

Disciplinary actions against malpractice:

A fragile balance

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Abstract

In a world of experience goods, consumers reveal the product quality after purchase, but cannot observe whether they encounter a low-quality product because of malpractice (low effort of producers) or because of bad luck. This well-known market failure impairs the incentives of providers to invest effort. In this article, we examine the interaction between two ex-post means to alleviate this market failure, costly lawsuits pursued by consumers and investigation of malpractice by the government. In this framework, the government intervention may alleviate malpractice but not in all circumstances. Specifically, the reliance of consumers on the government investigation may discourage them from pursuing lawsuits. Under plausible assumptions about the government efficiency and the cost of inspection, this crowding-out of consumers by the government may encourage malpractice of providers. Nevertheless, government transparency about its investigation results may restore the incentives of providers to excel effort. JEL codes: K13, L15

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1 Introduction

In the case of experience goods, one of the basic goals of government intervention is to reduce potential risks to consumers by inducing firms (referred to also as providers, producers or suppliers) to exert a certain level of effort in the production process. This article challenges the premise that governmental ex-post inspection of products always promotes this goal and increases the effort level of firms.

In our framework, the chance the government discovers malpractice depends on the probability that inspection is implemented (or on the number of inspectors, the choice variable of the government), the inspectors' productivity (or efficiency) in detecting malpractice and the cost of inspection, both assumed to be exogenous. Then, in case malpractice behavior is discovered by the government inspection, it is automatically followed by consumer compensation (with no cost to consumers).¹

When malpractice is not detected by the government, however, consumers choose whether to pursue (their own) costly lawsuit. In this case, consumers draw inferences about their chances of success without being able to recognize whether the government did not detect malpractice because the government did not implement inspection or because the firm well-behaves (invests effort).

In this framework, we argue that under plausible assumptions the chance of being inspected by a government agency may practically encourage malpractice by providers. The reason is that the introduction of government inspection crowds-out consumers, reducing

¹This assumption generalizes the practice in many countries that after the government finds evidence on malpractice behavior, there is a flood of successful class actions. Surely, class actions become more worthwhile when the evidence on their behalf was already collected by the government.

their incentives to pursue their own malpractice lawsuit against providers. On the other hand, in case the government never implements inspection in the market, consumers rely on themselves, and may exert more discipline on providers through lawsuits, promoting high effort in the market.

In many instances, it is difficult for consumers to assess whether products adhere to certain quality standards in a wide array of domains including vaccinations, therapeutic drugs, food, cars, and medical treatment, just to name a few. This asymmetric information between consumers and providers naturally entails potential risks to consumers.² Despite the potential risks, people consume these products constantly. Thus, understanding how to improve the incentives of firms to invest effort without crowding-out of consumers is of considerable interest to policy-makers.

While typically the effort of providers is unobservable to consumers, they may learn the quality of products from experience (for a review on experience goods see Tirole, 1988).³ Consequently, based on their experience, consumers may pursue a lawsuit if they suspect in malpractice behavior of the firms.⁴ Then, the courts follow the negligence rule defined in Shavell (2009), "under the negligence rule, an injurer is held liable for the accident losses he causes . . . only if his level of care was less than a level called due care that the courts specify. If the injurer exercised a level of care that equaled or exceeded due care, he will not be held liable".

Alternatively, as many of the markets for experience goods are heavily regulated, the official authorities may monitor the market in several ways.⁵ We focus on ex-post government

²To name several examples, home appliances may malfunction and cause damages, and automobile defects may expose passengers to injurious crashes. In the food industry, there is an ongoing debate surrounding the issue of not only the nutritional value of certain products, but also their quality and safety.

³'Credence goods', on the other hand, are products where consumers, regardless of their experience, never realize their true quality (see the vast literature dating back at least to Nelson (1970) Darby and Karni (1973) and Dulleck and Kerschbamer, 2006.

⁴In Hörner (2002), consumers also act as a disciplinary body, inducing providers to excel high effort. The discipline is not through lawsuits, however. When consumers realize they had bought a low-quality product, they shift their purchases to other providers pushing the transgressed provider out of the market.

⁵For example, governments regulate safety standards or enforce the provision of necessary information on the products. Shavell (1984) shows that safety standards may be lower when customers can sue producers.

intervention. If damage was caused to a customer, the government agency may investigate whether the supplier invested sufficient effort to prevent the damage or not.

To understand the incentives of providers to exert effort (and increase the share of high quality products) in the context of experience goods, our model analyzes the interaction between three types of players, providers, consumers and a government agency that monitors the product market. First, providers choose their level of effort invested in producing goods or services. For example, doctors invest effort when they treat patients. Insufficient effort of doctors, or malpractice, is potentially harmful to their patients. Nevertheless, increasing the effort level, there is still some probability that the treatment will be harmful. For simplicity we allow here only binary decision of the provider: to invest effort or not.

The second player is a consumer (or a customer, e.g., a patient). Consumers purchase products or services and reveal their quality through experience. In the example of doctors, a patient discovers whether her condition has improved or deteriorated after the treatment. Then, she decides whether to pursue a costly lawsuit for malpractice, considering that her lawsuit will succeed (and she will be compensated) only if malpractice indeed occurred, namely, the provider did not invest effort. The threat of being sued may encourage the providers to invest more effort.

The first two players, providers and consumers, interact with a third player, a government agency (e.g., a Ministry of Health or another official authority), interested in malpractice in order to reduce potential risks to consumers. We focus on ex-post means of the government to improve the incentives of firms to invest effort. Specifically, the government inspectors investigate providers to find evidence for malpractice (with some degree of productivity). Though, our model is richer and more realistic than a classical inspection game in that it includes another player that may monitor the firms' effort ex-post, the consumers.

Hua and Spier (2018) provide conditions for producers' liability to improve welfare, when the vulnerability of customers to accidents is private knowledge. Dranove and Jin (2010) review the growing volume of literature on the market response to certification and quality disclosure programs. These programs provide systematic information about the quality and safety in specific markets, including, for example, restaurant hygiene grade cards (Jin and Leslie, 2003) and nutritional labeling requirements (Mathios, 2000).

The chance of being compensated following a government investigation may crowd-out consumers, or patients, from pursuing lawsuits, relying on the government agency to pinpoint malpractice with some positive probability, which in turn may augment malpractice by providers, or doctors.

Therefore, if the government agency is insufficiently competent in detecting malpractice, its goal to prevent malpractice may be futile, and furthermore its existence may actually encourage malpractice. This undesirable result may be prevented if the government agency is sufficiently 'transparent' about the results of its investigation, where the transparency (or accountability) of the government in our model is measured by the probability that the government informs the customer that no malpractice was detected during investigation.

To support our main result that inefficient and non-transparent public agencies assigned to protect public health may in fact harm public health and encourage malpractice, we bring several examples from the US and Israel.⁶ While rational consumers rely on such public agencies, and consequently reduce their lawsuits and their caution from products, the industry as a result may actually reduce its effort to ensure product safety.

Regulation failures may allow a culture of cover-up of medical malpractice and lack of transparency. In Israel, legislation provides Full immunity of Hospitals in their internal investigating hearing and disciplinary hearings (see The Israeli Law of Patient's Rights, P. 21-22). Moreover, in external investigation committees, the protocols are confidential. Another alarming fact is that only in about 3.3% of cases of death with complaints on malpractice investigation by Ministry of Health actually takes place. Also note that even if investigation takes place, it is not simple do discover the truth. For example, whistle-blowers, who document failures in the hospital or procedures that endanger patient safety, may suffer sham peer review and excessive damage to their reputation.

In the USA, the FDA (the Food and Drug Authority) has a voluntary Reporting system

⁶We thank Jonathan Davies, a former principal editor of the journal 'Medicine and Law' (Hebrew), for providing examples and case studies.

that relies on self-reporting of adverse effects. Doctors are not required to report, only companies (that naturally have incentives to conceal data about risks). The result is under-reporting – 3-4% of adverse effects get reported to the FDA. As a result, it takes time until complaints build-up, during this time much harm is done. Another potential problem is that doctors and patients rely on the supposedly strict safety FDA procedures and believe that products are thoroughly tested by the FDA before distributed in the market to reveal their risks and failures. Nevertheless, in practice this is typically not the case regarding medical devices.

Originally, Congress intended that almost all new devices go through pre-market approval (PMA). A PMA is similar to a new drug application in that a manufacturer must test it first in humans, compile the data and present it to FDA scientists who will approve the device if it is in fact safe and effective.

But this process is less rigorous than the drug process, a one study often small (100 people, or even 50 people followed for a short time) is typically sufficient for approval. Furthermore, the objectivity of the studies may be questionable – medical companies fund most of the research these days, which naturally provides incentives to over-share positive findings in favor of the products, over-generalize to groups that have not been tested (like children), and under-report risks and failures of the studies.

