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Politically Induced Regulatory Risk and Independent Regulatory Agencies

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Abstract

Uncertainty in election outcomes generates politically induced regulatory risk. For monopoly regulation, political parties' risk attitudes towards such risk depend on a fluctuation effect that hurts both parties and an output–expansion effect that benefits at least one party. Irrespective of the parties' risk attitudes, political parties have incentives to negotiate away regulatory risk by pre-electoral bargaining. Pareto-efficient bargaining outcomes fully eliminate regulatory risk and are attainable through institutionalizing independent regulatory agencies with a specific objective. Key aspects of the regulatory overhaul of the US Postal system in 1970 are argued to be consistent with these results.

Keywords: regulation;independent regulatory agency;regulatory risk;electoral uncertainty
JEL Classification No.: D82

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1 Introduction

Given that regulation has become a pervasive feature of most markets, uncertainty about changes in regulatory environments is a major operating concern for firms. Indeed surveys on business risks (e.g. EUI 2005, Ernst&Young 2008, 2010, Allianz 2015) consistently rank this uncertainty as one of the main risks for businesses. Highlighting the active role that political institutions have in managing regulatory risk, Ernst&Young (2010, p.10) emphasizes that "governments need to move fast to remove uncertainty".

Consequently, this paper studies the question whether political parties have both an inherent incentive and the means to reduce regulatory risk, or whether modern political systems exhibit some perverse incentive that prevents them for doing so or even encourages them to artificially impose regulatory risk. The paper formally shows that, for monopoly regulation, political parties have indeed incentives to remove politically induced regulatory risk through political bargaining. It, moreover, argues that they can eliminate such risk by institutionalizing independent regulatory agencies. The paper therefore offers a new explanation for the prevalence of such agencies: their ability to limit regulatory risk. As discussed in Section 8, this empirical implication matches well the shaping of, for instance, the US Postal Regulatory Commission (PRC) as an independent regulatory agency.

Theoretical results are obtained in the regulation framework of Baron and Myerson (1982), where a benevolent government regulates a privately informed monopolist with the objective to maximize a weighted sum of consumer surplus and profits. I embed this framework in a political economy setup, where two political parties differ in their views about the appropriate weight on profits. These different political views cause a preference for different regulated output schedules. Hence, when election outcomes are random, the firm's output is random and this signifies the regulatory risk.

In order to evaluate the parties' risk attitudes towards this risk, I compare their expected payoffs with and without regulatory risk. This comparison reveals that regulatory risk affects political parties through two effects: a *fluctuation* and an *output-expansion* effect. These two effects follow directly from the fact that under regulatory risk the firm's output is random. Intuitively, the fluctuation effect represents the variance of this randomness, while the output-expansion effect is linked to the output's mean under the randomness.

Because consumers have a decreasing marginal utility in consumption, they dislike any variance in the firm's output so that the fluctuation effect affects consumer surplus adversely. Hence, the fluctuation effect also hurts political parties that put positive weight on consumer surplus.

In contrast, a party's attitude towards the output expansion effect is more subtle. The expansion effect expresses whether the firm's regulated output is, in expectation, larger or smaller than in the absence of the randomness. Depending on the convexity of the consumer's demand function, the output expansion effect can be positive or negative. If the expansion is positive, then it benefits the party that puts more weights on profits, while it hurts the other party. If the expansion effect is negative, these effects are reversed. Hence, exactly one party likes the expansion effect, while the other party dislikes it.

Taking both the fluctuation and expansion effect into consideration, it follows that at least one party unambiguously dislikes regulatory risk, whilst the other party dislikes regulatory risk only when the fluctuation effect outweighs the expansion effect. As I show this is the case when the party's winning probability is large or the overall degree of political divergence is small.

In order to study the link between regulatory risk and the independence of regulatory agencies, I next consider the parties' incentive to delegate the regulatory task to a regulatory agency. In particular, I allow parties to bargain about the agency's appropriate objective before the election, but with the outside option that if the pre-electoral bargaining breaks down, the party who wins the election chooses the agency's objective. I obtain that, regardless of the parties' attitudes towards regulatory risk, any Pareto efficient bargaining outcome eliminates all regulatory risk. Efficient bargaining therefore induces parties to institutionalize an independent regulatory agency whose objective is independent of the election outcome. This eliminates all regulatory risk and establishes the main insight of this paper: Benevolent political parties, who differ in the relative emphasis they put on consumer surplus versus profits, have a natural incentive to reduce rather than increase regulatory risk.

The rest of the paper is organized as follows. The next section discusses related literature. Section 3 sets up the framework and characterizes the comparative statics of the optimal regulation contract. Section 4 shows that electoral uncertainty without political bargaining induces regulatory risk. Section 5 analyzes the attitudes of political parties towards this risk, while Section 6 studies their incentives in eliminating it through political bargaining. Introducing political competition, Section 7 considers endogenous election outcomes. Section 8 illustrates that the theoretical insights help to understand how independent regulatory agencies are shaped in practise by discussing regulation of the US postal system. The paper closes with a discussion about the paper's theoretical results in Section 9. For those propositions that do not follow directly from the text, formal proofs are collected in the appendix.

2 Related Literature

The paper's focus on the effect of electoral uncertainty on optimal regulation relates it to the literature on the political economy of regulation. In particular, Baron (1988) studies how the political framework affects regulatory outcomes. Because there is no electoral uncertainty, Baron (1988) does however not exhibit regulatory risk. Introducing electoral uncertainty explicitly, Laffont (1996), Boyer and Laffont (1999), and also Laffont (2000) point out that politically controlled regulation leads to regulation outcomes that fluctuate with the uncertain election outcome. These fluctuations imply regulatory risk. The studies point out that fluctuations are excessive from an overall welfare perspective and, subsequently, study the welfare effects of reducing fluctuations by limiting the discretionary power of political parties. In contrast to this welfare orientated approach, the current paper provides a more positive analysis and shows that the political parties themselves have already incentives and ways to limit these fluctuations. Because this former literature abstracts from this possibility, this paper's results suggest that the negative welfare effects of fluctuations are less severe than these earlier studies indicate.

More generally, this paper is an illustration of the general insight in political science that, due to political uncertainty, politicians may benefit from smoothening fluctuations in political decision making. This smoothing motive is, next to the insulation motive, one of the main rationales for delegating political decisions to independent bureaucracies.[1] In particular, Fiorina (1982) provides an explicit analysis of the smoothing motive, demonstrating that the risk preferences of political actors is its main driver. He thereby implicitly criticizes that the smoothing motive "takes us willy-nilly into the realm of functional forms (Fiorina p.57, 1982)". By explicitly modeling the regulatory problem that underlies the political decision, this paper addresses this criticism by providing a micro foundation of these functional forms.[2] An additional advantage of the micro foundation is that it yields new and more concrete insights in the potential benefits of the smoothing motive – the fluctuation and the output-expansion effect, which can then be related directly to economic fundamentals such as the underlying demand conditions.

In contrast, the insulation motive expresses the incentive of an incumbent political party to insulate its policies against changes by opponents that come to power in the future. For example, Moe (1990, p.229) argues that political uncertainty induces current public authority holders to use delegation as "protective devices for insulating agencies from political enemies". In this vein, Faure-Grimaud and Martimort (2003) show in an economic environment how an incumbent government benefits from politically independent agencies in order to insulate its

[1] Protection against dynamic inconsistent behavior (e.g., Kydland and Prescott 1977; Rogoff 1985) provides a further strategic rationale for delegating power to independent bureaucracies, but is also not linked to political uncertainty or fluctuations in political control.

[2] See also de Figueiredo (2002), who investigates a model with political uncertainty where the parties' payoff functions are, by assumption, single-peaked and concave, implying risk averse behavior with respect to the one–dimensional policy variable.

policies against changes by differently minded politicians in the future. Although also the insulation motive favors commitment through delegation, this motive is not directly related to electorial uncertainty or regulatory risk. To see this, note that the insulation motive is strongest if the governing party is certain to lose the next election – i.e., when there is no risk; and the motive is weakened if there is electoral uncertainty so that the change is less certain. Hence, the insulation motive is related to electoral change rather than electoral risk. While both the insulation motive and regulatory risk are two possible drivers of delegation, the regulatory risk motive yields a more benign hypothesis for independent regulatory agencies.

The current paper also abstracts from any collusion possibilities of regulators. This allows it to show that already without collusion the trade–offs concerning political independence is nontrivial and economically relevant. It therefore differs from, for example, Faure-Grimaud and Martimort (2007), who explicitly focus on collusion and identify a positive stabilization effect of independent regulators when these regulators are more prone to collusion than independent ones.

