A Three-Person Game of Institutional Resilience versus Transition:
A Model and its Application to China-Japan Comparative History

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Abstract

Combining a model of three-person game and a comparative narrative, this article explores the endogenous nature of institutional resilience versus transition. The three-person game is played by a ruler, a challenger, and an opportunist who chooses a strategic position between the former two depending on the game situation. Under wide classes of game forms, the model is reduced to a super-modular game, in which dual Nash equilibria exist: one increases the likelihood of a transition to a new state and the other supports the status quo or increase the likelihood of failure by the challenger. Thus, in this model an institutional transition could take place even without a change in parameter value that represents economic structure but with a change in players’ common conjectures about others’ strategic choices brought in by a salient public proposition or by a bold strategy of a political entrepreneur. In its emphasis on multiple equilibria, the model may be contrasted with both the two-person game approach to the political economy of development and to the original global game approach to regime changes. Finally, the article applies the analytical results to revisit comparative economic histories and institutional changes from the pre-modern political-economic states in China and Japan.

**Keywords**: 3-person game model, super-modular game, institutional change, multiple equilibria, strategic complementarities/rivalries, state capacity, Xinhai Revolution, Meiji Restoration

**JEL classification codes**: B52, C70, C72, N90, N95
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1 Motivations of this Study

In an effort to understand the nature of human progress, unified growth theory offers a coherent framework, which combines economic, demographic, and technological variables to shed light on how human societies evolve from Malthusian stagnation to human capital-driven modern growth (Galor 2005). Yet, there are differences among countries and regions in terms of the timing of transition, say, from a stagnant agrarian economy to an endogenous growth path associated with a demographic transition. While the unified growth theory attributes such variations to country differences in costs, policies, institutions, culture, and so on that might have an impact on human capital formation (Galor 2011; Ngai 2004), new institutional economists argue that the establishment of an open and inclusive political order is an essential prerequisite for modern economic growth (North, Wallis, and Weingast 2012; Acemoglu and Robinson 2012).

Then, how does a growth-enhancing policy, or more fundamentally, a growth-enhancing political order, emerge from the pre-modern stage of political and economic development? Does it evolve through an enhancement of capacity of the pre-modern political state stimulated by economic development? Or rather is it established by a political, and often violent, challenge by various actors against an authoritarian political order that limits economic progress? Or is an exogenous political shock, say a foreign threat or a natural disaster, an essential trigger for a transition from a stagnant, agrarian political-economic order? To understand country differences in terms of the political aspects of an otherwise generic process of economic growth, unified treatment of economic and political-institutional variables may be required. This article seeks to make a modest contribution in this direction by combining an analysis of a game model and a related historical narrative in the context of a transition from a (pre-modern) political-economy order.

Let us posit generically that varied institutional forms of a “political state” can be understood as “stable equilibrium states” in a game of political competition played by the ruler (the government)
and the ruled (the people). At the same time, the players in the political competition game are likely to play an economic-exchange game strategically in a unified manner. Thus, institutional complementarities between the political and economic orders may evolve on the basis of strategic complementarities across players and across the political and economic domains (Aoki 2001). The nature and the properties of a possible institutional transition from one political state to another may then be explored analytically as a shift in the equilibrium state of play of the political competition game. This shift is likely to be associated with a complementary shift in the profile of the players’ strategic choices in the economic-exchange game. In other words, a certain political transition may be facilitated and made possible by a complementary change in the economic order (as in Besley and Persson, 2012), while it may also induce changes in economic performance (as in Acemoglu and Robinson, 2012). However, we also observe a variation in the mode and timing of a political transition against the same economic background and/or potentials across countries in spite of the possible complementarities. This possibility may be explored analytically as an instance of multiple equilibria in a political competition model.

This article attempts to offer an analysis of institutional transition by a simple and tractable, but somewhat novel, model of a 3-person, 2-period game, which is played by a ruler, a possible challenger, and an opportunist choosing one side or the other depending on the game situation. They compete for aiming at respective political-economic agenda with conflict management capacities that they invest in on the basis of economic resources that they can command. For a rather broad class of game forms, the game is reduced to a super-modular (strategic complementary) game and multiple equilibria are derived: one increasing, and the other decreasing, the likelihood of transition. Then, possible political mechanisms for equilibrium selection are heuristically derived using the game framework, in which interim negotiation based on a linguistic political proposition (idea), and/or political entrepreneurship plays an important role for making an equilibrium state of play as a salient focal point. Then, on the basis of insights gained from the model, the article attempts to elucidate and compare the unique aspects of the institutional transitions from the rural-based, pre-modern states in China and Japan, and suggests their legacies on the subsequent institutional trajectories.

In the recent literature of game-theoretic treatises on institutional/regime change in general,
there appear to be two major approaches in terms of focus and the associated formulation of the game type and its analysis. One is a focus on the distribution of various capacities—fiscal, military, legal, institutional, and so on—among a ruler (the incumbent government), its agents, competitors, challengers, and so on, to examine possible consequences of their strategic interactions. This analysis is usually performed in terms of a 2-person game, say, between the incumbent ruler and the opposition, two representative statelets competing for a state formation, or a 2-level principal-agent model. A traditional criticism of such a structural approach as a general explanation of regime change/revolution is that the same structural characteristics across economies may not necessarily be observed to result in the same institutional consequences (e.g., revolution) at the same time.

As mentioned above, one possible response to such criticism could be to explore the possibility of multiple equilibria within the same classes of parametric variables that represent structural factors, in which a shift from one equilibrium to another is determined by non-structural factors. But in the existing 2-person game models, the likelihood of each of the possible regime outcomes, such as peace between the ruler and the ruled, repression of the latter by the former, or civil conflict between them, is conditional on mutually exclusive combinations of the parametric values.

The other approach is a focus on the information-incentive aspects of regime change within the framework of a global game, originally due to Morris and Shin (1998, 2003). In this approach, the capacity of a political state/regime to rule over a continuum of agents (the population) is represented by a common prior. Each member of the population is in turn differentiated by independently distributed private information with regard to state capacity, but with the same preference structure. Accordingly as agents of a sufficient size in the continuum have an incentivize to challenge the state according to the public and private information, the likelihood of an institutional/regime change increases as a result of strategic complementarities among them. If the differences in the private information are small, then a small change in the capacity of the state induces an abrupt and dis-

2To quote a few examples of 2-person games of institutional resilience versus transition, see the contests between an incumbent ruler and an opposition in a development context (e.g., Besley and Persson 2012, chapter 4); the competition for hegemony toward the formation of a nation state among representative statelets (e.g., Gennaoli and Voth 2014); and the changing contracting modes between the king and the tax farmer in the evolution toward the French Revolution and the Glorious Revolution of England respectively (Johnson and Koyama 2014).

3However, Besley and Persson (2012) present empirical results derived from some developmental data that are claimed to confirm their parametric value-based predictions for viable regimes.

4Political-economy applications of the global game include riots (Atkeson 2000), the manipulation of information by the government (Edmond 2013), privately communicated rumors during revolution (Chen et al 2014), and violent actions by a “revolution entrepreneur” (Bueno de Mesquita 2010).
continuous change from the status quo by a strategic shift of a marginal agent. However, is this monotone property robust when information is endogenized and/or structural factors are introduced into global game framework? Indeed, research in this direction has been active, but the presumption that all agents constitutes a continuum might be considered to better fit a civil situation in which anonymous citizens confront the government as a mass. However, in order to understand the nature of some institutional changes, specifically in developmental contexts, structural factors that differentiate the relative positions of the agents may not be dismissed.

Thus, this article proceeds a midway between 2-person game models and models of a continuum of anonymous persons. What are then specific structural characteristics of a 3-person game that may have implications for institutional transitions that are distinct from a 2-person game and/or a global game? Some historical cases strongly suggest, as evidenced in Section 3 below, that the distribution of the outcomes of economic development in the pre-modern stage might not necessarily, or merely, be in favor of either a ruler, revolting peasants, or an outright political challenger. A group of insiders who strategically complement a ruler could become major beneficiaries of economic development. They might then acquire resources that they can potentially use for their own benefit by switching their strategies to those opposing the ruler, with or without joint actions with the challenger who may or may not possess comparable resources. This is but one example of structural characteristics that might entail the possibility of multiple equilibria for the same structural characteristic (fundamentals). The model presented below is simple, but an action of the opportunist (not a marginal agent in the global game) renders the behavior of the model discontinuous and non-smooth. Thus, an equilibrium analysis and a comparative static of a 3-person game may not necessarily be a trivial extension of a 2-person game. This calls for an application of a powerful super-modular analytic technique (Topkis 1979, Milgrom and Roberts 1990, and Milgrom and Shannon 1994) rather than the traditional technique of converting a Hessian matrix.

Factors responsible for multiple equilibria in a global game may include: an endogenous policy intervention by the state (Angeletos 2006), learning from repeated plays of a global game (Angeletos et al 2007), and the above-mentioned informational impact of a revolutionary entrepreneur (Bueno de Mesquita 2010). Among these, the latter appears to be unique in terms of suggesting a direction to build an explicit bridge between the structural and informational approaches. An analysis of the unique nature of some political states may also require a 3-person game framework rather than a 2-person framework. For example, the nature of democracy (Weingast 1997), a variety of types of political states as a parametric value-contingent multiple equilibria (Aoki 2001), or the podesta mediating between two competing clans in medieval Genoa (Greif 1994). These models primarily focus on the equilibrium/stability conditions required for the various political states rather than on the institutional transition per se.

Types of contest functions widely used in the literature on 2-person and symmetric n-person contests (e.g., Tullock 1980, Dixit 1987, Besely and Persson 2010) are not appropriate for comparative static analysis of asymmetric
On the other hand, the possibility of multiple equilibria calls for an inquiry into possible mechanisms for the equilibrium selection, or, more specifically, that for a transition from one equilibrium to another. Milgrom and Roberts (1990) propose an individually justifiable learning process that necessarily converges into some equilibrium out of many possible equilibria in a super-modular game. However, stability in this process is essentially local, as the agents adaptive behavior is based on their observations of past plays and it may not be workable for a global transition, such as that from the status quo to a new state. The model below thus attempts to identify two mechanisms that may work toward such a transition: (1) communications between the challenger and the opportunist that could overcome individually justifiable strategic choices using a simple political proposition (idea); and (2) a challenger’s individually unjustifiable, bold strategic choice that will eventually have an impact on the opportunist’s information and thus incentive to challenge the ruler. In such a regards the model may be thought of as a sharing of some ideas from the recent global models that deal with repeated plays of a global game (Angeletos et al 2007), private communications among citizens (Chen et al 2014), and informational actions by a vanguard as a third agent distinct from the continuum of citizens (Bueno de Mesquita 2010). The model below does not delve into such a sophisticated analysis of Bayesian multiple equilibria as theirs. Instead we heuristically suggest an important role of public propositions á la Lewis (1969) that will facilitate an interim renegotiation and make a salient focal state of play common knowledge.

With such motivations, the remainder of the article is organized as follows. Section 2 formally presents a simple, tractable model of a 3-person, 2-period game model of institutional resilience versus transition. A ruler, a challenger, and an opportunist are engaged in resource-based investments in conflict-management capacities in period I, and in their strategic uses in period II. The analysis identifies the possibility of three possible types of subgame perfect equilibria. They are either a structure-dependent status quo, or a challenge against the ruler initiated by the challenger in period I; and, if the latter is selected, two types of Nash equilibria, dubbed the $K^*$-type and the $K_*$-type, could exist in period II. In the former, the opportunist acts together with the challenger, either complementarily or competitively, against the ruler, whereas in the latter the opportunistic follows the ruler to sustain the existing order. Although the opportunist potentially may be better off at a $K^*$-type equilibrium, if he had complemented the ruler to sustain the status quo (say $K^0$) in the past, it may be individually rational for him to align his strategy toward a $K_*$-type strategy when

3-person games. See the discussion below based on Skaperdas (1994).
the challenger revolts. The possibility of two informational mechanisms alluded to above is then analytically and heuristically examined for a possible transition to a new state through a strategic alignment to \( K^* \)-type. But their plausibility and concrete forms need to be examined in references to the actual games of institutional transitions.