Besides the PMA, Congress established the 510(k) process, where all the manufacturer needs to demonstrate is that their device is substantially equivalent in regulatory term to another device that is already on the market (even if the previous device was recalled because it was proven dangerous). That provision which was meant as an exception became the rule. The vast majority of devices (98%), regrettably, are regulated under this provision with no feedback on their performance before being released to the market. While medical devices approved under this provision are presented as 'innovation', massive new technology is adopted with little evaluation of its outcomes and untested products flow to the market.

The ex-ante poor monitoring regulation is sometimes followed by the lack of ex-post

treatment of adverse effects by the FDA. An example is the Essure device. Nearly 12,000 adverse effects regarding this medical device were reported to the FDA in 2017, including massive pressure of patients through e.g., social networks, TV, a demonstration in a world-wide doctors' conference and meetings with Congressmen. The first peak of this public pressure was when patient advocates presented years of data to the FDA commissioner and asked him to remove Essure from the market.

Two months later the FDA required doctors to state the risks of Essure to patients but still allowed Essure to remain on the market arguing that 'the benefits outweigh the risks'. The manufacturer was not held accountable by the FDA.

At the same time, the equivalent of the FDA in Europe asked the producer to provide more safety data, and the producer at that point decided to withdraw it from the market due to lack of interest. Only shortly after the premiere of the film 'the bleeding edge', the second peak of the public pressure, the producer announced it would stop selling Essure in the US at the end of 2018. In these examples and more, although regulation entitles a government agency to investigate product safety ex-post, the courts play a much crucial role in their pursuit of justice against of medical malpractice.

As a motivation for our model, we describe the relation between safety outcomes and government efficiency across countries. We focus on the safety outcomes in two sectors, railroad transport fatalities per ton-kilometer in 19 European countries, and the estimated road fatalities per 100,000 population in 175 countries around the world (see full description of the variables and the data sources on the data Appendix).

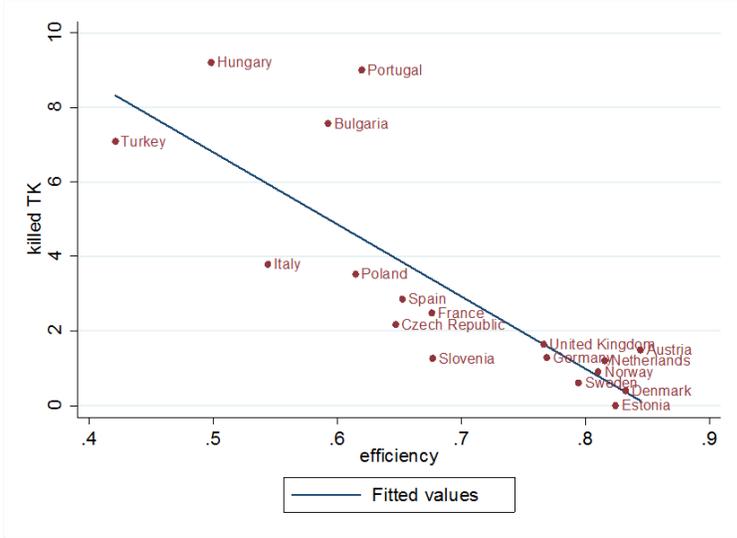


Figure 1.1: Victims in rail accidents per ton-kilometer VS government efficiency (EU countries). Sources: Railway safety data collected by the European Union; The World Justice Project (WJP) Rule of Law Index 2017-2018 report

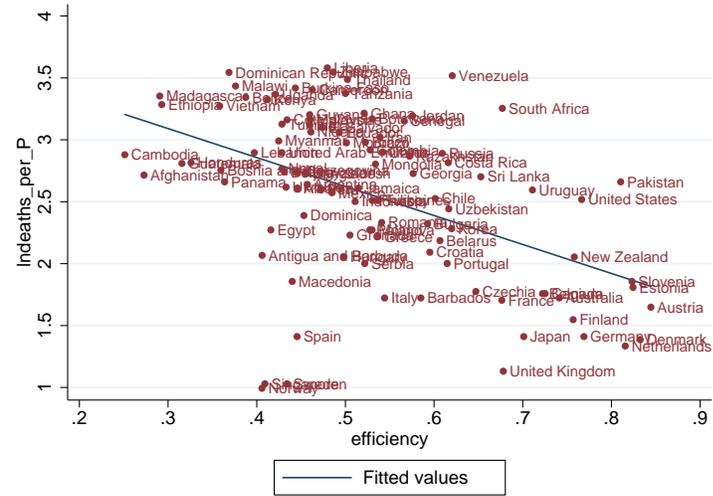


Figure 1.2: Road fatalities per 100,000 population (in log values) VS government efficiency (103 countries). Sources: Global status report on road safety 2015, World Health Organization; the World Justice Project (WJP) Rule of Law Index 2017-2018 report

These examples illuminate the relation between government efficiency and safety outcomes in the country, particularly the reduction of rail and road fatalities. That is, in countries with more efficient regulators the number of fatalities is relatively low.

Next, we split the data into two sub-samples of countries by the median efficiency level, 0.51, and plot the Road fatalities VS the efficiency level (similar to figure 1.2) for countries above the mean ('high efficiency') and countries below the mean ('low efficiency')

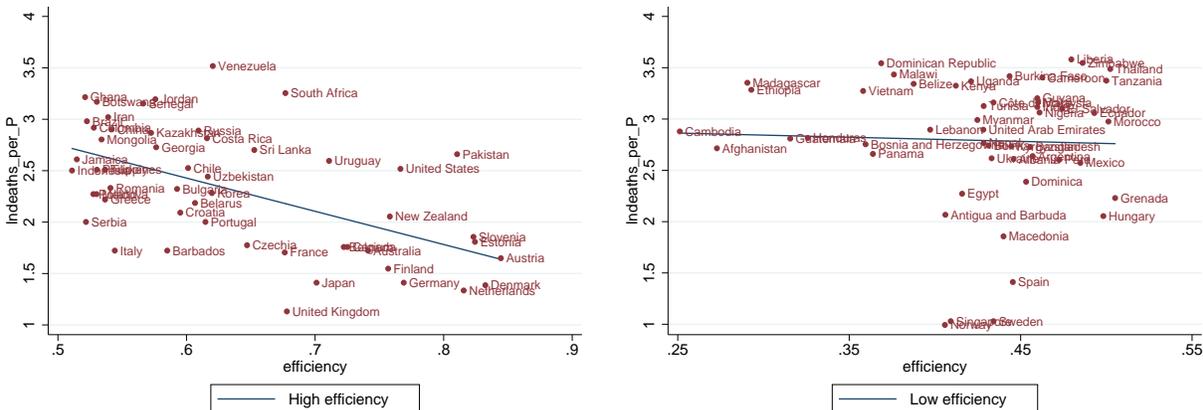


Figure 1.3: Road fatalities per 100,000 population (in log values) VS government efficiency for countries above the median efficiency level ('high efficiency') and countries below the median ('low efficiency'). Sources: Global status report on road safety 2015, World Health Organization; the World Justice Project (WJP) Rule of Law Index 2017-2018 report

Figure 1.3 indicates that government efficiency seems a main factor in safety outcomes only in the high values of government efficiency, while the relation is less pronounced in countries with low government efficiency, implying that there may be other factors in act when the government efficiency score is low. To verify our impression, we run a regression of the safety outcomes (Road fatalities per 100,000 population) on our indicator for government efficiency and GNI per capita on our two sub-samples of 'high' and 'low' efficiency countries, split by the median efficiency level, 0.51 (see Appendix A).

The high government efficiency sub-sample regression yields a significant negative relation of efficiency and road fatalities, whereas the regression for low government efficiency is rejected, and particularly the coefficient of efficiency is insignificant.

These evidence is consistent with the main result of our model. That is, when the government efficiency is high, its involvement reduces malpractice of providers (in the case of road accidents, the providers of safety outcomes on the road are the road construction companies

and the drivers themselves). However, if the government efficiency is low, then its involvement does not necessarily foster safety outcomes. The effect depends on other variables, particularly on its transparency, or accountability, regarding the results of its investigation. In our framework, low transparency may even encourage malpractice of providers (crowding out consumer lawsuits).

We illustrate the potential relation between the accountability of the regulator and safety outcomes. We focus on the railroad sector due to data limitations. We plot our indicator for the number of victims in railroad accidents vs. the accountability of the regulator in the railroad sector (see full description of the variables and the data sources on the data Appendix).

