Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Financial Intermediation 14 (2005) 283–317
Journal of Financial Intermediation
www.elsevier.com/locate/jfi

Financial innovations and corporate bankruptcy

Julian Franks [a,b], Oren Sussman [c,d,*]

[a] *Corporation of London, London Business School, UK*
[b] *CEPR, UK*
[c] *Said Business School, University of Oxford, UK*
[d] *Wadham College, University of Oxford, UK*

Received 1 March 2003

Available online 15 January 2005

Abstract

In this paper we construct an evolutionary theory of bankruptcy law in which bankruptcy law is perceived as a mechanism for standardizing the default clauses in debt contracts. Our theory is motivated by the comparative histories of England and the US. A central normative question is why bankruptcy law cannot be left to the contracting parties operating in a market environment. We argue that State intervention may be required because freedom-of-contracting regimes suffer from a problem of under-innovation and tend to slip into institutional stagnation. Judges and legislators can resolve the problem, but they tend to be biased towards the preservation of private benefits, and thus make bankruptcy law too soft. Our theory also explains why cycles in institutional structure may occur.

JEL classification: G28; G33; G38; K12

Keywords: Standard contracts; Financial innovations; Institutional stagnation; Corporate bankruptcy; Freedom of contracting

* Corresponding author.
E-mail address: oren.sussman@said-business-school.oxford.ac.uk (O. Sussman).

1042-9573/$ – see front matter
doi:10.1016/j.jfi.2004.07.002

1. Introduction

Much of the recent policy discussions about bankruptcy law have focused on whether the law should be 'hard' on the distressed company, firmly protecting the liquidation rights of the creditors, or whether it should be 'soft', giving the company a better chance to reorganize. Much less attention has been given to a different, perhaps more fundamental question, whether bankruptcy law should evolve out of private contracting, or be designed by judges and legislators. As we shall see, it is possible to conceive of a freedom of contracting regime where bankruptcy procedures are just a part of the debt contract, and where the State does not interfere with the terms negotiated ex ante between the debtor and the creditor. Clearly, the question touches upon the very relationship between law and finance. Should the law be confined to the provision of a 'tool kit' that market participants can use in order to draft commercial agreements, or should the law reflect the State's policy towards companies in financial distress?

The most common justification for State intervention in bankruptcy is that the debt contract often fails to internalize some of the going-concern value of the distressed company. Consider, for example, the case of distressed nineteenth-century US railroads, where courts intervened to block their liquidation, and where their decision provided the origins of the current US code. At first glance, it seems that such intervention can be easily justified on grounds that had the railroad been liquidated, it would have destroyed significant 'private benefits' to farmers, producers and consumers. Upon closer examination, however, we find the argument less compelling. Firstly, because once soft judicial decisions on distressed railways were turned into precedents, they were applied more broadly to cases where there were no significant private benefits. Secondly, we show that alternative methods developed in England to internalize the private benefits into the debt contract performed quite efficiently.

In this paper we provide an alternative argument, where State intervention is required in order to modernize the law that would otherwise stagnate. In England, which is closer to the freedom of contracting model, there is a belief among policymakers that the country's bankruptcy procedures suffer from institutional stagnation.[1] We find evidence in support of this claim in a sample of bankruptcy judgments, where the vintage year of English citations is much older than in the US.

It is important to realize that the arguments above are about the dynamics of the whole legal system, rather than the static properties of the debt contract. To better understand this problem, we construct a dynamic model of an economy with many cohorts of debtors and creditors. One of the main ideas is that even in a freedom of contracting regime, parties use standardized contracts, or standard legal concepts as a contractual tool kit. This standard contract changes over time through a sequence of innovations initiated by market players. There are three main results.

Firstly, since the cost of innovating a new standard is borne by the parties alone, and since the innovation—once standardized—may subsequently benefit other parties, the incentive to innovate may be distorted. As a result, parties may fail to innovate where a

[1] In England, the word bankruptcy applies to individuals only; insolvency law is the term applied to companies. For brevity, we use the word bankruptcy for both countries.

perfect lawmaker (motivated by social-welfare considerations) would innovate, and the whole system may slip into institutional stagnation. Moreover, even where parties innovate, they tend to converge to a stationary standard too slowly. This point can be better understood given our second result. We assume that it takes the courts some time to learn the exact intention of the innovating parties; during that transition period, enforcement is uncertain. Myopic parties select a contract that is optimal during the transition period, ignoring post-standardization benefits. As a result, the contracting parties overreact while innovating, causing the system to cycle from soft to hard bankruptcy law and vice versa, slowing down convergence to a stationary state (relative to a perfect lawmaker). Thirdly, an imperfect lawmaker, far-sighted but overly focused on the preservation of private benefits, resolves the slow convergence problem (indeed, would converge too quickly to a stationary state), but at the same time fixes the system into a standard that is too soft.

The paper is structured as follows. Section 1.1 discusses related literature. In Section 2, we use the historical experience of England and the US to motivate our formal modeling. We describe in detail how a freedom of contracting regime operates, the crucial role of legal standards and the proper specification of the cost of innovation. We also provide evidence in support of the three results above. We show that England's freedom of contracting system is perceived as under-innovative, that both legal regimes tend to generate cycles in institutional structure and that legal activism, intending to preserve private benefits, may institutionalize a bias towards a soft bankruptcy law. We quantify some of our observations using data that we have collected on citations in bankruptcy judgments. In Section 3 we consolidate our observations into a formal evolutionary model of bankruptcy law. We study the cases of a freedom of contracting regime, a perfect lawmaker, and a regime with judicial and legislative activism. Section 4 concludes.

1.1. Related literature

The La Porta et al.'s (1997, 1998) approach to law and finance is based on the notion of legal origin. It shows that countries within a family of common origin bear some resemblance in legal structure, for example in the extent they protect investors' rights. It then shows that some of the cross-country variation in financial structure, for example size of equity markets, can be explained by legal origin. According to Glaeser and Shleifer (2002), family characteristics were formed hundreds of years ago and have frozen ever since. Our work deals with a different question. Rather than exploring the correlation between legal structure and financial structure, we provide a structural theory of law and finance. Interestingly, we share with La Porta et al. the recognition that history is a major factor, and that stagnation is possible.[2] We differ, however, in some of the conclusions: although change is slow, it is highly significant in the longer run; moreover, although England and the US have a common origin, their bankruptcy laws have strongly diverged.[3]

There is an extensive literature about financial innovations; see Allen and Douglas (1994) and Duffie and Rahi (1995) for excellent surveys. The notion of standardization

[2] See also Bebchuk and Roe (1998) for 'path dependency' in the law.

[3] See Posner (1996), particularly pp. 36–37, for some skeptical comments on 'Anglo-Saxon law'.

is implicit in much of this literature, and explicit in Gale (1992) and Sussman (1999). As far as we know, however, the idea that standardization is achieved upon a precedent that resolves the inherent ambiguities in the new contract has not been analyzed so far. Also, there has been very little work on innovations in corporate finance. Tufano (2003) in an insightful survey mentions the possible link with both corporate finance and law, but leaves the impression that much needs to be done in this area. To some extent, our approach is closer to the industrial-organization analysis of technological standards. Like David (1985) and Besen and Farrell's (1994), our approach is evolutionary, and emphasizes the problem of under-innovation, or the lock-in effect.

In another strand of the literature, authors have argued that deviations from freedom of contracting may be required in order to resolve static externalities that cannot be internalized into bilateral contracts, cf. Aghion and Hermalin (1990) and Bebchuk (1989), or in the area of debt and bankruptcy, Manove et al. (2000), Biais and Mariotti (2003) or Bolton and Rosenthal (2002). While we obviously recognize the importance of static externalities, our focus in this paper is on dynamic externalities and the evolution of the legal system as a whole, where notions such as innovation and stagnation play a major role.

2. The evolution of bankruptcy law

Freedom of contracting and State activism in lawmaking (by either judges or legislators) represent two polar cases on a continuum of legal regimes; most real-world activity takes place in between. Yet, it is fair to say that in bankruptcy law, the US is closer to the latter pole while England is closer to the former (albeit, with recent small moves away from freedom of contracting). In this section, we review the history of corporate bankruptcy law in both countries. Our objective is not to characterize the legal systems of England and the US as such,[4] but rather to motivate the theoretical assumptions that we make, and to corroborate some of the results that we derive in Section 3.

In order to quantify some of our observations, we have created a large data set of legal citations. We sample the population of recorded bankruptcy cases (namely, cases recorded, edited and published, by the legal press), which were adjudicated during the 1990s. We scan the text of these judgments for citations of both cases and acts. Clearly, although our citing cases are all modern, the citations included in the judgments go back to the nineteenth century. Thus, the data set provides some interesting and quantifiable information on the history of bankruptcy law in England and in the US, as perceived by currently practicing lawyers. The data are particularly helpful in identifying periods of high innovation activity, and conversely, periods of stagnation. Appendix A provides some additional detail about the data set, data sources and sampling method.

2.1. Freedom of contracting

Within the second half of the nineteenth century, the English Parliament ruled that the principle of freedom of contracting should apply to corporate law (see Table 1 for

[4] See Skeel (2001) for a recent comprehensive history of US bankruptcy law.

Table 1
The evolution of bankruptcy law in England and in the US: a chronology

UK		US	
Year	Event/significance	Year	Event/significance
1720	The Bubble Act: mandatory unlimited liability		
		1789	The Constitution gives congress power to legislate a new bankruptcy law
1825	Bubble Act repealed		
1848	Act: Freedom of incorporation (without limited liability)		
1856	Act: limited liability is allowed		
1862	Consolidation Act: England's first corporate law		
1870	The *Panama* case: the innovation of the floating charge		
		1884	The *Wabash* case: the germ of automatic stay.
1896	The *Manila* case: the floating charge is standardized	1896	The *Penn Midland* case: the germ of super-priority finance
		1898	First Bankruptcy Act
		1938	The Chandler Act

a chronology of the main events mentioned in this section). The decision had a profound and enduring effect on England, down to the present day. It implied that the corporation is a multilateral contract, which may be written into several documents including the corporate charter and the debt contract. In such a system, the courts' only role is to enforce the ex ante intention of the parties. In the words of a contemporary politician, freedom of contracting implies that "the State leaves them [corporations] to manage their own affairs and has no desire to force on these little republics any particular constitution."[5]

Indeed, the Consolidation Act of 1862 (England's first comprehensive corporate law) left all matters of corporate governance and control to the contract. The law was confined to the procedure of writing the contract and disclosing it to potential trading partners. For example, a company may choose to limit its liability or it may choose not to do so. Either way, the decision should be written into the 'memorandum of association', which ought to be deposited with the Registrar of Joint Stock Companies, where it would be available to the general public. In the event that a company opts for limited liability, the word 'limited' should be posted "on the outside of every office ... in letters easily legible", so as to alert any potential lender.[6] The Act of 1862 remains a cornerstone of English corporate law; according to our data set it is the second most frequently cited act in English bankruptcies, to which 49% of judgments refer (see Table 2).

It follows that bankruptcy, namely the course of action to be taken following default, is a commercial affair that should be negotiated ex ante between the lender and the borrower.

[5] Robert Low, the President of the Board of Trade, cited by Hunt (1936, p. 135).
[6] See §41 of the 1862 Act.