Finally, the current paper is related to Strausz (2011), who develops a model of regulatory risk of which a variant is used here. An important difference is however that Strausz (2011) takes the degree of regulatory risk as exogenous and takes its source for granted. It moreover analyzes the impact of the fluctuation and expansion effect on the regulated firm, the consumer, and the regulator rather than some political party. In contrasts the current paper focuses on a particular source of regulatory risk – politically induced regulatory risk – and investigates the incentive of the responsible economic agents – political parties – to control this risk. It thereby endogenizes the degree of regulatory risk.

3 The Setup

A privately informed monopolistic firm produces a publicly provided good x at constant marginal costs c with no fixed costs. Hence, the firm's profit from producing a quantity x for a lump–sum transfer t is

$$\Pi(t, x|c) \equiv t - cx.$$

Marginal costs are c_l with probability ν and c_h with probability $1 - \nu$, where $\Delta c \equiv c_h - c_l > 0$. Only the firm learns the realization of its marginal costs c. Its outside option is zero.

Consumers pay a lump–sum transfer t in exchange for the consumption of a quantity x, and obtain a consumer surplus of

$$\Psi(t, x) \equiv v(x) - t.$$

The term $v(x)$ expresses the consumers' overall utility from the consumption of a quantity x of the good. It is increasing at a decreasing rate, i.e., $v' > 0$ and $v'' < 0$, and its third order derivative, v''', determines the local curvature of the consumers' aggregate demand function.[3]

Before regulation takes place, there is a general election between a party l and a party r. The election determines the ruling party that runs the government and, ultimately, decides about the regulation. Importantly, the election outcome is uncertain.[4] It is instructive to first take the level of electoral uncertainty as exogenous: party l wins the election with probability $\pi \in (0,1)$ and party r wins it with probability $1-\pi$. Section 7 endogenizes the degree of electoral uncertainty by introducing electoral competition.

Both parties are benevolent in that they maximize a weighted sum of consumer surplus and profits. In line with the economic literature on partisan politics[5], the parties attach different weights to profits. These differences express the extent to which the two parties differ in their perception of the appropriate weight α in society's social choice function and the extent to which they cater to the preferences of heterogeneous voter groups. In particular, party p's objective function is

$$W_p = \Psi + \alpha_p \Pi, \tag{1}$$

where the parameter $\alpha_p \in [0,1)$ represents the weight of party p on profits. Party r has a more business friendly orientation so that $\alpha_r > \alpha_l$. In summary, a firm that receives a transfer t and produces a quantity x at marginal costs c_i yields party $p \in \{l, r\}$ a payoff of

$$W_p(x,t,c_i) \equiv \Psi(x,t) + \alpha_p \Pi(x,t) = v(x) - \alpha_p c_i x + (1-\alpha_p)t.$$

The triple $(\pi, \alpha_l, \alpha_r)$ describes the *political system.* For a given political system, let $\Delta\alpha \equiv \alpha_r - \alpha_l > 0$ represent the *political divergence* of the system.

Following Baron (1988), the government delegates the regulatory task to a regulatory agency by endowing the agency with a specific objective function:

$$W_a = \Psi(x,t) + \alpha_a \Pi(x,t).$$

Hence, the government's decision is the weight α_a with which the agency is to regulate.

[3]The consumer's demand $x(p)$ solves $\max_x v(x) - px$ and satisfies the first order condition $v'(x(p)) = p$. By the implicit function theorem, differentiating twice and rearranging terms yields $x''(p) = -v'''(x(p))x'(p)^2/v''(x(p))$. Due to $v'' < 0$, the sign of v''' fully determines the curvature of demand.

[4]Moe (1990, p228, footnote 16) notes "political uncertainty is absolutely fundamental to the public sector".

[5]E.g., Baron (1988), Boyer and Laffont (1999), Laffont (2000), Faure-Grimaud and Martimort (2003) and Faure-Grimaud and Martimort (2007)

The paper concentrates on the following political game Γ:

$t = 0$: Parties may agree on institutionalizing an agency with a weight $\alpha_a \in [0, 1]$ on profits.
$t = 1$: Nature determines the election winner $p \in \{l, r\}$.
$t = 2$: Without agreement in $t = 0$, the election winner chooses the agency's weight α_a.
$t = 3$: The agency offers the firm a regulatory schedule.

Consequently, the only task of the agency is to propose a regulatory schedule to the firm. In particular, the agency does not engage in information acquisition or any other productive task. This limited role of the agency makes explicit that the incentives of the political parties whether to grant political independence is driven entirely by considerations of regulatory risk rather than other concerns such as information acquisition or collusion.

Given a specific weight α_a, the agency offers a regulatory schedule that is optimal given its objective function W_a. By the revelation principle, the optimal regulation contract is a direct mechanism (t_l, x_l, t_h, x_h) that maximizes the regulator's objective under the firm's participation and incentive constraints:

$$\begin{aligned} P: \max_{x(.),t(.)} \quad & \nu W_a(x_l, t_l, c_l) + (1-\nu) W_a(x_h, t_h, c_h) \\ \text{s.t.} \quad & t_h - c_h x_h \geq t_l - c_h x_l \text{ and } t_l - c_l x_l \geq t_h - c_l x_h; \\ & t_l \geq c_l x_l \text{ and } t_h \geq c_h x_h. \end{aligned} \tag{2}$$

Standard arguments imply that the incentive compatibility of the efficient firm c_l and the individual rationality constraint of the inefficient firm c_h are binding. Consequently, given a schedule (x_l, x_h) the optimal transfers are $\hat{t}_h(x_l, x_h) \equiv c_h x_h$ and $\hat{t}_l(x_l, x_h) \equiv c_l x_l + \Delta c x_h$. Using these expressions to substitute out the binding constraints leads to the following first order conditions that characterize the optimal quantity schedules $(\hat{x}_l, \hat{x}_h)$:

$$v'(\hat{x}_l) = c_l \text{ and } v'(\hat{x}_h) = c_h + (1-\alpha_a)\psi\Delta c, \tag{3}$$

where $\psi \equiv \nu/(1-\nu)$. Hence, the usual result obtains that the allocation of the efficient type coincides with the first best and the allocation of the inefficient type is distorted downwards. Party p's payoff from a schedule $(\hat{x}_l, \hat{x}_h(\alpha_a))$ is $\tilde{W}_p(\hat{x}_l, \hat{x}_h(\alpha_a))$, where

$$\tilde{W}_p(x_l, x_h) \equiv \nu W_p(x_l, \hat{t}_l(x_h, x_l), c_l) + (1-\nu) W_p(x_h, \hat{t}_h(x_h, x_l), c_h).$$

Applying the implicit function theorem to (3) reveals how output $\hat{x}_h$ depends on α_a:

$$\hat{x}'_h(\alpha_a) = -\frac{\psi\Delta c}{v''(\hat{x}_h)} \quad \text{and} \quad \hat{x}''_h(\alpha_a) = -\frac{v'''(\hat{x}_h(\alpha_a))}{v''(\hat{x}_h(\alpha_a))}[\hat{x}'_h(\alpha_a)]^2. \tag{4}$$

The first expression is, due to $v'' < 0$, positive and, therefore, $\hat{x}_h(\alpha_l) \leq \hat{x}_h(\alpha_r) \leq x_h^{fb}$. The more business friendly party r asks the firm to produce more, because it discounts less the information rent that is required with higher production. The second expression reiterates one of the main findings in Strausz (2011) that the curvature of demand, v''', determines the curvature of $\hat{x}_h$ with respect to α_a.

4 Politically Induced Regulatory Risk

Consider as a benchmark the political game Γ without the pre-electoral bargaining stage $t = 0$ so that in stage $t = 2$ the winning party simply chooses the agency's weight α_a. Because a weight α_a leads to a production $x_l = \hat{x}_l$ in case of an efficient firm and $x_h = \hat{x}_h(\alpha_a)$ in case of an inefficient firm, the choice α_a in $t = 2$ yields party p the expected payoff

$$\hat{W}_p(\alpha_a) \equiv \tilde{W}_p(\hat{x}_l, \hat{x}_h(\alpha_a)). \tag{5}$$

The following lemma confirms the intuitive but helpful property that $\hat{W}_p$ is single–peaked and attains a maximum at α_p.

Lemma 1 *The function $\hat{W}_p$ is increasing for $\alpha < \alpha_p$ and decreasing for $\alpha > \alpha_p$. It attains a unique maximum at α_p so that $\hat{W}_p'(\alpha_p) = 0$ and $\hat{W}_p''(\alpha_p) < 0$.*

From the lemma, it then follows that it is best for a ruling party p to endow the agency with its own weight α_p. This means that production fluctuates with the election outcome, because if party l wins, the inefficient firm ends up producing $x_h(\alpha_l)$, while it produces $x_h(\alpha_r)$ when party r wins. In the presence of uncertain election outcomes, this leads to politically induced regulatory risk.