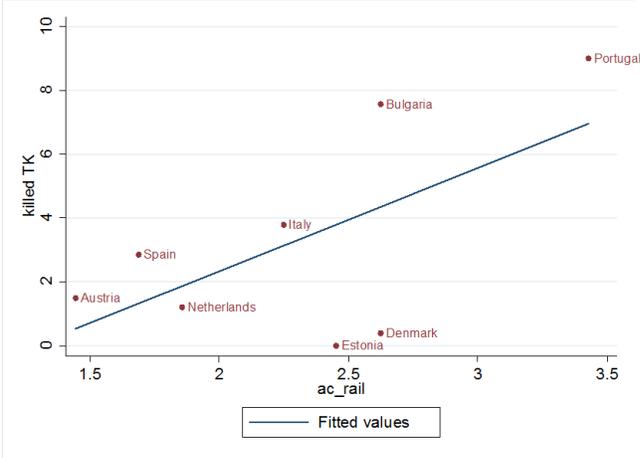


Figure 1.4: Victims in rail accidents per ton-kilometer vs Accountability of the regulator. Sources: Railway safety data collected by the European Union; OECD indicators for management practice of sector regulators, '0' is the largest accountability, '6' is the smallest.

(see full description of the variables and the data sources on the data Appendix)

Consistent with our model, the figure indicates that larger accountability scores may improve the safety outcomes of the country.

Figure 3.3 in Appendix A presents the indicator for three other industries, electricity, (in blue), gas (in red), and telecom (in green), summed up for each of the 40 countries. The figure illustrates the differences across sectors within countries and across countries.

The summed-up value of all sectors ranges between a large accountability of the regulator of roughly '2-3' in several countries and low accountability of around '10' in Estonia and Korea.

2 The Model

2.1 A model without inspector

This section presents a basic model as a benchmark to further analysis. Let P be a provider which produces some product or service, and denote by C a customer who buys the product. The provider P chooses to either exert effort (e) or not (ne), where the action chosen is a private knowledge of P. The effort may manifest in different stages of production, through e.g., the choice of production technologies, inputs, or its level of inspection throughout the production process. We assume that if no effort is made, the product is of low quality. Otherwise, the product is of high quality with probability α , $0 < \alpha < 1$, and of low quality with probability $1 - \alpha$. If the quality is high, the game ends, P obtains a payoff x , $0 < x < 1$, and the customer obtains a payoff 1. If the quality is low, then the customer C decides whether to pursue a malpractice lawsuit against the provider (s) or not to sue the provider (ns).

The consumer payoff increases with the quality of the product. Specifically, while a high-quality product generates a maximal payoff 1 to the consumer, a low-quality product obtains a payoff 0 to the consumer in case she does not pursue a lawsuit. If the consumer decides to sue, then she pays a lawsuit cost c , $0 < c$, that include the cost of hiring experts and additional court fees. We assume that a lawsuit reveals the occurrence of malpractice (or the effort level of the provider).⁷ Accordingly, if the provider chose (ne), the consumer C obtains a compensation of b for the malpractice, namely, the net payoff of C is $b - c$.

⁷While not in the model, in reality the courts use several processes for the purpose of extracting the truth (such as the investigation of experts and witnesses).

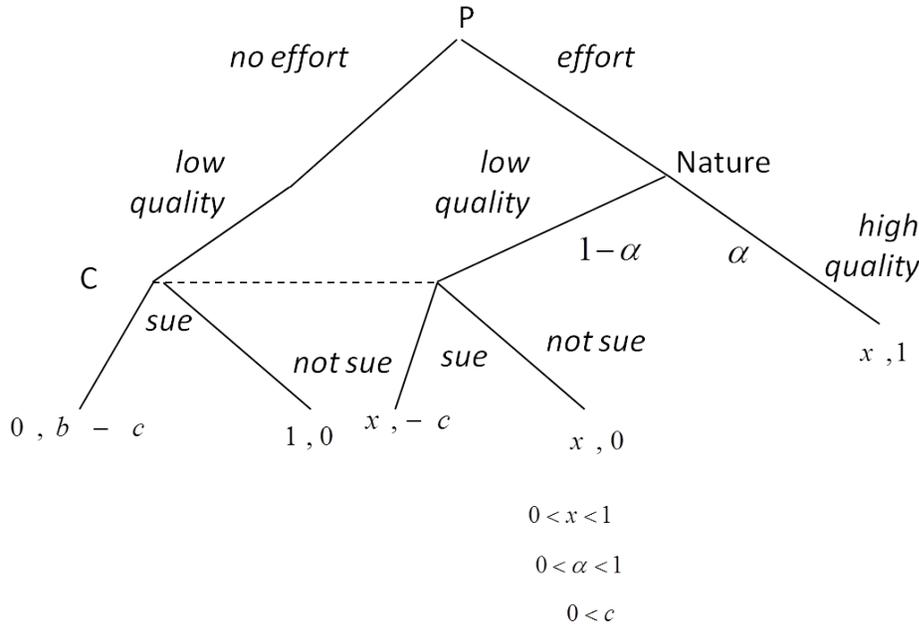


Figure 2.1: Γ_1 . In each pair of payoffs the first number denotes the payoff of the provider P, and the second one is a payoff of the consumer C.

If the provider well-behaved (or (e) was chosen), then the consumer malpractice lawsuit is rejected by the court and the consumer is not compensated (but still pays the lawsuit cost c). We assume here that once the customer applied to the court, the court discovers the whole truth. To justify this assumption, in Figure 1 in Appendix A, we plot government efficiency (in blue) and Civil Justice efficiency (in red) for each of the 103 countries. The impression is that typically the government efficiency rank is larger than the Civil Justice efficiency. This impression is strengthened by a t test that rejects the equality of means of the two variables for a P value of 7%. We discuss relaxation of this assumption later.

The payoff of the provider P depends on the occurrence of malpractice and whether it is discovered. Accordingly, the provider receives the largest payoff 1 if no effort was made and it was not sued by the consumer (ne, ns). A lawsuit reduces its payoff to 0. If the provider well-behaved, however, (e) was chosen, then its payoff is always x (whether it is sued or not). It follows that the cost of effort for the provider is $1 - x$, if not sued. This defines a game Γ_1 . See Figure 2.1 Denote by P_e the probability that P chooses (e) and by P_s the

probability that given the product is of low quality, the consumer C chooses (s). Then, the equilibrium of this game is unique and depends on whether the net payoff of the consumer in case of a justified lawsuit (on the basis of malpractice), $b - c$, is positive or not. Formally,

Proposition 1. The equilibrium of Γ_1 is characterized by following:

1. If $b < c$, the equilibrium of Γ_1 is unique and satisfies $P_e = 0$ and $P_s = 0$.
2. If $b > c$, the equilibrium of Γ_1 is unique and satisfies $0 < P_e < 1$ and $0 < P_s < 1$.

Proof See Appendix.

According to Proposition 1, if the net payoff of consumers is negative in case they file a justified lawsuit (the compensation, b , is lower than the cost, c), then consumers never pursue lawsuits, and as a result providers always choose (ne), or malpractice.⁸ However, when the net payoff from lawsuits is positive, it is worthwhile for consumers to pursue lawsuits (in a positive probability) and consequently, there is a positive probability that providers excel effort.⁹ In other words, the chance of being sued by consumers encourages providers to well-behave.

An attendant question is how the implementation of a government agency that searches malpractice may affect the incentives of providers to well-behave. We argue in the sequel that such an institution, if incompetent, may be harmful to the economy in the sense that it encourages malpractice.

⁸This case applies to a providerative action, where per consumer the benefit of lawsuit is lower than the cost.

⁹Note that the probability of consumers to sue increases in the cost of effort, $1 - x$. When the cost of effort rises, providers become reluctant to excel effort. The increase in the probability to sue maintains the indifference of providers between (e) and (ne). Additionally, the probability of the providers to excel effort rises in $b - c$. When the net payoff of consumers in case of a justified lawsuit, $b - c$, rises, it becomes worthwhile to sue. The increase in the probability to excel effort maintains the indifference of consumers between (s) and (ns). A similar argument applies to an increase in α , which augments $P(ne|l)$ (the chance of malpractice given that the product is of low-quality).

2.2 A model with inspection

In this section, we add a government agency (or a regulator) responsible to inspecting providers in order to prevent malpractice and reduce potential risks to consumers. We define the game Γ_2 , as an extension of Γ_1 . Let R be an inspector from a government agency, which serves as a regulator of the relevant market. The inspector moves first and commits to investigate¹⁰ the provider P with probability P_i , if it produces a low-quality product. We assume that the probability to be investigated, P_i , is known to provider P but not known to the consumer C. An motivation of this assumption is that provider can learn P_i from its experience of interaction with the regulator, while the customer has no such an experience and such an information.

Then, P chooses whether to excel effort (e) with a probability $P_e(P_i)$. If the quality of the product is high, the game ends. In this case, the payoffs of P and C are as in the game Γ_1 and R obtains a payoff 1. If the quality is low, the government agency investigates P with a probability P_i . The investigation is costly for R, namely, if the investigation is performed, R pays c_R , $0 < c_R$, and 0 otherwise.

