OPTIMAL LEGAL MOMENTS AND STABILIZATION RULES

FRANK FAGAN AND URMEE KHAN

Abstract. Lawmakers implement stabilization rules to prevent crises and reduce the magnitude of downturns from benchmark legal environments. Stabilization rules often depend upon complementary citizen action for increasing their effectiveness. For instance, preventive climate change policy that entails infrastructure spending can be enhanced through citizen relocation near planned evacuation routes and public transportation. Financial stabilization policy that entails capital injections can be enhanced through increased private lending and business expansion. We develop a model that illustrates an optimal legal effective date given a fixed lawmaking cost and a time-variant probability of legal downturn. Citizens take beneficial action if the policy arrives early enough, but lawmakers risk error if they implement the policy too soon and the downturn never arrives.

1. Introduction

This paper analyzes optimal timing of stabilization rules that take the form of trigger actions to avert crisis. Four aspects of the are important: a) there is an anticipation or possibility of a crisis (a negative shock to social utility), b) a costly action can be chosen to avert the crisis or at least preemptively minimize its effects and stabilize social utility, c) their is a choice to be made as regards to the timing of the costly action, and d) citizens on their part can make anticipatory costly investments that could enhance the impact of the action when it is finally taken. When future payoffs are discounted, postponing the incurring of cost has value, but on the other hand, there is the risk that the crisis may arrive before the action is taken, if it is delayed too long. We pose this problem in an environment where the probability of the arrival of the crisis increases over time, thereby creating a trade-off the benefit of delaying the cost, and the potential loss of utility from the crisis arriving before action could be taken. Our results show that when the lawmakers' action and the citizen investments

Fagan is Associate Professor of Law, EDHEC Business School, France. Khan is Assistant Professor of Economics, University of California, Riverside.

are complementary in minimizing the damages from the crisis, the optimal timing has to be chosen carefully so as to provide citizens incentive to make the precautionary investment. Waiting too long or moving too early can end up government action crowding out citizen investment.

Our paper is related to multiple strands of literature on cost-benefit analysis of lawmaking. In as much as lawmakers select optimal rules based upon a social objective function that is also effected by the actions of citizens, they must account for the expected behavior of agents. This factor has so far been overlooked in the literature. Typically, analysts consider a wide range of rules and compute the costs and benefits of each (Posner and Weyl 2014). But citizens react to rules, so analysts must compute costs and benefits in expected terms based upon predictions of how citizens will respond. In turn, expected costs and benefits influence rule selection, modification, adaption, and optimization of rule substance generally. While conventional cost-benefit analysis clearly permits citizen response to influence the substance of a rule, we propose that citizen response can, and in some instances should, influence the timing of a rule.[1]

Adjustments to timing can complement adjustments to substance (Kydland and Prescott 1977). For instance, optimal rule selection given global warming and rising sea levels may include public investment in sea walls, evacuation routes, public transport, secondary housing, and emergency infrastructure generally. When anticipating a new rule, citizens may be able to take actions that increase its effectiveness when it arrives: they can relocate, move near planned evacuation routes and public transport, place unused personal belongings in storage inland, search for service providers near planned secondary housing, and adopt transition strategies generally. If citizens are expected to underinvest in precaution and, for instance, remain near the sea, then optimal policy selection may favor the construction of sea walls instead of inland secondary housing. This is an example of a responsive adjustment to the policy's substance, which can be generated by carrying out a conventional cost-benefit analysis. On the other hand, lawmakers may induce precautionary investment by adjusting the

[1]To the extent that rules include sunset clauses, delays, phase-ins, and other timing rules, it may be said that timing is substance. As will become clear below, timing and substance are easily separated, and when the two are complements, explicit separation is essential for rule optimization.

policy's timing. Announcement that construction will begin in the near future may induce complementary investment that increases the value and effectiveness of a secondary housing policy. Our model captures the intuition that lawmakers anticipate precautionary over- and under-investment in new legal environments and respond by increasing or decreasing the speed of policy implementation. On the other hand, if lawmakers introduce policies too soon, they run the risk of making policy errors if downturns fail to arrive.