Proposition 1 *Without pre-electoral bargaining, regulatory risk results and a party p obtains the pre-electoral expected payoff of*

$$W_p^e \equiv \pi \hat{W}_p(\alpha_l) + (1 - \pi)\hat{W}_p(\alpha_r). \tag{6}$$

The rest of the paper investigates the attitudes of the political parties towards this risk and their incentives to negotiate it away in period $t = 0$.

5 Risk Attitudes

This section investigates the party's risk attitude towards politically induced regulatory risk by following the idea that the risky election outcome — weight α_l with probability π and α_r

with probability $(1-\pi)$ — is, in the sense of Rothschild and Stiglitz (1970), a mean preserving spread of the deterministic expected weight

$$\alpha_e \equiv \pi\alpha_l + (1-\pi)\alpha_r.$$

Hence, in line with classical risk analysis, a political party *dislikes regulatory risk* when its expected payoff with the risk is smaller than its payoff from regulating with the expected but deterministic weight α_e:

$$\hat{W}_p(\alpha_e) \geq W_p^e. \tag{7}$$

If the inequality is reversed, a party, in contrast, *likes regulatory risk*. Hence, the curvature of $\hat{W}_p$ determines party p's attitude towards risk. In particular, party p dislikes regulatory risk, when its payoff $\hat{W}_p$ is concave in α, whereas it likes the risk if its payoff is convex. The following lemma establishes a sufficient condition under which a party's payoff $\hat{W}_p$ is locally concave.

Lemma 2 *The function $\hat{W}_p(\alpha)$ is concave in the neighborhood of α when*

$$(\alpha_p - \alpha)\psi\Delta c v'''(\hat{x}_h(\alpha)) < [v''(\hat{x}_h(\alpha))]^2. \tag{8}$$

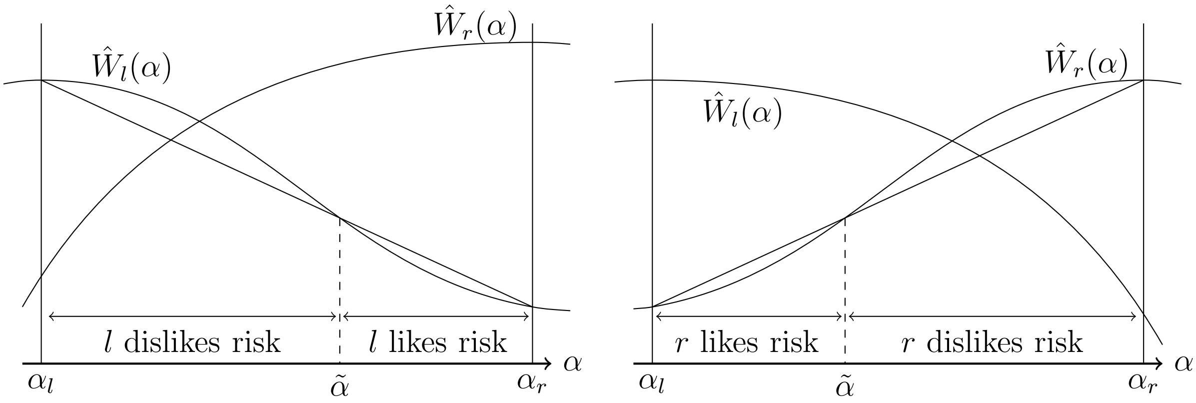
When the local condition (8) holds globally, the function $\hat{W}_p(\alpha)$ is concave globally, which implies that party p dislikes regulatory risk in general. Because the expected policy preference α_e lies in between α_l and α_r, the relevant interval for considering the curvature of $\hat{W}_p(\alpha)$ is $[\alpha_l, \alpha_r]$ rather than the overall domain $[0, 1]$. For $\alpha \in [\alpha_l, \alpha_r]$, all the signs of the different terms in (8) are unambiguously determined except for v''', which represents the curvature of demand. The following proposition states the extent to which risk attitudes depend on this curvature.

Proposition 2 *For linear demand ($v''' = 0$), both parties dislike regulatory risk. When demand is globally convex ($v''' > 0$), party l dislikes regulatory risk. When demand is globally concave ($v''' < 0$), party r dislikes regulatory risk.*

In order to understand the intuition behind Proposition 2, it is helpful to decompose the overall effect of regulatory risk in an *expansion effect* and a *fluctuation effect*.

First recall the result at the end of Section 3 that the curvature of demand, v''', determines the curvature of $\hat{x}_h$ with respect to α_a. In particular, the output $\hat{x}_h$ is convex in α_a when the consumer's demand is convex and vice versa. Hence, if one compares the allocation $\hat{x}$ at the expected weight α_e to the expected output under regulatory risk

$$\hat{x}_h^e \equiv \pi\hat{x}_h(\alpha_l) + (1-\pi)\hat{x}_h(\alpha_r),$$



Concave demand $v''' < 0$ Convex demand $v''' > 0$

Figure 1: Payoff effects of regulatory risk

then, under convex demand, $\hat{x}_h^e \geq \hat{x}(\alpha_e)$. This means that regulatory risk has a positive *expansion effect* on output when demand is convex. For concave demand, it follows $\hat{x}_h^e \leq \hat{x}(\alpha_e)$ so that the expansion effect of regulatory risk is negative. For linear demand, $\hat{x}_h^e$ and $\hat{x}(\alpha_e)$ coincide; regulatory risk has no expansion effect.

To understand the *fluctuation effect* of regulatory risk, consider first the case of linear demand where there is no expansion effect: $\hat{x}_h^e = \hat{x}_h(\alpha_e)$. In this case, regulatory risk has only a fluctuation effect in that, with regulatory risk, output fluctuates between $\hat{x}_h(\alpha_l)$ and $\hat{x}_h(\alpha_r)$, whereas without regulatory risk it is fixed at its expected value $\hat{x}_h(\alpha_e) = x_h^e$. Because of the consumers' decreasing marginal utility, the two parties dislike such fluctuations. This explains the statement of Proposition 2 that, with linear demand, both parties dislike regulatory risk.

Now if demand is convex, then the expansion effect is positive so that regulatory risk raises the expected value of the output itself. From the perspective of party l, regulatory risk therefore moves the expected allocation $\hat{x}_h^e$ further from its ideal output $\hat{x}_h(\alpha_l)$ so that the expansion effect hurts party l. Given that also the fluctuation effect is negative, the two effects reinforce each other and, therefore, party l unambiguously dislikes regulatory risk. This explains the second statement of Proposition 2 that, with convex demand, party l dislikes regulatory risk. In contrast, a positive expansion effect has a positive effect on party r, because it moves the expected output $\hat{x}_h^e$ closer to its ideal value $\hat{x}_h(\alpha_r)$. Hence, from party r's perspective, a positive output expansion effect counteracts the fluctuation effect. If the former is strong enough, party r actually likes regulatory risk. The opposite logic holds when the expansion effect is negative so that output contracts.

Figure 1 illustrates the role of curvature further. When demand is concave ($v''' < 0$), condition (8) is, due to the output contraction effect, satisfied for any $\alpha < \alpha_p$. This implies that the curve $\hat{W}_p$ is concave for all weights α that are smaller than the party's ideal weight α_p. As illustrated in the first graph of Figure 1, this implies for party r that its payoff function $\hat{W}_r$ is concave for the entire range $[\alpha_l, \alpha_r]$. For $\alpha > \alpha_p$, a party p benefits from the output contraction effect and, for α large enough, condition (8) is violated. As illustrated in the first graph of Figure 1, this implies that there exist a range of $[\tilde{\alpha}, \alpha_r]$ such that party l benefits from regulatory risk.

Proposition 2 gives a definite answer about risk preferences for demand functions that are either globally convex or globally concave. It is, however, uninformative about risk preferences for demand curves with a changing curvature. For such demand functions, the local effect of regulatory risk can change over the relevant domain $[\alpha_l, \alpha_r]$ and one has to consider the overall global effect of regulatory risk directly. The following proposition extends the previous one in that it shows that, independent of the demand curve, at least one political party dislikes regulatory risk.