The regulator R seeks to promote quality, e.g., public health. Alleviating malpractice serves this goal, because more effort of providers reduces potential risks to consumers. For example, the effort of doctors affects the expected quality of the treatment they provide to their patients, which in turn affects their health. Accordingly, the regulator's payoff function equals the expected product quality net of the investigation cost, namely, expected utility of R is

$$EU_R = \alpha P_e(P_i) - c_R(1 - \alpha P_e)P_i. \quad (1)$$

Given that investigation is performed by R, she detects malpractice (ne) with a positive probability r , $0 < r < 1$. The parameter r can be viewed as measuring how competent, or professional, the government agency is in detecting malpractice. We assume, for now, that

¹⁰A model with an inspector as a first mover appears in Andreozzi (2004).

r is a common knowledge in the economy. In the following section we alter this assumption. Then, after the regulator R plays, if malpractice was detected, then R announces publicly about this finding. In this case, the game ends. The consumer C obtains a compensation b .¹¹ In addition, R may impose a fine or another punishment on P. This outcome is the worst for the provider P, and its utility in this case is 0.

However, the regulator R may not detect malpractice (given that the product is of low quality) in three cases. First, there is a chance of $1 - P_i$ that R does not perform an investigation on the providers. Second, an investigation is performed by R but does not detect malpractice because P had chosen (ne) but was not detected. Third, R performs an investigation, detects that no malpractice took place, namely, P had chosen (e), and with probability $1 - t$ does not inform C that the provider well-behaved. We assume that C cannot distinguish between these three cases. Consequently, as C is not compensated, she may decide then to sue the provider P, and the game proceeds as Γ_1 . Alternatively, if R performs investigation and detects that no malpractice took place, with probability t R informs C that there was no malpractice ($0 \leq t \leq 1$, t is commonly known). In this case the game ends, no compensation is paid to the customer, and p obtains x . See Figure 2.2

he regulator is *more transparent* as higher is the parameter t . We define a *full transparency* case if $t = 1$, and *no transparency* case if $t = 0$.

Let us define the regulator as competent if its probability to detect malpractice is sufficiently high, and as costly if the inspection cost is sufficiently high.

Definition 1. 1. The regulator is competent if $r > 1 - x$. Otherwise, the regulator is incompetent.

2. The regulator is costly if $c_R > \frac{\alpha r}{(1-x)(1-\alpha)}$. Otherwise, the regulator is not costly.

Assume that $r \neq 1 - x$, $c_R \neq \frac{\alpha r}{(1-x)(1-\alpha)}$. If equality holds, there is a multiplicity of

¹¹Alternatively, the consumer may apply to the court, while evidence against the provider, which was found by the inspector, makes the lawsuit an extremely cheap decision for C. while acceptance of the lawsuit by the court is guaranteed.

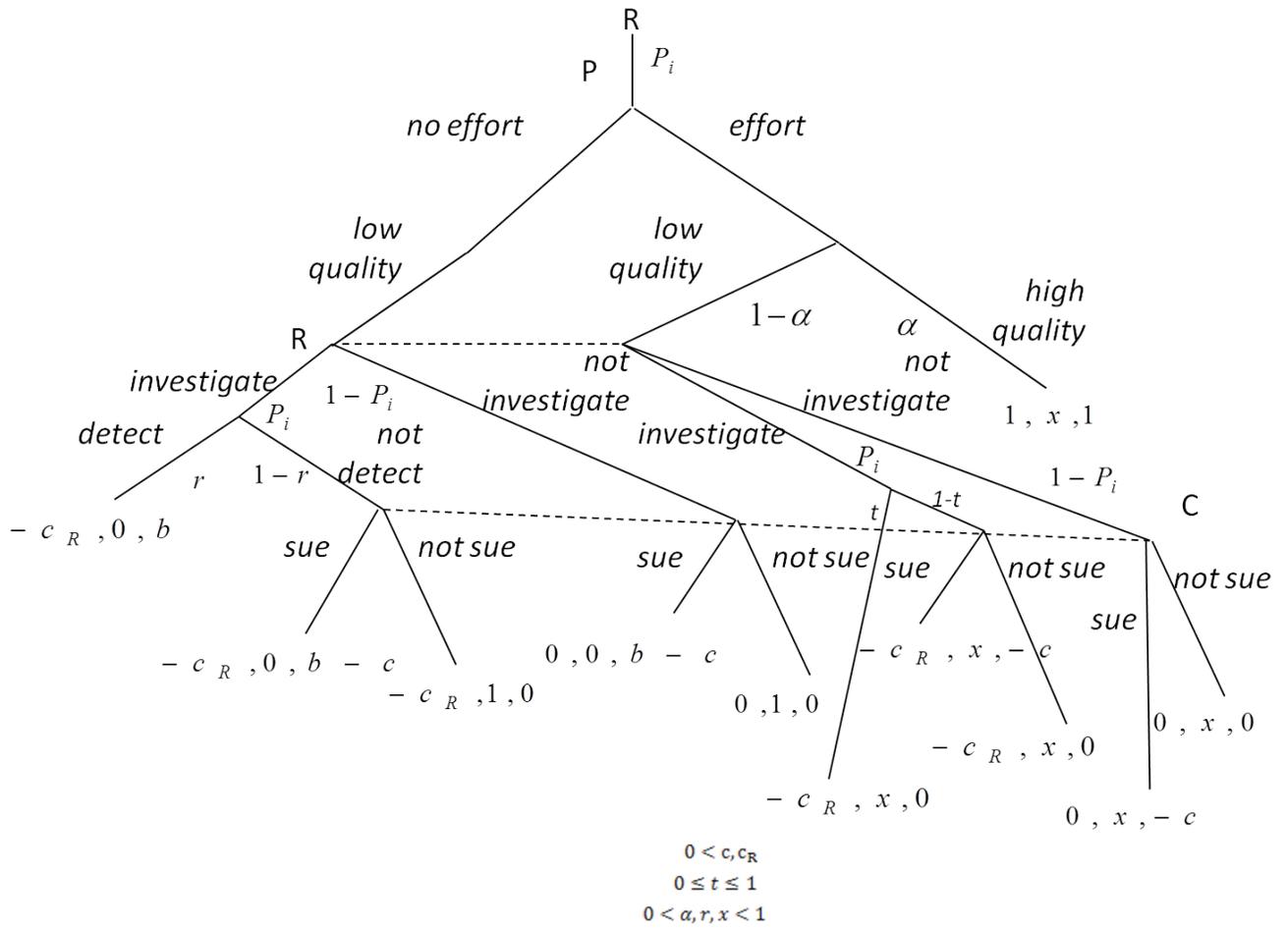


Figure 2.2: Γ_2 . In each triple of payoffs the first number is the payoff of R, the second one is the payoff of P, and the third one is the payoff of C.

equilibria.

According to the following propositions, the government involvement prevents malpractice completely if it is competent and not costly. In this case, the government agency fully takes the place of the consumers as a disciplinary body, and consumers decide not to pursue lawsuits. However, if the regulator is incompetent and not costly, then its intervention may encourage malpractice. In other words, the economy may deteriorate to an equilibrium where less discipline is entailed on providers through malpractice lawsuits, and as a result the occurrence of malpractice rises. An explanation is that an information given to C by R may be misleading. If no compensation is given to the costumer by the inspector, the customer learns that no malpractice was found, and may decide not to sue P. However, it may be a case that the malpractice took place, but was not detected due to inspector's incompetence. Formally,

Proposition 2. If the regulator is competent and not costly, there exists a unique equilibrium where P makes the effort (e) and C with certainty does not sue (ns).

Proof See Appendix.

Therefore, an competent and not costly regulator guarantees the effort of providers with certainty, and thereby consumers deter from pursuing lawsuits.

In case the regulator is incompetent or costly, the equilibrium depends on the other way to discipline providers, malpractice lawsuits. Therefore, it is straightforward that if pursuing lawsuits is not worthwhile for consumers (their net payoff, $b - c$, is negative), then consumers never sue (ns), in turn the regulator never inspects the providers ($P_i = 0$), and thereby similar to the equilibrium without a regulator, malpractice occurs with certainty,

Proposition 3. Let $b < c$. If the regulator is incompetent or costly, in the unique equilibrium of Γ_2 , P chooses pure (ne), and C chooses pure (ns).

The proof is straightforward since for $b < c$ (ns) is a dominant strategy for C.

In contrast, when a lawsuit may be worthwhile for consumers, (the compensation is higher than the cost, $b > c$), and the cost of regulation is sufficiently low, there exists an equilibrium where consumers pursue lawsuits with a positive probability and the regulator inspects the providers with certainty.

