Target Setting in Tournaments: Theory and Evidence from China*

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Abstract

Performance targets are widely used to incentivize agents in modern organizations. Motivated by the prevalence of economic targets in all levels of territory administrations in China, this paper proposes a Tullock contest model to study optimal target setting in a multi-layered tournament-based organization. In our model, targets are used by the upper-level official to convey the importance for economic growth and incentivize her subordinates in the tournaments. The key model assumptions are supported by our structural estimation of promotion function. Our model predicts a top-down amplification of economic growth targets along the jurisdiction levels which is consistent with the observed pattern in China. Using both provincial and prefectural level data, we test the model predictions and find consistent evidence.

JEL Classification: H11, H7, O2, P3
Keywords: Top-down amplification, bureaucratic incentives, multi-level government, regional competition

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1 Introduction

Performance targets, or performance standards, are widely used to incentivize managers in modern organizations. Starting from the seminal work of Weitzman (1976, 1980) and Holmstrom (1982), economists have found that performance targets are mainly determined by three factors: past performance, relative performance of outside peers, and evaluation of the difficulty of particular operations (Milgrom and Robert, 1992; Murphy, 2000).[1] The existing economics literature has focused primarily on the determination of one *single* target at one time, and also on the temporal relationship for targets by the same agent at different times (e.g., ratchet effect). Nevertheless, in practice performance targets exhibit a hierarchical nature: we commonly observe that both superiors and subordinates establish their targets sequentially in large, multi-layered corporations. However, little is known, either theoretically or empirically, about how performance targets are set in a multi-layered hierarchical organization and what roles these targets are expected to play.[2]

This paper studies the role of target setting in a multi-layered tournament-based organization (e.g. sub-national government in China). The regular announcements of GDP growth targets by different levels of the Chinese government, together with competition among Chinese local officials to gain promotion by delivering economic growth in their jurisdictions, provide a unique opportunity to investigate such target setting decisions in a hierarchical organization.[3] Target setting is one of the central tasks faced by all levels of Chinese officials. Growth targets on various economic indicators, including GDP, investment, and fiscal revenues, are announced annually at both national and local People's Congresses following rounds of discussion and debate within the government. Out of all the growth targets, the

[1] Industrial-organizational psychologists have also long engaged in research on the role of targets in influencing performance of organizational or work-related tasks. See Locke et al. (1981) and Locke and Latham (2002) for an extensive literature review.

[2] This is partly due to the lack of data recording the performance targets set by different levels of managers and their actual performance.

[3] Walder (1995) argued that the Chinese bureaucratic system can be viewed a large organization, in which each local government can be viewed as an industry unit and the political leaders of the government can be viewed as the managers of the unit.

GDP growth target is undoubtedly the single most important one.

The paramount popularity and significance of target setting in China raises two puzzles. First, although target setting was once an indispensable component of China's former planned economy before the profound market-oriented reforms in 1978, growth targets are *no longer mandatory*, either legally or bureaucratically, and serve more like guidelines. It is therefore unclear why Chinese officials at all levels of government continue to take growth targets so seriously even though the planning regime was abolished decades ago. Second, while growth targets are neither mandatory nor binding in nature, we observe a persistent pattern of "top-down amplification" along different jurisdiction levels, where lower-level governments' growth targets are typically higher than the upper-level ones. In this paper, we propose a theoretical model of target setting to explain these puzzles in the context of promotion tournament among Chinese officials. In our model, targets are used as incentive mechanisms for the local officials who play a key role in the economy.

Our model is based on two salient features of the China's political economy. First, the promotion of Chinese local officials can be regarded as a performance-based tournament in which the promotion of local officials has been highly linked with the economic growth of their jurisdictions since late 1970s. This creates a strong linkage between the private interests of local officials and regional economic development, thereby triggering an intensive tournament competition (Chen et al., 2005; Li and Zhou, 2005; Fan et al., 2009; Xu, 2011; Choi, 2012; Wu et al., 2013; Yao and Zhang, 2015; Jia et al., 2015). Second, Chinese local officials take the leading position in promoting the local economy (Frye and Shleifer, 1997; Qian and Weingast, 1997; Blanchard and Shleifer, 2001; Bardhan and Mookherjee, 2006; Zhou, 2010; Xu, 2011). Due to administrative and economic decentralization, Chinese local officials are highly capable of leveraging local investment and promoting local economic growth.[4]

[4]There are at least three channels for local officials to stimulate local economic growth. First, they can make direct investment through local investment and financing vehicles. These vehicles are government-owned and use fiscal funds and land as collaterals to leverage bank loans. Second, they may influence the investment of state owned enterprises. Third, they may issue a variety of preferential policies (e.g. subsidies and cheap land) to encourage investment from the private sector (Yu et al., 2016).

In our model, local officials compete for promotion via a Tullock contest based on economic growth that is determined by officials' efforts. The superior official set a GDP growth target to incentivize her subordinates by affecting their Contest Success Function (hereafter referred to as CSF) simultaneously. In particular, we make a "complementarity" assumption that a higher target will cause subordinates' promotion probability to become more sensitive to realized GDP growth rates . By changing the target and affecting subordinates' promotion rule, the superior conveys to her subordinates the importance of economic growth in their job responsibilities, and aligns her own interest with those of her subordinates.

We investigate the target setting behavior in a symmetric model with three layers of government (e.g., central, provincial and prefectural) and two levels of tournaments (among provincial and prefectural leaders respectively). We posit that the realized GDP growth rate in each prefecture is jointly determined by the efforts exerted by the central, provincial and prefectural leaders. The sequence of moves is as follows. The central leader first determines her efforts to promote economic growth and announces a growth target to all provincial leaders. Next, provincial leaders across the country simultaneously determine their own efforts and targets. Finally, the subordinate prefectural leaders in each province simultaneously choose their efforts. Provincial and prefectural leaders are incentivized only by promotion through tournaments, and they always have the option to quit the tournament by exerting zero effort, which implies a participation constraint on the leaders.

We characterize the *unique* symmetric subgame perfect equilibrium of this game. Observing the effort and target selected by the superior official, a subordinate official will either choose an effort level in pure strategy when he faces a low target, or randomize between a positive effort and quitting when he faces a high target. By setting a higher target, an upper-level official can incentivize her subordinates to exert higher efforts, but may also increase their probabilities of quitting. If the target is set so high as to induce mixed strategies, a higher target induces a lower expected effort exerted by a lower-level official, because the additional strategic risk makes it harder to satisfy the official's participation constraint.

Therefore, the optimal target is set such that the lower-level officials exert a pure strategy effort level, and their participation constraints are just binding. This enables us to explicitly characterize the equilibrium targets.

Our model attributes the top-down amplification of growth targets to the decreasing number of jurisdictions along hierarchical levels of government in China.[5] As the number of contestants decreases from the top down, the probability of winning the Tullock contest increases. Correspondingly, it becomes easier to satisfy the contestants' participation constraints, and the superior can set a higher target to induce higher efforts. So in equilibrium the growth target is higher at lower level of government.

We empirically investigate both the assumptions and the predictions of our theoretical model. We first estimate the promotion function in the tournament implied by our model. We apply a structural approach as simple OLS neither captures the nonlinearity of the promotion function nor deals with the situation that a contestant's probability of promotion depends on the economic performances of *all* contestants. Our estimates support the key assumptions in our model: the probability of promotion increases in the realized GDP growth rates, but decreases in the targets made by upper-level officials, which is consistent with our complementarity assumption.

We then examine the relationship between GDP growth targets and numbers of contestants. We find one increase in the number of prefectures in a province is associated with a decrease of 0.1 percentage point for both provincial five-year targets and annual targets. This result is robust to a number of concerns, including the province-specific time-varying unobservables, asymmetry among contestants, monitoring cost of superiors, and the endogeneity of contestant numbers. The negative relationship between the number of contestants and growth targets provides evidence supporting our theoretical explanation of the top-down amplification phenomenon.

Furthermore, we employ two policy experiments in China, the *Western Development*

[5]China has 31 provincial units. The number of prefectural cities varies across provinces and the average is 10-11. Each prefectural city has about 8-9 counties.

Program and the *Northeast Revival Program*, to test our theoretical predictions of the target setting. From the viewpoint of our model, these two programs decrease the costs in terms of effort requisite to develop the local economy, thereby resulting in a higher target level. Our difference-in-differences estimates show evidence consistent with this prediction. Growth targets made by provinces in the western region during *Western Development Program* are 10% higher, and targets made by northeastern provinces during *Northeast Revival Program* have increased 10% - 15% .

Finally, we rule out an alternative explanation that target setting constitutes a way of seeking support from the upper-level government. We find an insignificant correlation between the target level and the support from upper-level government, proxied by the fiscal transfers.

This paper is related to several strands of literature. There is a large theoretical literature examining how tournament serves as an incentive mechanism in organizations (Tullock, 1980; Lazear and Rosen, 1981; Green and Stokey, 1983; Konrad, 2009). Several studies provide empirical tests of the tournament theory in the context of sports (Ehrenberg and Bognanno, 1990; Guryan et al., 2009; Brown, 2011; Pope and Schweitzer, 2011). Others study tournament in modern corporations using lab or field experiments (Levitt, 1994; Eriksson, 1999; Carpenter et al., 2010). We contribute to this line of literature by incorporating target setting into a multi-level tournament structure with participation constraints. We offer theoretical insights and empirical evidence that targets play additional roles in a multi-layered, tournament-based hierarchy, by aligning multi-level incentives.

Starting from Weitzman (1976, 1980) and Holmstrom (1982), target setting and its effects on organizational performance have gained a great deal of attention in economics, psychology, management, and organization science literatures (Locke et al., 1981; Tubbs, 1986; Latham et al., 1986; Mento et al., 1987; Milgrom and Robert, 1992; Laffont and Tirole, 1993; Murphy, 2000; Hoegl and Parboteeah, 2003). As argued by Milgrom and Robert (1992) and Murphy (2000), performance targets are mainly determined by three factors: past performance, rela-

tive performance of outside peers, and evaluation of the difficulties of particular operations.[6] In this paper we focus on the second and third factors,[7] and examine optimal target setting in a multi-layered, tournament-based hierarchy, which has been rarely discussed in existing literature.

Our paper also contributes to research on the role of local leaders' political incentives in China's economic development. Previous studies have investigated the performance-based promotion tournament and its impact on China's economic growth (Maskin et al., 2000; Blanchard and Shleifer, 2001; Li and Zhou, 2005; Chen et al., 2005; Fan et al., 2009; Zhou, 2010; Xu, 2011; Choi, 2012; Wu et al., 2013; Yao and Zhang, 2015). While the existing literature focuses primarily on the incentives for local officials at one hierarchical level (province or prefecture), our study highlights the interaction between multiple levels of government in a tournament. We also rationalize the economic intuition for target setting in the promotion competition.[8]

The remainder of this paper is organized as follows. Section 2 provides some stylized facts on target setting in China, and it documents the top-down amplification of growth targets. Section 3 sets up our model and Section 4 analyzes the model and derives some comparative static results. Section 5 presents empirical evidence to support our theoretical assumptions and predictions. Section 6 concludes the paper.

[6] A consensus has emerged in the psychology literature that goal-setting improves organizational performance through psychological processes such as directing attention, mobilizing effort, increasing persistence, and motivating strategy development (Locke and Latham, 2006). Our study proposes an economic explanation of aligning interests in a tournament setting.

[7] The first factor is linked with the famous "ratchet effect": managers tend to withhold effort in the current period in order to avoid facing a higher target in the next period. Recent empirical works find that such a ratchet effect may not exist, at least in some empirical contexts (Indjejikian et al., 2014).

[8] Similar to our paper, both Tsui and Wang (2004) and Xu (2011) point out that growth targets help to align the interests of leaders and subordinates. Deviating from studies that only argue for the role of economic targets, our paper conducts a formal theoretical and empirical analysis of economic targets and more importantly establishes and rationalizes the "top-down amplification" phenomenon, which previous studies do not touch upon at all.

2 Target Setting in China

Target setting in economic plans originated from the early 1950s when China started to adopt the Soviet model of a planned economy. While economic reforms have abolished most planning practices, the making of economic plans on a five-year or annual basis survives and remains a routine practice for Chinese governments at all levels to this day. A major difference between economic targets nowadays and those during the planned economy period is that they are no longer mandatory or binding and only serve as guidelines.

The typical sequence of plan drafting is a top-down process: the central government sets the national plan first, and then provincial and prefectural governments follow sequentially and establish their own economic plans. Government leaders at all territory levels take the economic plans very seriously. It usually takes several months for each level of government to complete the plan, and in order to set up a proper target, the government holds numerous meetings to seek advice and build consensus (Kennedy and Johnson, 2016). The finalized versions are released in *Government Work Report* for five-year plans, and *Government Development Plans* for annual plans. They include key economic targets, such as the growth rates of GDP, industry value added, fiscal revenues and expenditures, as well as some social development targets, such as population growth and environmental protection.