Table 2
Patterns of citations of cases and acts

Variable	England	US
Sampling window	1990–2002	1990–2000
Number of citing cases	144	9139
	Citation of acts	
Most-frequently-cited act: name of act	Insolvency Act 1986	Bankruptcy Reform Act 1978
(percentage of citing cases referring to the act)	(60.4%)	(78%)
Second-most-frequently-cited act: name of act	Company's Act 1862	Uniform Commercial Code
(percentage of citing cases referring to the act)	(49.3%)	(2.5%)
	Citation of cases	
Mean (SD) citation vintage year	1954	1985
	(49.1)	(15.4)

In this table we provide descriptive statistics on the patterns of citations of acts and cases. The data is based on a sample of recorded bankruptcy cases in England and in the US. For more detail about definitions, data sources and sampling method, see Appendix A.

Indeed, the bankruptcy procedure most commonly used in England was based upon the "floating charge", a high-powered mortgage that was innovated in the 1870s.[7] While a fixed charge applies mainly to physical capital (such as buildings, machines or ships), the floating charge can also apply to circulating assets such as cash and inventories, including assets that would be acquired after the floating charge is issued. In order to seize these assets in bankruptcy, the floating-charge holder is given broad powers, effectively complete default-contingent control over the company. Thus, when a floating charge is granted by the debtor, which happens in the vast majority of cases,[8] a bankruptcy procedure is put in place. In the event of default, the floating-charge holder has full discretion whether, when and how to liquidate the company. The court's only role is to protect the contractual rights of all the parties involved.

A few famous examples may illustrate how freedom of contracting actually works. The *Manila*[9] case of 1896 involved a debenture (the document where the rights of the floating-charge holder are specified), which was badly phrased and thus gave rise to conflicting interpretations. Although this was an appeal to the House of Lords, England's highest court, it is clear that the judges confined themselves to a reconstruction of the original intention of the parties from the text of the debenture. Says Lord Shad: "I confess that upon first reading the words [of the debenture] ... I was impressed ... that the appellants' interpretation was sound; but upon further examination of the language I have come to a different opinion."

So strong was the commitment to freedom of contracting, that the courts even refused to provide a generic definition of the floating charge, because such definition might constrain the parties' ability to express intention in their own way. A contemporary judge said that "the term 'floating' [charge] is one that until recently was a mere popular term. It certainly

[7] By high-powered we mean that the instrument was widely used and was successful in its objective of concentrating control rights in the hands of the creditor holding the charge.

[8] See Franks and Sussman (2003, Table 3).

[9] *Government Stock Investment Company v. the Manila Railway Company* (1896).

had no distinct legal meaning"; yet, "I certainly do not attempt myself to give a definition of the term".[10] He offers, though, a colorful illustration: the floating charge is "shifting in its nature, hovering over and, so to speak, floating with the property, until some event occurs, ... which causes it to settle".

Provided that the rights were properly contracted, the courts did not interfere with the contract even when they were convinced that it was flawed. A judge named Buckley (among many others) felt that the floating-charge holder had excessive powers that were often abused: "if the company is wound up there is nothing for anyone but the debenture holders".[11] Particularly, a trade creditor "may have lent his money or consigned his goods to the company last week, but if he has the audacity to ask for payment ... the debenture-holders obtain a receiver ... taking his money or his goods." Hence, "I have taken the opportunity to look into the case in order to see whether ... it is possible to prevent the injustice which is now of frequent occurrence." Nevertheless, he had no authority to interfere: "I regret to be driven to [the] conclusion that as the law stands those are the rights of debenture holders".

It is interesting to contrast this state of affairs with the US, where the ultimate power with respect to bankruptcy lies with Congress. According to Article 1, Section 8 of the Constitution (1789), "Congress shall have the power ... to establish ... uniform laws on the subject of bankruptcies throughout the United States". Notwithstanding, Congress failed to pass any enduring statute until 1898,[12] creating a gap that State legislatures and the Federal Courts had to fill. As we shall see, the Federal Courts were particularly active in the rescue of distressed railroads. Their lenient approach to railroads was later formulated into a reorganization procedure, which was applied in 1938 to all companies, leading eventually to the current US code.

Even before the railroad cases, American courts have exercised their power to interfere in contracts even against the explicit intention of the parties. Indeed, the courts have disallowed the floating lien, an instrument that closely resembles the floating charge in all but name. The case of *Mitchell v. Winslow* involved a loan made in 1839, backed by the security of all the company's machines, including those to be purchased in the future. Upon default, the floating-lien holder took possession of all the property and sold it off. Meanwhile, the company went into bankruptcy and the other creditors sued the floating-lien holder in an attempt to recover some of the proceeds. They argued that a mortgage could not be applied to future assets. A State judge by the name of Story rejected the appeal on freedom of contracting grounds. However, higher courts later accepted that 'after acquired property' could not be charged, even if the intention was clearly expressed by way of a contract.[13]

[10] Justice Romer in *Re. Yorkshire Woolcombers' Association Limited* (1903).

[11] See the case of the *London Pressed Hinge Company Limited* (1905).

[12] Various Acts allowing personal bankruptcy were passed in response to widespread failures and panics, in 1800, 1841 and 1867, but they were quickly repealed. See also Berglof and Rosenthal (2001).

[13] The restrictions on the floating lien were relaxed in Benedict v. Ratner (1925), and abolished completely in 1934; see Gilmore (1965, p. 33). However, by that time the US had a bankruptcy law, with many other restrictions on the power of the secured lenders.

2.2. Innovation and standardization

The floating charge was innovated by the *Panama Company*,[14] which issued in June 1866 1000 debentures (£100 each bearing interest of 6% PA) secured on "the said undertaking, and all sums of money arising therefrom". When *Panama* defaulted, the parties disputed whether the word 'undertaking' implied all the assets of the company including the ships and the cash, or whether it implied the cash balances only. In 1870 the court ruled that it covered all the assets held by the company upon bankruptcy. As a result, the word 'undertaking' gained a precise technical meaning, which is in common usage to the present day.

It is important to realize that the crucial importance of the *Panama* judgment is not in the novelty of the idea but rather in its standardization. According to Palmer's (1905) classic textbook on English company law, "long previously it has been decided, no doubt, that in equity future property, or even possibilities could be effectively charged . . . provided [that] the intention was sufficiently expressed . . . Nevertheless, the decision [in *Panama*] was one of the greatest practical importance, as it judicially recognized and established the power of a company to give a floating charge on its undertaking, a form of security which has since approved itself to the commercial community".[15] Hence, it was not the ingenuity of the idea that made *Panama* a landmark case, but rather that through enforcement the courts have accepted that by writing the word 'undertaking' into a contract, the debtor could grant the creditors the same rights as were enforced in *Panama*.

The basic insight that emerges is that the law may be analyzed as a set of contractual standards. Freedom of contracting does not mean that the parties to each transaction write their own contract, but rather that legal standards are created by a market process. Within such a market, lenders and borrowers negotiate the contract, the courts enforce it, and some agency records the judgment into a book that fixes the meaning of the words used in the contract. This book serves a purpose similar to a dictionary, defining meaning by way of examples, each example being an adjudicated case. The parties can use standardized concepts, or they can innovate new ones, which would force the courts to provide an interpretation. Crucially, under freedom of contracting the State makes no attempt to interfere with the substance of the book. In contrast, in an activist regime the State may try to influence the content of the book, either by authorizing judges to interpret contracts in a way that was not intended by the parties, or the State may write the book directly via legislation.

2.3. The cost of innovation

The very phenomenon of contract standardization is an indication of a significant cost of innovation. Had the cost of innovation been low, we would observe the parties to each transaction writing their own contract de novo, or at least having a large set of differentiated standard instruments. We now look more closely at the different components of the cost of innovation.

[14] The *Panama New Zealand and Australia Mail Company, Limited*.

[15] See Topham and Topham (1933, pp. 63–64).

In its simplest form, the cost of innovation is the value of the resources spent on drafting a new contract, and where necessary litigating in order to obtain enforcement. The spending may come in the form of lawyers' fees or the parties' time and effort. One may think that such direct costs are not that significant. However, the innovation process is more complicated than implied so far. In the case of the floating charge, although the principle was established in *Panama*, much of the practical detail was worked out in subsequent cases. Thus, for example, only the above-mentioned *Manila* case (1896) resolved the following practical question: does the floating charge attach to the company's assets (or 'crystallizes' in legal jargon) upon default or upon the appointment of a receiver? The case has established the latter interpretation. Related cases came before the courts during the early twentieth century. Hence, the innovation actually involved a large number of cases over a period of thirty or forty years, multiplying the cost of innovation over and above the direct cost to the parties in *Panama*. Evidence to the length of the innovation period is presented in Fig. 1, which plots the vintage year of the cases cited in our data set. There is a clear 'hump' in the English data for the period 1870–1910.[16] Thus, even today, lawyers and

Fig. 1. Vintage of case citation, England and the US. *Note*. Number of citations per year, deflated by number of citing cases, smoothed by a five-year moving average, plotted against a logarithmic vertical axis. In graphing the series we have added a constant of 0.2 to both in order to deal with the problem of a near-zero citation rate before 1950.

[16] We evaluate the hump against trend. The trend is positive and strongly convex. We interpret the high citation rate of recent cases as indicating a substantial rate of depreciation (or obsolescence) in court cases: the older the case is, the less relevant it becomes.

judges refer to cases of that period more often, relative to the immediate period before or after.

The length of the innovation period draws attention to another, and more interesting component of the cost of innovation. Before standardization was accomplished, creditors were securing loans against rights whose exact content was not clearly defined. Such 'enforcement uncertainty' must have made the return on lending less certain. Consider, again, the *Manila* case and the ruling that the floating charge crystallizes upon the appointment of a receiver. Since crystallization transfers ownership of assets from the company to the floating-charge holder, any ambiguity with respect to the timing of crystallization has a direct effect on the risk-profile of the loan.

Some current cases provide vivid examples of the effect of enforcement uncertainty. *Siebe Gorman* & Co. *v. Barclays Bank* (1978) established the possibility of securing receivables (money owed to the debtor by a third party) with a fixed charge. That was a valuable innovation to the UK banking industry: although banks typically take both a fixed and a floating charge, the tax authorities (as 'preferential creditors') are senior to the floating-charge but junior to the fixed charge.[17] Hence, the innovation increased the bank's recovery rate and ultimately the company's borrowing capacity. Recently, however, the tax authorities have challenged the rule and two cases are currently pending in the courts.[18] One bank has informed us that until the matter is resolved, it manages two sets of accounts depending on the resolution; the difference in recovery rates between the two can exceed 30%.[19] Hence, enforcement uncertainty directly affects the parties' payoffs and risk exposure.

In the above example, the effect of enforcement uncertainty can be much reduced by pricing in the risk. In such cases, enforcement uncertainty would not have a significant effect on the contracting parties although it would have a dramatic effect on the evolution of the law and on the social cost of innovation (see Section 3 for a more precise analysis). There are many cases, however, when even after proper pricing enforcement uncertainty has a significant effect on the parties, for example when the risk is born by non-diversified individuals. Hence, when limited liability was innovated, and the new clauses were still subject to enforcement uncertainty, the parties were uncertain whether their personal assets are protected or not; see Section 2.5. In such cases, the loss of utility due to the personal exposure, or the loss of investment opportunities due to the reluctance to bear that risk, can be included as part of the cost of innovation, increasing it over and above lawyers' fees and the parties' time.