The baseline model treats policy selection as fixed. This restriction allows us to focus on the optimal selection of timing for a given policy. Existing literature on optimal policy selection generally treats the timing of all policies as immediate at time t. It compares the immediate implementations of policies x and y. The basic model suggests that policy y may be superior when comparing x and y implementations at time $t + 1$, and shows that implementation of policy x at time t may be superior to its implementation at time $t + 1$, $t + 2$, and all other times. For instance, policymakers may question the optimal level of capital injection for a failing bank, where variance in the capital amount varies the policy. The analysis below considers the optimal timing of a fixed capital injection level. It is possible that a policy implemented at time t may be superior to the same policy implemented at a different time, but remain inferior to a different policy. For example, a delayed capital injection of x dollars may be superior to an immediate capital injection of x dollars, but inferior to an immediate or delayed capital injection of y dollars. The optimal selection of timing for a fixed policy represents an important class of legal decisionmaking. Lawmakers may be constrained by a maximum dollar amount that they can inject, or they may be constrained by framework legislation, judicial or executive mandates, constitutional boundaries, politics, and generally, the ability to develop and implement alternative policies. We leave for future work the analysis of the optimal joint-selection among an unconstrained choice of legal rules and their timing.

Apart from extending traditional cost-benefit analysis to include comparisons of alternate moments of rule implementation, our work builds on the rapidly expanding literature on timing rules. Parisi et al. [2004] develops a model where lawmakers delay implementation of rules to the extent that (1) lawmaking expenditures are sunk; (2) the legal environment becomes increasingly certain; (3) the value of rule implementation is increasing over time;

and (4) the immediate and short-term benefits of the rule are small. Similarly, Posner and Gersen [2007] suggest that the timing of implementation of a legal rule determines whether benefits and costs are created sooner or later, which influences their distribution across competing groups. Fagan and Faure [2011] build on this suggestion and identify scenarios where incremental rulemaking with temporary legislation permits lawmakers to maximize social benefits. Fagan [2013] provides a model. Ranchordas [2014] emphasizes that legal experimentation with temporary law can maximize benefits. Fagan and Bilgel [2015] and Bar-Siman-Tov [2017] provide empirical evidence that lawmakers use timing rules for optimization. Nearly all of the timing rules literature views the citizen response to new rules as an increase in information that is made available to lawmakers for future rounds of lawmaking. For this reason, the literature suggests that incremental and experimental lawmaking strategies such as temporary or phased-in rules can be superior to their less flexible alternatives which myopically ignore, or at least inefficiently leverage, the information generated by new rules. Public law scholarship, when pragmatically considering the benefit of incorporating greater levels of information into future rounds of lawmaking, favors constitutional approval with various safeguards Kouroutakis [2016] and Niblett [2017]. Our analysis here sets aside the possibility of multiple rounds of lawmaking and considers the optimal timing of a single implementation of a rule. The results hold for any number of future (or previous) iterations of policymaking. We simply focus on the optimal timing of implementation to a change to an existing legal environment given a prevailing set of lawmaker beliefs about the precautionary behavior that citizens will take following announcement of a forthcoming rule, and the possibility that an earlier implementation prior to crisis can generate lawmaking error.

2. The Timing of Lawmaking: Baseline Model with Fixed Policy Selection

When anticipating new laws, citizens can take actions that increase or decrease their effectiveness when they arrive and are implemented. Lawmakers can respond, taking citizen action in account, by adjusting the law's contents or timing, or some combination of the two. Any implementation of a new rule comes at a fixed cost set by a constitution and a prevailing political environment. Legislators must incur private costs to create and pass legislation, regulators must confer with the public via notice and comment periods, and judges must decide the merits of a case once parties have invested in litigation. Citizens bear private costs when taking actions in anticipation of the arrival of a new rule that might increase its effectiveness once it becomes effective. Hence there can be under- or over-investment on the part of citizens in such beneficial actions when compared against some benchmark.[2] We present the lawmaker's response as a one-dimensional adjustment of the law's timing. Anticipating citizen investment level, lawmakers implement a rule earlier or later.