The non-binding nature of economic targets in the post-reform era raises the suspicion that targets are mere cheap-talk messages and thus may convey no informational content. Although the prolonged discussions and deliberations that precede the public release of targets have already signaled the prominence of targets, we want to add more pieces of evidence to refute this concern. Firstly, targets are responsive to large economic shocks, as government officials announce growth targets to demonstrate their blueprint of economic development. For example, when the Asian Financial Crisis struck China in 1998, the central government set the annual growth target at 8 percent and urged local governments to guarantee the achievement of this target.[9] Secondly, the private sector regards the growth

[9]Although it was widely believed that 8 percent GDP growth was virtually impossible to fulfill in that

target as an important economic indicator that affects the business operations, investments, and other activities. The announcement of growth targets always receives intensive media coverage domestically and abroad.[10] International financial actors, such as IMF, World Bank, and investment banks, make or adjust their forecasts on the Chinese economy as well as the global economy based on China's announced economic growth targets.[11]

A third piece of evidence, which we regard as the most important substantiation of the critical importance of target setting, is the persistent pattern of top-down amplification of GDP growth targets. In the following paragraphs, we document the patterns of growth targets across different levels of government during the post-reform era.[12]

Table 1 reports the relationship between growth targets set by the central and provincial governments, using province-level data on five-year plans ranging from the 7th to the 13th plans (starting in 1986 and ending in 2016).[13] We observe a clear pattern of amplification from the center to the provinces for the five-year targets during this period. Systematically, provincial targets are 10% - 30% higher than the central one, and the amplification is quite widespread, as the proportion of provinces with targets higher than the central ones ranges from 74% to 100%. Table 2 reports a similar pattern using annual plans from 1997 to 2015.[14] From 1997 to 2014, provincial annual targets have never been lower than the national target, and they are strictly above the national one in most cases. In terms of magnitude, there is an average of 2% amplification on top of the national targets lying between 7% to 8%, which implies a 20% increase.[15]

year, the central government still used this target to show its pressing need to avoid an economic free-fall. Similar episodes reoccurred when the global financial crisis hit China in 2008. Chen et al. (2016) also find that the growth targets have a huge impact on China's monetary policy.

[10]For example, Economist (2015)

[11]See IMF (2016); Kennedy and Johnson (2016).

[12]The pattern of growth targets before 2010 was also documented in Zhou et al. (2015). But that paper did not provide any theoretical explanation.

[13]The 7th five-year plan is the earliest five-year plan in which province-level data are available.

[14]The government work reports are collected from regional almanacs at various levels of governments as well as government websites. For the growth targets at the prefecture and county levels, we rely heavily on government websites. Realized economic growth data for provincial and prefectural governments are gathered from *China Statistical Yearbooks* and *China City Statistical Yearbooks* for various years.

[15]In the Online Appendix, we also provide evidence of top-down amplification at the prefectural level using county target data from three provinces: Shanxi, Fujian, and Gansu.

Table 2 documents the average annual growth targets for both provinces and prefecture cities from 2004 to 2015.[16] Ideally we wish to tabulate provincial and city growth targets for each province during this time period, but the space limitation prevents us from doing this. Instead we only report the average growth targets for 27 provinces and the average growth targets of prefecture cities for these provinces.[17] Table 3 presents overwhelming evidence on the acceleration of growth targets from provinces to prefecture cities. Generally speaking, the city targets are 2-3 percentage points higher than provincial ones (Column 1 and Column 3 of Table 3). Given the fact that provincial governments have already added 2-3 percentage points to the central benchmark (for the 10th and the 11th five year plans), the amplification of city government targets over the provincial benchmarks implies that at the city level about 4-6 percentage points are added up to the central targets. This result is not driven by a small number of provinces with abnormally high prefectural targets. In fact, we find that 90% of the provinces have provincial targets lower than the average prefectural targets in their territories across all years through 2015 (Column 2, Table 3).

Given these facts about target setting behavior in the Chinese government, a fundamental question remains: do the growth targets actually translate into realized growth rates at all? We find a positive correlation between targeted and realized GDP growth rate both for provinces and for prefectures, as illustrated in Figure 1 and Table 4 after controlling for province (prefecture) fixed effects and year fixed effects. In column (4) of Table 4, we use the growth rate of electricity consumption to proxy realized economic growth, due to long-standing concerns about the validity of Chinese GDP data. We still find a positive correlation with the provincial annual growth targets. Although these analyses cannot prove that a causal relationship exists, a strong correlation implies that the growth targets are not arbitrarily set and have real impact on the economy to some extent.

[16] We focus on the annual growth targets here since the five-year plans for prefectural cities are not available. The prefectural annual targets start from 2004 because prior to 2004 missing data is quite serious.

[17] Beijing, Tianjin, Shanghai and Chongqing are excluded from Table 2 since the district-level data on growth targets is unavailable for these regions.

3 Promotion Tournament with Targets

This section presents a model to analyze the promotion tournament with targets. We model the top-down hierarchical government structure with three layers of government: central, provincial, and prefectural. The model is also applicable to other specifications of government hierarchy (e.g. from provincial to prefectural to county level). Although we only consider three layers of government, the number of layers can be easily extended. The provincial and prefectural leaders compete for promotion through realized GDP growth rates via relative performance evaluation in a promotion tournament. We use the Tullock contest model incorporating targets to capture the promotion rule, where targets change the shape of the CSF as described in Section 3.2.

3.1 Model Setting

We model China's promotion tournament in the following way. There is one central government and $n \geq 2$ symmetric provincial governments. In each province $i = 1, 2, \cdots, n$, there are $k \geq 2$ symmetric prefectural cities denoted by $\mathcal{K}_i = \{i1, \cdots, ik\}$.[18] There are $n + 1$ tournaments in our setting: one among provincial leaders, and n among prefectural leaders in each province.[19] In the provincial (prefectural) tournament, n (k) contestants compete via economic performance to get promoted. For the sake of simplicity, we assume that in each of the $n+1$ tournaments, only one of the contestants gets promoted. Suppose the gain from promotion for a provincial (prefectural) leader is V_1 (V_2). We treat the values of V_1 and V_2 to be predetermined (such as political rents or social prestige) and unable to be changed by the political leaders.

The final output in each prefecture city $ij \in \mathcal{K}_i$ is denoted as y_{ij} (interpreted as GDP growth rate). y_{ij} is determined jointly by the efforts of the central leader, provincial leader

[18] The symmetry assumption is just for analytical simplicity. Tournaments with asymmetric players can be analyzed similarly but only in general without explicit solutions.

[19] As argued by Che et al. (2013), the selection of officials is crucial for an economy. The promotion tournament serves as an important device to select officials in China.

i and prefectural leader ij.[20] In particular, we assume that $y_{ij} = Ax_{ij}x_ix_0$, where x_{ij} is the effort made by prefectural leader ij, x_i the effort made by the provincial leader i and x_0 the effort made by the central leader. x_0 benefits all cities nationwide, and x_i benefits all cities in province i. The efforts by different levels of officials are complements, which reflects the reality, since there is wide-spread complementarity among different units within one organization (Milgrom and Brynjolfsson, 2012). Our main comparative statics results do not change in the case with substitutional efforts, as shown in the Online Appendix.

Effort x_0 costs $\frac{1}{2}c_0x_0^2$ to the central leader; effort x_i costs $\frac{1}{2}c_1x_i^2$ to the provincial leader i; and effort x_{ij} costs $\frac{1}{2}c_2x_{ij}^2$ to the prefectural leader ij. Parameters c_0, c_1 and c_2 measure the difficulties of improving economic performance for each layer of government. For the sake of simplicity, we assume that the values of c_0, c_1 and c_2 are common knowledge. The functional forms of production and cost are not restrictive, as our analysis can be easily extended to more general forms. In particular, our main results still hold for any twice continuously differentiable, convex, strictly increasing cost function C with $C(0) = 0$.

The central leader has utility function:

$$u_0 = \frac{\lambda}{nk}\sum_{i=1}^{n}\sum_{j=1}^{k} y_{ij} - \frac{1}{2}c_0x_0^2,$$

where λ measures the relative importance of economic growth in the central leader's preferences. Chinese officials bear a range of responsibilities in their territories for tasks such as economic growth, fiscal revenues, environmental protection, education, and social stability(Qian and Weingast, 1997; Zhou, 2010). Although economic growth is always a key component, its relative importance λ among all responsibilities may vary. For the theoretical analysis, it is without loss of generality to normalize $\lambda = 1$. We will further discuss how the change of λ affects target setting behavior in Section 5.2.

[20]We use "effort" to proxy officials' decisions to stimulate economic growth. Examples include, but are not limited to, infrastructure investment and economic-stimulating policies. This assumption simplifies the determination of China's GDP growth while reflecting the leading role of government in the process of economic growth, as emphasized in the introduction section.

The provincial (prefectural) leaders incur a cost $\frac{1}{2}c_1x_i^2$ ($\frac{1}{2}c_2x_{ij}^2$), and if they get promoted, they will gain a value of V_1 (V_2). So the provincial leader i gets payoff $u_i = V_1 \cdot \mathbb{1}(\text{promoted}) - \frac{1}{2}c_1x_i^2$, and prefectural leader ij gets payoff $u_{ij} = V_2 \cdot \mathbb{1}(\text{promoted}) - \frac{1}{2}c_2x_{ij}^2$. [21]

Finally, each player has a normalized reservation utility of zero.[22] The introduction of reservation utility is an important feature of our model. Basically, it implies that every player has the choice of quitting by exerting zero effort. This imposes an additional individual participation constraint in our model: by participating in the contest, each player's expected payoff should be at least zero.

3.2 The Role of Targets

Local government leaders compete through a Tullock contest for promotion.[23] In reality, a leader with the best economic performance will not necessarily get promoted because there are other factors such as political loyalty and political connections (Jia et al., 2015). The probabilistic feature of Tullock competition is consistent with this reality in China. The game proceeds as follows. First, the central leader chooses a growth target $\bar{y}_0$ and an effort level x_0. Observing $\bar{y}_0$ and x_0, each provincial leader i simultaneously chooses his own targets $\bar{y}_i$ and effort x_i. Finally, the prefectural leaders ij simultaneously choose efforts x_{ij}.

Targets in our model are mere cheap-talk messages, as an official's gain (i.e. promotion) is not determined by the target he makes. We incorporate the role of targets into a standard Tullock model in the following way. For a prefectural leader $ij \in \mathcal{K}_i$, the probability of being promoted p_{ij} depends on his relative output among all of the prefectures within province i and the target set by province i. More specifically, when the leader has an output of $y_{ij} > 0$,

[21] It is assumed for the sake of tractability that the provincial and prefectural leaders do not get any payoff from the realized economic growth. Our analysis can be easily extended to the case where realized economic growth also enters into officials' payoff functions.

[22] In the context of China, the reservation utility can be interpreted as ending up in a position without real power (such as Director of the National People's Congress or Chairman of the National People's Political Consultative Committee).

[23] The introduction of Tullock contest model can be found in Tullock (1967), Tullock (1980), Corchón (2007), and Konrad (2009).

the promotion probability is:

$$p_{ij}(y_{i1}, \cdots, y_{ik}, \bar{y}_i) = \frac{g(y_{ij}, \bar{y}_i)}{\sum_s g(y_{is}, \bar{y}_i)}.$$

The above specification inherits the standard form of CSF, and the score function $g(y_{ij}, \bar{y}_i) \geq 0$ measures the impact of y_{ij} in the contest. Notice that we allow the function $g(y_{ij}, \bar{y}_i)$ to depend on $\bar{y}_i$, the target set by province i. A change in $\bar{y}_i$ changes the shape of CSF, and hence affects the optimal effort level chosen by each prefecture leader in province i.[24] We assume that any leader has zero probability of promotion if his output is zero, even when all of his competitors have zero output. This assumption is natural since exerting zero effort means giving up the promotion tournament.

Similarly, for provincial leader $i = 1, 2, \cdots, n$, the promotion probability function q_i is specified as:

$$q_i(y_1, \cdots, y_n, \bar{y}_0) = \frac{h(y_i, \bar{y}_0)}{\sum_t h(y_t, \bar{y}_0)},$$

where $y_i = \frac{1}{k}\sum_j y_{ij}$ is the average performance in province i. In the above specification, we use a different functional form h to allow for different promotion rules for central and provincial tournaments.

We impose several natural assumptions on both g and h functions in CSF. Since the roles of g and h in CSF are identical, we only state assumptions on function g and the assumptions on function h are exactly the same.

Assumption 1 *For any $\bar{y}$, function $g(y, \bar{y})$ satisfies:*

1. *$g(\cdot, \bar{y}) \geq 0$ is twice continuously differentiable in $\mathbb{R}_+$;*

2. *$\frac{\partial g}{\partial y} > 0$, $\frac{\partial^2 g}{\partial y^2} \leq 0$;*

3. *$\lim_{y \searrow 0} \frac{\partial g}{\partial y} = +\infty$, $\lim_{y \nearrow +\infty} \frac{\partial g}{\partial y} = 0$.*

[24] One may also argue that g can also depend on $\bar{y}_{ij}$, the targets set by subordinates. But as will be shown in Section 5.1, this is not supported by our structural estimation.

The above assumptions are standard in a Tullock contest model (Corchón, 2007). Part (2) says that better performance increases the probability of promotion, which is consistent with the fact that the promotion of Chinese local officials has been significantly linked with the GDP growth of their jurisdictions. We further require that function g is concave in the final output to guarantee the validity of first order approach. Part (3) essentially imposes the well-known Inada condition.

