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AN INSTITUTIONAL ANALYSIS OF CHANGE IN CHINA'S FOREST POLICY 1949-2009

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AN INSTITUTIONAL ANALYSIS OF CHANGE IN CHINA'S FOREST POLICY

1949-2009

By

Michael W. Stone

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ABSTRACT

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This thesis will study institutional change in China's forest ownership following the Communist Revolution in 1949. This study will divide the history of forest land tenure reform in China into four eras and provide an extended study of the political rhetoric and regulations related to these forest land tenure regimes. Then the thesis will provide two longitudinal regression analysis models to test the impacts of institutional change on forestry in China. Finally, a general analysis of the credibility of the formal institutions of forest land tenure in China will be considered.

In dedication to my parents

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I would like to thank many people for their contributions large and small on this thesis. In particular I want to thank those friends and family who listened to many hours of my ranting about the nuances of Chinese forest policy. I am very grateful for their patience and advice.

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A special thank you is owed to Dr. Can Liu. His book, "Collective Forestry Institutions and Forestry Development in China" (2008) inspired many of my regression ideas and generated many questions I sought to answer, of which only a handful I was able to address. Furthermore, he provided data resources and office space for me during a crucial phase of this work. Quite literally, this would not have been possible without his support.

I would like to especially thank Dr. Runsheng Yin, who from the beginning nurtured and guided my interest in forestry. His "PREMIUM" program laid the initial seeds for this work and many happy years working together. Additionally, this research was funded in part by a grant from the National Science Foundation (# 61-2559) which was awarded to Dr. Yin for investigating China's forestry policy and reforms. I can only hope he finds this paper to be a fruit worthy of harvest.

Finally, in a very unusual acknowledgment, I wanted to thank this thesis for itself. During the research and writing of this thesis I met my wife, Dan Li, whom I never would have met without having embarked on this project. Quite literally, this thesis changed my life in ways I never imagined and I am forever grateful for this experience in whole and all of those people who were a part of these past three very good years.

PREFACE

Forestry and land tenure in China has been a passion for me during the last five years and has resulted in this humble paper. It has shaped my life in many wonderful ways and brought me many gifts. I hope this comes across to my readers in my discussion of China's institutional reform in the collective forestry sector. China has had a unique and stunning series of changes in its forestry sector that deserve widespread scholarly attention, but to date it has failed to attract a large audience of interested academics. Despite the enormous investment in afforestation in recent years (the Slope Land Conversion Project (SLCP)); despite the government's protracted efforts to utilize forestry for the development of hundreds of millions of China's rural poor; despite China's radical experiments with land ownership regimes; little international scholarly attention has been paid to China's forests. With the exception of a few excellent books and articles, the case for China's forestry deserving in-depth study has gone unchampioned. If I can hope for any grand outcome for this thesis, it is that it can convince a few more people that China's forestry experience has been deeply exciting.

Table of Contents

List of Tables

List of Figures

KEY Abbreviations:

CCP: Chinese Communist Party

CRS: Contract Responsibility System

GOV: Gross Output Value

GRP: Gross Regional Product

HRS: Household Responsibility System

MOF: Ministry of Forestry (currently SFA)

NFPP: Natural Forest Protection Program

PRC: People's Republic of China

RMB: Renminbi

SFA: State Forest Administration (formerly MOF)

SLCP: Slope Land Conversion Program

TVE: Township Village Enterprise

I. Introduction

The modern history of forestry in the People's Republic of China (PRC) has included a series of literally revolutionary changes. China's transformation from feudalism, to private ownership, to communes, back to private ownership has demonstrated a varied set of regulatory institutions. This thesis aims to show the importance of these different institutions for all aspects of the forestry in China. This suggests that the changes to China's land tenure regimes, specifically forest land tenure regimes, are best viewed through the political aspects. By understanding changes in regulatory institutions through the lens of political transformation, this thesis will establish a framework for understanding institutional impacts on timber production and land use.

The rights, rule and regulations regarding land use in China have undergone a series of transformations which have been closely linked to changes in the ideology of the Chinese Communist Party (CCP). The initial approach to agricultural land use by the CCP was to allow private ownership but quickly transformed into a Commune level organization of land management. By the end of the 1970s, Commune management was transformed into a system of contracted use rights which remains in the present day. These transformations occurred in direct response to upheaval at the highest levels of government;

however there have been numerous intermediate changes which have come and gone with less dramatic ideational shifts. The procession of ideas and regulation transforming land use has resulted in sizable shifts in the production outputs accordingly. Thus, the focus of this thesis will be to marry the history of ideas, regulation and production into a single unified discussion of institutional change over the last 60 years of the People's Republic of China.

This discussion of the institutions governing forestry and forest land tenure will be divided into four distinct eras. These four eras are the Land Reform era of 1949 to 1957, the Collectivization era of 1958 to 1980, the Decentralization era of 1981 to 2001 and finally the Institutional Reform era of 2002 to present. This thesis will seek to demonstrate that these periods were characterized by distinctive approaches to forest land tenure which are worthy of extended study and analysis. To demonstrate this claim this thesis will use in-depth historical review to describe the key institutional differences in China's forest land tenure regimes during these various time periods, and longitudinal regression analysis to determine the production and land use impacts of those regimes.

There have not been many attempts to synthesize the history of China's forestry experience or forest policy. However, this thesis will approach the discussion of China's forest policy in a manner similar to previous work. For example, Yin (1994) and Liu (2001) describe China's land reform by dividing it into a series of time periods based on the regulation style which is prevalent. In both these articles the summary of the historical events is excellent, but the most

recent major shift in regulation has occurred since the publication of these articles.

In the realm of regression analysis which addresses the entire national picture of timber production and forest land use, there appears to be only one such model in the literature. Namely, Liu (2008) utilizes dummy variables in a longitudinal model to describe similar institutional periods as this thesis will. However, that book uses both geographic and institutional dummy variables in a panel model that is paneled on provincial variance. It could be argued that the panel's α_j controls for a variable which is also considered in the dummy variables. Additionally, this thesis aims to focus on the institutional effects purely and connects those explicitly to the historical perspective.

The literature studying China's forest tenure is not as rich as one may expect. The land reform changes have typically not attracted as much attention as some other programs, but some notable articles do exist (Lin 1988; Dong 1996; Kung and Liu 1997; Liu, Carter et al. 1998; Ho 2001; Brandt, Huang et al. 2002). However, it is interesting to notice that the number of publications focusing on forest tenure reform dropped off precipitately at the turn of the century. The reason for this appears to be a shift in research focus which occurred in the research community. Following a series of natural disasters in 1997 and 1998[1] the Chinese government introduced large reforms of both state-owned timber production and the practice of farming on steeply sloped land while encouraging afforestation onto these lands. These reforms seemed to have captured the interest of the academic community as publications on these topics

1 See pages 30-33for further discussion on these events.

exploded at roughly the same time as publications on tenure reformed waned. Accordingly, by focusing on both the political aspects to tenure reform as well as studying the latest series of reforms will be a significant contribution to the literature.

This thesis will add the current literature on China's forest land tenure reforms in two key ways. First, this thesis updates the history of land tenure reform by including the period 2002 to 2009 in the analysis. Second, the historical perspective and quantitative models will be used in coordination to more richly describe the role of institutional change on timber production and land use change. These additions are valuable because they extend the body of scholarly material on institutional change in China and will provide a nuanced perspective on the effects of regulatory institutional change.

Analytical Approach

In analyzing the major policy changes which have occurred in the last sixty years this research will adopt a perspective which draws much inspiration and intellectual debt from the institutional economics literature (North 1990; Schmid 2004). North's (1990) understanding of what is an institution will resonate throughout this thesis:

> Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic. Institutional change shapes the way societies evolve through time and hence is the key to understanding historical change (North 1990).

In keeping with the influence of the institutional economics literature, this thesis will focus on the way regulatory institutions influence human behavior in timber production and land use. In order to create a consistent framework for understanding the regulatory institutions governing forest land tenure in China, this thesis will look at the political aspects as well as the types of land use regimes.

To understand the political elements of institutional change requires a method of policy analysis. Turner and Hume (1997) create a method for policy analysis which emphasizes understanding governance from the environment the policy is created in. They find four kinds of environments which are important for understanding policy formation: economic, cultural, demographic and political (Turner and Hume 1997). Their method focuses on uncovering what the public sector contributes to the creation of policy. This is a plausible approach for understanding the Chinese tenure reforms, but it will require some alteration to make it more specific. Namely, economic, cultural and demographic factors were important for the development of China's forest policy, but the political aspects seem to be at the forefront. China after the Communist Revolution was a state possessed by its ideology and the concern of developing a perfect communist society would become the prime motivation (Fenby 2008). Furthermore, in analyzing community land tenure policy special emphasis should be given to understanding the political particularities of community land management.

To focus on the most relevant political aspects, the four historical periods are delineated on the basis of the policy environments guiding China's forest

governance in each period. While each period contained a number of different specific policies, the broader policy environment represents the guiding ideology behind the specific policies. Thus, for embarking on this research the policy environment can be defined as: *the regulatory structure which directs regulation enforcement and forms the ideological language typical of a period in time.* It is a useful perspective for the purposes of discussing China's land tenure because of the overriding importance of ideology in China's governance. Over the years in China, change in governance has happened in large campaigns and mass mobilizations coordinated by the Chinese Communist Party (CCP) at multiple levels of government (Lam 2006). While this research will later address the outcomes of these policy environments, the policy environment itself can only be described as the intellectual and motivational forces which are at work during each period of time.

Typically in China these policy environments began suddenly with minimal or no prior experience, were announced at the national level as change in official policy, and found instant widespread support, though what that support actually meant had enormous variety and in some cases existed only in name (Lam 2006). Therefore, the focus of this thesis is the language and structure of official policies and directives in an attempt to understand these time periods as they were understood by those living in them.

The other key framework for this thesis regards defining what the different types of forest tenure regimes mean for the case of China. Taking the distinctions defined in Baland and Platteau (2000):

> Economists tend to adopt another analytical grid which is particularly appropriate to raise pertinent theoretical questions. Here, the distinction is between open access (which is equivalent to a no-property or res nullius regime under the above legal typology), unregulated common property (access rules prevail that define insiders as against outsiders), regulated common property (not only is access delimited but rules of use are also defined), and private property. It must be emphasized that the regulating agency under regulated common property can take various concrete forms ranging from a small community to a state apparatus. Yet, when the State does not actually regulate, a regime of nationalized commons is akin to open access even though the State is the legal owner. As for private property, it differs from regulated common property only in so far as the rule-defining agent is also the unique user of the resource.

This list forms an excellent base, but one addition has to be made to make this suited for application to modern China. Namely, a "state-owned tenure regime" would be where the government controls all of the inputs, outputs and rights for a particular portion of land.

Using this analytical framework about the varieties of possible tenure regimes as a background to refer to throughout the rest of the thesis, it is important to understand that China has seen a shift back and forth among the different property regimes and it is difficult to say any single definition of tenure regime could be utilized for each of the policy environments. This is made more confusing as a result of multiple types of forest use being allowed for a particular area and in certain periods of time, multiple conflicting classifications or owners may have overlapped for a particular forest plot.

Research Questions

The purpose of this research is to attempt to draw out the impacts and implications of the different historical periods which have shaped China's rural land rights. Thus this thesis will seek answers to three primary questions:

1) What was the impact of the different policy environments on the production of timber?
2) Has the change in forest ownership generated forest contract holder investment in afforestation?
3) Do the forest contract holders believe the latest reforms are a long term change?

The aim of the first two questions is to see if there are statistically significant variations to the different policy eras and what the direction of this variation is. Specifically, has giving land use rights to rural collectives caused more timber production and more investment in afforestation? It is crucial for the analysis of these policy environments to know if the talk matched the results.

The third research question cannot be addressed through the econometric model but is important for the purposes of interpreting its findings. This question has been raised previously, for example, Peter Ho's (2006) article on forestry tenure reform credibility raised the question of how the forest tenure reforms have been received by the actual contract users. He suggests that for the reforms to be effective it is critical that the contract holders believe that the legal framework governing the reforms is stable and will last long enough for the forests to come to a harvestable age. Ho (2006) uses the framework from Diermeyer et al. (1997) on the importance of credibility for China and other states which are transitioning away from centrally planned economies:

> Formal institutions are credible to the extent that people believe they are not subject to arbitrary change. In the absence of credible formal institutions people often create informal institutions that promote many types of economic activity. These informal rules, however, often do not

> provide as strong an incentive for economic actors to invest their assets in the most socially productive uses. Therefore, the credibility of formal rules established by the government plays an important role in shaping economic activity and promoting economic growth (Diermeyer et al. 1997; Ho 2006).

