_H + C_L}$$

For legal regimes weaker than this specified level  $\lambda^*$ ,  $p_N(\lambda) < p_s$ , the unlimited liability firms will innovate more aggressively than the socially optimal level. To the extent the limited liability form serves to make the innovation policy more aggressive, there would then be no role for limited liability in case when the legal system is weak ( $\lambda < \lambda^*$ ). We note this observation below.

**Lemma 1** For all  $\lambda \in [0, \lambda^*]$ ,  $p_N(\lambda) < p_s$ , the unlimited liability firm innovates more aggressively than the socially optimal level.

### C. Limited Liability

We now consider the innovation policy of a corporation with limited liability. Similar to the case of unlimited liability corporations, the owners of a limited liability corporation face the prospect of gaining  $(H - C_H \lambda)$  in case of a successful innovation. However, unlike in unlimited liability corporations, the owners of a limited liability corporation can walk away from any claims by non-financial claimants in case of innovation failure. Therefore, the limited liability corporation chooses to innovate whenever the success probability  $p(H - C_H \lambda) > I$ . Thus, the limited liability corporation implements all innovations with success probability  $p > p_L(\lambda)$ , where

$$p_L(\lambda) = \frac{I}{H - C_H \lambda} \quad (7)$$

### **Proposition 3**

*The increased incentive to innovate due to limited liability represented by  $(p_N(\lambda) - p_L(\lambda))$  is an increasing function of the legal strength,  $\lambda$ .*

Proof: See Appendix.

To see the above result note that, similar to the innovation policy of an unlimited liability firm ( $p_N(\lambda)$ ), the innovation policy of the limited liability firm also gets progressively more conservative as legal strength increases. However, unlike the unlimited liability firm, this increased caution arises only from the lost claims in the good state ( $\lambda C_H$ ) and not from any higher losses in the low state. Thus the difference between the relative incentives to innovate increases as legal strength increases. Figure 1 summarizes the innovation policies of the unlimited liability and limited liability firms.

## **V. Law and Corporate Taxation**

We now proceed to examine the role of law in the design of corporate tax and the equilibrium social impact of corporations. To do so, we endogenize the corporations' choice of organizational form.

### **A. The Corporation's Choice of Organization Form**

Firm owners benefit from limited liability as it allows them to walk away from the social costs they impose in excess of the corporation cash flows (corresponding to the low state in the model considered). However, in the presence of corporate taxation, this benefit comes at a price. In this subsection, we consider the corporation's choice of organizational form, given the above tradeoff. In a regime with legal strength  $\lambda$  and corporate tax  $T$ , the owners of a limited liability corporation receive  $H(\lambda)(1 - T)$  when the innovation succeeds and 0 in the low state, where  $H(\lambda) = (H - \lambda C_H)$ .

Therefore, the value of a limited liability corporation is

$$V_L = \int_{p_L(\lambda, T)}^1 [H(\lambda)(1-T)p - I] dp.$$

$$\text{where } p_L(\lambda, T) = \frac{I}{H(\lambda)(1-T)}$$

As in the case of a limited liability corporation, owners of an unlimited liability corporation receive  $H(\lambda)$  in the success state but now also pay  $\lambda C_L$  in the failure state. Therefore, the value of an unlimited liability corporation is

$$V_N = \int_{p_N(\lambda)}^1 [H(\lambda)p - \lambda C_L(1-p) - I] dp, \text{ where } p_N(\lambda) = \frac{I + \lambda C_L}{H(\lambda) + \lambda C_L}$$

Consequently, a corporation will choose to be a limited liability corporation if  $V_L > V_N$ . This leads to the following equivalent condition:

$$\frac{H(\lambda)(H(\lambda) - I)^2}{H(\lambda) + C_L \lambda} < \frac{[H(\lambda)(1-T) - I]^2}{(1-T)} \quad (8)$$

The following proposition arises from an investigation of this condition.

**Proposition 4**

*For each  $\lambda$ , there exists a tax rate,  $\hat{T}$ , such that a corporation is indifferent between remaining an unlimited liability organization and choosing a limited liability organizational form. For all tax rates lower than  $\hat{T}$ , the corporation will choose to be a limited liability organization. Further,  $\hat{T}(\lambda)$  is an increasing function of the legal strength,  $\lambda$ , in the economy.*

Proof: See Appendix.

The tax rate  $\hat{T}(\lambda)$  at which corporations are indifferent between the two organizational forms is a function of the strength of the legal regime  $\lambda$ . This is because of the benefits to limited liability is a function of the strength of the legal regime  $\lambda$ . As the strength of the legal regime increases, the threat of being held responsible for negative externalities increases. Limited liability thus

provides greater benefits now and consequently corporations are willing to pay a higher tax and yet opt for limited liability. Thus the benefits of limited liability increase as legal strength increases. In the extreme scenario of poor legal strength ( $\lambda = 0$ ), the corporation derives no benefits from limited liability. Therefore, only for a corporate tax rate of 0 the corporation is indifferent between the organizational forms, i.e.,  $\hat{T}(\lambda = 0) = 0$ ; for any positive tax rate, given poor legal strength ( $\lambda = 0$ ), the firm prefers to be an unlimited liability organization, i.e.,  $\hat{T}(\lambda = 0) > 0$ . More generally, the tax rate at which the corporation is indifferent between the two organizational forms  $\hat{T}(\lambda)$  is increasing with the legal strength,  $\lambda$ .