Assumption 1 specifies the relationship between score g and realized economic growth y. The next assumption imposes restrictions on the relationship with growth target $\bar{y}$ through the elasticity: $e_g(y, \bar{y}) = \frac{\partial g/\partial y}{g/y}$.

Assumption 2 *Function $e_g(y, \bar{y})$ satisfies:*

1. *For any $\bar{y}$, $e_g(y, \bar{y})$ is decreasing in y;*

2. *For any y, $e_g(y, \bar{y})$ is increasing in $\bar{y}$;*

3. *For any y, $\lim_{\bar{y} \searrow 0} e_g(y, \bar{y}) = m$ and $\lim_{\bar{y} \nearrow +\infty} e_g(y, \bar{y}) = M$ with $m < 2 < 4 < M$.*

Part (1) of Assumption 2 is a technical assumption to guarantee the uniqueness of symmetric Nash equilibrium (Proposition 1). The key assumption is part (2), which further requires that the elasticity of function g with respect to the final output be increasing in $\bar{y}$. In other words, under a higher target, one *percentage* increase in output y will induce a higher proportional increase in the score, and thus a larger increase in the probability of promotion. It is called the "complementarity assumption" because the realized growth rate and the target proposed by the superior are complements. We later provide empirical support for this condition in Section 5.1. Finally, the two additional requirements in part (3) are imposed to guarantee the existence of an interior solution when solving the optimal target $\bar{y}$.

A leading example of the score function which satisfies Assumption 2 is $g(y, \bar{y}) = \alpha_0 +$

$\alpha_1(y - \bar{y})$, with $\alpha_1 > 0$.[25] This is an extension of the score function $g = y$, which is widely used in the literature. There is a very intuitive interpretation of the score function $g(y, \bar{y}) = \alpha_0 + \alpha_1(y - \bar{y})$. Under this function form, the score of the subordinates depends on the difference between their own GDP growth rates and the target set by their superior. This actually highlights the role played by the target as an incentive scheme. When the superior considers economic growth more valuable, she can set a higher target to make subordinates' promotion more responsive to their economic performance.[26] In response, the subordinates will exert more effort to achieve the target in pursuit of their promotion. Therefore the superior can use target as a guideline to incentivize subordinates to exert greater effort and promote economic growth, even though it is not mandatory. In this sense, growth targets help to align the interests of leaders and subordinates in the promotion tournament.

4 Model Analysis

The game is solved in a backward procedure. We first characterize the equilibrium in the last period where the prefectural leaders choose their efforts simultaneously. Given the best responses of the prefectural leaders, we solve the optimal efforts and targets chosen by the provincial leaders in the second period. Finally, we characterize the central leader's optimal strategy in the first period.

[25]Part (1) of Assumption 2 is satisfied only when $e_g > 1$. As evident from the analysis below, the equilibrium cannot occur at $e_g \leq 1$. The Inada condition of Assumption 1 is not satisfied by this linear functional form. But the Inada condition is unnecessarily strong to guarantee the existence of the symmetric Nash equilibrium for general score functions (see the proof of Proposition 1). It is straightforward to show the existence of symmetric Nash equilibrium in linear score function specification.

[26]For example, in 1998 after the Asian financial crisis, although it was widely believed to be difficult to achieve high economic growth rate, the central government still set the national GDP growth target at 8 percent and emphasized the necessity of achieving the eight percent goal. By contrast, the economic growth target in 2012 was adjusted down to 7.5 percent, the first time it was below 8 percent ever since 2004, when concerns about environmental protection and structural adjustment became more prominent.

4.1 Equilibrium in the Last Period

In the last period, prefectural contestants act in a simultaneous move game with complete information. Since national and provincial level targets and efforts have already been chosen, they are fixed and the game in the last period becomes a standard Tullock contest setting. Hence, it is straightforward to characterize the symmetric Nash equilibrium in this period given the previous choices x_0, x_i and $\bar{y}_i$.

Proposition 1 *Given $x_0 > 0$, $x_i > 0$ and $\bar{y}_i$, denote $x^\star_{ij}$ to be the unique solution to the following equation about x_{ij}:*

$$(k-1)V_1 e_g(y_{ij}, \bar{y}_i) = k^2 c_2 x_{ij}^2, \tag{1}$$

where

$$y_{ij} = A x_{ij} x_i x_0.$$

Then, there exists a ***unique*** *symmetric Nash equilibrium in the third period where each contestant's effort is given by the following:*

$$x_{ij} = \begin{cases} x^\star_{ij} & \text{if } 0 \leq \frac{V_1}{k} - \frac{1}{2}c_2(x^\star_{ij})^2; \\ \begin{cases} \hat{x}_{ij} & w/p\ \gamma; \\ 0 & w/p\ 1-\gamma \end{cases} & \text{otherwise.} \end{cases}$$

$\hat{x}_{ij}$ and x^*_{ij} are identical to all $ij \in \mathcal{K}_i$ (i.e., $\hat{x}_{ij} = \hat{x}_{ij'}$ and $x^*_{ij} = x^*_{ij'}$), and $\hat{x}_{ij}$ and γ are determined uniquely by the following system of equations:

$$[1-(1-\gamma)^k]V_1 = \frac{1}{2}\gamma k c_2 \hat{x}_{ij}^2 \tag{2}$$

and

$$\sum_{t=0}^{k-1} \binom{k-1}{t} \gamma^t (1-\gamma)^{k-t-1} \frac{t}{(t+1)^2} V_1 e_g(\hat{y}_{ij}, \bar{y}_i) = c_2 \hat{x}_{ij}^2, \tag{3}$$

where

$$\hat{y}_{ij} = A\hat{x}_{ij}x_i x_0.$$

Proof: See the Appendix.

The above characterization of the symmetric Nash equilibrium reflects the most important feature of our model: the target is not mandatory but plays the role of a guideline. Applying the complementarity assumption to (1), it is straightforward to verify that $x^{\star}_{ij}$ is increasing in $\bar{y}_i$. As the provincial target increases, the prefectural leaders will put more effort into promoting economic growth, even though they are not required to achieve the targeted growth. This is because a higher provincial target signals that economic performance plays a more important role in the promotion of prefectural leaders. However, provincial leaders cannot achieve an arbitrarily high economic growth rate by setting an arbitrarily high target, because of the individual rationality constraint on the prefectural leaders. In particular, when the provincial target is set too high, compared to exerting effort $x^{\star}_{ij}$, the prefectural leaders would rather quit the tournament by exerting zero effort.[27] This is allowed since the target is not mandatory to reach. Therefore, in the unique symmetric Nash equilibrium, the realized provincial growth rate increases with the provincial target as long as the provincial target is not set so high as to violate the prefectural leaders' individual rationality constraints. Otherwise, the prefectural leaders are likely to quit by playing a symmetric mixed strategy Nash equilibrium. Using Assumptions 1 and 2, we show that this symmetric mixed strategy Nash equilibrium has a very simple structure: player ij exerts effort $\hat{x}_{ij}$ with probability γ, and quits with the complementary probability. And the next corollary shows that as the growth target $\bar{y}_i$ increases, the effort level $\hat{x}_{ij}$ will increase but the probability γ of choosing effort $\hat{x}_{ij}$ will decrease.

Corollary 1 *When* $0 > \frac{V_1}{k} - \frac{1}{2}c_2(x^{\star}_{ij})^2$ *and the prefectural contestants are playing the unique*

[27] Specifically, prefectural leaders are quitting "probabilistically" in a mixed strategy, as specified in the equilibrium.

symmetric mixed strategy Nash equilibrium, the effort $\hat{x}_{ij}$ and the probability γ satisfy:

$$\frac{\partial \hat{x}_{ij}}{\partial \bar{y}_i} > 0 \quad \textit{and} \quad \frac{\partial \gamma}{\partial \bar{y}_i} < 0.$$

Since the effort level $\hat{x}_{ij}$ and the probability γ change in different directions, the realized provincial growth rate may not necessarily increase with the provincial target. As will be shown later, the expected realized provincial growth rate *decreases* with the provincial target when the prefectural leaders are playing the symmetric mixed strategy Nash equilibrium.

4.2 Equilibrium in the First Two Periods

In the second period, anticipating the prefectural leaders' best responses in the third period, the provincial leaders choose their efforts and targets simultaneously, given the central leader's effort and target. From Proposition 1, a provincial leader can either choose a high target to induce the symmetric mixed strategy Nash equilibrium in the third period, or choose a low target to induce the symmetric pure strategy Nash equilibrium. The next proposition implies that the optimal provincial target must induce pure strategy equilibrium and extract the full surplus from the prefectural leaders in the third period.

Proposition 2 *In the second period, if provincial leader chooses $x_i > 0$, the optimal target $\bar{y}_i$ set by this leader induces the prefectural leaders to choose $x^*_{ij} = \sqrt{\frac{2V_2}{kc_2}}$, and thus*

$$e_g(y^e_{ij}, \bar{y}_i) = \frac{2k}{k-1}, \tag{4}$$

where $y^e_{ij} = A\sqrt{\frac{2V_2}{kc_2}} x_i x_0$.

Proof: See the Appendix.

The above proposition is quite intuitive. When the prefectural leaders play the symmetric pure strategy Nash equilibrium, an increase in the target $\bar{y}_i$ will increase prefectural leader's equilibrium effort level without any cost. Naturally, it is optimal to keep increasing until

$x_{ij}^{\star} = \sqrt{\frac{2V_2}{kc_2}}$, which makes the participation constraint binding. By doing so, the provincial leader extracts the full surplus from the prefectural leaders. Notice that the provincial leader also extracts the full surplus if the prefectural leaders play mixed strategy equilibrium in the third period. But it is always suboptimal to do so. This result comes from the concavity of g and h functions with respect to the final outputs. First, the concavity of $h(y, \cdot)$ with respect to y makes the provincial leaders actually be risk-averse and playing mixed strategy will reduce the provincial leaders' expected payoffs. Second, the concavity of $g(y, \cdot)$ with respect to y makes the prefectural leaders risk-averse as well. As a result, the induced expected effort will be lower to compensate the strategic risk. Therefore, the optimal provincial target level set in the second period should induce the pure strategy effort $\sqrt{\frac{2V_2}{kc_2}}$ in the third period.

The provincial leaders face another promotion tournament with promotion probability

$$q_i(y_1, \cdots, y_n, \bar{y}_0) = \frac{h(y_i, \bar{y}_0)}{\sum_t h(y_t, \bar{y}_0)}.$$

Denote $e_h(y, \bar{y}) = \frac{\partial h / \partial y}{h/y}$. Given that the target is set such that the prefectural leaders always choose $\sqrt{\frac{2V_2}{kc_2}}$ in equilibrium, the equilibrium effort level exerted by the provincial leaders can be characterized in the following proposition:

Proposition 3 *Given $x_0 > 0$ and $\bar{y}_0$, denote $x_i^{\star}$ to be the unique solution to the following equation about x_i:*

$$(n-1)V_1 e_h(y_i, \bar{y}_0) = n^2 c_1 x_i^2, \tag{5}$$

where

$$y_i = A\sqrt{\frac{2V_2}{kc_2}} x_i x_0.$$

Then, there exists a unique symmetric Nash equilibrium in the second period where each

contestant's effort is given by the following:

$$x_i = \begin{cases} x_i^\star & \text{if } 0 \leq \frac{V_1}{n} - \frac{1}{2}c_1(x_i^\star)^2; \\ \begin{cases} \hat{x}_i & w/p\ \zeta; \\ 0 & w/p\ 1-\zeta \end{cases} & \text{otherwise.} \end{cases}$$

$\hat{x}_i$ and ζ are determined uniquely by the following system of equations:

$$[1-(1-\zeta)^n]V_1 = \frac{1}{2}\zeta n c_1 \hat{x}_i^2 \tag{6}$$

and

$$\sum_{t=0}^{n-1} \binom{n-1}{t} \zeta^t (1-\zeta)^{n-t-1} \frac{t}{(t+1)^2} V_1 e_h(\tilde{y}_i, \bar{y}_0) = c_1 \hat{x}_i^2, \tag{7}$$

where

$$\tilde{y}_i = A\sqrt{\frac{2V_1}{kc_2}}\hat{x}_i x_0.$$

The results are the same as the one in Proposition 1. The proof is also identical and hence is omitted.

Given this characterization of the equilibrium strategies of the provincial and prefectural leaders, we can finally solve the optimal effort and target chosen by the central leader in the first period. The results are given by the following proposition:

Proposition 4 *In the first period, it is optimal for the central leader to choose effort*

$$x_0^\star = \frac{A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}}}{c_0}, \tag{8}$$

and the optimal target $\bar{y}_0^\star$ is set such that

$$e_h(y^\star, \bar{y}_0) = \frac{2n}{(n-1)}, \tag{9}$$

where

$$y^{\star} = (A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}})^2/c_0. \tag{10}$$

As in Proposition 2, the optimal target $\bar{y}_0$ is set such that the provincial leaders play the symmetric pure strategy Nash equilibrium with the highest effort $x_i^* = \sqrt{\frac{2V_1}{nc_1}}$ and hence in the first period, x_0 is chosen to maximize:

$$A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}}x_0 - \frac{1}{2}c_0x_0^2,$$

where $\sqrt{\frac{2V_2}{kc_2}}$ is the equilibrium effort exerted by the prefectural leaders and $\sqrt{\frac{2V_1}{nc_1}}$ is the equilibrium effort exerted by the provincial leaders. The first order condition immediately implies that the optimal effort chosen in the first period is given by (8). In the symmetric equilibrium, all cities have the same growth rate $y^{\star} = (A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}})^2/c_0$.