Proposition 3 *In any political system $(\pi, \alpha_l, \alpha_r)$, at least one political party dislikes regulatory risk. If the expansion effect is positive ($\hat{x}_h^e \geq \hat{x}_h(\alpha_e)$), then party l dislikes regulatory risk. If the expansion effect is negative ($\hat{x}_h^e \leq \hat{x}_h(\alpha_e)$), then party r dislikes regulatory risk.*

In the light of the intuition behind Proposition 2, the reasoning behind Proposition 3 is straightforward. As argued, the fluctuation effect impacts the political parties negatively. A positive expansion effect, therefore, reinforces party l's dislike of the fluctuation effect so that this party dislikes regulatory risk. Similarly, a negative expansion effect reinforces the negative impact of the fluctuation effect of party r. Because, the expansion effect is either positive, negative, or zero, there is at least one party for whom the negative impact of the fluctuation effect is (weakly) reinforced by the expansion effect. As a consequence, at least one political party dislikes regulatory risk.

Proposition 3 reveals that at least one party dislikes regulatory risk, but Figure 1 illustrates that the other party may or may not like it. Using Lemma 2 one may characterize political systems in which both parties dislike regulatory risk. Defining a political system as risk averse when both parties dislike regulatory risk and by defining[6]

$$\bar{v} \equiv \min_{x \in [0, \hat{x}_h(1)]} \frac{(v''(x))^2}{|v'''(x)|}, \tag{9}$$

the following comparative static results obtain.

Proposition 4 *A political system $(\pi, \alpha_l, \alpha_r)$ is averse to regulatory risk whenever*

[6] If $v'''(x) = 0$ for all $x \in [0, \hat{x}_h(1)]$, then let $\bar{v} = \infty$.

i) political divergence $\Delta\alpha$ is small and, in particular, smaller than $\bar{v}/(\psi\Delta c)$;

ii) the winning probability of the regulatory risk averse party is small enough;

iii) the difference in costs Δc is small and, in particular, smaller than $\bar{v}/(\psi\Delta\alpha)$;

iv) the probability of an efficient firm, ν, is small and, in particular, smaller than $\bar{v}/(\bar{v} + \Delta\alpha\Delta c)$.

To understand the first result of the proposition, note that, because the curve $\hat{W}_p(\alpha)$ reaches its maximum at α_p, it is strictly concave around α_p. By continuity it then follows that, a party's objective function $\hat{W}_p(\alpha)$ is concave for weights α close to the party's ideal weight α_p. The first result, therefore, follows from the observation that a party's payoff must be concave over the whole range $[\alpha_l, \alpha_r]$ when this range is small.

The second result shows that a sufficient condition for a political system to be averse to regulatory risk is that the party which may potentially like regulatory risk is likely enough to win. At first sight this seems surprising, but the result follows again from the observation that the curve $\hat{W}_p$ is necessarily concave around α_p. When party p has a high enough probability of winning then this implies that the expected α_e lies close to α_p and the curve $\hat{W}_p$ is, therefore, also concave in the neighborhood of α_e. This explains that, irrespective of the expansion effect, a party necessarily dislikes regulatory risk, when its probability of winning is high enough.

The economic intuition behind the last two results of Proposition 4 follows from considering the fundamentals of the regulation problem. When Δc or ν become small, the private information problem disappears and information rents become irrelevant. Because the parties differ only in the way they evaluate these information rents, these differences disappear when the private information problem becomes negligible.

6 Political Bargaining and Independent Regulators

When the political system is averse to regulatory risk, parties benefit from fully eliminating it by institutionalizing a politically independent agency that attaches the weight α_e to profits. Hence, for such systems, one may expect regulatory risk not to occur.

For political systems that are not averse to regulatory risk, at least one party loses from institutionalizing an agency with the weight α_e. In this case, the parties may try to reach a mutual beneficial agreement on another weight α_a, meaning that with the possibility of pre-electoral agreements an exclusive focus on the average weight α_e is too limited. Moreover, rather than bargaining over a single weight α_a, parties can expand negotiations to pairs of

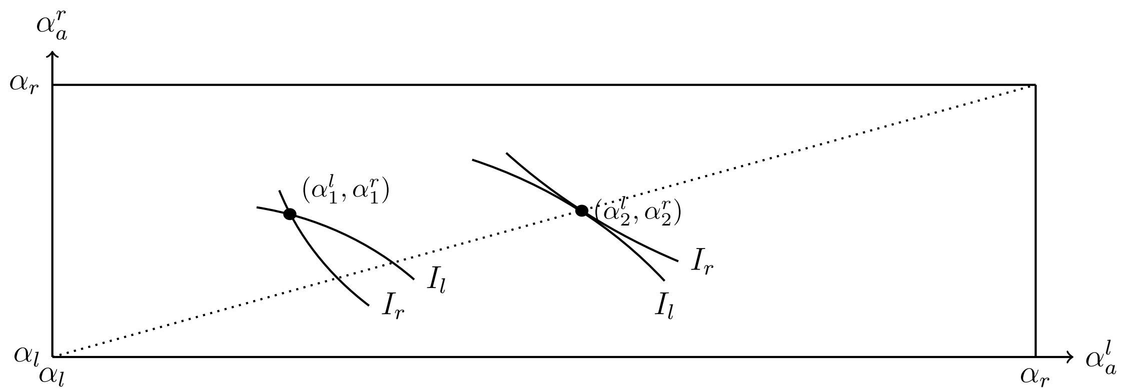


Figure 2: Non-Pareto (α_1^l, α_1^r) vs. Pareto (α_2^l, α_2^r) agreements

weights (α_a^l, α_a^r) with the interpretation that when party p wins the election, the regulatory agency regulates on the basis of the weight α_a^p. Such conditional pre-electoral agreements are more general since they comprise the unconditional ones (i.e. set $\alpha_a^l = \alpha_a^r = \alpha_a$).

Whenever political parties agree on a pair with $\alpha_a^l \neq \alpha_a^r$, the resulting agreement does not fully eliminate regulatory risk, since the output schedule which the agency implements still depends non-trivially on the election outcome. This section shows that, even if parties have diverging risk attitudes, they have an incentive to fully eliminate regulatory risk, i.e. choose $\alpha_a^l = \alpha_a^r$, rather than to reduce it only partially (or even to increase it).

In order to demonstrate this result, note that the pre-electoral expected payoff of party $p \in \{l, r\}$ from a partially independent agency (α_a^l, α_a^r) is

$$W_p^b(\alpha_a^l, \alpha_a^r) \equiv \pi \hat{W}_p(\alpha_a^l) + (1 - \pi)\hat{W}_p(\alpha_a^r).$$

Consequently, define a pre-electoral agreement (α_a^l, α_a^r) as Pareto optimal if there exists no other pair $(\hat{\alpha}_a^l, \hat{\alpha}_a^r)$ such that

$$W_r^b(\hat{\alpha}_a^l, \hat{\alpha}_a^r) \geq W_r^b(\alpha_a^l, \alpha_a^r) \wedge W_l^b(\hat{\alpha}_a^l, \hat{\alpha}_a^r) \geq W_l^b(\alpha_a^l, \alpha_a^r)$$

with at least one strict inequality.

Figure 2 illustrates that Pareto optimal agreements can be characterized by using the standard techniques of indifference curves in consumer theory. Because of the differences in the slopes of the indifference curves that go through a point off the 45-degree line, agreements which do not eliminate all regulatory risk are not Pareto optimal. To make this observation precise, consider the marginal rate of substitution

$$MRS_p(\alpha_a^l, \alpha_a^r) \equiv -\frac{\partial W_p^b / \partial \alpha_a^l}{\partial W_p^b / \partial \alpha_a^r} = -\frac{\pi(\alpha_p - \alpha_a^l)}{(1 - \pi)(\alpha_p - \alpha_a^r)} \frac{\hat{x}_h'(\alpha_a^l)}{\hat{x}_h'(\alpha_a^r)}, \tag{10}$$

from which follows that

$$MRS_r(\alpha_a^l, \alpha_a^r) = MRS_l(\alpha_a^l, \alpha_a^r) \frac{(\alpha_r - \alpha_a^l)}{(\alpha_r - \alpha_a^r)} \frac{(\alpha_a^r - \alpha_l)}{(\alpha_a^l - \alpha_l)}.$$

Because the marginal rate of substitution expresses the slope of the indifference curve, an indifference curve I_r associated with a point above the 45-degree line, where $\alpha^l < \alpha^r$, is steeper than its corresponding indifference curve I_l. Hence, agreements that exhibit $\alpha^l < \alpha^r$ are not Pareto optimal, since moving towards the 45-degree yields a Pareto improvement. Similarly for pairs below the 45-degree line where $\alpha^r < \alpha^l$, the indifference I_l is steeper than I_r so that again moving closer to the 45-degree line yields a Pareto improvement. Pareto optimal pairs are only found on the 45-degree line, where the marginal rates of substitution coincide. The following lemma summarizes the result.

