Chapter 4

A Model of Institutions and Commitments in Illiberal Regimes

This chapter presents a formal model of the political dynamics of tax commitment in regimes with weak accountability mechanism. This model more explicitly exposes the core assumptions of the theory presented in the preceding chapter and formalizes the logic and arguments using fairly basic solution concepts in non-cooperative game theory such as Nash equilibrium and subgame perfection. In particular, this model features two important specifications of the strategic scenario underlying the mechanism of commitment in regimes with weak institutions. The first specification is that the ruler of the regime cannot discriminate domestic and foreign agents when setting the tax rate. The second is the one that characterizes international institutions primarily as the set of instruments that reduce the cost on the foreign investors in resorting to the outside option once the implemented tax rate deviates from the optimum. The model in general shows the external institutions that reduce the transaction cost among the foreign actors can have significant impact on the domestic policy outcome given the strong presence of the economic contribution by foreign factor owners.

4.1 A Simple Model of Commitment Difficulty

I start this chapter by presenting a simple model that characterizes the source and nature of the commitment difficulty in non-democratic regimes. Commitment difficulty of all kinds largely stems from the existence of time-inconsistent behavior and policies which are usually modeled in dynamic settings. Here I present a very simple baseline model of
commitment difficulty making use of very basic solution concepts such as Nash equilibrium and subgame perfection. Such a simple model is developed to keep the analysis as tractable as possible so that future extensions can be applied in a straightforward manner. This simple model captures the central mechanism of interactions between the state and economic actors in a specific political context and presents concise characterization of the sources of commitment difficulty. In later part of the chapter I release the assumptions of the simple model and explore the strategic choice of the actors in the respective political economy context.

There are two actors in this model – a producer ($P$) and an autocratic ruler ($A$). The producer is endowed with an unity of divisible resource and she can invest part or all of it into the production from which consumable good is produced. Let $e \in [0, 1]$ denote the amount of the resource that is invested by the producer. The uninvested part of the resource cannot be consumed and has no direct value. The ruler does not own any resource and does not participate in the production process, but she has the unilateral power to tax the output of the production with a linear tax rate, $\tau \in [0, 1]$. Making investment and collecting taxes are costly for the producer and the ruler and the cost is marginally increasing in the amount of investment and the linear tax rate respectively. Let $E$ and $T$ denote the set of strategies of the producer and the ruler respectively. $E \times T$ is the set of all possible combinations of strategy. The utility function of both the ruler and the producer are strictly concave. The utility function of the producer is given by the after-tax income:

$$Y(e) = (1 - \tau)e - \frac{1}{2}e^2.$$

Notice the production function is simply $Q(e) = e$ with an unity output elasticity. The utility function of the ruler is formulated as

$$R(\tau) = \tau e - \frac{1}{2} \mu \tau^2,$$
where $\mu \in \mathbb{R}^+$ denotes the marginal cost of taxation. The utility functions of the actors adopt these specific forms for illustration purposes but the major results of the model will hold with any concave functions that guarantees an unique interior solution to the respective maximization problem.

4.1.1 The Case of Credible Commitment: Sequential Moves

This subsection characterizes the dynamics of the game where the ruler can make credible commitment on any tax rate between zero and one. To enable the ruler to convince the producer of the credibility of commitment at any $\tau$ in $[0, 1]$, I let the game to proceed sequentially where the ruler leads the game by setting the tax rate $\tau$. The producer then observes the $\tau$ set by the ruler and then decide how much investment is to be made. It is an one-shot game thus the ruler must implement the announce tax rate after the output is yielded. Thus, the ruler could make credible commitments on any tax rate and the producer is assured that the announced tax rate will be implemented. In this game with the ruler being the Stackelberg leader, the set of tax rates on which credible commitment can be made is simple the set of all real numbers falling between zero and one. This structure of the game is oftentimes referred to as the “commitment power” of the leader in Stackelberg game. In the political economic context of the model, such a game characterizes a scenario where it is impossible for the leader to renege on previously made commitments because of existing institutional constraints. Solving the game by backward induction, the unique subgame perfect equilibrium is $\{e^D, \tau^D\}$ where

$$e^D = \frac{1 + \mu}{2 + \mu} \quad \text{and} \quad \tau^D = \frac{1}{2 + \mu}$$

The logic of backward induction very well captures the credibility of policy induced by institutional constraints and its impact on the strategic incentive of the ruler in setting the optimal tax rate. Because the credibility of the commitment on any tax rate is guaranteed,
the producer invests $e$ according to her best response function

$$BR_P : e(\tau) = 1 - \tau$$

Thus, any $\tau$ set by the ruler leads to a subgame in which the producer’s decision is characterized by $BR_P$. By doing backward induction, the ruler plugs $e(\tau)$ into $R(\tau)$ and maximizes it with regard to $\tau$, from which $\tau^D$ is obtained. The ruler picks the $\tau$ that maximizes the revenue given the well-anticipated response from the producer. Because the ruler cannot renege on the tax rate after investment is made, $\tau^D$ and $e^D$ mutually reinforce each other as the equilibrium behavior. The outcome of the equilibrium $\{e^D, \tau^D\}$ characterizes the most efficient strategy combination among all incentive compatible outcomes.

This subgame perfect equilibrium is, however, very sensitive to the sequential specification of the game. As I show in the next subsection, the ruler’s strategy in the subgame perfect equilibrium is no longer the best response to $e^D$ if the ruler can no longer be Stackelberg leader of the game.

### 4.1.2 The Case of Limited Credibility: Simultaneous Moves

Rulers in illiberal regimes are less likely to be bound by formal institutional constraints on their behavior and policy than leaders in democratic regimes. Thus the central temporal setting of the Stackelberg game is barely applicable to regimes with weak democratic institutions and little checks and balance of power. Instead of constraining the ability of the ruler to renege on tax rate, the model in this section assumes the ruler and the producer moves simultaneously. Specifically, the producer is unable to observe the tax rate set by the ruler before investment decision is made. Specifying the game in such a manner captures the structure of commitment difficulty as follows. Since the producer cannot observe the tax rate set by the ruler, commitments on tax rate are mostly non-credible except for those that spontaneously emerge in the Nash equilibrium of the game with simultaneous moves. Nash
equilibrium of the game describes the steady state of the strategic interaction that emerges out of an institution-vacuum environment—the actors can alter their behavior and hence the outcome of the game whenever they feel like and none of them can lock-in to any outcome of the game as in the Stackelberg game.

