

The Evolution of the German Tort Law in the Nineteenth Century: an Economic Analysis of the Evolution of Law

by
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Abstract: This essay combines the main ideas of neo-institutionalism with those of Evolutionary Economics in order to construct a model of the process of legal evolution. The cognitive creativity of the actors on the one hand, and wealth effects caused by negative technological externalities - resulting from the use of new technologies - on the other hand, are interpreted as the decisive factors that explain legal change. The fruitfulness of this approach is shown by its application to the development of tort law in nineteenth-century Germany. There, a trial-and-error-process of legal innovations and imitations was triggered, resulting in the present-day broad diffusion of the strict liability rule in German tort law.

1. Introduction

The introduction of railways in the nineteenth century did not only have a serious impact on industrialisation and on the evolution of the modern corporation, but also on property rights' structures, at least in Germany. Eight days after the first Prussian railway line was opened in 1838, the *Preußische Eisenbahngesetz* (Prussian Railway Law) was enacted. Among other things, this law prescribed that railway accidents had to be treated by the courts according to the strict liability rule. This was a complete break with the whole German tradition of tort law, which for centuries had been firmly based on the negligence rule. From then to the present day, legal development and court rulings have extended the application of the strict liability rule to ever more fields. Apart from the passing of the Prussian Railway Law, a decisive step in the evolution of the modern German liability law was the adoption of the *Allgemeine Deutsche Handelsgesetzbuch* (General German Code of Commercial Law) in 1861. The Code prohibited the contractual exclusion of liability, thereby seriously restricting the free-

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dom of contract. The Railway Law and the Code of Commercial Law were the first in a long series of legal acts in the evolution of the modern German tort law which led from the hitherto ubiquitous predominance of the negligence rule to the widespread use of the strict liability rule today.

While the Economic Analysis of Law and the New Institutional Economics (NIE) allow us to assess the economic consequences of individual legal rules, we know relatively little about the mechanisms of legal change.¹ Despite important efforts in this area of research, there is as yet no elaborate economic theory of the evolution of law, which might be used to analyse the complex trial-and-error-process of legal innovations and imitations.² NIE primarily considers how institutions affect the incentive structure of economic agents, being enormously successful in explaining the role of institutions for economic performance (Eggertsson, 1990). However, as NIE is based on the neoclassical paradigm, it is mainly concerned with analysing and comparing static equilibria. It is less well suited to examining processes of innovation which by necessity always entail some novelty, thereby making the concept of a given set of alternatives - from which the best one is chosen according to some objective function - improper.³ Like NIE, Public Choice Theory, which analyses the properties of different political structures and rules, has contributed to our understanding of the incentives of political systems and thus on the outcomes of political processes (Mueller, 1989; 1997). However, Public Choice, too, remains within the neoclassical framework by assuming a given set of political alternatives from which the actors chose the best one according to their particular objective functions. Public Choice does not deal with how novel - i.e. hitherto unknown - legal innovations are generated. Finally, North and Thomas (1973) and North (1981, 1990) have made important contributions to an economic theory of institutional change. However, this conceptual framework, too, cannot be used for explaining legal

¹Because the subject of the following is the process of legal innovations and imitations, we are not concerned with the economic incentives set by legal rules. With regard to the efficiency aspects and distributional consequences of the negligence rule compared to the strict liability rule, see for example Cooter and Ulen (1995), Landes and Posner (1987), Posner (1992, pp. 163-216) and Schäfer and Ott (1995, pp. 127-181).

²See for example Aranson (1992), Cooter and Ulen (1995), Eggertsson (1990), Hayek (1973; 1976; 1979), Knight (1992), Mueller (1989), North (1981; 1990), Okruch (1999), Posner (1992) and Richter and Furubotn (1997). For a comprehensive discussion of these different approaches see Eckardt (2001, pp. 24-108).

³The neoclassical maximisation rule, according to which the efforts of the acquisition of new information or of innovatory activities are optimal if the marginal return equals the marginal costs, can only be applied under the assumption of a given and closed set of alternatives, from which the best one can be chosen. If one integrates novelty, the maximisation method can no longer be applied because we do not have a closed action space anymore (Hesse, 1997).

change caused by technological innovations: it does not deal with such innovative processes in detail, and does not contain a coherent evolutionary theory of institutional change. Where the generation of new institutions is explicitly considered, it is therefore impossible to use central approaches of New Institutional Economics. Still, NIE has given us important insights into the incentives that are exerted by different political, bureaucratic and organisational restrictions, and these insights will be applied in the following analysis.

Combining the main ideas of Evolutionary Economics and New Institutional Economics, this paper is intended to contribute to our understanding of the highly complex mechanisms of legal evolution. While our focus is on the co-evolution of technical and legal change, we simplify our analysis by examining only one direction of this interrelation. Taking technological change as exogenous, we analyse the resulting incentives on changing the law. The starting point of our analysis is the insight that the introduction of technical innovations does not only have positive effects, but involves negative technological externalities,⁴ too, that is, externalities which reduce the welfare and income of some actors. As legal rules always refer only to problems and damages which are already known, the new negative externalities require an innovative process of adapting the law, so that the new damaging activities are prohibited or compensations are paid for them.⁵ Obviously, as any political activity, changing the law involves costs. Hence, the persons negatively affected by a new technology will act collectively only if the volume of wealth reduction is sufficiently high, relative to the costs of political action. In what follows, we assume that the decisive factor that determines the opportunity costs of political activities is the rate at which the new technology is adopted. As this changes over time, it also induces a change in the volume of negative externalities. Therefore, the opportunity costs of political action change over the lifecycle of a technology. Thus, a trial-and-error process of legal innovations and imitations is set off, where wealth effects and cognitive aspects are the decisive factors.

To model this experimental process of legal change, we refer to some of the core ideas of Evolutionary Economics. While not being as well-developed as the neoclassical paradigm, Evolutionary Economics offers some promising building blocks for solving our problem. After all, it is concerned with processes of economic change in which the generation and diffusion of innovations are at least in part treated as endogenous, and are not assumed to be completely exogenous

⁴In the following, we always refer to negative technological externalities if not stated otherwise.

⁵As we are concerned only with processes of statutory innovations in this paper, we take no account of legal innovations by court decisions. But of course, a comprehensive economic theory of the evolution of law must contain this mechanism of the generation of legal innovations, too. See Aranson (1992), Cooter and Ulen (1995), Hayek (1973), Okruch (1999) and Posner (1992).

(Nelson, 1995). Evolutionary Economics has been developed mainly with regard to the study of technical evolution and its impact on economic change.⁶ One important step in the study of the impact of technical innovations on the economy was the development of the life cycle theory. Based on Schumpeter's (1928, 1939) ideas, Heuss (1965) presented a comprehensive theory of the market cycle, which tried to integrate processes of technical as well as of economic change. Berg (1995) extended this concept to comprehend rent-seeking activities taking place in the different stages of the market cycle. However, whereas he applied evolutionary arguments only to technical change, we try to apply this line of reasoning to statutory innovations, too, modelling their emergence as a trial-and-error-process. Reacting to new problems, which result from the use of new technologies, the actors involved (government, political parties, interest groups and individuals) begin to experiment with new legal rules. If these rules are judged to be useful devices, they are positively selected; if not, they are modified so as to eliminate their shortcomings, thus creating path-dependencies.

In section 2, the main elements of such an economic theory of legal evolution are introduced. The usefulness of this approach will then be illustrated in section 3 where it is applied to the innovations of German liability law in the nineteenth century mentioned above.

2. The basic elements of an economic theory of legal evolution

In recent years, Evolutionary Economics has made great efforts to analyse innovations without assuming them as exogenously given (Hodgson, 1993; Nelson, 1995; Witt, 1992). One promising way follows the analogy drawn from evolutionary biology, using a variation-selection-approach (Nelson, 1995), but without overstressing it, as it is dealing with human beings as the central actors. Social, not biological factors are therefore central to our reasoning. By describing the variation mechanisms, we can study how new economic products, technical devices or institutions like legal rules are generated, while by specifying the relevant selection environment and its mechanisms we can derive hypotheses about what kind of innovations won't be viable and can therefore possibly be excluded.