4.3 Testable Implications

Our model has rich testable implications for both the targets and the realized economic growth rates. Since the focus of our study is the role of targets in the promotion tournament, we will devote our attention to the model predictions and empirical tests regarding the targets.[28] The first sub-section discusses how the equilibrium targets change with the underlying parameters. The second sub-section compares the equilibrium targets set by the central leader and provincial leaders, and investigates the conditions under which there would be a top-down amplification of targets.

4.3.1 Comparative Statics

The next proposition provides a set of comparative statics results about the provincial targets $\bar{y}_i$ based on the equilibrium characterizations. All results apply to any functional form of

[28]The additional benefit of focusing on growth targets instead of realized growth is that the reported economic growth rates are likely to be manipulated while growth targets are 100 percent genuine as they are publicly released in the government work reports.

$g(\cdot)$ and $h(\cdot)$ that satisfy Assumptions 1 and 2.

Proposition 5 *In equilibrium, we have:*

1. $\frac{\partial \bar{y}_i^\star}{\partial V_1} > 0$ *and* $\frac{\partial \bar{y}_i^\star}{\partial V_2} > 0$;
2. $\frac{\partial \bar{y}_i^\star}{\partial A} > 0$, $\frac{\partial \bar{y}_i^\star}{\partial c_1} < 0$ *and* $\frac{\partial \bar{y}_i^\star}{\partial c_2} < 0$;
3. $\frac{\partial \bar{y}_i^\star}{\partial k} < 0$.

The comparative static results shown in the above proposition are very intuitive. The equilibrium provincial target level becomes higher if (1) government officials get a higher value from promotion, measured by a higher V_1 or V_2; and (2) it is easier to promote economic growth (higher A and lower c_1, c_2). Notice that the provincial targets change with the prefectural leaders' effort cost parameter as well. So when the prefectural leaders' effort cost parameter c_2 decreases, the provincial leaders will increase the target by anticipating that the prefectural leaders will increase their efforts. In addition, the equilibrium target decreases with the number of prefectural contestants: $\frac{\partial \bar{y}_i^\star}{\partial k} < 0$. This is due to the fact that in our Tullock contest setting, an increase in the number of contestants generates a negative externality in the sense that each prefectural leader faces a lower chance of winning the promotion tournament. As a result, the prefectural leaders' individual rationality constraints to play the symmetric pure strategy of high effort become harder to satisfy. Anticipating this, the provincial leader will decrease the target level to lessen the individual rationality constraint for each prefectural leader.

4.3.2 Top-down Amplification of Targets

Proposition 4 and Proposition 2 characterize the equilibrium central target $\bar{y}_0^\star$ and the equilibrium provincial targets $\bar{y}_i^\star$, respectively. In the symmetric equilibrium, the final output is the same as $y^\star = (A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}})^2/c_0$, and hence the equilibrium targets should satisfy the

following equations:

$$e_h(y^\star, \bar{y}_0^\star) = \frac{2n}{(n-1)} \quad \text{and} \quad e_g(y^\star, \bar{y}_i^\star) = \frac{2k}{(k-1)}. \tag{11}$$

As documented in section 2, we observe a significant pattern of top-down amplification: $\bar{y}_0^\star < \bar{y}_i^\star$. The following theorem states when this phenomenon can occur in equilibrium.

Theorem 1 *If $h = g$, top-down amplification $\bar{y}_0^\star < \bar{y}_i^\star$ occurs if and only if $n > k$.*[29]

The proof of the above theorem is very straightforward and hence is omitted. The theorem offers a novel explanation for the top-down amplification phenomenon. First of all, it implies that this phenomenon has nothing to do with other parameters such as the values of promotion (V_1 and V_2) and the cost of promoting economic growth (c_0, c_1, and c_2). No ad-hoc assumptions are required about the relative promotion valuation / effort cost for officials at different levels of jurisdiction. These parameters affect the level of targets as shown by Proposition 5, but the impact is only through the change in final outputs. As the real economic growth for provinces (prefectures) is the same, these parameters do not affect the central (provincial) targets.

Secondly, Theorem 1 attributes the top-down amplification to the larger number of provinces compared to the number of prefectures in each province.[30] The number of jurisdictions in our model proxies the number of players faced by local political leaders at each hierarchical government level. As in the traditional Tullock contest model, when the number of contestants increases, the degree of competition increases and each contestant's probability of winning the contest decreases. Moreover, as the probability of winning decreases, the participation constraint of playing the symmetric pure strategy equilibrium is more likely to fail, and hence due to the complementarity assumption, the upper-level leader will lower the

[29] If $n = k$, $\bar{y}_0^\star < \bar{y}_i^\star$ if and only if $e_h(y, \bar{y}) > e_g(y, \bar{y})$.

[30] Another possible explanations for the top-down amplification phenomenon requires that the central government's promotion rule is more sensitive to economic growth ($e_h > e_g$), which is hard to test.

target to soften competition and incentivize subordinates. So the top-down amplification phenomenon comes from the decrease in promotion probability along the hierarchical levels.

The decreasing number of jurisdictions under each level of government accords exactly with China's reality. China has 31 (n) province-level administrative units and 333 city-level administrative units. On average, each province has about 10-11 (k) city-level administrative units and no province has more than 30 city-level administrative units. Therefore, the condition $n > k$ in Theorem 1 is satisfied and this explains why the provincial targets exceed the central target. Moreover, although we only include central, provincial and prefectural governments in our model, it is straightforward to extend the model to include county level governments. Similar logic implies that the prefectural targets will exceed the provincial targets if the number of counties in each city is smaller than the number of cities in each province. This is also true in reality. In China, there are 2,862 county-level administrative units and on average each city has about 8-9 county-level administrative units, which is smaller than the number of administrative units within one province.

Another implicit assumption in our model is that only one of the local leaders can get promoted. In reality, the number of possible positions that local leaders may be promoted to in the next layer of government may vary and exceed just one. Therefore, the number of jurisdictions is not the only determinant of the competitiveness faced by each layer of political leaders. Using our data, we also calculate the promotion probabilities of provincial and prefectural leaders. From Appendix Table 10, it is obvious that the provincial leaders are much less likely to get promoted than the prefectural leaders. The logic in Theorem 1 then implies that the provincial targets should be higher than the central target.

5 Empirical Tests

This section reports the empirical evidence for our theoretical assumptions and predictions about the target setting behavior. We first empirically test the key complementarity as-

sumption of our model by estimating the promotion function in a structural way. We then show supporting evidence on the comparative statics derived from our model, including the effect of contestant number on target setting, and the response to policy shocks that may alter the cost parameters of local officials' efforts in pushing economic growth. Finally, we rule out an alternative explanation for target setting based on resource allocation.

5.1 Structural Estimation of Promotion Function

We make two key assumptions in our theoretical model: (1) the probability of promotion increases with realized GDP growth; (2) the complementarity assumption that the higher the growth target the subordinate faces, the more responsive his promotion is to GDP growth. The first assumption has gained empirical support in the existing literature (Chen et al., 2005; Li and Zhou, 2005; Wu et al., 2013; Yao and Zhang, 2015), whereas the second complementarity assumption has never been tested before. Our first goal is to show some empirical evidence validating these two assumptions.

Standard linear regression does not offer consistent evidence because promotion is determined by the local officials' own growth rates as well as by the growth rates of their competitors. The nonlinearity of the promotion function is another factor that invalidates the OLS estimation. In order to enable consistent inference and more precise quantification, we employ a structural approach to estimate the promotion function. More specifically, we assume a linear score function for contestant i in tournament t as

$$g(y_{it}, \bar{y}_t, x_{it}) = 1 + \alpha_1 y_{it} + \alpha_2 \bar{y}_t + x_{it}\beta$$

where y_{it} is the realized GDP growth rate by contestant i in tournament $t \in \{1, 2, ..., T\}$, $\bar{y}_t$ is the target imposed by the superior and faced by all contestants in this tournament, and

x_{it} includes other control variables. The corresponding promotion probability is

$$p_{it} = \frac{g(y_{it}, \bar{y}_t, x_{it})}{\sum_j g(y_{jt}, \bar{y}_t, x_{jt})}$$

We observe $(y_{it}, \bar{y}_t, x_{it})$ together with the indicator for promotion $d_{it} \in \{0, 1\}$, so the log-likelihood is[31]

$$\log L = \frac{1}{T} \sum_{i,t} \left(d_{it} \log p_{it} + (1 - d_{it}) \log(1 - p_{it}) \right)$$

From our parametric model above, the two key assumptions we have made are interpreted as $\alpha_1 > 0$ and $\alpha_2 < 0$.[32] Table 5 reports our estimates above using provincial tournaments for the promotion of prefectural leaders. In column (1), although insignificant, the promotion score function is estimated to be increasing in the realized growth rate (b=0.004, se=0.007), and decreasing in the provincial target made by superiors (b=-0.061, se=0.021). After including officials' characteristics in column (2), this two estimates become significant at 0.014 (se=0.003) and -0.081(se=0.030).

Column (3) includes the growth targets made by prefectural leaders themselves as a robustness check. This coefficient is insignificant (b = -0.004, se = 0.003), which supports our explanation for the target setting: targets are mainly used as a mechanism to convey preference to subordinates, but prefectural officials who set the targets cannot benefit directly from the increase of their own targets. As a result, conditional on the realized growth as an outcome, self-made targets do not affect the probability of promotion.

[31]The intercept term is normalized because if not, the scale of the parameter is not identified. In other words, if we use a function without imposing normalization, $g = \alpha_0 + \alpha_1 y_{it} + \alpha_2 \bar{y}_t + x_{it}\beta$, then $(\alpha_0, \alpha_1, \alpha_2, \beta)$ and $(k\alpha_0, k\alpha_1, k\alpha_2, k\beta)$ are observationally equivalent. This model is different from standard multinomial logit or probit models in two ways. First, the numerator is linear rather than exponential. We use the linear function to guarantee the concavity assumed in our theory. Moreover, it is straightforward to check whether $e_g(y, \bar{y}) = \frac{\alpha_1 y}{1+\alpha_1 y+\alpha_2 \bar{y}+x\beta}$ is increasing in $\bar{y}$ for any y by the sign of α. Second, more importantly, is that there can be none or more than one contestants getting promoted, whereas in the standard logit model, only one alternative gets picked. This assumption is motivated by the reality in China, as there might be zero, one, two, or even more contestants getting promoted from a single tournament.

[32]It is easy to show $e_g = \frac{\alpha_1 y}{1+\alpha_1 y+\alpha_2 \bar{y}+x\beta}$, which is increasing in $\bar{y}$ if and only if $\alpha_2 < 0$

5.2 Target Setting in Response to National Regime Switching

In our model, changes in relative importance of the economic growth in the central leader's utility function result in changes in growth targets. As our model illustrates, when economic growth becomes more (less) important, all of the targets including the central and provincial ones will be set higher (lower). This economic intuition can help to explain the changes in growth targets since 1980's.

Take the provincial five-year plans in Table 1 as an example. We see two turning points during these seven rounds of five-year plans: Deng Xiaoping's championing of market-oriented reform and economic growth during his Southern Tour in 1992, and Xi Jinping's downplaying of GDP-growth-oriented evaluation in 2014. Both events strongly affected the mentality of the Chinese Communist Party (CCP) about GDP growth and in turn profoundly shaped the phenomenon of target amplification.

Before 1993, there was a heated debate between advocates of reform and conservatives at the central level about whether China should move to a market-oriented economy or stick to the planning regime with certain modest modifications. Confusion caused by this debate about the central leadership's position might make some provincial leaders take a strategic position and respond to the growth targets in a modest way. Some other leaders might align with the conservative stance and set a target lower than the central one. These different strategic responses to the central targets are clearly reflected in Table 1. While we observe some degree of overall amplification from provincial governments in the 7th five-year plan, a significant proportion of provinces put forward targets lower than the central one. In order to break this stalemate, Deng Xiaoping, then the de-facto top leader of the CCP, made a well-known Southern Tour in 1992 to fight back against the conservative policies, urging the Party and government to boldly embrace market-oriented reforms.

This tour proved to be a big breakthrough in China's economic reform process. Since then, pushing for market-oriented reforms and high economic growth has dominated the

agendas of both central and local governments.[33] Consequently the central government reset its national GDP growth target in 1993 from 6 percent to 8.5 percent. Provincial governments revised their targets even more aggressively, yielding an average provincial GDP growth target of 10.37 percent and only three provinces setting targets slightly lower than the central one. In the following three five-year plans, the central growth target virtually became the baseline for the provincial targets: in the 9th five-year plan, there was only one province (Qinghai) with a target slightly lower than the central benchmark, and all other provinces set much higher goals; in the 10th and 11th plans, every province set a growth target higher than the central plan. The difference between the provincial and central targets since the 9th five-year plan ranges from 1.98 to 2.45 percentage points, which accounts for about 30 percent of the central benchmark.