2.4. Under-innovation

Since the law, like other standards, is a public good, and since in a freedom of contracting system the cost of innovation is privately borne by the parties alone, the incentive to innovate might be distorted. This 'under-innovation' may result in the system 'getting

[17] See Franks and Sussman (2003) for a discussion of preferential creditors' rights.

[18] *Re. Brumark Investments* (2001) and *Royal Bank of Scotland v. Spectrum Plus* (2003).

[19] Decision is not expected before three years. We are told that the cost of litigating is £1–2 million. It is expected that the appeal would reestablish the principle that only fixed assets could be charged by a fixed charge.

stuck' or failing to respond to new business circumstances (Section 3 formalizes and refines this argument). Recently, concerns about this problem have motivated the legislation of the Enterprise Act (2003), which intends to trim the powers of the floating-charge holder and take the system closer to the American model. Due to enforcement uncertainty, the full extent of the reform is presently unknown.[20] (Note that enforcement uncertainty can apply to a new statute, as well as a new contract.)

Some evidence on the perceived under-innovation problem is worth mentioning. A government strategy paper states "that the laws on insolvency and bankruptcy have their origins in the nineteenth century, and some of the principles underlying them are now out of date".[21] In a keynote speech to the Cambridge law faculty, Patricia Hewitt, a government minister, says that UK corporate law "was largely created in the nineteenth century. But what was a source of competitive advantage to us then, is now a source of competitive disadvantage. The law has got out of date and became encrusted with all sorts of amendments and case law. ... [We now] need to reflect the huge change we have seen in our economy since Victorian times. ... Back then, Rowland Hill had just introduced the Penny Post. Now we've got emails, the Internet, text messaging, faxing, computerized book-keeping and so on."[22]

There is some indirect evidence that the Victorian legislators were also aware of the under-innovation problem. At the same time that English corporate bankruptcy was placed under freedom of contracting, personal bankruptcy remained in the hands of the legislator; see Jenks (1920). Such a decision is consistent with the idea that much of the cost of innovation is fixed, so that innovation costs for small players are prohibitive. It is thus better to leave personal bankruptcy to the legislator. In contrast, large corporations can afford the cost of innovation, and should be placed under a regime of freedom of contracting.

Our data set provides dramatic evidence on the under-innovation problem. Firstly, within our sampling window, there are 144 English judgments against 9139 US judgments (see Table 2). Since the sample is drawn from a population of judgments recorded for their interest and novelty, it is legitimate to interpret the numbers above as measures of the current rate of innovation. Secondly, the mean vintage year of cases cited in England and in the US is 1954 and 1985, respectively. It is possible that these numbers understate the differences between the two countries. This is because innovations are often triggered by new legislation. The US trigger (the 1978 Bankruptcy Law Reform) is eight years older than the most recent English reform (the 1986 Insolvency Act[23]). We might therefore conclude that citations in England are on average two to three times older than in the US.

[20] According to the new law, an administrator will replace the receiver in implementing the floating charge. The administrator will be legally liable to all creditors, not only the floating-charge holder. Whether this is a relabeling of receivership or a genuine reform remains to be seen.

[21] See 'Enterprise and Productivity: The Government's Strategy For the Next Parliament', June 2001, p. 15.

[22] Transcript available on request.

[23] This act probably marks the beginning of the trend away from freedom of contracting in England: it introduced 'collective procedures' but has allowed the floating-charge holder to veto them.

2.5. Cycles in institutional structure

An important prediction of our model is of cycles in institutional structure. The phenomenon seems to be quite generic; Rajan and Zingales (1999) document long cycles in financial structure in several countries. Berglof and Rosenthal (2001) describe the legislative history of the US as 'turbulent' and characterized by "dramatic fluctuations over time in the orientation of bankruptcy law". It is thus interesting to note that we can identify such cycles in England as well. We find evidence that cycles are generated by both the State and by contracting parties in a market environment.

We start with corporate bankruptcy where the markets have played a crucial role. The traditional position of English law was that the best form of a business association was a partnership with unlimited liability.[24] The crash of the London market following the South Sea Bubble strengthened the view that limited liability companies, particularly those which issue publicly traded shares, are instruments for fraud and speculation. Hence, the Bubble Act of 1720 reaffirmed an old policy by which a corporation could be established by a Royal or Parliamentary charter alone. Charters were not granted unless a clear public interest in the company was demonstrated, for example in the case of canals. Thus, most business were organized as partnerships and had to borrow against the personal assets of the members (with a legal restriction on the number of owners limiting the amount of diversification). In addition, imprisonment for default was widely used. Clearly, bankruptcy law in that period was very hard.

So intense was the trauma of 1720 that the Bubble Act was repealed only in 1825 under the pressure of the industrial revolution. However, even "before the Bubble Act was repealed in 1825 most of its teeth had been drawn"[25] via private contracts with limited-liability clauses. The newly innovated clauses met the fierce resistance of "our courts [who] were very unwilling to believe that men have done anything so foolish" (an extreme example of enforcement uncertainty). However they had to accept, eventually, that "if a man sells goods and says in so many words that he will hold none personally liable ... must we not hold him to his bargain?" With limited liability recognized officially in the Act of 1856, and before the innovation of the floating charge, bankruptcy law must have been relatively soft. Hence, over the entire period, English bankruptcy law have moved from very hard to soft and then hard again.

Cycles in institutional structure can be also be discerned in a regime where the State is legally active. Jenks (1920)[26] describes a cycle in English personal bankruptcy law. As already mentioned above, personal bankruptcy has remained under statutory control: initially, there was a "tendency to keep a tight official hand on the administration of the bankrupt estate". However, the Bankruptcy Act of 1869 has manifested a "distinct reaction" against this policy, opting instead "to entrust everything to the creditors in the belief that motives of self-interest would produce efficiency ... Unfortunately, however, the confidence in enlightened self-interest ... did not prove to be entirely justifiable. ... Ac-

[24] See Gower (1969).

[25] See Maitland (1904, p. 44).

[26] See Jenks (1920, pp. 386–387). Note that bankruptcy legislation is very old, going back to 1542; obviously, the distinction between personal and corporate is nineteenth century.

cordingly, in the year 1883, Mr. Joseph Chamberlain, then president of the board of trade, determined upon radical change of policy and the statute of that year is as remarkable for its insistence on State control".

2.6. Private benefits and State activism

An important motive for State activism in lawmaking is the need to address some static market failures. US railways seem to provide a classic example, with many 'stakeholders' (such as employees, passengers and, farmers transporting their products to market) who are not party to the debt contract and whose interests are not properly represented when a liquidation decision is taken. Since the markets fail to internalize their 'private benefits', the debt contract tends to be too hard, and needs to be softened by public policy, which in the US was achieved through ex post judicial activism. The US experience reveals some disadvantages of that policy. Firstly, ex post intervention tends to violate contractual rights. Secondly, judicial decisions may be used as a precedent and be applied more broadly, to industries where private benefits are not as significant. Thirdly, taken ex post, the decisions may give insufficient weight to ex ante incentives and soften the contract too much. As a result, violations of contractual rights and deviations from absolute priority are institutionalized; see Baird (1986), Jensen (1989) and Franks and Torous (1989). We demonstrate below that this is not inevitable: in England the same problems were tackled by ex ante intervention that internalized the private benefits into the debt contract.

We start with the lessons from the US innovation process. The leading case involved the *Wabash Railway Company*,[27] which on the verge of default petitioned a Federal Court to allow the appointment of two of its own ex-directors as receivers.[28] The company's lawyers were willing to admit that the only purpose of the request was to preempt the lenders from exercising their contractual right to appoint a receiver. They insisted, however, that such a violation of the creditors' rights served the common good: "as soon as default shall be made, ... supplies, materials, rolling stock, and other personal property will be seized under execution and attachments, and the complainant will be deprived of the means necessary to the operation of said roads". The court accepted the petition, and instructed the receivers to preserve the railroad as a going concern, laying the foundation for the principles of automatic stay and debtor-in-possession which are still central to US bankruptcy law to the present day.[29]

By 1887 an important legal textbook was still expressing the hope that the *Wabash* "decision will not become a precedent".[30] In reality, not only did *Wabash* become a precedent, it was also extended by further judgments and legislation. For example, in *Rutherford v. Penn. Midland R.R.* (1896) the court sanctioned the issue of new debt senior to pre-

[27] Wabash, St. L. & P. Ry. Co. v. Central Trust Co. of New York and others, Circuit Court, ND Ohio, WD June, 1884 (*Federal Reporter*, 22).

[28] Wabash, St. L. & P. Ry. Co. v. Central Trust Co. of New York and others, Circuit Court, ND Ohio, WD June, 1884 (*Federal Reporter*, 22).

[29] See Tufano (1997) and Skeel (2001) for a comprehensive analysis of economic, legal and political aspects of the railway cases.

[30] Charles Beach in *Commentaries on the Law of Receivers*, cited in Martin (1974).

bankruptcy debt, innovating super-priority finance. By the end of the nineteenth century, these judgments developed into an institution called equitable receivership, the forerunner of Chapter 11 of the 1978 Bankruptcy Reform Act. The Bankruptcy Act of 1933 codified it into a general procedure for the rescue of distressed railways, and the Chandler Act of 1938 extended it to all companies.

One might argue that such a development was unavoidable given the considerable private benefits in railways. After all, preserving value that the market has failed to account for is the State's main economic role. There are, however, some other ways to preserve private benefits. Those used in England are particularly interesting.

It was a traditional policy in England that public utilities, including railways, operate under a Parliamentary charter. Usually, the charter prevented the company from mortgaging its fixed assets, allowing only the cash flows to be mortgaged, so that if a receiver was appointed the normal operation of the company was not undermined. As a result, English and US railways had quite a different capital structure. "Weak railway companies in the United States have frequently been declared insolvent by the courts, owing to their inability in periods of commercial depression to meet their acknowledged obligations ... The situation in Great Britain has been wholly different. The debt in that country is relatively small in amount, and is not represented by securities based upon hypothecation of the company's real property, as with the American railroad bond, resting on a first, second or third mortgage."[31] Hence, the English policy was to internalize the private benefits into the debt contract. One might be tempted to conclude that both the English and the American approaches are based upon State intervention and, as such, quite similar. However, the two types of intervention generate very different incentives for the borrower. Ex ante intervention increases the cost of capital and restricts the company's borrowing capacity. It is thus in the company's best interest to play down the importance of the public good aspect of the business. Ex post, it is obviously in the company's best interest to exaggerate the public-good aspect of its business, using precedents created by genuine public utilities. Indeed, the restrictions on borrowing in English railways charters had no effect on legal practice beyond public-utilities law. In the US, court intervention in railways had shaped modern bankruptcy law.

3. Theory

In this section we consolidate the insights gathered in the previous section into a dynamic theory of legal evolution. We show how the cost of innovation and the presence of enforcement uncertainty distort the incentive to innovate, slow down convergence to a stationary state, and generate cycles in institutional structure along the equilibrium path. In order to study the role of the State, we analyze three legal regimes: freedom of contracting, a perfect lawmaker, and an imperfect lawmaker who internalizes the benefits of subsequent users of the innovation, but is also biased towards the preservation of private benefits.

[31] See Encyclopedia Britanica (1911), 'Railways'.