## B. Design of Corporate Taxation

Having specified a condition that captures the corporations' choice of organization form as a response to the legal structure and corporate taxation, we can now proceed to solve for the tax rate that maximizes social welfare. For an economy of legal strength  $\lambda > \lambda^*$ , the tax rate has to accomplish two objectives: (1) The tax rate has to provide incentives for the firm to adopt a limited liability organizational form, i.e., it has to be lower than  $\hat{T}(\lambda)$  (as stated in Proposition(4)), and (2) The optimal tax rate would be able to induce the limited liability firm to innovate according to the socially optimal innovation policy given by equation (5) (i.e., align the innovation policy of the limited liability firm's innovation policy with the socially optimal innovation policy). Before we prove that such a tax rate exists, it is useful to note an important implication of our framework.

**Proposition 5** *The socially optimal tax rate  $T_s(\lambda)$ , that induces the limited liability firm to innovate according to the socially optimal innovation policy, is a decreasing function of the legal strength,  $\lambda$ .*

Proof: See Appendix.

The socially optimal tax rate  $T_s(\lambda)$ , that would induce the socially optimal innovation level, is decreasing with the legal strength. This result follows from the ability of the legal regime to hold the firm responsible for negative externalities in the good state. Having chosen a limited liability organizational form, a corporation is less likely to follow an overly aggressive innovation

policy in better legal regimes since the corporation stands to lose more from lawsuits in the good state. The required corporate taxation needed to align the interests of the financial and the non-financial claimants is hence lower. In other words, law and taxes act as potential substitute instruments for the social planner, whose problem we now consider.<sup>20</sup> In other words, the tax penalty that needs to be imposed on the limited liability firms to curb their excessive innovation (compared to the socially optimal benchmark) is smaller in a stronger (higher  $\lambda$ ) legal system.

As a final issue, we just need to check that the socially optimal tax rate  $T_s(\lambda)$  is indeed lower than the tax rate that makes firms indifferent between the two organizational forms. Formally, the social planner would choose a tax rate to maximize social welfare (as defined in Section IIIA) over all viable tax rates subject the following conditions. As we have discussed earlier, the condition,  $T < \hat{T}$ , is necessary such that the firms would optimally choose the limited liability organizational form. The second condition is that projects be viable and hence taxes not be onerous; that is,  $T < \left[1 - \frac{I}{H(\lambda)}\right]$ . If this condition is violated, the limited liability firms would never innovate, and the project is not viable. In other words, the social planner's design of the optimal tax rate can be characterized as follows.

$$S_L^* = \max_T \int_{p_L}^1 \left[ (H - C_H + B_H) p - C_L (I - p) - I \right] dp.$$

$$\text{such that } T < \hat{T} \text{ and } T < \left[1 - \frac{I}{H(\lambda)}\right]$$

The following proposition summarizes the choice of corporate taxation.

### **Proposition 6**

*The optimal corporate tax rate depends on  $\lambda$ , the strength of the legal regime. For all  $\lambda < \lambda^*$  the optimal tax rate is zero and unlimited liability firms do not under invest. For all  $\lambda > \lambda^*$ , where*

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<sup>20</sup> Law and taxes, however, might not be substitutes in use, since corporations' choices respond to the legal environment. For example, when law is weak, a corporation will not choose limited liability form for any tax rate greater than 0, thus taxes cannot be increased to compensate for poor legal regimes. Consequently, this argument for the inability to 'use' law and taxes as substitutes is not because tax enforcement is a function of legal strength.

*the excessive innovation problem associated with limited liability exists, the optimal tax rate is equal to the socially desirable tax rate (analogous to Proposition 2) and induces innovation at the socially optimal level.*

Proof: See Appendix.

The proposition above states that, for strong legal structures ( $\lambda \geq \lambda^*$ ) the tax rate can be set to the socially desirable tax rate; corporations will still opt for limited liability and innovate at the socially optimal levels. The outcomes of organizational form and corporate taxation can therefore be grouped into two distinct regions based on legal strength. The first region is characterized by weak legal strength. This region corresponds to the region where  $\lambda < \lambda^*$  in Figure 2. Here there is no need for corporate taxation. The second is a region of limited liability and corporate taxation where the socially optimal innovation policy is observed. This occurs in stronger legal regimes ( $\lambda \geq \lambda^*$ ). It is interesting to note that the optimal corporate tax rate, when greater than 0, is decreasing with the legal regime. However, in countries with very weak legal regimes the optimal tax rate is 0.

### **C. Social Impact**

It is often suggested that corporations are responsible for social harm and that they do not internalize externalities on society. However, we take the perspective of the social planner who focuses on the optimal tradeoff between the negative and positive externalities of corporate activities. In this section, we investigate the equilibrium social impact in different legal structures. Based on the results in the previous subsections, we know that the socially optimal innovation policy is achieved when legal strength is above  $\lambda^*$  (see proposition 5). For all  $\lambda < \lambda^*$ , the social welfare is lower because of too much innovation.