Section 3 is thus devoted to illustrating and supporting the analytical results of Section 2 through feedback from historical information. It is drawn from two major institutional transitions – from the pre-modern political-economic states in China and Japan. Application of this model to these two events provides a new interpretation of the comparative histories of China and Japan. In both Qing China and Tokugawa Japan, a dynasty-governing tax state, on the one hand, and a family-based rural economy, on the other, existed in complementary relations (e.g., Wong 1997). A recent article by Sng and Moriguchi (2014) compares impacts of a difference in geographical size between the two countries on the monitoring capacities of the respective dynastic rulers. They do so in terms of rulers’ agency relations with their own bureaucrats. But this scope is not broad enough to examine the order, decay, demise, and legacy of each of the dynastic rules in a unified manner. This article introduces the dual strategic relations of intermediate agents – the gentry in China and samurai-bureaucrats in the Han (autonomous domain governments) in Japan – \textit{vis-a-vis} the dynastic ruler and its administration on one hand and the peasantry in their domain on the other. As these intermediate agents accumulated their own economic resources and conflict-management capacities, some gradually drifted away from a strategic position complementary to the ruler and/or became outright challengers to the ruler. Particular public propositions that facilitated a broader coalitional-making in a path-dependent manner were instrumental in such a shift to ultimately result in an institutional transition through the Meiji Restoration or the Xinhai Revolution. Then the particularities of these events appear to have imprinted their legacies on subsequent games of institutional evolution and the associated modes of economic development in the two countries.

2 The Model

2.1 The basic structure of the model

This section builds a simple and tractable model of a 3-person, 2-period game that serves as a useful guide to interpret different patterns of (institutional) change/resilience from pre-modern to modern states of political play.
**The possibilities of the players' choice:** Suppose that there are three agents in the (pre-modern) political economy: the ruler, the possible challenger, and the opportunist who chooses a strategic position between the former two. They are denoted as \( R, C, \) and \( O, \) respectively. The economy has sustained a stable state of play up to the present time, denoted by \( (u^R, u^O, u^C) \) in terms of the players’ payoffs, which is referred to as the canonical state. During the period starting from now, referred to as period I, \( C \) decides whether or not to deviate from the canonical state of play. In the case that \( C \) deviates, the gross payoff profiles will be: \( (u^R - \Delta \gamma, u^O - \Delta \gamma, u^C + \beta(\Delta \gamma)) \), where \( \Delta \gamma \) is the external cost imposed on \( R \) and \( O \) by \( C \), whereas \( \beta(\Delta \gamma) \) is \( C \)’s benefit (or cost) from deviation, if it is positive and increasing (or negative and decreasing). If \( C \) deviates, \( R, O, \) and \( C \) immediately prepare for a possible conflict situation, to be specified later, that may arise during period II by investing in conflict-management capacities. Higher levels of such capacities are represented by lower values of \( \mu^R, \mu^O \) and \( \mu^C \), representing the costs per unit of deployment of a conflict-management strategy. To achieve a lower level of deployment costs, a correspondingly higher level of capacity investments, measured by monotone decreasing functions \( \varphi^i(\mu_i) \leq M_i \) is necessary for \( i = R, O, \) and \( C, \) where \( M_i \) represents \( i \)’s resource constraint.

If \( C \) does not deviate during period I, the canonical state of play continues to prevail during period II. Otherwise, \( R \) decides at what level, \( k_R \), it should deploy its conflict management capacity in period II to punish/resist \( C \)’s challenge at cost \( k_R \mu_R \), while \( C \) decides at what level, \( k_C \), it should deploy its conflict management capacity to counteract \( R \) at cost \( k_C \mu_C \). \( O \) decides with whom and at what level, \( k_O \), it should deploy its conflict management capacity, with \( k_O < 0 \) (alternatively, \( k_O > 0 \)) implying \( O \)’s action against \( C \) (respectively, \( O \)’s action against \( R \)) and at cost \( \mu_O |k_O| \). Let \( (k_R, k_O, k_C) \) represent the choice profile in the conflict situation during period II, where

\[
0 \leq \mu_R k_R \leq K^R, 0 \leq \mu_O |k_O| \leq K^O, 0 \leq \mu_C k_C \leq K^C.
\]

Also, denote by \( K^+, K^-, \) and \( K^0 \) the following sets

\[
K^+ \equiv [(k_R, k_O, k_C)|0 \leq \mu_R k_R \leq K^R, 0 \leq \mu_O k_O \leq K^O, 0 < \mu_C k_C \leq K^C]
\]

\[
K^- \equiv [(k_R, k_O, k_C)|0 \leq \mu_R k_R \leq K^R, -K^O \leq \mu_O k_O < 0, 0 \leq \mu_C k_C \leq K^C]
\]

\[
K^0 \equiv (0, 0, 0)
\]

and \( K \equiv K^+ \cup K^- \). The upper limits of the \( k \)'s are to be determined endogenously later, but for now they may be taken as the parameters.
Institutional resilience/transition and the players’ payoffs. The choice profile \((k_R, k_O, k_C)\) yields one of two consequences at the end of period II: either transition to a new state – denoted by \(N\) – that puts \(R\)’s rule to an end, or the failure of \(C\)’s challenge – denoted by \(F\) – which restores the canonical state of play, with a punishment of \(C\) (and possibly of \(O\)), with the respective probabilities being \(P^N(k_R, k_O, k_C)\) and \(P^F(k_R, k_O, k_C) = 1 - P^N(k_R, k_O, k_C)\).

When \((k_R, k_O, k_C) \in \mathcal{K}^+\), the net payoff profile in each stochastic event is given by

\[
\begin{align*}
\text{(N)} & \quad (u^{R*} - L^R - \mu_R k_R, u^{O*} + \pi^O(k_O, k_C) - \mu_O k_O, u^{C*} + \pi^C(k_O, k_C) - \mu_C k_C) \\
\text{(F)} & \quad (u^{R*} + \Delta^C(\Delta) - \mu_R k_R, u^{O*} - \Delta^O - \Delta^C(\Delta) - \mu_C k_C)
\end{align*}
\]

where \(L^R > 0\) represents the deadweight loss that \(R\) suffers when it loses its governing position due to the transition, while \(L^O \geq 0\) is the penalty imposed on \(O\) by \(R\) when \(O\) does not act with \(R\) against \(C\) but the revolt ends in failure, with \(L^O = 0\) if \(k_O = 0\); \(\pi^O\) and \(\pi^C\) represent the political-economic gains expected from a transition to the new state \(N\) – simply referred to as the expected post-transition gains accruing to \(O\) and \(C\), with \(\pi^O(0, k_C) = 0\). Denoting partial derivatives of the functions by subscripts of the relevant variables, we assume that \(\pi^O \geq 0\) and \(\pi^C \geq 0\). If \(\pi^O_C, \pi^C_O > 0\) (alternatively < 0), they represent positive (respectively, negative) externalities on the expected post-transition gains. Even if there are negative externalities, that is, even if \(\pi^O_C, \pi^C_O < 0\), the strengthening of one’s own strategy by each player could mitigate the effects so that \(\pi^O_{OC}\) and \(\pi^C_{OC}\) > 0. We do not need to assume the usual convexity for \(\pi^O\) and \(\pi^C\) in the following analysis. \(\Delta^C(\Delta)\) is the penalty imposed on \(C\) by \(R\) when the revolt by \(C\) fails, which increases in the magnitude of the external damage caused by \(C\)’s deviation during period I.

If \((k_R, k_O, k_C) \in \mathcal{K}^-\), the net payoff profile in each stochastic event is given by

\[
\begin{align*}
\text{(N)} & \quad (u^{R*} - L^R - \mu_R k_R, u^{O*} - \mu_O|k_O|, u^{C*} + \pi^C(k_O, 0) - \mu_C k_C); \\
\text{(F)} & \quad (u^{R*} + \sigma \Delta^C(\Delta) - \mu_R k_R, u^{O*} + (1 - \sigma)\Delta^C(\Delta) - \mu_O|k_O|, u^{C*} - \Delta^C(\Delta) - \mu_C k_C),
\end{align*}
\]

where \(L^{O-}\) represents the deadweight loss that \(O\) suffers when it resists successful move of \(C\) toward the transition to the new state, and \(\sigma\) is the parameter representing \(R\)’s share in the transfer from \(C\) in the event of \(C\)’s failure, with \(1 \geq \sigma > 0\).

On \(\mathcal{K}^0\), the payoff profile is \((u^{R*}, u^{O*}, u^{C*})\), with a probability of 1, that is, the status quo at the canonical state of play. Overall, the payoff functions become discontinuous or non-smooth at \(k_O = 0\).
The probability measure functions $P^N$ and $P^F$ summarize the probable institutional outcomes in terms of the profile of levels of the players’ strategic deployments of their conflict-managing and their interactions. Therefore, we refer to $P^N$ as the transitional probability measurement (TPM). Denoting partial (cross) derivatives of the probabilities measurement functions with respect to their variables by corresponding subscripts, we assume $P^N_O, P^N_C \geq 0$ and $P^N_R \leq 0$. We refer to the case of $P^N_{OC} > 0$ on $\mathcal{K}^+$ as that of strategic complements in the deployment of the conflict-management capacities in the transition to the new state (or simply the strategic complements) between $O$ and $C$. Even if $P^N_O, P^N_C > 0$, it could happen that $P^N_{OC} < 0$. This case is referred to as one of strategic rivalry during transitional efforts, which is distinct from external diseconomies in the expected post-transition gains introduced earlier. As we will see below, this distinction is important for assessing the existence and implications of multiple equilibria. The above assumption on payoff structure implicitly implies that $P^F_{|O|R} \geq 0$ and $P^F_{|O|C} < 0$ on $\mathcal{K}^-$, that is, $R$ and $O$ strategically complement each other in resisting the transition to $N$, whereas $C$ and $O$ strategically oppose each other. We always assume that $P^N_{RC} < 0$ (thus, $P^F_{RC} > 0$), that is, the intensification of conflict between $R$ and $C$ makes the transition less likely (thus the failure of $C$’s challenge more likely). By the same token, we assume that $P^N_{RO} \leq 0$ on $\mathcal{K}^+$ and thus $P^N_{RO} \leq 0$ on $\mathcal{K}^+ \cup \mathcal{K}^-$ by noting the sign convention about $k_O$.