Applying this approach to the evolution of legal rules, we must first specify who the relevant actors are and how they generate new rules, then, what the

⁶See for example Coombs, Saviotti and Walsh (1987), Dosi et al. (1988), Metcalfe and Saviotti (1991), Nelson and Winter (1982), Saviotti (1996), Silverberg, Dosi and Orsenigo (1988) and Witt (1993b).

relevant selection environment is - i.e. which restrictions determine the viability of innovations -, and finally, through which mechanisms the selection process works.

2.1 The variation mechanism: a cognitive-creative model of action

As our approach is based on methodological individualism, individuals are the central actors. They are the agents who generate technical as well as institutional innovations. When we examine legal innovations generated by legislation, we find the ruler or government on the supply side of the political market, and the political parties and the affected individuals and interest groups on the demand side.

Having determined who the actors who create legal innovations are, we must specify the assumptions about their cognitive capabilities. Firstly and most importantly, we assume that people's cognitive capability is characterised by creativity (Boulding, 1956; Lachmann, 1943; Shackle, 1958; 1979). As cognitive science tells us, the human brain seems spontaneously to recombine sensual perceptions, thus continuously offering us new interpretations and new ideas about the outside world (Hesse, 1990; Pöppel, 1985). It is, therefore, the ultimate source of novelty, from which all innovations stem. As we are unable to predict in advance either the content of our next thought, or after what time (of thinking about it) a particular idea will come up, the whole notion of the neoclassical theory of information economics makes no sense with regard to the emergence of novel ideas. Because of our creativity, we don't know what our next idea will be. Consequently, we also don't know which alternatives our action space contains. Therefore, we can't use an algorithm to derive the optimal alternative.

Secondly, we assume that people are able to perceive and interpret the outside world only in a subjective way. In order to interpret the relationships between the impressions they cognitively perceive, they need theories. These theories, in turn, cannot be objectively tested for their substance because, as the theory of knowledge shows us (Hayek, 1952; Popper, 1987), every such proof is itself based on subjective interpretations of the objective world. The same idea lies behind the "mental models" put forward by Denzau and North (1994, p. 4) as "internal representations that individual cognitive systems create to interpret the environment".

Thirdly, we assume that the actors rationally choose from the action space they have thus created. However, under the assumptions listed above their actions will have the desired outcomes only by chance or in well-structured and stable environments. Because of their subjective theories about the underlying situation, their limited cognitive capacities in processing available information, and because other actors, whose action space will be affected, may react in a creative way, unexpected side-effects are bound to occur. The actors can try to

improve their subjective mental models (Denzau and North, 1994) through feedback-effects from the external environment and through communication,⁷ but - to stress the point again - there is no way to know how close one's mental model is to reality (i.e. whether one has the *true* model of reality or not).

What consequences do these assumptions have for the analysis of the generation of legal innovations? Firstly, as *all* actors are assumed to be creative, the generation of novelty is ubiquitous. Each perception of a situation and each resulting action contains some novelty, no two persons being exactly alike and all therefore having their own subjective interpretations. This, then, This, then, is a source that endogenously generates new ideas which are the basis of potential innovations. Secondly, even cases where one actor simply tries to imitate the actions of another actor by using the same devices or adopting the same strategies constitute creative acts which again entail some sort of novelty, as the literature on the diffusion of technical innovations has shown (Dosi, 1988; Silverberg, Dosi and Orsenigo, 1988).

Basing our argument on these realistic assumptions about human action should lead us to expect omnipresent and abundant heterogeneity. Yet in reality, the world is much more structured than our premises may lead us to assume. To explain why, despite the continual generation of new ideas, we perceive a much more homogenous world, we must turn to the selection mechanisms that determine which new ideas will be successful.

2.2 Selection environment and mechanisms

Schumpeter (1942) and Downs (1957) modelled political phenomena as competitive processes that take place in analogy to the market, and Public Choice and NIE took up this line of research. According to this approach, we can distinguish between the supply- and the demand-side of legal innovations. The ruler or the government are the actors on the supply side of the political market. On the demand side, the relevant actors are the companies which use the new technology, thereby producing negative externalities, and the people who suffer from the resulting wealth reductions.⁸ The latter are customers and employees of the companies⁹ as well as actors without any contractual relationship to them.

⁷Learning processes play an important role in this respect.

⁸To complete the picture, it is necessary to include companies and employees who suffer from competition by the new technology, acting in stagnating markets. In the political process they, too, demand regulations in order to protect their market position.

⁹Negative externalities may also exist when there is a contractual relationship, if the contract does not take account of the externalities.

Combining the cognitive-creative model of action introduced above with the elaborate models of Public Choice Theory allows us to overcome at least part of the static nature of traditional Public Choice (Meier and Haury, 1990; Meier and Slembeck, 1994). As statutory innovations always require some sort of collective action, the actors on the supply- and demand-side must achieve a common collective understanding of the relevant problem. To be more precise, the generation of some kind of a shared mental model - at least among the relevant political actors - is a necessary condition, promoting their interests in form of a legal innovation being otherwise impossible. Setting up a politically effective interest group requires, therefore, a political entrepreneur able to create a common cognitive framework among the group's potential members - a framework which concerns both the problem at hand and potential legal solutions to it. The selection mechanisms specified by the constitution (access to the legislation, voting rules etc.) then determine which of the legal innovations that have been suggested will be successful. That having happened, the legal ruling is subject to a further external selection process which decides whether it is an adequate problem-solving measure or not. If not, there may be new efforts to modify it via another legislative procedure.

Setting up an interest group does not only require some shared mental model, but also enough people willing to expend the necessary organisational costs (Olson, 1965; 1982). Whether the group's potential members are willing to do this depends on their opportunity costs, which are influenced by the relevant political and economic selection environment. On the one hand, the constitution of a polity determines the access of different groups of the population to the legislation, thus imposing different costs on different groups of actors. On the other hand, the opportunity costs of interest group formation are influenced by the extent to which the individuals are affected by the negative externalities of the new technology. Accordingly, in the following section we will first analyse those costs of political activity which the constitution and its selection mechanisms impose. Subsequently, we examine how the opportunity costs generated by a new technology change during its life cycle. Changes which occur here result in changes in the incentive structures of different interest groups, which compete for political influence in order to influence the law according to their respective interests. Finally, we briefly study the supply side of new legal rules.

2.2.1 The political environment - constitutional restrictions and interest groups

The constitution, which we take as exogenous, restricts access to the process of legal innovation by statutory law-making.¹⁰ It stipulates who is allowed to vote and what kind of people are to be elected, as well as defining the central tasks and powers of the government. The constitution also outlines the essential selection mechanisms of legislative law-making (especially the voting rules). These constitutional rules determine the basic costs of political activity for the supply and demand side of legal innovations. Because they grant different degrees of access to the political process to various groups of the population, the respective costs of political activity differ, too. Roughly speaking, the more formal the constitutional right to participate in legislation is, the lower are the costs of political activities for the actors belonging to the part of the population which has been granted this right. Therefore, the constitution defines the fundamental selection environment that limits the range of the interest groups which are successful in creating new legal rules. By identifying these restrictions, we can thus derive first tentative hypotheses about which interests will be articulated more easily than others in the political process, and which therefore will have a better chance of being realised.

Following North (1990a), we distinguish between different political systems according to the form and range of participation in the legislation which different parts of the population are entitled to. Thus, in a very abstract way we can capture the main features of the political systems in nineteenth-century Germany. The first model, which also characterises the Prussian monarchy of the early nineteenth century, is an autocratic polity with a ruler on the one hand, and a constituency without universal suffrage on the other. Obviously, for most people who act in such a political environment the costs of influencing the process of law-making are virtually prohibitive. In accordance with North (1990a, pp. 48f), we assume that the sovereign has nevertheless to act “like a discriminating monopolist, offering to different groups of constituents protection and justice or at least the reduction of internal disorder and the protection of property rights in return for tax revenue”. As the ruler’s main objective is to maximise his power, he will enact regulations both in order to promote economic growth and to reduce political unrest of influential interest groups.