Specifying the game in this way results in a shift of the equilibrium away from that of the Stackelberg game, essentially because the ruler now can no longer hold on to $\tau^D$ if he can alter the tax rate even after the investment decision is made. The ruler is unable to make credible commitments on low tax rates because she will always attempt to grab more of the output once the investment is made. In other words, the optimal tax rate that maximizes $R(\tau)$ given $e = e^D$ is always higher than $\tau^D$. To see this, note the best response function of the ruler is

$$BR_A: \tau(e) = \frac{e}{\mu}$$
Plugging in $e^D$, the optimal tax rate is given by

$$\tau(e^D) = \frac{1 + \mu}{\mu} \cdot \frac{1}{2 + \mu},$$

which is strictly greater than $\tau^D$. Thus, it is impossible for the ruler to convince the producer that $\tau^D$ will be implemented because the producer is intelligent and can foresee the ruler’s incentive in deviating to higher tax rates. $\tau^D$ is thus not in the set of tax rates on which commitment can be made. Anticipating the tax rate, $\tau^D$, to be non-credible, the producer will lower the investment to be made, which then again induces the ruler to adjust the tax rate downward. This game with simultaneous move is a simple reductionist characterization of the time-inconsistency problem. Analogous to the logic of repeated elimination of strictly dominated strategies, deviations away from \{\(e^D, \tau^D\}\} will eventually converge to a steady state which is the Nash equilibrium of the game with simultaneous moves, \{\(e^S, \tau^S\}\} where

$$e^S = \frac{\mu}{1 + \mu} \quad \text{and} \quad \tau^S = \frac{1}{1 + \mu}.$$

This equilibrium characterizes the steady state of the strategic interaction when both actors are allowed to alter their actions indefinitely until both of them are satisfied with the outcome. Comparing to the subgame perfect equilibrium which is induced by the institutional environment, this equilibrium is more of a spontaneous outcome that remains stable even the actors are given considerable freedom of moves in the game. Such a spontaneous equilibrium is, however, less efficient than the subgame perfect equilibrium. It is easy to see the equilibrium tax rate in the spontaneous equilibrium is always greater than that in the subgame perfect equilibrium, i.e. $\tau^S > \tau^D$. From the perspective of the level of total output, higher tax rate is always inefficient because it suppresses the investment by the producer, resulting in a lower total output. Figure 4.1 visually compares the ruler’s revenue function in the spontaneous equilibrium and the subgame perfect equilibrium. Notably, $\tau^D$ and $\tau^S$ correspond to the maxima of the revenue functions, $R(\tau|e^S)$ and $R(\tau|e(\tau))$, in each of the scenarios. The dashed curve in the figure, $R(\tau|e^D)$, represents the revenue function given
the producer invests $e^D$ as in the subgame perfect equilibrium and it is obvious to see in the figure that the optimal $\tau$ that corresponds to the maximum of $R(\tau | e^D)$ is greater than $\tau^D$. Thus $\tau^D$ cannot be sustained in the spontaneous equilibrium. If the ruler bothers to make any commitment on tax rate, only the commitment to $\tau^D$ would be credible.

The efficiency implication of the model is salient. As Figure 4.1 shows, the spontaneous equilibrium results in lower revenue in the equilibrium for the ruler. The ruler could induce more investment with lower tax rate from which greater tax revenue can be extracted, i.e. and $R(e^S, \tau^S) < R(e^D, \tau^D)$. In fact, the payoffs for the ruler and the producer in the spontaneous equilibrium are both less than those in the subgame perfect equilibrium. Notice the best response for the producer is always $e(\tau) = 1 - \tau$ regardless the sequence of play. Rewriting the after-tax income function of the producer with $e = e(\tau)$, it is obtained

$$Y(\tau) = \frac{1}{2} (1 - \tau)^2,$$

(4.1)

which is monotonically decreases in $\tau$ in the internal $[0, 1]$. Thus it is easy to see

$$Y(e^S, \tau^S) < Y(e^D, \tau^D).$$

The spontaneous equilibrium is thus Pareto inefficient. In essence, the model implies that both the ruler and the producer could be better-off if the ruler can expand the range of $\tau$ at which credible commitment can be made. This model of commitment is the central component of the political model I developed in the succeeding part of the chapter where the ruler in the simultaneous equilibrium attempt to remedy the inefficient outcome. Specifically, the possibility of improvement concentrates on the revenue function, $R(\tau | e(\tau))$, as plotted in Figure 4.1 because the function between $\tau^D$, and $\tau^S$ represents the set of the outcomes that are incentive compatible Pareto improvements upon $\{e^S, \tau^S\}$. Incentive compatibility is attained when the outcome constitutes the stable combinations of strategies had the ruler have the ability to credibly commit to each of the tax rates lower than $\tau^S$. In the succeeding
sections, motivated by the incentive to remedy the inefficiency, the ruler attempt to make use of commitment devices to induce outcomes that improves upon the spontaneous equilibrium.

4.2 A Political Model of Economic Commitment

In this section I extend the commitment model to allow the ruler to modify domestic institutions as a way to expand the range of tax rates on which credible commitment can be made in the spontaneous equilibrium. In the spontaneous equilibrium in the model presented above, the producer has no other means of affecting the policy of the ruler except for reducing the amount of investment in the production. This is sort of true in illiberal regimes where the citizens are deprived of any political rights and underinvestment is one of the few economic weapon that they could wield against the ruler. To improve the economic performance and optimize tax extraction, the ruler needs to introduce some constraints that can push the ruler to refrain from deviating to higher tax rate once investment decision is made by the producer.