\footnote{Does there exist a type of TPM that allows for the various properties assumed above? This is not a trivial question. Kinds of contest success function as that widely used in the literature on a 2-person or symmetric N-person conflict situation (e.g., Tullock 1980, Dixit 1987; Besley and Persson 2012) may be thought of as extendable to a 3-person game situation in such a form as $P^N(k_R, k_O, k_C) = f(k_R + k_O + k_C)[f(k_R + f(k_O + k_C))].$ However, the conditions such as $P^N_{OC} > 0$ cannot be represented in such a relative ratio form, while $P^N_{RO} \leq 0$ and $P^N_{RC} < 0$ on $\mathcal{K}^+$ can only be conditional on the relative magnitude of $g(k_R)$ vis-à-vis $f(k_O + k_C)$. However, the possible complementarities between $O$ and $C$, $P^N_{OC} > 0$, cannot be represented in such a relative ratio form, while in the rivalry relations between $R$ on the one hand and $O$ and $C$ on the other, $P^N_{RO} \leq 0$ and $P^N_{RC} < 0$ on $\mathcal{K}^+$ can only be conditional on the relative magnitude of $g(k_R)$ vis-à-vis $f(k_O + k_C)$. There is indeed a fundamental problem with the use of relative ratio in a 3-person game, if there is a possibility of strategic complementarities between $O$ and $C$. Skaperdas (1994) shows axiomatically that the contest success function of the relative type is one, and only one, type of TPM that satisfies the “independence from irrelevant alternative” property, that is, the outcome of the 2-way contest among the members of the 3-person game should not depend on the choice of the 3rd player. However, if the choices are strategic choices, when $R$ and $C$ contest with each other, their choices may not be independent of the possible choices by $C$. An example of the TPM that allows for all of the above varieties by parametric variations could be given in the following simple additive form with a proper normalization of $\mathcal{K}^+$ such that $\mathcal{K}^+ \leq 1/3$,

$$P^N(k_R, k_O, k_C) = \min[2/3, (k_O + k_C)^\alpha / e^{-k_R}] - \min[1/3, k_R^\beta] + 1/3 \text{ on } \mathcal{K}^+$$
$$= \min[2/3, (k_R + |k_O|)^\gamma] - \min[1/3, k_C^\lambda / e^{-k_R}] + 1/3 \text{ on } \mathcal{K}^-$$

If $\alpha > 1$ (alternatively $< 1$), then $O$ and $C$ are strategic complements (respectively, strategic rivals) of $\mathcal{K}^+$. We do not need to assume the conventional convexity of the functions involved: that is, $\alpha, \beta, \gamma$, and $\lambda$ may exceed 1. The inverse
What has been specified above may be summarized in terms of the timeline of the events as follows:

1. At the beginning of period I, \( C \) (the challenger) decides whether or not to deviate, and at what level if it does, from the historically given canonical state of play.

2. If \( C \) deviates, everyone invests in one’s own conflict-management capacity in an amount measured by \( \mu_i^{\text{max}} - \mu_i, i = R, O, \) and \( C \), in order to prepare for a possible conflict situation during period II.

3. If \( C \) does not challenge the canonical state in period I, the canonical state continues to prevail in period II. If \( C \) does challenge the canonical state in period I, \( O \) decides whether to side with either \( R \) or with \( C \) by choosing \( k_O < 0 \) or \( k_O \geq 0 \). Every player decides the strategic level, \( k_i \), of the deployment of its own conflict-management capacity at cost \( \mu_i|k_i| (i = R, O, \) and \( C \).

4. At the end of period II, the game ends with a transition to a new state with a probability of \( P_N(k_R, k_O, k_C) \), or the punishment of \( C \) (and \( O \), if \( k_O > 0 \)) by \( R \) (and \( O \) if \( k_O \leq 0 \)) with a probability of \( 1 - P_N(k_R, k_O, k_C) \).

This sets the static benchmark. Later we will consider a situation in which the game is repeatedly played for subsequent rounds with the same or a different challenger, as long as it ends with the failure of \( C \)’s challenge or the status quo at the end of a period II. In this extended dynamic framework, resource constraints for capacity investment (the structural “fundamentals”) may change, but possible timing of transition could be dependent on players’ information, learning, and endogenous changes of the parameter values caused thereby.\(^9\)

2.2 The possibility of multiple equilibria during period II

We solve the model by working backward from period II to derive a sub-game perfect equilibrium. During period II the efficiently levels of the conflict-management capacities of the players, \( \mu_i \), are taken as given (\( i = R, O, \) and \( C \)). Although the model presented above is sufficiently simple to capture the unique features of a 3-person game in a bare form, the payoff functions of the players are either discontinuous or non-smooth at \( k_O = 0 \) in period II, while the usual assumption of of \( e^{-k_R} \) represents the diminishing marginal diseconomies that \( R \) can inflict on \( C \)’s (and \( O \)’s) strategy to bring about a transition.

\(^9\)These properties can be thought of as reminiscent of those of Angeletos et al (2007) in a global-game framework.
convexity is not imposed on the \( \pi \) functions or on the TPM that constitutes the payoff functions. Therefore, in order to ascertain the conditions for the existence and stability of equilibrium (possibly multiple equilibria) in period II, we proceed in a somewhat roundabout way. Namely, we first examine the possibility of an equilibrium when the domain of play is separately constrained on \( K^- \cup (k_R, 0, k_C) \) and on \( K^+ \). We then examine whether any equilibrium derived separately for each domain, if it exists, could survive as an undominated equilibrium even after the fictitious constraints are removed. In order to do this, we rely on a super-modular analysis (Topkis 1979; Milgrom and Roberts 1990; Milgrom and Shannon 1994). That is, we examine under what conditions the cross derivatives of the expected payoff functions become uniformly non-negative with respect to the strategic variables on the specified domains (for the existence of equilibrium) as well as under what conditions between the strategic variables and the parameters (for the comparative static of equilibrium) become uniformly non-negative. It turns out that there may be multiple equilibria under certain conditions.

First, let us first examine if the equilibrium condition is possible on \( K^- \cup (k_R, 0, k_C) \) when \( u^O(k_R, 0, k_C) = u^O \) with \( L^O = 0 \) for the state \( N \) and with \( \sigma = 0 \) for the state \( F \). This could be the case, if the choice of \( O \) is constrained by an specified reason, such as his cognitive limit, inertia, norms prevailing between \( R \) and \( O \), or else. Straightforward calculations of the cross derivatives of the expected payoff functions provide the following inequalities on \( K^- \):

\[
\begin{align*}
Eu_R^R &= P_{R|O}^F [L^R + \sigma L^C(\Delta \gamma)] > 0 \\
Eu_R^C &= P_{R|C}^F [L^R + \sigma L^C(\Delta \gamma)] < 0 \\
Eu_O^R &= P_{O|R}^F [L^O - (1 - \sigma)L^C(\Delta \gamma)] > 0 \\
Eu_O^C &= P_{O|C}^F [L^O - (1 - \sigma)L^C(\Delta \gamma)] < 0 \\
Eu_C^R &= P_{C|R}^N [\pi^C(k_C) + L^C(\Delta \gamma)] + P_R^N \pi_C^C(k_O, 0) \\
Eu_C^O &= P_{C|O}^N [\pi^C(k_C) + L^C(\Delta \gamma)] + P_O^N \pi_C^C(k_O, 0)
\end{align*}
\]

If the following conditions hold, then the last two equations are non-positive and \( (Eu_R, Eu_O, Eu_C) \) are super-modular in \( (k_R, |k_O|, K^+ - k_C) \), or equivalently in \( (K^R - k_R, k_O, k_C) \) on \( K^- \).

\[
[SM0] \quad \frac{\pi^C}{\pi^C + L^C} \geq -\frac{P_N^R}{P_R^R} \quad \text{and} \quad \frac{\pi^C}{\pi^C + L^C} \geq -\frac{P_N^C|O|}{P_O^N|O|}
\]
These weak inequalities imply that on $K^-$, the direct marginal impacts of C’s strategic strengthening on its own net payoff are never smaller than those of opponents’ reactive strategies on TPM in percentage terms.

Thus, the following holds:

**Lemma 1** If the strategic domain of $O$ is constrained to $K^- \cup (k_R, 0, k_C)$ and the TPM satisfies $t[SM0]$ on $K^-$, there exists the largest undominated strategy $k_{R*} \geq 0$ for player $R$, the largest undominated strategy $k_{O*} \leq 0$ for player $O$, and the smallest undominated strategy $k_{C*} \geq 0$ for player $C$, or equivalently, the profile of the smallest undominated strategy $(K^R - k_{R*}, k_{O*}, k_{C*})$. Moreover, the pure strategy profile $K_\ast = (k_{R*}, k_{O*}, k_{C*})$ is a Nash equilibrium on $K^- \cup (k_R, 0, k_C)$.

Next, we turn to the case where the strategic domain of $O$ is constrained as $k_O \geq 0$. The straightforward calculation of the cross derivatives provides the following inequalities on $K^+$:

$$Eu^R_{RO} = P^F_{RO}[L^R + L^O + L^C(\Delta \gamma)] < 0$$
$$Eu^R_{RC} = P^F_{RC}[L^R + L^O + L^C(\Delta \gamma)] < 0$$
$$Eu^O_{OR} = P^N_{OR}[\pi^O(k_O, k_C) + L^O] + P^N_{RO} \pi^O(k_O, k_C) < 0$$
$$Eu^O_{OC} = P^N_{OC}[\pi^O(k_O, k_C) + L^O] + P^N_{CO} \pi^O(k_O, k_C) + P^N_{C} \pi^O(k_O, k_C) + P^N_{OC} \pi^O(k_O, k_C)$$
$$Eu^C_{CR} = P^N_{CR}[\pi^C(k_O, k_C) + L^C(\Delta \gamma)] + P^N_{RC} \pi^C(k_O, k_C) < 0$$
$$Eu^C_{CO} = P^N_{CO}[\pi^C(k_O, k_C) + L^C(\Delta \gamma)] + P^N_{CO} \pi^C(k_O, k_C) + P^N_{CO} \pi^C(k_O, k_C) + P^N_{OC} \pi^C(k_O, k_C)$$

Thus the possibility for $(Eu^R, Eu^O, Eu^C)$ to be super-modular in $(K^R - k_R, k_O, k_C)$ depends on whether $Eu^O_{OC}$ and $Eu^C_{CO}$ can be positive. Any of the following, mutually exclusive conditions is sufficient for this to hold:

- **[SM1]** $P^N_{OC} > 0$, $\pi^O_C \geq 0$ and $\pi^C_O \geq 0$;
- **[SM2]** $\pi^O_C$ and/or $\pi^C_O < 0$, $\frac{P^N_{OC}}{P^O_{OC}} > -\frac{\pi^O_C}{\pi^O_C + L^O}$ and $\frac{P^N_{CO}}{P^C_{CO}} > -\frac{\pi^C_O}{\pi^C_O + L^C} \geq 0$;
- **[SM3]** $P^N_{OC} < 0$, $\left|\frac{P^N_{OC}}{P^O_{OC}}\right| \leq \frac{\pi^O_C}{\pi^O_C + L^O}$ and $\left|\frac{P^N_{CO}}{P^C_{CO}}\right| \leq \frac{\pi^C_O}{\pi^C_O + L^C}$.

$^{10}$Undominated strategies are those that remain after the iterated elimination of pure strategies that are strictly dominated by other pure strategies. Because we do not assume the convexity of the expected payoff functions of the players, there may be multiple equilibria, the largest and the smallest. Although the following comparative static property applies both to the largest and the smallest pure strategies (see Milgrom and Shannon 1994: Theorem 13), here we only focus on the smallest equilibrium for a reason to be clear shortly.
In case [SM1] \( O \) and \( C \) are strategic complements in their development deployment of a conflict-management capacity and there are no negative externalities in their expected post-transition gains. In this case, there is no specific feature unique to a 3-person game because there is no qualitative asymmetry between \( O \) and \( C \). In case [SM2] the strategic choices of \( O \) or/and \( C \) are expected to generate rivalries in the post-transition gains, but these external diseconomies are overcome by their stronger strategic complementarities in defeating \( R \) in elasticity terms. In [SM3] the strategic rivalries in the deployment of conflict-management capacities are expected overcome by strong mutual externalities on the expected post-transition gains in elasticity terms. Under either of these conditions, the following holds:

**Lemma 2** If the strategic domain of \( O \) is constrained as \( k_O \geq 0 \) and the TPM satisfies any of mutually exclusive conditions [SM1],[SM2], or [SM3], the largest undominated strategies \( K_R - k_R^* \) for \( R \), \( k_O^* \) for \( O \), and \( k_C^* \) for \( C \) will exist. Moreover, the pure strategy profile \( (k_R^*, k_O^*, k_C^*) \) is a Nash equilibrium on \( K^+ \).