Considering the institutional reforms through this perspective is useful, particularly for the last two historical eras, which were characterized by an expansion of forest use rights. Economists would expect that with expanded rights, forest users would have greater incentive to increase forest investments. However, from Ho's perspective, if forest users do not believe that the new policy environment will last long enough for them to enjoy the profits of any investments they make, then the policy environment cannot yield this outcome.

These research questions aim to uncover the impacts of regulatory change to both observable outcomes as well as to try and generally assess the changes to informal institutions in China. To assess these impacts this thesis will begin with an extended historical perspective which will move through each different time period in turn. The focus of these sections will be to contextualize the important events and draw focus to the role of the regulatory institutions. Following this, the thesis will turn to the quantifiable impacts through longitudinal regression analysis. First, the thesis will look at the impacts of the various regulatory institutions on timber production. Then the thesis will turn the same method of regression analysis to the second research question of impacts on forest area. Finally, having established a rich historical perspective and a clear quantitative analysis of impacts on timber production and land use, the thesis will

conclude by discussing what these different results suggest about the credibility of the land tenure reforms.

This thesis aims to make a novel contribution to knowledge about China's forestry in the last 60 years as well as institutional change. The thesis will try to inform the academic community about latest land tenure reforms as well as to describe the impact of all of the different reforms. This should help contextualize these changes in addition to clarifying what makes them a break from the past. Additionally, this thesis will make explicit the connections between political, regulatory and informal institutional changes. These changes do not exist in a vacuum and this thesis will draw the connections between them.

Thesis Organization

The thesis will move through the four sections of historical perspective in order which the events occurred. Namely, it will cover the 1949-1957 Land Reform era, then the 1958-1981 Collectivization era, then the 1981-2001Decentralization era and finally the 2002 to present Institutional Reform era[2]. Then this thesis will turn to describing the methodology of the qualitative panel models. Then the thesis will lay out the timber production model in full followed by the land use model. The thesis will conclude by looking at the broader impacts of the reforms in terms of the informal institutional impact on the

2 The reader will surely notice that the middle two eras overlap. This is because the first relevant events for the Decentralization era are announced in 1981 but are not widely realized until 1982. Accordingly, the historical perspective allows overlap, but the regressions will later put the start of the Decentralization era beginning with 1982.

reform credibility and look at some possible future research directions which are available.

II. Historical Perspective

The history of forest policy in China has seen a great deal of back and forth movement between collective, state and private ownership. In presenting these transitions this research is taking a view of history as moving in eras. This is helpful to a certain degree as it allows for a useful simplification, but creates room for disagreement. For example, this research is in partial agreement with both Dr. Can Liu (2008) and Dr. Dachang Liu (2001). This thesis agrees with Dr. C. Liu (2008) about the timing of the Land Reform era but disagrees with his timing of the start of Decentralization era. However, this research will shift positions and agree with Dr. D. Liu (2001) about the Decentralization era starting point while disagreeing about the end point of the Land Reform era. While this type of debate may seem exceptionally abstract, making these differences of opinion more explicit can underscore how difficult to use this kind of typology with clear authority.

1. Land Reform: 1949 - 1957

China's rural population's interactions with forest land were feudalistic until the middle of the 20th century when the Chinese Communist Party implemented land reform. At the time of the Communist revolution, most of rural China existed

as a feudal society of land-owners and land-workers as it had for many centuries (Lee 1948). Similar to agricultural land, forest land in the old feudal system was owned by merchants, government bureaucrats, self-sustaining farmers and landlords. This led to widespread sharecropping by landless peasants. In regards to forests, this share cropping behavior was continued with landless peasants clearing forestlands for the landlords. The landlord received the profits from the timber sale while the peasants were allowed to grow crops on the land while the forest regenerated (Sun 1992). However, there were also examples of state owned forestry and collective forestry prior to 1949. In most cases of collective forestry, the rights to the forest were controlled by a village or religious group[3]. The sale and use of timber from this forest was usually aimed at funding a specific public good like a ferry or school (Liu 2001).

Immediately following the revolution in 1949, land tenure reform was one of the most important and driving issues. A significant portion of the revolution's success was attributed to the Communists tapping into anger at the land tenure system's injustices (Mao 1990). Thus, changing ownership structure became one of the first goals of the CCP. Beginning in 1950 and continuing until the end of 1952, the "Land Reform Campaign" consisted of redistributing the farm land, forest land and means of production owned by the landlords and rich peasants and dividing it equally among the total populace (Liu 2001). Over 100 million acres of land was redistributed and following this reform the crop area which was controlled by poor peasants doubled to comprise 47% of the total arable land

3 In the case of religious ownership, the forest could be for either economic ends or could have a religious purpose in the case of a 'holy forest.'

(Fenby 2008). However, the actual process of dividing the land became ideological in nature. Class struggle became the chosen tool of reform whereby all village dwellers were categorized as being in one of over a dozen classifications including landlords, poor peasants, professionals or vagabonds. After the CCP 'work teams' completed their classification they would parade so called 'black' class enemies so that the villagers could make accusations. After the 'struggle meetings' concluded, the property of those found guilty, including any animals or farm implements, were then redistributed to the poor. This resulted in many homes owned by landlords or local temples becoming housing for poor families (Fenby 2008).

By the conclusion of 1952, when the land reforms were declared complete, it had become apparent that many of the larger capital investments related to farm ownership were in short supply. Namely, draft animals or farm machinery were not common enough to operate farms at a peak efficiency level (Yin 1994). To rectify this discrepancy the government began an experimental program of "Mutual Aid Teams" to group farmers into bigger units to share large capital investment costs and benefits. These teams would form the initial precursor to the forthcoming complete collectivization of the country. Soon these initial groupings would be aggregated into larger groups referred to as elementary cooperatives (Yin 1994).

Regarding forest ownership in the early post-revolution years, large natural forests, like all other natural resources, were nationalized by the Communist Party in 1949 (Yin 1994). However, the ownership of private small

forestlands or individual groupings of fruit trees which had been distributed as a part of the "Land Reform Campaign" were upheld despite early movements towards labor collectivization (Liu 2001). This conversion to state owned forestry included the creation of one hundred and thirty state owned forest bureaus across China whose primary objective was the production of timber. In China's fledgling economy, timber was seen as a vital resource for both development and commercial rehabilitation of China's economy (Yin 1994).

In this early period economic growth blossomed and broad enthusiasm appeared throughout China as the revolution was initially seen to be a boon for the rural poor as Gross Domestic Product and production statistics soared. Between the end of the "Land Reform Campaign" and the initiation of the People's Commune system, 1953 to 1957, China's GDP soared from 6,264 million Chinese Yuan to 8,925 million Chinese Yuan and grain production grew from 1,551,377 tons in 1953 to 1,690,003 in 1957[4] (CCS 2005). Forestry and the timber industry grew swiftly in the post-revolution years similar to the rest of the Chinese economy. Timber yield levels were 17,535 thousand cubic meters in 1953 and 27,775 thousand cubic meters by 1957 (CFSY 1987; CFY 1987). Similarly, afforestation was 27,133 hectares in 1953 and 196,933 hectares in 1957(CFSY 1987). However, the elementary cooperative organizations were rarely involved in tree-planting or timber management (Yin 1994). Instead the expansion of afforestation was driven by the establishment of state-run forest

4 These GDP values are time adjusted to be in 2004 Yuan. Grain tonnage is a weighted average so as to allow a variety of products to be included such as rice, wheat and potatoes.

farms; between 1949 and 1957 the number of forest farms increased from 74 to 1387(CFSY 1987; Yin 1994)

Beginning at the end of 1955 advanced collective farms were a further aggregation of the elementary cooperative farms and comprised four percent of rural households, then in September 1956 expanded rapidly to seventy three percent and then ninety six percent by the end of 1956 (Liu 2001). With the implementation of the advanced cooperative, the previously individually parceled farm land and forestland were redistributed into collective management.

When trying to typify the early policy environment in early post-revolutionary China, there are essentially two phases. First, following the 1949 revolution until the Land Reform Campaign was declared complete in 1952, the ownership of land plots that of spontaneous turnovers from the elite landowners to the local peasantry. This was a period of confusion and chaos as the former landlords were now being rapidly brought onto par with their former workers and property was swiftly redistributed. The second phase of the early reform begins when the "Land Reform Campaign" is ended in 1953 and the first Five Year Plan is implemented, spanning from 1953 to 1957. This phase is where we see the initial movements towards socialism begin and the state begins to shift private plots into rudimentary communes. Thus, the "Advanced Cooperative" and the "Mutual Aid Teams" act as bridges between the initial radical redistribution to a second redistribution into the upcoming "People's Commune" system. With the advent of early socialism on the rural economy, state owned industries and planned economy oriented production became the dominant method of timber

production in China. As almost all of the forest area during this period is declared state-owned, private forestry is limited and as the collectives do not yet truly exist, collective forestry is also absent (Yin 1994).

During this period, the land rights were initially what Baland and Platteau (2000) would have considered private property. The land was parceled out to individuals and the final arbitrator of use was the parcel owner. Interestingly, this period is the only one is which land use in the PRC was truly private property. Even the early commune systems could largely be called private property. The focus of these early communes was joint utilization of tools and animals with the mutual aid teams adding joint labor. However, the individual owners retained the parcels themselves and the products of the farmland parcels remained as the property of individuals. Small forest plots and fruit trees had a similar standing and remained decidedly the property of individuals.

2. Collectivization: 1958 to 1981

"Without thorough destruction, there can be no real construction."

–Jiang Qing, Wife of Chairman Mao and Gang of Four member[5]

Spurred on by the economic success in the early 1950s, the Chinese authority became eager to move towards Marx's ideal Communist society and began a campaign to reorganize the farmers. In a period of only three months in 1958 the advanced cooperative system was replaced with the "People's Commune" system which further enlarged the size of the collective farms to 4,800 households per commune on average (Liu 2001). Under this system open

5 As quoted in Fenby (2008)

kitchens were created from which an unlimited supply of food was distributed free of charge. Due to the lack of a pricing system or proper signals to indicate shrinking food stocks, famine broke out in 1959 despite bumper crops in 1957 and 1958 (Johnson 1988). In addition to these famous food supply issues, the implementation of the People's Commune system had distinctive forestry impacts.

Under the People's Communes, a specialized work group implemented technical aspects of forest management and practices while mass mobilization of labor was used to handle tree-planting and timber harvesting (Yin 1994). This switch to mass mobilization generated higher villager participation in forestry, but also a dramatic decline in production. This drop in production was due to declining labor productivity, from liquidation of timber holdings, inadequate financing and lowered morale (Song et al. 1997). This panoply of issues attached to collective labor and land use had not been anticipated by the ideologically driven early transition to commune production, but by this time the state organs carried almost all responsibility for timber production under the 5 year plans with the collectives acting as minor complements.

The other key attempt to create an ideal Marxist society came from the CCP Chairman and a central revolutionary figure, Mao Zedong, declaring a radical production orientation shift with the Great Leap Forward national campaign from 1958 to 1960. While this campaign included many different facets, they roughly encompassed producing more of everything and taking steel production as the 'key link' (Fenby 2008). From the forestry perspective, the most

important aspect of the Great Leap Forward was that it began a wave of deforestation and denudation. In order to produce the necessary steel and iron for Mao's intended industrial advancement; the farmers around the country were mobilized en mass. By October 1958, 600,000 backyard steel furnaces had been set up across the country (Liu 2001). This mobilization involved cutting down large swaths of forestland and using the timber to meltdown any available tools or other sources of metal for the production of steel. Between 1958 and 1960, 20 million cubic meters of timber was harvested for fuelwood in steel-making (CFSY 1987; Yin 1994).

In response to the problems under the People's Communes, in the early 1960s a revision of the central planning system occurred and all production activities, including forestry, were put under a rigid system of quotas (Yin 1994). Regarding forestry tenure, a devolution of ownership occurred that moved forest management from the People's Commune level down to the level of the production brigades and production teams, which were approximately the previous size of the advanced cooperatives and the elementary cooperatives (Liu 2001). At this time the scattered fruit and non-timber trees which had been collectivized during the generation of advanced cooperatives were now again redistributed as private property to nearby households (Liu 2001).