In the model presented in this section I depict a scenario where the ruler could politically empower the producer which help bind the ruler’s hands and induce credible commitments at lower tax rates. The key logic in the political model of commitment is that the autocratic ruler could tie her hands by enabling the domestic producers, if they choose, to replace him with a successor at a cost, which disincentivizes the ruler from being overly predatory in taxation. Once the domestic producers decide to replace the incumbent ruler, I assume the successor that comes to power would have the capability of making credible commitment at any tax rate. That is, the game will allow the successor to be the Stackelberg leader if the incumbent ruler is ever deposed by the domestic producers.
4.2.1 Core Assumptions of the Model

4.2.1.1 Actors and Strategies

The set of actors in this political model is \( \{ A, P, S \} \) where \( A \) is the autocratic ruler, \( P = \times_{i \in n} P_i \) is the set of homogeneous domestic producers with the mass of one. \( S \) represents the potential successor if the incumbent ruler is removed by the domestic producers.

The ruler has two decisions to make. First, she sets a linear tax rate, \( \tau \in [0,1] \), as in previous models. Secondly, she can directly shape the cost of deposition, \( c \). This can be easily done in illiberal regimes by changing the level of political repression. Here I assume the game start with a status quo value of \( c \), \( c^0 \), and the ruler may set a new \( c \) that is different from \( c^0 \) if needed. Setting a new value of \( c \) is costly for the ruler and the cost is linear in the distance between the chosen level of \( c \) and the initiate state of the cost of deposition, \( c^0 \). As I show later, because the ruler’s decision on \( c \) directly affects the optimal level of taxation, it is the core instrument for making credible commitments. The successor, \( S \), who does not get to play in the game until the producers decides to depose the ruler, is identical to the ruler except for the fact that he could lead the game by setting the tax rate that is observable to the producers.

The same as in earlier models, the producers choose the amount of resource, \( e \), to be invested. Moreover, the producers can now depose the ruler if they find the successor more favorable than the incumbent. The decision to depose the ruler or not is indicated by \( d \in \{ 0, 1 \} \). \( d = 1 \) indicates the decision to depose the incumbent and \( d = 0 \) indicates the decision to keep the incumbent in power.
4.2.1.2 Sequence of Play

The model is specified as a static one-shot game which is intended to provide a reductionist characterization of the central mechanism of the political model of commitment. The sequence of play is formulated as follows:

1. The ruler moves first by setting the value of \( c \) which is immediately observable by the producer.

2. Simultaneously, the ruler set the tax rate \( \tau_A \) and the producer makes investment, \( e_A \). \( \tau_A \) and \( e_A \) become common knowledge once the decisions are made.

3. Upon observing \( \tau_A \) and \( e_A \), the producer chooses \( d = 0 \) or \( d = 1 \):
   - if \( d = 0 \), the game ends and the ruler and producer receive their payoffs, which are \( R_A(e_A, \tau_A, c) \) and \( Y(e_A, \tau_A) \) respectively.
   - if \( d = 1 \), the game play enters the subgame \( \Gamma^{d=1} \). The producer pays the cost, \( c \), and the ruler is replaced by a successor and receives zero as her payoff. The successor then leads the subgame \( \Gamma^{d=1} \) by setting \( \tau_B \), which is then observed by the producers before choosing \( e_B \). The successor and the producers receives their payoffs, which are \( R_S(e_B, \tau_B) \) and \( Y(e_B, \tau_B) - c \).

Specifically, the sequence of play is set in this order such that the producer is given the chance to depose the incumbent ruler after observing the tax rate and her investment. This characterizes the mechanism of the political device of commitment with which the realization of the ruler’s revenue income hinges on the satisfaction of the producer on the tax rate being set.

4.2.1.3 Utility Functions and Payoffs

The payoffs of the actors are obtained from the utility functions specified as follows. The incumbent ruler’s payoff at the end of the game is a combination of the revenue function
and the producer’s decision to depose or not, which is given by

$$R_A(\tau,c) = (d - 1) \left[ \tau e - \frac{1}{2} \mu \tau^2 - \alpha |c^0 - c| \right]$$  \hspace{1cm} (4.2)

The term $\alpha |c^0 - c|$ on the RHS indicates the cost associated with changing the level of political repression. $\alpha$ is the marginal cost of switching $c$ away from the status quo. The incumbent will receive zero if the producer decides to replace her with the successor. If the producer ever deposes the incumbent, the successor’s payoff is simply the revenue function:

$$R_S(e,\tau) = \tau e - \frac{1}{2} \mu \tau^2$$  \hspace{1cm} (4.3)

The producer’s income function $Y(\cdot)$ is given by:

$$Y(e,\tau) = (1 - \tau)e - \frac{1}{2} e^2$$  \hspace{1cm} (4.4)

At the end of the game, the producer receives $(d - 1)Y(e_A,\tau_A) + d(Y(e_B,\tau_B))$ as her payoff.

### 4.2.2 Analysis

The model can be solved with backward induction starting from the subgame $\Gamma^{d=1}$. Note the subgame is identical to the the equilibrium in the credible commitment model presented earlier. The equilibrium in $\Gamma^{d=1}$ is \{e\_B = e\_D, $\tau$\_B = $\tau$\_D\}

The producers will depose the ruler upon observing the tax rate set by the ruler, $\tau_A$, if

$$Y(\tau^D) - c \leq Y(\tau_B)$$  \hspace{1cm} (4.5)

The ruler prefers to stay in power($R > 0$) with the maximized tax revenue so he will choose $\tau$ such that $Y(\tau_B) \geq Y(\tau^D) - c$ or

$$\tau \leq Y^{-1}[Y(\tau^D) - c] \equiv \hat{\tau}(c)$$  \hspace{1cm} (4.6)

Since $\tau_B = Y^{-1}(\cdot)$ monotonically decreases in $Y$, $\hat{\tau}(c)$ increases in $c$. Plugging in the best response of the producer, the tax revenue function for the ruler is

$$R(\tau) = \tau (1 - \tau) - \frac{1}{2} \mu \tau^2$$  \hspace{1cm} (4.7)
Letting \(\alpha |c^0 - c|\) denote the cost of liberalization which increases as the cost of deposition decrease, the ruler at the start of the game faces the following problem:

\[
\max_c \{ R(\hat{\tau}(c)) - \alpha |c^0 - c| \}
\]

(4.8)

c\(^0\) is the initial level of the cost of deposition. Because \(R(\tau)\) decreases in \(\tau\) and \(\hat{\tau}(c)\) increases in \(c\), \(R(\hat{\tau}(c))\) decreases in \(c\). Thus \(c\) in equilibria should never be greater than \(c^0\) and \(|c^0 - c| = c^0 - c\). Let \(R(\hat{\tau}(c)) - \alpha (c^0 - c) \equiv U^\alpha(c, \alpha)\), it is easy to notice

\[
\frac{\partial^2 U^\alpha(c, \alpha)}{\partial c \partial \alpha} = 1 > 0
\]

c\(^*\)(\(\alpha\)) \(\in \) arg max\(_c U^\alpha(c, \alpha)\). According to monotone comparative statics, \(c^*\) is increasing in \(\alpha\).