If both the conditions stated in Lemma 1 and Lemma 2 hold, then the original unconstrained game played on \( K^+ \cup K^- \) becomes super-modular. The next question is whether the equilibria in the constrained domains of play, \( K_* = (k_R^*, k_O^*, k_C^*) \), and \( K^* = (k_R^*, k_O^*, k_C^*) \) can survive as dual equilibria after integration, unless they are identical with \( K_* = K^* = (0, 0, 0) \). For this to be the case, it is necessary and sufficient for the strategy of each player in each equilibrium to be undominated by the corresponding strategy in the other equilibrium (Milgrom and Shannon 1994). For example, if the following conditions are all satisfied, then equilibrium \( K_* \) is undominated.

\[
\begin{align*}
[UD_R] & \quad [P^F(k_R^*, k_O^*, k_C^*) - P^F(k_R^*, k_O^*, k_C^*)][L^R + \sigma L^C(\Delta \gamma)] \geq (k_R^* - k_R^*)\mu_R \\
[UD_O] & \quad P^F(k_R^*, k_O^*, k_C^*)[L^O^- + (1 - \sigma)L^C(\Delta \gamma)] - L^O^- - |k_O^*|\mu_O \geq P^N(k_R^*, k_O^*, k_C^*)[\pi_O(k_O^*, k_C^*) + L^O] - L^O - k_O^*\mu_O \\
[UD_C] & \quad P^N(k_R^*, k_O^*, k_C^*)[\pi_C(k_C^*, 0) + L^C(\Delta \gamma)] - k_C^*\mu_C > P^N(k_R^*, k_O^*, k_C^*)[\pi_C(k_C^*, 0) + L^C(\Delta \gamma)] - k_C^*\mu_C \end{align*}
\]

These inequalities imply that even if each player alone changes its strategy from the one corresponding to \( K_* \) to the one corresponding to \( K^* \), its expected gains will not be sufficient for
overcoming expected cost increase. Suppose analogous conditions hold as regards the opposite direction. Then, the following proposition holds:

**Proposition 1**  If the conditions stated in Lemma 1 and Lemma 2 hold and $K^*$ and $K_*$ are mutually undominated on $K^+ \cup K^-$, then $K^*$ and $K_*$ are the largest and smallest Nash equilibria on $K^+ \cup K^-$ respectively. If either $K^*$ or $K_*$ is dominated by the other, then the undominated strategies become a unique equilibrium. If $K^* = K_* = K_0$, it is status quo at the canonical state.

Then, by applying Theorem 7 from Milgrom and Roberts (1990), we can derive the following welfare implication:

**Proposition 2**  Nash equilibrium $K_*$ is preferred by $R$, whereas Nash equilibrium $K^*$ is preferred by $O$ and $C$.

If the game is not dominant solvable for unique equilibrium, then it is necessary for $O$ and $C$ to coordinate, rather than act in an individually justifiable way, to move to the mutually preferred strategic choices that enhances the likelihood of transition. To prepare for a discussion on this, however, let us first check the comparative static of the equilibria in response to parametric changes. Below the possibilities of increasing differences of the players’ expected payoffs in respective strategic variables, $-k_R, k_O$, or $k_C$ (for any fixed other variables) and some selected parameters are listed (if not explicitly listed, the corresponding differences are zero or ambiguous). By a super modular analytic property, if the increasing differences in a parameter (with a proper sign convention) are weakly positive across the players, then the strategic variables weakly increase across the players when the value of the parameter increases. The following properties except for the last hold for both equilibria of $K^*$–type and $K_*$–type, if they exist.

\[ \text{CS1] } \frac{\partial^2 F^R_u}{\partial (-k_R) \partial (-\mu_R)} > 0, \frac{\partial^2 F^O_u}{\partial (k_O) \partial (-\mu_O)} > 0, \frac{\partial^2 F^C_u}{\partial (k_C) \partial (-\mu_C)} > 0 \text{ and other differences in } \mu \text{'s are zero:} \]
\[ \text{A higher efficiency of each player’s conflict-management capacity induces a higher deployment of his/her own conflict-management capacity (i.e., } \frac{\partial k_i}{\partial \mu_i} < 0 \text{ for all } i \text{) and a non-increasing deployment by the others (i.e., } \frac{\partial k_i}{\partial \mu_i} \geq 0 \text{ for } i \neq j \text{) except for between } O \text{ and } C \text{ (i.e., } \frac{\partial k_O}{\partial \mu_C} \leq 0 \text{ and } \frac{\partial k_C}{\partial \mu_R} \leq 0). \]

\[ \text{CS2] } \frac{\partial^2 P^R_u}{\partial (-k_R) \partial (-L_R)} > 0, \frac{\partial^2 P^O_u}{\partial (k_O) \partial (-L_R)} = 0, \frac{\partial^2 P^C_u}{\partial (k_C) \partial (-L_R)} = 0; \text{ The prospect of a lower deadweight loss imposed on } R \text{ in the event of a transition to a new state induces a lower deployment of a} \]
conflict-management capacity by $R$.

$$\text{[CS3]} \frac{\partial^2 [P_{NuR}]}{\partial (-L(\Delta \gamma))} > 0, \frac{\partial^2 [P_{NuO}]}{\partial (-L(\Delta \gamma))} \geq 0, \frac{\partial^2 [P_{NuC}]}{\partial (-L(\Delta \gamma))} > 0: \text{Increase in the magnitude of } C\text{’s deviation and the associated penalty on } C \text{ in the event of his failure induces higher strategic deployments of conflict-management capacities by } R \text{ and } C \text{ and a non-decreasing deployment by } O.$$  

$$\text{[CS4]} \frac{\partial^2 [P_{FuR}]}{\partial (-L(\Delta \gamma))} > 0, \frac{\partial^2 [P_{FuO}]}{\partial (-L(\Delta \gamma))} > 0, \frac{\partial^2 [P_{FuC}]}{\partial (-L(\Delta \gamma))} = 0: \text{Decrease in the share of transfer to } O \text{ in the event of } C\text{’s failure induces } O\text{’s lower strategic deployment of conflict management capacity while inducing that of } R.$$  

These comparative static properties are utilized in a general equilibrium analysis of period I capacity investments and the heuristic discussion on equilibrium shift in the next section.

Proposition 1 and the subsequent comparative static analysis provide sufficient conditions for the existence and comparative static properties of equilibrium by transformation of the game into a super-modular game. However, there may also be the possibility of a game form that does not satisfy any of conditions [SM1]—[SM3], that is, one in which $O$ and $C$ are strategic rivals in their transitional efforts as well as in their expected post-transition gains. We represent this strategic submodular case by the following specification. Assuming that $k_O \in K^+$ so that $O$ plays independently of $R$, we specify the TPM to be a kind of contest function as $P^N(k_R,k_O,k_C) = \frac{k_O + k_C}{k_R + k_O + k_C}$, and the post-transition payoffs of $O$ and $C$ with negative externalities as:

$$\pi^O(k_O,k_C) = \frac{k_O}{k_O + k_C} - \frac{k_C L^O}{k_R + k_O + k_C},$$

$$\pi^C(k_C,k_O) = \frac{k_C}{k_R + k_C} - \frac{L^C(\Delta \gamma)}{k_O + k_C}$$

where penalties $L^O$ and $L^C(\Delta \gamma)$ are assumed to accrue to the winner of the contest, while, as in the previous cases, penalty $L^R$ for $R$ for losing the contest is a deadweight loss. Then the condition for a symmetric general equilibrium solution is:

$$k_i^* = 0, \text{ if } \frac{\mu_i}{B_i} > \sum_{l \neq i} \frac{\mu_l}{B_l}, \text{ and } = 2(\sum_{l \neq i} \frac{\mu_l}{B_l} - \frac{\mu_i}{B_i})/(\sum_{l \neq i} \frac{\mu_l}{B_l}) \text{ otherwise } (i = R, O, \text{ and } C),$$

where $B^R = L^R + L^O + L^C, B^O = 1 + L^O, B^C = 1 + L^C(\Delta \gamma)$. $B^i, i = R, O, C$ is player $i$’s marginal gain from winning the contest and avoiding the penalty by increasing its own level of
deployment of its conflict-management capacity. Therefore, the ratio $\mu_i/B^i$ represents $i$’s marginal cost-benefit ratio in the deployment of its own conflict-management capacity. The player whose ratio is greater than the sum of the ratios of the two other players will exit from the contest in period II to avoid a penalty. If the ratios are sufficiently close among all the players, then fierce competition will ensue. It holds that $dk_i^*/d(\mu_i/B^i) < 0$ and $dk_i^*/d(\mu_j/B^j) = 0$ for $j \neq i$ so that each player will try to increase the deployment of its own conflict-management capacity only when its own cost-benefit ratio improves, but it will not respond to changes in the others’ ratios. In comparison to the comparative static properties of the super-modular game, this strategy appears to be too simple. But this property is a necessary outcome of the restrictive premise behind a ratio-type contest function, as already noted in footnote 8.

Proposition 3 In the three-way competitive case specified above, there are non-negative equilibrium strategies for all of the players if their cost-benefit ratios in the deployment of a conflict-management capacity are not too different from one another. They increase their strategies only when there is an increase in their own cost-benefit ratios.

We refer to the relevance of the 3-party competitive case toward the end of this article. By then, we have limited our discussion only to supper-modular cases so that dual equilibria are possible.

2.3 A general equilibrium of capacity investment decisions during period I

Moving backward from period II to period I, let us deal with the players’ choices of $\mu_i$’s and solves for their general equilibrium, $\mu^* = (\mu_{R}^*, \mu_O^*, \mu_{C}^*)$. Suppose for now that players’ common conjectures are that $O$ will play on either of the domains $K^-$ or $K^+$. In either case, equilibrium value of $K$ is expected to behave qualitatively in the same way in response to period I choice of $\mu$ accordingly as [CS1]. Therefore let us suppress the super/subscript that distinguishes between the two and represent the players’ rational conjecture simply as $K(\mu) = (k_R(\mu), k_O(\mu), k_C(\mu))$ with the derivative properties stated in [CS1]. Ignoring the players’ time preferences, each player’s expected payoff then can be written as $U^i = 2u^i* + P(k(\mu))u^{i+}(k_i(\mu)) + (1 - P(k(\mu)))u^{i-}(k_i(\mu)) - \mu_i k_i(\mu) - \varphi^R(\mu_R)$, where $u^{i+}$ and $u^{i-}$ represents $i$’s benefit in the event of transition and otherwise. The choice of $\mu^i_{\text{max}} - \mu_i$ at investment cost $\varphi^i(\mu_i)$ in period I is player $i$’s investment in its conflict–management capacity, where $\mu^i_{\text{stat}} = \varphi^{i-1}(0) \geq \mu_i \geq \mu^i_{\text{min}} = \varphi^{i-1}(M_i)$ with $M_i$ representing $i$’s initial resource constraints relevant to its capacity development and $\mu^i_{\text{stat}}$ is his/her initial
capacity endowment. The following Euler condition provides the individual optimal investment $\mu_i^*$ for each player:

$$ dB^i(\mu_i^*) = \left. \frac{d\varphi^i}{d\mu_i} \right|_{\mu_i^*}, \text{if} \int_{\mu_i^*}^{\mu_i^{\text{stat}}} dB^i(\mu_i) - \varphi^i(\mu_i^*) + \beta_i(\Delta \gamma) \geq 0 $$