In a second model, North assumes that apart of the sovereign, there is a “representative body reflecting the interests of constituent groups and their role in bargaining with the ruler” (North, 1990a, p. 49). For the actors represented by

¹⁰Constitutions are part of the formal political rules of a society. They “broadly define the hierarchical structure of the polity, its basic decision structure, and the explicit characteristics of agenda control” (North, 1990a, p. 47).

this body, the costs of political influence are much lower now than for those without any formal rights to participate in legislation. Such a body, the *Herrenhaus*, which represented members of the nobility appointed for life by the king of Prussia, was established by the Prussian Constitution of 1850 which also provided for an elected parliament, the *Abgeordnetenhaus*. The members were elected according to a three-class electoral system which gave more political weight to the wealthier classes of the population. Thus, Prussia was a constitutional monarchy which contained both democratic and feudal elements. Political power was divided between the ruler, a representative body and a parliament, supremacy residing with the monarch and the wealthier parts of the electorate. Still, the establishment of an elected parliament reduced the costs of political activities for broader parts of the population and facilitated the emergence of interest groups.¹¹

Different types constitutions impose different costs of political activities on the political actors. The transition from an autocratic constitution to a constitutional monarchy, which allows larger shares of the population to take part in legislation at least to a limited degree, shifts the costs of expressing one's interests. Thus, the costs of achieving their objectives increase for those groups which hitherto enjoyed a more exclusive access to legislation, whereas for actors who were hitherto disadvantaged, the costs of political activities fall. We can therefore expect that in a representative monarchy, more interest groups will be directly competing for political influence than in an autocratic regime. Under a stable economic environment, a wider participation in legislation will cause more intensive competition among a growing number of newly formed interest groups which try to further their interests by creating appropriate legal rules. Besides, if the government wants to stay in power, it cannot afford to ignore the interests of those parts of the population whose influence has grown. Therefore, we can expect changes in favour of these groups from the supply side of legal innovations, too.

Over and above this outline of the costs imposed by different constitutions on the formation of interest groups, we can also formulate more precise hypotheses if we examine the opportunity costs generated over the life cycle of a new technology.

¹¹See North (1990a, pp. 49f) for the changes which the existence of multiple interest groups brings about in representative democracies.

2.2.2 The economic environment - technological life cycle and the demand for legal innovations

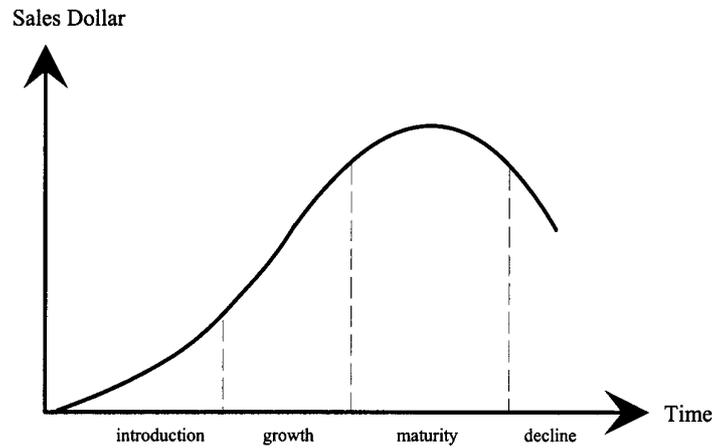
Let us for the moment assume that the constitution is not subject to any alterations, so that we can better examine the effects exerted by changes during the life cycle of a new technology on the costs of political activities. We will do this first with regard to the actors who are negatively affected by the new technology, and then with regard to those who generate the negative externalities as a by-product of their economic activities.

To model the change in the economic environment with its effects on the demand for legal innovations by the negatively affected actors, we use life cycle theory as an heuristic device. According to this theory, industries show some uniform patterns with respect to the rate of market entries and exits, output growth, changes in prices and so on (Audretsch, 1987; Heuss, 1965). Several different phases in the evolution of a market can be distinguished, each with its own characteristic constraints, behavioural incentives, and outcomes (see Figure 1). Over these different market stages, the pressure to solve the accompanying problems varies, thus setting incentives to change the law.

In the introductory stage of a market, an innovating entrepreneur with little risk aversion introduces a new technology (for the following see Heuss, 1965). If the technology turns out to be a success, he or she will earn innovational profits from his or her leading position, thereby unintentionally attracting other entrepreneurs who enter the market and imitate the successful innovation in order themselves to realise some of the potential gains (growth phase). When the technology becomes more common and competition increases, the profits begin to melt away. Thus, we can observe the transition from a monopoly to increasing competition as the typical development of a market structure. The last phase is characterised by a concentration process which results in an oligopolistic or again monopolistic market structure, as demand is saturated (mature phase). Each stage of this cycle is linked to a change in the main strategic action parameters which the firms use, and thus also to a change in the relevant selection mechanisms (price competition, product differentiation, advertising and so on).¹²

Over the life cycle of the new technology, the volume of negative externalities varies (Eckardt, 2001, pp. 112-116). There are scale effects, too, because the overall volume of externalities increases with the growing use of the new

¹²The selection mechanisms of the economic environment play only a secondary role because in this paper, we are interested in legal innovations as a result of the political process.



Source: Audretsch (1987, p. 299).

Figure 1. The technological life cycle

technology. Thus, either more people will be affected by the resulting negative wealth effects, or the same people will be affected to a greater extent. A third possibility is that both effects will take place simultaneously, depending on the respective technology and on the spatial dissemination of its externalities. With the increasing externalities and the resulting individual wealth reductions, the opportunity costs of political activities aimed at changing the law and at getting some form of compensation fall. Because of this drop in the opportunity costs of political action, we can expect that during the later stages of the life cycle, interest groups which try to reduce or prevent such wealth reductions will emerge. Thus, *ceteris paribus*, the demand for legal innovations, which offer compensation for wealth reductions or which prohibit the further production of these negative externalities, will be most intensive in the stages of maturity or stagnation of an industry (Eckardt, 2001, pp. 161-170).

If we assume that some kind of organisation, which the negatively affected actors can employ to promote their interests, already exists at the beginning of the market cycle, we must modify this hypothesis. The formation of a new interest group always requires high set-up costs. A political entrepreneur must convince others of his or her point of view. Moreover, he or she must create some kind of shared mental model among the potential members of the respective organisation (Meier and Slembeck, 1994). The high degree of uncertainty involved, the necessity to form an organisation able to overcome the free-rider behaviour of potential members, and the economies of scale with respect to the resources necessary to become well-known, are the principal factors which

account for the high set-up costs of establishing an interest group (Olson, 1965, 1982). As these costs are sunk costs, they will no longer be taken into account once they have been spent. Consequently, from then on the costs which the members of the organisation must incur if they want to express their interests in the political process are lower.¹³ If the actors affected by negative technological externalities are already organised, we may hence expect some demand for legal innovations, which reduce or prevent the further production of the externalities, even in cases when the welfare loss is not very serious.

To complete the picture, let us turn to the producers of the negative technological externalities. Can we expect any demand for legal innovations from their part, too? The answer is yes. To see why, let us first consider under which circumstances the formation of interest groups on the part of the producers is likely. Here, the changing selection environment over the life cycle of the new technology also plays an important part (Berg, 1995, 153ff). In the introductory and growth stages of the life cycle, high profits can be made due to early market entries and the resulting monopolistic market structure, and because of the high rates of productivity growth which are associated with the steep learning curve of the initially immature technology. In contrast to this, the stages of maturity and decline are characterised by lower rates of productivity growth, by a technological paradigm which has been largely exhausted, and by low profits because of intensive competition. Hence, the opportunity costs of political activities vary over the life cycle. Whereas in the early market phases, the gains from investment in the further technical and economic development of the new technology are high relative to the potential gains from political activities, this changes in the later phases, when the technological paradigm becomes exhausted and the economic selection environment is transformed. Therefore, we can expect the surviving companies to try to protect their market position by rent-seeking. Moreover, declining productivity rates and more intensive competition force these companies to reduce production costs in the stagnation phase. Thus, they face incentives to externalise as many costs as possible or to prevent other interest groups from internalising these externalities through legislation. In the later stages of the life cycle, we can therefore expect intensive competition for political influence among interest groups with opposing objectives.