Intuitively, this results shows that politically conservative regimes tend to be more repressive even if such repressiveness lowers the political efficiency.

**Lemma 4.2.2.1.** \(c^*(\alpha, \mu) \in \) arg max\(_c U^\alpha(c, \alpha)\) decreases in \(\mu\) and increases in \(\alpha\).

Similarly, given

\[
U^\alpha(c, \mu) = \hat{\tau}(c)[1 - \hat{\tau}(c)] - \frac{1}{2}\mu[\hat{\tau}(c)]^2 + \alpha c
\]

and

\[
\frac{\partial^2 U^\alpha(c, \mu)}{\partial c \partial \mu} = -\frac{\partial \hat{\tau}(c)}{\partial c} < 0,
\]

c\(^*\) decreases in \(\mu\). This results shows that fiscally weak regimes tend to be less repressive followed by the observation that the marginal return in revenue extraction could not compensate the marginal cost of repression at high levels of repressiveness.

**Proposition 4.2.2.1.** \(\hat{\tau}(c)\) decreases in \(\mu\) and increases in \(\alpha\).

Moreover, the tax revenue in equilibrium decreases in \(\mu\), indicating states with strong extractive capacity could achieve higher revenue in equilibrium with higher levels of repression than regimes with weaker extractive capacity.

**Corollary 4.2.2.1.** *The overall efficiency in the political economic system increases in \(\mu\) and decreases in \(\alpha\).*
4.3 A Model of Commitment with Foreign Input

I now extend the political model of commitment by considering the impact of foreign investors on the domestic commitment. All of the assumption of the earlier model is retained except for there are producers contributing in the production process who are not citizens of the regime. The foreign producers and the domestic producers are different in that the option to depose the ruler is not available to foreign producers. However, foreign producers have outside options once they find the tax rate set by the ruler unacceptable. Foreign producers may choose to withdraw their investment if they can obtain higher income elsewhere given the tax rate set the ruler. For now I assume the foreign producers are homogeneous with the mass of $\gamma$ relative to the mass of domestic producers in the economy. Letting $g$ denote the investment made by foreign producers in the economy, the after-tax income function of the foreign producers is the same as the domestic producers:

$$Y_g = (1 - \tau)g - \frac{1}{2}g^2$$

Given the presence of foreign producers in the economy, the ruler’s revenue function becomes

$$R^r = \tau \frac{(e + \gamma g)}{1 + \gamma} - \frac{1}{2} \mu \tau^2,$$

which is different from the revenue function presented earlier in that there are domestic and international sources of investment. The weight of foreign producers in the economy relative to domestic producers is indicated by $\gamma \in \mathbb{R}^+$. 

The timing of the game play is similar to the model of autarky except for that the foreign producers could choose to resort to the outside option once they observe the tax rate set by the ruler. If outside option is not revoked and the domestic producer deposes the ruler, the foreign producers follow the successor by investing after the new tax rate is set. The equilibrium of the subgame $\Gamma^d$ when the incumbent is deposed is identical to that in
the autarkic model which is \( \{ e^D, \tau^D \} \).

### 4.3.1 Pattern of the Interaction between the Foreign Producer and the Ruler

In this part I explore the way that foreign producers interact with the ruler and how such interaction affect the equilibrium tax rate. For this moment I assume the domestic producers are not given the chance to depose the ruler so the game ends after the foreign producers’ decision to withdraw or not. The foreign producers may resort to the outside option after observing the tax rate set the ruler. If the outside option is revoked, the ruler only get the domestic portion of the total investment. Letting \( q \in \{0, 1\} \) denote the decision to withdraw investment, foreign producer has the following utility function when faced with the decision to resort the outside option or not.

\[
Y_g = (q - 1) \left\{ (1 - \tau)g - \frac{1}{2}g^2 \right\} + q\hat{Y}
\] (4.9)

where \( \hat{Y} \) is the payoff from the outside option. Again the foreign producer decides on \( q \) after observing the tax rate set by the incumbent ruler. By backward induction, obviously,

\[
q = \begin{cases} 
0 & \text{if } (1 - \tau_A)g - \frac{1}{2}g^2 \geq \hat{Y} \\
1 & \text{if } (1 - \tau_A)g - \frac{1}{2}g^2 < \hat{Y}
\end{cases}
\] (4.10)

Let \( \tau^g = Y_g^{-1}(\hat{Y}) \). i.e. \((1 - \tau^g)g - \frac{1}{2}g^2 = \hat{Y}\). \( \tau^g \) thus provides the maximum tax rate at which foreign producers would not strictly prefer to resort to the outside option. The best response function of foreign producers is given by:

\[
g = \begin{cases} 
1 - \tau & \text{if } \tau \leq \tau^g \\
0 & \text{if } \tau > \tau^g
\end{cases}
\] (4.11)

Accordingly, the ruler’s utility function is given by:

\[
R^\tau = \begin{cases} 
\frac{\tau e + \gamma g}{1 + \gamma} - \frac{1}{2}\mu \tau^2 & \text{if } \tau \leq \tau^g \\
\frac{\tau e}{1 + \gamma} - \frac{1}{2}\mu \tau^2 & \text{if } \tau > \tau^g
\end{cases}
\] (4.12)
If the domestic producer is not given the chance to depose the incumbent, the equilibrium when $\tau \leq \tau^g$ is provided by $\{e^S, \tau^S\}$ and the equilibrium when $\tau > \tau^g$ given by:

$$
\hat{\tau}^* = \frac{1}{1 + \mu(1 + \gamma)}; \\
\hat{e}^* = \frac{\mu(1 + \gamma)}{1 + \mu(1 + \gamma)}
$$

(4.13) (4.14)

The following assumption is introduced to bound the payoff from outside option to a meaningful range such as that the equilibrium results derived later are non-trivial.