Proposition 5 *Pareto optimal pre-electoral agreements (α_a^l, α_a^r) exhibit $\alpha_a^l = \alpha_a^r$, implying that in any political system, the efficient pre-electoral agreements fully eliminate politically induced regulatory risk by institutionalizing an independent regulatory agency with a unconditional weight α_a.*

According to the proposition, Pareto optimal agreements can be characterized by a single unconditional $\alpha_a \in [0, 1]$. Recalling expressions (5) and (6) allows a characterization of agreements that are also mutually beneficial to the parties. In particular, a politically independent agency with weight α_a yields party p at least its expected status quo payoff exactly when

$$\hat{W}_p(\alpha_a) \geq W_p^e. \tag{11}$$

Hence, let $\alpha_p^* \in [\alpha_l, \alpha_r]$ satisfy the relation

$$\hat{W}_p(\alpha_p^*) = W_p^e.$$

Because W_p^e lies in between $\hat{W}_p(\alpha_l)$ and $\hat{W}_p(\alpha_r)$ and $\hat{W}_p$ is continuous and monotone on the interval $[\alpha_l, \alpha_r]$, the value α_p^* exists and is unique. Moreover, party l strictly prefers a politically independent agency with a weight $\alpha_a < \alpha_l^*$ to the risky default option, because $\hat{W}_l$ is decreasing on $[\alpha_l, \alpha_r]$. Similarly, party r strictly prefers a politically independent agency with a weight $\alpha_a > \alpha_r^*$ to the risky default option. Proposition 5 implies that $\alpha_r^* \leq \alpha_l^*$ so that both parties prefer an independent regulator operating with a weight α_a for any $\alpha_a \in (\alpha_r^*, \alpha_l^*)$. This reasoning leads to the following result.

Proposition 6 *In a political system $(\pi, \alpha_l, \alpha_r)$, both parties benefit from institutionalizing a politically independent agencies with weight $\alpha_a \in A^* \equiv [\alpha_r^*, \alpha_l^*]$.*

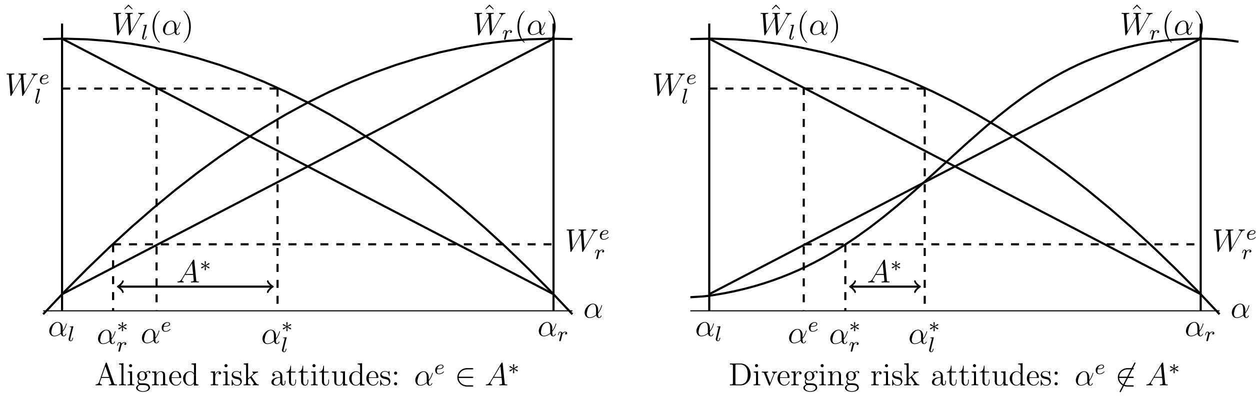


Figure 3: Mutual beneficial unconditional pre–electoral agreements A^*

For a fixed α^e, Figure 3 illustrates the construction of the proposition's set A^*. The first graph illustrates its construction in the case where both parties dislike regulatory risk, whereas the second graph illustrates the case where one party actually likes regulatory risk. As illustrated, only in the former case it holds $\alpha^e \in A^*$.

7 Endogenous Election Probabilities

Investigating political uncertainty as the driver behind regulatory risk, the previous sections treated this uncertainty as exogenously fixed. Such exogenous uncertainty can be taken as an illustration of the extreme case where the main issues that interest voters are not primarily related to the regulation problem. This section studies the other extreme, where voters are only interested in the regulation outcome. This approach endogenizes the election outcome and, moreover, enables to analyze the effect that political bargaining affects the winning probabilities of the competing political parties. The previous analysis abstracted from this effect. The main point of this section is to show that all qualitative results are robust to this additional effect.

A median voter model is used as a micro foundation for uncertain elections.[7] In particular, consider voters whose preferences differ only in one dimension: the weight α attached to profits. The voters' preferences concerning α are distributed according to the cumulative distribution function $F(\alpha|s)$, where s describes the state of the world. When posting their platforms, the political parties do not know the state s and are therefore ignorant of the exact distribution

[7] An alternative micro foundation for random election outcomes would be an electoral setup with costly voting. E.g., Palfrey and Rosenthal (1983) show that, for intermediate voting costs, the political economy model exhibits a mixed equilibrium, where each individual randomizes concerning his decision whether to vote. Because of its low analytical tractability of the mixed equilibrium, the current paper takes a different approach.

of voters. To model this uncertainty explicitly, let $G(s)$ describe the cumulative probability distribution of s.

The timing of the political game with endogenous elections, Γ^e, is as follows:

$t = 1$: Each party commits to a platform α^p non–cooperatively.
$t = 2$: Nature draws s and thereby determines the distribution of voters $F(\alpha|s)$.
$t = 3$: Voters determine the winning party by majority vote.
$t = 4$: The winning party p institutionalizes an agency with platform α^p.
$t = 5$: The agency offers the firm a regulatory contract.

In this one–dimensional voting model, the median voter theorem holds so that the median voter determines the election outcome. The median voter rationally votes for the platform closest to his own preferences. When the platforms are the same, he randomizes with probability 1/2. Because the political parties do not know the exact distribution of voters, they also do not know the exact preferences of the median voter α^m. Indeed, given platforms (α^l, α^r) the probability that party l wins is

$$\pi = \pi(\alpha^l, \alpha^r) \equiv \Pr\{|\alpha^m - \alpha^l| < |\alpha^m - \alpha^r|\}.$$

Consequently, the expected payoff of party $p \in \{l, h\}$ is

$$W_p(\alpha^p) = \pi(\alpha^l, \alpha^r)\hat{W}_p(\alpha^l) + (1 - \pi(\alpha^l, \alpha^r))\hat{W}_p(\alpha^r). \tag{12}$$

Given these payoff functions, the political parties simultaneously choose their platforms at stage $t = 1$. The pair $(\hat{\alpha}^l, \hat{\alpha}^r)$ forms a Nash equilibrium if $\hat{\alpha}^l$ is a best reply to $\hat{\alpha}^r$ and vice versa.

From the primitives $G(s)$ and $F(\alpha|s)$ the cumulative probability distribution $G^m(\alpha^m)$ obtains, representing the probability that the median voter's preferences do not exceed α^m. Given the parties' platforms (α^l, α^r), the probability that party l wins is

$$\pi(\alpha^l, \alpha^r) = \begin{cases} \Pr\{\alpha^m < (\alpha^l + \alpha^r)/2\} = G^m((\alpha^l + \alpha^r)/2), & \text{if } \alpha^l < \alpha^r \\ 1/2, & \text{if } \alpha^l = \alpha^m \\ \Pr\{\alpha^m > (\alpha^l + \alpha^r)/2\} = 1 - G^m((\alpha^l + \alpha^r)/2), & \text{if } \alpha^l > \alpha^r. \end{cases}$$

Under the assumption that the density g^m of G^m is continuous with support $[0, 1]$, it follows $\pi(\alpha^l, \alpha^r) \in (0, 1)$ for all $\alpha^l, \alpha^r \in (0, 1)$ and the following lemma.

Lemma 3 *Any Nash equilibrium $(\hat{\alpha}^l, \hat{\alpha}^r)$ exhibits $\alpha_l < \hat{\alpha}^l < \hat{\alpha}^r < \alpha_r$.*

The lemma shows that, due to the uncertainty about the preferences of the median voter, the parties do not offer identical platforms. Hence, also the framework with political competition induces regulatory risk. The competition, however, reduces regulatory risk to some degree, because $|\hat{\alpha}^l - \hat{\alpha}^h| < |\alpha_l - \alpha_h|$. More specifically, it leads to regulation on the basis of $\hat{\alpha}^l$ with probability $\pi = F((\hat{\alpha}^l + \hat{\alpha}^r)/2)$ and $\hat{\alpha}^r$ with probability $1 - F((\hat{\alpha}^l + \hat{\alpha}^r)/2)$.