Referring to Olson (1965, 1982), we can try to derive further statements about the relative strength of the conflicting interest groups in the legislative process. Whereas the producers of negative externalities are a rather small group with homogeneous objectives, the actors negatively affected by these externalities

¹³Important examples are trade unions, chambers of commerce, trade associations and so on. Their formation may take a lot of time and require a lot of efforts and resources, but once they exist, the costs of using them for expressing demand in the political arena are much lower.

ties may be a large group of widely dispersed people with heterogeneous aims. Thus, the producers of externalities may exert more influence in the polity, being able to prevent legal innovations which would internalise the wealth reductions to their disadvantage. The picture is different if the harmed actors are themselves a small group with homogeneous interests, for example if the companies producing intermediate products and their buyers operate in an oligopolistic market structure. In case like this, it is impossible to predict the outcome of the competition for influence on the legislature without more information about the relative bargaining-power of the parties involved in the political process.

Let us summarise how the economic selection environment influences the demand for legal innovations. The formation of interest groups is modelled as a function of the market cycle which is characterised by changing opportunity costs for political activities. We have shown that the demand of the negatively affected actors should be higher in the later market stages. Only if these actors already have an organisation, which they can use to represent the new interests generated by the new technology, they can be expected to demand statutory innovations in the early market stages. Similarly, the demand of the producers of the negative externalities will be higher in the later market stages because the potential gains from political investments are then higher than in the early stages, when the profits from investment in R&D etc. exceed the rather uncertain gains from political investments.

If we combine these findings with the previous statements about the influence of the constitution, we can derive further hypotheses according to the additional costs imposed on different groups of actors by the constitutional restrictions.

2.2.3 The supply of legal innovations by the ruler or the government

Like North (1990a, p. 48), we have assumed that the main objective of the ruler or the government is to stay in power. Because of the assumption of an endogenously changing environment and of the cognitive-creative model of action described above, it is not at all clear which means are available to the ruler or the government to achieve this end. Therefore, he or she will experiment with all kinds of regulations. That is, in our approach, the ruler or the government don't just react to the demand expressed by different interest groups, but act as political entrepreneurs who offer legal innovations in order to gain or to keep the support of the population. Thus, there is an *autonomous supply* of legal innovations by the ruler or the government, that is, a supply which is independent of any demand expressed by groups of the population (Eckardt, 2001, p. 171). However, usually we are not able to decide whether the enactment of a statute is the consequence of such an autonomous supply or of the demand from some interest group: after all, interest groups frequently demand some kind of legal innovation

at the same time at which the government makes its offer. Therefore, in the following, we speak of an *autonomous* supply of legal innovations by the government only in cases where we can't discover any demand made by a well-defined interest group. Referring to our above-made statements about the demand for legal innovations expressed by interest groups, we can expect that an obviously autonomous supply will emerge only in the early market stages.

It is possible to distinguish several motives of such an autonomous supply (Eckardt 2001, pp. 170-175). First, there may be some diffuse demand in the population - e.g. some fear about the possible consequences of the use of a new technology etc. - that calls for action, but has not yet led to the formation of a politically effective interest group. In this case, we can expect the government to act by passing a law to quieten public apprehension. Further, there may be some demand from the lower tiers of the public administration, whose members are directly confronted with the negative impacts of a new technology and call for more precise instructions. Finally, the economic policy model of the ruler or the government, which guides their political perceptions and the resulting activities, might structure their mental models in such a way that convinces them of the necessity of some collective legal rule. Even if we assume that the ruler or the government pursue only their own interests, their actions are based on cognitive perceptions about public responsibilities, the underlying problems and the means available to solve them (Meier and Slembeck, 1994; North, 1981, 1990b). Based on these perceptions they may consider it necessary to supply legal innovations to cope with new problems, which arise as by-products of technical innovations.

2.3 Summary - main hypotheses

By using a variation-selection approach, we modelled the evolution of law as a trial-and-error process. New problems, which emerge as side-effects of technical innovations, trigger an experimental process where legal innovations are generated and modified if they do not turn out to be appropriate for the underlying problems. We have tried to show that both cognitive creativity and wealth effects are the decisive factors in this process of legal evolution. Whereas the cognitive creativity of the actors leads to the endogenous generation of novel legal innovations, statements about legal solutions which are viable can be derived by specifying the political and economic selection environment.

Thus, our hypotheses can be summarised as follows:

- Over the life of a new technology, the volume of negative technological externalities - which are a by-product of the use of this technology - grows.

- The wealth reductions caused by these negative externalities also vary over the life cycle, altering the opportunity costs for the formation of interest groups, and hence the incentive structure for political activities
- As the opportunity costs of the damaged actors fall in the later stages of the market cycle, these actors will express a demand for legal innovations that are favourable to them. The same holds for the producers of the negative externalities.
- In the early market stages an explicit demand for legal innovations is to be expected only if a suitable organisation already exists, because only under this condition it is not necessary to spend the high set-up costs of forming an interest group.
- It is also in these early stages that an autonomous supply of legal innovations by the ruler or the government may occur.

The appropriateness of this approach to legal evolution will be shown by applying it to the evolution of the German tort law in the nineteenth century.

3. Empirical analysis of the evolution of the German tort law in the nineteenth century

In the following, we focus on the introduction of the strict liability rule under the Prussian Railway Law of 1838, and on the prohibition of the contractual exclusion of liability under the General German Code of Commerce of 1861. After briefly describing the content of each legal innovation, we will analyse the changes in the economic and political selection environment, in particular with respect to the relevant actors and interest groups. Subsequently, we examine the different legal variants of the respective innovation processes which were suggested at the time. A short look at the impacts of the legal innovation finally enacted indicates what motivated further processes of legal innovation (for a detailed analysis cf. Eckard, 2001, pp. 207-311).

3.1 The introduction of the strict liability rule with the Prussian Railway Law of 1838

With the introduction of railways in the various German states and the successive development of the industrial sector based on fossil fuels and modern technology like steam engines, the problem of negative technological externalities like industrial injuries and environmental pollution was put on the agenda. The evolution of the modern German tort law began when the Prussian Railway Law

(PRL) was passed in 1838. This was the first of a number of legal innovations which tried to cope with the problems caused by the process of industrialisation.

3.1.1 *The earlier tort law and the content of § 25 PRL*

Traditionally, German law was based on the so-called *Gemeine Recht* (German Common Law), which was derived from ancient Roman law and medieval law (Schlosser, 1993). In Prussia, a modified version of this law - the *Allgemeines Landrecht für die Preußischen Staaten (ALR)* - had been in force since 1794. Everywhere, tort law was based on the negligence rule (Coing, 1989, 512ff; Ogorek, 1975). According to this rule, the victim of an accident received compensation by the party which had caused the harm only if this party had acted wilfully or negligently, in particular if it had violated some legal duties. The burden of proof rested with the victim, who had to offer one hundred percent evidence that the defendant had really caused the damage. If the victim could not prove this, she or he would not receive any compensation. Under the *ALR*, a strict liability rule came into force only in some special cases. Carriers like landlords, carters, and bargees were subject to this more severe rule (*receptum*) (Ogorek, 1975, 81ff). They were liable for every damage caused by their activities regardless of fault. Furthermore, they were also liable for any damage which was caused by their employees. Only if the damage was caused by the plaintiff or resulted from acts of God were they not liable.