**Proposition 7** *Social welfare is increasing with legal strength for all  $\lambda < \lambda^*$  and at its maximal level for  $\lambda \geq \lambda^*$ .*

Proof: See Appendix.

This follows from noting that when legal structures are strong (i.e.,  $\lambda \geq \lambda^*$ ), taxation can be

used to align the interests of financial and non-financial groups and consequently the social welfare is maximized. For weak legal regimes,  $\lambda < \lambda^*$ , limited liability and taxes do not play a role. It is also interesting to note that the negative externalities imposed are also higher with better legal strength. These are, of course, internalized by the corporation through courts but this might shed light on why there exists an anti-corporation sentiment even in countries such as the United States. By simply having a greater number of cases that appear before courts, the negative externalities are also more publicized. The positive externalities are less visible and are precisely the benefits that poor legal regimes give up.

## VI. Extensions

In this section, we discuss some issues related to the central analysis of the paper that have been ignored in the basic models thus far. We begin with the impact of personal wealth on the results outlined in the paper.

### A. Personal Wealth

In this subsection we highlight the impact of the owners' wealth on the benefits and costs of limited liability. Wealth constraints at the corporation owner level can reduce the effective liability of unlimited liability corporations. For example, corporate owners who have no personal wealth are automatically liable for only the corporations' cash flows. More specifically, if the owners combined personal  $W$  is such that:

$$0 < W < C_L \lambda, \tag{9}$$

the costs that the unlimited liability corporation internalizes is now not  $C_L \lambda$  but only  $W$ .<sup>21</sup>

Therefore, the benefits of opting for limited liability decrease as corporate owners are less wealthy. Therefore, the tax rate  $\hat{T}$  at which the firm owner is indifferent between remaining as an unlimited liability organizational form and the limited liability organizational form is declining in  $W$ . Hence, poorer owners are more likely to remain as unlimited liability firms. Effectively then, deficiencies in personal wealth limit the legal liability and reduce the benefits

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<sup>21</sup> The use of non-pecuniary forms of punishment, such as imprisonment, to hold the firm owners responsible would, however, reduce the importance of personal wealth.

of corporate limited liability. Further, it can be seen from (9) that, for a given  $W$ , the constraint on personal wealth is less likely to be relevant in weaker legal regimes. Thus, the effect of personal wealth in determining the choice between limited or unlimited liability is lower in weaker legal regimes.

## B. Limitation of Liability: Generalization

In our model,  $\lambda$ , the strength of the legal system determines the fraction of the social costs  $C_H$  and  $C_L$  accountable to the firms. Thus,  $\lambda C_i$  ( $i = L, H$ ) is the maximum compensation that the non-financial claimants are able to recover from the corporate owners through the legal channel. We have also assumed that the strength of the legal system ( $\lambda$ ) in place is exogenously given. However, the extent to which the firm is actually obligated to pay up its liability  $\lambda C_i$  ( $i = L, H$ ) may further depend on its organizational form and the availability of assets and cash in the firm. The firm, that is organized as a limited liability corporation, will have its legal liability limited to the extent of cash flows available in the firm. In our case, the firm is liable for the entire liability,  $\lambda C_H$ , since  $H > \lambda C_H$ . However, in the failure state its legal liability is limited to the available cash flows which was assumed to be equal to zero. On the other hand, an unlimited liability organization in the same economy would be held liable for  $\lambda C_H$  in the good state and  $\lambda C_L$  in the failure state.

These specifications of the two organizational forms can be thought of two particular ways of defining liability for firms depending on their choice of organizational form. More generally, the social planner can assign to a particular organizational form a liability structure defined as follows:  $[f_H C_H, f_L C_L]$ . Here the firm is responsible for a liability  $f_H C_H$  in the success state and  $f_L C_L$  in the failure state. More importantly, the social planner can set the fractions  $f_H$  and  $f_L$  different from  $\lambda$ , the legal strength in the economy (i.e.,  $f_H \neq \lambda$ ,  $f_L \neq \lambda$ ,  $f_H \neq f_L$ ). The social planner can choose  $(f_H, f_L)$  pairs optimally such that the firm operating in that organizational form would pursue an innovation policy consistent with social optimality.

Some special cases of the above general definition of limitation of liability is of particular interest. In any given system  $\lambda$ ,  $f_H = f_L = \lambda$ , simply represents the unlimited liability organizational form

that we have discussed in the earlier parts of the paper (Sections IV and V). Similarly,  $f_H = \lambda$  and  $f_L = 0$ , corresponds to the limited liability organizational form, with the attendant corporate taxation of  $T_s$ . In Proposition 6 we show that, given this liability structure and the corporate tax rate  $T_s$ , the firm would innovate at the socially optimal level. Interestingly, the reader can verify that the firm with the liability structure  $f_H = (\lambda + T_s)$  would also innovate at the socially optimal level. Instead of using taxation to curb the aggressive innovation policy of the limited liability firm, the social planner can use a more punitive liability structure to restrain the limited liability firm so that it innovates at the socially optimal level. Using the extent of liability,  $f_H = (\lambda + T_s) > \lambda$ , corresponds to a legal system in which punitive damages are imposed on firms that may exceed the realized social costs in the successful state. This is similar to double taxation in the profitable state, which can be thought of the price of limited liability enjoyed by the firm in the failure state.