From (12) it follows that the first order conditions

$$g^m((\hat{\alpha}^l + \hat{\alpha}^r)/2)[\hat{W}_l(\hat{\alpha}^l) - \hat{W}_l(\hat{\alpha}^r)]/2 = -G^m((\hat{\alpha}^l + \hat{\alpha}^r)/2)\hat{W}_l'(\hat{\alpha}^l)$$

and

$$g^m((\hat{\alpha}^l + \hat{\alpha}^r)/2)[\hat{W}_r(\hat{\alpha}^r) - \hat{W}_r(\hat{\alpha}^l)]/2 = (1 - G^m((\hat{\alpha}^l + \hat{\alpha}^r)/2))\hat{W}_r'(\hat{\alpha}^r),$$

characterize the Nash equilibrium $(\hat{\alpha}^l, \hat{\alpha}^r)$.

Because regulatory risk persists in the presence of political competition, the question whether the political parties have an incentive to reduce it through political bargaining remains relevant also with political competition. Extending the political game Γ^e by an initial stage $t = 0$, where parties can agree on installing some (partially) independent regulator with objectives (α_a^l, α_a^r), one may again study the question what kind of pairs (α_a^l, α_a^r) the parties find mutually beneficial, i.e. which yield either party more than its payoff in the original game Γ^e.

A first observation is that with respect to politically independent regulatory agencies all previous results remain valid. To see this, suppose political agreement about a politically independent regulatory agency α_a changes the party l's winning probability from $\pi(\alpha^l, \alpha^r)$ to some π'. In this case, party p is better off from agreeing to α_a than entering the political game Γ^e exactly if α_a satisfies

$$\pi(\alpha^l, \alpha^r)\hat{W}_p(\alpha^l) + (1 - \pi(\alpha^l, \alpha^r))\hat{W}_p(\alpha^r) \leq \pi'\hat{W}_p(\alpha_a) + (1 - \pi')\hat{W}_p(\alpha_a) = \hat{W}_p(\alpha_a).$$

For the specific case $\alpha_a = \alpha^e$ this inequality is identical to (7). It therefore follows that the results of Section 5 concerning the risk attitudes towards regulatory risk extend to situations where this risk is due to political competition rather than exogenous uncertainty. The reason is that, although endogenous election outcomes generate the additional effect that winning probabilities are no longer constant, this effect is irrelevant because by institutionalizing a politically independent regulatory agency the parties are actually indifferent about who wins the election.

The final step is to argue that also the results of Section 6 are robust to considering endogenous election outcomes. Here the main result was that, independent of the political system, Pareto optimal pre-electoral bargaining outcomes necessarily eliminate all regulatory risk. As argued, this depends on the marginal rates of substitution. Using (10) it follows

$$\frac{|MRS_l(\alpha_a^l, \alpha_a^r)|}{|MRS_r(\alpha_a^l, \alpha_a^r)|} = \frac{(\alpha_a^l - \alpha_l)(\alpha_r - \alpha_a^r)}{(\alpha_a^r - \alpha_l)(\alpha_r - \alpha_a^l)}$$

so that, again, only for $\alpha_a^l = \alpha_a^r$ the marginal rates of substitution coincide.

8 An Illustration: The US Postal System

Using as a concrete example the US Postal Regulatory Commission (PRC), I illustrate the extent to which this paper's theoretical insights help to understand how regulatory agencies are shaped in practise. Formerly called the Postal Rate Commission, the main task of the PRC is to regulate the rates of the United States Postal Service (USPS), which has a government-enforced monopoly on the delivery of first-class mail.

The PRC was created by the Postal Reorganization Act of 1970 and was instrumental in resolving the postal strike of 1970 that crippled the country to such an extent that President Nixon had to declare a state of emergency and call in both the armed forces and the National Guard to reinstate postal services.[8] The Postal Reorganization Act of 1970 abolished the then United States Post Office Department, which, at the time, was one of the largest employers in the world.[9]

Chaifetz (1971) explains that the Postal Reorganization Act of 1970 was a direct response to the smothering, close political control of both the US presidential cabinet and the US Congress. Already the Kappel Report (1968), which formed the basis of the Act, attributed the failure of the US Postal system mainly to the excessive political control. This control not only led to a low working moral which culminated in the postal strike, but also expressed itself in politically induced regulatory risk.

Before the Act, the head of the Postal Department, the Postmaster General, was a direct member of the President's cabinet and was appointed solely on the basis of political affiliation. A change of political control typically led to a replacement of the Postmaster General.[10] This change in control closely reflects the politically induced regulatory risk as modelled in this paper, because whenever a presidential election led to a president with a different political affiliation, the Postmaster General changed and, thereby, the objectives of the organization.

Moreover, the postal rate was directly set by the US Congress through the Senate Committee on Post Office and Civil Service.[11] This second channel of political control opened the door for a different source of politically induced regulatory risk: political favoritism and outright bribery. For instance, in order to oppose a postal rate increase in 1967, the mail order catalogue company, Spiegel Inc., illegally contributed to the campaign of a member of the Senate Committee on Post Office and Civil Service.[12] As the opportunities for political favors and bribery typically depend on which politicians are elected, electoral uncertainty generates regulatory risk associated with

[8]See Nixon (1970a).
[9]See Kappel Report (1968) supra note 2, at 15.
[10]See Chaifetz (1971) page 1152.
[11]See Chaifetz (1971) page 1158-1159.
[12]United States v. Brewster (506 F.2d 62 (D.C. Cir. 1974). See also Welch (1989) page 1359-1362.

political favoritism and bribery.

With the explicit goal of minimizing political control, the Act transformed the Post Office from an executive department under direct political control to an independent establishment of the executive branch.[13] Consistent with the arguments in this paper, the main tool for safeguarding postal regulation from political influence was institutional: the creation of the Postal Rate Commission as a politically-independent agency to which the US Congress delegated its power to regulate postal rates.

Moreover, the Act followed after intense political bargaining between all political parties involved as President Nixon himself stresses in his remarks on signing the Act: "We could not have this measure had it not been for the bipartisan support, Democrats and Republicans, working together for this reform legislation."[14] In line with the arguments in this paper, this political bargaining explicitly involved the objective of the Postal system. Against the advice of the Kappel Report (1968) to run the Post Office as a for-profit organization, it was agreed upon that the Post Office continues its operation as a public service.[15] In order to ensure a politically balanced governance, the Act also explicitly specifies that of the PRC's five members no more than three may be of one political party.

Despite highly disruptive forces on the postal services such as the advance of the internet, the institutional setup has proven remarkably stable. Since 1970 only a relatively minor reform took place under the Postal Accountability and Enhancement Act of 2006. This Act changed the name from Postal Rate Commission to Postal Regulatory Commission and only strengthened the Commission's independence in regulating postal rates. The Act now explicitly requires the Commission to develop and maintain regulations for a modern system of rate regulation. The Act did not change the rule that no more than three of the Commissioners can be from any one political party.

9 Conclusion

The analysis shows that, while political parties, in general, have conflicting attitudes towards regulatory risk, they have a common interest in fully eliminating it. Consequently, the incentives of the political system are in line with the concerns of practitioners to reduce uncertainty as mentioned in the introduction. This also means that political parties have no interest in exacerbating regulatory risk artificially. I conclude this section discussing possible limitations, extensions, and applications of the results.

[13]See Chaifetz (1971) page 1159.

[14]See Nikon (1970b).

[15]See Chaifetz (1971) page 1160-1161.

Commitment and Delegation

The analysis followed the literature on delegation in its assumption that political parties can implement pre-electoral agreements by delegating the regulatory task to independent regulators and commit not to replace them after the election. Even though the micro foundation underlying "commitment–by–delegation" is unclear, it has strong empirical and intuitive appeal.[16]

In the specific context of regulation, appropriate institutional arrangements strengthens commitment by delegation.[17] This is for example illustrated in the discussion of "regulatory holidays" in the European fibre optic markets. Initiated by threats in 2006 to hold back on a 3 billion euro (US$3.86 billion) investment in ultra high-speed broadband network, the German government initially exempted the Deutsche Telekom from regulation. In December 2009, the European Court of Justice (ECJ) ruled against this regulatory holiday.[18] In its judgement, the ECJ clarifies that its ruling was driven by its concern that the imposition of a regulatory holiday threatened the independence of national regulatory agencies.[19] The official opinion of the advocate general Poiares Maduroin states: "NRAs [national regulatory agencies] have been set up and given particular powers by the Community regulatory framework for a reason: they are expected to be insulated from certain interests and to reach their decisions governed only by the criteria established in that framework." Commission (2009) clarifies: "As the guardian of the EC Treaty, the Commission has the option of commencing infringement proceedings, under Article 226 of the EC Treaty, against a Member State, which in the eyes of the Commission infringes Community law, in this case the Directives that make up the telecoms regulatory framework." Hence, in the European context an explicit, well established supranational framework exists that safeguard the political independence of national regulatory agencies. Similarly in the US, the federal government can safeguard the independence of regulatory agencies against local state politics.