Present utility flows are represented as $\overline{u} > 0$. Lawmakers expect a new state of the world that represents a welfare-decreasing downturn from the baseline present, and draft legislation, regulations, or pronounce judgments to address it. For instance, lawmakers may anticipate environmental crisis and draft an emissions tax; anticipated financial downturns may be met with capital injections or new disclosure requirements; or expected decreases in corporate profits may lead to less stringent controls on corporate activities. The key assumption is that lawmaker and citizen utility is aligned and that both parties take actions to maximize a common goal. Both desire avoidance of environmental and financial crisis or decreases in corporate profits.[3] We are interested in the optimal timing a new rule's legal effective date in anticipation of the new state of the world. This new state may be precipitated by crisis, or any downturn from the baseline legal environment, and arrives at a random time W. Lawmakers can respond with preventive measures at a fixed lawmaking cost κ, which is understood as the cost to the public at large, incurred by the lawmakers on their behalf. If measures are not in place before W, then $\overline{u}$ will be reduced to a utility flow normalized to 0. If measures are in place, W will reduce utility flows to $\underline{u}$, with $\overline{u} > \underline{u} > 0$. Preventive rules therefore reduce losses in case the downturn in the legal environment arrives, but if the

[2]Citizen actions are considered beneficial when assuming that the new rules are welfare-enchancing.

[3]We leave aside cases where utility is not aligned. For instance, lawmakers may expect and uptick in crime and respond with harsher sentencing guidelines. While citizens could begin marshaling resources toward legal activity and away from criminal activity as a precaution against the forthcoming increase in expected punishment, the model does not generalize to those cases because, as will be shown, precaution and stabilized payoffs from preventive lawmaking tradeoff. Citizens would be avoiding investment in criminal activity in order to avoid future harsh penalties, and would not be contributing to a downtick in crime or maintenance of existing crime levels.

downturn does not arrive, then the lawmaker will have incurred a superfluous lawmaking cost. In addition, preventive rules that are implemented at time t reduce the probability of downturns occurring by changing their arrival densities from $f(w)$ to

$$f_\theta(w;t) = \begin{cases} f(w) & \text{if } w < t \\ (1-\theta)f(w) & \text{if } w \geq t. \end{cases} \tag{1}$$

Following inoculation, $\theta \int_t^\infty f(w)\,dw$ of the probability shifts to the mass point at infinity, that is, to the downturn not arriving. To the above setting we now add the possibility for private citizens to adopt a precautionary measure, and thereby exert control over the effectiveness of the anticipated legislation, regulation, or judgment. They engage in a precautionary investment $\theta \in \Theta$ at the private cost of $c(\theta)$. For instance, citizens can move nearer to public transportation in anticipation of an emissions tax; they can increasingly reduce risky lending practices, or expand corporate activities–each at cost $c(\theta)$.

The model is presented as a game between two players, one representing the lawmakers, and the other, a group of citizens. For simplicity, free-riding and other collective action problems are ignored, and each player is assumed to carry out a strategy that is majoritarian or otherwise representative of a collective bargain or the outcome of an agreed upon voting rule. In this simple version, lawmakers and citizens wish to maximize a common benefit function, but each has different control variables and costs. The structure of the game is as follows. At time 0, a continuous time interval begins at which point the downturn is anticipated to occur at a random time W in the future. Lawmakers announce the preventive rule's legal effective date t. Citizens take t into account to choose θ at cost $c(\theta)$ immediately following the lawmakers' announcement. The selection of θ is a one-time choice, which impacts the effectiveness of the legislation when it finally arrives at time t.[4] Both lawmakers and citizens discount time at a common discount rate r. Below we characterize the equilibria in the ensuing leader-follower game.

2.1. **Expected Flow Benefits.** We begin by analyzing the citizen's choice following the lawmakers' announcement of time t. Expected net benefits to lawmakers for waiting until t are represented with the function $\psi(t)$. Expected benefits are depicted for three events, $W <$

[4] [explain how multiple iterations would work and change the result]

t, $t < W < \infty$, and $W = \infty$, that is, respectively: a downturn occurs before implementation of the preventive measure, implementation occurs before a downturn, and the downturn never arrives.

To see how the choice of θ impacts the lawmakers' expected utility flows, consider the three event types given t, as listed above, and their cumulative discounted flow payoffs, expected values, and derivatives with respect to θ.

Three event types

The individual probability of each event occurring is affected by the choice of t, [(A)]:

(1) $W = w$ and $0 \leq w < t$,

(2) $W = w$ and $t \leq w < \infty$, and

(3) $W = w$ and $w = \infty$.