Now consider the liability structure,  $0 < f_H < \lambda$ , and  $f_L = 0$ . In this case, in addition to the conventional limitation of liability in the failure state, the firm's liability in the successful state is capped at  $f_H C_H$  which is less than  $\lambda C_H$ . Examples of such a limitation of liabilities would be appropriate in industries where the social benefit ( $B_H$ ) is so large such that Assumption 2 (Section III.C) is violated. When Assumption 2 is violated, the limited liability firm no longer overinvests, but actually becomes unduly conservative and innovates less than the socially optimal level. The limitation of liability in the profitable state (in addition to the limited liability in the failure state) can be thought of as an added inducement to move the firm toward the socially optimal policy. For example, the Price-Anderson Act (public law 85-256) limits liability from nuclear accidents (see footnote 4 for details).

Another important case of limitation of liability is suggested by our result in section V (B), that in a legal regime,  $\lambda = \lambda^*$ , the unlimited liability firm would innovate at the socially optimal level. As mentioned earlier, the low level of liabilities attributed to the firm in a weak legal regime makes up for the fact that it ignores  $B_H$ , the non-monetizable social benefits. This opens up the possibility that the social planner can hold the firms responsible for a fraction  $f$  of the social costs which is lower than the fraction  $\lambda$  of the social costs that would be attributed to the firm by the legal system in place. The objective of pursuing such a lenient liability structure would be

to induce firms to pursue a more aggressive innovation policy, consistent with social optimality.

Consider the following liability structure in an economy with legal strength  $\lambda$ :  $f_H = f_L = \lambda^* < \lambda$ . In other words, the corporation is held responsible for only a fraction  $f$  of the costs it imposes, such that

$$p_s = \frac{C_L + I}{H - C_H + B_H - C_L} = p_N(f) = \frac{fC_L + I}{H - fC_H + fC_L} \quad (10)$$

Under this liability structure, when  $f$  is chosen as in equation (10), the innovation policy of the firm will be equal to the socially optimal level. The innovation policy in the limited liability firm is too conservative because the owners consider only the costs they impose on society and not the benefits. In the proposed liability structure the firm's incentives to innovate are realigned with social optimality by limiting its liability to only a fraction  $f$  (as optimally set in equation 10) of the social costs in both the success and failure states of the world.

### C. Heterogeneous Firms

Finally, we discuss the impact of enriching our framework from the case of a representative corporation to that of heterogeneous corporations. The socially optimal innovation policy can be characterized as (for a single corporation economy)

$$p_s(i) = \frac{C_L(i) + I}{H - C_H(i) + B_H(i) + C_L(i)}$$

Consider an economy with multiple technologies and allowances for innovation based tax deductions  $D_i$  (e.g., depreciation). Consistent with observed tax corporate tax systems, the economy can then be characterized by a uniform corporate tax code with constant tax rates but deductions varying across sectors.<sup>22</sup> The tax-induced optimal innovation policy for the limited liability corporation is then:

$$p_i(H_i - C_H(i) - T(H_i - D_i)) > I \rightarrow$$

$$p_i = \frac{I}{[H_i - C_H(i)](I - T) + TD_i} < \frac{I}{(H_i - C_H(i))(I - T)} \quad (11)$$

<sup>22</sup> See John, Senbet and Sundaram (1993) on why there the tax code should be uniform.

From (11), it can be seen that the limited liability corporations innovates more in the presence of tax deductions. The increased innovation level can now be compared to that of the socially optimal level to get

$$\frac{I}{[H_i - C_H(i)](I - T) + TD_i} = \frac{I + C_L(i)}{H_i - C_H(i) + B_H(i) + C_L(i)} \rightarrow$$

$$\frac{T(H_i - C_H(i) - D_i)}{H_i - C_H(i)} = 1 - \frac{I(H_i - C_H(i) + B_H(i) + C_L(i))}{(I + C_L(i))H_i} \quad (12)$$

Proposition 2 can now be stated in an alternative form for the corporation/sector specific case; namely that there exists a uniform corporate tax rate  $T$  and a corporation-specific depreciation deduction  $D_i$  that replicates the corporation-specific socially optimal tax rate ( $T_s(i)$ ).

$$T_s(i) = \frac{T(H_i - C_H(i) - D_i)}{H_i} = T \left( I - \frac{D_i}{H_i - C_H(i)} \right) \quad (13)$$

it is also clear that  $D_i$  is unique for a given  $T$ , and vice-versa. Thus, for a given uniform corporate tax rate  $T$ , there exists a socially optimal corporation/sector-specific depreciation rate that replicates the socially optimal tax rate. Thus, the design of uniform corporate tax system calls for an economy-wide  $T$  that is at least equal to  $\max T_s(i)$  (for all  $i$ ) and setting the corresponding corporation-sector specific deduction  $D_i$  that satisfies

$$D_s(i) = [H_i - C_H(i)] \frac{[I - T_s(i)]}{T} \quad (14)$$

This expression also sheds light on the social impact of an observed and much analyzed tax deduction - that due to debt. While the deductibility feature encourages investments, debt also has an associated underinvestment incentive in the presence of the stockholder-bondholder conflict (Myers, 1977). To the extent that debt controls investment, it curtails the overinvestment effect of corporate limited liability, thus requiring a lower tax rate.