**Assumption 4.3.1.1.** The maximum tax rate begetting non-zero foreign investment give the outside option $\hat{Y}$, $\tau^g(\hat{Y})$, is bounded between the equilibrium tax rate that is Pareto optimal and the equilibrium tax rate with no credible commitment, i.e. $\tau^g(\hat{Y}) \in (\tau^D, \tau^S)$.

Based on the assumption, several results are derived. First, the ruler always prefer to set the minimal tax rate at which the foreign producers do not strictly prefer the outside option. In other words, the ruler is always better off if the foreign producers do not resort to the outside option.

**Lemma 4.3.1.1.** $\max\{R^\tau(\check{\tau}^*, e^*)\} \equiv R^\tau(\hat{\tau}^*, \hat{e}^*)$. i.e. the ruler always obtains greater tax revenue when the foreign producers are present, or $R^\tau(\hat{\tau}^*, \hat{e}^*) > R^\tau(\check{\tau}^*, e^*)$.

**Proposition 4.3.1.1.** In equilibrium, the ruler always sets $\tau = \tau^g(\hat{Y})$. The foreign producers set $q = 0$ and all producers set $e = 1 - \tau^g(\hat{Y})$.

Proof. See Appendix.

Proposition 4.3.1.1 states that the ruler will always set the tax rate which makes the foreign producers indifferent between making investment and resorting to the outside option. Given this tax rate is lower than the tax rate given no outside option, the existence of foreign producers always improves the efficiency in the domestic political economic system by inducing a lower tax rate and higher level of investment in the equilibrium.
Corollary 4.3.1.1. The social welfare in the political economic system improves as \( \hat{Y} \) grows, i.e. both \( R \) and \( Y \) in equilibrium increases in \( \hat{Y} \).

Corollary 4.3.1.2. The social welfare in equilibrium associated with \( \hat{Y} \) decreases in \( \mu \). The presence of foreign producers contributes to greater improvement of efficiency in cases of low cost of taxation and high extractive capacity.

4.3.2 Taxation under Deposition and Diversion of Foreign Investment

In the preceding section the domestic producers are deprived of the right to depose the incumbent and the only mechanism of inducing lower tax rate hinges on the outside option of the foreign producers. Now I allow the domestic producer to depose the ruler at a cost and the ruler can determine the cost, \( c \), while the threat of diversion of foreign input is present. The cost of adjusting \( c \) is set to be associated with the initial states of the deposition cost, \( c^0 \), at the start of the game. For this moment, assume the foreign producers have no exit option or \( R(\tau) \equiv R^g(\tau) \). The ruler faces the following problem with regards to \( \tau \) and \( c \):

\[
\text{arg max}_{c \in [0,c^0]} \{ R(\tau) - \alpha |c - c^0| \}
\]

For now I introduce the following assumption to narrow the range of the initial state of the \( c^0 \) to illiberal regimes with high levels of repression. Recall that given certain \( \tau \), there exists a corresponding minimum level of \( c \) such that the domestic producers are indifferent between deposing and not deposing the ruler. Define \( \hat{c} : T \rightarrow C \) to be the function which provides the minimum \( c \) that keeps the ruler in power. To limit the analysis to those regimes plagued by commitment difficulty, the initial state of \( c^0 \) is assumed to be greater than or equal to the minimum \( c \) that politically sustains the sub-optimal tax rate \( \tau^S \) under no credible commitment.

Assumption 4.3.2.1. \( c^0 \geq \hat{c}(\tau^S) \).

Allowing the foreign producers to withdraw investment, the ruler may be able to avoid paying the cost of liberalization while achieving more optimal taxation and investment.
Lemma 4.3.1.1 suggests the presence of foreign input enables the ruler to credibly commit to $\tau^g(\hat{Y})$. Given Proposition 4.3.1.1, the existence of foreign producers always improves efficiency upon the outcome under no credible commitment even with no adjustment of $c$. If the revenue under foreign input, $R(\tau(\hat{Y}))$, is greater than the maxima of the revenue with reduced $c$, the ruler could attain greater efficiency without liberalizing. Otherwise, the ruler will still liberalize such that greater revenue can be attained. The maxima of $R(\tau, c)$ in equilibrium will be the greater among the two.

$$R^*(\tau, c) = \max\{R(\tau(\hat{Y})), R(\hat{\tau}(c^*)) - \alpha|c^0 - c^*|\}$$

Given that $R(\tau(\hat{Y}))$ is continuous and increasing in $\hat{Y}$, there exists a value of $\hat{Y}$ at which the ruler is indifferent between liberalizing to $c^*$ or setting the maximum tax begetting foreign investment.

**Proposition 4.3.2.1.** Given $\mu \in M$, $\alpha \in A$, and $c^0 \in C^0$, corresponding to each element in $M \times A \times C^0$, there exists a $y^D \in Y^D$ such that $R(\tau(y^D)) = R(\hat{\tau}(c^*)) - \alpha|c^0 - c^*|$.

*Proof.* See Appendix.

**Proposition 4.3.2.2.** $R(\tau(\hat{Y})) \geq R(\hat{\tau}(c^*)) - \alpha|c^0 - c^*|$ iff $\hat{Y} \geq y^D$.

*Proof.* See Appendix.

Thus the function $f : M \times A \times C^0 \rightarrow Y^D$ provides the value of $\hat{Y}$ at which the ruler is indifferent between liberalizing or not. The critical value of $y^D$ is shaped by $\mu$.

**Corollary 4.3.2.1.** $y^D$ increases in $\mu$.

**Corollary 4.3.2.2.** $\tau(y^D) \geq \hat{\tau}(c^*)$.

When the cost of taxation is low, the ruler is less likely to liberalize. Moreover, there exists a $\mu^D$ such that the ruler would liberalize ($c = c^*$) iff $\mu > \mu^D$. This is shown in Figure 4.2. This simple model presents a logic in which foreign producers with bargaining
leverages (indicated by favorability of outside options) could constitute effective commitment device that substitutes political liberalization. The substitution effect is particularly strong if the regime has greater extractive capacity. The rationale for this claim is as follows. As shown earlier, greater extractive capacity leads to greater distortion of efficiency, which asks for more radical liberalization to remedy. Contrary to the efficiency loss from liberalization, the presence of foreign input incurr no cost on the ruler’s revenue. Thus at given levels of $y^D$, the credible commitment induced by foreign actors attains more efficiency gains than the commitment induced by domestic liberalization as the cost of taxation, $\mu$, decreases.