If (1) occurs, payoffs are $\int_0^w \overline{u}e^{-rs}\,ds + \int_w^\infty 0e^{-rs}\,ds = \int_0^w \overline{u}e^{-rs}\,ds = \frac{1}{r}\overline{u}(1-e^{-rw})$.

If (2) occurs, payoffs are $\int_0^w \overline{u}e^{-rs}\,ds + \int_w^\infty \underline{u}e^{-rx}\,dx = \frac{1}{r}[(1-e^{-rw})\overline{u} + (e^{-rw})\underline{u}]$.

If (3) occurs, payoffs are $\int_0^\infty \overline{u}e^{-rx}\,dx = \frac{\overline{u}}{r}$.

Expected flow payoffs and their derivatives

Integrating over case (1), expected flow payoffs are

$$\mathbb{E}(\frac{1}{r}\overline{u}(1-e^{-rw})) = \int_0^t \frac{1}{r}\overline{u}(1-e^{-rw})f(w)\,dw$$

Integrating over case (2), expected flow payoffs are

$$\mathbb{E}(\frac{1}{r}[(1-e^{-rw})\overline{u} + e^{-rw}\underline{u}]) = \int_t^\infty \frac{1}{r}[(1-e^{-rw})\overline{u} + e^{-rw}\underline{u}](1-\theta)f(w)\,dw$$

Integrating over case (3), expected flow payoffs are

$$\mathbb{E}(\frac{\overline{u}}{r}) = \theta\int_t^\infty \frac{\overline{u}}{r}f(w)\,dw = \frac{\overline{u}}{r}\theta(1-F(t))$$

Total expected benefits are the sum of these three components. The cost of choosing θ is $c(\theta)$. We assume that $C(\cdot)$ is a strictly increasing, strictly convex function of θ. Taking derivatives with respect to θ and collecting terms gives the FOC that characterizes the optimal level of the citizen's precautionary investment θ^*:

$$r\,c'(\theta) = \overline{u}(1 - F(t)) - \int_t^\infty [(1 - e^{-rw})\overline{u} + e^{-rw}\underline{u}]f(w)\,dw \tag{2}$$

The interpretation of this condition is intuitive and straightforward. The RHS consists of the sum of the expected marginal flow benefit of θ, in the two cases where it is valuable. The LHS is the flow version of its marginal cost.

Relationship between t and θ: Let $\theta^*(t)$ be the optimal value of θ that solves the FOC. Taking the derivative of the FOC with respect to t and collecting terms results in:

$$\frac{d}{dt}C'(\theta^*) = \frac{1}{r}[-(\overline{u} - \underline{u})e^{-rt}]f(t) \tag{3}$$

Recall that $c(\cdot)$ is convex. The LHS of the condition above is $C''(\cdot)\theta'(t)$, the sign of which depends on the sign of $\theta'(t)$. The RHS is negative, implying that optimal θ^* is a decreasing function of t.

For the next set of results, we assume a parametric form for citizen's cost function, $C(\theta) = \frac{1}{2}\theta^2$, for exposition. All results will qualitatively go through any strictly increasing, strictly convex function.

Parameterization of the cost function results in a closed form expression for $\theta^*(t)$:

$$\theta^*(t) = \frac{1}{r}[\overline{u}(1 - F(t)) - \int_t^\infty [(1 - e^{-rw})\overline{u} + e^{-rw}\underline{u}]f(w)\,dw] \tag{4}$$

In addition:

$$\theta'(t) = \frac{1}{r}[-(\overline{u} - \underline{u})e^{-rt}]f(t) \tag{5}$$

Consider again climate change policy. Lawmakers may foresee increasing temperatures that lead to rising sea levels and increased need for infrastructure such as evacuation routes, public transportation, sea walls, and secondary housing. If lawmakers announce that new construction will take place at a time in the relatively near future, and before citizens expect the downturn to take place, then anticipatory action that supports the new rule, such as remaining in parcels of land situated behind sea walls, will benefit citizens. Accordingly, they will invest in increasing the effectiveness of the coming change in the legal environment. As the delay in legal effective date t decreases, citizen investment in precautionary measures θ increases, though citizens view increased stabilization payoffs from legal change u as substitutes for private investment and will invest at a slower rate as u increases. If citizens instead believe that the rule will arrive exceedingly far into the future, following a downturn, then they will not have incentive to remain in place or invest in actions that increase the effectiveness of the legal rule.