3.1. The model

Consider a discrete-time economy: $t = 0, 1, 2, \ldots$, ad infinitum. In each *period*, one penniless entrepreneur (endowed with one project) meets one wealthy financier. Both are risk neutral. Their business spans across several *stages* and will be wound up by the end of that period. The intra-period discount rate is zero, while the inter-period discount rate (relevant for social accounting only) is ρ. The distinction between a period and a stage is semantic: the parties to the same contract interact across stages, while standards evolve from one period to the next.

The following is a description of the interaction between the financier and the entrepreneur:

- Stage one: the project requires an initial injection of capital, k. Exerting some effort, the entrepreneur affects the probability of the project's success, π_t. We use the words 'probability of success' and 'effort', interchangeably.
- Stage two: the project yields a cash flow, y, if successful and zero if it fails. Then, the project may be liquidated, or it may be continued, depending on the contract (see below). The project's liquidation value is $L \geqslant 0$.
- Stage three: if continued, the entrepreneur collects some non-transferable 'private benefits', $b > L$. Note that the private benefits accrue even if the outcome of stage two is failure, provided that the project is continued.

The entrepreneur's disutility of effort is represented by the function f, such that the entrepreneur has to bear a disutility $f(\pi)$ in order to achieve a probability of success π. The function f has the following properties:

(A1) $f' > 0$, $f'' > 0$, $f''' > 0$, $\lim_{\pi \to 0} f' = 0$, $\lim_{\pi \to 1} f' = \infty$.

Our assumptions so far yield a contract problem with three decision variables: the amount of effort selected by the entrepreneur, π, her repayment, R, contingent on the event of success, and the liquidation policy, $\beta \in [0, 1]$, which is the probability of liquidation conditional upon default. Hence, a high β is dubbed a 'hard' liquidation policy (like in England), while a low β is dubbed a 'soft' liquidation policy (like in the US).

The following technical assumptions guarantee the regularity of the contract problem. Define,

$$\Pi(\beta) \equiv \left\{\pi \mid y + \beta b - f'(\pi) \geqslant k/\pi\right\}.$$

To guarantee that the contract problem has a solution, we assume

(A2) $\Pi(1) \neq \phi$.

To guarantee that the solution is away from the corners we assume that

(A3) $\Pi(0) = \phi$,

and

(A4) $k - \tilde{\pi}^2 f''(\tilde{\pi})(1-\tilde{\pi}) < 0$, where $\tilde{\pi} = \sup \Pi(1)$.

Three properties of the contract problem deserve some elaboration:

- Liquidation destroys value: since $b > L$, the project's going concern value is always greater than its liquidation value, like in the railway cases.
- The conditions for the Coase theorem are not satisfied: in spite of the fact that liquidation destroys more value to the entrepreneur than it creates value for the financier, the former cannot buy the latter out of her liquidation right because of a shortage of liquidity.[32]
- No 'static' externalities: in our economy, the entrepreneur and the financier are the only living agents at the time of the deal. Unlike in the railway cases discussed above, the model has no 'stakeholders' who have no contractual rights although they have some private benefits in the project, which will be lost in case of liquidation. It follows that all intra-period (static) externalities are assumed away, so that the contract negotiated between the financier and the entrepreneur is intra-period efficient, privately and socially. Our model is thus focused on the dynamic externalities that stem from the distorted incentive to innovate. The model thus represents an economy where the static externalities are already resolved by various charter restrictions, which internalize the private benefits into the contract (like in England).

We turn next to the detail of contract standardization. It is assumed that transacting under a standard liquidation policy, which has been used and enforced before, is free of any charge. As noted above, the very fact that contracts are standardized implies that innovation is costly. Denote by B the direct cost of innovating a new contract: the effort required in order to phrase the new liquidation policy in the technical legal language that will be acceptable to the courts (including the cost of litigating in order to obtain enforcement). In addition to the direct costs, we have identified in Section 2 enforcement uncertainty, which is the result of inherent ambiguities in new legal formulas. To simplify the modeling, we assume that there are only two possible outcomes to a court action. With a probability of λ, the court understands the innovation and enforces it as intended; with a probability of $(1-\lambda)$, the court fails to understand the innovation, in which case it enforces the old standard. However, once the innovation is enforced, it takes precedent and becomes the new standard.[33] To summarize, our specification of the 'standardization technology', denote by s_t the period t standard, while $\beta_t \neq s_t$ denotes a newly-innovated liquidation policy. Then,

$$s_{t+1} = \begin{cases} \beta_t & \text{with probability } \lambda, \\ s_t & \text{with probability } (1-\lambda). \end{cases} \tag{1}$$

Note that if the court fails to enforce the innovation, there is likely to be another attempt to innovate a contract with the same liquidation policy, possibly with slightly different

[32] This is a common modeling strategy; cf. Aghion and Bolton (1992).

[33] We assume that this market can support only one standard.

wording, but aiming at the same β. Note also that if the innovation is standardized (so that $s_{t+1} = \beta_t$), the parties may opt for another round of innovation β_{t+1}, so as to get the standard closer to the optimal liquidation policy. It follows that the expected social cost (SC) of one *round* of innovation consisting of, possibly, several *attempts* to get the message through the court system, satisfies[34]

$$SC = B + (1-\lambda)\frac{SC}{1+\rho}; \quad \text{hence} \quad SC = \frac{(1+\rho)B}{\lambda+\rho}. \tag{2}$$

Clearly, the direct cost of innovation falls as λ grows (approaching B as $\lambda \to 1$). Note that if, additionally, $B \to 0$, the notion of standardization becomes trivial. For then, the innovation is costless and free of enforcement uncertainty, in which case it always (weakly) dominates the existing standard. (In such a world, every transaction innovates its own contract de novo, regardless of the experience accumulated so far.) To guarantee the dynamic stability of the system, we assume[35]

(A5) $\lambda > 1/2$.

Within a freedom of contracting regime, the innovating parties fail to internalize the effect of their innovation upon subsequent users. We evaluate the inefficiency generated by this externality against a benchmark of an idealized perfect lawmaker, whose innovation decisions are made so as to maximize the net present value of the economy. To make the two regimes comparable, we assume that the perfect lawmaker operates under the same standardization technology (1) as the freedom-of-contracting parties. Namely, the perfect lawmaker faces the same communication problems with the court system as the parties: he has to write down (or 'legislate') a contract at a cost of B, and obtain enforcement with a probability of λ. Possibly, this assumption is somewhat contrived as legislators might be able to phrase and enforce a new liquidation policy at a lower cost relative to the market. It is made, however, for technical reasons, so as to place the lawmaker and the contracting parties on equal technological footing. As we shall see, even with the same technology the perfect lawmaker achieves better results than freedom of contracting; giving him a technological advantage would make the result stronger still.

However, real-world lawmakers, judges or legislators, are hardly impartial as our idealized perfect lawmaker. We model their bias towards preserving private benefits by assuming that the imperfect legislator is forward looking, but takes his decision at stage two of the interaction between lender and borrower. Since the effort decision has already taken place at this stage, the imperfect legislator is bound to be somewhat biased towards the preservation of the private benefits. As in the case of the perfect lawmaker, we preserve the assumption that the imperfect lawmaker operates under the same standardization technology as the parties in a freedom-of-contracting regime. In particular, his communication

[34] It is assumed implicitly that every non-standard contract has to be enforced in court, regardless of whether the project has failed or not. Had we assumed that only failed companies go to court, the timing of standardization would become random as well, which would implicate the contract a great deal, without any substantial interest gained.

[35] Since R and β are bounded, the dynamics can never explode. Hence, the role of this assumption is actually to simplify the dynamics.

with the courts is constrained by an enforcement uncertainty. This assumption makes it more difficult to interpret the imperfect lawmaker as an activist court, for then, the court faces no communication problems with itself. We maintain the assumption nevertheless, since giving an imperfect legislator a technological advantage over the two other regimes would prevent any meaningful comparative dynamics.

3.2. The contract problem

In this section we analyze the contract problem, ignoring for the moment any issue of standardization (suppose, $B = 0$, and $\lambda = 1$). The main result is that when effort is private information, the optimal contract involves liquidating the projects sometimes, so as to provide the entrepreneur with a sufficient incentive to exert effort, but not too often so as to avoid excessive loss of private benefits. In other words, the optimal contract has to balance-off ex ante against ex post efficiency. For the sake of brevity, we omit the time index for the rest of this section.

We start by providing the benchmark case of observable effort. In that case, the parties should maximize the total surplus arising from the project

$$\max_{\pi,\beta} \pi(y+b) + (1-\pi)\big[\beta L + (1-\beta)b\big] - f(\pi).$$

Since $b > L$, the optimal liquidation policy is the corner $\beta = 0$. Interpretation: when effort is contractible, the optimal liquidation policy should preserve ex post efficiency, which means never liquidate. In this case, failing to generate cash does not indicate low effort, only bad luck, which should not be penalized. To simplify the analysis further, we assume from now on that the liquidation value is insignificant,

(A6) $L = 0$.

Let us turn next to the case where effort is a hidden action. It is convenient to solve the contract problem in two stages. At the first stage, we solve the program (3)–(6) for an arbitrary value of the liquidation policy, β; at the second stage, we look for an optimal liquidation policy. Hence,

$$u(\beta) = \max_{\pi,R} \pi(y - R + b) + (1-\pi)(1-\beta)b - f(\pi), \tag{3}$$

s.t.

$$\pi R = k, \tag{4}$$

$$\pi \in \arg\max_{\pi} \pi(y - R + b) + (1-\pi)(1-\beta)b - f(\pi), \tag{5}$$

$$\pi \in [0,1], \quad R \in [0, y]. \tag{6}$$

Equation (4) is the participation constraint (PC), while Eq. (5) is the incentive-compatibility (IC) constraint; Eq. (6) provides the feasibility constraints.

We solve the program (3)–(6) with the aid of Fig. 2. Calculating a first-order condition for (5) we obtain

$$f'(\pi) = y + \beta b - R. \tag{7}$$

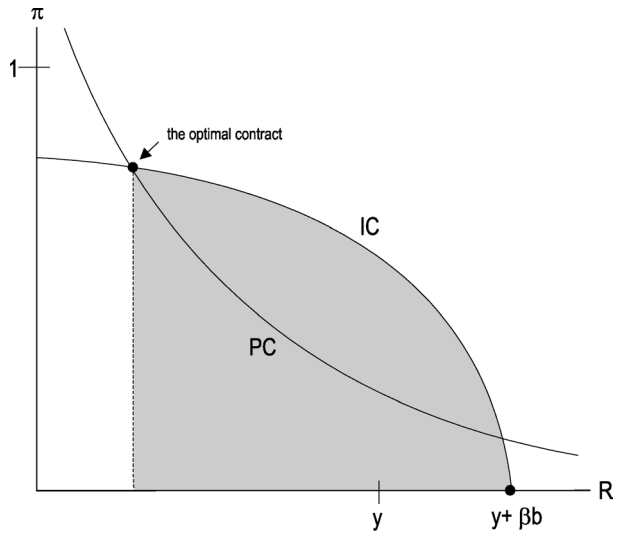

Fig. 2. The contract problem, effort as a function of repayment. *Note*. Effort π, against repayment, R; the liquidation policy, β, is given. y denotes the cash flow generated by the project (if successful) and b denotes the private benefits (if the project is continued). IC is the incentive-compatibility constraint and PC is the participation constraint.