This method of forest management was further impacted by two major changes in the mid-1960s. First, the relationship between the PRC and the Soviet Union was deteriorating, compounding the PRC's general isolation from the international community. As a result the party leadership recognized the

necessity of self-sufficiency. This meant that food production was given the highest priority and economic crops (such as timber) were only allowed after quotas for food grain were fulfilled (Lardy 1983). The second major shift was the implementation of the Dazhai model of production. Named after a village of the same name in eastern Shanxi province, the Dazhai model emphasized improving farm fields by damming and terracing, among other methods. This model viewed trees and shrubs as impediments to the expansion of farmland. The Dazhai paradigm would lead to forestry becoming virtually ignored. This attitude resulted in widespread and improper clearance of forest land mainly during the Cultural Revolution (lasting from 1966 to 1976) and is often referred to as the second wave of forest depletion by Chinese foresters (Yin 1994).

The Cultural Revolution brought still more changes to forest tenure rights throughout China. During the Cultural Revolution, the CCP Chairman Mao Zedong declared that the Chinese youth should forge their own internal revolution to eradicate "the four olds," – old thoughts, old culture, old customs and old habits. In practice, this meant an active mass mobilization of "Leftist" youth under Chairman Mao's banner who would assault and "struggle against" leadership figures and established managers causing widespread disruption of production (Fenby 2008).

While production brigades and production teams retained control of forest management, the recently decollectivized fruit and non-timber trees were now recollectivized as Mao's Leftists claimed this conflicted with socialism (Liu 2001).

This process of shifting ownership back and forth is best illustrated with an example from the Dengguang production brigade of Chuxiong County, Yunnan:

> Ownership of fruit trees was transferred from households to advanced cooperative in 1956 and further to commune in 1958; commune back to households in 1961; households to production team in 1969; production team to households in 1971; households to production team in 1977; and production team to households in the late 1970s (Liu 2001).

This process of frequent and unpredictable changes would lay a foundation for cynicism about timber tenure security throughout China.

Following the Cultural Revolution the early vestiges of community based forestry appeared. Since the beginning of the collectives in the 1950s, farmers were aware of the weaknesses of the various production responsibility systems and responded with a variety of alternatives (Yin 1994). In a variety of attempts to create a direct connection between work and reward, farmers attempted sub-division of team work, piece-rate systems and output contracts. However, with each new attempt Leftists in the Chinese government attacked the program until it was shut down (Yin 1994). But following the end of the Cultural Revolution in 1976, the power of the Leftists waned and broad institutional change was burgeoning.

With Chairman Mao's death in 1976 and the prosecution of the "Gang of Four," Chairman Mao's co-leaders during the Cultural Revolution, China faced a series of important political transformations. Once again, land tenure reform would become a central policy orientation. While China had seen a variety of changes in tenure arrangements up to this point, this new shift coincided with a shift in politics seeing a new group take control. For several years Chairman

Mao's associates were in control, but quickly Deng Xiaoping, a long time central figure in CCP politics, took control with policies putting stability as the 'key link.' Primary among these shifts was Deng Xiaoping's political shift towards market based economics, which he would term "socialism with Chinese characteristics" (Fenby 2008). In 1977, in some of the poorer regions of Anhui and Sichuan, a system of team contracts began secretly that would result in significantly improved yields (Yin 1994). This system would gain the attention of Deng Xiaoping and other high ranking government officials and sparked a debate that would lead to a series of debates and culminating in 1978 as the Third Plenary Committee of the Communist Party central committee would announce a series of sweeping agricultural reforms (Lin 1988).

The Third Plenary session of 1978 opened up diversification of agriculture nationally, but also paved the way for regional comparative advantage, product specialization, expansion of free markets and a significant rise in the government procurement prices (Lin 1988). Additionally, this point marked an important decline in the power of the political Leftists. After a year of the secret contract systems returning large improvements in yield, the system was able to move into broader acceptance. Initially it was condoned only for poor areas, but the system gained enthusiastic support even in wealthy areas. By the time the contract system was formalized as the Household Responsibility System (HRS) in 1981, it had become universally accepted and recognized (Lin 1988). In an ironic sense, Chinese agricultural policy had come full circle now embracing a system of

tenant farming which strongly resembled the system implemented after the revolution thirty years prior (Yin 1994).

Overall the policy environment under collectivization was chaotic, driven by ideology and frequently totally dysfunctional. Goals set in the 5 year plans commonly had no roots in reality. Moreover, large portions of the statistics regarding rural production were simply the unconfirmed boasting of local officials (Fenby 2008). As for the ownership rights themselves, this period saw the high water mark of confusion and erratic institutional structures. However, it is a mistake to suggest that this period, ending thirty years ago, has been forgotten. As can be consistently seen since this time, farmers and rural land users have been deeply distrustful of the security of any land right they are given.

In describing the land rights during this era using the Baland and Platteau (2000) spectrum, this period has moments of private property but is truly dominated by state owned industrial production and forest nationalization. It would be a difficult case to suggest that regulated common property or unregulated common property can define the periods while the production brigades were the primary forest users. A specialized team holding responsibility for roughly five thousand households could not be recognizable as 'common property.' Rather, at the People's Commune level, forestry production in this period was divorced from individual households. Despite the name of this period in time suggesting otherwise, all of the rules, regulations, decisions about production and the enrichment from the forests themselves all were state-oriented during this era (Liu 2008).

3. Decentralization: 1981-2001

The immediate impact of the HRS on forestry was that households which had been forest-oriented under the collectivized system saw the improvements made by the HRS on agricultural households and demanded the same rights for their activities. In March 1981, the PRC leadership released a document called "the Forest Law" detailing a policy frequently referred to as the "three fix" policy to reform forest tenure in a manner similar to agriculture land tenure. The "three fixes" specifically involved stabilizing ownership of forests and mountains, identifying boundaries of household plots and establishing the Contract Responsibility System (CRS) (Demurger and Yang 2006; Liu 2001). The CRS was similar to the HRS in that it allowed private use of the land without allowing ownership of the land. Thus the central change instituted by the CRS is that it made use of the trees and profit from them belonged to the contract holder. The share of households participating in the CRS expanded rapidly and by 1983 included 55 percent of forest collectives and by 1984 roughly 30 million hectares of forestland was under the CRS.[6] However, it should be noted that transformation of the forestry sector was not as complete as in the agricultural sector, as forest contract-holders had to sell their production to monopsonistic state-owned wood processing operations (Hyde et al. 2003).

The transition to the CRS also reflected an overall national process of relaxing central government control and the adoption of a federal government

6 By comparison 50 million hectares were controlled by the state owned forest bureaus with another 20 million hectares remaining under centralized collective management (Hyde et al. 2003)

system. Instead of national level direction, bureaucratic control over the rural sectors increasingly moved to the provinces and localities (Hartland-Thunberg 1989). The lasting result was that the question of ensuring farmers fair benefits was left unanswered and great variation appeared in the institutions regarding incentivizing shareholder behavior. For example, in Southeastern China regional authorities demonstrated resistance to the CRS. At this time they presumed household operations were too small to conduct long-run forestry activities. This led to two recurring conflicts; the denial of private property rights associated with collective forests and boundary disputes regarding the collectivized lands (Yin and Newman 1997). However, next door to the limited adoption of CRS, the entirely opposite direction in policy implementation was taken in Yunnan province in Southwestern China where authorities adopted the "household contract" as its primary form of collective forest management (Liu 2001). In yet another formulation, the central and northern farm regions adopted primarily a variation called "land carrying trees." In this format trees near contracted agricultural land were assigned to the nearby landowner. Additionally, large shelterbelts and commercial forests were kept in collective ownership but then contracted out for management. This arrangement led to a variety of intercropping schemes being implemented throughout the region (Yin 1994). Obviously, with widespread variation in regulation and China's starkly uneven distribution of forest land, the movement towards regional specialization in forest management across China became increasingly radical.

By the mid-1980's the Ministry of Forestry (MOF) realized China's forest resources were in a difficult situation which they henceforth referred to as the "two crises." These crises consisted of widespread ecological degradation and economic losses (Bennett, Jiang et al. 2008). Despite such early concerns, no significant action would appear until the turn of the century. The ecological crisis would not lead to forestry reforms until severe flooding occurred in 1998 as a result of over logging. The crisis of economic loss-making was not fully addressed until major reforms of the state owned forestry in 1998 (called the National Forest Protection Program which will be discussed in the next era) and the widespread forestry reforms beginning in 2002 which signal the start of the next policy environment era. This late action led to the standing volume of the state owned timber having been continually drawn down and by 2001 many of China's state-owned forests would no longer be able to support their related mills or forest workers (Hyde et al. 2008).

By 1984, the reforms had designated 20 million hectares of 'barren hills' (荒山荒地) as being under some 50 million household contracts and over 5 billion hectares of barren land as being under timber contracts, largely in the southern region of China (Sun 1992). These 'barren hills and wasteland' were land which was too steep or remote for agricultural production, but lacked any standing trees. Such land was considered a viable candidate to convert to forestland, but the government had not invested in afforesting it (Sun 1992). However, under this initial expansion a number of issues appeared almost immediately. Foremost, the government generally retained the best and most

productive potential timber land (Sun 1992). Additionally, plots were often highly fragmented and plot sizes were often small with the average household having less than one hectare for management (Yin and Newman 1997). Compounding these issues, the structure of the market itself had a highly problematic system of incentives for households making effective long term development decisions.

This early stage of the CRS was marked nationally by an incentive structure that generally did not support tree planting or long term management.[7] At this time, use contracts typically had a short duration (ranging from 3 to 15 years) and allowed farmers rights to management and profit from the timber but not the land where the timber was grown (Zhang 2003). In early 1985, a central government document briefly mentioned abandonment of the initial compulsory delivery system which had been the source of the quotas and price controls to regulate the market (Sun 1992). With the market abruptly opened, timber prices jumped by 100% to 150%. Under these new prices, timber from all sources (state-owned companies, private timber dealers, farmers and even government departments) flooded the market. This opening of the market diluted government timber company monopolies, improved timber utilization and increased farmer income (Sun 1992). However, this opening failed to induce long term investment from farmers. Cynical from frequent changes in timber tenure arrangements since founding of the PRC, risk aversion became the priority and farmers did not expand reforestation or forest management (Yin and Newman 1997).

7 An exception to this point would include shelterbelt development in the regions using the "land carrying trees" format (Yin 1994).

Farmer cynicism about government reversals was reinforced in 1986 when the national government changed its position on having an open timber market. Worried by liquidation of forest resources and the stagnation of forest management, the government returned to state controlled procurement companies and implemented tough quota regulations on harvest volumes (Yin and Newman 1997). In regard to the trees which remained under the CRS system, now farmers had to apply for harvest permits and they were returned to a monopsonistic arrangement of potential buyers[8]. These state-owned buyers offered prices which were approximately half of what the market prices were. Additionally, the government began consolidating contracted timberlands while also raising taxes and fees from contract-owned timber sales so as to fund reforestation efforts (Yin and Newman 1997). Yet, the CRS was not the only land use rights system in China which was struggling.

During this period the HRS system was also facing serious issues which were strongly related to the CRS and are helpful for further illuminating the overriding issues. Namely, in the late 80s and into the 90s interest in the HRS waned and was replaced by a growing enthusiasm for the Township Village Enterprise (TVE) system (Fenby 2008). TVE's were small factories set up in the rural countryside, particularly in coastal provinces, and would use cheap village labor to produce export goods. The explosion of TVE's in the 1980s and 1990s were seen as a key method for rural development. In 1984 farm production hit a high water mark and many in the CCP felt that grain supply issues and farm

8 It should be noted that this experience was not identical in all regions. For example, in the northern regions where forestry was not a major business, farmers remained free to sell to any buyers, without harvest permits and faced low taxes or fees (Yin and Newman 1997).

management had been solved (Bernstein 1999). Thus, the provincial governments began to divert their attention, and the agricultural financial resources, to the TVEs as the difference in return on investment was enormous. From 1981 to 1985 the average provincial investment in agriculture was 6% of the budget, but by 1994 the average investment was down to only 0.6% of the budget (Bernstein 1999). Yet, the provincial governments would frequently cite their falling agricultural productivity as proof for the need for additional Central government resources. "'Nearly every province has asked for more money from the central government to pump into agriculture, but none has been too willing to invest its own funds' (as quoted in Berstein 1999)." This problem was further exacerbated by local officials' corruption leading to erratic fees being levied. As this cycle continued in both the case of the HRS and CRS, higher level government officials began to panic.