Similarly, lawmakers may anticipate economic crisis and may wish to inject capital or purchase banking assets. If lawmakers announce that a capital injection or asset purchase will take place in the near future, and before financiers expect crisis to take place, then aligned inoculation measures against deep crisis such as a continued and relaxed lending policy will benefit financiers. As the delay in legal effective date t decreases, continued private investment θ increases. On the other hand, private investors view increased stabilization payoffs from public capital injections and asset purchases as substitutes for their own investments and will invest at a slower rate as the magnitude of public intervention and its resultant payoff u increases. If financiers believe that intervention will occur exceedingly far into the future, following a deep crisis, then they will have no incentive to invest and increase the intervention's effectiveness.

2.2. **Optimal Legal Effective Date.** Lawmakers' choice of t, given the response by the citizens, can be characterized by the FOC for optimal t^*:

$$h(t^*) = \frac{rK}{\frac{1}{r}[2\theta\overline{u} + (1 - 2\theta(t))(\underline{u})] - K} \tag{6}$$

where $h(t)$ is a decreasing function of θ. For comparison, consider the case where θ is exogenous, that is, where lawmakers' face a single-agent decision problem independent of citizen action and simply choose the optimal timing of the legal effective date. In this case, the FOC for an interior optimum is given by:

$$h(t^*) = \frac{rK}{\frac{1}{r}[\theta\overline{u} + (1-\theta(t))(\underline{u})] - K} \tag{7}$$

Comparing the two cases, it is easy to see that the optimal moment for legal action arrives earlier in time when citizens choose θ at their own cost. The impetus to effectuate preventive policies earlier rather than later, therefore, is a result of reduced citizen investment as preventive measures arrive increasingly later into the future. The model suggests that immediate policy implementation maximizes complementary actions on the part of citizens, but note that policy cost K increases as the policy is introduced earlier in time. Earlier policy implementation incorporates less information about the legal environment and generates less option value for lawmakers as a result (Parisi et al. 2004).

Return to the example of flooding infrastructure. If citizens move away from flooding zones because they believe sea wall construction and other precautionary measures will be in place too late, then earlier introduction of infrastructure projects will increase their value. By selecting an earlier legal effective date, lawmakers induce citizens to invest in complementary action that increases the policy's effectiveness. Citizens may remain in place or move within the sea wall's safety zone, undertake personal repairs, and take other actions that enhance the sea wall's value. However, if the sea wall policy is made too early, lawmakers' option value of flooding infrastructure policy is reduced. They may situate it in a less than optimal site, it may be too thick or thin, or too high or low. At worst, information may surface that infrastructure is not required at all. Similarly, if financial institutions refuse to invest because they believe that a public capital injection will take place too far into the future, then an earlier capital injection will increase its value. By choosing to implement a liquidity policy earlier in time, lawmakers can induce financial institutions to undertake private investment which complements and increases the value of the policy. But if the liquidity policy is implemented too soon, lawmakers will not benefit from the option value of waiting. A liquidity crisis may have been over- or under-stated because interconnectedness and systemic risk were poorly understood, some classes of assets may have been toxic or not, or information about other characteristics of the legal environment may have been miscalulated. By implementing the policy too soon, lawmakers risk error. But policy delay risks citizen inaction, which can be instrumental in averting deeper crisis and stabilizing a policy environment. Inasmuch as citizen action is essential, increasingly distant policy horizons place downward pressure on carrying out policies of stabilization. This implies a divergence between the optimal timing of stabilization rules and rules implemented by a social planner where legal effectiveness is not subject to citizen action. When citizen action matters little, lawmakers can exercise patience. When citizen action matters much and is complementary to policy, there is pressure to introduce the law earlier in time.

3. The Timing of Lawmaking: Variable Policy Selection

Now we extend the baseline model, and add a choice for the lawmakers to set the level of stabilized payoff (at a cost), along with the timing of the trigger action.