We plot the IC curve by rotating the graph of the f' function by 90° counter clockwise, placing the origin at the point $y + \beta b$. Assumption (A1) guarantees that the curve is concave. The participation constraint (4) is represented by a rectangular hyperbola PC. It follows that the feasible set of the program (3)–(6) contains, at most, two points. The value of the program (3)–(6) is represented by the shaded area beneath the IC curve, plus a constant $(1 - \beta)b$. Hence, the optimal contract is the upper-left among the two points within the feasible set.

The main result of this section is that the optimal liquidation policy, β^*, involves liquidating the failed project with some probability $0 < \beta^* < 1$, so that the $u(\beta)$ function has an internal maximum on $[0, 1]$. The reason for this result is that a very soft liquidation policy would sub-optimally decrease entrepreneur's effort incentive.[36] Increasing β would shift the IC curve rightwards and encourage her to put more effort into the project. But in line with our conclusions above, any non-zero β entails some ex post inefficiency because of the loss of private benefits. Hence, the optimal liquidation policy has to strike a balance between providing the entrepreneur with an incentive to make an effort ex ante, and the need to avoid excessive loss of value ex post. Proposition 1 provides a full proof of this result and derives some additional features of the u function (see Fig. 3), particularly local concavity which is necessary for the analysis of the perfect lawmaker.

[36] To see the point technically, just substitute $\beta = 0$ into the first-order condition (7) and compare effort to the contractible effort case where $y = f'(y)$.

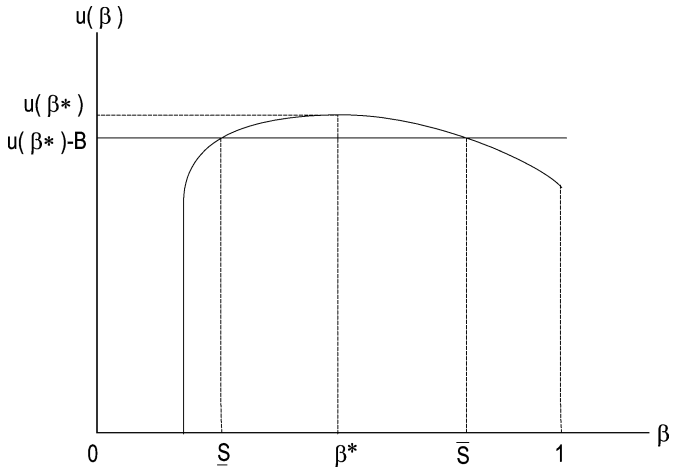

Fig. 3. The value of the contract as a function of the liquidation policy. *Note*. The value of the contract, u, is set against the liquidation policy, β. The value of the contract is maximized at β^*. Given the cost of innovation, B, the boundaries of the freedom-of-contracting absorbing set are determined at $\underline{S}$ and $\overline{S}$.

Proposition 1. *Under technical assumptions (A1)–(A4), the u function has a maximum at some internal point* $\beta^* \in (0, 1)$. *Moreover, u is concave, at the neighborhood of* β^*.

Proof. See Appendix B.

3.3. Freedom of contracting

In this section, we analyze the dynamics of *laissez-faire* lawmaking, where the liquidation policy of private contracts is standardized by court enforcement.

To understand how the enforcement uncertainty interacts with the incentive scheme provided by the contract, consider an economy with a standard liquidation policy, s_t, and an innovation β_t. It can be verified that the contract problem (3)–(6) remains the same, only that β_t is replaced by

$$e_t = \lambda\beta_t + (1-\lambda)s_t. \tag{8}$$

Hence, the parties face an *effective* liquidation policy, which is just a linear combination of the existing standard and the new innovation; it follows that the innovation would yield a surplus of $u(e_t)$.

Now the parties have to make two decisions: whether to innovate, and in the event that they do, what liquidation policy should they innovate. Let $I^F(s)$ be an indicator function, receiving a value of 1 if the parties decide to innovate, and zero otherwise; let $\beta = \phi^F(s)$

denote the parties' innovation in case $I^F(s) = 1$. The parties' problem is thus[37]

$$\max_{\{I^F, \phi^F\}} u(e) - I^F(s_t)B. \tag{9}$$

Let $\underline{\phi}^F$ be the optimal innovation, given the existing standard subject to the additional constraint that the parties *must* innovate:

$$\underline{\phi}^F(s) = \arg\max_{\beta} u(e) - B. \tag{10}$$

The solution is immediate: innovate such that $e = \beta^*$, or using Eq. (8),

$$\underline{\phi}^F(s) = \left(\frac{1}{\lambda}\right)\beta^* - \left(\frac{1-\lambda}{\lambda}\right)s. \tag{11}$$

We now address the first question: should the parties innovate? Clearly, if they innovate, the entrepreneur's surplus is given by $u(\beta^*) - B$; if they do not innovate, the entrepreneur's surplus is just $u(s_t)$. Hence, an innovation will take place if the former exceeds the latter. Let[38]

$$\underline{S} < \overline{S} \quad \text{be the roots of } u(S) = u(\beta^*) - B; \tag{12}$$

see Fig. 3. It follows that the parties keep on innovating until the standard converges to the absorbing set $[\underline{S}, \overline{S}]$. To summarize,[39]

Proposition 2. *The dynamics of a freedom of contracting economy is characterized as two time-invariant functions as follows*:

$$I^F(s) = \begin{cases} 0 & \text{if } s \in [\underline{S}, \overline{S}], \\ 1 & \text{otherwise}, \end{cases}$$
$$\beta_t = \underline{\phi}^F(s_t), \quad \text{provided that } I^F(s_t) = 1,$$

and the standardization technology (1).

To check the stability of the process, we compute

$$\left(\underline{\phi}^F\right)'(s) = -\left(\frac{1-\lambda}{\lambda}\right), \tag{13}$$

which is smaller than one in absolute value by assumption (A5).

Figure 4 provides a graphic description of the system's dynamics. The current standard is plotted against the horizontal axis, the subsequent standard on the vertical axis. The

[37] At this point, the assumption about the non-pecuniary nature of B simplifies the analysis; otherwise, the entrepreneur has to borrow the money to finance the innovation. Note that the assumption that B is borne by the entrepreneur is not really binding: since the financier is on his participation constraint, the cost of innovation has to come at the expense of the entrepreneur's rent.

[38] We assume that B is small enough to restrict the model to the region where u is concave. Hence, the equation in (11) has exactly two roots. That such a region exists is guaranteed by Proposition 1.

[39] The proof of Proposition 2 is contained in the preceding discussion.

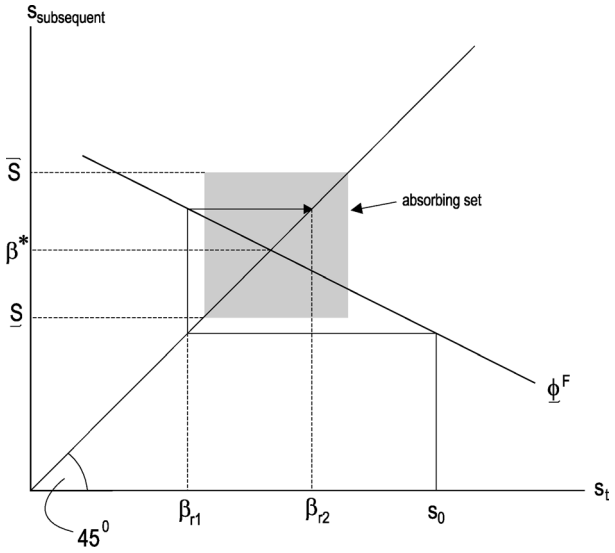

Fig. 4. Freedom-of-contracting dynamics. *Note*. In a freedom of contracting regime, the subsequent standard liquidation policy is determined by the difference equation $\underline{\phi}^F$ and the period-t standard liquidation policy, s_t; s_0 is the initial standard; β_{r1} and β_{r2} are the first and second round innovations. The absorbing set is defined in Fig. 3.

transition from the current standard to the next is via the innovation $\underline{\phi}^F(s_t)$. Note that $\underline{\phi}^F$ is a downwards-sloping line, with (due to assumption (A5)) a slope smaller than one (in absolute value); it also satisfies $\underline{\phi}^F(\beta^*) = \beta^*$. The absorbing set is described by the shaded square. Note that although the subsequent standard is determined by the current standard deterministically, the transition is Markovian: the probability that the innovation is standardized after n attempts is $\lambda(1-\lambda)^{n-1}$. For the point s_0 (see Fig. 4), the process will converge to the absorbing set after two rounds of innovation where β_{r1} is innovated in the first round and β_{r2} is innovated in the second (and last) round, after which the system is stationary.

Three properties of the equilibrium deserve some elaboration. Firstly, there are cycles in financial structure. The reason for this result is the enforcement uncertainty and the special way it interacts with incentives via the contract. Consider an initial standard that is too soft, so that the entrepreneur is under-provided with an incentive to exert effort in the project. Suppose also that the initial standard is outside the absorbing set. The parties will innovate a new contract with a harder liquidation policy and a stronger incentive for the entrepreneur to exert effort. Internalizing the dilution effect of the enforcement uncertainty, the parties overreact: they innovate a contract with a liquidation policy harder than β^* so that given the enforcement uncertainty the effective liquidation policy is β^*. After a few attempts, the courts will enforce the innovation and turn it into law. At that point the enforcement uncertainty vanishes, and the parties find themselves with a standard liquidation policy tighter than β^*. That may push them towards another round of innovation, this time with a softer liquidation policy than β^*.

The model thus captures a simple idea: that it takes time to learn how to deal with new institutions. During learning, within the transition period, the newly-innovated institution performs differently from the way it would perform post-standardization. The problem with a freedom-of-contracting regime is that the parties design the innovation so as to achieve efficiency within the transition period, ignoring the long run, post-standardization. As we shall see below, a perfect lawmaker would take the long run effect into consideration, and would thus converge to the stationary state with less erratic fluctuations (with cycles still).

Secondly, once the economy converges to a stationary state, it has a tendency to get stuck and resist any 'fundamental change'. Consider a stationary system where one of the contract's parameters, say the private benefits b, has increased. That would soften the optimal liquidation policy so as to conserve more private benefits.[40] In terms of Fig. 4, the graph of the difference equation and the absorbing square will both shift leftwards. However, the existing standard may still be within the new absorbing square, and no innovation will take place in response to the new fundamentals; hence, the idea that England's bankruptcy law reflects the economic conditions of times past, rather than the current needs of business and industry. The next subsection would refine this point, showing how a freedom-of-contracting system gets stuck is indeed sub-optimal.

Thirdly, it is worth analyzing the relationship between the enforcement uncertainty and the direct cost of innovation. It might be argued that since $e_t = \beta^*$ during transition, the enforcement uncertainty imposes no cost on the innovating parties. However, the enforcement uncertainty directly affects the social cost of innovation. For the higher is the enforcement uncertainty (lower λ), the more attempts it takes to standardize an innovation and the higher is *SC* in Eq. (2). Moreover, the lower is λ the steeper is the graph of the difference equation $\underline{\phi}$ and the more likely it is that the economy would go into another round of innovations, increasing the direct costs yet again.