Prevailing emphasis on GDP growth has continued until very recently. In May 2014, Xi Jinping delivered a public speech in Henan province, proclaiming that China must adapt itself to a "New Normal" of modest growth and keep more focus on preventing risks, maintaining sustainability, and reforming the banking system (Bloomberg, 2014). According to Xi's speech, GDP growth will no longer predominate in the performance evaluation of local leaders as much as before. The notion of a "New Normal" became widespread immediately, and as a result, the amplification of growth targets became much smaller than in previous five-year plans, indicating that provincial leaders have adapted themselves to a new regime of performance evaluation. As shown in Table 1, the percentage of provinces with target amplification dropped significantly to 84 percent in the new regime of Xi from 100 percent in the 12th five-year plan made in the previous regime under the leadership of Hu Jintao. Table 2 shows a more detailed change in provincial target amplifications. Since Xi took power in late 2012, the percentage of target amplifications has declined from 100 percent in 2012 to 97 percent in 2013, 94 percent in 2014, and 80 percent in 2015 and 84 percent in 2016. A more revealing change is reflected in the fact that since 2015, several provinces proposed

[33]Note that the 8th five-year plan is split into two sub-periods at 1992 because after Deng's Southern Tour, both the central and provincial governments revised their previous 8th five-year plans.

growth targets even lower than the central one while in previous regimes, no provinces had announced growth targets lower than the central one since 1997, even in the worst years of 1997 and 2008 when China was struck by the Asian and global financial crises.

5.3 Target Setting and Number of Contestants

The central prediction of our model is the negative relationship between the target level and the number of contestants in the tournament, which is critical for our explanation of the top-down amplification phenomenon. A higher target can incentivize subordinates to exert more effort to promote economic growth, but at a cost of making contestants more likely to give up the tournament and exert zero effort. When there are more contestants participating in the tournament, the chance of winning, thus the expected gain from exerting positive effort, is smaller. So the target has to be lower to lessen the individual rationality constraint.

Table 6 tests the empirical validity of the above prediction using data from provincial five-year plans in Panel A, and annual economic plans in Panel B.[34] In all columns, we include year fixed effects and logarithm of GDP per capita to control for common economic trends and tournament-specific economic shocks, respectively.

In column (1), we find a significant and negative correlation between provincial five-year targets and the number of cities in a province. One additional prefecture lowers the provincial target by 0.032 (se = 0.017) percentage point. The average number of cities in one province is 14, which implies that doubling the number of cities will decrease the average provincial five-year target from 9.24% to 8.79%. Due to the lack of within-province variation in the number of cities, this estimate may be subject to omitted variable bias. Specifically, there might be an inertial effect of growth, whereby it is more difficult for larger provinces with more cities to grow rapidly. In order to address this concern, and to further control for province-specific time-varying economic environments that affect target setting, we control one period lagged realized growth rate in column (2). As expected, the estimate for city

[34]Results for the prefectural targets are similar and are shown in the Online Appendix.

number decreases to -0.028 (se = 0.016).

One alternative explanation for the negative correlation between target level and city number is administrative and monitoring costs: a province with more cities to govern probably has higher administrative and monitoring costs than those provinces with fewer subordinate cities, which leads to a lower provincial growth target. To rule out this explanation, we include the average distance to provincial capital across all cities as a measure of administrative and monitoring costs in column (3). Our main result remains robust. One additional city will lower the provincial target by 0.027 percentage point.

Another potential concern is that asymmetry among subordinate cities as contestants may bias our result. For example, in the provincial tournament with city leaders as contestants, only those leaders from rich cities are likely to be the winners of the tournament. The chances of promotion for leaders from small cities are quite small.[35] In order to capture this effect, we construct a measure for the number of effective contestants by calculating the number of important cities within a province, which equals the minimum number of cities that make up to 70% of the total GDP in that province.[36] Column (4) reports the estimates using the number of effective cities. We find a larger effect due to the change in effective city number. One additional effective city will lower the provincial target by 0.127 percentage point. The average number of effective city is 6, which implies that doubling the effective city number will lower the average provincial target from 9.24% to 8.48%.

Finally, we use the number of cities in 1956 as an instrumental variable for the number of city today in order to control for potential endogeneity from reverse causality: provinces with higher economic performance may tend to build more cities, producing a downward bias for the negative effect of the number of cities on provincial targets. Column (5) reports this estimate using the instrumental variable. As expected, after dealing with such inverse

[35]In some cases, a province consists of a dozen cities, but several bigger ones contribute the lion's share of the provincial GDP. For example, Hebei province has 11 prefectural cities, but the five biggest ones contribute 70 percent of its GDP.

[36]The results are robust to different threshold levels of the GDP share for important cities, ranging from 60%, 70%, 80% to 90%.

causality, the city number becomes a more important determinant of the provincial target level. One more city will lower the provincial target by 0.095 percentage point.

Panel B replicates the above estimation using the provincial annual targets. All patterns are similar; however, the effect is smaller compared to the five-year targets. One additional city will lower the provincial annual target by 0.018 (column 6), which is smaller than the effect for the five-year plan in column (2). Annual targets are noisier and more subject to unanticipated, short-run economic shocks, and thus less predictable than the five-year ones. This explanation is also confirmed by a larger effect of the provincial specific time-varying economic factors measured by the lagged realized growth rate.

5.4 Targets in Response to Large Economic Programs

The Chinese central government is capable of influencing the economy through large economic stimulus programs. We exploit two economic stimulus programs in our data window, the *Western Development Program* and the *Northeast Revival Program*. The central government initiated and launched both programs in 2000 and 2006 respectively. These two programs aimed at directing resources towards the two specific regions and boosting economic development, by offering better access to bank loans, more fiscal funding and tax benefits, higher infrastructure investment from the central government, and other policy benefits.[37] In our framework, the two programs had the effect of lowering the cost of stimulating economic growth for local officials in the beneficiary regions, thus facilitating a difference-in-differences estimation.

Specifically, the identification strategy of difference-in-difference is enabled in two ways.

[37]The *Western Development Program* involves 12 provinces located in the western part of China, specifically including: Shanxi, Shaanxi, Gansu, Qinghai, Ningxia, Gansu, Xinjiang, Guizhou, Sichuan, Yunan, Tibet and Chongqing. These provinces tend to be relatively poor regions, and the main goal of the program is to mitigate the regional imbalance between eastern and western provinces. See e.g., `https://en.wikipedia.org/wiki/China_Western_Development`. The *Northeast Revival Program* targets four provinces: Heilongjiang,Jilin, Liaoning, and Inner Mongolia. The northeastern region used to be a major manufacturing center in China, but has lagged behind economically since the 1980s. In China both the western and northeastern regions have been well defined in terms of their geographical boundaries and the provinces they include.

First, both programs were launched by the central government and individual provinces cannot self-select whether to participate in. Second, the western and northeastern regions targeted by the two programs have had well-defined geographical boundaries. Once a region is picked up, the provinces located in that region are settled automatically. Given these two facts, we can consider the implementation of the two regional programs as exogenous shocks to the provincial governments.

Table 7 reports the results. We define a province in a treatment group ("West" or "Northeast") if it is located in the one of the program regions. In all regressions, we include provincial fixed effects to control for province-specific unobservables, and year fixed effects for time-varying common economic shocks. Columns (1) and (3) use the sample of provincial five-year plans while columns (2) and (4) use annual provincial plans. All results are consistent with our model predictions: that the treated provinces are induced to announce higher targets. Specifically, we find that five-year and annual targets for western provinces are 10.8% and 11% higher respectively after the *Western Development Program* in 2000 (columns 1 and 2). And the *Northeast Revival Program* also increases the provincial targets by 15.5% and 9.3% for five-year and annual plans respectively (columns (3) and (4)).

5.5 Do Higher Targets Induce More Central Transfers?

We propose in this paper that growth targets are used to convey superiors' preferences to subordinate officials and find evidence supporting the model predictions. There can be other alternative explanations regarding target setting behavior. One is that the target serves to signal a locality's growth potential or the ability/political loyalty of the local officials.[38] This signal may enable the subordinates to gain more support (e.g. income transfers) from superiors in the budgeting process.

We test this explanation directly using the transfer payments received by the local gov-

[38]Another possible explanation is that the target may be used as a commitment device. But this is inconsistent with reality since the target is not mandatory and the realized performance can be lower than the target.

ernments, which proxies the support from superiors. Specifically, we regress the logarithm of transfer payments on the growth targets; a positive coefficient implies the validity of the above support-seeking argument. Individual province or prefecture fixed effects are also included. Table 8 reports the results. Columns (1) - (2) report the provincial transfer payments, and columns (3) - (4) report the prefectural level results. In all columns, the growth target has no significant correlation with the transfer payments from the upper level, thereby refuting the above support-seeking argument. Since the main function of transfer payment is income redistribution from rich regions to poor ones, we control for per-capital GDP whose estimated coefficient is indeed negative and significant, as shown in columns (2) and (4).[39]

6 Conclusion

China's sustained and strong economic growth for nearly four decades has spawned myriad studies about the potential driving forces behind the country's remarkable development. This paper offers a clue to understanding China's strong growth by focusing on the role of growth targets in political competition at the multiple layers of government in China. Using a large dataset on five-year and annual economic development plans, we first document stylized facts about the top-down amplification of growth targets along hierarchical levels of government. We then build a Tullock contest model with targets to analyze target setting as an incentive scheme for local government officials to promote regional economic growth. In our model, political superiors use targets to convey their preference for economic growth and align the interests of superiors and their subordinates involved in promotion tournaments. This model explains the top-down amplification of economic growth targets along the different levels of jurisdiction that is observed in China. The model also derives other testable predictions supported by the empirical evidence. In addition, we rule out an alternative resource-seeking explanation of the growth targets.

[39]The support-seeking argument also struggles to explain the top-down amplification. In particular, for the purpose of seeking support, the target announced by each local government should be orthogonal to the upper-level growth target. Hence, this argument also goes against the existence of top-down amplification.

While target setting in multi-layered political competition is helpful to generate high economic growth in the context of China, it may also produce overly strong incentives for boosting economic growth at the expense of other equally important government goals. The undesirable side effects that typically occur in a multi-tasking setting are manifest in China's worsening environmental quality, excessive energy consumption, insufficient provision of education and social security and other socio-economic problems. The current administration led by Xi Jinping recognizes the severity of these side effects, and it has already started to lower the growth target in the 12th five-year plan in order to address the issues that arise in a multi-tasking setting. How the lowered growth targets impact multi-layered political competition and China's future growth path is an important topic for future research.

Our research also contributes to the large literature on target setting and its effect on organizational performance. In particular, our paper is the first to investigate both theoretically and empirically how a multi-layered hierarchical organization sets performance targets at its different hierarchical levels. Using an innovative theoretical model and supporting empirical evidence, we argue that in a multi-layered tournament-based organization, targets can serve an important function by transmitting superiors' preferences to subordinates, and hence incentivizing subordinates to behave in accordance with the superiors' preferences. Since such hierarchical target setting is very common in large, multi-layered corporations, we hope that our study can inspire more future research on the target setting behavior in such organizations.

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Table 1: Growth Targets in Provincial Five-year Plans

Five-year Plan	Central Targets	Provincial Growth Targets			Compared to Central (%)		
		Mean	Min	Max	Above	Equal	Below
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
7th (1986-1990)	7.50	8.15	4.41	10.90	0.69	0.10	0.21
8th (1991-1992)	6.00	6.83	5.00	15.50	0.50	0.23	0.27
8th (1993-1995)	8.50	10.37	7.75	16.00	0.83	0.07	0.10
9th (1996-2000)	8.00	10.45	7.50	15.00	0.94	0.03	0.03
10th (2001-2005)	7.00	8.98	7.50	12.05	1.00	0.00	0.00
11th (2006-2010)	7.50	10.15	8.55	13.05	1.00	0.00	0.00
12th (2011-2015)	7.00	10.70	8.00	13.00	1.00	0.00	0.00
13th (2016-2020)	6.55	7.68	6.05	10.05	0.84	0.06	0.10

Notes: Central and provincial five-year targets are collected from *Report on the Work of the Government* in various years.