Following an upsurge of conservative politics following the Tiananmen protests in 1989 the government considered recollectivizing the farms. Rumors of this got out and prompted a wave of sales of livestock and destruction of property (Bernstein 1999). By 1991 Deng Xiaoping reversed his early edicts about the importance of market economics for stability and now claimed that the degree to which the CCP improved the lives of peasants was the central concern for regime stability. His fear that the rural countryside was becoming unstable were confirmed in 1992 and 1993 when hundreds of protests and riots erupted in villages across China protesting local official corruption, primarily the levying of illegal taxes and fees, as well as the government grain procurement agencies'

failure to pay in cash (Bernstein 1999). These issues emboldened the central government and in 1993 the "Law on Agriculture" provided the farmers the "right to refuse" improperly authorized fees levied on them (Bernstein 1999). This was buttressed by a 1994 change in regulation which extended the HRS contracts to 30 years. However, by this point in time the damage was already done. It had become clear that China's development was being driven by industry while pure farming communities without any TVEs or industrial activity fell further into poverty. The situation in collective forestry regions was often very similar. Erratic fees and low return on investment ensured that these counties often became among the poorest and enthusiasm for the CRS program was overall torpid (Liu and Landell-Mills 2003). These issues would later become central to the discussion of forestry for rural development in the next era.

With the troubled HRS receiving attention, some actions were taken to try to spur afforestation. Sale of wastelands (barren land not in active use) would prove one of the stronger driving forces of afforestation following allowance of wasteland auctioning in 1993 (Hyde et al. 2008). By allowing private purchase and use of land designated as barren land or wasteland (荒山荒地) for forestry operations this policy led to rapid results. As early as 1996, 3.7 million hectares had been auctioned into private ownership. The success of this system would eventually lead to the auctioning of both newly planted and mature forest stands into private use (Hyde et al. 2008). Another major attempt at spurring afforestation was the gradual extension of time of the leasing arrangement under

the CRS. While the initial contracts only allowed for very short time spans[9], they were extended again in 1993 up to 30 years (Ho 2001). This gradual movement towards longer contracts stemmed from recognition by the Chinese government of the need for long term usage to facilitate afforestation and forest management activities; however, these reforms would not stem the farmers' cynicism (Ho 2006).

Forestry in China would reach a major turning point following widespread recognition of environmental degradation. In 1997 severe drought in the Yellow River basin followed by 1998 flooding in the Yangtze River basin as well as parts of northeastern China led to national attention on erosion and deforestation across China (Bennett, Mehta et al. 2008). Additionally, the MOF was downgraded to become the State Forest Administration (SFA) in a government ministry shakeup (Ho 2006). Having these issues gain prominent national attention led the SFA to drive itself into a new direction. Beginning in 1998 the SFA began four years of negotiation and policy changes to direct China towards new ecological and rural development goals in forestry (Zhou 2006). At this time the political willpower appeared to push for ecological and land use reforms.

Initially the CRS had aroused enthusiasm for new ownership regimes, but with time the poorly structured method of determining and securing the rights to the forest contract land caused recognition that the CRS was failing and major institutional change was needed. Thus, the first problem to be addressed was the issue of land redistribution. In the 1998 "Land Administration Law,"

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9 As mentioned earlier, they were at 3 years in 1981 then extended to as long as 15 years in 1984.

redistribution of land was changed so that now two thirds of the village council had to approve of the local authorities redistributing land or a land contract user leasing land to someone from outside the village (Ho 2006)[10]. By this point the government had realized that the contract system had been badly applied with too many parties having authority.[11] Adding to this problem, there was an overall lack of coordination or clarity about the land rights themselves.

> ...permits have been issued twice or not at all. In addition, due to the needs for economic construction and management changes since 1981, there have been great changes in forest titles. ... The multiple changes in titles have not been assessed in time, as a result of which many places feature 'permits but no forest, or forests but no permits.' Worse, the content recorded by permits often does not match with the actual site, leading to numerous disputes. Lastly, to date there is no standardized model for the forest permits (SFA 2000 as translated in Ho 2006).

While the problems of the CRS were beginning to be addressed, the SFA and the CCP saw broad need for action and began one of the biggest investments in forestry in all human history (Xu, Katsigris et al. 2001).

In 1999 the SFA initiated the Sloping Land Conversion project (SLCP) to convert farmland on hills and steep slopes into forestland in exchange for grain subsidies.[12] The program carries a hefty price tag at $40 billion USD and covers a huge area, 14.67 million hectares of cropland. Once finished, this program will have increased China's forest area by 10-20% and decreased the arable cropland by 10% (Xu et al. 2009). However, this was not the only major reform

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10 It is worthwhile to explain why this is not a total ban on redistribution. While the possibility of redistribution does reduce the stability of the contracts, redistribution was favored by most farmers as it was seen as an insurance of their equity as the land given to a family could shift as the family size and needs changed (Kung and Liu 1997).

11 This excessive numbers of parties controlling land right authority is cited as one of the key reasons for the downgrading of the MOF to become the SFA (Ho 2006).

12 Some authors refer to this as the "Green for Grain" program.

planned. The National Forest Protection Program (NFPP) was a similarly enormous restructuring for China's forestry. Following the successive natural disasters mentioned above in 1997 and 1998, there was little argument against the idea that deforestation had become a major environmental crisis in China (Xu, Katsigris et al. 2001). The NFPP sought to tackle this issue directly by creating strict logging quotas for the state forestry bureaus in regards to the cutting in nationalized forests. While quotas on timber production had existed for a long time in China's forestry, applying them to the state-owned production was a major shift away from the old model of an unrestricted state-oriented timber industry. Furthermore, the state-owned timber companies were required to seek a major transformation from timber production to afforestation activities. Fundamental to this was a major restructuring of the workforce. The government decided it would subsidize these costs as well as laying off and then retraining the workforce (Bennett, Jiang et al. 2008).

While these two ecological policies may seem unrelated to collective forestry tenure reform, they are actually a key sign that forestry in China was changing. Namely, whereas previously forestry was only viewed through the lens of timber production and as being less worthy of attention or investment compared to industrialization; now forestry was becoming important for ecological services as well as rural development. The CCP had realized that the way rural development lagged behind urban development and the lack of attention to China's forest resources had both proved unsustainable. Thus, the

new era of forestry tenure reform is to be born from this wave of environmental awareness and concern.

The policy environment during the decentralization era could best be defined as reforms without enthusiasm (Liu 2001). While the initial changes from the People's Communes to the HRS aroused great enthusiasm, the government soon focused its attention on developing industry rather than agriculture or forestry. When the CCP's attention returned to agriculture it was driven by panic as the failure of the system was becoming irrefutable. Forest contracts followed a similar route with poor or barren land being the primary 'forest land' which was being distributed to individuals while the collective controlled forestry maintained the best plots. These issues compounded with the confusion over ownership showed that the CRS was failing and no one had paid much attention. Only massive environmental disasters and rural civil unrest could bring sufficient attention to forestry for the CCP to change their priorities.

The ownership regimes in this period included both regulated and unregulated common property with some private property and state ownership. This variety of institutional responses demonstrates a central factor in this period's reforms; decentralization of collective and state forest ownership was the product of a simultaneous decentralization of the PRC government power structure (Yin and Newman 1997). Instead of having a new "Dazhai model" or mass campaign for all the communes to introduce, local authorities created a wide range of responses based on their own biases. As previously mentioned, there are examples of Southeastern provinces with large collective areas

refusing to fully implement the CRS at the same time as the Northwestern plains region was strengthening ownership rights, releasing production quotas and eliminating price controls. Thus there coexisted both regulated common property and unregulated common property in the CRS itself depending on how the land rights were distributed. The Northwest had the strongest contract rights, in most cases private property, while in the Northeast and Southwest the state-owned timber production was totally dominant while collective forest area and the entire contract system was practically non-existent[13]. An important note is that during the Institutional Reforms era this diversity has not disappeared, but rather began to remold itself so that provincial governments moved towards new goals for forestry.

4. Institutional Reforms: 2002 - 2008

The post-2002 period of forestry reforms have been an entirely new direction while simply repeating the past. While on its face this seems to be a contradiction, in reality it is demonstrative of the complex issues which pervade forestry in China. Once again major reforms are generated as a result of moving radically, constituting a major ideological shift and readdressing issues which were thought solved decades before. Interestingly, in this new atmosphere the language of the SFA and the CCP changed so that the new phraseology for this period was 'Institutional Reform' (制度改革). This change in terminology originally began with the early CRS reforms, but became the central topic of

13 For a more in-depth consideration of regional diversification consider reading Hyde et al. (2003) or Liu (2008).

discussion in this new period with seemingly every government forestry publication carrying this as a chapter heading or keystone phrase for discussion. Understanding the Chinese conception of 'Institutional Reform' thus becomes the key to understanding the latest period of China's forestry.

While the 1998 'Land Administration Law' was an important step in unifying ownership rights, it did not make any change in the CRS itself. Similarly, the NFPP and SLCP ushered in a new role for forestry as an environmental necessity, but didn't address collective forestry in China. Rather, the real change to the CRS came in the form of the 2002 'Law on Land Contract in Rural Areas.' This new law was a major reform of the HRS, CRS and the contracting of grasslands. These tenure reforms adopted the basic principles of the 'socialism with Chinese characteristics' which created the CRS and applied a new standard of success which emphasized rural development.

The tenure reforms constituting 'Institutional Reform' from the 2002 policy have been the strongest strengthening of community/ private forestry yet (Liu 2008). The government designed these reforms to convince farmers to begin planting, by ensuring that it would be more profitable and produce long term benefits. Thus, the primary focal points of these reforms were (1) improving forestry financing, (2) reduction in taxes and fees, (3) encouraging better management practices, (4) liberalize pricing while reducing power of timber processing monopsony and (5) above all strengthen the contracts themselves. These primary tenets demonstrate this new focus on rural development; whereas

previously the CRS simply emphasized the allowance of timber ownership, these new reforms aimed to make it more profitable and secure.

Improved financing is an important consideration for the CRS reforms. There are two primary considerations for this change in banking policy. First, the Chinese government has approved non-state owned companies to take out loans for forestry related purposes as well as create an interest subsidy policy for forestry development. The reasoning for this is that stark regional differences have appeared in China's forestry production capacity (SFA 2007 pg 5). The second primary consideration for forestry financing change is the new allowance for using CRS owned timber as bank collateral for small loans. This emphasis is drawn from the recently shown power of micro-financing. This also allows for groups of farmers or forest workers to combine as a group to make an application for a loan (SFA 2007 pg 347). These banking regulation changes are seen as opening an important barrier to forestry development. By making forestry investment easier, the government hopes to improve the potential investment opportunities in contract forestland as well as allow forest ownership to become a valuable source of fixed assets for those who live in rural areas.