Let cost of $\mathbf{u} = k + g\left(u\right)$

Now we get an additional FOC for $\mathbf{u}$ characterizing the optimal choice of $\mathbf{u}$

$$g'\left(u\right) = \frac{\frac{1}{r}\left(1-\theta\left(t\right)\right)\int_t^\infty e^{-rw}f\left(w\right)dw}{\left(1-F\left(t\right)\right)e^{-rt}}$$

For a convex cost function $g(\cdot)$, and with appropriate restrictions on parameters, we see that stabilized payoff is increasing in $\mathbf{t}$; in other words, a longer wait time is associated with a higher stabilized payoff.

The three first order conditions simultaneously determine the optimal choice of timing, stabilized payoff and precautionary investment by citizens. Comparative statics on the three equations capture the trade-odd between waiting and delaying on one hand, and the effect of both timing and stabilized payoff levels on citizen investment. To summarize, a longer delay (higher $\mathbf{t}$) makes people lower their investment, as it raises the probability of the crisis arriving earlier than the preventive action, and thereby lowering the expected value of the investment. Accordingly, if lawmakers choose a longer wait time, they will have to compensate with a higher level of stabilized payoff, to counteract the effect of the delay, and keep the citizen level of investment intact .

We can also interpret it in terms of social insurance provided by lawmakers' action. The future stabilized payoff can be compared to insurance payout, and precautionary citizen investment as upfront payment of premium by the citizens. Only the promise of a larger future payout can make the citizens willing to pay a higher premium ex-ante, given any timing choice by the lawmakers.

4. Conclusion

As noted above, an important extension is the analysis of optimal joint-selection among an unconstrained choice of legal rules and their timing. Lawmakers are routinely faced with constrained policy selection given constitutions, framework legislation, stare decisis, and budgetary limitations. But in other circumstances, they can have substantial latitude to vary policy. Different combinations of timing and substance will, in some cases, generate differences in the optimal legal effective date of stabilization policies.

Our model describes a subclass of situations where citizen and lawmaker interests are aligned. Both want to avoid costly climate change or financial crisis. Thus, citizen action and lawmaker policy selection pull in the same direction. Other cases that remain to be investigated are where interests are misaligned, or where interests are aligned but action and policy selection pull in opposite directions. For instance, with respect to misalignment, a majority of citizens and a group of controlling lawmakers may have divergent discount rates which lead, in turn, to divergent preferences for preventive climate change policy. If citizen action is unexpected regardless of legal effective date, then the optimal moment for implementation may be entirely based upon the probability of downturn. On the other hand, it is unclear whether misalignment would lead to citizen inaction in all cases. With respect to aligned interests, but citizen action and lawmaker policy selection pulling in opposite directions, consider that capital injections may lead to hording even if they occur early in time. Financial institutions may believe that a stabilization policy will benefit by strengthening its balance sheet. An extension would consider the optimal timing of a policy given aligned interests, but divergent actions.

Conclusion paragraph

References

Bar-Siman-Tov, I. (2017). Temporary legislation, better regulation and experimentalist governance: An empirical study. *Regulation and Governance*.

Fagan, F. (2013). After the sunset: The residual effect of temporary legislation. *European Journal of Law and Economics*, 36:209–226.

Fagan, F. and Bilgel, F. (2015). Sunsets and federal lawmaking: Evidence from the 110th congress. *International Review of Law and Economics*, 41:1–6.

Fagan, F. and Faure, M. (2011). The role of lawmakers, lobbyists, and scholars in the normative evaluation of timing rules. *University of Pennsylvania Law Review Online*, 160:61–72.

Kouroutakis, A. (2016). *The Constitutional Value of Sunset Clauses: An Historical and Normative Analysis*. Routledge.

Kydland, F. E. and Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *The Journal of Political Economy*, 85:473–492.

Niblett, A. (2017). Delaying declarations of constitutional invalidity. In Fagan, F. and Levmore, S., editors, *The Timing of Lawmaking*, chapter 13, pages 299–321. Edward Elgar.

Parisi, F., Fon, V., and Ghei, N. (2004). The value of waiting in lawmaking. *European Journal of Law and Economics*, 18:131–148.

Posner, E. A. and Gersen, J. (2007). Timing rules and legal institutions. *Harvard Law Review*, 121:543–589.

Posner, E. A. and Weyl, E. G. (2014). Benefit-cost paradigms in financial regulation. *The Journal of Legal Studies*, 43(S2):S1–S34.

Ranchordas, S. (2014). *Constitutional Sunsets and Experimental Legislation*. Edward Elgar.