Nevertheless, the regulator is incompetent, and as a result cannot induce providers to exhibit pure (e) ($P_i = \frac{1-x}{r} > 1$ is not feasible). Moreover, malpractice occurs in a higher probability compared to the equilibrium without a regulator

Denote

$$c_R^* \equiv \alpha \frac{(b-c)(1-r)}{(1-\alpha)((1-r)(b-c) + c(1-t))}$$

Proposition 4. Let $b > c$, the regulator is incompetent, $c_R < c_R^*$ and $t < 1$. Then, there exists a unique equilibrium, where $P_s = \frac{1-x-r}{1-r}$, $P_i = 1$. In this equilibrium $P_e(1) < \frac{b-c}{b-\alpha c}$, if $t < r$ and $P_e(1) > \frac{b-c}{b-\alpha c}$, if $r < t$.

Proof See Appendix.

According to Proposition 4, the presence of an incompetent regulator induces malpractice (a lower chance that providers exert effort) compared to the equilibrium without a regulator. Moreover, by (6), as r is higher (but still lower than $1-x$, and $c_R < c_R^*$), the lower is the probability that the provider makes the effort and the lower is the probability that the consumer pursue a lawsuit. This result seems surprising at a first glance. The explanation lies in the consumer response to the government intervention. The consumer relies on the inspection by the government agency to detect (ne), and thus sues the provider with a lower probability than in the absence of regulation. As a result, the chance of malpractice rises. However, if R is sufficiently transparent, the probability of malpractice is lower than in the absence of the regulator.

Note that the economy may benefit from the existence of the regulator not only because the effort of providers is augmented, but also by saving the cost of lawsuits. The expected

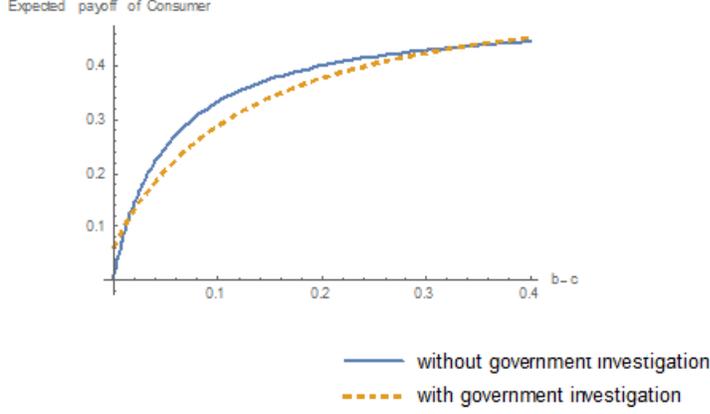


Figure 2.3: Expected payoff of C for $\alpha = 0.5$, $c = 0.1$, $r = 0.6$, $c_R < c_R^*$, $x < 1 - r$.

payoff of C in Γ_1 is

$$EU_C = \alpha P_e, \quad (2)$$

and the expected payoff in Γ_2 , in equilibrium characterized in Proposition 4 is

$$EU_C = \alpha P_e(1) + br(1 - P_e(1)). \quad (3)$$

In Figure 2.3 we compare numerically (2) and (3) for $t = 0$, and show that it may be a case that if b is low, the consumer is better off in the model without regulation, but this is not true if b is high. We assume that the expected payoff of the consumer if the provider well-behaves (or excels effort (e)), α , is always larger than the payoff of the consumer if compensated for malpractice, b . Namely, $\alpha > b$. This is justified by the well-known principal in law systems, that the payoff achieved by a malpractice lawsuit at most compensates for the damage, or returns the consumer to her position if the malpractice had not occurred.

Note that while in this section, we consider only equilibria where R uses pure strategies, namely, selects some P_i with probability one, a full characterization of the equilibrium of Γ_2 appears in Proposition 7 in Appendix.

In the following section, we add asymmetric information with respect to the competence

of the regulator and analyze the resulting equilibrium.

2.3 A model with regulation and asymmetric information

In reality, most consumers do not know a precise level of competence of the regulator. Suppose next only R and P know the value of the competence of inspection, r . C does not know r , and has a prior on the distribution of r , $G : [0, 1] \rightarrow [0, 1]$. This game is denoted as Γ_{asym} . We consider two cases. In the first C believes with high probability that R is competent. In the second, she believes that the inspector is incompetent, but C does not know precisely how incompetent R is. In this section, we assume $b > c$ and $t = 0$.

Consider first a case where C believes with high probability that R is competent. The following proposition show that lack of ex-ante information about the level of r may be harmful (encourage malpractice) when the inspector is discovered less competent than expected. The intuition is straightforward. On the one hand, if consumer believed that there is a sufficiently low chance that the government agency is incompetent and costly, they behave as though this chance is zero. Accordingly, consumers rely on the regulator to inspect the provider and thereby do not pursue lawsuits assuming that in most cases providers excel effort. Naturally, when the realization of r is low, the reliance of the consumers on the regulator is not justified and (given that consumers do not sue and providers take that into account) malpractice occurs with certainty.

Proposition 5. Let the probability that the regulator is incompetent and costly be sufficiently low, $G(r \leq \max[1 - x, \frac{c_R(1-\alpha)}{\alpha}(1 - x)]) < \frac{c}{b}$. Then in an equilibrium of Γ_{asym} :

$$P_i = \begin{cases} \frac{1-x}{r} & , r \geq \max[1 - x, \frac{c_R(1-\alpha)}{\alpha}(1 - x)] \\ 0 & , otherwise \end{cases}$$

$$P_e(P_i) = \begin{cases} 1 & , P_i \geq \frac{1-x}{r} \text{ and } r \geq \max[1 - x, \frac{c_R(1-\alpha)}{\alpha}(1 - x)] \\ 0 & , otherwise \end{cases}$$

and $P_s = 0$.

Proof See Appendix.

By Proposition 5, if the customer believes that (with a sufficient high probability) the regulator is competent, she behaves as though R is certainly competent and does not sue the provider. If the realization of r is low, the regulator does not inspect P, and in turn P does not excel effort. In this case C is worse-off in a model with asymmetric information, because she gets a low-quality product (zero payoff) with certainty, whereas if C would have known r ex-ante there would have been a positive probability to encounter a high-quality product or to be compensated if the quality is low (recall Proposition 3).

Next, we assume C believes that R is incompetent. We further show that consumer may be better-off with asymmetric information. When consumers believe that there is a high chance that the realization of r is low (providers are more costly and incompetent), they step in and pursue lawsuits in a positive probability. When the realization of r is higher than the consumers expected, providers are induced to excel effort with certainty, reducing the occurrence of malpractice to zero.

Proposition 6. Let $r_{min}, r_{max} < 1 - x$. C assigns probability θ to R being of type r_{max} and probability $1 - \theta$ to type r_{min} . If c_R and θ are sufficiently low, there exists an equilibrium where if R is of type r_{max} , P chooses (e) with certainty, namely, with probability higher than if $r = r_{max}$ is common knowledge.

Proof See Appendix.

3 Discussion

We show that incompetent regulators can lead to lower quality of products or services. However, even incompetent regulators can encourage the providers to excel effort by being

transparent about their findings. Next, we discuss some of our assumptions, given that r is commonly known.

We assume that the court's chance to discover the truth is larger than the Regulator's (without loss of generality, the court always discovers malpractice behavior). This assumption is plausible in our framework, where the court always plays after the regulator, and thereby can use at least all the information that the Regulator had considered and even more. This is more prevalent in the continental juridical system, where the court, following a lawsuit, may initiate its own investigation and collect information on top of the Regulator's and on top of the evidence supplied by the parties.

Suppose now that the court is not perfect, namely, the court discovers malpractice with some probability $q < 1$ (that measures the competence of the court). Then, in the no transparency case, for q sufficiently high, the results are similar to our private case of $q = 1$. However, if both q and r are low, there is an equilibrium where there is no inspection and the provider makes no effort, but nevertheless the customer does not pursue a lawsuit given the incompetence of the court. Note also that in reality the competence of the court and the regulator may be related to some extent.

Another related assumption in our paper is that while providers who invest effort are not immune to lawsuits, they will never pay a fine or compensation to the customer (because the court always discovers the truth). However, in reality, even an innocent party may be mistakenly charged. In this case results similar to ours can be obtained. However, if this type of error is taken into account, a more complicated model may be considered, where the provider and the customer bargain on the compensation to the customer. For example, in Daughety and Reinganum (2011) the plaintiffs and the producer reach a settlement, when number of victims is not known.

To change another assumption, consider a model where R does not commit to any probability of inspection, and decides whether to inspect or not after observing a low quality product. Then, there is no equilibrium where effort is guaranteed. Again, it may be the case

that the consumer is worse off if regulation is present.