$$ \mu_i^* = \mu_i^{\text{min}}, \text{if} dB^i(\mu_i^*) > \varphi^i(\mu_i^{\text{min}}) \text{ and } \int_{\mu_i^{\text{min}}}^{\mu_i^{\text{stat}}} dB^i(\mu_i) - \varphi^i(\mu_i^{\text{min}}) + \beta_i(\Delta \gamma) \geq 0 $$

$$ \mu_i^* = \mu_i^{\text{stat}} \text{ otherwise}, $$

where $dB^i(\mu_i)$ is $i$’s marginal benefit:

$$ dB^i = \sum_j \frac{\partial P^N}{\partial k_j} \frac{\partial k_i}{\partial \mu_i} (u^+ - u^-) - (k_i + \frac{\partial k_i}{\partial \mu_i}) \text{ for } i = R \text{ and } O \text{ on } K^-; \text{ and } $$

$$ dB^i = \sum_j \frac{\partial P^N}{\partial k_j} \frac{\partial k_i}{\partial \mu_i} (u^+ - u^-) + P^N(k_0) \frac{\partial \pi^i}{\partial k_O} \frac{\partial k_O}{\partial \mu_i} + \frac{\partial \pi^i}{\partial k_C} \frac{\partial k_C}{\partial \mu_i} - (k_i + \frac{\partial k_O}{\partial \mu_O}) \text{ for } i = O \text{ on } K^+ \text{ and } C $$

and $\beta_i(\Delta \gamma) = -\Delta \gamma$ for $i = R \text{ and } O$. The negative of the first term in each equation represents the respective player’s conjectured payoff gain from its own capacity investment via its impact on the TPM. The negative of the second term in the second equation represents the respective player’s expected marginal transitional gains, including those via the others’ reactive (positive or negative) strategic adjustments. The term $-(k_i + \partial k_i/\partial \mu_i)$ represents the player’s period II net cost-savings effect of its capacity investment.

Comparative property [CS1] for period I is easily transposed into the following equilibrium property of investment decisions (A proof is in note 11 below).\footnote{11}{The cross derivative, $\partial^2 U^i/\partial \mu_i \partial \mu_j = U^i_{ij}(i = R, O, C \text{ and } j \neq i)$, are derived as:

$$ U^i_{ij} = \sum_h P^N_h (\partial^2 k_h/\partial \mu_i \partial \mu_j)(u^+ - u^-) + 2[\sum_h P^N_h (\partial k_h/\partial \mu_i)] [\sum_h (\partial u^+/\partial k_h)(k_h/\partial \mu_i)] + P^N \sum_h (\partial(u^+ - u^-)/\partial k_h)(\partial k_h/\partial \mu_i \partial \mu_j) - \partial k_i/\partial \mu_j - \mu_i \partial^2 k_i/\partial \mu_i \partial \mu_j. $$

If an internal equilibrium is expected in period II, then by the envelope theorem, it is simplified as:

$$ U^i_{ij} = 2[\sum_h P^N_h (\partial k_h/\partial \mu_i)] [\sum_h (\partial(u^+ - u^-)/\partial k_h)(\partial k_h/\partial \mu_i)] - \partial k_i/\partial \mu_j. $$

If $O$ is expected to play on $K^-$ in period II, then for $i = R \text{ and } O$, $\partial(u^+ - u^-)/\partial k_h = 0$ for all $h$ so that $U^i_{Rj} = -\partial k_R/\partial \mu_j \leq 0$ for $j \neq R$ and $U^i_{OC} = -\partial k_O/\partial \mu_C \geq 0$. Between $O$ on $K^+$ and $C$, $U^i_{ij} = 2[\sum_h P^N_h (\partial k_h/\partial \mu_i)] [\sum_h (\partial u^+/\partial k_h)(\partial k_h/\partial \mu_i)] - \partial k_i/\partial \mu_j$, which is positive at least in the neighborhood of period II equilibrium except for a corner solution if it exists. Thus, $(U^R, U^O, U^C)$ are super modular in $(\mu_R, \mu_O^{\text{stat}} - \mu_O, \mu_C^{\text{stat}} - \mu_C)$. As $\partial \mu_i/\partial M_i \geq 0$, $U^i$ has increasing differences in $\mu^i$ (alternatively, $-\mu^i$ in case of $i = R$) and $M^i$, and thus [CS2] follows.
Proposition 4 If non-zero strategic equilibrium in period II is rationally expected by the players, then \((\mathcal{U}^R, \mathcal{U}^O, \mathcal{U}^C)\) are super modular in \((\mu_R, \mu_O^{stat} - \mu_O, \mu_C^{stat} - \mu_C)\) and there exist corresponding (locally-stable) equilibrium of positive investment decisions by all the players in period I. For this equilibrium, the following properties hold:

[CS5] each player’s investment is a non-decreasing function of his/her own resource endowment \(M_R\) on one hand, and \(C\) on the other would react negatively to the other’s resource endowment. \(O\) would react positively to \(R\)’s resource endowment if it expects equilibrium of type \(K^*\) and negatively otherwise.

[CS6] Investment decisions by \(O\) and \(C\) increases (alternatively decreases), if they expect mutual externalities (alternatively, rivalries) on the respective post-transition gains.

While a trivial outcome of the model, comparative Static property [CS6] re-focuses on the crucial leverage of the capacity building accumulated and distributed among all of the players as the “fundamentals” behind the institutional evolution path. And such capacities are certainly supported by the fiscal, economic, physical, and human resources. In this quasi-endogenous view of the institutional process, our model shares insights with the 2-person game model as developed by Besely and Perrson (2012) and others, although we emphasize shortly the importance of communicative and entrepreneurial elements of capacity. It is contrasted with the premise found often in the literature, such as that the polity determines the economy (e.g., Acemoglu and Robinson 2008), or that “the implied outcome of [political equilibrium]... is extremely difficult to alter, short of major shocks imposed from outside” (Brandt, Ma, and Rawski 2014; p. 66).  

2.4 Two coordination mechanisms for a transition

Finally, we consider \(C\)’s decision of \(\Delta \gamma\) at the beginning of the game, that is, with regard to whether or not, and how much if at all, to deviate from the canonical state of play as well as its possible impacts on the subsequent equilibrium path. First, let us note that simple calculations show the following increasing difference of \((\mathcal{U}^R, \mathcal{U}^O, \mathcal{U}^C)\) in \(\mu_i (i = R, O, C)\) and \(\Delta \gamma\):

\[
\frac{\partial^2 \mathcal{U}^R}{\partial (-\mu_R) \partial \Delta \gamma} = \sigma \frac{\partial P^R}{\partial (-\mu_R)} L_C' (\Delta \gamma) > 0; \quad \frac{\partial^2 \mathcal{U}^O}{\partial (-\mu_O) \partial \Delta \gamma} = (1 - \sigma) \frac{\partial P^O}{\partial (-\mu_O)} L_C' (\Delta \gamma) > 0 \text{ on } K^- \text{ and } = 0 \text{ on } K^+; \text{ and } \frac{\partial^2 \mathcal{U}^C}{\partial (-\mu_C) \partial \Delta \gamma} = \frac{\partial P^N}{\partial (\mu_C)} L_C' (\Delta \gamma) > 0. \text{ Thus, the larger the deviation of } C \text{ from the canonical state of play at the beginning of period I, every player will step up its investment in its}
\]

\footnote{To be fair, their narrative is essentially strategic.}
own conflict-management capacity, except that $O$ may adopt an opportunistic attitude when it is expected to play on $K^+$. Suppose first that, at the time of the initial decision, $C$ believes that $O$ will play on $K^−$ in period II and it chooses $\Delta γ$, based on the rational expectation that it would generate an equilibrium conflict situation, $k_∗(\mu(\Delta γ)) = (k^R∗(\mu(\Delta γ)), k^O∗(\mu(\Delta γ)), k^C∗(\mu(\Delta γ)))$ in period II which will, in turn, generate the possibility of an institutional transition to a new state with the TPM equal to $P^N(k_∗(\mu(\Delta γ)))$. Recalling that his/her investment decision is constrained by his/her resource endowment (cf. [CS5]), (s)he then maximizes

$$\Delta γ∗ = \arg \max_{\Delta γ} U^C(k_∗(\mu(\Delta γ : M^C)) + β^C(\Delta γ))$$

where $β^C(\Delta γ)$ is, as already introduced, $C$’s initial benefit (or cost if it is negative) from revolt in the beginning of period I. If the maximand is non-positive for any $\Delta γ > 0$, then $\Delta γ∗ = 0$, which is followed by $μ∗ = (μ^Cstat, μ^Ostat, μ^Cstat)$ in period I and $k∗ = (0, 0, 0)$ in period II, thus the canonical status quo as a subgame perfect equilibrium.

Suppose that $C$ otherwise ventures to solely challenge the canonical state of platy. The outcome will be a transition to a new state or his/her defeat according to the corresponding TPM. At this point, no insights qualitatively different from an analysis of a 2-person game are gained. However, suppose that, as long as the outcome is the status quo or the defeat of the challenger, the game will be repeatedly played for the next round by the same players or by their successors who might learn from the past plays. How do they learn? Proposition 2 reveals that $O$ may potentially be better off if an equilibrium of a type–$K^∗$ is materialized, even if ex ante investments were made in the expectation of equilibrium of type–$K^∗$ in period I. But as already noted, this preference alone would not immediately justify the $O$’s unilateral shift of play to $k^O∗(\Delta γ)$ that is dominated by $k^O∗(\Delta γ)$ for $O$ without coordination (cf., [UD_{O∗}]). Between $C$ and $O$, there may be two possible mechanisms to overcome this to achieve coordination, even possibly involving $R$.

One is a possibility of a simple agreement between $C$ and $O$ to make the joint choices of $k^O∗(\Delta γ)$ and $k^O∗(\Delta γ)$ as a way out of the smallest Nash equilibrium and to exploit the possible strategic complementarities in a conflict situation in II. This could become possible if

$$P^F(k^R∗, k^O∗, k^C∗)[L^O−+ (1−σ)L^C(\Delta γ)]−L^O−−|k^O∗|μ^O(\Delta γ) < P^N(k^R∗, k^O∗, k^C∗)[π^O(k^O∗, k^C∗)+ L^O]−L^O−−k^O∗|μ^O(\Delta γ);$$

$$P^N(k^R∗, k^O∗, k^C∗)[π^C(k^O∗, 0) + L^C(\Delta γ)]−k^C∗|μ^C(\Delta γ) < P^N(k^R∗, k^O∗, k^C∗)[π^C(k^C∗, k^O∗)+ L^O].$$
\[ L^C(\Delta \gamma) - k^*_C \mu_C(\Delta \gamma). \]

Theoretically, this is an obvious mechanism. However, if \( O \) and \( C \) have been entrenched in the status quo at the canonical state of play in the past or have invested in conflict-management capacities in anticipation of strategic rivalries with each other, such an implementation may not be automatic. As David Lewis (1969) recognized some time ago, more than individual rationality is needed for all the players to know, all know that all know, and so on ad infinitum about the others’ conjectures regarding which path of play the others will follow. A solution to this time-honored cognitive problem may be provided, as suggested by Lewis himself, by a public summary representation of a focal state of play from which all can derive inferences relevant to its realization.\(^{13}\) Therefore, when a transition from one Nash equilibrium to another is at issue, various public propositions may compete for a position of saliency to re-direct the strategic realignments. Envisioning and reaching a coordination agreement may then require conflict-management capacities of \( C \) and \( O \) that involve political, diplomatic, expressive, and other kinds of skills not limited to fiscal and military capacities.