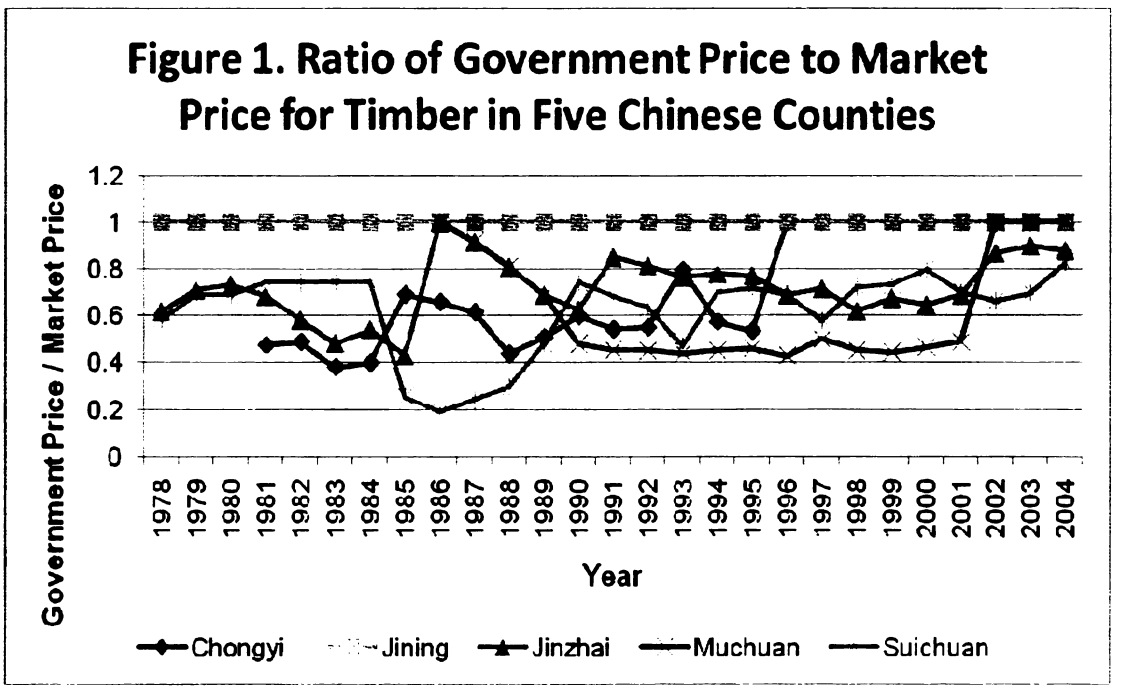
Another primary financial incentive for collective forestry is the overall reduction in fees. It is common in provinces which are more collective-oriented for the forestry departments to fund operation costs by charging taxes and fees on forestry practices. Jiangxi province alone claimed it annually needed 300 million Chinese Renminbi (RMB) to pay for forestry department operations (SFA 2007 pg 232). Thus, in 2004 the provincial forest departments began being

funded by the central Chinese government so that they could switch from collecting fees to enforcing forestry regulations (*ibid*). These changes also meant the provincial forestry departments decreased fees overall while making a shift to promote additional education about forestry laws and rights (SFA 2007, pg 80 and pg 124). However, this new transformation was only part of a broader change in encouraging better management practices.

At the same time the harvesting and transportation fees were being phased out, the institutional reforms advocated increased verification of management guideline compliance and the collection of vegetation recovery fees which fined those who cut but failed to reforest. By 2005 the area of land checked for having been replanted after cutting was up to 94% from 82.5% in 2000 (SFA 2007 pg. 49). However, the management of forests remains a serious concern for the future of forestry development. Accordingly, the time period between 1999 and 2005 includes over a dozen new policies generating new standards and regulations guiding the management of forest resources (SFA 2007 pg. 46). Included in this emphasis on strengthening the management of small scale forestry, the government was also breaking up the state-owned control over the forestry sector more broadly.

There are two key restrictions against market-based collective forestry operation which have been relaxed under the institutional reforms. First, the government has been moving towards reducing or eliminating the forest department's monopsonist pricing and replacing it with the timber market price. Figure 1 displays data taken from five county forestry bureaus reporting the ratio

of government offered price to the market price.[14] This graph demonstrates that marked variability continues to exist across China but the overall movement is towards less price control. In Jining county which is in northern Shandong province, we can see that there never was any difference between the prices; whereas in Suichuan county in Jiangxi province, a largely collective forestry oriented county, we see frequent variation in this ratio. However, the overall movement has been towards less and less government restriction on pricing.[15] Second, as a part of the NFPP the government has been breaking up the monopsonist control of timber processing by state-owned industries (SFA 2007 pg 179). While this is primarily important for the state-oriented provinces, it is also relevant for the collective forestry provinces which also have a similar structure to their timber processing industry.



14 This data was originally collected by Dr. Can Liu in 2008 when the county forestry bureaus graciously allowed access to their statistics. It was provided to the author of this thesis in December 2008 in full.

15 See Liu (2008) pg 102 for his similar interpretation of this same data.

While the already mentioned changes are all important, the true core of the Institutional Reform era is a strengthening of the contracts governing collective forest land use. This strengthening came from a variety of documents and edicts, but all make the same point that the contracts have value and meaning. For example, the 2003 'Decision of the CCP Central Committee and the State Council on Accelerating the Development of Forestry' forwarded a clear national rule: 'the person who planted owns it, the investor is the beneficiary' (SFA 2007 pg 35 and 339).[16] However, merely having the planter being guaranteed to be able to collect on their investment would not be a very strong incentive. Thus, the reforms also allow the contract rights to be mortgaged, outsourced or loaned to a third party (SFA 2007 pg 225 and 345). However, perhaps the most crucial change was that this new edict made forest contracts inheritable (SFA 2007 pg 345). In Chinese culture family is a central concern and contract transference upon death was a key missing component which likely maintained the popularity of weaker use rights (Kung and Liu 1997). These kinds of reforms have been a major shift to making the contracts look more and more like private property rights. This seems to show that the CCP is very serious about seeing the contracts succeed under the institutional reforms.

Despite these major changes key restrictions remain. Namely, the volume and timing of cutting remains under strict quota control. Thus, classical forestry economics questions of timing a timber harvest for maximizing profitability have no meaning in China where cutting may be rushed or slowed as the forest contract holder applies to cut under a lottery system for quota distribution which

16 This thesis author's translation, but SFA (2007) is the source.

is common in many provinces. Adding to this, the only silvicultural removal system available to contract holders is a selection cut, a limited removal, overseen by the forestry department. This means that a variety of management techniques are simply unavailable to China's collective forests. These cutting restrictions help ensure that deforestation is strongly controlled by the forestry departments, but it also means that collective forestry in China will have weakened economic incentives.

In the spectrum of forestland ownership regimes in this period, it is identical to the previous period, except that unregulated common property has all but disappeared and the areas with regulated common property are verging on private property. Additionally, as the state-oriented forestry also dropped off swiftly during this time period, its role diminished both as a producer of timber and as the sole processer. Thus, the primary difference of this period to the previous is that while great diversity remains, it has diminished whereby private property and regulated common property have gained significant prominence.

During this era of Institutional Reform, the policy environment is one of tectonic shifts for forestry development. Large monetary investments, dozens of new legal reforms and new CCP attention to rural development all suggest that this era is one of major change. The CCP was no longer willing to tolerate the failure of the CRS system as ecological degradation had become a hazard. In the institutional reforms the CCP seems to be committed to making serious changes. Yet a lingering question remains: have these formal institutional changes generated changes in the behavior of the forest contract holders? The new

sweeping changes were seeking more than a formal regulatory change; the CCP is seeking a reform of the informal institutions in China's collective forestry so as to convince farmers to invest in afforestation. The next section of this thesis will address the question of what the numerical changes have been induced in aggregation so as to understand the degree to which China has undergone these changes.

III. Quantitative Analysis

Considering the broader history of China's forest policy, it becomes clear that the primary challenge facing the new institutional reforms is whether they have changed contract holder behavior. Thus, in this section this research will perform longitudinal studies on timber production from 1953 to 2007 and forest area from 1981 to 2007 in an attempt to understand the impacts of the changing policy environments. The relevant question being: whether the different policy environments induced changes in the amount of timber harvested and the amount of area used for forestry.

There are two models which will be utilized. The models will test the hypotheses: (a) The different periods show distinct variation from each other and (b) timber production and forest area increased under the Decentralization and Institutional Reform policy environments.

1. Models

Model 1 seeks to understand the policy environment changes on timber harvest. Similarly, Model 2 focuses on the policy environment impacts on land

use. In all models the subscript *i* represents the data unit is each province and *t* represents each year. Model 1 is specified as:

$$(1) \qquad Y_{it} = \beta_0 X_0 + \beta_1 Y_{it-1} + \beta_p X_{itp} + \delta_j D_j + \alpha + \upsilon_{it}$$

Y_{it} is timber production (木材产量) in 10,000 cubic meter units. Timber production should show the overall activity of the Chinese forest industry which will inform this research as to whether the different policy environments are changing timber production.

X_0 is the intercept. Because of the nature of policy environment dummy variables, this intercept should be interpreted as the timber production intercept for the Land Reform era of 1953 to 1957.

Y_{it-1} is a lagged timber production dependent variable in year *t-1*. This lagged dependent variable can be interpreted as the capacity for production and processing, the production levels set under the various 5 year plans, and the quota values set for the collective forestry production. This variable covers a lot of ground, but is necessary as timber production in China has largely been under a command economy structure during the last 60 years.

X_{itp} represents the group of independent variables in the model and are numbered 2 through 5 as the 1 designation is assigned to the lagged dependent variable. The subscript *p* indicates the four independent variables utilized in the model: X_{it2} is population, X_{it3} is industrialization ratio, X_{it4} is per capita grain production and X_{it5} is area afforested. Population of a province is in units of

10,000 people at year end. The level of industrialization of the provincial economy is demonstrated by a ratio of the non-primary product Gross Regional Product (GRP)[17] divided by total GRP. Therefore the ratio measures the primacy of non-agriculture, forestry or natural resource economic output. In other words, this measure indicates how developed a province is, whereby a higher relative amount of non-primary production suggests a more urban, more industrial province. Per capita grain production measures grain volume in units of metric tons per person. The afforestation area (造林地面积) is the land area which was aerially seeded, naturally regenerated or had saplings planted in units of tenth of a hectare. The survival rate of the area is not considered. This understanding of afforestation may be confusing to some English language foresters, but in the Chinese language the notion of afforestation includes activity which normally would be classified as afforestation as well as activity which would be considered reforestation.

There are four dummy variables, D_j (j = 1, 2, 3 and 4). The first three D are dummy variables[18] representing the policy environment impacts. As mentioned above the intercept represents the first policy environment period. D_1 is the 'Collectivization' policy environment period which covered 1958 to 1980. D_2 is a dummy variable for the 'Decentralization' policy environment period which

17 Gross Regional Product (GRP) is the term for Gross Domestic Product for an individual province.
18 Dummy variables take the value of 0 or 1; 1 being where the province during that year is under the effect, 0 if not. .

covered 1981 to 2001. D_3 is a dummy variable for the 'Institutional Reform' policy environment period which covered 2002 to 2007.

D_4 is a dummy variable for the Natural Forest Protection Program (NFPP) which covers the years the program was implemented in various provinces. Many provinces do not participate in this program, but most of those provinces that enter the program start in 1998 with a few beginning the program later.

Because this is a panel model, α_j is the fixed effect, which removes the non-time varying effects particular to each province. Primarily this is the natural environment of the provinces. This will control for impacts of provinces which are more biologically productive and thus capable of naturally higher timber production. This research uses a fixed effects panel model because it is guaranteed to give consistent estimators.

Finally, u_{it} is the unexplained error for the model.

Model 2 follows a similar panel model format to Model 1. However, in Model 2 Y_{it} is the forest area (有林地面积), in 10,000 square kilometer units.

$$(2) \quad Y_{it} = \beta_0 X_0 + \beta_p X_{itp} + \delta_1 D_1 + \alpha_i + u_{it}$$

X_0 is the intercept. This intercept should be interpreted as the forest area under the policy environment for the Decentralization era of 1981 to 2001.

X_{itp} represents the group of independent variables in the model. The *p* indicates the five independent variables utilized in the model: X_{it1} population, X_{it2} industrialization ratio, X_{it3} is the government investment in afforestation, X_{it4} is the

Gross Output Value (GOV)[19] of grain production and X_{it5} is the GOV of forestry production. The population is again in units of 10,000 people at year end. The industrialization ratio is calculated identically as in Model 1. Investment by the provincial government in afforestation (营林投资) is measured in units of 10,000 Chinese Renminbi (RMB). Gross Output Value (GOV) of grain products and GOV of forest products are measured in units of 1 billion RMB.

A general expectation would be that forest area should have a lag following afforestation. Simply, if a plot of land was registered as "barren" but undergoes an afforestation effort the land will be designated as forest area if it has sufficient canopy coverage and tree height. As the amount of time required to reach this time will vary between province, types of tree and type of planting it is very difficult to exactly predict the length of time lag. Accordingly, this research will not give any specific time lag to the afforestation values. Because there seems to be a persistent trend in each of the variables, it seems sufficient to say that the effect of this lag is negligible.

D_1 is a dummy variable for the 'Institutional Reform' policy environment period which covered 2002 to 2007.

α_j is the non-time varying fixed effect which is removed for each province.

u_{it} is the unexplained error for the model.

2. Data

19 Gross Output Value (GOV) is the value of the particular product in Chinese RMB. Thus the RMB values of all the grain products or forest products of a province are combined in this measure.