Our simplifying assumption that a customer does not know the probability of inspection is crucial. Otherwise, the customer's best reply would depend on the probability of inspection, chosen by R. Then Γ_1 is a subgame of Γ_2 , if probability 0 of inspection is chosen. However, our results are robust to a slight modification, where it is commonly known that inspection is mandatory and occurs with certainty. This may be the case when the damage caused by low quality is extremely severe.

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Appendix

- Proof of Proposition 1.* 1. Let $b < c$. Then (s) is a dominated strategy of C. Therefore, P chooses (ne) with certainty and obtains a payoff 1.
2. Let $b > c$. In this case, there is no equilibrium with pure strategies. If P chooses (e) with certainty, then (ns) is the best reply of C, but then P is better off by deviating to (ne) . Similarly, it is easy to verify that pure (ne) , (s) and (ns) are not possible in the equilibrium. In the unique equilibrium of Γ_1 , P is indifferent between (e) and (ne) , namely,

$$x = 1 - P_s,$$

equivalently,

$$P_s = 1 - x.$$

Let $P(ne|l)$ be the probability C assigns to the event "F chooses (ne) " if the quality

of the product is low. Note that

$$P(ne|l) = \frac{1 - P_e}{P_e(1 - \alpha) + 1 - P_e} = \frac{1 - P_e}{1 - \alpha P_e}.$$

Since in equilibrium C is indifferent between (*s*) and (*ns*),

$$bP(ne|l) - c = 0,$$

or,

$$P_e = \frac{b - c}{b - \alpha c}. \quad (4)$$

□

Proof of Proposition 2. F weakly prefers (*e*) iff $x \geq 1 - rP_i$, which is equivalent to

$$P_i \geq \frac{1 - x}{r}.$$

Namely, P excels effort if the probability to detect malpractice is sufficiently high,

$$P_e(P_i) = \begin{cases} 1 & , P_i \geq \frac{1-x}{r} \\ 0 & , P_i < \frac{1-x}{r} \end{cases}. \quad (5)$$

To ensure the effort of the provider (pure (*e*)) with minimal inspection cost, the regulator R chooses $\frac{1-x}{r} = P_i < 1$ (which is feasible because the regulator is competent).

The consumer C, decides not to sue (*ns*). For $b < c$ (the lawsuit cost exceeds the compensation), (*s*) is a dominated strategy of C, which ends the proof. For $c < b$, (*ns*) is the best reply for C, because P chooses (*e*) with certainty.

Uniqueness follows from Proposition 7. □

Proof of Proposition 4. Let $P_i = 1$. Then, P is indifferent between (e) and (ne) iff

$$x = (1 - r)(1 - P_s),$$

or

$$P_s = \frac{1 - r - x}{1 - r},$$

and $0 < P_s$ because the regulator is incompetent. In this case, for $P_i < 1$, F strictly prefers (ne).

In order to define the incentive constraint of the consumer, let $P(ne|nbl)$ be the probability C assigns to the event "P chose (ne)" if the quality of the product is low and no information is provided by R to C (thus, C was not compensated, and not informed that no malpractice is found, and may have an incentive to sue).

$$P(ne|nbl) = \frac{(1 - P_e(1))(1 - r)}{P_e(1)(1 - \alpha)(1 - t) + (1 - P_e(1))(1 - r)}.$$

C is indifferent between (s) and (ns) iff

$$P(ne|nbl) = \frac{(1 - P_e(1))(1 - r)}{P_e(1)(1 - \alpha)(1 - t) + (1 - P_e(1))(1 - r)} = \frac{c}{b},$$

by rearranging terms we obtain

$$P_e(1) = \frac{(b - c)(1 - r)}{(b - c)(1 - r) + c(1 - \alpha)(1 - t)}. \quad (6)$$

By (6), $P_e(1) < \frac{b-c}{b-\alpha c}$ for $t < r$ and $P_e(1) > \frac{b-c}{b-\alpha c}$ for $r < t$. It is easy to verify that $EU_R > 0$ for $c_R < c_R^*$.

Uniqueness follows from Proposition 7. □

Proof of Proposition 5. The proof is similar to Proposition 3. The customer's best reply is

(*ns*) if the payoff from (*ns*) is larger than the payoff from (*s*):

$$0 \geq -c + bG(r \leq \max[1 - x, \frac{c_R(1 - \alpha)}{\alpha}(1 - x)]),$$

and it holds for $G(r \leq \max[1 - x, \frac{c_R(1 - \alpha)}{\alpha}(1 - x)]) < \frac{c}{b}$. □

Proof of Proposition 6. In case of a realization $r = r_{min}$, assuming that $P_i = 1$, the provider P is indifferent between (*e*) and (*ne*) if:

$$x = (1 - r_{min})(1 - P_s),$$

and by rearranging terms we obtain that

$$P_s = \frac{1 - r_{min} - x}{1 - r_{min}} < 1.$$

P_s is feasible because the regulator R is incompetent.

In case of realization of r_{max} , the provider P prefers (*e*) if

$$x \geq (1 - r_{max}P_i)(1 - P_s).$$

It is easy to verify that for realization of r_{max} , $P_e(P_i) = 1$ if $P_i \geq \frac{r_{min}}{r_{max}}$ and $P_e(P_i) = 0$, otherwise. Then, to induce the provider P to excel effort, in case of r_{max} the regulator R chooses

$$P_i = \frac{r_{min}}{r_{max}} < \frac{1 - x}{r_{max}}.$$

$EU_R > 0$ for sufficient low c_R .

The consumer C is indifferent between (*s*) and (*ns*) if:

$$0 = -c + b \frac{(1 - \theta)(1 - r)(1 - P_e^{r_{min}})}{((1 - r)(1 - P_e^{r_{min}}) + [\theta + (1 - \theta)P_e^{r_{min}}(1 - \alpha)]),}$$

equivalently,

$$P_e^{r_{min}} = \frac{(1 - r_{min})(1 - \theta)(b - c) - (1 - \alpha)c\theta}{c(1 - \alpha)(1 - \theta) + (1 - r_{min})(1 - \theta)(b - c)}.$$

$P_e^{r_{min}} > 0$ for sufficiently low θ .

□

Next we characterize equilibrium of Γ_2 for regions, others than in Proposition 2 and 4.

Let $c < b$.

Proposition 7. Let $c < b$.

1. Let $c_R > \max[\frac{\alpha}{1-\alpha}, \frac{\alpha r}{(1-\alpha)(1-x)}]$. Then in an equilibrium of Γ_2 , R mixes between $P_i = 0$ and $P_i = \frac{\alpha}{(1-\alpha)c_R}$. In the former case P chooses pure (ne), in the latter case he chooses pure (e). C sues P with positive probability.
2. Let $t < 1$, $c_R^* < c_R < \frac{\alpha}{1-\alpha}$ and $r < 1 - x$. Then in the unique equilibrium of Γ_2 , R mixes between $P_i = 0$ and $P_i = 1$. In the former case P chooses pure (ne), in the latter case he chooses (e) with a positive probability. C sues P with positive probability.
3. Let $t = 1$, $c_R < \frac{\alpha}{1-\alpha}$ and $r < 1 - x$. Then in the unique equilibrium of Γ_2 , R chooses $P_i = 1$, P chooses pure (e) and C sues P with positive probability.

Proof. We start with following lemma.

Lemma 1. Let $c < b$. Then, in equilibrium of G_2 :

1. no pure (ne) is chosen;
2. $0 < P_i < 1$ and $0 < P_e(P_i) < 1$ is not possible;
3. no pure $P_i = 0$ is chosen. In a mixed strategies equilibrium, if $P_i = 0$ is chosen with positive probability, P's best reply is pure (ne).

Proof. 1. Assume by contradiction that P chooses (ne) with certainty. Then, the best reply by C is $P_s = 1$, but then P is better off by deviating to (e) . This is a contradiction to (ne) being an equilibrium strategy of P.

2. Suppose by contradiction that there is an equilibrium where $0 < P_i < 1$ and $0 < P_e(P_i) < 1$. Since R can guarantee payoff 0 by choosing $P_i = 0$, $EU_R \geq 0$. P is indifferent between (e) and (ne) . In this case, for $P_i = P_i + \epsilon$, (ϵ sufficiently small), P strictly prefers (e) , namely, $P_e(P_i + \epsilon) = 1$. Accordingly, R can improve its payoff by increasing the probability of inspection by ϵ , which in turn induces the provider to excel effort (e) with certainty,

$$\Delta EU_R = \alpha[1 - P_e(P_i)] - \epsilon c_R[(1 - \alpha)(P_i + \epsilon) - (1 - \alpha P_e(P_i))P_i] \rightarrow \alpha(1 - P_e(P_i)) > 0.$$

This is a contradiction to P_i^* being an equilibrium strategy.