Table 2: Growth Targets in Provincial Annual Plans

Year	Central Targets	Provincial Growth Targets			Compared to Central (%)		
		Mean	Min	Max	Above	Equal	Below
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1997	8.00	10.19	8.50	13.00	1.00	0.00	0.00
1998	8.00	9.67	8.00	12.00	0.93	0.07	0.00
1999	7.00	8.79	7.05	10.05	1.00	0.00	0.00
2000	7.00	8.53	7.00	13.00	0.90	0.10	0.00
2001	7.00	8.90	7.00	12.05	0.97	0.03	0.00
2002	7.00	8.84	7.00	12.05	0.97	0.03	0.00
2003	7.00	9.37	7.55	12.05	1.00	0.00	0.00
2004	7.00	9.77	8.00	13.00	1.00	0.00	0.00
2005	8.00	10.30	8.50	15.00	1.00	0.00	0.00
2006	8.00	10.27	8.50	15.00	1.00	0.00	0.00
2007	8.00	10.40	9.00	15.00	1.00	0.00	0.00
2008	8.00	11.01	9.00	15.00	1.00	0.00	0.00
2009	8.00	10.09	8.00	13.00	0.94	0.06	0.00
2010	8.00	10.36	8.00	13.05	0.94	0.06	0.00
2011	8.00	10.92	8.00	13.50	0.94	0.06	0.00
2012	7.50	11.08	8.00	14.00	1.00	0.00	0.00
2013	7.50	10.66	7.50	14.00	0.97	0.03	0.00
2014	7.50	9.68	7.50	12.50	0.94	0.06	0.00
2015	7.00	8.30	6.00	12.00	0.80	0.07	0.13
2016	6.75	7.81	6.00	10.05	0.84	0.10	0.06

Notes: Central and provincial annual targets are collected from *Government Development Plans* in various years.

Table 3: Growth Targets in Prefectural Growth Targets

Year	Provincial Targets		Prefectural Targets	Compared to Superior Provincial (%)			
	Mean	Ampl.		Above	Equal	Below	Missing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2004	9.73	0.89	12.10	0.74	0.02	0.05	0.18
2005	10.27	0.93	12.65	0.73	0.05	0.05	0.16
2006	10.27	0.93	13.01	0.83	0.03	0.05	0.10
2007	10.46	0.89	13.19	0.86	0.03	0.04	0.07
2008	11.01	0.93	13.52	0.85	0.04	0.03	0.07
2009	10.03	0.93	12.06	0.79	0.12	0.03	0.06
2010	10.30	0.96	12.57	0.82	0.09	0.04	0.05
2011	11.00	0.93	13.69	0.86	0.03	0.02	0.08
2012	11.18	0.93	13.33	0.81	0.06	0.03	0.09
2013	10.78	0.89	12.27	0.78	0.06	0.08	0.08
2014	9.74	0.93	10.63	0.70	0.17	0.06	0.07
2015	8.26	0.82	8.73	0.62	0.19	0.12	0.07

Notes:

1. Columns (1) and (2) report the provincial level statistics across 27 provinces in each year, excluding four direct-controlled municipals: Beijing, Tianjin, Shanghai and Chongqing. Column (1) reports the average provincial target, and column (2) the percentage of provinces with amplifications. A province with amplification is defined as the one whose province-level target is lower than the average targets of all its subordinate prefectures.
2. Columns (3) - (7) report the summary statistics across all prefectural targets. Column (3) reports the average prefectural targets, columns (4)-(6) report the percentage of prefectures with targets smaller than its superior provincial target, and column (7) reports the percentage of prefectures with missing targets due to the lack of data availability.
3. Provincial and prefectural annual targets are collected from *Government Development Plans* in various years.

Table 4: Realized Growth Rates and Targets

	Realized GDP Growth			Electricity Growth
	Provincial		Prefectural	Provincial
	(1)	(2)	(3)	(4)
Target growth rate	0.966***	0.910***	0.604***	1.392***
	(0.280)	(0.063)	(0.062)	(0.253)
Five year FE	Yes	No	No	No
Year FE	No	Yes	Yes	Yes
Provincial FE	Yes	Yes	No	Yes
Prefectural FE	No	No	Yes	No
Observations	183	558	3453	455
Adjusted R^2	0.403	0.761	0.496	0.517

Notes: Column (1) includes 31 provinces over six five-year periods from 7th to 12th five-year plans (1986-1990, ..., 2011-2015), excluding 7th five-year plan for Hainan province, 7th and 8th five-year plans for Chongqing, when they were not yet established as separate provincial units. Column (2) includes 31 provinces over 18 years from 1997 to 2014. Column (3) includes 337 prefectures over 12 years from 2003 to 2014. Prefectural targets are missing for 15% of the prefecture-years. Column (4) includes 31 provinces over 15 years from 1997 to 2011, where the dependent variable, energy growth rate, is missing for 6% of province-years. Column (5) includes 31 provinces over 15 years from 2000 to 2014, where the dependent variable, electricity growth rate, is missing for 2% of the province-years. Robust standard errors are reported in the parenthesis. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1% respectively.

Table 5: Promotion Function for Prefectural Leaders

	(1)		(2)		(3)	
	b	se	b	se	b	se
Realized growth	0.004	(0.007)	0.014***	(0.003)	0.014***	(0.004)
Target faced	-0.061***	(0.021)	-0.081***	(0.030)	-0.084**	(0.042)
Target made					-0.004	(0.003)
Missing target made					-0.476	(0.407)
Party secretary			0.617	(0.391)	0.524*	(0.269)
Age			0.003	(0.006)	0.001	(0.010)
Tenure			0.306***	(0.066)	0.359***	(0.047)
College graduate			0.102	(0.391)	0.355***	(0.072)
Number of tournaments	517		517		517	
Number of contestants	6441		6441		6441	
Log Likelihood	-4.988		-4.802		-4.772	

Notes: All columns use 517 provincial level tournaments over 27 provinces (excluding four direct-controlled municipalities: Beijing, Tianjin, Shanghai, and Chongqing) from 2003 to 2014 among prefectural secretaries and mayors. We do not include year 2015 as the realized GDP growth is not publicly available. The tournaments, indexed province-year-position (secretaries / mayors) are included if the information on all the variables, especially personal information on prefectural secretaries and mayors, is complete.

Table 6: Provincial Targets and the Number of Subordinate Cities

	Dependent variable: Provincial target				
	OLS				2SLS
Panel A: Five-year plans	(1)	(2)	(3)	(4)	(5)
City number	-0.032*	-0.028*	-0.027*		-0.095**
	(0.017)	(0.016)	(0.016)		(0.040)
Effective city number (70%)				-0.127***	
				(0.047)	
Realized growth, lag 1		0.126***	0.125***	0.129***	0.080*
		(0.032)	(0.032)	(0.034)	(0.042)
Log avg. distance to capital			0.192	0.310	0.197
			(0.180)	(0.243)	(0.189)
Log gdp per capita, lag 1	Yes	Yes	Yes	Yes	Yes
Five-year FE	Yes	Yes	Yes	Yes	Yes
Observations	153	153	153	134	135
Adjusted R^2	0.609	0.644	0.644	0.659	0.650
	OLS				2SLS
Panel B: Annual plan	(6)	(7)	(8)	(9)	(10)
City number	-0.018*	-0.024***	-0.023***		-0.089***
	(0.009)	(0.006)	(0.006)		(0.013)
Effective city number (70%)				-0.114***	
				(0.017)	
Realized growth, lag 1		0.493***	0.488***	0.461***	0.480***
		(0.027)	(0.026)	(0.030)	(0.025)
Log avg. distance to capital			0.159**	0.285***	0.084
			(0.066)	(0.101)	(0.070)
Log gdp per capita, lag 1	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	558	558	558	486	486
Adjusted R^2	0.270	0.634	0.637	0.632	0.654

Notes: Columns (1)-(5) include five five-year periods from 8th to 12th five-year plans (1991-1995, ..., 2011-2015). Columns (1)-(3) include all 31 provinces, excluding 8th five-year plans for Chongqing and Hainan, when they were not established as separate provincial units yet. Column (4) further excludes four directly-administrated metropolitans: Beijing, Tianjin, Shanghai and Chongqing for all five five-year plans and Chongqing for the last four five-year plans. Column (5) includes 27 provinces (excluding Hainan, Chongqing, Tibet, Ningxia that were not established as separate provincial units in 1956). Columns (6)-(10) include 17 years from 1997 to 2014. Columns (6)-(8) include all 31 provinces. Column (9) excludes four directly-administrated metropolitans: Beijing, Tianjin, Shanghai, and Chongqing. Column (10) excludes Hainan, Chongqing, Xizang, and Ningxia for the same reason as in column (5). Columns (5) and (10) uses the number of cities in 1956 as an instrumental variable for the current city number. Robust standard errors are reported in the parenthesis. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1% respectively.

Table 7: Provincial Targets and Policy Shocks

	Dependent variable: Ln provincial target			
	Five-year	Annual	Five-year	Annual
	(1)	(2)	(3)	(4)
West * After2000	0.108**	0.110***		
	(0.042)	(0.025)		
Northeast * After2006			0.155***	0.093***
			(0.046)	(0.028)
Ln GDP per capita, lag 1	Yes	Yes	Yes	Yes
Provincial FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	183	558	183	558
Adjusted R^2	0.583	0.505	0.581	0.497

Notes: Columns (1) and (3) include 31 provinces over six five-year periods from 7th to 12th five-year plans (1986-1990, ..., 2011-2015), and excludes 7th five-year plan for Hainan, 7th and 8th five-year plan for Chongqing, when they were not established as separate provincial units yet. Columns (2) and (4) include 31 provinces over 18 years from 1997 to 2014. Robust standard errors are reported in the parenthesis. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1% respectively.

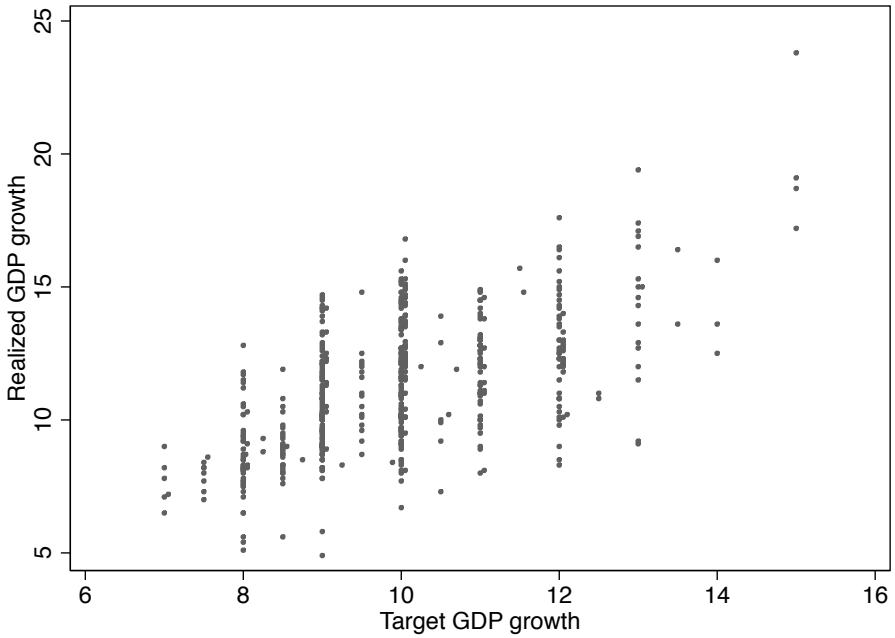
Table 8: Annual Transfer Payment and Growth Targets

	Dependent variable: Ln transfer payment			
	Provincial		Prefectural	
	(1)	(2)	(3)	(4)
Target Made	-0.005	-0.019	-0.001	-0.002
	(0.025)	(0.022)	(0.004)	(0.004)
Ln(lag GDP per capita)	-0.014	-0.033	0.082	0.043
	(0.029)	(0.026)	(0.088)	(0.095)
Lag(Tertiary GDP/Secondary GDP)		-0.372*		-0.147*
		(0.184)		(0.075)
Missing target made			-0.055	-0.065
			(0.048)	(0.049)
Year FE	Yes	Yes	Yes	Yes
Provincial FE	Yes	Yes	No	No
Prefectural FE	No	No	Yes	Yes
Observations	558	558	1961	1961
Adjusted R^2	0.955	0.957	0.902	0.902

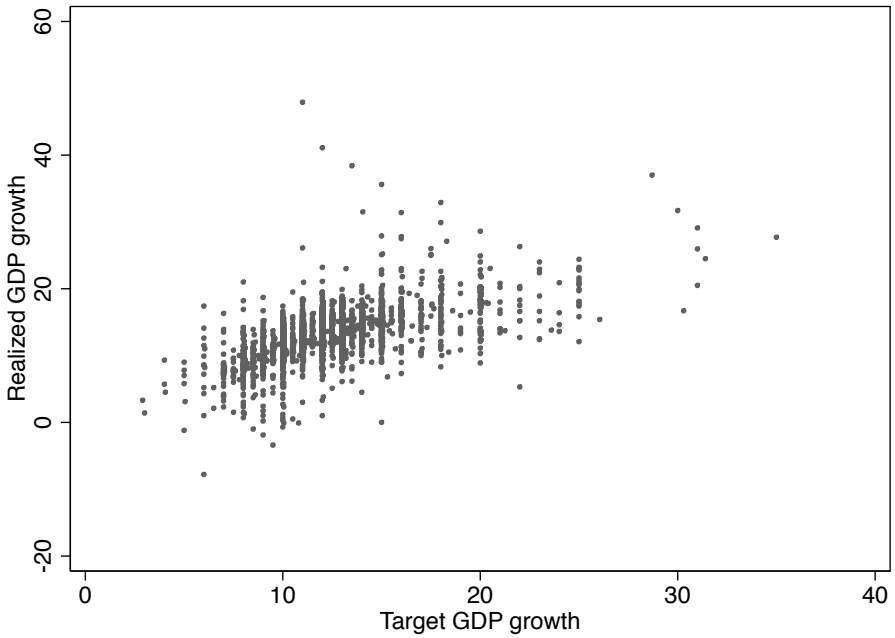
Notes: Columns (1) and (2) include 31 provinces over nine years from 1997 to 2014. Columns (3) and (4) include 286 prefectures over seven years from 2003 to 2009. Robust standard errors are reported in the parenthesis. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1% respectively.