The model can be made more realistic by a couple of Extensions. First, the foreign producers may not be identical to each other and could differ from each other in some characteristics and the structure of such heterogeneity may affect the ruler’s strategy. Secondly, resorting to outside options is so far assumed to be costless for foreign producers, which is barely true in reality. The cost associated with outside option may be modeled as

Parameter value: $\alpha = .1; c^0 = .4; y^D = .3$.

Figure 4.2: Cost of Taxation and Liberalization Payoff
endogenously derived by the outcome of interaction between the foreign producers and the autocratic state. The next section present a model that undertakes these two considerations.

Parameter value: $\mu = .5; \gamma = .2; \lambda = 0$. Incentive Compatibility (IC) curves are shown in dashed curves.

Figure 4.3: Equilibrium Tax Rate and Revenue: Costless Outside Options

### 4.3.3 Heterogeneous Producers and External Commitment Devices

Now I release the assumption that foreign producers are homogenous. Foreign producers now differ in their outside options $\hat{Y}$ which are distributed between $\underline{y}$ and $\bar{y}$ with distribution function $F_Y(\cdot)$. Inheriting Assumption 4.3.1.1, $\underline{y} = Y(\tau^S)$ and $\bar{y} = Y(\tau^D)$. Furthermore, I introduce the cost of diverting investment, $\lambda \in \mathbb{R}^+$, into the model. If producer, $i$, decides to divert investment to outside option, her payoff is now given by $\hat{Y}_i - \lambda$. Given certain tax rate set by the ruler, $\tau$, the proportion of the foreign investors who would not resort to the outside option is given by $F_Y(Y(\tau) + \lambda)$. Since the income function of foreign producers is identical to that of the domestic producers, as long as a foreign producer stays in the economy, she invests the same amount as all the domestic producers. Thus the
effective investment made in the country given $\tau$ is now weighted by:

$$\frac{1 + \gamma F_Y(Y(\tau) + \lambda)}{1 + \gamma}.$$ 

If the ruler can make credible commitment at any tax rate (i.e. the ruler is Stackelberg leader), the equilibrium is identical to that in the previous section regardless of the cost of outside option.

Parameter value: $\mu = .5; \gamma = .2; \lambda = .1$. Incentive Compatibility (IC) curves are shown in curves.

Figure 4.4: Equilibrium Tax Rate and Revenue: Costly Outside Options ($\lambda = .1$)

**Proposition 4.3.3.1.** If the ruler can credibly commit to any tax rate, the unique equilibrium of the game with heterogenous foreign producers is $\{\tau^D, e^D\}$.

Define $\hat{\tau}(\hat{Y}_i)$ to be the maximum tax rate to make producer $i$ to stay, which is obtained through solving $Y(\tau) = \hat{Y}_i - \lambda$ for $\tau$. To simplify the algebra, instead of making assumption on the function form of $F_Y(\cdot)$, I turn to assuming $\hat{\tau}$ follows continuous uniform distribution, i.e. $\hat{\tau} \sim U[\tau^D - \lambda, \tau^S - \lambda]$ with distribution $F_T(\cdot)$. Thus I transform heterogeneity in outside
option $\hat{Y}$ into the heterogeneity in the maximum tax rate to keep foreign producers with different $\hat{Y}$. This makes the analysis easier to work with and results in negligible and trivial changes. The proportion of producers will not divert to outside option at $\tau$ is given by $1 - F_T(\tau) = \tilde{F}_T(\tau)$ where

$$
\tilde{F}_T(\tau) = \begin{cases} 
0 & \text{if } \tau \geq \tau^S + \lambda \\
\frac{\tau^S - \tau + \lambda}{\tau^S - \tau^D} & \text{if } \tau^D + \lambda < \tau < \tau^S + \lambda \\
1 & \text{if } \tau \leq \tau^S + \lambda 
\end{cases}.
$$

$\tau^S + \lambda$ and $\tau^D + \lambda$ provides the cutpoints of the tax rates begetting full and null foreign investment respectively. The revenue function of the ruler can be rewritten as:

$$
R(\tau) = \tau e \frac{1 + \gamma \tilde{F}_T(\tau)}{1 + \gamma} - \frac{1}{2} \mu \tau^2.
$$

Parameter value: $\mu = .5; \gamma = .2; \lambda = .2$. Incentive Compatibility (IC) curves are shown in dashed curves.

Figure 4.5: Equilibrium Tax Rate and Revenue: Costly Outside Options ($\lambda = .2$)
The revenue function is now piecewise linear and continuous with regard to $\tau$. For now I focus on the cases where $\lambda = 0$. Scenarios in which resorting to outside option is costly, i.e. $\lambda > 0$ is discussed later. Given that the revenue function is furthermore affected by the $\tau$ in $F_T(\tau)$, the ruler gains stronger incentive to set a lower tax rate. This enables the ruler to credibly commit to a tax rate that is lower than $\tau^S$.

**Proposition 4.3.3.2.** If the ruler cannot make credible commitment to tax rate, i.e. the ruler and the producers move simultaneously, the unique equilibrium of the game of heterogenous foreign producers is identical to that in the game with homogeneous producers, $\{\tau^S_h, e^S_h\}$.

**Corollary 4.3.3.1.** Heterogenous foreign producers results in lower tax rates and higher investments in equilibria under non-credible commitment, i.e. $\tau^S_h < \tau^S$ and $e^S_h > e^S$.

**Proposition 4.3.3.3.** The presence of heterogenous foreign producers in the economy results in Pareto Improvement upon the equilibrium under autarky, i.e. $R_f(\tau^S_h) > R(\tau^S)$ and $Y(e^S_h) > Y(e^S)$.