3. (a) In equilibrium, $P_i(0)$ cannot be higher than 0 and lower than 1. Assume by contrary that $0 < P_i(0) < 1$. Namely, P is indifferent between (ne) and (e) . Then, similar to part 2, R can improve upon $P_i = \epsilon$, ϵ sufficiently small, contradiction.
- (b) If $P_e(0) = 1$, then P strictly prefers (e) for any $P_i \geq 0$. Then $P_s = 0$ is a best reply of C, but then $P_e(0) = 0$ is a best reply of P, contradiction.
- (c) Assume by contrary that R chooses pure $P_i = 0$. This is a subgame of Γ_1 , therefore, no pure $P_e(0)$ is chosen. Contradiction to (a).

□

By Lemma 1, only following strategy profiles can be considered in equilibrium: pure $0 < P_i < 1$ and $P_e(P_i) = 1$ (Proposition 2); pure $P_i = 1$ (Proposition 4 and part 3 of the current proposition); mixed strategies equilibrium, where R chooses with a positive probability some $P_i > 0$, while P reacts with pure (e) (part 1 of the current proposition);

and mixed strategies equilibrium, where R chooses $P_i = 1$ with a positive probability (part 2 of the current proposition).

1. Consider R mixes between $P_i = 0$ and some positive P_i^* . In the latter case $P_e(P_i^*) = 1$. R is indifferent between these two strategies, namely,

$$\alpha - (1 - \alpha)c_R P_i^* = 0,$$

equivalently,

$$P_i^* = \frac{\alpha}{(1 - \alpha)c_R}.$$

This implies $c_R > \frac{\alpha}{(1 - \alpha)}$.

P_i^* is the minimal probability for which P weakly prefers (e), namely,

$$x = (1 - rP_i^*)(1 - P_s).$$

This implies

$$P_s = \frac{1 - rP_i^* - x}{1 - rP_i^*},$$

and $P_s > 0$ for $c_R > \frac{\alpha r}{(1 - \alpha)(1 - x)}$. Note, $\max[\frac{\alpha}{1 - \alpha}, \frac{\alpha r}{(1 - \alpha)(1 - x)}] = \frac{\alpha}{1 - \alpha}$ for $r < 1 - x$.

2. Consider R mixes between $P_i = 0$ and $P_i = 1$. R is indifferent between these two strategies, namely,

$$\alpha P_e^*(1) - (1 - \alpha P_e^*(1))c_R = 0,$$

equivalently,

$$P_e^*(1) = \frac{c_R}{\alpha(1 + c_R)}.$$

This implies $c_R < \frac{\alpha}{(1 - \alpha)}$. Let y^* be a probability with which R chooses $P_i = 1$. Following low quality product and no information given by R, C is indifferent between suing and

not suing for

$$y^* = \frac{b - c}{(b - c)[P_e^*(1) + 1 - rP_e^*(1)] + cP_e^*(1)(1 - \alpha)(1 - t)}.$$

$0 < y^* < 1$ for $c_R > c_R^*$. Note, that for $t = 1$, $c_R^* = \frac{\alpha}{(1-\alpha)}$, namely, no c_R satisfies $c_R^* < c_R < \frac{\alpha}{1-\alpha}$.

$P_i = 1$ is the minimal probability for which P weakly prefers (e), namely,

$$x = (1 - r)(1 - P_s).$$

This implies

$$P_s = \frac{1 - r - x}{1 - r},$$

and $P_s > 0$ for $r < 1 - x$.

3. $P_e(1) = 1$ and $P_i = 1$ implies that $P_i = 1$ is the minimal probability for which P weakly prefers (e). Thus,

$$x = (1 - r)(1 - P_s),$$

and

$$P_s = \frac{1 - r - x}{1 - r}.$$

$P_s > 0$ for $r < 1 - x$. Note, that the event "the quality of the product is low and no information is provided by R to C", where C chooses to sue or not, occurs with zero probability for $t = 1$ (that is the only case where (s) with positive probability is a best reply to $P_e(1) = 1$). For $P_e(1) = 1$, R weakly prefers $P_i = 1$ if

$$\alpha - c_R(1 - \alpha) \geq 0,$$

which holds for $c_R < \frac{\alpha}{1-\alpha}$.

Data appendix

This section describes our data sources, all publicly available, and the variables we use.

Government efficiency -

We use the World Justice Project (WJP) Rule of Law Index 2017-2018 report drawn from the assessments of more than 110,000 citizens and 3,000 legal experts in 113 countries and jurisdictions. Each score of the Index is calculated using a large number of questions drawn from two original data sources collected by the World Justice Project in each country: a General Population Poll (GPP) and a series of Qualified Respondents' Questionnaires (QRQs). They capture the experiences and perceptions of ordinary citizens and in-country professionals in their country, where 1 signifies the highest score and 0 signifies the lowest score. The report presents 8 composite factors that are further disaggregated into 44 specific sub-factors. For our purpose, we use several sub-factors. First, the indicator for government efficiency, sub-factor 6.1, measures the extent to which 'Government regulations are effectively enforced', where government regulations include e.g., labor, environmental, public health, commercial, and consumer protection regulations. This factor does not assess which activities a government chooses to regulate, nor does it consider how much regulation of a particular activity is appropriate. An alternative measure that provides similar qualitative results is sub-factor 6.3 that measures whether administrative proceedings are conducted without unreasonable delay at the national and local levels.

Civil Justice efficiency -

We take the indicator for Civil Justice efficiency from the same dataset, the WJP Rule of Law Index, and it is similarly measured by sub-factor 7.6, 'Civil Justice is effectively enforced'. This indicator examines if decisions are enforced effectively, the effectiveness and timeliness of the enforcement of civil justice decisions and judgments in practice. Correspondingly, an

alternative measure that provides similar qualitative results is sub-factor 7.5 that measures whether court proceedings are conducted (and judgments are produced) without unreasonable delays.

Rail safety -

Railway safety data are collected by the European Union Agency for Railways through the Common Safety Indicators. For our purpose, we use the number of victims in rail accidents to measure the safety of rail transport, available for 19 countries. To obtain a measure for relative safety, the number of victims must be linked to traffic performance. Therefore, we divide the number of victims in ton-kilometers. A ton-kilometer is a unit of measure of freight transport which represents the transport of one ton of goods (including packaging and tare weights of intermodal transport units) by rail over a distance of one kilometer. Only the distance on the national territory of the reporting country is taken into account for national, international and transit transport. We obtain qualitatively similar results using the number of rail accidents instead of the number of victims, and correspondingly passenger-kilometers instead of ton-kilometers. A passenger-kilometer is the unit of measurement representing the transport of one passenger by rail over one kilometer.

Road safety -

We use the Global status report on road safety 2015, World Health Organization, P. 264, table A2. The variable of interest is the estimated road road traffic death rate per 100 000 population.

The global status reports on road safety have been developed through an iterative and consultative process with participating Member States. In the first phase, requests for data were sent out through a survey administered by the WHO Headquarters to Regional and National Data Coordinators (R/NDC) appointed in each region or country. With coordination by the NDCs, experts from different sectors within each country discussed and came to an agreement on the responses to the survey questions using information available. Based on the reported number of road traffic deaths and the source of data, adjustments were made to

account for the potential under-reporting due to differences in definitions as well as limitations in the Civil Registration and Vital Statistics (CRVS) in many countries. This process resulted in an estimated number of fatalities. Following this, a final consultation was carried out to allow Member States to respond to any changes that resulted from the verification and validation process. This consultation also provided Member States an opportunity to comment on the WHO estimates for road traffic fatalities, which is often much higher than the official statistics.

GNI -

Our data source is the World Development Indicators database, World Bank, 2015. We take the per capita in US dollars is the dollar value of a country's final income in a year divided by its population.