3.4. A perfect lawmaker

The system described in Section 3.3 is affected by a dynamic externality: the innovating parties fail to internalize the effect of their decisions on subsequent users of the innovation. Yet, in order to characterize fully the effect of the externality on the economy, one has to solve for the case of a perfect lawmaker (who maximizes the ex ante net present value of output) and compare the result to the freedom-of-contracting equilibrium. The main conclusion is that a freedom-of-contracting regime suffers from under-innovation, and that the system converges too slowly to the stationary state. Namely, the absorbing set is too large, and the transition period too long, involving too many rounds of innovation.

The perfect lawmaker's problem is to find an innovation policy $\phi^P(s)$ and $I^P(s)$ (defined in a similar manner to ϕ^F and I^F) that solves the program

$$v(s_0) = \max_{\{\phi^P, I^P\}} E_0 \sum_{t=0}^{\infty} \frac{1}{(1+\rho)^t} \big[u(e_t) - I^P(s_t)B\big], \tag{14}$$

[40] To prove the point formally, see the expression for u' in the proof of Proposition 1.

given the standardization technology (1) and the initial standard s_0.[41] Note that although the problem is written in terms of the entrepreneur's surplus, u, it is actually equivalent to maximizing the entire output from the project, including private benefits but net of the disutility of effort and the cost of innovation. (This can be seen by adding the constant πR to Eq. (14).)

We start by comparing the size of the absorbing sets for the freedom-of-contracting and the perfect lawmaker regimes.

Proposition 3. *The absorbing set of the perfect lawmaker is strictly contained within the absorbing set of a freedom of contracting economy*; *hence, the perfect lawmaker would innovate in cases where the freedom of contracting economy would avoid innovation.*

Proof. See Appendix B.

The logic of the proof is simple: consider a freedom-of-contracting system and an initial point just on the margin of the absorbing set. By definition, the parties are indifferent between innovating and not innovating. Yet, the parties consider only the one-period benefit from the innovation. A social planner, who faces the same cost, will see more benefits simply because he discounts the whole future of the economy. Indeed, the planner may improve further upon the present value of the parties' innovation by choosing a different time-path (another liquidation policy and/or more rounds of innovations). It must be the case that the social planner sees greater benefits from the innovation relative to the freedom of contracting parties; hence, he is no longer indifferent between innovating and not innovating.

We can now confirm that the tendency of a freedom of contracting system to resist fundamental change is indeed sub-optimal. To see the point more clearly, imagine two stationary economies, identical in all fundamental respects, but different in their legal regimes. Both face an unanticipated change in fundamentals that affect the optimal liquidation policy. Since the absorbing set of the freedom-of-contracting regime is larger, it is less likely to innovate in response, relative to the perfect lawmaker. In other words, it is more likely that the freedom-of-contracting economy would get stuck.

We now turn to the main result of this section: the perfect lawmaker would converge more rapidly towards the point β^*.

Proposition 4. *The perfect lawmaker's optimal innovation policy also generates cycles in institutional structure. However, the fluctuations are less erratic relative to a freedom-of-contracting regime*; *hence, for any standard s_t, the lawmaker's innovation will be closer to β^*, relative to a freedom-of-contracting economy.*

In order to prove Proposition 4, we derive first the lawmaker's value function. Let $\underline{v}^{P,n}(s)$ be the value of a program similar to (14), but subject to the constraint that the

[41] It is implied that s_0 is restricted to the region where u is concave.

planner *must* go through exactly n rounds of innovation. Clearly,

$$\underline{v}^{P,0}(s) = \frac{1+\rho}{\rho}u(s), \tag{15}$$

and

$$\underline{v}^{P,n}(s) = \max_{\beta} u(e) - B + \frac{1}{1+\rho}\left[\lambda \underline{v}^{P,n-1}(\beta) + (1-\lambda)\underline{v}^{P,n}(s)\right]. \tag{16}$$

Now, the value function of the program (14) is simply the unconstrained envelope of the family of $\underline{v}^{P,n}$ functions. To characterize this envelope, we prove the following technical results.

Lemma 1. $\underline{v}^{P,n}$ *has the following properties*:

(a) $\underline{v}^{P,n}(\beta^*) > \underline{v}^{P,n+1}(\beta^*)$,
(b) *for any* n, $\underline{v}^{P,n}$ *is concave*.

Proof. See Appendix B.

The family of constrained value functions, $\underline{v}^{P,n}$, is described in Fig. 5. By point (a) of Lemma 1, at the point β^*, $\underline{v}^{P,n}$ decreases as n increases. This is because of a higher direct expected cost of innovation (as there are more rounds of innovation), without any substantial benefit in terms of incentives (as the system is already at β^*). However, as s moves further away from β^*, there might be some benefit from an innovation, and thus, the graph of $\underline{v}^{P,n}$ might intersect with $\underline{v}^{P,n-1}$. Point (b) of Lemma 1 states that all the value functions within the $\underline{v}^{P,n}$ family are concave. We prove the result by induction, falling ultimately on the concavity of u. Given Lemma 1, we can proceed with the proof of Proposition 4. The basic idea is that the perfect lawmaker would take into consideration not only the value created by the innovation during the current round, but also its effect on the next round of innovation. The concavity of the next-round value function guarantees that the latter effect would push the innovation closer to β^* (see the planner's first-order condition Eq. (B.2) in the proof of Proposition 4 in Appendix B). The proof itself is made complicated by the non-differentiability of the value function v and by the discontinuity of the policy function.

Proposition 4 strengthens the previous result about the tendency of a freedom-of-contracting system to converge to a point far off the optimal standard. Not only is the absorbing set too large (Proposition 3), but also the dynamic process is too erratic (Proposition 4). Hence, the innovation process will end prematurely and the economy fails to converge closely enough to the efficient standard. Hence, the problem with a freedom of contracting regime like England's is not just that its bankruptcy law has remained unchanged for a considerable period since Victorian times. It is also that even in those days the innovation process was too focused on the transition period, and thus failed to approach the ideal perfect-law-making point closely enough.

Another important implication of Proposition 4 is that in order to achieve efficiency, the perfect legislator must suppress freedom of contracting. A policy of subsidizing the

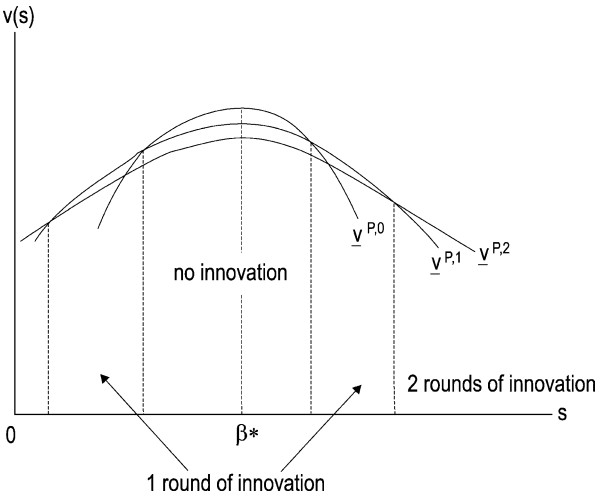

Fig. 5. The perfect lawmaker's value function. *Note*. $\underline{v}^{P,n}$ is the perfect lawmaker's value function, subject to the constraint that he must go through n rounds of innovation. The unconstrained value function is the envelope of all the constrained functions. Given the initial standard, the figure shows how the optimal number of rounds of innovation is determined.

direct cost of innovations (and thus decreasing B) will not suffice. This is because with freedom of contracting and a subsidized B, the parties still ignore the effect of their own innovation on subsequent users of the standard, so that the innovation process is, again, too erratic. Note, however, that this argument in favor of violating freedom of contracting is valid only within the transition period. By Proposition 3, once the perfect lawmaker has converged, the stationary point must be within the absorbing set of the freedom-of-contracting economy, leaving the parties with no desire to innovate, thereby willing to use the lawmaker's standard.

It is important to emphasize, however, that our model does not imply that a freedom-of-contracting regime would necessarily have a smaller number of innovations relative to the perfect lawmaker (given the same initial standard). For the combined effect of the slow convergence result (Proposition 4) and the under-innovation result (Proposition 3) on the amount of innovations is ambiguous. On the one hand, slow convergence implies that the planner covers an 'equal distance' with fewer rounds of innovation. On the other hand, the perfect lawmaker gets closer to β^*, and thus has a 'greater distance' (from s_0) to cover. In Lemma 2 we provide an extreme example whereby the former effect dominates the latter. We show that when the perfect lawmaker has a high valuation of future generations' welfare (low ρ), and when the enforcement uncertainty is high (low λ), the perfect lawmaker might opt for an immediate convergence, while a freedom-of-contracting regime might approach β^* in such small steps that convergence is prolonged to infinity. The result is interesting as it shows that a freedom-of-contracting system with slow convergence may innovate hyper-actively, while a perfect lawmaker may focus from the beginning on a target, and converge to it with little delay.

Lemma 2. *Suppose that* $\rho \to 0$ *and* $\lambda \to 1/2$ (*from above*). *Then, there exists a set of initial conditions from which a perfect lawmaker will converge to a stationary state by one round of innovation, while the parties will keep on innovating 'indefinitely'.*

3.5. An imperfect lawmaker

By the very definition of the objective function (14), the perfect lawmaker always (weakly) dominates a freedom-of-contracting regime. The result is generic: perfect State intervention can always mimic uncoordinated private action where such action achieves efficiency, and improve on it when it fails. Obviously, the result is not realistic, for the State (just like the market) is imperfect. In order to operate, it needs to delegate power to various agencies. By the inherent 'incompleteness' of any delegation of power, the agency is likely to follow objectives that differ from those intended by the principal, just like in any incomplete-contract problem; see Hart (1995), for example.

In Section 2 we provide some evidence demonstrating that the State tends to have a strong preference for the preservation of the going-concern value of the company. The modeling of this idea is straightforward: the imperfect lawmaker is forward-looking (like the perfect lawmaker), but selects his innovation policy $\{\tilde{\phi}^M, \tilde{I}^M\}$ between stage one and stage two of the financier-entrepreneur interaction, after the latter has already sunk his effort into the project. Since the lawmaker's decision has no effect on the effort choice, he has a distorted view of the trade-off between ex ante and ex post efficiency (towards the latter). We thus write the decision problem of the imperfect lawmaker as:

$$\begin{aligned}&\big\{\tilde{\phi}^M(s_0), \tilde{I}^M(s_0)\big\}\\&\quad= \arg\max_{\{\beta,\tilde{I}\}}(1-\pi)(1-e_0)b - \tilde{I}B + \frac{1}{1+\rho}\big[\lambda y^M(\beta) + (1-\lambda)y^M(s_0)\big],\end{aligned} \tag{17}$$

given the standardization technology (1). $y^M(s)$ is the net-surplus function, which depends on the innovation policy of subsequent lawmakers $\{\phi^M, I^M\}$. If the period-t lawmaker decides to innovate, i.e. $I^M(s_t) = 1$, then

$$\begin{aligned}y^M(s_t) &= u\big[\lambda\phi^M(s_t) + (1-\lambda)s_t\big] - B\\&\quad + \frac{1}{1+\rho}\big\{\lambda y^M\big[\phi^M(s_t)\big] + (1-\lambda)y^M(s_t)\big\};\end{aligned} \tag{18}$$

otherwise,

$$y^M(s_t) = \frac{1+\rho}{\rho}u(s_t). \tag{19}$$

Note that while the current lawmaker selects his policy for the initial period, he takes the policy of subsequent lawmakers, $\{\phi^M, I^M\}$, as given.[42] The (symmetric) equilibrium condition for this 'repeated Stackelberg' game is $\{\tilde{\phi}^M, \tilde{I}^M\} = \{\phi^M, I^M\}$. Namely, subsequent

[42] Or alternatively, if the future lawmaker is the same agency as the current one, he still cannot pre-commit himself to follow the same, or any other, policy in the future.

lawmakers take their decisions on the same basis as the current one, but the current lawmaker cannot commit subsequent lawmakers by his own action. Note also that the lender and the borrower anticipate rationally that the lawmaker will soften bankruptcy law (see Eq. (18)), but again, this anticipation cannot help the lawmaker to commit himself.