Figure 4.3 visualizes the difference between the equilibrium with heterogeneous foreign producers and that where foreign producer is absent. Notably, the tax rate that maximizes the revenue given the equilibrium investment crosses the Incentive Comparatibility (IC) curves corresponding to whether heterogenous foreign producers are present. As the Incentive Compatibility curve with heterogeneous producers ($IC^h$) shows, the ruler suffers greater loss in tax revenue as more foreign producers resort to outside option at high tax rates. Although the revenue on the Incentive Compatibility curve shrinks in the presence of heterogeneous foreign producers, such salient efficiency implication nevertheless enables the ruler to credibly commit to lower tax rates which enhances the overall efficiency in the political economic system. In Figure 4.3, even though the foreign investment accounts for only 20% of the total input in the economy, its presence lowers the equilibrium tax rate by 30% and doubles the equilibrium output.
4.3.3.1 Costly Outside Options and External Commitment Devices

If the cost of resorting to outside option becomes costly, i.e. \( \lambda > 0 \), the equilibrium tax rate would get higher. When the cost of outside option is high enough, the tax rate in equilibria in the presence of heterogeneous producers becomes identical to the equilibrium tax rate under autarky. Defining \( \tau_h^S(\bar{F}_T) \) to be the optimal tax rate given linear loss of foreign investment, I obtain the following lemma.

**Lemma 4.3.3.1.** The ruler strictly prefer to begetting full foreign investment, iff the maximum tax rate begetting full foreign investment is greater than or equal to the optimal tax rate given linear loss of foreign investment, i.e.

\[
\arg \max_\tau R^a(\tau | e_h^S) = \begin{cases} 
  \tau_h^S(\bar{F}_T) & \text{if } \tau^D + \lambda \leq \tau_h^S(\bar{F}_T) \\
  \tau^D + \lambda & \text{if } \tau^D + \lambda > \tau_h^S(\bar{F}_T)
\end{cases}
\]

**Proposition 4.3.3.4.** \( \frac{\partial \tau_h^S}{\partial \lambda} > 0 \) and there exists a \( \lambda = \hat{\lambda} \) such that \( \tau_h^S = \tau^S \).

Figure 4.5 plots the revenue function and equilibrium tax rate when resorting to outside option is costly. Notably the equilibrium tax rate, \( \tau_h^S \), is higher than that when outside option is costless as Figure 4.3 shown. Because the cost of outside option deters some of the foreign producers from exiting, the ruler could beget foreign investment in full at a higher tax rate, which compromises her ability to credibly commit to lower tax rate. As a result, the revenue in equilibrium with costly outside option is less than that with costless outside option. Note in Figure 4.5, the revenue function and the Incentive Compatibility curve given \( \lambda = 0.2 \) are piecewise functions and setting any tax rate lower than \( \tau^D + \lambda \) could guarantee a full input from foreign producers whereas tax rates high than \( \tau^D + \lambda \) would incur linear loss of investment on the ruler’s revenue function.

**Proposition 4.3.3.5.** There exists a \( \gamma = \hat{\gamma} \) such that \( \frac{\partial \tau_h^S}{\partial \gamma} < 0 \) if \( \gamma < \hat{\gamma} \), and \( \frac{\partial \tau_h^S}{\partial \gamma} = 0 \) and \( \tau_h^S = \tau^D + \lambda \) if \( \gamma \geq \hat{\gamma} \).
Proof. See Appendix.

Corollary 4.3.3.2.

\[
\frac{\partial \hat{\gamma}}{\partial \lambda} < 0 \text{ and } \frac{\partial^2 \tau^S}{\partial \gamma \partial \lambda} \leq 0.
\]

Proposition 4.3.3.5 formalizes the impact of the weight of foreign investment in the economy on the equilibrium tax rate. Greater weights of foreign investment results in low equilibrium tax rates. Moreover, as Corollary 4.3.3.2 suggests, such an effect is most significant when the cost of outside option is low. The dynamics is visualized in Figure 4.6. Notably, it is seen in Figure 4.6 that \( \lambda \) results in greater differences in equilibrium tax rate when \( \gamma \) is sufficiently large. Thus, the efficiency implication of the cost of outside option is most salient when there is extensive involvement of foreign factors of production in the economy.

4.3.3.2 Endogenous Cost of Outside Option

\( \gamma \) was introduced into the model to capture the factors that shape the involvement of foreign producers in the domestic production independent of the mechanism formalized in the model.\(^1\)

As I show in the following, \( \gamma \) gains significance in determining the equilibrium outcome as the cost of outside option is modeled as endogenous. Proposition 4.3.3.4 implies that both the ruler and producers would benefit from lower cost of resorting to outside options. Thus in the following analysis, I endogenize the cost of outside options to the revenue-maximizing incentive of the ruler. Assuming the ruler is now able to shape the cost of outside option at a linear cost, she would want to reduce the cost of outside option as much as possible until

\(^1\) These factors could be market size, factor endowment, resource abundance, colonial heritage or other economic, historical and geographical features of the country that affect the involvement of foreign actors in the economy.
the marginal cost starts to exceed the marginal gain. Here I claim the reduced cost of outside option can only be attained through external commitment devices, such as inter-state arrangement and institutions governing cross-national investment. When the ruler made international commitments that are formalized by international institutions, the cost of resorting to outside options will become lower for the foreign producer. The linear cost on the ruler associated with reducing the cost of outside option is analogous to the direct operational cost of bargaining and maintaining inter-governmental agreement or the undesirable side-effect of tying hands with external constraints imposed by international institutions. In this sense, small values of $\lambda$ correspond to high levels of external constraints and greater values of $\lambda$ correspond to low levels of external constraints.

Endogenizing $\lambda$ shows the impact of foreign involvement on the optimal level of con-
Parameter value: $\mu = .4$, $\gamma = .3$.