Consequently, to the extent higher debt is associated with a conservative investment policy, tax deductions based on debt are only consistent with the presented framework. We however note that although the underinvestment problem due to debt is now well known (see Berger and Ofek (1997) for supporting evidence) and might also be more difficult to constrain through covenants, the

importance of this underinvestment effect due to debt might differ in magnitude from the overinvestment effect of limited liability.<sup>23</sup> To the extent these two effects are comparable, this might provide a rationale for why a random security that has a payoff structure resembling a loan is provided tax shields.

Finally, the paper also shows that the conflict between various financial claimholders (bondholders and equityholders) can help align the interests of the corporate owners and the non-financial claimants. To this end, the paper justifies a feature of corporate taxation that has often been questioned tax deductibility of debt. Although the consequences of the tax advantage of debt over equity have been studied widely in financial economics, the rationale for it seems to have received little attention. Why would the taxing authority grant tax advantage to one type of claims over others? Is it optimal, in any sense, for the social planner to selectively encourage the use of claims with the pay-off structure of debt? In this paper, we provide a rationale as to why it may make sense from the perspective of social optimality to encourage corporations to use external claims with the debt pay-off structure. By providing incentives to issue debt, the conflict between shareholders and the non-financial claimants are reduced.<sup>24</sup>

## **VII. Legal Systems and Taxes on Corporate Form: Some Stylized Facts**

In this section, we provide some stylized facts that are consistent with one of the predictions of the model, i.e., the negative relationship between the strength of the legal system and the degree of the entity level taxation of the corporate form (as characterized by Proposition 5). We utilize two main data sources for this purpose. We use data from Djankov, La porta, Lopez-Silanes and Shleifer (2003) on the efficiency of courts. We utilize four different measures of judicial efficiency in business disputes, especially in the absence of formal contracts. We use them to proxy for the ease with which non-financial stakeholders can resort to the legal channel for any negative externalities imposed on them.

The first measure captures the extent to which the legal system is honest and uncorrupt (`hon_unc`).

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<sup>23</sup> See Myers (1977) for a discussion of under investment.

<sup>24</sup> The impact of financing decisions on the claims of nonfinancial claimholders has also been examined in Titman (1984), Fama (1985) and Cornell and Shapiro (1986). However, to our knowledge, ours is the first paper to examine the role of corporate taxes and organizational form in aligning the interests of non-financial claimants and financial owners.

The second measure captures how affordable the legal system is (affordable); the third deals with whether the court system is consistent (consistent) and the fourth measures the extent of public confidence in the legal system (confidence). We normalize each of these measures to derive a measure between 0 and 1 and then create an index (LEGAL) that adds these four measures (legal strength) for 44 different countries. The index has a mean value of 2.2, with a minimum value of 1.57 and a maximum value of 3.32.

We then utilize tax information from the data compiled by La Porta, Lopez-Silanes, Shleifer and Vishny (1999, henceforth LLSV). LLSV (1999) have compiled data on the personal taxes on capital gains and corporate payouts, which allow us to measure the effective tax penalty to corporate form of organization. Assuming that corporate income is taxed nominally at the same rate as other forms of business income (e.g., partnership income), we can compute the effective tax disadvantage of corporate form based on personal taxes on corporate payouts versus capital gains. . To compute this tax disadvantage, we simply use a transformation of the variable in LLSV(1999). The variable used by LLSV is a ratio of post-tax income that one gets from a pre-tax dollar paid out by corporations to the income that one gets from a pre-tax dollar of capital gains (RATIO).<sup>25</sup> We define tax disadvantage of limited liability to be  $TAXDISADV = 1 - \text{RATIO}$ .

Using the data available for the 32 countries, we can already make some observations that are consistent with our framework. First, there is a distinct tax disadvantage on corporate payouts, and the average value for the TAXDISADV is 20%. We now proceed to check if the tax disadvantage is indeed lower in stronger legal regimes. The correlation between our index of legal strength and the tax disadvantage is -0.13.<sup>26</sup> As an indicator of the economic importance of this variable, it is useful to note that the coefficient on the civil status variable is also -0.17. That civil law countries have a lower tax disadvantage is also interesting in its own right. To the extent that the governments in civil law countries use other mechanisms to obtain a more stakeholder oriented society, such lower tax disadvantages are consistent.

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<sup>25</sup> For more details, see La Porta, Lopez-Silanes, Shleifer and Vishny (2000). Note that in the construction of this variable (RATIO), the authors have taken into account imputation taxes.

<sup>26</sup> While we do not conduct a formal empirical analysis, a preliminary regression of the tax disadvantage on this index (LEGAL), civil law status and GDP, the coefficient on legal strength (LEGAL) is -0.17, and significant at the 10% level. A limitation of this regression is the use of only 19 observations. The R-squared is 25%.