With the PRL, strict liability was extended to damages which were caused in transit by rail (Eger, 1896, 213ff). Under § 25 of this law, each railway company was liable for all damages incurred persons or goods during the railway journey, damages which were caused by the harmed person or which happened by unavoidable chance being the only exceptions. But the dangerous nature of railway transport did not fall in this latter class. § 25 PRL was not part of the obligatory law; it could be altered or excluded by contract at any time.

At first sight, this extension of the strict liability rule to railways seems a quite straightforward application of the carrier liability of the *ALR* to this new means of transport. But a closer examination of the innovation process reveals that this was by no means a matter of course for the political actors who participated in the legislative process. Firstly, we analyse the economic and political selection environments which set the outer bounds for the actors who had a chance to express their interests in the legislation process. Then we look at the various legal variants that were proposed and at last, we examine the effectiveness of the finally enacted legal innovation.

3.1.2 *The economic selection environment*

The PRL was enacted on November the 3rd, 1838, with the first Prussian railway line having been opened only four days earlier on October the 30th (Klee, 1982). The length of this line was 34 km, the whole German railway network being no longer than 141 km at that time (Fremdling, 1975, p. 48). Railways were a completely new transport technology both in Germany and in Prussia. If we take the length of the railway network as an indicator of the market phase, railways clearly were in the introduction stage of their life cycle. Because of the low rate of use, the volume of negative technological externalities was also very small. Unfortunately, we do not have any figures about these, but as the introduction of railways caused much public excitement, we can assume that high figures would quickly have become known to the public (Then, 1997). Therefore, we should not expect that any demand existed for a more strict liability rule than the negligence rule of the *ALR*.

Why, then, was a special railway law passed in Prussia during the introduction phase of the railway technology? The law was mainly concerned with questions of the compulsory purchase of property, compensations for the land-owners along newly projected lines, and with the regulation of the operation and the tariffs of private railway companies, the Prussian monarch having decided against a state-owned railway system. As since 1833 an increasing number of entrepreneurs had demanded concessions for railway lines from the Prussian administration, the king instructed his executives to draw up a statute in 1835; the outcome was the enactment of the PRL in 1838 (Stumpf, 1938, 16ff). To gain insight in the innovation process that led to the introduction of the strict liability rule under § 25 of this law, we must more closely examine the political selection environment and the actors who were involved.

3.1.3 *The political selection environment*

Following North (1990a, p. 48), early nineteenth-century Prussia was an autocratic regime where the monarch and his executives held the legislative authority. The sovereign was not formally subject to any control by the population (Boldt, 1987, 91ff). The estates had to be summoned only for granting new loans, but they had no right to participate in legislation. Apart of the monarch and his ministers, a legislative commission which was part of the Home Office (*Gesetzeskommission*), and the Council of State (*Staatsrat*), an advisory board, took part in the legislative process. The members of these groups were either members by birth, like the princes who made up part of the council of state, or had been appointed by the monarch himself, as for example the ministers and the public servants.

The legislative process proceeded as follows: after the monarch had ordered the ministers to draft a bill, the legislative commission made a first proposal which was discussed among the ministers in charge. The resulting bill was forwarded to the monarch, who for his part obtained advice from the Council of State. He could then either agree to the bill and sign it, or recommit it to the ministers and the legislative commission, who then had to work out a new version which was again forwarded to the monarch, and so on. Among the ministers, the legislative commission and the Council of State, the majority rule was in force, but the ultimate decision-making powers rested with the king who was free to disregard all previous decisions of his executives.

Thus, the power of the monarch was formally nearly absolute, as he had the ultimate decision-making powers over the passing of statutes. Moreover, formally, he alone decided what kind of problems the ministers and public servants were to discuss. As he was not subject to an election and formally did not have to ask any part of the population for their consent, he had much scope to pursue his own interests. Correspondingly, actors who had no formal rights to participate in the legislative process faced nearly prohibitive costs of political activity. There were neither organised political parties nor interest groups in the modern sense. Only through informal relations to the monarch or his executives was it possible to advance one's special interests. As in these days Prussia was still a feudal society, it seems appropriate to assume that only the nobility and the wealthier part of the population could influence legislation by such informal contacts. But as far as we know, there was no interest group which explicitly expressed a demand for particular legal protection with respect to railway accidents and related externalities around the passing of the Prussian Railway Law. Therefore, it has to be assumed that this legal innovation was an autonomous supply based on the cognitive conceptions of economic policy by the ruler and his administration. In contrast to that, rent seeking interests did not play an important role, if any at all. To see whether this hypothesis - which corresponds to the above-described theoretically derived hypothesis about the supply and demand structure for legal innovations over the life cycle of a new technology - is correct, we must take a closer look at how the new legal rule itself was generated.

3.1.4 The process of legal innovation

As already mentioned, in 1835 the Prussian king had ordered his ministers to submit a railway bill, but the tightening of the liability law for railways was not put on the agenda before 1837. In the following period, five different variants of legal tort rules were presented in the various bodies which were involved in law-making.

At first, the minister of justice suggested a strict liability rule for all damages that were caused directly or indirectly by the operation of railways (Stumpf, 1938, 38ff). He justified this by claiming that such a rule would result in a higher standard of care taken by the responsible railway companies. The minister of police, who was responsible for public safety and trade inspection, took a different view. According to him, the existing negligence rule under the *ALR* was sufficient. In his view, there was no need for a tightening because of the low numbers of railway accidents in other countries and because the railway companies were bound to avoid accidents for reasons of self-interest. Moreover, applying a strict liability rule would have meant to break with the whole tradition of German tort law. Finally, the first draft of the PRL proposed a third variant. The railway companies should be liable for all damages caused by their employees during transport, if the victim himself or herself could not successfully sue. In its assessment, the Council of State was in favour of the first variant, i.e. of the strict liability rule suggested by the minister of justice. They recommended that alternatively, the victim should be entitled to subsidiary damages against the railway companies if they could not gain any compensation from the responsible party. The railway companies, in turn, should be entitled to recourse to the responsible party. This recommendation of the Council of State was justified by informational asymmetries between the companies and the victims of accidents, and by the resulting impossibility for a victim unambiguously to prove who had caused an accident or some other negative externality. Furthermore, the Council pointed to the particular obligation of the state to care for its citizens as a motive for a more severe liability rule. In this hearing, the strict liability for carriers under the *ALR* with respect to damages caused by railway accidents was referred to for the first time. The rule finally passed under § 25 PRL was a modification of the first suggestion put forward by the minister of justice. The strict liability rule was not applied to all damages that resulted from the running of railways, but only to those that occurred during transport.

The process of legal innovation was a multi-layered process in which different views and perceptions about the problem at hand were expressed. Over a period of nearly two years, diverse liability rules were discussed. For the actors involved, it was by no means obvious from the start that applying the strict liability rule for carriers to damages caused by railways would be adequate or even necessary. In this context, there is no indication that organised interest groups tried to influence legislation by rent seeking. Rather, cognitive processes seem to have prevailed. Because of the novelty of railway technology and of the resulting potential negative externalities, the perceptions of the actors about the problem at hand and about possible solutions to it played a central role. While discussing and modifying the several liability rules which had been suggested, the actors involved formed a shared mental model about how risky railways were.

3.1.5 *The external selection of the strict liability rule for railway*

The next question to be answered is whether the dominant perception that the strict liability rule was adequate for railway accidents proved to be accurate. In the following section, we first analyse the further technological and economic developments and their impacts on the volume of negative externalities caused by railways. Then we examine how effective § 25 PRL was.

Technical improvements

Over the decades which followed the introduction of railways, a large number of important technical innovations were made which improved the security of the railway transport, thus reducing both the injuries incurred by the passengers and damages to the carried goods (Röll, 1893, 530ff, 544ff, 3292ff; Reichsverkehrsministerium, 1938, 79ff). For the prevention of railway accidents, those innovations which affected the embankment and the materials used, the construction of the wheels, axles and steam engines, and the introduction of continuous brakes for the whole train in contrast to brakes for each single freight car proved to be most important (Hertwig, 1935; Mahr, 1935; Metzelin, 1935). Furthermore, innovations which helped to improve the co-ordination of the growing volume of traffic contributed to the security of railway transport. In particular, the introduction of telegraphs and changes in signalling techniques turned out to be very important (Born, 1935; Matschoß, 1935; Mester, 1985b). Whereas telegraphs were already diffused around the mid-1840s and installed next to the railroad tracks, the introduction of improved signalling and of continuous brakes did not take place until the mid-1870s.