Differentiating Eq. (17), we derive the first-order condition of the current lawmaker,

$$(1-\pi)b(1+\rho) = y^{M\prime}(\beta), \tag{20}$$

which is independent of the initial standard, s_0. It follows that the innovation function is flat, and that if the subsequent lawmaker innovates, he aims at exactly the same point as the current one. Since innovation is costly, he would not do so; it follows that the imperfect lawmaker achieves immediate convergence. Using (19), the first-order condition is reduced to

$$(1-\pi)\rho b = u'\big(s^{*M}\big), \tag{21}$$

where s^{*M} is the stationary point of the imperfect lawmaker. Using the concavity of u, one may conclude that $s^{*M} < \beta^*$, and that the distance between the two points increases the higher are the private benefits, b, the probability of failure, $(1-\pi)$, and the social discount rate, ρ. This is because of the lawmaker's tendency to preserve private benefits is moderated by his concern about distorting effort incentives for subsequent cohorts of entrepreneurs. It follows that the more myopic the lawmaker is, the less he cares about future distortions and the more he softens bankruptcy law. In the extreme, if ρ is very high, the lawmaker would hit the corner solution with a zero β. In the opposite case when $\rho = 0$, the lawmaker is so concerned about the future that he converges to β^* upfront. Note that such quick convergence is sub-optimal: a perfect lawmaker would take into consideration the loss of incentives for the current generation, and would overreact so as to take e_0 closer to β^*, thus giving rise to cyclical convergence. The imperfect (but far-sighted) lawmaker ignores this aspect of his policy as he takes decisions after the entrepreneur has already put effort into the project.

Lastly, we turn to the decision whether to innovate at all. Substituting the stationary state into (18) and then into the objective function of (17) we get the value of the economy in case the lawmaker innovates,

$$(1-\pi)(1-e_0)b - \frac{1+\rho}{\rho+\lambda}B + \frac{1-\lambda}{\rho+\lambda}u(e_0) + \frac{\lambda}{\rho+\lambda}\frac{1+\rho}{\rho}u\big(s^{*M}\big), \tag{22}$$

compared with the alternative of doing nothing:

$$(1-\pi)(1-s_0)b + \frac{1}{\rho}u(s_0). \tag{23}$$

Note that unlike parties in a freedom of contracting regime, the imperfect lawmaker takes into consideration the effect (both costs and benefits) of his innovation on subsequent cohorts of parties. We summarize[43]:

[43] Proof of Proposition 5 is contained in the previous discussion.

Proposition 5. *The imperfect lawmaker will converge immediately to a stationary state, s^{*M}, where $s^{*M} < \beta^*$; the distance between s^{*M} and β^* increases with private benefits, b, and the discount rate, ρ, and the probability of failure,* $(1-\pi)$.

Three points are worthy of some elaboration. Firstly, the imperfect lawmaker converges to the stationary point without any cycle. This, however, is not a generic result. It follows from the simplifying assumption that ex post efficiency is linear in β. To see the point more clearly, consider a myopic lawmaker ($\rho \to \infty$), who cares about ex post efficiency only, but where the fundamentals are such that the ex post value is non-linear in β, so that there exists an internal solution to the ex post optimization problem. Once the planner sets the effective liquidation policy, e, to that internal solution, we obtain cycles once again.

Secondly, it is worth drawing attention to another simplifying assumption: that the imperfect lawmaker takes a decision at stage two of the financier-entrepreneur interaction. More realistically, the lawmaker could take his decision at stage three of the financier-entrepreneur interaction. In such a case, the imperfect lawmaker would be triggered into action by the entrepreneur's failure, which in our setting can be interpreted as recession (in line with Berglof and Rosenthal, 2001). The extra complication of such formalization would be that legislation itself would become a random variable.

Thirdly, and most importantly, the relative advantages of the two, second-best (or rather third-best) regimes can be observed. The main weakness of the freedom of contracting regime is that the welfare of future generations is not internalized by the parties. As we have seen above, if the direct cost of innovation and the enforcement uncertainty are small, the loss of value due to this externality is also small. At the same time, the ex post bias of the imperfect lawmaker may still cause a significant long-term loss of value to the economy. In such a case one should opt for freedom of contracting. If, however, the opposite happens and the private benefits are small enough so that the ex post bias is not significant, then an imperfect lawmaker may dominate. This is particularly true if ρ is small so that the optimal policy is to converge quickly (see Lemma 2) and the initial conditions are not too close to β^* (in which case freedom of contracting is trivially efficient).

4. Conclusions

We have constructed a dynamic model of bankruptcy law, where the law is considered as a mechanism for standardizing commercial agreements. The main question is why the State cannot leave the standard-formation process in the hands of the market. We argue that under-innovation is the reason.

We believe that the questions discussed here go beyond bankruptcy law, and apply to issues such takeovers and ownership law. Under the Act of 1862, English law has left issues like directors' powers, internal governance structure and rules about tendering for outside acquisitions to the corporate charter. However, it is also clear that long ago English corporate-governance law has departed from freedom of contracting. Future research will have to determine to what extent our approach may help to explain these trends.

Acknowledgments

Both authors acknowledge the financial support from the European Union's Training and Mobility of Researchers Network, Contract No. FRMX-CT960054. The first author is also grateful to UCLA for research support while he was visitor.

We would like to thank Alexander Guembel, David Goldreich, Colin Mayer, Alan Morrison, Elu Von Thadden, Bill Wilhelm and two anonymous referees for very helpful comments. We would also like to thank Rong Leng for excellent research assistantship.

Appendix A. The citation data set

Structure

Our sampling window is 1990–2002 for England and 1990–2000 for the US (Fig. A.1). Within that window, we survey all the bankruptcy cases for both England and the US. These are our 'citing cases'. Each citing case cites both other cases and acts. 'Cases cited' are traced back in time back to the nineteenth century. Clearly, there may be more 'citations' than citing cases. The figure below describes an example with three citing cases, three cases cited and four citations.

Data sources

There are two sources: 'Lexis Nexus' for England and 'West Law' for the US. Both are computerized databases of recorded cases. Each database is generated by a publisher who identifies, edits and publishes cases of professional interest to the legal community.

Identifying bankruptcy cases

In order to identify bankruptcy cases we have scanned the whole text of every judgment in the databases (within the sampling window) for keywords indicating bankruptcy. In England, the keywords are 'receiver' and 'floating charge'. In the US, the keywords are 'Chapter 11' and at least one of the following: 'reorganization plan', 'cramdown', 'automatic stay' or 'debtor in possession'. The result is 144 citing cases in England and 9139 citing cases in the US.

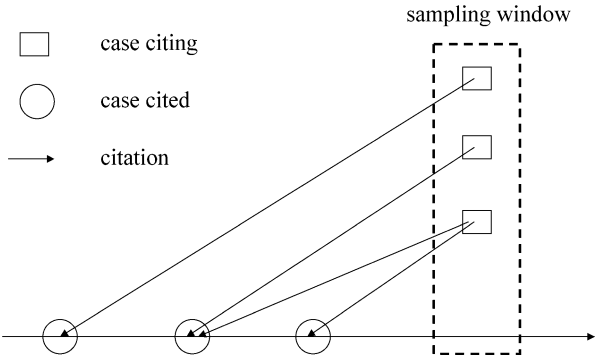

Fig. A.1.

Citations

We then scan the text of the citing cases for citations of both acts and previous cases. Ultimately, every record in our data set is a citation of either an act or a previous case with details about both the citing case and the case (or act) cited. The vintage year of the case cited is particularly important. Since acts are often cited by an index number (particularly in the US), we have no information of satisfactory quality about the vintage of acts cited.

Appendix B. Proofs

Proof of Proposition 1. It is easy to compute

$$\frac{\mathrm{d}\pi}{\mathrm{d}R}\Big|_{\mathrm{IC}} = -\frac{1}{f''} \geqslant -\frac{\pi}{R} = \frac{\mathrm{d}\pi}{\mathrm{d}R}\Big|_{\mathrm{PC}}.$$

The direction of the inequality follows from the relative slopes of the IC and PC curves at the optimal-contract point. Hence,

$$\pi'(\beta) = -\frac{b\pi}{R - \pi f''} > 0, \quad \text{and} \quad R'(\beta) = -\frac{k\pi'(\beta)}{\pi^2} < 0.$$

Using the envelope theorem, it is easy to compute

$$u'(\beta) = -\pi R' - (1-\pi)b.$$

According to assumptions (A2)–(A3), there exists a $\beta \in [0,1]$ where the IC and PC curves are tangent, $R = \pi f''$, $R' \to -\infty$ and thus $u' \to +\infty$.

It follows from assumption (A4) that $u'(1) < 0$. The continuity of u guarantees an internal maximum.

It is clear from Fig. 1 that, apart from the tangency point, u' is continuous as well. Hence, u must be concave around the internal maximum of u. □

Proof of Proposition 3. Consider the right-hand boundary of the absorbing set of a freedom of contracting economy, $\overline{S}$. (A symmetric argument applies to the right-hand side of the absorbing set.) By definition, for $s = \overline{S}$, the parties within a freedom of contracting environment are indifferent between innovating and avoiding innovation. In case they avoid innovation, the expected present value of the economy would be $[(1+\rho)/\rho]u(\overline{S})$. Now suppose the parties do innovate; clearly, the innovation β_F should satisfy $\lambda\beta_F + (1-\lambda)\overline{S} = \beta^*$. In such a case, the expected present value of the economy is

$$y = \big[u(\beta^*) - B\big] + \frac{1}{1+\rho}\left[\lambda\frac{1+\rho}{\rho}u(\beta_F) + (1-\lambda)y\right].$$

Remembering that $u(\beta^*) - B = u(\overline{S})$ and solving out for y, it is easy to see that

$$y = \frac{1+\rho}{\rho}\left[\frac{\rho}{\rho+\lambda}u(\overline{S}) + \frac{\lambda}{\rho+\lambda}u(\beta_F)\right].$$

It follows that by innovating the parties increase the value of the economy by

$$\frac{1+\rho}{\rho}\cdot\frac{\lambda}{\rho+\lambda}\big[u(\beta_F) - u(\overline{S})\big],$$

which is strictly positive (see Figs. 2 and 3). (Remember that a social planner can generate even more welfare adopting an even better innovation policy than β_F.) Yet, freedom-of-contracting parties are indifferent between innovating and not, as they ignore the future expected value generated by the innovation. It follows, by the continuity of u, that within a certain neighborhood to the left of $\overline{S}$, a social planner will innovate while freedom-of-contracting parties will not. □

Proof of Lemma 1. We prove both points by induction. Firstly, it is quite clear that if $s = \beta^*$, the planner's best course of action is to innovate β^*, for n rounds. Using Eqs. (15) and (16), one can derive

$$\underline{v}^{P,1}(\beta^*) = \frac{1+\rho}{\rho}u(\beta^*) - \frac{1+\rho}{\lambda+\rho}B,$$

(just $\underline{v}^{P,1}$ minus the expected direct cost of innovation as derived in Eq. (2)) and

$$\underline{v}^{P,n}(\beta^*) = \frac{1+\rho}{\lambda+\rho}\left[u(\beta^*) - B + \frac{\lambda}{1+\rho}\underline{v}^{P,n-1}(\beta^*)\right].$$

It follows that

$$\underline{v}^{P,n}(\beta^*) = \frac{1+\rho}{\rho}\left\{u(\beta^*) - \left[1 - \left(\frac{\lambda}{\lambda+\rho}\right)^n\right]B\right\},$$

which implies the first point of Lemma 1.