To check which aspect of the legal strength is more important, we also check the correlation between the tax disadvantage (TAXDISADV) and each of the four legal measures. We find that in each case the correlation between the tax disadvantage (TAXDISADV) and the measure is negative: -0.02 (for confidence), -0.07 (for honest and uncorrupt), -0.10 (for consistent) and -0.30 (for affordable). Although these results are only suggestive, and hence presented as stylized facts, they are consistent with one of our central results (Proposition 5) and thus the framework.

We now deviate from an investigation of law to further shed light on our conjecture - that corporate taxes play a role in mitigating conflict between shareholders and other stakeholders. We characterize two conditions when such conflict is likely to be higher. The first deals with the accounting standards in the country. In the absence of high standards that force firms to reveal their activities, such conflicts are more likely. Thus, if taxes indeed play a mitigating role, we would expect a higher tax rate when accounting standards are weak. Indeed, the correlation between the tax disadvantage and accounting standards is negative (-0.06). The second deals with diversity in the population. Since conflicts are likely to arise as the number of groups in the community increase, we attempt to proxy for the potential conflicts with a variable that captures ethnic fractionalization. Ethnic fractionalization is computed as one minus the Herfindahl index of ethnic group shares. This calculation considers the probability that two persons, randomly chosen, from a population belong to different groups. Again, we find that the taxes are lower in a more uniform society, with a positive correlation of 0.20 between ethnic fractionalization and the tax disadvantage. In sum, we document evidence that suggests that taxes, indeed, play a role in mitigating the conflict between shareholders and other stakeholders.

## **VIII. Conclusions**

When firms impose externalities on society at large, the legal structure and the organization form alter the sharing rule between the owners of a corporation and the non-financial claimants. The sharing rule, in turn, affects the externalities imposed by corporations on the society at large. In strong legal regimes, unlimited liability may discourage innovation relative to the socially desirable level. Limited liability, however, might be accompanied by excessive innovation. In the presence of limited liability, we show that corporate taxation plays an important role in aligning the interests of non-financial claimholders and the owners of a limited liability corporation by reducing

corporation cash flows in profitable states.

Thus, taxes can be viewed as the price to pay for limited liability, and corporations trade off the benefits of limited liability with the potential costs of taxation in choosing their organizational forms. This, in turn, provides a rationale for the existence of corporate taxation. Such a rationale was part of the legislative debate over the introduction of the tax in 1909. As Avi-Yonah (2004) points out, Senator Cummins, an opponent of the proposed tax stated that:

*If this tax is intended not to create a revenue, but if it is intended for the purpose of supervising and regulating corporations, that is quite a different proposition. I should like to know before we get through with this whether it is proposed through this tax to impose supervisory regulation upon all the corporations of the United States...*

Our solution has implications for the current debate on the mechanisms used for the resolution of the current financial crisis. The role of taxation can be viewed in the same manner as the government taking claims in the private firms. The government, in exchange for bailing out failing financial institutions, is known to have taken equity-like claims, such as preferred stock and warrants, as a mechanism for repaying the tax payer. In this respect, we note that corporate taxation plays two roles. First, taxation of profitable states works in a fashion similar to the government holding non-voting equity or warrants in the private firms in a setting of *ex post* resolution of crisis. Second, corporate taxation has *ex ante* incentive effects, since as we show, it can play a role in realigning the incentives of private firms with the goals of the government. Thus, incentives are realigned in the right way without mandating specific innovation levels through invasive regulation.

Finally, we highlight the importance of the legal regimes when corporations choose their organization form. In this analysis, we focus on the role of law in the design of corporate tax and the equilibrium social impact of corporations by endogenizing the choice of organizational form. This enables us to generate cross country comparisons in tax rates and the social costs imposed by corporations. We show that low corporate tax rates prevail in environments with strong legal protection, whereas countries with poor legal structures, on an average, have higher corporate tax rates. The rationale for taxation in this paper would imply a stand against the repeal

of double taxation through corporations. In addition, this view of taxation presents an interesting ingredient in analyzing social implications when countries compete for innovation and investment based on corporate taxes. An interesting question to analyze is the social impact of tax competition between countries that differ in their legal strengths.

In the main model of this paper we have assumed that the strength of the legal system ( $\lambda$ ) in an economy is exogenously given, and the optimal institutions are designed using taxation and organizational forms as the ingredients. Going beyond the conventional liability structures (limited and unlimited liability), we analyze the general liability structures in which firms are only held accountable for the part of the social costs that are assigned to them by the legal system. This opens up other interesting possibilities in which the social planner can discriminate among industries based on the positive external ties that they generate. Such differential limits of liability already exist in practice. For instance, the Price-Anderson Act (Public Law 85-256) limits liability from nuclear accidents. In addition to providing a menu of liability structures, the social planner can also optimally choose, as an additional instrument, the strength of the legal enforcement ( $\lambda$ ). Although our framework is general enough to allow for an analysis of institutional design in which  $\lambda$  is endogenously chosen by the social planner, such a task is left for future research.

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## Appendix: Proofs

### Proposition 1

A straightforward comparison of the relevant cut-off probabilities in equations (1), (2), and (3), implies the results.