One of the primary propositions examined in this thesis is whether each policy environment period is different from the previous era and this difference can be observed in China's aggregated forestry statistics. However, by utilizing China's public statistics there is an added vulnerability because some Chinese government statistics are known to be inaccurate. "Cadres at the local level may underreport certain figures to evade taxes, as in the case of cultivated land, or [over report] certain figures gain political favors, as in the case of tractor-plowed areas (because this is one of the indexes of modernization in Chinese agriculture)" (Lin 1988). These issues have been longstanding and continue today as many Chinese statistics are the responsibilities of local level officials who have incentives to be dishonest (Wu 2003). However, there is a general recognition that while the statistics are not accurate, they do capture trend behavior and display sufficient consistency for use in regression analysis (Dernberger 1980; Lin 1988). This reliance on the truthfulness of the trend behavior has continued as the Chinese government statistics have appeared in a myriad of journals and books in the years since. Despite many warnings such as *caveat emptor*, the quantitative study of China demands data and often the government data is simply the only choice. Regarding forestry data this is clearly the case and most articles make no reference whatsoever to the questionable nature of the statistics themselves. The saving grace for this thesis is that it is specifically looking at overall trends to determine if they diverge in aggregation; the government forestry data is sufficiently consistent for this endeavor. Furthermore, the forest survey inventory data which supplies some data for this

thesis, including forest area data, is based on sound scientific methodology and is not subject to political tampering (SFA 2006).

Specifically the data utilized in this thesis comes from a few primary sources: China Compendium of Statistics 1949-2004 (CSB 2005), China Statistical Yearbooks 2005 to 2008(CSB 2005; CSB 2006; CSB 2007; CSB 2008), China Forestry Yearbooks 1987 to 2007(MOF 1988; SFA 2008), and the book Forest Resources of China(SFA 2006). The data utilizes each province, each year as the basic unit of analysis. Additionally, this research is using two different sets of data to answer the first two research questions. The 'Model 1' corresponds to 'Data Set A' and 'Model 2' is linked to 'Data Set B.' Data Set A covers the years from 1953 to 2007 and contains data points collected from 26 of China's provinces with data from Beijing, Hong Kong, Macau, Shanghai, Taiwan and Tianjin being excluded. In Data Set A, the data from Chongqing province has been added into the data for Sichuan province when it was available and likewise the data for Hainan province is added into the data for Guangdong province where available[20]. Thus Data Set A is designed to demonstrate the changes in timber production resulting from the Chinese policy environment during all four periods. In contrast, Data Set B is much more limited. Covering 1981 to 2007, Data Set B contains only the 19 provinces which comprised the Southeast, Northwest and Central regions[21]. This data set is much more restricted because

20 This aggregation was because the data for Hainan and Chongqing were included in the Guangdong and Sichuan data prior to Hainan and Chongqing becoming independent provinces.
21 The Southeast is Anhui, Fujian, Guangdong (which again contains Hainan), Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Liaoning and Zhejiang. The Northwest is Gansu, Ningxia, Qinghai, Shaanxi and Xinjiang. The Central Provinces are Hebei, Henan, Jiangsu and Shandong. These classifications are designed to match those used in Liu (2008), but similar classification can be seen elsewhere such as Hyde et al. (2003).

it is seeking to describe the changes in forest area during the last two policy environments. This limited investigation is largely because the earliest collection of forest area data occurs in the first national forest inventory survey which spanned 1974 to 1977. Thus, instead of incompletely studying the era of collectivization, Data Set B will expressly focus on the time during which the CRS was in effect. An important note for this data set is that the dependent variable was collected roughly every five years in the national forest inventory but the regression analysis treats it as if it was collected every year. This is done by linearly estimating the data points which fall in between any two surveys of the forest area. Additionally, this study will only use these three regions because they are not dominated by the state-owned forestry. Thus, Data Set B is a close look at how collective forestry contract use affected land use.

3. Results

The coefficients of the dummy variables and the intercept in Model 1 are of particular interest if they are statistically significant. But before any inferences can be made the primary step is to ensure that the model is appropriately specified.

The first question to be addressed is whether the variables have strong correlations. Thus, a correlation coefficient matrix is presented in Table 1.

Table 1: Correlation Coefficient Matrix for the Variables in Model 1

	Y_{it}	Y_{it-1}	X_{it1}	X_{it2}	X_{it3}	X_{it4}	D_1	D_2	D_3	D_4
Y_{it}	1.0									
Y_{it-1}	.979	1.0								
X_{it1}	.054	.054	1.0							
X_{it2}	.236	.238	.282	1.0						
X_{it3}	.472	.470	.203	.307	1.0					
X_{it4}	.187	.191	.284	.410	.267	1.0				
D_1	-.097	-.098	-.241	-.420	-.370	-.331	1.0			
D_2	.113	.127	.212	.344	.309	.187	-.687	1.0		
D_3	.059	.045	.186	.464	.168	.357	-.304	-.282	1.0	
D_4	.013	.029	-.018	.392	.268	.487	-.293	-.003	.547	1.0

From the matrix it is clear that the timber yield is extremely related to its previous year, however, this was to be expected. Because the state-owned industry is working off set 5 year plans and quotas for harvests are dominant in collective forestry, it can be assumed that there is a very strong and important connection between the timber harvests of any two consecutive years. To check for a multicollinearity effect for the timber yield equation a tolerance test to determine the amount of unique variability was performed and got a result of 0.7121. In such a tolerance test it is customary to worry about multicollinearity if the value is under 0.2. So, in this case it is not a concern. Overall, this matrix shows that the variables individually do not have strong correlations.

The estimated results are reported in Table 2.

Table 2: Regression Results for Model 1

Coefficient Name	Variable Name	Coefficient Estimate	t test
β_1	Lagged Timber Yield	0.8557***	61.75
β_2	Population	-0.0036	-1.40
β_3	Industrialization	50.2364**	2.21
β_4	Per Capita Grain Production	58.7705***	2.88
β_5	Afforestation Area	0.0003**	1.97
β_0	Land Reform Era	-11.2228	-0.85
δ_1	Collectivization Era	0.7168	0.11
δ_2	Decentralization Era	1.9967	0.22
δ_3	Institutional Reform Era	33.9895***	2.82
δ_4	NFPP	-53.3946***	-7.53

Notes: 1. The NFPP is the Natural Forest Protection Program
2. * = 10% significance, ** = 5% significance, and *** = 1% significance
3. N = 1404 and R^2 = 0.7936

Overall the model seems to explain most of the variability of China's timber production with a R^2 of 0.79. This suggests that the model is a good fit and controls for sufficient variability to claim that *ceteris paribus* has been reasonably achieved for analysis of the policy environment dummies.

Looking at the independent variables themselves, lagged timber is clearly the most important factor. Because the Chinese government was centrally planned during the first two policy environment eras, production remained

dominated by state-owned firms afterwards and the CRS was also governed by production quotas, the lagged dependent variable is a key *ceteris paribus* component.

On the other hand, population proves to be the least significant explanatory variable for timber production. While originally this was included on the assumption that a total increase in the labor pool would result in gains to timber production through additional labor, but it turns out that by holding fixed the industrialization of China and the labor tradeoff from farm labor to migratory labor (which will soon be discussed in considering the per capita grain variable); the total change in the population does not have any significant effect.

The industrialization ratio is controlling for the level of economic development of the provincial economy. The coefficient suggests that the increasingly industrial economy has a rising demand for wood products which is typical of a developing economy.

The per capita grain production coefficient represents the increased availability of labor resulting from increases in farm land productivity. The increase in land productivity is linked to the HRS changes which in turn has brought increasing labor availability (de Brauw, Huang et al. 2002; Kung 2002); in regards to forestry this labor shift has two main effects. First, this increase allows more migratory labor to appear as farms can be leased out and less family members are tied to farm land. This allows for additional work opportunity on the timber harvesting crews which frequently utilize migratory labor. This follows a similar trend to the overall migratory labor phenomenon throughout China

whereby land productivity and increases in rural mobility is seen as releasing additional labor into cities and rural industrial work (de Brauw, Huang et al. 2002). Second and more importantly, individual farmers have more available time to manage their forest plots or cut trees on the plots they are given. It is important to avoid confusion and be clear that this is a change in decisions in how to allocate labor time and not how to allocate land. While an increase in agricultural productivity may leave some people thinking this would suggest a transition of land use, but the way land contracting works the agricultural land can have fruit trees but cannot be converted to timber production (though the SLCP program does just that) (SFA 2006).

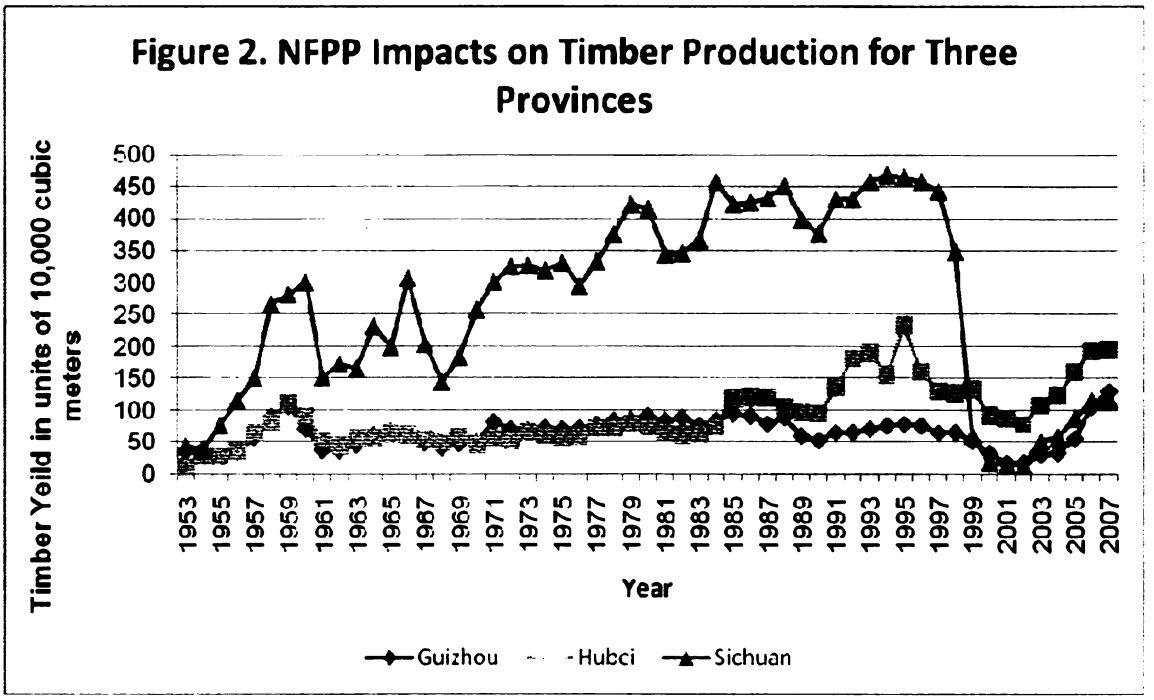
The positive afforestation value coefficient suggests that availability of mature timber trees is one of the major limiting factors in timber production in China. Specifically this is suggested because current planting affects current cutting. It is well known that the available levels of mature standing timber has dwindled greatly with time and this kind of relationship suggests that awareness of new investment encouraged removal from the limited mature stock (Hyde, Wei et al. 2008). Yet, there are two complicating factors to be wary of. First, the afforestation values are certainly inflated.[22] However, the significant coefficient suggests that the increasing afforestation seems to have some nugget of truth about level of resource availability. In fact, even if the values are inflated, this would likely only have an impact on the magnitude but not the significance of this variable. Second, it is important to consider if the variable may be suggesting a

22 Afforestation area statistics are commonly suspected of numerical inflation by local officials. This will be further considered in the discussion of the investment in afforestation variable.

reverse causality effect. If it had a reverse causality effect then the afforestation value would only be explaining the replanting after cutting. But there is a reasonable argument that the afforestation is not a response variable. If it was a response variable it would likely be strongly covariant with the timber yield variable, but as can be seen in Table 1 this is not the case. In fact, they have a very weak covariance of only 0.19.