If institutional arrangements are too weak to circumvent commitment problems directly, then, as formalized by the literature on repeated games, repeated interactions provide an alternative way to circumvent such problems. In the context of political economy, de Figueiredo (2002) provides a fully fledged, formal analysis of the conditions under which such repeated interactions circumvent commitment problems in a political economy. His framework is especially well suited to study commitment in the regulatory context of this paper, because it studies a

[16]Moe (1990, p245) notes that "the fact is that new governments do not take office and begin demolishing the existing bureaucracy. The vast bulk of government seems pretty safe from this sort of thing." Yet, the empirical analysis of Gilardi (2002, 2005) reveals that this delegation is often far from perfect.

[17]In the explicit context of regulation see also Spulber and Besanko (1992) and Calvert, McCubbins, and Weingast (1989).

[18]Case, C-424/07 European Commission v. Germany, Judgment of 3 December 2009.

[19]See `http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62007C0424:EN:HTML`.

model in which the parties' payoff functions are single peaked and concave with respect to a one–dimensional policy variable.

Political Bargaining

The formal analysis characterizes Pareto optimal pre-electoral agreements and shows that they imply a complete elimination of regulatory risk. Under efficient bargaining political parties will reach an efficient agreement and, hence, agree to institutionalize an independent regulatory agency. The set of mutually beneficial agreements is generally however not a singleton. This raises the question on which of these agreements the political parties agree. This question is nontrivial, because within the set of mutually beneficial agreements A^*, the two political parties have diverging preferences. For instance, party l prefers values close to α_r^* whereas party r prefers values close to α_l^*. It then depends on the relative bargaining strengths and the specific bargaining procedure which kind of politically independent agency $\alpha_a \in A^*$ the parties will institutionalize.

When bargaining is inefficient, political parties will only reach an agreement if the benefits from the agreement outweigh the bargaining costs. Especially when empirically testing the theoretical implications of the model, it is important to point out that bargaining costs limit the applicability of some of the results. In particular, when there is little political divergence, the gains from pre-electoral agreements is small so that negotiations may not outweigh bargaining costs. The discussion of the regulatory overhaul of the US Postal System in Section 8 however indicates that, in practise, political parties do manage to reach such agreements when the potential gains are high.

Because monetary side payments seem inappropriate in a political economy context, the analysis concentrated on a setup where political parties are unable to use direct side payments to facilitate bargaining. If one allows such side payments then efficient bargaining leads to a regulation on the basis of a regulatory variable α_{lr}^* that maximizes the common surplus $\hat{W}_{lr}(\alpha) \equiv \hat{W}_l(\alpha) + \hat{W}_h(\alpha)$. It is straightforward to see that the common surplus function is equivalent to twice the surplus function $\hat{W}_p(\alpha)$ that obtains from an individual party p with the weight $\alpha_p = (\alpha_l + \alpha_r)/2$. It is then immediate that $\alpha_{lr}^* = (\alpha_l + \alpha_r)/2$. The possibility of side payments, therefore, strengthens the positive result that political parties have an incentive to eliminate the regulatory risk, because it follows, by Lemma 1, that the common surplus function has a unique maximum.

Appendix

Proof of Lemma 1: From (3) it follows

$$v''(\hat{x}_h)\partial\hat{x}_h/\partial\alpha = -\psi\Delta c$$

so that $v'' < 0$ implies $\partial\hat{x}_h/\partial\alpha > 0$. Since $\partial\hat{W}_p/\partial\alpha = \partial\tilde{W}_p/\partial x_h \partial\hat{x}_h/\partial\alpha$, the sign of $\hat{W}_p'(\alpha)$, therefore, coincides with the sign of $\partial\tilde{W}_p/\partial x_h$. Note that

$$\frac{\partial\tilde{W}_p}{\partial x_h} = -\nu(1-\alpha_p)\Delta c + (1-\nu)(v'(\hat{x}_h) - c_h) = -\nu(1-\alpha_p)\Delta c + (1-\nu)(\psi\Delta c) = (\alpha_p - \alpha)\Delta c.$$

Hence, $\partial\tilde{W}_p/\partial x_h$ and, therefore, $\hat{W}_p'$ is positive for $\alpha < \alpha_p$ and negative for $\alpha > \alpha_p$. This shows that $\hat{W}_p(\alpha)$ is increasing for $\alpha < \alpha_p$ and decreasing for $\alpha > \alpha_p$. Consequently, $\hat{W}_p$ attains a unique maximum at α_p. Because $\hat{W}_p$ is twice differentiable it holds $\hat{W}_p'(\alpha_p) = 0$ and $\hat{W}_p''(\alpha_p) < 0$. Q.E.D.

Proof of Lemma 2: The function $\hat{W}_p(\alpha)$ is concave around α if $\hat{W}_p(\alpha)$ is concave with respect to some interval $[\underline{\alpha}, \overline{\alpha}]$ around α. A sufficient condition for this is that $\hat{W}_p''(\alpha) < 0$.

It follows

$$\hat{W}_p(\alpha) \quad = \quad \nu[v(\hat{x}_l) - c_l\hat{x}_l - (1-\alpha_p)\Delta c\hat{x}_h(\alpha)] + (1-\nu)[v(\hat{x}_h(\alpha)) - c_h\hat{x}_h(\alpha)].$$

Using (3), differentiation of $W_p(.)$ yields

$$\begin{aligned} \hat{W}_p'(\alpha) &= -\nu(1-\alpha_p)\Delta c\hat{x}_h'(\alpha) + (1-\nu)[v'(\hat{x}_h(\alpha)) - c_h]\hat{x}_h'(\alpha) \\ &= -\nu(1-\alpha_p)\Delta c\hat{x}_h'(\alpha) + (1-\nu)(1-\alpha)\psi\Delta c\hat{x}_h'(\alpha). \end{aligned}$$

Using the definition of ψ and (4), a further differentiation of $W_p(.)$ yields

$$\begin{aligned} \hat{W}_p''(\alpha) &= [-\nu(1-\alpha_p)\Delta c\hat{x}_h''(\alpha) + (1-\nu)(1-\alpha)\psi\Delta c\hat{x}_h''(\alpha)] - (1-\nu)\psi\Delta c\hat{x}_h'(\alpha) \\ &= (\alpha_p - \alpha)\nu\Delta c\hat{x}_h''(\alpha) - (1-\nu)\psi\Delta c\hat{x}_h'(\alpha) \\ &= (1-\nu)\left[(\alpha - \alpha_p)\psi\Delta c\frac{v'''(\hat{x}_h(\alpha))}{v''(\hat{x}_h(\alpha))} + v''(\hat{x}_h(\alpha))\right]\hat{x}_h'(\alpha)^2. \end{aligned}$$

Hence, $\hat{W}_p''(\alpha) < 0$ exactly when

$$(\alpha_p - \alpha)\psi\Delta c v'''(\hat{x}_h(\alpha)) < [v''(\hat{x}_h(\alpha))]^2.$$

Q.E.D.

Proof of Proposition 2: For the special case where demand is convex ($v''' > 0$) it follows, for any $\alpha \in (\alpha_l, \alpha_r)$, that $(\alpha_l - \alpha)\psi\Delta c v'''(x) < 0 < (v''(x))^2$. Hence, inequality (8) is satisfied so that $\hat{W}_l(\alpha)$ is concave and, therefore, $\tilde{W}_l^e$ is smaller than $\hat{W}_l((1-\pi)\alpha_r + \pi\alpha_l)$ for any $\pi \in (0, 1)$.

For the special case where demand is concave ($v''' < 0$), it follows, for any $\alpha \in (\alpha_l, \alpha_r)$, that $(\alpha_r - \alpha)\psi\Delta c v'''(x) < 0 < (v''(x))^2$. Hence, inequality (8) is satisfied so that $\hat{W}_r(\alpha)$ is concave and, therefore, $\tilde{W}_r^e$ is smaller than $\hat{W}_r((1-\pi)\alpha_r + \pi\alpha_l)$ for any $\pi \in (0,1)$.

Linear demand case ($v''' = 0$) implies $\hat{x}_h^e = \hat{x}_h(\alpha_e)$. I showed that, for this case, both party r and party l dislike regulatory risk. Q.E.D.