Further, as coordination becomes more likely between \( O \) and \( C \), enhancing the likelihood of a transition, \( R \) might become better off by a reduction in the expected loss \( L^R \) in a possible event of a transition. This loss can be characterized by various kinds: they may be either (expected) psychological losses, a depreciation of political and social capital, or even the possibility of deadly physical penalties on the ruler or the challenger (e.g., the guillotine or harakiri). Their standards may be given at the beginning of period I, for instance as part of what the canonical state of play implies. But their actual applications may also be renegotiable during period II, depending on the evolution of the conflict situation at that time. If such a move is indeed reached among the players possibly with the position-shifting \( O \) as an intermediary, then \( R \)'s resistance would be mitigated (cf.[CS2]), which would further enhance the likelihood of a transition. The historical narrative in the next section provides prominent examples of salient public propositions that make such a strategic deal public and thus common knowledge.

The second mechanism focuses on the entrepreneurial role of \( C \).\(^{14}\) Suppose that when \( C \) chal-

\(^{13}\)For recent game-theoretic and philosophical discussion on relations between equilibrium and its linguistic representations (e.g., political proposition, idea, rules, norm and so on), see Aoki (2011) and Hindricks and Guala (2014).

\(^{14}\)A somewhat similar mechanism is analyzed in Bueno de Mesquita (2010) that joins a third party, the “revolutionary entrepreneur”, to a global model.
lenges the canonical state of play, every one chooses an investment strategy by learning from past rounds of play of the game in the following a way: there is no other strategy that will do better against every combination of the past strategies. Then a super-modular analysis can assure that the evolving state of play will approach some equilibrium after a certain time, without exploding as in cases of the best response dynamics or fictitious play (Milgrom and Roberts 1990: Theorem 8 and its corollaries). If the game has been played according to the canonical state of play or on domain $K^-$, what this adaptive process would likely to converge to is a type-$K_*$ equilibrium. Suppose, however, that all of sudden $C$ takes a bold and sole move to experiment with dominated strategy $k^*_C$ as formalized in $[UD_{C_+}]$. This may not appear as rationalizable. However, if such a strategic possibility is incorporated into the $O$’s information set, it may enhance the $O$’s information structure and thus provide an incentive to experiment on domain $K^+$, which may eventually lead the game to a type-$K^*$ equilibrium. A transition to a new state still may not occur, if the value of TPM is not sufficiently high. But successive rounds of such a play, combined with changes in the fundamentals $M^i$’s, might eventually lead the game to a transition, although its timing cannot be predicted. Such mechanism of institutional entrepreneurship is illustrated in the following section.

3 Feedbacks between the Model and Historical Information

This section provides a narrative on the stability, decay, and demise of the political-economic orders of Qing China (1644 - 1912) and Tokugawa Japan (1603 - 1868) in a manner that parallels the analytical story in the previous section. The stage of economic growth in each country during these periods may be considered to roughly correspond to the Malthusian phase of economic growth in which a predominant portion of GDP is produced in the rural economy. However, this section omits the technological and demographic variables that are the foci of standard unified growth theory (Galor 2005, 2011) and instead focuses on the relationship between the political and economic variables: How were the economic orders during the Malthusian phase in each country politically supported and constrained, and how were their political orders eventually undermined by the emerging economic potentials, ultimately leading to their demise. This involves both generic as well as unique elements in each country. In order to examine them in a unified manner, the above model provides a useful framework.

The discussion below proceeds in chronological order by comparing China and Japan in similar manners: (1) first, it describes the canonical state of play as the stable strategic relationship between
the ruler, the peasantry, and the intermediary agents: the gentry in the case of China and the Han (the incorporated body of the Samurai bureaucrats) in the case of Japan; (2) it then observes the emergence of instability in the canonical order caused by increasingly opportunistic strategies by the gentry and the Han; (3) next, it pinpoints the roles of transitional entrepreneurs and political propositions to bring about coalition-making in a manner reminiscent of the convergence to a type $K^*$ equilibrium; and (4) finally, albeit beyond the scope of the model, it discusses the impacts of the particular modes of transition on post-transitional conflicts regarding the constitutional design. The historical narrative below is highly stylized and limited to the bare minimum that is necessary for feedback between the analysis and the histories that allows for a reinterpretation of the histories.\textsuperscript{15}

### 3.1 Stylized states of play constituting the canonical states

During the heyday of the Qing dynasty and Tokugawa dynasty (roughly, in the mid-seventeenth century), their economic foundations were rural economy-based, whereby the overwhelming share of productive activities, both agricultural and handicraft manufacturing, were managed and carried out by independent conjugal peasant families. On the other hand, the political states could be characterized as types of tax states. A tax state in a modern market economy, as first envisioned by Schumpeter (1918/91), consists of 3-elements: (1) universal taxation on the population by a unitary government; (2) the provision of basic public goods, such as national defense, internal security and protection of property rights, by a government holding a monopoly over legitimate force; and (3) the existence of a permanent bureaucracy administering both public finance and military affairs. There were significant and unique modifications and deviations from these generic principles in the pre-modern states of China and Japan, but we posit that their characterizations as peasant economy-based tax states may not be markedly off the point. Then what were basic relations between this type of state and the peasant-based economy? Were they nothing more than ubiquitous authoritarian rule by the dynastic ruler (e.g., Landes 2006), only subject to occasional revolts from the peasantry?

\textit{Qing China: Webs of strategic complementarities.} More than three-quarters of the official public revenue in Qing China during the eighteenth century was derived from land taxes.\textsuperscript{16} The

\textsuperscript{15} For more detailed historical information, as well as for more comprehensive references, Aoki (2012), Brandt, Ma, and Rawski (2014), and Sng and Moriguchi (2014) may be consulted.

\textsuperscript{16} The actual share would be much higher if the unofficial tax surcharges on farmland, as discussed below, were included. There were no official taxes on commerce or manufacturing at the national level, with the exception of taxes on
land tax was officially imposed on landowners in the official registry. Self-managing peasants may, or may not, have owned the lands they cultivated. But large landlords, estimated to have owned not more than one-quarter of the farmlands, did not manage farming by themselves and they leased out the own lands to peasant families. In that way, the agricultural productivity of the peasantry, which constituted more than 95 percent of the population, was the essential tax base for the Qing ruler. On the other hand, more than one-half of the official public expenditures by the central government were made to sustain the monopoly by the quasi-nomad Manchu Qing ruler over legitimate force. As is well known, public finance and military service were officially administered by the centralized bureaucratic apparatus, which was served by scholar-officials selected through multi-level imperial examinations. The essential reason for the adoption of this indigenous, time-honored apparatus by the Qing ruler was that it served as a device to prevent the possible emergence of challenges by landownership-based, force-backed local powers.\textsuperscript{17}

But there was more than just that. There was a type of complementarities between Qing governance and the peasant family-based economy. The Qing’s ability to collect taxes depended on the peasants’ productivity, while the security of the peasants’ productive activities, property rights in productive assets, including those related to non-taxable domestic manufacturing, were assured by the Qing’s centralized military and police power against possible aggression by foreigners, competing armies, bandits, and so forth. It should be noted that this differed from the situation in medieval Europe when manufacturing activities and assets had to be protected by the walls of autonomous city (Wong 1987; Rosenthal and Wong 2011). Theoretically, if there were such complementarities and if the dynastic ruler was aware that he could not observe all the efforts of the peasantry so that taxation has distortional effects on peasants effort allocation, then it was in his interests to provide more public goods and impose less tax on the peasantry than otherwise (e.g., Bardhan 2014).

However, set aside from the centralized military power, the size of the Qing government apparatus was small relative to the scale of national land and the size of population (e.g., Sng and Moriguchi 2015). There were fewer than 40,000 office-holders \textit{vis-à-vis} the population of some 380 millions in 1820. At the county level, on average a magistrate ruled over a population of 200,000 or more. The solution was tax farming by the gentry who resided locally. These were the people who had passed the imperial examinations at the county levels but did not hold off-

\textsuperscript{17}This is originally due to an insight by the Japanese Sinologist Konan Naito. On this, see Brandt, Ma, Rawski (2014), p.49.
of positions, numbering about 700,000, occupying 0.18% percent of the entire population in 1842 (Chang 1955: p.102). The amount of land owned by the gentry was not as much as that owned by the gentry in contemporaneous England. In fact, a large majority of the gentry were even landless (Chang 1967). However, some enterprising people from the gentry class became active in intermediating public finance, both in tax collection and public goods provision. In the Yangzi delta region where commerce and agriculture were the most advanced, they formed formal organizations, known as landlord bursaries (zuzhan). They collected rents from (tens of) hundreds of lease-holding peasant families, and from these rents they paid taxes to the magistrate, charged fees to be kept for themselves, and distributed the remainder to the landlord members of the bursaries. They also sought the assistance of the magistrate to use official force and legal provisions whenever necessary to settle any rent arrears by tenants (Muramatsu 1966). For political correctness, these organizations were often disguised as clan organizations, but in fact they assumed corporate characteristics, such as voluntary participation by the landlords including those unrelated by blood, perpetual life independent of lives of individual members, and permanent administrative organizations. Thus the local officials and the gentry strategically complemented each other to mutually facilitate tax and rent collection.

There were, however, also subtle elements of complementarities between the gentry and the peasantry as well. Some peasant families disguised their land ownership as lease holdings from the gentry to hide them from the magistrates and their clerks so as to protect themselves from abusive tax surcharges by local officials, while the gentry extracted protection fees from the peasant families in the disguise of rents. In addition, because the actual length of the terms in office of the county magistrates was short— from one to five years— much of the practical management of local public goods, such as the repairing of roads, the building of bridges, the construction of dikes, and so forth,

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18 Today members of the Chinese Communist Party constitute about 6 percent of total population.
19 Moral hazard problems at the county level caused by tax farming are well documented by Zelin (1984) and studied empirically by Sng (2014) using a principal-agency framework.
was in the hands of the local gentry. Further, in the early nineteenth century and thereafter when
the security of peasants’ property rights was increasingly threatened by bandits, secret societies,
rebellious religious groups, and so on, the powerful gentry became active in organizing village-
level militia training groups, called \textit{tuanlian}, which existed in some tension with the official local
security forces (Kuhn 1970).

Thus the gentry possessed a Janus-like character. One face was directed to the dynastic ruler
and the office-holders, facilitating the latter’s governability while aided by the latter in sustaining
their own political and power in the locality. The other face was directed to the peasantry, provid-
ing local public goods and security for the peasants’ property rights, thereby achieving economic
gains, local political power, and social prestige. Let us refer to these stable patterns of strategic
linkages among the dynastic ruler, the scholar-officials, the gentry, and the peasant families, which
sustained the complementarities between the Qing tax state and the peasant family-based economy,
as the \textit{Q-canonical state of play}. As the complementarities were essentially strategic-based, their
sustainability could become problematic if the major agents accumulated a capacity to deviate from
the canonical state. This indeed became the case in the second half of the nineteenth century.

\textit{Tokugawa Japan: A nested structure of strategic coalitions.} The geography of Tokugawa Japan
was divided into the largest domains governed by the Shogunates government, the Bakufu, and
some 260 other domains, large and small, each governed by the respective Han possessing the
characteristics of a peasant economy-based tax state by itself. There was no difference between
the Bakufu and the Han in that they each had exclusive rights within their respective domains to
universal taxation on the farmland cultivated by the peasant families listed in the official registry
as well as to legitimate force. Both public finance and military affairs were administered by the
corporate body of inheritable samurai-bureaucrats, the Samurai Inc., to which the word Han may be
referred.