Figure 1: Realized and Target Growth Rate

(a) Provincial Annual



(b) Prefectural Annual



Notes: These two figures plot the annual realized and targeted GDP growth targets. Panel A includes 558 provinces from 2003 to 2014. Panel B includes 337 prefectures from 2003 to 2014.

Appendix

Proof of Proposition 1

Proof In the last period, given x_0, x_i and $\bar{y}_i$, the prefectural leaders face a symmetric game. Given the other players' strategies σ_{-j} (possibly mixed),[40] a prefectural leader j's expected payoff can be written as

$$V_1 \mathbb{E} p_{ij}(y_{ij}, \sigma_{-j}, \bar{y}_i) - \frac{1}{2} c_2 x_{ij}^2.$$

The proof of this proposition proceeds in four steps. The first step establishes an important property of any equilibrium: there cannot exist two interior efforts both maximizing a prefectural leader's expected payoff given the other players' strategies. The second step characterizes the unique symmetric Nash equilibrium in pure strategies and shows when this equilibrium exists. The third step derives the candidate symmetric Nash equilibria in mixed strategies when the symmetric pure strategy Nash equilibrium does not exist. And the final step shows that the symmetric Nash equilibrium in mixed strategies is unique, and this equilibrium exists if and only if the symmetric pure strategy Nash equilibrium does not exist.

Step 1. Given the other players' efforts, and thus final outputs, leader j's expected payoff is

$$\Pi_{ij} = \frac{g(y_{ij}, \bar{y}_i)}{g(y_{ij}, \bar{y}_i) + \sum_{s \neq j} g(y_{is}, \bar{y}_i)} V_1 - \frac{1}{2} c_2 x_{ij}^2. \tag{12}$$

For an interior maximizer, the first order condition implies that:

$$\frac{\partial \Pi_{ij}}{\partial x_{ij}} = \frac{\partial g(y_{ij}, \bar{y}_i)/\partial y_{ij}}{\Big(g(y_{ij}, \bar{y}_i) + \sum_{s \neq j} g(y_{is}, \bar{y}_i)\Big)^2} A x_0 x_i V_1 \sum_{s \neq j} g(y_{is}, \bar{y}_i) - c_2 x_{ij}. \tag{13}$$

From Assumption 1 (the concavity of function g), it is straightforward to verify that the first

[40] Here we suppress i and use j to denote prefectural official ij.

term is strictly decreasing in x_{ij} and hence $\frac{\partial \Pi_{ij}}{\partial x_{ij}}$ is strictly decreasing in x_{ij} as well. Since this is true for any possible realization of the other players' final outputs, it is also true when the other players are using mixed strategies. Therefore, we conclude that there cannot exist two interior efforts both maximizing the prefectural leaders' expected payoffs given the other players' strategies.

Step 2. In a pure strategy Nash equilibrium, every player chooses the same effort. The first order condition (13) implies

$$\frac{(k-1)\partial g(y_{ij}, \bar{y}_i)/\partial y_{ij}}{k^2 g(y_{ij}, \bar{y}_i)} A x_0 x_i V_1 - c_2 x_{ij} = 0.$$

Invoking the definition of elasticity $e_g(y, \bar{y})$, we obtain Equation (1) immediately. The existence of $x_{ij}^\star$ is guaranteed by the Inada condition in Assumption 1, and $x_{ij}^\star$ is unique since $\frac{\partial \Pi_{ij}}{\partial x_{ij}}$ is strictly decreasing in x_{ij}. Assumption 2 implies that as $\bar{y}_i$ goes to infinity, e_g goes to the upper bound M, and hence the cost of effort $\frac{1}{2}c_2 x_{ij}^\star$ goes to $\frac{k-1}{2k^2}MV$. From Equation (12), the expected payoff in this symmetric equilibrium is

$$\frac{V_1}{k} - \frac{k-1}{2k^2} M V_1 < 0$$

since $M > 4$ and $k \geq 2$. This obviously violates the individual rationality constraint; a contestant is better off by not participating the tournament. Therefore, every prefectural leader choosing $x_{ij}^\star$ is a Nash equilibrium if and only if $0 \leq \frac{V_1}{k} - \frac{1}{2}c_2 (x_{ij}^\star)^2$.

Step 3. If $0 > \frac{V_1}{k} - \frac{1}{2}c_2 (x_{ij}^\star)^2$, we can construct a symmetric Nash equilibrium in mixed strategies.[41] From Step 1, in any Nash equilibrium, a player cannot randomize between interior efforts. This leaves the only possibility that each prefectural leader is mixing over two effort levels: a positive effort $\hat{x}_{ij}$ and zero. Suppose in a symmetric equilibrium, each prefectural leader $s \neq j$ chooses $\hat{x}$ with probability γ, prefectural leader j chooses x_{ij} to maximize:

[41] Notice that it is never a Nash equilibrium for each prefectural leader to exert zero effort since there is a profitable deviation by putting a tiny amount of effort if other players all exert zero effort.

$$\sum_{t=0}^{k-1}\binom{k-1}{t}\gamma^t(1-\gamma)^{k-t-1}\frac{g(Ax_{ij}x_ix_0,\bar{y}_i)V_1}{t\cdot g(A\hat{x}x_ix_0,\bar{y}_i)+g(Ax_{ij}x_ix_0,\bar{y}_i)}-\frac{1}{2}c_2x_{ij}^2.$$

The first order condition implies Equation (3). Meanwhile, in the mixed strategy equilibrium, each prefectural leader is indifferent between choosing $\hat{x}_{ij}=\hat{x}$ and putting zero effort. This implies that:

$$\sum_{t=0}^{k-1}\binom{k-1}{t}\gamma^t(1-\gamma)^{k-t-1}\frac{V_1}{t+1}-\frac{1}{2}c_2\hat{x}_{ij}^2=0.$$

With the following identity

$$\sum_{t=0}^{k-1}\binom{k-1}{t}\gamma^t(1-\gamma)^{k-t-1}\frac{1}{t+1}=\frac{1-(1-\gamma)^k}{\gamma k},$$

we obtain Equation (2).

Step 4. In this final step, we want to show that the symmetric mixed strategy Nash equilibrium exists if and only if the symmetric pure strategy Nash equilibrium does not exist. To establish this result, we first rewrite Equations (2) and (3) as:

$$\sum_{j=0}^{k-1}\binom{k-1}{j}\gamma^j(1-\gamma)^{k-j-1}\frac{1}{(j+1)}V_1=\frac{1}{2}c_2\hat{x}^2 \tag{14}$$

and

$$\sum_{j=0}^{k-1}\binom{k-1}{j}\gamma^j(1-\gamma)^{k-j-1}\frac{j}{(j+1)^2}V_1=\frac{c_2\hat{x}^2}{e_g(\hat{y},\bar{y}_i)}. \tag{15}$$

Dividing Equation (15) by Equation (14) yields:

$$\frac{\sum_{j=0}^{k-1}\binom{k-1}{j}\gamma^j(1-\gamma)^{k-j-1}\frac{j}{(j+1)^2}}{\sum_{j=0}^{k-1}\binom{k-1}{j}\gamma^j(1-\gamma)^{k-j-1}\frac{1}{(j+1)}}=\frac{2}{e_g(\hat{y},\bar{y}_i)}. \tag{16}$$

Equation (14) defines $\hat{x}$ as a function of γ, and we denote this function as $\hat{x}_1(\gamma)$. Equation (16) also defines $\hat{x}$ as a function of γ, and we denote this function as $\hat{x}_2(\gamma)$. Obviously, a symmetric mixed strategy Nash equilibrium exists if and only if curves $\hat{x}_1(\gamma)$ and $\hat{x}_2(\gamma)$

intersect at some $\gamma < 1$. It suffices to show that this occurs if and only if $\frac{V_1}{k} - \frac{1}{2}c_2(x_{ij}^\star)^2 < 0$, the condition which preludes the existence of the symmetric pure strategy Nash equilibrium.

First of all, since

$$\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)} = \frac{1-(1-\gamma)^k}{\gamma k}$$

is decreasing in γ, the curve $\hat{x}_1(\gamma)$ is decreasing in γ.

Second, the left hand side of Equation (16) can be rewritten as:

$$\frac{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{j}{(j+1)^2}}{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)}} = 1 - \frac{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)^2}}{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)}},$$

and

$$\frac{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)^2}}{\sum_{j=0}^{k-1} \binom{k-1}{j} \gamma^j (1-\gamma)^{k-j-1} \frac{1}{(j+1)}}$$

is decreasing in γ.[42] From Assumption 2, $e_g(\hat{y}, \bar{y})$ is decreasing in $\hat{y} = A\hat{x}x_i x_0$. Hence, the left hand side of Equation (16) is increasing in γ while the right hand side is increasing in $\hat{x}$. Therefore, $\hat{x}_2(\gamma)$ is increasing in γ. The curves $\hat{x}_1(\gamma)$ and $\hat{x}_2(\gamma)$ can intersect at $\gamma < 1$ if and only if $\hat{x}_2(1) > \hat{x}_1(1)$ and $\hat{x}_2(0) < \hat{x}_1(0)$, as illustrated by Figure 2.

$\hat{x}_2(1) > \hat{x}_1(1)$ is equivalent to the condition $0 > \frac{V_1}{k} - \frac{1}{2}c_2(x_{ij}^\star)^2$. $\hat{x}_2(0) < \hat{x}_1(0)$ is naturally satisfied as $\hat{x}_1(0) > 0$ and $\hat{x}_2(\gamma) = 0$ for some $\gamma \in (0, 1)$, as illustrated by Figure 2. Moreover, if the curves $\hat{x}_1(\gamma)$ and $\hat{x}_2(\gamma)$ intersect, the intersection is unique. This completes the proof of the uniqueness of the symmetric Nash equilibrium.

Proof of Corollary 1

Proof An increase in $\bar{y}_i$ does not affect the curve $\hat{x}_1(\gamma)$, but moves the curve $\hat{x}_2(\gamma)$ upward since $e(\hat{x}, \bar{y}_i)$ increases in $\bar{y}_i$ and decreases in $\hat{x}$. As a result, the new intersection must satisfy

[42] We prove this by taking the derivative with respect to γ. We can collect terms with any pair (j, j') (e.g., $\eta'(\gamma; j)\frac{1}{(j+1)^2}\eta(\gamma; j')\frac{1}{1+j'}$ with $\eta(\gamma; j) = \binom{k-1}{j}\gamma^j(1-\gamma)^{k-j-1}$). Simplification always yields a negative term.

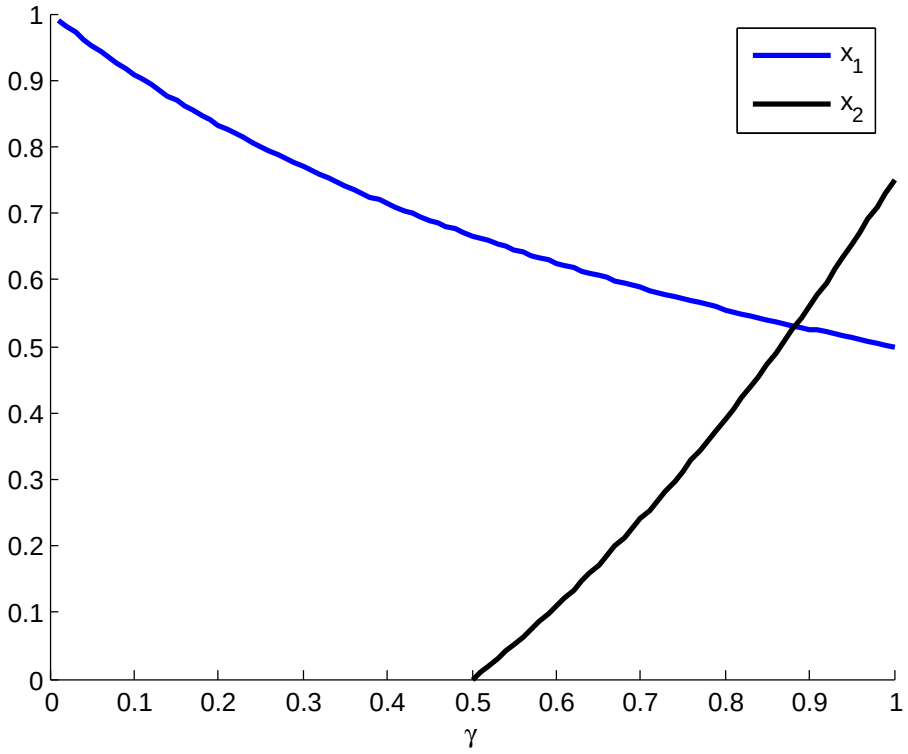


Figure 2: An illustration of $\hat{x}_1(\gamma)$ and $\hat{x}_2(\gamma)$.

that γ becomes lower and $\hat{x}$ becomes higher. This proves the corollary.