Next, we prove concavity in the usual manner. The concavity of $\underline{v}^{P,0}$ is guaranteed by the concavity of u. It is easy to see that if $\underline{v}^{P,n-1}$ is concave, $\underline{v}^{P,n}$ is also be concave. Consider two initial points s_1 and s_2, with corresponding optimal innovations β_1 and β_2 and effective liquidation policies e_1 and e_2, such that

$$\underline{v}^{P,n}(s_1) = \frac{1+\rho}{\lambda+\rho}\left[u(e_1) - B + \frac{\lambda}{1+\rho}\underline{v}^{P,n-1}(\beta_1)\right],$$
$$\underline{v}^{P,n}(s_2) = \frac{1+\rho}{\lambda+\rho}\left[u(e_2) - B + \frac{\lambda}{1+\rho}\underline{v}^{P,n-1}(\beta_2)\right].$$

It follows from the concavity of u and $\underline{v}^{P,n-1}$ that

$$\begin{aligned}
&\frac{1+\rho}{\lambda+\rho}\left(u\left\{\lambda\left[\alpha\beta_1 + (1-\alpha)\beta_2\right] + (1-\lambda)\left[\alpha s_1 + (1-\alpha)s_2\right]\right\} - B\right.\\
&\qquad\left. + \frac{\lambda}{1+\rho}\underline{v}^{P,n-1}\left[\alpha\beta_1 + (1-\alpha)\beta_2\right]\right)\\
&\quad > \frac{1+\rho}{\lambda+\rho}\left\{\alpha u(e_1) + (1-\alpha)u(e_2) - B\right.\\
&\qquad\left. + \frac{\lambda}{1+\rho}\left[\alpha\underline{v}^{P,n-1}(\beta_1) + (1-\alpha)\underline{v}^{P,n-1}(\beta_2)\right]\right\}.
\end{aligned}$$

Namely, a linear combination of the innovation policies would generate more value than the linear combination of the values of the innovations. □

Proof of Proposition 4. Note first that if an innovation policy is unconstrained at one point, it is also unconstrained at any other point down the innovation path. Consider a standard s_0. Suppose that $\underline{v}^{P,n}(s_0)$ happens to be unconstrained with an optimal innovation β_0 and an effective liquidation policy e_0. Suppose, however (by contradiction) that $\underline{v}^{P,n-1}(\beta_0)$ is constrained. It follows that $\underline{v}^{P,n-2}(\beta_0) > \underline{v}^{P,n-1}(\beta_0)$. But then,

$$\frac{1+\rho}{\lambda+\rho}\left[u(e_0) - B + \frac{\lambda}{1+\rho}\underline{v}^{P,n-2}(\beta_0)\right] > \frac{1+\rho}{\lambda+\rho}\left[u(e_0) - B + \frac{\lambda}{1+\rho}\underline{v}^{P,n-1}(\beta_0)\right],$$

and thus

$$\underline{v}^{P,n-1}(s_0) > \underline{v}^{P,n}(s_0),$$

which contradicts the assumption that $\underline{v}^{P,n}(s_0)$ happens to be unconstrained.

It follows that to the family of constrained value functions, $\underline{v}^{P,n}$, there is a corresponding family of policy functions, $\underline{\phi}^{P,n}$, calculated, simply from the first-order conditions to (16),

$$u'(e) + \frac{1}{1+\rho}\left(\underline{v}^{P,n-1}\right)'(\beta) = 0. \tag{B.1}$$

Now, ϕ^P is made of the unconstrained segments of this family.

Note that all theses functions satisfy $\underline{\phi}^{P,n}(\beta^*) = \beta^*$, and also,

$$\left(\underline{\phi}^{P,n}\right)'(s) = -(1-\lambda)\Big/\left[\lambda + \frac{(\underline{v}^{P,n-1})''(\beta)}{(1+\rho)u''(e)}\right], \tag{B.2}$$

which is smaller, in absolute value, than the slope of the innovation function of the parties within a freedom-of-contracting regime (13). That proves Proposition 4. □

Proof of Lemma 2. Consider first the parties in a freedom-of-contracting regime. Their absorbing set is not affected either by ρ or by λ. At the same time, the slope of $\underline{\phi}^F$ approaches minus one, so that if the initial conditions are out of the absorbing set, an innovation process may be prolonged indefinitely. As for the social planner, if she innovates, it will be β^*; see Eqs. (15) and (B.1). To find her absorbing set, find the roots (in terms of S) of

$$u(\beta^*) - \frac{\rho}{\lambda+\rho}B = u(S).$$

Clearly, the absorbing set shrinks down to a singleton. At the same time, the area from which the planner will converge to β^* in a single round of innovation is quite large. To see that, note that

$$\underline{v}^{P,1}(S) = \frac{1+\rho}{\lambda+\rho}\left\{u\big[\lambda\beta^* + (1-\lambda)S\big] - B + \frac{\lambda}{\rho}u(\beta^*)\right\},$$

$$\underline{v}^{P,2}(S) = \frac{1+\rho}{\lambda+\rho}\left\{u\big[\lambda\beta_1 + (1-\lambda)S\big] - B + \frac{\lambda}{1+\rho}\underline{v}^{P,1}(\beta_1)\right\},$$

where S is some initial condition and β_1 the first among two rounds of innovations. Using some algebra, one may verify that there will be only one round of innovation as long as

$$\underline{v}^{P,1} - \underline{v}^{P,2} = \frac{1+\rho}{\lambda+\rho}\left\{u\big[\lambda\beta^* + (1-\lambda)S\big] + \frac{\lambda}{\lambda+\rho}u(\beta^*) - u\big[\lambda\beta_1 + (1-\lambda)S\big] - \frac{\lambda}{\lambda+\rho}u\big[\lambda\beta^* + (1-\lambda)\beta_1\big] + \frac{\lambda}{\lambda+\rho}B\right\} > 0.$$

A sufficient condition for the above inequality to hold is

$$u(S) > u(\beta^*) - \frac{B}{1-\lambda}.$$

Hence, the area from which the planner will converge to the stationary point in one round is significantly larger than the absorbing set of the parties. □

References

Aghion, P., Bolton, P., 1992. An incomplete contracts approach to financial contracting. Rev. Econ. Stud. 59, 473–494.

Aghion, P., Hermalin, B., 1990. Legal restrictions on private contracts can enhance efficiency. J. Law, Econ., Organ. 6, 381–409.

Allen, F., Douglas, G., 1994. Financial Innovations and Risk Sharing. MIT Press, Cambridge.

Baird, D., 1986. The uneasy case for corporate reorganizations. J. Legal Stud. 15, 127–147.

Bebchuk, L.A., 1989. Limiting contractual freedom in corporate law: The desirable constraints on charter amendments. Harvard Law Rev. 102, 1820–1841.

Bebchuk, L.A., Roe, M., 1998. A theory of path dependency in corporate governance and ownership. Stanford Law Rev. In press.

Berglof, E., Rosenthal, H., 2001. The political economy of American bankruptcy: The evidence from roll call voting, 1800–1978. Mimeo.

Besen, S.M., Farrell, J., 1994. Choosing how to compete: Strategies and tactics in standardization. J. Econ. Perspect. 8, 117–131.

Biais, B., Mariotti, T., 2003. Credit, wages and bankruptcy laws. Mimeo.

Bolton, P., Rosenthal, H., 2002. Political intervention in debt contracts. J. Polit. Economy. In press.

David, P.A., 1985. CLIO and the economics of QWERTY. Amer. Econ. Rev. 75, 332–337.

Duffie, D., Rahi, R., 1995. Financial innovations and security design. J. Econ. Theory 65, 1–42.

Encyclopedia Brittanica, 1911. Enterprise and productivity: The goverments strategy for the next Parliament, June 2001.

Franks, J.R., Sussman, O., 2003. Financial distress and bank restructuring of small to medium size UK companies. Mimeo.

Franks, J.R., Torous, W.N., 1989. An empirical investigation of US firms in reorganization. J. Finance 44, 747–770.

Gale, D., 1992. Standard securities. Rev. Econ. Stud. 59, 731–755.

Gilmore, G., 1965. Security Interests in Personal Property, vol. 1. Little Brown & Co.

Glaeser, E.L., Shleifer, A., 2002. Legal origins. Quart. J. Econ. 117, 1193–1230.

Gower, L.C.B., 1969. The principles of Modern Company Law, third ed. Stevens and Sons, London.

Hart, O., 1995. Firms, Contracts and Financial Structure. Clarendon, Oxford.

Hunt, C.B., 1936. The Development of the Business Corporation in England, 1800–1867. Harvard Univ. Press, Cambridge, MA.

Jenks, E., 1920. A Short History of English Law. Methuen, London.

Jensen, M., 1989. Active investors, LBOs and privatization of bankruptcy. J. Appl. Corp. Finance 2, 35–44.

La Porta, R., Lopez De Salines, F., Shleifer, A., Vishny, R.W., 1997. Legal determinants of external finance. J. Finance 52, 1131–1150.

La Porta, R., Lopez De Salines, F., Shleifer, A., Vishny, R.W., 1998. Law and finance. J. Polit. Economy 106, 1113–1155.

Maitland, F., 1904. Trust and corporation. Z. Privat Offentlich Recht, Bd. XXXII. Electronic version: http://socserv.mcmaster.ca. McMaster University Archive for the History of Economic Thought.

Martin, A., 1974. Railroads and the equity receivership: an essay on institutional change. J. Econ. History 34, 685–709.

Manove, M., Padilla, J., Pagano, M., 2000. Collateral vs. project screening: A model of lazy banks. Mimeo.

Palmer, F.B., 1905. Palmer's Company Law: A Practical Handbook. Stevens and Sons, London.

Posner, R.A., 1996. Law and Legal Theory in England and America. Clarendon, Oxford.

Rajan, R.G., Zingales, L., 1999. The politics of financial development. Mimeo. University of Chicago.

Skeel Jr., D.A., 2001. Debt's Dominion: A History of Bankruptcy Law in America. Princeton Univ. Press.

Sussman, O., 1999. Economic growth with standardized contracts. Europ. Econ. Rev. 43, 1799–1818.

Topham, A.F., Topham, A.M.R., 1933. Palmer's Company Precedents, part III, fourteenth ed. Stevens and Sons, London.

Tufano, P., 1997. Business failure, judicial intervention, financial innovation: Restructuring US railroads in the nineteenth century. Bus. History Rev. 71, 1–40.

Tufano, P., 2003. Financial Innovation. In: Constantinides, G.M., Harris, M., Stulz, R.M. (Eds.), Handbook of the Economics of Finance. North-Holland.