As this Bakufu-Han regime was firmly institutionalized, actual tax collection was farmed out to
autonomous village offices headed by elite peasant families: a practice called village-undertakings
\textit{(mura-uke)}. The tax rate was then subject to de facto bargaining between the Bakufu/Han gov-
ernment and the village office, sometimes accompanied by collective actions by village members,
including primitive uses of violence, called \textit{ikki}. As the state of play between the Samurai, Inc. and
the village thus generated a de facto pact (Asao 1994), the peasantry as a collectivity became the
residual claimant after fulfilling their tax obligations. This led to a norm of cooperation in developing local infrastructure such as irrigation, maintaining internal security, handling disputes with the government and other villages, and so forth, enforced by the autonomous policing power and the threat of social ostracism against a member’s shirking. On the other hand, the Samurai, Inc. was able to secure tax collection by enforcing the pact and constraining peasants’ mobilization out of the village based on threats of potential use of its force. Thus, the quasi-tax state of the Bakufu/Han and the peasant-based economy became institutional complements.

Then what was the nature of the strategic relations between the Bakufu and the Han, each embedding a strategic pact of its own with the village under its respective jurisdiction? Conventionally, this has been characterized as a feudal state à la medieval Europe. However, the initial assignment of a domain to each Han by the Shogunate was not really a reward for loyal military service by the Daimyo to the Tokugawa family. Rather, it represented a military equilibrium among the various samurai corps who had competed for jurisdiction over exclusive tax authority during the preceding Warrior period. The Tokugawa family was no more than a distinct leader of the winning coalition that emerged during that era. The Tokugawa family was able to enjoy a certain degree of discretion in the initial domain assignments to the Daimyo after being endowed with the symbolic title of the Shogunate (inheritable commander-in-chief) by the Emperor as a public representation of the achieved military equilibrium. However, Shogunate’s ability to do so were implicitly constrained. In one case, the Shogunate attempted to transfer a Daimyo from the productive Tsuruoka Han, but had to forgo the attempt when it faced oppositions including from other unrelated Daimyo and tax-paying peasants in the domain.

Thus an institutional aspect of the Bakufu-Han regime may be understood as an all-inclusive coalition of the Han, with the residual power of the Shogunate such as foreign diplomacy and mintage as the focal representation of this order. This coalitional structure of the Han nesting the pact with peasant village may be referred to as a T- canonical state of play.

3.2 The emergence of resource-based, decentralized capacities that destabilized the canonical order

Qing China: The emergence of de facto fiscal federalism. More so than the Opium War which was provoked by British troops, a first major challenge against the Q-canonical state of play was the internal Taiping Rebellion (1850-64). During this period, the population was reduced by some 50
millions (about 13 percent of the population), including death toll due to famine and starvation.\textsuperscript{20} The military capability of the regular armies of the Qing was too weak to resist the rebellion. The final defeat of the rebellion was owed to the quasi-public armies organized by elite scholar-officials off duties on the basis of networking the aforementioned village-based militia groups. Local gentry and peasantry in the relatively affluent Yang-zi Delta region whose property and lives were threatened by the rebel’s aggression were recruited to join the armies. The heavy cost of supporting the quasi-public armies was mainly financed by the introduction of regional commercial taxes. This was a major departure from the principle of avoidance traditionally observed in the Qing tax state in which the scholar-officials were separated from the indigenous sources of economic gains and political force. It became clear that the Q-canonical state could not be sustained against domestic rebellion without the strategic support of the elite gentry’s conflict-management capacity.

The elite gentry chose to continue to play with the dynasty even after the settlement of the mass rebellion, however, but with much more autonomy. Fifteen former officers of the quasi-public armies later became viceroy}s and provincial governors. They engaged in developing their own industrial and military capacities in respective provinces by increasingly relying on the regional commercial taxes and promoting homemade industrial policies. Such opportunities were facilitated by the development of commerce at the treaty ports that intermediated the rising commercialization of products by “peasant-family firms” in the hinterlands (Brandt 1989; Keller, Li, and Shuie 2012). Some provincial governments acquired the right to mint higher denominations of copper coins to facilitate trade and obtained substantial seigniorage, as the value of copper appreciated by approximately 25 percent against the officially used silver between the end of the Taiping Rebellion and the turn of the century.

The second major trigger for altering the nature of the rural-based tax state was the Qing defeat in the Sino-Japanese War (1894-95) and the devastating impact of the Boxer Uprising (1900). These two incidents made even the conservative and inward-looking imperial court aware of the need to strengthen its military capability through modern training and improved weaponry. It thus decided to replace the traditional Eight Banners Armies by the New Armies to be established in the provinces. After the 1905 abolition of the centuries-long tradition of the imperial examinations, many aspiring youths entered the newly created military academies, and hundreds were sent annually by the government to Japan for military education. Members of this new generation of

\textsuperscript{20}The number is from Maddison (2006), Appendix Table 5a, p.538.
military trainees were eventually appointed commanders, councilors, or officers in the provincial New Armies, replacing the scholar officials as an autonomous organization equipped with legitimate force. The costs of decentralizing military power to the provincial levels were borne by the respective provinces.

Parallel with the increasingly autonomies of the provincial governments and the new armies, elite gentry in urban centers were able to develop stronger strategic alliances with them. They were made to bear the costs for the provision of local public goods as well as costs of supporting new armies in the form of arbitrary tax assignments and voluntary contributions. However, the development of economic and social infrastructure, and the internal security afforded by military force of the new armies, facilitated the expansion of trade and secured their commercial and private property rights and monopoly market positions. In this way, the focal point of strategic complementarities between the gentry and the government now slanted to the province level, on the basis of the regional commercial development of the peasant-based rural economy. Thus the Qins tax state increasingly incorporated elements of a de facto fiscal federalism, limiting the scope of the Board of Revenue only to control of the marginal transfers from the wealthier to the poorer provinces. Accordingly, the local elites shifted their strategic positions from complementing the dynastic ruler to substituting for it, if not yet openly challenging the Qing ruler.

Japan: Internal challenges within the Bakufu-Han regime. In the 1830s situations emerged that destabilized the T-canonical state of play, both in terms of the Han-village pact and the Bakufu-Han coalitional regime. Public finance by the Han traditionally had relied on taxation denominated in quantities of rice, and gradually it was supplemented by borrowing from merchants based on rice-exchange promissory notes. However, the Han governments in the productively more-advanced domains began an attempt to capture rents from the increasing commercialization of their peasant family-based economies. Take the example of the Choshu Han that was to play an important strategic role in the forthcoming Meiji Restoration. The production of commercialized crops and handicraft goods by peasant households developed to such an extent that more than one-half of the Han GDP was produced outside of traditional farming. The Han government set up monopsonic product-exchanges managed by wealthy merchants. This tax-farming device incited large-scale

21For the political economy of the Choshu, see Nishikawa (1987) and Saito (2005); and for its political role as an entrepreneurial challenger inclusive of the peasantry, see Tanaka (1998)
peasant *ikki* against the Han offices and merchant houses. They demanded a deregulation of market transactions and a reduction in land taxes as well as democratic reform of the village offices. The Han government had to yield to this by replacing the Han monopsony with commercial taxes imposed on licensed merchants. Radical lower-class samurai-bureaucrats eventually took over the Han government through a coup d’etat and organized the quasi-official “odd-soldiers troop,” including recruits from peasants and outcasts, which were to play a significant role in the decisive conflict with the Bakufu army during its final days.

Even within the Bakufu domain, there were widespread peasant revolts during the last decade of Tokugawa rule. By then, the village undertaking in the Bakufu domain had been institutionalized as a formal pact between the local offices of the Bakufu government and the quasi-official organizations of village representatives who were the relatively well-to-do farmers. But the latter came under increasing pressure from the middle-class peasant activism and the lower-class peasant militancy. By the 1830s the Bakufu government leaders, indoctrinated by the conservative agrarian ideology, never promoted a proto-industrial policy in its domain. It tried to expand the tax basis by costly reclamation, which did not produce the expected outcome. Thus the Bakufu government was forced to rely on seigniorage for needed revenue, while imposing larger shares of the rising costs for national defense and public work expenditures on the Han. Thus inflation was inevitable and undermined the official austerity policy of the Bakufu. The powerful Han started to question the leadership role of the Shogun in the Bakufu-Han coalitional regime. When the Bakufu government signed open-trade treaties with the Western powers without imperial sanctioning, some of the more powerful Han and lower-ranked radical samurai-bureaucrats across the Han found a legitimate reason to openly challenge the Bakufu’s leadership. During the final two decades of Tokugawa rule, leadership conflicts became increasingly confrontational, involving terrorist actions and small-scale military engagements between regular troops on both sides in breach of the T- canonical rule of play.

### 3.3 The final events: Transitional entrepreneurship and salient public propositions.

The final exits from the canonical state of play was realized in each country by the formation of a strategic alliance against the ruler among determined challengers, on the one hand, and opportunists or moderates, on the other, in a manner reminiscent of a transition through an equilibrium of type-$K^*$ based on [SM2]. However, such a formation was achieved only after trial and error on each side, involving strategic experiments by transitional entrepreneurs. During the final stage a broadly
acceptable and legitimizing proposition swept a way to a transition by making a broad anti-dynastic coalition possible.

**Japan: The Meiji Restoration.** Various oppositions against the Bakufu employed the slogan of Expel the Barbarians. However, its connotation soon became to represent the need for nation-state building in the midst of Western aggression rather than unrealistic retreat to seclusion from it. Under pressure, the Bakufu tactically shifted its stance to its own version of Expel the Barbarians by seeking an alliance with the Emperor who felt the insecurity of his position. In an attempt to break this *ad hoc* Emperor-Bakufu alliance, the Choshu mobilized its military force in Kyoto where the Emperor resided, but its attempt failed. The Choshu Han was officially declared to be an enemy of the imperial court by the Emperor. Yet, the Choshu Han dared to bomb allied European battleships passing through the strait facing the domain on the very day that the Bakufu had promised that the treaties with the Western powers would be nullified. Not surprisingly, they lost the battle and ended up paying large indemnities to the Europeans, but their rebellious entrepreneurship earned them moral prestige among the radicals, both inside and outside the domain. Militarily powerful Satsuma Han, also bombed by the British Navy in retaliation of the killing of an Englishman by its member, became also aware of the need to remove the Bakufu from the ruling position for the ski of strong nation-building.

By skillful diplomacy Satsuma and Choshu eventually succeeded in forming a formidable alliance with the moderates, the Tosa Han and the Hizen Han. The Tosa had formerly advocated the establishment of a congress in which all the Daimyo were to be represented with the Shogun as a possible chair, while the Hizen had been active in industrial policy by taking an advantage of its position responsible for the defense of open Nagasaki port. They made the slogan Reverence for the Emperor as their sole public proposition, while shelving their potential differences on all other political issues. They mobilized their troops against the Bakufu under the pretext of an imperial order issued by the new Meiji emperor. At that point, the Tokugawa family gave up its resistance, surrendering the title of Shogunate to the imperial court in 1867. The four Han organized a transitional government, formally ending the Bakufu-Han regime 1871, which is now referred to as the Meiji Restoration. The head of the Tokugawa family was compensated by the new government with entitlement to the rank of the highest court.
China: The Xinhai Revolution. As the weakened governing capacity of the Qing ruler became ever more apparent, the Confucian fiction of governance as the mandate of Heaven began to lose its legitimizing power. Prior to the emergence of Western nationalism, the most appealing revolutionary slogan in southern China in the late nineteenth century was Oppose the Qing, Restore the Ming, meaning the restoration of governance by the Han ethnic group over the territory of the preceding Ming dynasty. Later in 1985, influenced by Western nationalism, the oath of membership to Sun Yat-sen’s Revive China Society used the rhetoric of Expel the Tartar Barbarians, Restore Zhonghua – meaning in classical Chinese the middle country where moral and literary principles thrive –, and Establish a United Government.22 This anti-Manchu proposition gradually captured the minds of the Han people, particularly the young soldiers in the south.