### Proposition 2

Equating  $p_T$  in equation (4) to  $p_S$  in equation (1) and simplifying yields the given expression for the optimal tax rate  $T^*$ . The comparative statics results with respect to  $C_L$ ,  $p_L$  and  $B_H$  follows readily from the form of the expression for  $T^*$ . Rearranging the derivation of  $T^*$ , we can also see that  $T^* = p_L \Phi$ . It follows that  $T^*$  is increasing in  $\Phi$ .

### Proposition 3

From the expression for  $p_N(\lambda)$  in equation (6) and  $p_L(\lambda)$  in equation (7) we can rewrite

$$p_N(\lambda) = \frac{\lambda C_L + X}{Z + C_L \lambda}$$

and

$$p_L(\lambda) = \frac{X}{Z}$$

where  $X = I$  and  $Z = (H - C_H \lambda)$ . Since  $C_L \lambda > 0$ ,  $p_N(\lambda)$  is higher than  $p_L(\lambda)$ . Similarly, since  $C_L \lambda$  is increasing in  $\lambda$ ,  $[p_N(\lambda) - p_L(\lambda)]$  is an increasing in.

### Proposition 4

When  $T=0$ , the right hand side of inequality (8) is simply  $(H(\lambda) - I^2) > \frac{H(\lambda)(H(\lambda) - I)^2}{H(\lambda) + C_L \lambda}$ . For

$T = 1 - \frac{I}{H(\lambda)}$ , the right hand side is 0. To see how the right hand side of (8) changes with the

tax rate, consider the partial derivative that yields

$$-\left[ (H(\lambda))^2 - \left( \frac{I}{1-T} \right)^2 \right]$$

Thus, for all  $(1-T)H(\lambda) > I$ , the right hand side is decreasing in T. Since  $(1-T)H(\lambda) > I$  (or else the project would not be viable), as the tax rate increases, the condition is less likely to hold, and there exists an interior rate  $0 < \hat{T} < 1 - \frac{I}{H(\lambda)}$  such that the corporation is indifferent between the choice of limited or unlimited liability.

### Proposition 5

The socially optimal tax rate  $T_s(\lambda)$  is an increasing function of  $(p_s - p_L)$ , the difference between the socially optimal innovation policy and the innovation policy of the limited liability corporation. Since  $p_s$  is independent of  $\lambda$  and  $p_L$  is increasing in  $\lambda$ ,  $(p_s - p_L)$  is decreasing in  $\lambda$ . Therefore, the socially optimal tax rate  $T_s(\lambda)$  is a decreasing in  $\lambda$ .

### Proposition 6

At  $\lambda = \lambda^*$ ,  $p_N(\lambda) = p_s$ . Since  $p_N$  is increasing with  $\lambda$ ,  $p_N > p_s$  for all  $\lambda > \lambda^*$ . Also, the value of a firm is higher as its optimal innovation policy, given by  $p$ , is lower. Thus, the firm would prefer all rules such that their optimal innovation policy will be less than  $p_N$ . Since  $p_s$  is less than  $p_N$  for all  $\lambda > \lambda^*$ , the optimal tax policy will be implementable. For  $\lambda < \lambda^*$ , there is no conservatism in innovation problem and hence no role for limited liability in our framework.

### Proposition 7

From Figures 1, 2, and Proposition 6, we have that the firms would choose to stay as unlimited liability firms for all  $\lambda < \lambda^*$ . As  $\lambda$  increases,  $p_N(\lambda)$  increases, getting closer and closer to  $p_s$ , and hence welfare increases with  $\lambda$ . For  $\lambda > \lambda^*$ , given the

socially optimal tax rate  $T_s(\lambda)$ , firms choose the limited liability organizational form and innovate at the socially optimal level, attaining the maximum level of welfare.