Figure 4.7: Maximum Revenue in Equilibrium and Cost of Outside Option

Constraints on the autocratic ruler. Since tying hands with constraints from international institutions is a gradual process, I assume the initial value of $\lambda$ is sufficiently high such that none of the foreign producers are able to resort to the outside option. The cost of lowering $\lambda$ is given by $\kappa$:

$$\kappa = \beta |\lambda^0 - \lambda|,$$

where $\lambda^0$ corresponds to the initial state where no external constraint is imposed on the ruler. Assuming $\lambda \in [0, \lambda^0]$, $|\lambda^0 - \lambda| = \lambda^0 - \lambda$. The cost is linear with regard to the distance between $\lambda$ and the status quo. $\beta$ captures the linear marginal cost of reducing $\lambda$ by one unit. Larger $\beta$ indicates greater linear cost and smaller $\beta$ indicates smaller linear cost. Now the ruler is faced with the problem of find the $\lambda$ such that the revenue is maximized. If $\beta = 0$, the utility function with regard to $\lambda$ is plotted in Figure 4.7 which is concave and piecewise linear and continuous. The value of $\lambda$ in equilibrium is determined by the equation
Figure 4.8: Equilibrium Cost of Outside Option and $\beta$

$R_M' = \kappa'$. Given $\kappa' = -\beta$, the utility maximizing $\lambda$, $\lambda^M$ is provided by the tangent line in Figure 4.7. As $\beta$ diminishes, $\lambda^M$ decreases until $\beta = \beta$, after which the maximizing $\lambda^M$ remains constant, as seen in Figure 4.8.

An important result is that $\lambda^M$ decreases in $\gamma$. This indicates regimes with larger weight of foreign investment in the economy is likely to make more external commitments than regimes with less weight of foreign investment. The finding is plotted in Figure 4.9. The revenue functions are identical until $\lambda$ is greater than $\lambda^M'$, the optimal cost of outside option for the regime with relatively low foreign involvement in the economy. Because the equilibrium $\lambda$ is determined by when the revenue function passes by the tangent line with respective $\beta$, the regime with lower foreign involvement in the economy ($\gamma = .1$) could never set a equilibrium $\lambda$ lower than $\lambda^M'$, whereas regimes with higher $\beta$ will continue to
Parameter value: $\mu = 4$.

Figure 4.9: Weight of Foreign Investment and Equilibrium Cost of Outside Option

get marginally compensated as $\lambda$ goes below $\lambda^{M'}$ at lower $\beta \in [\bar{\beta}, \tilde{\beta}]$. Thus, if the marginal cost of reducing $\lambda$ is sufficiently low, regimes with more foreign involvement would sign on to more external commitments than regimes with low foreign contribution. On the other hand, if the marginal cost of reducing $\lambda$ is sufficiently high, different foreign involvement would not result in differences in the level of external commitments made.

**Proposition 4.3.3.6.** $\lambda^M$ decreases in $\gamma$ if $\beta < \tilde{\beta}$, i.e.

\[
\frac{\partial \lambda^M}{\partial \gamma} = \begin{cases} 
< 0 & \text{if } \beta < \tilde{\beta} \\
0 & \text{if } \beta \geq \tilde{\beta}
\end{cases}
\]

**Corollary 4.3.3.3.** $\max\{R^M + \kappa\}$ increases in $\gamma$ if $\beta < \tilde{\beta}$, i.e.

\[
\frac{\partial \max\{R^M + \kappa\}}{\partial \gamma} = \begin{cases} 
> 0 & \text{if } \beta < \tilde{\beta} \\
0 & \text{if } \beta \geq \tilde{\beta}
\end{cases}
\]
But when will the margin cost of reducing $\lambda$ be low enough to separate regimes with high $\gamma$s and low $\gamma$s? I argue the autocratic ruler can establish commitment devices at the domestic level to reduce $\lambda$ but the most effective and economical ones exists at the international level. The ruler could possibly establish specialized institutions at home to credibly commit to foreign actors such as making specially tailored domestic arrangements that compensate the foreign actors in cases of violation of contracts, but these arrangements are likely to be inferior to alternatives existing at the international level. The nature of the vulnerability of foreign economic agents to domestic predation determines that the credibility of the regime is more likely to be restored by introducing constraints from outside of the political system. In particular, existing institutionalized arrangements at the intergovernmental level that governs transnational economic relations provides quick and effective solutions that make outside options less costly for foreign investors. Signing onto these international arrangements and becoming members of existing institutions incur low cost relative to the effect of strengthening commitments. In some sense, the existing institutions allow regimes with commitment difficulty to “free-ride” the institutional arrangements that have already been constructed and help strengthen the bargaining power of the foreign investors. By contrast, using domestic commitment devices for the purpose of assuring foreign actors are expensive as it may cause domestic backlashes and, more importantly, less likely to be effective given the nature of commitment difficulty under non-democratic rules. Thus, the cost-effective solutions to foreign commitment is readily available, make the difference between regimes with various levels of foreign involvement significant. Notably, the domestic alternative of reducing $\lambda$ is conceptually different from political liberalization that empowers the domestic citizens in that it only targets the foreign actors who are aliens in the domestic political process.

A basic observation regarding the effect of extractive capacity is that regimes with higher extractive capacity set higher equilibrium tax rates ceteris paribus, because the additional taxation can be marginally compensated due to a lower marginal cost of taxation.
Thus, regimes with higher extractive capacity would prefer to set a relatively high cost of outside option to make the higher optimal tax rate achievable. Thus, extractive capacity is negatively correlated with the optimal level of external commitment made by the ruler.

**Proposition 4.3.3.7.** $\lambda^M$ increases in $\mu$, i.e.

$$\frac{\partial \lambda^M}{\partial \mu} > 0.$$  

The proposition implies regimes with low extractive capacity will be willing to make more external commitments than regimes with high extractive capacity. Moreover, the equilibrium tax revenue that the ruler seizes would be lower under the high extractive capacity. This finding suggests that external commitments is of significant weakness in remedying inefficiency when the intrinsic obstacle to optimal behavior in the political economic system is greater. This characterizes a dilemma plaguing high capacity regimes: while regimes with greater extractive capacity have more to gain from making credible commitments at lower tax rate, such an advantage in tax extraction nevertheless fuels the predatory tendency in taxation which compromises the incentive compatibility of more efficient equilibrium of the game. This observation is particularly strong when the ruler relies exclusively on external commitment devices in making credible commitments.

When both diversion of foreign investment and domestic deposition is present, what is the ruler’s strategy in maximizing the revenue extraction? Several findings are established based on the previous model. First, countries with more foreign output are more likely to resort to external commitment device in enhancing the credibility of commitment. Secondly, countries with high extractive capacity is more likely to use domestic liberalization to strengthen domestic credibility in that external commitment device is not as effective as domestic liberalization in inducing lower equilibrium tax rates.