Accountability -

We use the OECD indicators for management practice of Sector Regulators. The data include measures of the governance of the bodies that design, implement and enforce the regulations on six network sectors, including railroad transport infrastructure data on 17 countries. The indicator of accountability is constructed by the OECD as a weighted average of 9 questions that measure the accountability of the regulator towards various stakeholders, including the government, the regulated industry and the general public. It directly draws on the first, fourth and fifth governance principles, asking, for instance, to whom the regulator is accountable by statute, whether it collects and publishes various types of performance information, whether it publishes a report on its activities and whether it engages in public consultations and hearings. The indicator's range is 0-6, where a country score of '0' represents the largest 'accountability' and '6' denotes the smallest value of the indicator. Figure 3.1 provides detailed description of the questions and their weights. It is taken from the 'Schemata sector regulators' on the OECD website. It describes each question and its weight in the construction of the 'accountability' indicator,

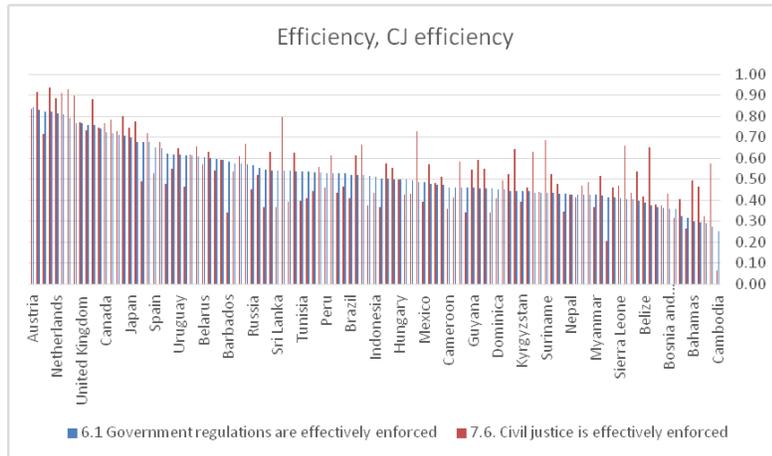
<http://www.oecd.org/economy/reform/indicatorsofproductmarketregulationhomepage.html>

Table 1. Accountability

| | Question weight a _i | Subquestion weight b _i | Coding of answers | | | |
|--|-----------------------------------|--------------------------------------|---|--|-----------------|-----------------------|
| | | | | | | |
| To whom is the regulator directly accountable by law or statute? | 1/9 | | parliament 0 | government or representatives from regulated industry 6 | | |
| Are the duties/objectives of the regulator defined in law/published? | 1/9 | | yes 0 | no 6 | | |
| Does the regulator need to submit proposals for new regulation to other bodies for approval? | 1/9 | | to the parliament 3 | to the government 6 | no 0 | |
| Through which body can the decisions of the regulator be appealed in the final instance? | 1/9 | | court 0 | special body 3 | ministry 4.5 | regulator itself 6 |
| Is there a legislative requirement for the regulator to produce a report on its activities on a regular basis (e.g. annual) and is this report published online? | 1/9 | | yes 0 | no/not applicable 6 | | |
| Does the regulator collect the following performance information? | 1/9 | | | | | |
| Industry and market performance | | 1/7 | 0 | 6 | | |
| Operational/service delivery | | 1/7 | 0 | 6 | | |
| Organizational/corporate governance performance | | 1/7 | 0 | 6 | | |
| Quality of regulatory process | | 1/7 | 0 | 6 | | |
| Compliance with legal obligations | | 1/7 | 0 | 6 | | |
| Economic performance | | 1/7 | 0 | 6 | | |
| Financial performance | | 1/7 | 0 | 6 | | |
| If such performance information is collected, is it available via the internet? | 1/9 | | 0 | 6 | | |
| Are the costs of operating the regulator published and accessible to the public? | 1/9 | | 0 | 6 | | |
| Are the following legislative requirements in place to enhance the transparency of the regulator's activities? | 1/9 | | | | | |
| Publication of all decisions, resolutions and agreements | | 1/4 | 0 | 6 | | |
| Public consultation on relevant activities | | 1/4 | 0 | 6 | | |
| Publication of a report on the regulators activities | | 1/4 | 0 | 6 | | |
| Publication of a forward-looking action plan | | 1/4 | 0 | 6 | | |
| Country scores (0-6) | | | $\Sigma a_i \Sigma b_i \text{ answer}_{ij}$ | | | |

Figure 3.1: Accountability

Appendix A



t-Test: Paired Two Sample for Means

| | Variable 1 | Variable 2 |
|------------------------------|--------------|------------|
| Mean | 0.528126271 | 0.543782 |
| Variance | 0.018364879 | 0.027897 |
| Observations | 113 | 113 |
| Pearson Correlation | 0.744641629 | |
| Hypothesized Mean Difference | 0 | |
| df | 112 | |
| t Stat | -1.485389416 | |
| P(T<=t) one-tail | 0.070125008 | |
| t Critical one-tail | 1.658572629 | |

```

regressions_high_low.txt
Low-efficiency (efficiency<=0.51)

-----
Source |      SS      df      MS      Number of obs   =      51
-----+-----
Model |   .035730329      2   .017865165   F(2, 48)         =      0.04
Residual |  20.6889607     48   .431020015   Prob > F         =      0.9594
-----+-----
Total |  20.724691     50   .414493821   R-squared        =      0.0017
                                           Adj R-squared    =     -0.0399
                                           Root MSE        =      .65652

-----
Indeaths_per_P |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-----+-----
efficiency |   -.38786   1.512178    -0.26   0.799    -3.428298
2.652578
GNI_per_capita | -.0003054   .0032006    -0.10   0.924    -.0067406
.0061299
_cons |   2.972716   .6446492     4.61   0.000     1.676562
4.26887
-----

High-efficiency (efficiency>0.51)

-----
Source |      SS      df      MS      Number of obs   =      52
-----+-----
Model |   5.74227328      2   2.87113664   F(2, 49)         =     11.50
Residual |  12.2303008     49   .249597975   Prob > F         =      0.0001
-----+-----
Total |  17.972574     51   .352403412   R-squared        =      0.3195
                                           Adj R-squared    =      0.2917
                                           Root MSE        =      .4996

-----
Indeaths_per_P |      Coef.   Std. Err.      t    P>|t|     [95% Conf.
Interval]
-----+-----
efficiency |  -3.213928   .6803955    -4.72   0.000    -4.581234
-1.846622
GNI_per_capita |   .0017085   .0025735     0.66   0.510    -.0034632
.0068801
_cons |   4.272518   .4581484     9.33   0.000     3.351834
5.193201
-----

```

Figure 3.2: regressions of road fatalities per 100,000 population (in log values) on government efficiency and GNI per capita for two sub-samples: countries above the median efficiency level ('high efficiency') and countries below the median ('low efficiency'). Source: Global status report on road safety 2015, World Health Organization; the World Justice Project (WJP) Rule of Law Index 2017-2018 report

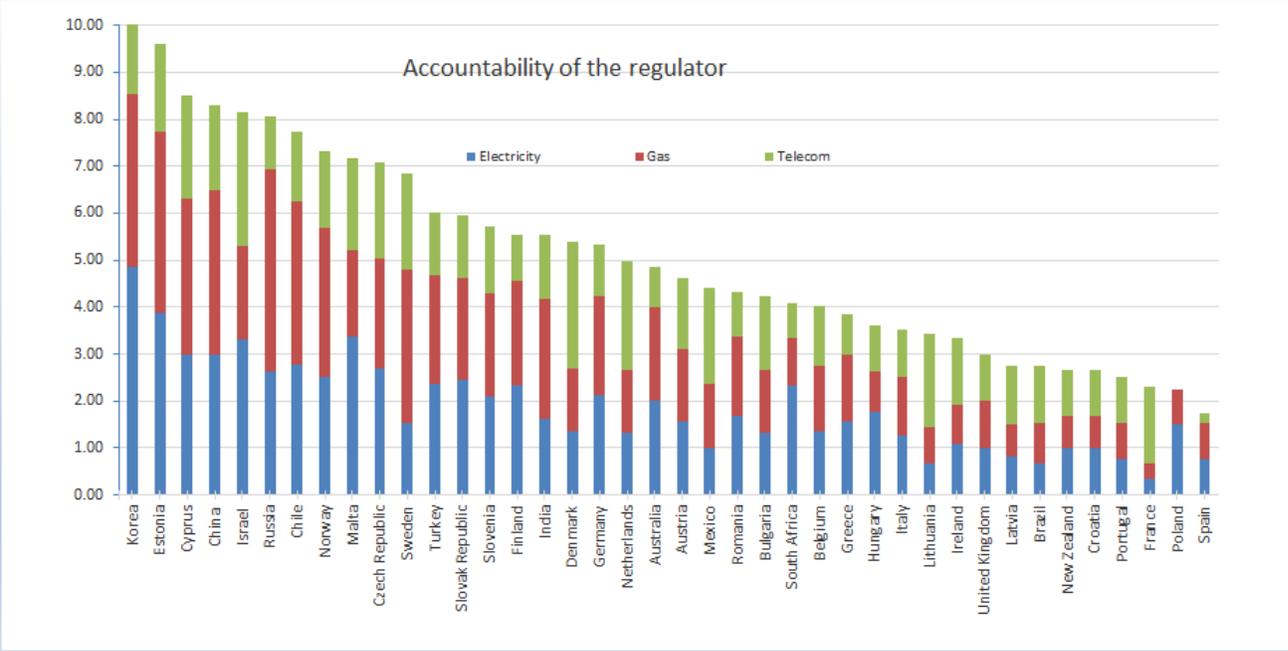


Figure 3.3: Accountability.