The foundation of the *Verband der Deutschen Eisenbahnverwaltungen* (German Railway Association) in 1847 - which originated from the *Verband der Preussischen Eisenbahnen* (Prussian Railway Association) founded in 1846 - was also very important ("Festschrift ...", 1896). Both private and public railway lines were members, and apart from companies from the several German states, foreign railways like the Hungarian, Austrian and Belgian ones took part. At first sight, the formation of this interest group seems to contradict our above-mentioned hypothesis that during the introduction and growth stages of a new technology, such organisational activities don't occur. However, in this case the main motives for the early formation of an interest group were technical necessities rather than rent seeking interests. With the growth of the railway network and the resulting traffic expansion, more co-ordination was necessary. Until the German Empire was founded in 1871, Germany was an loose confederation of thirty-nine sovereign states whose areas, constitutions, statutes, currencies and units of weights and measurement differed considerably. The expansion of the railways caused an increase in cross-border traffic among these sovereign states,

and this obviously needed to be co-ordinated (Mester, 1985a; Völkel, 1985). Apart from this, the German Railway Association also dealt with security aspects. In 1850, the first meeting of railway technicians took place, where unified norms and standards were discussed which were gradually to be introduced by the members ("Festschrift ...", 1896, pp. 43ff, Reichsverkehrsministerium, 1938, p. 535). In 1851, the German Railway Statistics began to be published, where *inter alia* the causes of railway accidents were listed, especially fractures of axles, wheels and switches. Thus, it seems quite plausible to assume that the underlying reasons of the foundation of the German Railway Association were the particular needs of railway technology rather than rent seeking interests.

One would expect that the large number of technical improvements would cause an improvement in the security of rail traffic, thus reducing the number of accidents and the volume of damages done by rail transport. That is, the growing technical knowledge should have led to decreasing negative externalities over the market cycle. However, before we can accurately assess this, we must take a look at scale effects, too.

Economic changes

Between 1840 and 1850, in Prussia the single-track railway network grew from 185 km to nearly 3000 km, i.e. it increased about sixteen fold. In Germany as a whole it grew from 462 km to 5875 km, that is, about twelve fold (Fremdling, 1975, p. 48). In the following decades, the growth rates of the single-track lines remained fairly constant (about 85% on average per decade until 1880), while the railway companies promoted the extension of double-track main lines and the construction of branch lines (*ibid.*). The increase in the number of railway company employees paralleled this development (*ibid.*, 24f). With the growing railway network, both passenger services and freight traffic increased (*ibid.*). The same held for income, expenditure and earnings on capital (*ibid.*). Parallel to this, the transport charge per kilometre fell (*ibid.*, 55ff). The development in Prussia was similar to that in the other German states. From the end of the 1850s, a growing concentration of railway companies took place. On the one hand, small companies merged, while on the other, the Prussian state increasingly engaged in the railway business. The state either built and maintained small local lines which were not profitable for private companies, or held shares and lent capital at reduced rates for the construction of new lines (Breitfeld, 1985, 186; Röhl, 1893, 2696ff; Ziegler, 1996, 46ff).

If we consider the various input and output indicators, we recognise a more than proportional growth per year until around 1870, albeit with decreasing annual growth rates. In the following decades, the railway sector was characterised by nearly steady growth, until in the 1930s the competition from mass automobilisation led to a relative decline in the volume of rail traffic (Hamm,

1984). Thus, the railways were in the growth stage of their life cycle from around 1840 to 1870, then they moved into the mature stage which lasted until the 1930s. Because of the high profits in the early years, a large number of companies who followed the leading entrepreneur entered the market. In the 1860s, the first wave of concentration took place, with growing efforts of the state to nationalise the profitable private railway lines in the following years (Ziegler, 1996).

Volume of wealth reductions

In section 2 we argued that in the growth stage of a new technology, the volume of technological negative externalities will increase. We don't have detailed figures about this volume with regard to the use of railways, but from the 1840s on, statistics about railway accidents in Prussia exist. These data can be used to test our hypothesis.

The number of people injured or killed by railway accidents rose from 52 in 1851 to 1403 in 1879 (Statist. Nachrichten). Over the years the number of people injured or killed increased, stabilising by around 1870. The group most affected were railway employees. From 1851 to 1870, on average three quarters of all people killed or injured were railway employees, 6% were passengers and 13% were people who had no contractual relationship with the railway companies. The high proportion of employees can be put down to the fact that they not only suffered injuries by accidents during passenger services, but also during freight traffic, most accidents moreover happening not while a train was in motion but during loading and unloading and during the switching of the trains and wagons at the stations.

However, the number of accidents went up not only in absolute, but also in relative terms. Since the 1860s, the number of persons affected by a railway accident in relation to all passengers had been increasing. While in 1860, on average 1 person per 100,000 passengers was injured or killed in a railway accident, by 1870 this relation fell to 1 person per 60,000 passengers (Statist. Nachrichten). The same holds true if one relates the number of people affected by accidents to kilometres covered. Thus, with the growing importance of railway traffic, the number of people negatively affected increased more than proportionally. This seems to support our hypothesis that the volume of externalities grew in the growth stage of the railway technology - a process which was not halted by the increased knowledge about the reasons for and measures required to reduce these effects. In other words, in spite of technical improvements with regard to the security of rail transport, the rapid growth of the volume of traffic had a contradictory impact on the volume of negative externalities, as measured by the number of people killed or injured in railway accidents.

To assess whether in spite of the absolute and relative increase in people harmed by railway accidents, § 25 PRL might still have provided incentives to reduce the volume of negative externalities, we finally must analyse how effective this legal innovation was.

Effectiveness of § 25 Prussian Railway Law

During the drafting and hearings of § 25 PRL, the critics of the traditional negligence rule expressed the opinion that this rule would be ineffective because of asymmetries in information and market power among the parties involved. That this view was quite correct also became obvious with regard to the version of the strict liability rule which was finally adopted. § 25 PRL was no compulsory law, i.e. it could be abandoned at any time in favour of other rules about which the parties had reached a contractual agreement. In particular, the parties could agree to use the traditional negligence rule of the *ALR* instead of the stricter risk liability rule. This possibility was indeed widely used by the railway companies. Due to their large market power, they weakened the liability rule in their business terms, either by completely abandoning it or by reducing the damages paid (Eger, 1896, 486ff, 513ff, 554ff; “Festschrift ...”, 1896, 192ff, 259f, 271f).

Lawsuits under the traditional negligence rule were usually decided in favour of the railway companies. Generally, the damaged party was not able to prove that the railway company itself had caused the accident and the resulting damage. Usually, the defendant was an employee against whom it had to be proved that he had wilfully or negligently caused a steam engine explosion or a derailment, for example. If the cause of the accident was purely technical, for example a defect in the material, no defendant at all was at hand. Because of asymmetric information, it was as a rule impossible for the plaintiff unambiguously to prove what had caused an accident. Therefore, he had almost no chance to win any damages. If he still succeeded in proving this, the convicted party normally had no savings to pay the damages (Lehmann, 1864; 1865; 1869; Ogorek, 1975). Moreover, there was much scope for interpreting § 25 PRL. It was particularly controversial which kind of damages the terms “acts of God” and “chance” covered, which kind of accidents were part of accidents that happened during the transport by the railway, and whether this paragraph should be applied only to steam engine railways or also to railways drawn by horses or to streetcars (*ibid.*).