The NFPP dummy is a significantly negative institutional variable. In other words, introduction of the NFPP in 2001 has led to a strong decline in timber output. Following the 1998 implementation of the NFPP the relevant provinces saw major timber declines. In the cases of those provinces where the state-owned timber industry was large the declines were particularly dramatic. For example, looking at Figure 2 it is clear that those provinces all had a sizable decline following the NFPP adoption, but in Sichuan which was a major state owned timber industry center the change was revolutionary.[23] However, what makes these cases particularly interesting is that when the 2002 institutional reforms are adopted each province showed a major rejuvenation of timber production. As the NFPP remained in place this suggests that the growth in production had to come from the collectively-owned forests reacting to the legal changes which ushered in the institutional reform era.

23 Figure 2 uses the information from Data Set A.



The use of the policy environment dummies in this model is a mixed success. Clearly the three policy environment dummies which covered 1953 to 2001 are completely non-significant. This is likely because there is minimal variability during this time span that is not explained by the lagged dependent variable. The planned economy and quota production were totally dominant during these eras. While there are blips of activity like the Great Leap Forward deforestation or the 1984 opening up of contract timber sales, these are not sufficient to mark the entire time span as being distinctive. This suggests that despite the outbursts of ideology which accompanied each policy environment, the overall landscape of timber production remained unchanged. However, this is actually an interesting result in itself. It shows that the decentralization under the CRS did not actually create new decision making possibilities for collective forestry as no positive or negative change appeared. The collective forest contract holders were constrained by the quotas and unfavorable economic

conditions (such as high fees) and were not very involved in timber production. Under the CRS timber cutting was now termed as being the responsibility of households, but the CCP controlled the real economic decision making of forest production. Therefore, this suggests that the notion of decentralization was more window dressing than reality.

While the first three policy environment dummies showed no statistical significance, the institutional reform shows startling significance. This highlights that these new reforms have been a real change in the CRS. The new strengthening of the contracts and the weakening of government regulation of the market seem to generate new cutting. What makes this particularly interesting is that the quota system which controls the cutting under collective contracts is still largely intact. This suggests that the areas where the quotas are non-existent or weakly enforced are responding to the new reforms strongly. Considering how fees have been reduced and price controls relinquished, it seems very reasonable to say that those people who had available contracted standing timber were eager to cut.

While this is an encouraging sign, it does not answer the question of whether these reforms have generated credibility and investment. A reduction in fees coupled with an increase in prices should be expected to induce cutting. The interesting thing this model tells us that only during the period of institutional reforms did the contract holders find conditions favorable enough to induce cutting. Seeing a strong cutting response under the last policy environment

confirms that the collective forestry contract holders are making decisions about their standing timber.

In regards to the hypotheses: (a) The different periods show distinct variation from each other and (b) timber production and forest area increased under the Decentralization and Institutional Reform policy environments, Model 1 shows a partial affirmation to both. Only the last era had a distinct variation, but it did show a distinct increase in timber production.

The second model is aimed squarely at answering the question of credibility by determining if the contract holders have invested in afforestation themselves. While this model covers a less expansive time period and geographical area, it is a much more focused inquiry into the behavior of the collective forests under the CRS.

Repeating the previous method of inquiry the model results begin with a correlation coefficient matrix.

Table 3: Correlation Coefficient Matrix for Model 2

	Y_{it}	X_{it1}	X_{it2}	X_{it3}	X_{it4}	X_{it5}	D_1
Y_{it}	1.0						
X_{it1}	.184	1.0					
$X_{it\,2}$	.053	.110	1.0				
$X_{it\,3}$	.136	.122	.472	1.0			
$X_{it\,4}$	.136	.683	.558	.526	1.0		
$X_{it\,5}$	.581	.502	.502	.369	.710	1.0	
D_1	.164	.091	.552	.7702	.488	.495	1.0

This matrix shows there are two high, but not worrying correlation effects.[24] First, the GOV farm and GOV forest products have a strong correlation. This indicates a tradeoff between the two which will be discussed in depth when discussing the model results. Second, we see a strong relationship between investment and the institutional reform dummy. This is largely because in 1998 when the government began its many ecological programs they involved large increases of investment in afforestation (the SLCP and the NFPP are both prominent with other programs making smaller contributions). As these reforms overlap the institutional reforms in time, it means the two show some relationship. However, this is part of the reason that investment in afforestation variable was chosen for this model rather than using an afforestation area variable. While, these interactions will be considered fully in the results section, it is important to control for the impacts of these ecological programs so as not to make the institutional reform dummy accidentally into a model of the SLCP and NFPP impacts.

Again to check for potential multicollinearity, tolerance tests were performed to determine the level of unique variability. The results were GOV Forest Products = 0.2088, GOV Farm Products = 0.4257, the Decentralization dummy = 0.3241, and Institutional Reform dummy = 0.3259. As the borderline for worrying about multicollinearity is 0.2 it is clear that GOV Forest Products is close, but seems to not actually have multicollinearity.

24 "Not worrying" because this correlation would cause a drop in significance, but as can be seen in the results of the model this is not the case.

Table 4: Regression Results for Model 2

Coefficient Name	Variable Name	Coefficient Estimate	t test
β_1	Population	0.0235**	2.29
β_2	Industrialization	492.5519***	7.94
β_3	Investment in Afforestation	0.0002***	3.70
β_4	GOV Farm Products	-0.1071***	-7.12
β_5	GOV Forest Products	2.6554***	12.55
β_0	Decentralization Era	-117.7365***	-2.75
δ_1	Institutional Reform Era	-34.6586***	-3.49

Note. 1. * = 10% significance, ** = 5% significance, and *** = 1% significance
2. N = 506 and R^2 = 0.7111

The second model seems to be defining the *ceteris paribus* conditions for the dependent variable (forest area) very well with all of the variables showing strong significance. Additionally, with an R^2 of 0.71, the model has a high goodness of fit. These two factors suggest that this model adequately estimates some poignant parameters which affect the area forested for much of China.

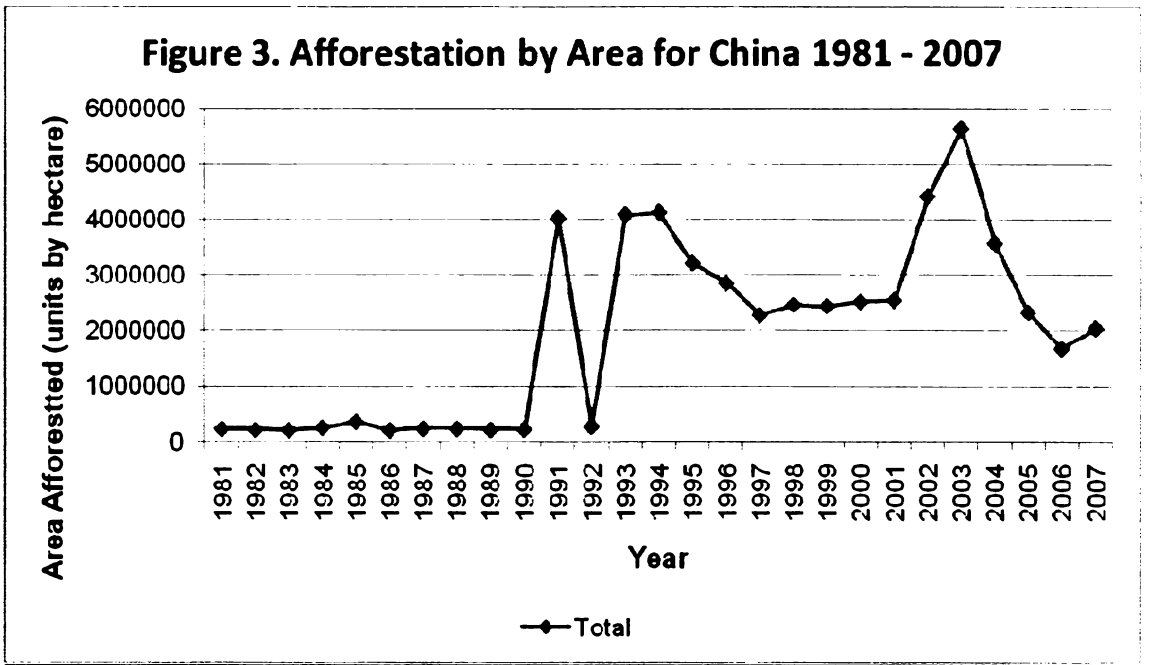
Population having a significant impact on forest area should not be a surprise, but it having a positive coefficient may be to some people. However, the reason for this is simple. The regions covered by this data set include some highly urbanized coastal provinces with large forestland as well as other provinces which are sparsely populated grasslands. While there is no magic dividing line, there does seem to be a relationship between the more populated provinces also containing a larger proportion of the forested land as well.

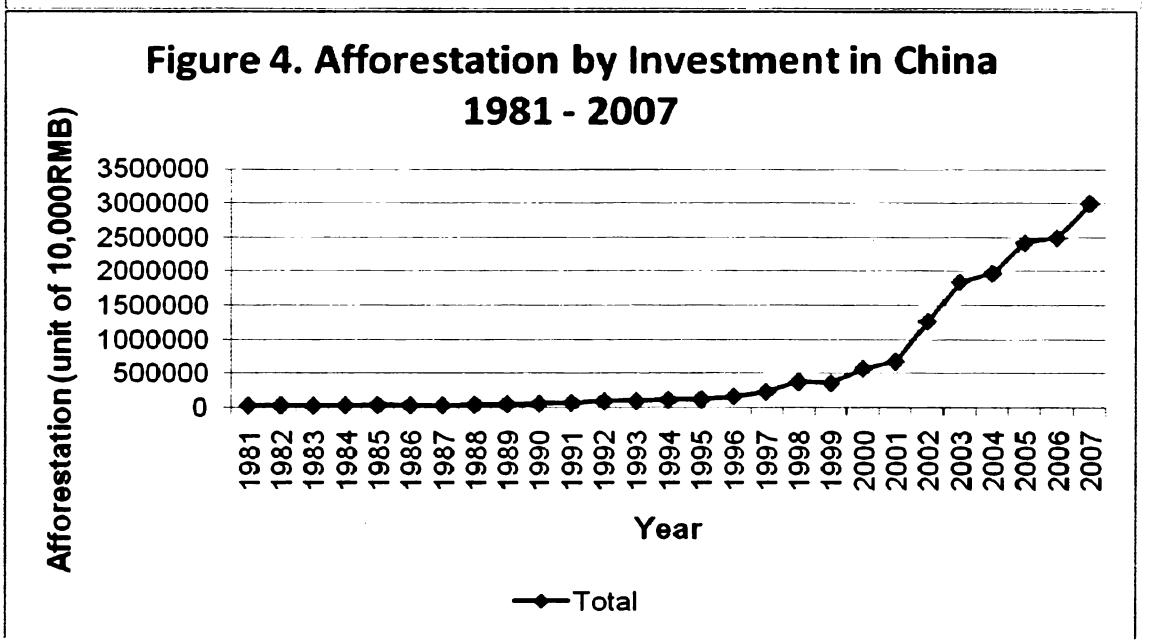
The industrialization ratio of the economy was used in the timber yield model again shows a significantly positive coefficient. This suggests that not only does more industrial development help improve the timber industry, but it also reduces the pressure on forest area. While this may seem strange, it should be noted that a key relationship between an industrialized economy and forest area is how urbanized the population is. A more industrial and service oriented economy can only exist by becoming more city-centric. While there is a well known migration in China from rural areas to urban, this industrialization ratio shows that this behavior also seems to have an accompanying increase in forest area. Namely, it means that as more families enter into the cities and the urbanized work forces, the fewer people are involved in putting pressure on forests. Likely this means there is a reduction in fuelwood collection and it potentially allows for land conversion on the poorest land from agriculture to forestry.

The decision to use investment in afforestation rather than afforestation area was important in that the investment variable controlled for two important factors simultaneously. First, the new variable controls for the silvicultural activities of the forestry departments, central among those is aerial seeding. In regards to this factor, either measure of afforestation would be sufficient. However, when looking at the actual behavior of the two different variables it is clear that they are not in sync (see Figures 3 and 4). While the likely corruption of the afforestation area statistic was mentioned previously, these graphs make a strong argument that the purported high levels of afforestation without any

funding in the early 1990's are likely not rooted in reality. However, the focal reason for switching to this measure is that in the prior model the concern was being able to capture the relationship between cutting and resource availability. If no investments are made in afforestation before or after a cut, the natural regeneration may result in regeneration anyway so the afforestation area measure was previously a superior variable. However, by utilizing the 'amount paid' only artificial regeneration is recorded; but in the model this becomes a critical control on the afforestation activities of the ecological restoration programs. Thus, the most important reason for using the new measure is to control for the impacts of the ecological restoration projects.