**FIGURE 1: LAW, ORGANIZATIONAL FORM AND INVESTMENT**

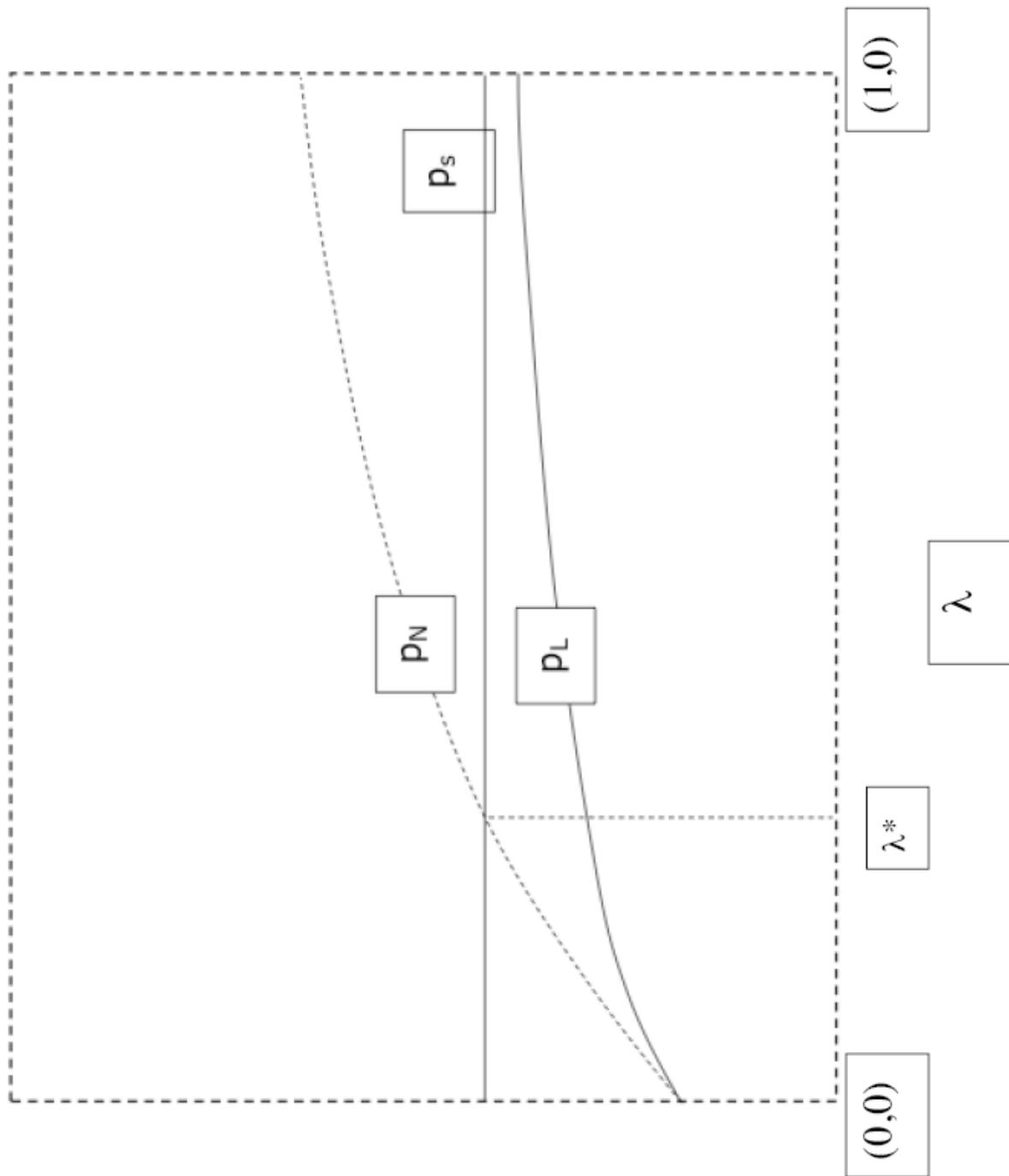
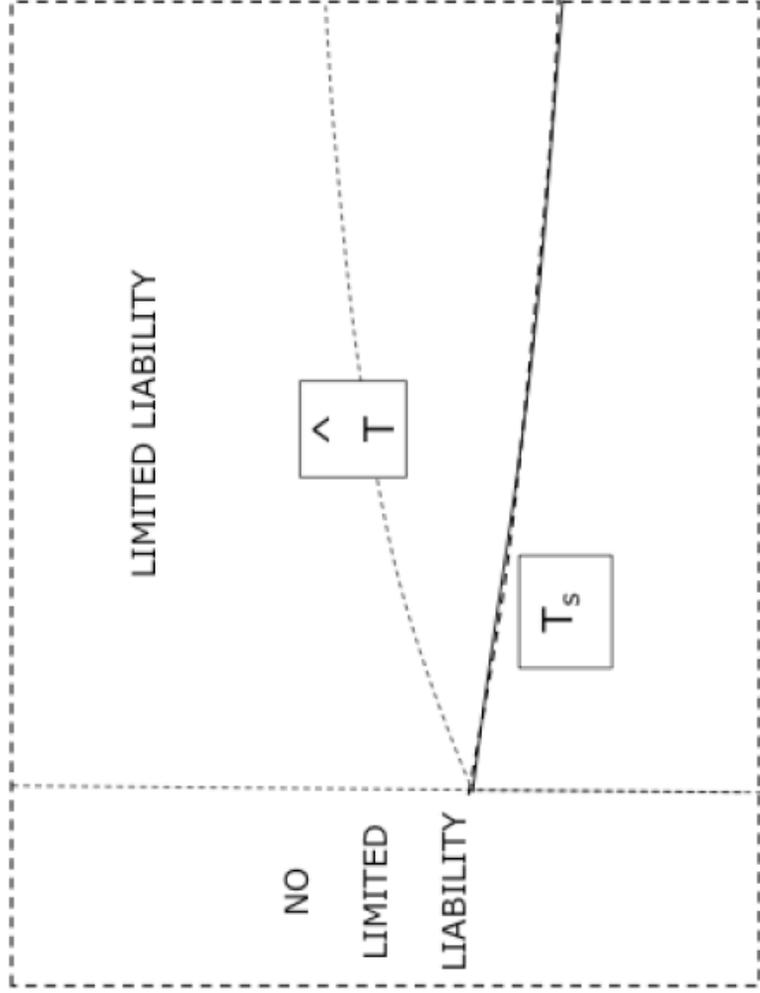


FIGURE 2: LEGAL STRENGTH AND TAXES



(0,0)

$\lambda^*$

$\lambda$

(1,0)