Proof of Proposition 3: I first prove the second part of the Proposition. It follows

$$\begin{aligned}
W_r^e - \hat{W}_r(\alpha_e) &= (1-\pi)\hat{W}_r(\alpha_r) + \pi\hat{W}_r(\alpha_l) - \hat{W}_r(\alpha_e) \\
&= (1-\pi)\tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_r)) + \pi\tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_l)) - \tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_e)) \\
&= \Big[(1-\pi)\tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_r)) + \pi\tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_l)) - \tilde{W}_r(\hat{x}_l, \hat{x}_h^e)\Big] \\
&\quad + \Big[\tilde{W}_r(\hat{x}_l, \hat{x}_h^e) - \tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_e))\Big] \\
&= (1-\nu)\left[(1-\pi)v(x_h(\alpha_r)) + \pi v(x_h(\alpha_l)) - v(x_h^e)\right] \\
&\quad + \Big[\tilde{W}_r(\hat{x}_l, \hat{x}_h^e) - \tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_e))\Big].
\end{aligned}$$

Due to $v'' < 0$, the first term in squared brackets is negative. The second term in square brackets is non–positive, because $\hat{x}_h^e \leq x_h(\alpha_e) < \hat{x}_h(\alpha_r)$ and $\partial\tilde{W}_r/\partial x_h > 0$ for $x_h < x_h(\alpha_r)$ imply $\tilde{W}_r(\hat{x}_l, \hat{x}_h^e) \leq \tilde{W}_r(\hat{x}_l, \hat{x}_h(\alpha_e)$. As a result the overall expression is negative and, therefore, party r dislikes regulatory risk.

Similarly for party l, it follows

$$\begin{aligned}
W_l^e - \hat{W}_l(\alpha_e) &= (1-\nu)\left[(1-\pi)v(x_h(\alpha_r)) + \pi v(x_h(\alpha_l)) - v(x_h^e)\right] \\
&\quad + \Big[\tilde{W}_l(\hat{x}_l, \hat{x}_h^e) - \tilde{W}_l(\hat{x}_l, \hat{x}_h(\alpha_e))\Big].
\end{aligned}$$

Due to $v'' < 0$, the first term in squared brackets is negative. The second term in square brackets is non–positive, because $\hat{x}_h^e \geq x_h(\alpha_e) > \hat{x}_h(\alpha_l)$ and $\partial\tilde{W}_l/\partial x_h < 0$ for $x_h < x_h(\alpha_l)$ imply $\tilde{W}_l(\hat{x}_l, \hat{x}_h^e) \leq \tilde{W}_l(\hat{x}_l, \hat{x}_h(\alpha_e)$. As a result the overall expression is negative and, therefore, party l dislikes regulatory risk.

Hence, if party l likes regulatory risk then, necessarily, $\hat{x}_h^e < \hat{x}_h(\alpha_e)$, but party r then dislikes regulatory risk. Similarly, if party r likes regulatory risk then $\hat{x}_h^e > \hat{x}_h(\alpha_e)$, but party l then dislikes regulatory risk. Hence, if some party likes risk then the other party dislikes it. Q.E.D.

Proof of Proposition 4: From (8) it follows that $\hat{W}_p(\alpha)$ is concave for the range $[\alpha_l, \alpha_r]$ whenever $|\alpha_p - \alpha|\psi\Delta c < [v''(\hat{x}_h(\alpha))]^2/|v'''(\hat{x}_h(\alpha))|$. Because for this range $|\alpha_p - \alpha| < \Delta\alpha$, (9) implies that a sufficient condition for the concavity over this range is $\Delta\alpha\psi\Delta c < \bar{v}$. Comparative static results i), iii) , iv) then follow directly from this condition.

In order to demonstrate ii), first suppose party l is a regulatory risk averse party. Because $W_r(\alpha_r) > W_r(\alpha_l)$, the expression $W_r^e(\pi)$ is strictly decreasing in π and, in particular, $W_r^{e\prime}(1) <$

0. Moreover,

$$\left.\frac{d\hat{W}_r(\alpha_e(\pi))}{d\pi}\right|_{(1-\pi)=1} = \left.\frac{\partial\hat{W}_r(\alpha_e(\pi))}{\partial\alpha}\frac{\partial\alpha_e(\pi)}{\partial\pi}\right|_{(1-\pi)=1} = \hat{W}_r'(\alpha_r)\alpha_e'(1) = 0,$$

because $\hat{W}_r'(\alpha_r) = 0$. Because $\hat{W}_r(\alpha_e(1)) = W_r^e(1)$, it then follows that $\hat{W}_r(\alpha_e(\pi)) > W_r^e(\pi)$ for $(1-\pi) < 1$ but close enough to 1.

If party l is not a regulatory risk averse party, then, by Proposition 3, party r is regulatory risk averse. By a similar argument, one can then show that $d\hat{W}_l(\alpha_e(0))/d\pi = 0$. Because $W_l^e(\pi)$ is strictly increasing in $(1-\pi)$, it then follows that $\hat{W}_l(\alpha_e(\pi)) > W_l^e(\pi)$ for $(1-\pi) > 0$ but close enough to 0. Q.E.D.

Proof of Proposition 5 : Follows directly from the text. Q.E.D.

Proof of Proposition 6 : Follows directly from the text. Q.E.D.

Proof of Lemma 3: Suppose, by contradiction, that $\hat{\alpha}^l > \hat{\alpha}^r$ is a Nash equilibrium. It must then hold that $\hat{\alpha}^l > \alpha_l$ or $\hat{\alpha}^r < \alpha_r$. Suppose $\hat{\alpha}^l > \alpha_l$. In this case $\hat{W}_l(\hat{\alpha}^l) < \hat{W}_l(\hat{\alpha}^r)$ so that $W_l(\hat{\alpha}^r|\hat{\alpha}^r) > W_l(\hat{\alpha}^l|\hat{\alpha}^r)$. Hence, $\hat{\alpha}^l$ is not a best reply to $\hat{\alpha}^r$, because already $\alpha^l = \hat{\alpha}^r$ yields party l more. By a similar argument, $\hat{\alpha}^r$ does not maximize $W_r(\alpha^r|\hat{\alpha}^l)$ if $\hat{\alpha}^r < \alpha_r$.

Next, suppose, by contradiction, that $\hat{\alpha}^l = \hat{\alpha}^r$ is a Nash equilibrium. It must then hold that $\hat{\alpha}^l \neq \alpha_l$ or $\hat{\alpha}^r \neq \alpha_r$. The case $\hat{\alpha}^l \neq \alpha_l$ does not represent a Nash equilibrium because it would then follow $W_l(\alpha_l|\alpha^r) = \pi(\alpha_l,\alpha^r)\hat{W}_l(\alpha_l) + (1-\pi(\alpha_l,\alpha^r))\hat{W}_l(\hat{\alpha}^r) > \pi(\alpha_l,\alpha^r)\hat{W}_l(\hat{\alpha}^r) + (1-\pi(\alpha_l,\alpha^r))\hat{W}_l(\hat{\alpha}^r) = \hat{W}_l(\hat{\alpha}^r) = W_l(\alpha^l|\alpha^r)$ so that α_l yields party l strictly more than $\hat{\alpha}^l = \hat{\alpha}^r$. Likewise, the case $\hat{\alpha}^l \neq \alpha_l$ does not represent a Nash equilibrium because α_r would yield party r strictly more that $\hat{\alpha}^r = \hat{\alpha}^l$.

Suppose, by contradiction, that $\hat{\alpha}^l < \hat{\alpha}^r \leq \alpha_l$ is a Nash equilibrium. In this case it follows $W_l(\hat{\alpha}^r|\hat{\alpha}^r) > W_l(\hat{\alpha}^l|\hat{\alpha}^r)$ so that $\hat{\alpha}^l < \alpha^r$ is not a best reply against $\hat{\alpha}^r \leq \alpha_l$. Likewise, $\hat{\alpha}^r > \hat{\alpha}^l \geq \alpha_r$ cannot be a Nash equilibrium.

For any Nash equilibrium it therefore holds $\alpha_l \leq \hat{\alpha}^l < \hat{\alpha}^r \leq \alpha_r$ so that the payoff functions of party l and r simplify to, respectively,

$$W_l(\alpha^l|\alpha^r) = G^m((\alpha^l+\alpha^r)/2)[\hat{W}_l(\alpha^l) - \hat{W}_l(\alpha^r)] + \hat{W}_l(\alpha^r) \tag{13}$$

and

$$W_r(\alpha^r|\alpha^l) = (1 - G^m((\alpha^l+\alpha^r)/2))[\hat{W}_r(\alpha^r) - \hat{W}_r(\alpha^l)] + \hat{W}_r(\alpha^l), \tag{14}$$

Finally, evaluating the derivative of the payoff function of party p with respect to α^p at $\alpha^p = \alpha_p$ reveals that a Nash equilibrium cannot exhibit $\alpha^p = \alpha_p$. Q.E.D.

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