Looking at Figure 4, it is clear that the programs which began in 1998 were associated with sizable new funding allocation and this behavior has continued. By controlling for the impact of those programs on forest area a much clearer picture of the role of the institutional reforms appears. The institutional reforms have not been associated with increases to afforestation area, but can be associated with an increase in investment in afforestation. Therefore, making this change is a crucial one for creating *ceteris paribus* conditions without erasing possible change in land use which could be associated with the land reforms.



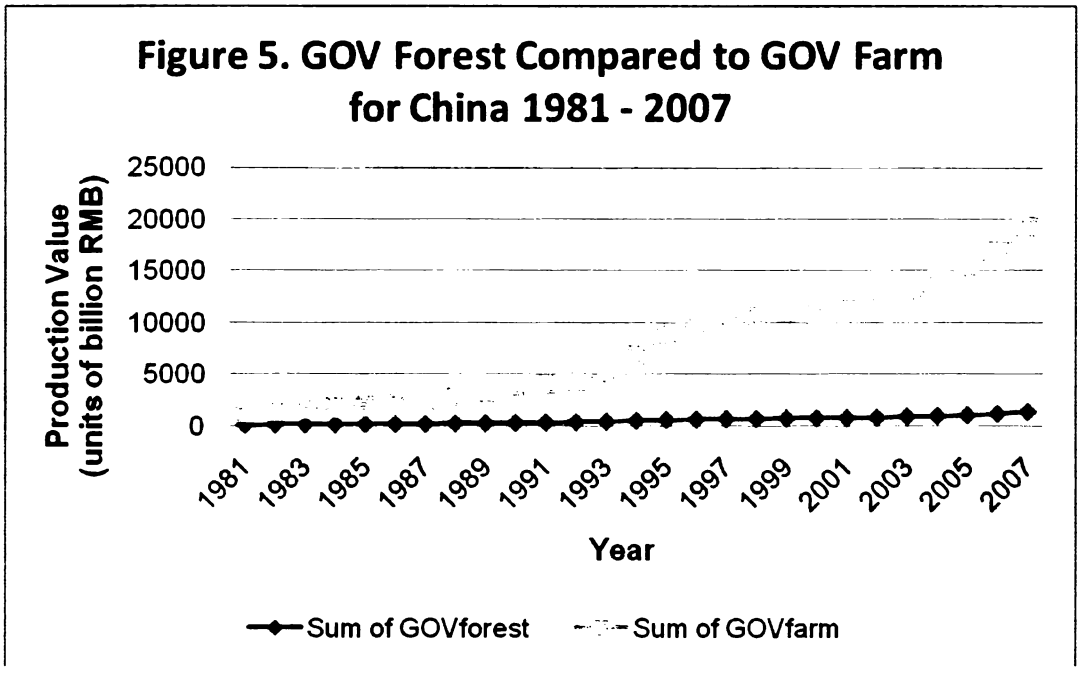


Gross Output Value of grain products (β_4) and Gross Output Value of forest products (β_5) are both significant and share an important *ceteris paribus* effect. It is a simple resources issue where farms and forests cannot coexist (with some exception to agroforestry and shelterbelts.) Thus, both are significant but have opposing coefficients. Simply, they produce forest products where there are forests; they produce farm products where they have farm fields. But they do not

produce farm products in forests and they do not produce forest products from rice paddies. While this relationship may seem obvious and simplistic, this is actually an important set of control variables. These are holding fixed some of the important dynamics which directly change forest size. These two coefficients combine to produce countervailing forces which can describe the important cyclical dynamics related to how the rural economy orients itself based on natural conditions and resource availability. Therefore these two variables act like the lagged dependent variable did in the previous model. These are critical *ceteris paribus* effects for allowing the clearest view of the impact of the institutional dummies.

It is important to note there is a potential complaint which can be lobbied at the use of the GOV variables. Namely, if the CRS and its reforms spawned cutting, it would estimate a corresponding rise in the GOV forest products variable which would predict new planting and possibly cause the dummy variable to underestimate new planting. While this may be a real flaw in this model, there are several strong arguments to make the case that it should not be problematic. First and foremost, the basic method of applying a dummy variable is based on the premise that *ceteris paribus* holds. Therefore, the dummy should explain the aggregated behavior for all the provinces when all other factors are constant. Another important argument is that the previous model predicts a rise in timber production, but it has been shown that many provinces will see an overall decline in their production as a result of the NFPP. Again, looking at Figure 2, there is a net decline in timber production by the end of time under

study. Finally, some may worry about growth of GOV of forest production erasing gains to forest area, but this is unnecessary as because it is important to look at what happens to its countervailing force, GOV of grain production. Looking at Figure 5 which is also taken from Data Set B, it seems that if the model were to have any concern it would be that it is spuriously predicting an increase to forest area from the Institutional Reforms. But, as can be seen in the intercept and policy environment dummy this is not likely the case.



The constant in this regression is, in effect, the policy environment dummy of the Decentralization era of 1982 to 2001. Its negative and highly significant coefficient shows that the CRS system did not generate sufficient planting to replace timber harvesting. Likewise, the Institutional Reform dummy covering the 2002 to 2007 period shows similar results to the decentralization era dummy. It shows that the new reforms did not induce sufficient replacement planting. While the exact balance sheet of cutting area to replanting for any particular contract

holder is not known, the aggregate picture is that the contract holders are not investing in the contract land sufficiently to replace cutting despite the improvements to their rights. While the area by which the forest area declined under the new reforms is less than the amount it declined under the initial CRS implementation, the time span is also much shorter.

The results of Models 1 and 2 suggest that the institutional reforms have had strong results, but not the ideal ones sought by the CCP. Both models seem to have strong answers to the hypotheses which are consistent with the previous historical investigation into China's forestry. Referring back to the hypotheses; (a) the different periods show distinct variation from each other and (b) timber production and forest area increased under the Decentralization and Institutional Reform policy environments. Model 2 showed a strong result for hypothesis (a) in that both of the periods were distinct, but hypothesis (b) had a surprise negative coefficient result. Rather than the predicted increase to forest area, the tenure reforms seem to be associated with forest area decline.

The future question for the CCP now is whether to stay on course in regards to these reforms. The CCP has a long history of reversing itself if it is finding the results unfavorable, but there is an argument that to generate institutional change takes time. This suggests that perhaps it will take more years of the contract holders having the institutional reforms in place before they respond.

IV. Conclusion

Forest ownership in China during the last 60 years can be characterized as a diverse series of reforms, changes and reversals. Exemplifying this point, in these last 60 years every kind of land use regime mentioned (and more) by Baland and Platteau (2000) appeared. Amongst these institutional variations a few lessons about forest policy can be learned.

Having both taken a long look at the ideology of the policy environment and the overall shape of the timber industry in China, it becomes clear that while the regulation and rights varied extensively, production behavior was far more stable. The non-significance of the first three policy environment dummies in Model 1 suggests that for the most part, the fact that China's economy was centrally planned was far more important than the nuances of rights and decision making. Consider this point, during the extremely political and tumultuous years of the Cultural Revolution, timber production in most provinces showed almost no variation. While there were outbreaks of short term real changes in production behavior, the time periods in aggregation show that despite the policy environment being so turbulent the production behavior showed stability. However, this fact is also what makes the new institutional reforms so fascinating.

The last ten years have been a major departure from the prior fifty. There has been a highly significant reduction in state-owned timber production and a

large shift towards collective oriented production. As this time period also coincides with China's massive ecological restoration programs and a radical reevaluation of the CRS system, it is fair to say these shifts have been revolutionary. However, the results have proven far less spectacular.

Seeing a growth in the timber harvesting as a result in policy environment change suggests that decision making power has increased or that the production of timber has finally become profitable for the small scale collective contract holders. Regardless of which reason is the primary cause of this increase, it seems that so far the key goal of the reforms has failed to materialize. The institutional reforms continuing the previous trend of cutting without replanting suggests that the reforms have not created credibility as was defined by Diermeyer et al. (1997). However, it is important to be cautious about these results. The findings in this thesis are based on a very short time span. Institutional reform is generally a lengthy process and it would be premature to say that the institutional reforms have failed. What the findings show is that so far the changes have not appeared and that future studies are needed to continue assessing the institutional reform impacts.

Thus the third research question returns to the forefront, "Do the forest contract holders believe the latest reforms are a long term change?" Despite this seemingly fundamental and longstanding problem of credibility, different researchers have their varying theories on what are the key components. In his study on this topic, Ho (2006) suggests the problems are primarily based on the titling confusion and unregistered changes in forest use. He then suggests that

the solution should be to "get institutions right" by focusing on clarifying titling, reducing fragmentation of national forests, and making a consistent legal and regulatory framework that can lead to commercialization of the collective forests. However, this may be too much of a simplification and some additional research in this direction would be useful.

Some interesting possible future research directions exist in regard to this question of changes and credibility. While this thesis approached the reforms from a very broad aggregated picture, it would be useful to go to the household level and perform some in-depth household surveys to try and understand farmers' perceptions of their incentive structures and their available capital directly. Another similar option would be to do a county level case study. While an entire county is large for a detailed case study, it is important to consider this level as witnessing the variety of the decisions about forest land use requires a larger spacial scale. If the county had some villages which are more enthusiastic than others it may help to develop some ideas about what is needed for reaching the necessary credibility to induce investment.

Yet there are certain elements of credibility which can already be understood from the information in this thesis. Specifically, the latest series of reforms have focused entirely on regulatory reform and while they have spawned additional extraction behavior, they have failed to induce equal investment behavior. Seemingly this is in part because the farmers do believe the contracts lack credibility, but perhaps there is a more complicated central reason for lack of investment. Specifically, the CCP has encouraged increasing urbanization and

development driven by coastal manufacturing for the last thirty years. Central to these changes, China's labor force has included a large portion of migrants from rural areas fueling low wage manufacturing and construction (de Brauw, Huang et al. 2002). Recently, these migrants are still involved in the village to the degree that they rent their land or have it tended by family, but if they could sell it and change their rural registration to urban many likely would. China's rural poor have gotten the point loud and clear that development has two speeds and the cities are improving much faster. Considering this, why would the farmers spend their limited potential liquid capital on additional resources which keep them tied in the long term to the rural economy? This is exacerbated when considering that the village leadership can redistribute land based on 2/3 majority approval (Kung and Liu 1997). If a farmer were to make the investment in planting on the contract land and also move to the cities, they would then have to fear their investment would be redistributed by jealous former neighbors. Therefore, if the farmer has aspirations to become an urban resident, then investing in afforestation would be of little value as the timber contract would be too weak to protect the investment. On the other hand, the problem with strong contract rights is that if the forest contracts become true private property then the likely behavior of those wanting urban residency would be to sell the land and use it as part of transitioning to their new residence. This may result in an accumulation of the forest rights which would create an economy of scale effect typical of most American or European forestry operations, but the only viable buyers to accumulate those rights would

be the already wealthy. Thus, the potential of forestry for rural development, one of the CCP's current stated goals, could be wasted.

Even without afforestation investment by contract holders this situation has potential to be considered a success for the CCP. As mentioned earlier, these Institutional Reforms may very well be sufficient to eventually convince contract holders to invest and waiting is a low cost gamble for the CCP. Even if investment never appears, the ecological restoration programs generating large scale increases to forest area will likely keep the lack of sufficient replanting under the CRS obscured. Simply, if the government decides to wait for farmers to start planting there will be not likely be negative consequences as it has no pressing concerns for delivering results.

The real gamble would be if the reforms fail to produce development opportunities for the rural areas. As mentioned, the gap between coastal and inner China has grown wide. If the new cutting behavior improves livelihoods but fails to change investment behaviors, the CCP may still decide it is a victory for the reforms. The ecological reforms will have lots of environmental success stories to promote for some time, and if the Institutional Reforms are not among them it is of limited concern. However, if rural China continues to seem devoid of growth, the CCP will have much more serious concerns as the numbers of disaffected people may grow radically. If the Institutional Reforms continue to provide much needed access to capital and fixed assets for inner China, the CCP can continue to promote its model of stability-oriented development as a success.

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