The statistics show that 52% of the passengers who had suffered an accident on the railway were counted as being injured with no fault of their own (Statist. Nachrichten). One can therefore assume that a little more than half of the affected passengers received some kind of damages. The other half was either shown to have been partially to blame for the accident, so that they were not entitled to any damages, or the defendant could prove that the accident happened by chance. In contrast to this, only 12% of all railway employees who suffered

injury or loss from a railway accident were granted some damages. As most victims were part of this group, only a very small proportion was compensated for the injury incurred. With respect to the objective of § 25 PRL - to give incentives to enhance the security of the railway transport and to compensate the victims of railway accidents - it can therefore be stated that this objective was not reached. There was neither a drop in the number of accidents, nor were the people negatively affected compensated. Thus, this first legal innovation which tried to cope with the new negative externalities of railway technology turned out not to be an adequate response to the problem as it was perceived by the contemporaries. With the absolute and relative increase of railway accidents and people involved, the initial opinion advanced by parts of the Prussian administration that the railway technology was “harmful” proved to be accurate. The strict liability rule under § 25 PRL turned out to be neither an adequate nor a successful legal solution to this problem, especially with regard to occupational accidents of railway employees. Hence, further processes of legislative innovation should be expected - and in fact, they did take place. However, they were not motivated by worries about occupational accidents. Rather, the well-organised merchants proved able to push through a statute that served their interests.

3.2 Renewed legislative efforts: the General German Code of Commerce of 1861

With the enactment of the *Allgemeines Deutsches Handelsgesetzbuch* (General German Code of Commerce) in 1861, the contractual exclusion of liability with respect to damages incurred on goods during the transport by railways was prohibited under art. 423. Only damages which were caused by peculiarities of freight itself did not fall under this rule. Thus, the property rights structure changed in favour of the merchants and to the disadvantage of the railway companies. At first sight, this contradicts our hypothesis that in the growth stage of a new technology, no organised interest groups and no legal changes that are results of distributional demands are to be expected. But a closer look at the particular circumstances reveals that the selection environment contributed to reducing the costs of political activities of the merchants.

3.2.1 The selection environment

During industrialisation, the political and economic integration among the German states increased (Treue, 1994). In 1848, the National Assembly gathered in the Paulskirche in Frankfurt on the Main passed a resolution for a unified code of commercial law for all German states (Schlosser, 1993, 144ff). However, it was not before 1857 that a committee was set up in order to draft such a statute, and this was finally enacted in 1861. The General German Code of Commerce

(GGCC) was based on the French *Code de Commerce*, which was passed in 1807, and on a Prussian and an Austrian draft bill. It should be stressed that again, the legal regulation of railway accidents was not the original cause of the legislative process. One can only speculate whether the pressure exerted by damages caused by railways would have been sufficiently high to set off such a process. Probably this would not have been the case, so that there would have been no tightening of the liability law.

The formal constitutional frame within which the GGCC was generated was the *Deutsche Bund* (German League), the above-mentioned confederation of sovereign German states which existed from 1815 to 1866 (Boldt, 1987; 1993). As the League had no legislative power of its own, the bills agreed upon had to be ratified by its member states. Thus, this was a multi-layered legislative process. Within the German League, a committee was set up in which the individual member states were represented according to the size of their respective population. Bills were read three times, the final version having to be passed by a majority. This version was then proposed to the assembly of the league (*Bundesversammlung*), where the member states were also represented according to their size. After the assembly had passed the bill, it still had to be ratified by the governments of the member states in accordance to their respective constitutions. Prussia for example, which played an important part in this law-making process, had adopted a new constitution in 1850 which contained some democratic elements. According to this constitution, legislative power was divided between the monarch, the *Herrenhaus*, that is the Upper House of parliament which mainly consisted of members of the nobility appointed for life by the monarch, and the *Abgeordnetenhaus*, the House of Commons which was elected according to the three-class electoral system under which the wealthier parts of the electorate received more seats and thus more influence. Compared to the earlier Prussian constitution, more actors had formal rights to participate in legislation, the costs of political activities dropping accordingly.

3.2.2 *Competing interest groups: The German Railway Association and the Chambers of Commerce*

Because of the large numbers of actors involved, diverse perceptions, interests and suggested solutions to problems entered the legislative process. Apart from the committee set up by the German League, the administrations of the various member states - especially the Prussian and Austrian one - played an important role in generating different variants both of the GGCC as a whole and of provisions for damages caused by railway accidents. Competition for influence among the opposing interest groups took place before this constitutional background. On the one hand, the merchants were interested in improvements of the terms of transportation, because the more the railway network grew and tariffs

fell, the more important did freight transport by rail become. On the other hand, the market power of the Prussian railway companies was so great that they could abolish the strict liability rule of § 25 PRL in their business terms. Hence, the merchants had to rely on the negligence rule of the *ALR*, which in practice meant that they had to bear the costs of the damages themselves. The same held true for most of the other German states, where damages caused by railway accidents were decided according to the German Common Law and thus according to the negligence rule. Moreover, because of the high rate of population growth, the monarchs of the different states presumably had an interest in low food prices and thus in low transport costs. Therefore we can assume that they would have supported an improvement in the liability law for freight. However, the railway companies who had joined in the German Railway Association were not interested in weakening their own legal position. As we have already pointed out, the foundation of this association in 1847 was first and foremost a result of the particular requirements of railway technology, especially with respect to the coordination and standardisation of the growing international volume of traffic. Still, once the set-up costs had been covered, this organisation could also be used for other purposes. And indeed, the German Railway Association soon proved to be an influential interest group, well able to influence politics in the interest of its members (“Festschrift ...”, 1896).

Whereas there were relatively few railway companies (both state-owned and private enterprises), there were many more merchants who had, accordingly, to incur higher costs if they wanted to form an effective interest group. The merchants, however, had quite limited interests (improvements in the liability for freight), and what is more, they already had a well-established organisation. From 1815 on, chambers of commerce, which enjoyed governmental support, developed in Prussia (Fischer, 1964, Ullman, 1988). They were modelled along French lines. In 1848, the *Handelskammergesetz* - a statute on the chambers of commerce - was passed, which combined elements of institutions traditional applying to guilds with new elements. Of utmost importance was the rule that every merchant had by compulsion to be a member of a chamber of commerce. Between 1850 and 1870, many new chambers were founded in Prussia, umbrella organisations like the Prussian *Handelstag* and the German *Handelstag* being set up in 1860 and 1861, respectively. In addition, individual chambers of commerce, such as the Cologne branch, enjoyed great political influence. On the one hand, these associations had to implement governmental measures, while on the other, they represented the special interests of their members. The statute of 1848 enormously reduced the costs of setting up a well-organised interest group, while the free-rider problem was solved with the help of the introduction of compulsory membership. With these organisations, the merchants had institutionalised access to the public administration and to the government - circumstances which also made it less costly for them to express political demands.

Despite these advantages, the individual chambers of commerce don't seem to have been able directly to push through their interests against the railway companies and the German Railway Association. In particular, they could not prevent the German Railway Association from laying down in their conditions for freight transport, passed in 1850, that the strict liability rule under § 25 PRL should not apply. For this reason, the merchants seized the opportunity to pursue their interests with the help of the political process and used the passing of the GGCC to achieve a tightening of the liability for freight by statute rather than by direct contractual arrangements.

3.2.3 The process of legal innovation: the variants under consideration and the final outcome

The legislative process itself was characterised by a large number of petitions handed in by these interest groups during the hearings and readings of the GGCC bill (Eger, 1895, 25ff). The interest groups approached both the committee which had the task to draft the bill, and the governments of the member states of the German League. Their demands found partial expression in the variants of the statutory provision of the liability on freight which were considered and discussed while the GGCC was drafted.