After several abortive attempts of violent actions by the radicals under the entrepreneurial influence of Sun Yat-sen, finally in 1912 the uprising of the New Army in Wuhan was able to proclaim the independence of Hubei province from Qing rule. This move was quickly followed by similar declarations by the New Armies and/or the consultative gentry councils in fourteen other provinces. Their anti-Manchu sentiments among them were symbolized by their eighteen-star flag representing the number of provinces of Han ethnic origin. Representatives of these provinces elected Sun Yat-sen as president of the provisional republican government. Under Sun’s influence, they proceeded to declare the establishment of a republic to be run by people of the five nationalities (the Han, Manchu, Tibetans, Mongols, and Muslims) rather than by the Han alone, however, and after heated debate they adopted the five-star flag instead of the eighteen-star flag.

This inclusive proposition was effective in forming a broader transitional coalition and reducing the resistance by the Qing ruler and his supporters. Sun offered to yield the presidency to Yuan Shikai, a formidable military commander of the New Army in the capital province of Zhili, if Yuan could coax the imperial court into voluntary abdication. Yuan had been under imperial orders to suppress the independence movement militarily, but the softened political stance of the Revolutionary group vis-à-vis the Manchu ruler certainly made him easier to accept this offer. The young imperial ruler had no choice but to abdicate on the assurance that he could stay on with his family and staff in the Forbidden Palace before moving to the Summer Palace.

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22In 1905, the Tongmenhui, a united revolutionary group also led by Sun Yat-sen, having by then been influenced by Western socialism, modified this oath by replacing the third item with Establish a democratic state; Distribute land property rights equally.
3.4 Impacts on the post-transition constitutional agenda

The final exits of both China and Japan from their respective canonical states of play had certain basic common features. They were realized when moderates or opportunists abandoned their state-abiding strategies and a broad anti-dynastic coalition was formed, subsequent to transitional entrepreneurial actions by the determined challengers. As a result, in both Japan and China, the transition from a pre-modern state was realized in a relatively bloodless way, reminiscent of the comparative static property [CS2]. However, there is also a difference between their two paths that may have had an impact on their respective subsequent institutional evolutions.

In the case of the Meiji Restoration, the formation of a transitional coalition was negotiated and implemented among players with similar backgrounds as the samurai-bureaucrats who had administered their own tax states within their domain. Even the Shogunate’s staff, who had negotiated the bloodless surrender of the Edo castle with the four Han, had the same background. The rebel troops of the four Han also had even popular support of the village members for their anti-Bakufu movement in their domain and beyond, at least up to the Meiji Restoration.\(^\text{23}\) In contrast, the Xinhai Revolution was realized by ad-hoc alliance-making among agents of varying backgrounds and varying policy orientations: from the self-claimed revolutionaries led by Sun Yat-sen, to the liberal officials and soldiers in the New Armies in the south, to the urban elite gentry in local public offices and quasi-private domains, and even to conservative and ambitious military leaders, such as Yuan Shikai who later proceeded to make a futile attempt to become emperor. In the sense that the way in which the strategic capacities and orientations of the players were diverse and were mobilized in a manner of “proceeding separately, but hitting the same target together,” the Xinhai Revolution may be thought of being more consistent with the conditions for a transition [SM2].

This difference between the two appears to have left their legacies on the subsequent institutional paths in each country. In Japan, the difference in pre-transition policy orientations between the hard-liners and the moderates re-emerged in the post-transition debate over constitutional design. The hard-line Choshu clan pushed for the establishment of a centralized bureaucratic state legitimatized by imperial authority. The clan skillfully engineered its supremacy over the ex-Tosa moderates and others who advocated the introduction of a constitutional monarchy. However, after

\(^\text{23}\)This de facto political alliance between the activist samurai-bureaucrats and village members quickly became problematic when the transitional government executed the militant leaders of the odd-soldier troop from Choshu who opposed the way by which national conscripted army was to be formed (Tanaka 1998).
proclamation of the constitution by the Meiji Emperor in 1889, there emerged a sort of co-existence of an authoritarian government bureaucracy on one hand and a parliament dominated by large landlords who acquired de facto veto power over government budgets on the other (Banno 2014: 98-99). It was as if a structure somewhat homeomorphic to the pact between the Samurai, Inc. and the village (officials) in the T-canonical state of play were replicated at national level.24

In contrast, soon after the euphoria of Xinhai Revolution, China faced a formidable challenge for the building of a nation state, which required the reconstruction of administrative bureaucracy, legitimate force, and fiscal capacities in the vacuum left by the demise of the Qing ruling apparatus. Its quintessential question was how to strike a balance between the traditional centralized unification and the emergent trend toward federalism or regionalism. The Provisional Constitution of 1912 stipulated a unitary state, but it did not define the organizational position of the provincial governments within the framework of the unitary republic, relations between the (civic) administration and the army, and so on. Indeed, underlying the conflict between centralization and federalism, there was a fundamental political-economy issue about how the potential of the peasant-based economy could be linked to the political state in lieu of the Qing tax state. Although the prosperity of the federalist-oriented provinces prior to the transition was based on their market linkages to the developing peasant-based economy in their hinterlands, there was no clear political program among the transition-seekers to develop this potential.25

During his tenure as president of the Republic, Yuan Shikai succeeded in achieving a modicum of unification of the national economy, as evidenced by the expanded circulation of the national currency. The appreciation of silver during World War I contributed to its wider acceptance as well as to a reduction in the real value of the governments debt obligations to foreigners. After the failure of abortive attempt by Yuan Shikai to become emperor by himself and subsequent his death in 1916, his generals began to compete with one another for military hegemony that would assure them an access to land taxation. To counter this, Sun Yat-sen attempted to advance to the North to complete his unification agenda, organizing his own troops and relying on fiscal resources in the relatively

24 As Francis Fukuyama (2014) and Junji Banno (2014) point out, it would be possible to posit a counter-factual history where such system evolved in a more English style democratic direction absent an autonomous military.

25 In his speech at a reception by the Shanghai Newspaper Guild Sun Yat-Sen (1912) expressed his agricultural land policy as that parliaments were to determine farmland prices and government would then charge a tax in a fixed proportion, say 10 percent, to the value, and government would acquire a portion of the ownership equivalent to the subsequent appreciation in value. Its implementation would be far from realistic in terms of administrative burdens and would be inconsistent with wither of the peasants’ and landlords’ incentives for economic development.
prosperous South. The military conflicts thus put colossal pressures on the public finance capacity of the provinces. Chen Jiongming, civil governor of Guangdong province and commander-in-chief of the Guandong Army, resisted the Sun’s unification drive by force and advocated the idea of a “federation of self-governing provinces” (liansheng zizhi) along the legacy of the autonomous tendency in the southern provinces during the late Qing era.26 Even young Mao expressed a federalist inclination, just three years prior to his joining in the formation of the Communist Party in 1921 (Mao 1920/92: 526-530). The uncompromising three-way contest without much room for strategic complementarity was only settled by the establishment of military hegemony under Chiang Kai-shek in a manner that resonates with Proposition 3.

4 Summary and Concluding Remarks

This article combines an analysis of a new 3-person game model and comparative institutional interpretations of Chinese and Japanese political-economic histories. The basic idea is to conceptualize an institution as a stable state of play in a game and its transition as a move from one stable state of play to another. In lieu of the 2-person game and global games in the literature on regime change, this article proposes a 3-person, 2-period model. The introduction of a third party, dubbed the opportunist in this article, enriches the performance of the game. The model predicts that, if certain technological and/or preference conditions hold, there may be two types of equilibria, dubbed the type-$K^*$ and the type-$K_*$, with a high or low likelihood of transition, respectively. However, the selection of one of the two possibilities cannot entirely be resolved by an assumption of individual rationality in terms of learning and dynamic adaptation. Instead, this article points to two possible mechanisms for facilitating the institutional transition: a public-proposition-based coalitional agreement between the challenger and the opportunist; and a transitional entrepreneurial role by the challenger. The article then illustrates and substantiates this analysis-based story with a historical narrative on two major events of institutional transition from pre-modern states: the Meiji Restoration in Japan and the Xinhai Revolution in China. Paralleling the historical narratives with

26 For recent studies on Chen’s federalist movement based on detailed documentary evidence, see Chen (1999) and Duan and Ni (2009). In current official histories of both the Chinese Communist Party and the Kuomintang, Chen is now dismissed as an evil warlord. However, Bertrand Russell, who was a visiting professor at Peking University in 1920, had a high opinion of Chen, as did John Dewey who at the time was engaged in consultancy on education reform. See Russell (1922: 67, 26869). With regard to potential for federalism, Chinese style, in the context of recent economic-reform, see Montinola, Qian, and Weingast (1998).
the performance characteristics of the strategic model facilitates new comparative interpretations of the two events.

The analysis and narrative hopefully make it clear that the fundamentals of a game of institutional resilience versus transition are economy-based political capacities among agents. The sizes, relative distribution, and interactive uses of these capacities among the agents determine the likelihood of an institutional status quo, resilience, or transition. In turn, a political transition may accelerate or inhibit technological and human capital development to achieve economic process, depending on the ways in which the agents’ political capacities are generated and mobilized. Thus, a political institutional transition may be regarded as co-evolving with a phase-shift in the economic growth path that is envisioned in unified growth theory.

Admittedly, the model and the interpretation of the historical narrative in this article only focus on some particular aspects and cases during the institutional process. As a result, there are certainly limits to the scope of the model, requiring both some comment and an apology. First, the model focuses only on the endogenous nature of the institutional process. Of course, in actual development processes some external shocks, such as foreign military and economic impacts, natural environmental disaster, and so on, may prompt strategic readjustments among the domestic agents. This was particularly conspicuous during the period of our narrative—nineteenth-century China and Japan. More generally, any institutional process proceeds through feedbacks of the environmental dynamics to the endogenous play of domestic game. However, it is the evolving configuration of strategic choices by the internal agents that ultimately shapes the domestic institutional forms. Attributing the sources and the consequences of the institutional process entirely to foreign shocks could mislead us to a biased historical awareness of the practical implications. Of course saying so does not imply that the impacts of Western imperialism (and Japanese imperialism in the first half of the twentieth century) are regarded as irrelevant or insignificant for understanding political-economic processes in East Asia since two centuries ago. The players’ beliefs and values about the external impacts can be understood as implicit in their payoff functions and their derived strategies, however, as exemplified by the public rhetoric such as Expel the Barbarians.

Second, some characteristics of the institutional transitions from pre-modern states in China and Japan may appear to be rather unique as that of revolution. They may include the crucial role of some inside agents in the old establishments as active carriers of transitional movement; the removal of the dynastic rulers without bloodshed; and the absence of prior agreements about the
post-transition political agenda among the challengers. These phenomena may be better explained in terms of the 3-person game rather than the 2-person game which would rather entail only a black-or-white outcome. But does this mean that a 3-person model, more broadly conceived, is East Asian-specific and irrelevant elsewhere? We may wonder however if it is not the case that the North-Weingast (1989) perspective on the Glorious Revolution, as well as that of Weingst (1997) on the fundamental nature of the rule of law, is also built on insights from a class of 3-person game. What about the nature, processes, and consequences of the fierce conflicts between moderates and radicals surrounding the decay, demise, and legacy of ancient regimes, say, through the French Revolution or the February-October Revolution in Russia? It is hopeful that, although limited in scope and simple as a model, this article can provide food for thought on the possible relevance and enrichment provided by a broader class of 3-person games as a useful toolkit for comparative historical analysis beyond East Asia.

References