The early Prussian bill for a single German Code of Commerce - dating from 1850 - did not provide for any change of the traditional liability for carriers (Eger, 1895, 27ff). However, the first reading of the GGCC contained a variant according to which all carriers should be prohibited from contractually excluding liability. This provision would have implied a tightening of the liability rule not only for railways but also for carriers and bargees, for example. In the second reading of the GGCC, a further variant was put forward which stipulated that the exclusion of liability should be banned only for railway companies, but not for other carriers or the postal services. This variant caused widespread activities of the German Railway Association, which tried to influence the governments of the member states of the German League in order to prevent such a rule from being enacted. In reaction to these activities, the merchants filed petitions and memorandums. The result was a kind of compromise which found expression in the third reading of the bill. According to this, the exclusion of liability could be banned if it was in the interest of free trade and traffic, or if it contributed to the balance of power among the contracting parties. This variant led to further rent seeking-activities. Both the private Prussian railway companies and the powerful Chamber of Commerce of Cologne submitted petitions to the Prussian *Herrenhaus*. In the end, neither group was able to push through its interests. The GGCC, finally passed in 1861, contained a final variant under art. 423 which, on the one hand, provided for a tightening of the liability law for railway companies as it prohibited the exclusion of liability by contract, while on

the other hand, it provided for exceptions to this rule if the merchants themselves demanded cheaper conditions for transport, or if the freight itself was particularly susceptible to damages. These were only cases where the strict liability rule was not applied.

Art. 423 GGCC thus definitely improved the legal position of the merchants and weakened the property rights of the railway companies. However, the available sources don't allow us to decide whether the merchants had been more successful in winning influential member states to support their objectives in the legislation, or whether this question was primarily part of the wider bargaining process and therefore used instrumentally by the governments involved.

Despite the fairly efficient provision which tried to allocate the risk for damages according to the informational asymmetries among the parties, it is again impossible to detect a deterministic or functional mechanism which led to the final legal innovation under art. 423. Unfortunately, we do not know the details of the discussions among the many actors involved. But we can assume that, like in the innovation process from which § 25 PRL emerged, many diverse proposals were discussed: this must have been the case because of the large number of creative actors who were involved and whose interests and cognitive backgrounds differed considerably. With regard to the cognitive frameworks we can state that, in contrast to the emergence of § 25 PRL, in this case a shared mental model does seem to have existed. The problem at hand was merely a distributional, not a cognitive one. Thus, the different variants were all within the scope of the strict liability rule of the traditional carrier liability and of § 25 PRL. And whereas almost two decades earlier, heated discussions took place as to whether the imitation of the strict liability rule for railways would not mean to break with the whole tradition of the German tort law, now a relatively strict restriction of the freedom of contract between merchants and railway companies was agreed upon which notably contradicted the *laissez-faire* attitude of civil law that prevailed in these days, and yet did not provoke much unrest.

Because the actors had underlying shared perceptions of the problem at hand and of adequate ways to solve it, distributional aspects dominated the debate. But because of the large number of creative actors involved and because of the power relations among them, the legal rule which was finally adopted can not be seen as the only viable one, as we do not know how important historical contingencies were in this case.

3.3 The external selection process: further modifications and legal innovations

With the introduction of art. 423 GGCC, the tort law for the transport of goods by rail was only slightly modified within the scope of the strict liability for carriers and § 25 PRL. Still, the enactment of a statute just goes to show that its various legal provisions had successfully passed the internal selection mechanism of

the political law-making process. To assess a particular legal rule - like the strict liability rule for railway accidents - one must take account of the external selection, too (for more details cf. Eckardt, 2001, pp. 239-311).

The strict liability rule for freight by railways according to art. 423 GGCC was in force from the enactment of the GGCC in 1861 until its replacement by the *Handelsgesetzbuch* (German Commercial Code), which was passed in 1897 and which is still in force today. The strict liability for railways can now be found under art. 454 with slight modifications of the terminology used, but with the same content. In this respect, therefore, the innovation of art. 423 GGCC was positively selected, being in existence now for nearly one and a half centuries. Furthermore, to assess whether this rule was not only in force, but also positively selected by the courts, that is, by the judges, one has to examine court decisions, a task that is beyond the scope of this paper. Because of the discretion which the application of each statutory provision implies, juridical qualifications would be necessary, too, in order to assess whether the rule on hand was applied according to the interests of the political actors who had supported its enactment.

However, the rule would have been effective if it had created incentives for the actors to reduce the volume of negative technological externalities or to pay damages for the ones still existing. Unfortunately, we don't have figures about the damage in freight transport caused by railways. However, in 1869 the prohibition of the contractual exclusion of strict liability was imitated for the passengers services in Prussia by the *Preußisches Zusatzgesetz*, that is, via a statute additional to the PRL (Eger, 1895, p. 32; Ogorek, 1975, p. 63). It thus improved the legal position of the potential victims of accidents related to rail transport, as the Prussian railway companies in general had excluded the strict liability rule under § 25 PRL by contract for their employees and customers. For the railway employees, however, this was still just a marginal improvement of their property rights. Instead of the contractual exclusion of the strict liability, the railway companies now started to raise the duties of care for their employees in such a way that nearly each occupational accident could be traced back to the violation of such a duty by the employee. Because of this contributory negligence, the employee then lost any claims for damages. Moreover, as most occupational accidents occurred not during transport by rail but during other activities related to its operation, the main reason for occupational accidents was still excluded. Therefore, the actual situation of individuals most affected by railway accidents did not improve much, despite the tightening of their property rights (ibid.).

Finally in 1871 an extension of § 25 PRL was set in force when the *Reichshaftpflichtgesetz* (RHG) (Imperial Liability Law) was passed. The personal and objective scope of the strict liability of railway accidents was raised. Still, only with the introduction of the *Unfallversicherungsgesetz* (Accident Insurance Law) in 1884 a long-lasting solution for the problem of industrial injuries was found (Wickenhagen, 1980). The strict liability rule was succes-

sively imitated to cope with new technologies that were judged to be risky.¹⁴ And although the negligence rule remained the central liability rule of the German tort law, the courts have raised the standards for the duty of care of the producer or user of new technologies to such an extent that this traditional liability rule increasingly creates incentives similar to the strict liability rule.

4. Conclusions

The objective of this paper was to contribute to our understanding of the co-evolution of technical and legal change. Because of the complexity of this subject we have confined our study to exploring the process of legal innovations by legislation. Thus, we assumed technical innovations as being exogenous, and analysed the incentives that were exerted by them on the process of legal change. We have tried to show the fruitfulness of this approach by applying it to the evolution of German tort law in the nineteenth century.

Legal changes are interpreted as the results of cumulative variation-selection-processes. The cognitive creativity of the actors involved provides for the generation of legal (as well as technical) innovations. But the potentially large number of heterogeneous outcomes is limited by the political and economic selection environment, which determines the opportunity costs of collective political activities that are a precondition for statutory innovations. In this respect the wealth reductions caused by the negative technological externalities are of decisive importance, being by-products of the use of technical innovations. As they vary over the lifecycle of a technology, the opportunity costs of political activities and thus the incentives for statutory changes vary, too. In addition, legal innovations are influenced by the hitherto applied legal rules which to some extent structure the cognitive frameworks of the actors involved, and thus shape the path of legal change.

It seems that there is still a long way to go until a coherent economic theory of legal evolution is formulated. Even with respect to the problem discussed in this paper - legal innovations caused by technical change - a number of unresolved questions remain. Theoretically, a more formal specification of the variation and selection mechanisms seems to be adequate. Moreover, with respect to the retention mechanisms we only dealt with path-dependencies resulting from the cognitive frameworks and shared mental models of the actors. However,

¹⁴It was imitated for statutory provisions on accidents by motor vehicles in 1908, by air transport in 1922, by the mains in 1943, to damages of the water balance in 1957, to the use of nuclear power in 1959, to drugs in 1972, to product liability in 1989, to genetic engineering in 1990 and to negative technological externalities caused by plants in 1990.

there are other aspects which need to be integrated, like for example network externalities, scale effects and learning processes. Furthermore, the interdependencies of statutory and judicial legal innovations have to be studied in more detail, because only taken together do they make for a theory of legal change. Still, all in all this combination of evolutionary and neo-institutional theorising seems a promising way to reach a coherent theory of the co-evolution of technical and legal change.

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