Proof of Proposition 2

Proof In the second period, the provincial leaders choose x_i and $\bar{y}_i$ simultaneously. Notice that the choice of $\bar{y}_i$ does not enter the payoff function directly but it affects the choice of x_{ij}. Given $x_i > 0$, one possibility is to induce the symmetric pure strategy Nash equilibrium in the third period (i.e., $x^\star_{ij} \leq \sqrt{\frac{2V_1}{kc_2}}$). Since $\bar{y}_i$ can be changed freely, it is optimal to make x_{ij} as high as possible. This implies that when the provincial leaders are going to induce the symmetric pure strategy Nash equilibrium, the optimal target is chosen such that $x^\star_{ij} = \sqrt{\frac{2V_1}{kc_2}}$.

Another possibility is to induce the symmetric mixed strategy Nash equilibrium, where the prefectural leaders randomize between $\hat{x}_{ij}$ and zero. We want to show that if a provincial leader does this, his probability of winning the tournament is always less than the correspond-

ing probability under the symmetric pure strategy Nash equilibrium with $x_{ij}^{\star} = \sqrt{\frac{2V_1}{kc_2}}$.

Notice that given other provincial leaders' final outputs y_{-i}, provincial leader i's probability of winning the tournament is:

$$P_i = \sum_{t=0}^{k} \binom{k}{t} \gamma^t (1-\gamma)^{k-t} \frac{h(\frac{t}{k}\hat{y}_i, \bar{y}_0)}{\sum_{s \neq i} h(y_s, \bar{y}_0) + h(\frac{t}{k}\hat{y}_i, \bar{y}_0)}.$$

Since $h(y, \bar{y}_0)$ is concave in y by Assumption 1,

$$\frac{h(\frac{t\hat{y}_i}{k}, \bar{y}_0)}{\sum_{s \neq i} h(y_s, \bar{y}_0) + h(\frac{t\hat{y}_i}{k}, \bar{y}_0)}$$

is concave in t as well. By Jensen's inequality, provincial leader i's probability of winning the tournament is less than:

$$Q_i = \frac{h(\gamma\hat{y}_i, \bar{y}_0)}{\sum_{s \neq i} h(y_s, \bar{y}_0) + h(\gamma\hat{y}_i, \bar{y}_0)}$$

which is increasing in $\gamma\hat{y}_i$.

From Equation (2) in Proposition 1, we know that

$$[1-(1-\gamma)^k]V_1 = \frac{1}{2}\gamma k c_2 \hat{x}_{ij}^2$$

and

$$\hat{y}_i = A\hat{x}_{ij} x_i x_0.$$

Therefore, $\gamma\hat{y}_i$ is proportional to $[1-(1-\gamma)^k]^{1/2}(\gamma)^{1/2}$, which is increasing in γ. When $\gamma = 1$, the corresponding target $\hat{y}$ coincides with the target y_i^* to induce pure-strategy effort. As a result, for any $\gamma < 1$, it is always the case that $\gamma\hat{y}_i < y_i^{\star}$ with $y_i^{\star} = Ax_{ij}^{\star} x_i x_0$. Therefore, if provincial leader i is going to induce the symmetric mixed strategy Nash equilibrium, the

probability of winning the tournament satisfies

$$P_i < Q_i < \frac{h(y_i^\star, \bar{y}_0)}{\sum_{s \neq i} h(y_s, \bar{y}_0) + h(y_i^\star, \bar{y}_0)},$$

where the last term is the winning probability under the symmetric pure strategy Nash equilibrium with $x_{ij}^\star = \sqrt{\frac{2V_1}{kc_2}}$. Hence, independent of the other provincial leaders' strategies, it is always optimal for the prefectural leaders to induce the symmetric pure strategy Nash equilibrium with effort $x_{ij}^\star = \sqrt{\frac{2V_1}{kc_2}}$. Plugging $x_{ij}^\star = \sqrt{\frac{2V_1}{kc_2}}$ into Equation (1) yields Equation (4).

Proof of Proposition 4

Proof Obviously, the central leader gets zero utility if he puts in zero effort in the first period. If he would like to exert effort $x_0 > 0$, the target can be chosen either to induce the symmetric pure strategy Nash equilibrium or to induce the symmetric mixed strategy equilibrium. Similar to the argument in the proof of Proposition 2, when the provincial leaders play the mixed strategy equilibrium, the expected output $\zeta \hat{y}_i$ is increasing in ζ and hence the optimal target is set to induce the pure strategy equilibrium with the highest effort $x_i^* = \sqrt{\frac{2V_0}{nc_1}}$. Given in equilibrium $x_i^* = \sqrt{\frac{2V_0}{nc_1}}$ and $x_{ij}^* = \sqrt{\frac{2V_1}{kc_1}}$, the central leader chooses effort x_0 to maximize:

$$A\sqrt{\frac{2V_1}{kc_2}}\sqrt{\frac{2V_0}{nc_1}}x_0 - \frac{1}{2}c_0 x_0^2.$$

The first order condition immediately implies that

$$x_0^\star = \frac{A\sqrt{\frac{2V_1}{kc_2}}\sqrt{\frac{2V_0}{nc_1}}}{c_0}.$$

Since the corresponding optimal utility is strictly positive, this is indeed strictly better than exerting zero effort.

Table 9: Summary Statistics

	obs	mean	sd	min	max
Provincial level:					
City number	31	13.84	6.50	3.00	40.00
Effective city number (70%)	27	5.74	2.18	1.00	10.00
City number in 1956	27	14.74	4.82	8.00	28.00
Avg. distance to capital	31	200.47	118.62	24.38	543.29
West	31	0.39	0.50	0.00	1.00
Northeast	31	0.13	0.34	0.00	1.00
Five-year:					
Central target	6	7.17	0.68	6.00	8.00
Provincial target	183	9.24	1.95	4.41	15.50
Annual:					
Central target	18	7.64	0.45	7.00	8.00
Provincial annual:					
Target growth	558	9.94	1.44	7.00	15.00
Realized growth	558	11.19	2.45	4.90	23.80
GDP per capita (1K)	558	18.87	19.25	0.00	100.11
Electricity growth	455	10.73	6.63	-28.31	37.94
Transfer payment	558	515.01	621.22	4.89	3277.31
Tertial GDP / secondary GDP	558	0.97	0.44	0.50	3.58
Prefectural annual:					
Target growth	3195	12.63	3.06	2.90	76.60
Realized growth	3195	13.28	3.86	-35.70	55.00
GDP per capita (1K)	3195	26.10	25.19	0.10	467.75
Transfer payment (1M)	1961	0.30	0.25	0.00	2.77
Tertiary GDP / Secondary GDP	1961	0.84	0.37	0.06	2.94
Promotion	6441	0.13	0.33	0.00	1.00
Secretary	6441	0.51	0.50	0.00	1.00
Age	6441	51.01	3.93	34.00	61.00
Tenure	6441	2.18	1.64	0.00	11.08
College degree	6441	0.94	0.23	0.00	1.00

Table 10: Promotion Probability

Year	Provincial	Prefectural
1997	0.10	0.31
1998	0.11	0.09
1999	0.03	0.11
2000	0.05	0.22
2001	0.02	0.17
2002	0.26	0.26
2003	0.05	0.09
2004	0.05	0.12
2005	0.00	0.10
2006	0.06	0.19
2007	0.18	0.29
2008	0.00	0.05
2009	0.05	0.06
2010	0.06	0.15
2011	0.08	0.20
2012	0.40	0.26
2013	0.00	0.04
2014	0.00	0.00

Online Appendix: Extension and Additional Evidence (Not for Publication)

A.1 Substitutional Efforts

Although it is widely acknowledged the complementarity of efforts in different levels of government in China, as well as the widespread complementarity among different units within one organization, in this section we illustrate that our main results are still preserved in a setting with substitutional efforts. For illustrative purpose, we consider numerical examples with the linear score functions $g = h = \alpha_0 + \alpha_1(y - \bar{y})$, and change the production function from the complementary one $y_{ij} = Ax_{ij}x_ix_0$ to the substitutable one $y_{ij} = x_{ij} + x_i + x_0$.

If the production function is $y_{ij} = Ax_{ij}x_ix_0$, by simple algebra we obtain the equilibrium targets as

$$\bar{y}_0^\star = \frac{\alpha_0}{\alpha_1} + \frac{n+1}{2n}y^\star, \quad \text{and} \quad \bar{y}_i^\star = \frac{\alpha_0}{\alpha_1} + \frac{k+1}{2k}y^\star,$$

where $y^\star$ is defined by Equation (10):

$$y^\star = (A\sqrt{\frac{2V_2}{kc_2}}\sqrt{\frac{2V_1}{nc_1}})^2/c_0.$$

Obviously, the condition $n > k$ implies the top-down amplification of targets: $\bar{y}_i^\star > \bar{y}_0^\star$. And it is straightforward to verify all of the comparative statics results in Proposition 5.

If the production function is $y_{ij} = x_{ij} + x_i + x_0$, we can similarly characterize the unique symmetric equilibrium. Denote $x_0^\star = 1/c_0$, $x_i^\star = \sqrt{\frac{2V_1}{nc_1}}$, and $x_j^\star = \sqrt{\frac{2V_2}{kc_2}}$. Then following the insight that the targets are set such that the subordinates are playing the symmetric equilibrium with pure strategies and the participation constraint is binding, we can immediately obtain:

$$\bar{y}_0^\star = \frac{\alpha_0}{\alpha_1} + \frac{n+1}{2n}x_i^\star + x_0^\star + x_j^\star, \quad \text{and} \quad \bar{y}_i^\star = \frac{\alpha_0}{\alpha_1} + \frac{k+1}{2k}x_j^\star + x_0^\star + x_i^\star.$$

It is straightforward to verify all of the comparative statics results in Proposition 5. And there is amplification of targets $\bar{y}_0^\star < \bar{y}_i^\star$ if and only if $\frac{k-1}{2k}\sqrt{\frac{2V_2}{kc_2}} < \frac{n-1}{2n}\sqrt{\frac{2V_1}{nc_1}}$. Hence, amplification of targets can be also caused by $\frac{V_2}{c_2} < \frac{V_1}{c_1}$, which is likely to be true as the political rents from being a central leader is much higher than the ones from being a provincial leader.

A.2 Adding More Layers of Government: Targets in Prefectures and Counties

Our model demonstrates the rationale of target setting in a three-layer government structure. The economic intuition and the key results can easily be extended to a setting with more hierarchical layers: the pattern of top-down amplification of targets will be preserved. In China there are five layers of government, consisting of central, provincial, prefectural, county and township governments. This provides a good opportunity to test whether the target

amplification in a three-layer setting will be preserved in a four-layer government setting.[43]

Table 11 collects the growth targets set by 290 counties from 2005 to 2012 in three provinces: Shanxi, Fujian, and Gansu. When it comes to the county targets, the data missing becomes fairly serious, as shown in column (6). We pick Shanxi, Fujian, and Gansu for the sake of data availability and regional representativeness. From these three provinces, we see the amplification of targets from provincial to prefectural levels, and finally down to county governments (columns 1, 2, and 5). Note that the target amplification at the county level is not driven by any extremely high county targets within some specific prefectures. Actually, we find that in all prefectures with non-missing target data, the average county target in the territory is higher than the prefectural target in all of the years observed (column 3).

We also document the determination of prefectural targets as a response to the number of counties in a prefectural city in Table 12, which is a replication of the empirical specification in Table 6. We find that one additional county will lower the prefectural target by 0.04 - 0.07 percentage point. We control for provincial-specific, year-specific unobserved heterogeneity by including provincial fixed effects and year fixed effects. Our estimates are also robust to controlling for higher-level (provincial) targets, lagged GDP growth rates, average distance to the prefectural capital, and using effective county numbers instead for reasons similar to the main text.

[43]Due to the data availability, we can only extend our empirical analysis to the fourth layer of the Chinese government, namely the county level.

Table 11: County Growth Targets

Province	Year	Provincial Targets	Prefectural Targets			County Target	
			Mean	Ampl.	Missing	Mean	Missing
		(1)	(2)	(3)	(4)	(5)	(6)
Shanxi	2005	10.00	12.89	1.00	0.18	12.77	0.81
	2006	10.00	12.45	1.00	0.00	14.79	0.73
	2007	10.00	11.73	1.00	0.09	14.39	0.55
	2008	10.00	12.14	1.00	0.09	16.56	0.50
	2009	8.00	8.64	1.00	0.18	9.51	0.34
	2010	8.00	9.05	1.00	0.00	11.27	0.38
	2011	12.00	14.44	1.00	0.09	18.03	0.11
	2012	12.00	13.55	1.00	0.00	18.43	0.11
Fujian	2005	9.50	11.54	1.00	0.33	13.96	0.61
	2006	9.50	11.73	1.00	0.00	13.86	0.54
	2007	10.00	12.74	1.00	0.00	13.94	0.33
	2008	11.00	13.81	1.00	0.00	15.19	0.29
	2009	11.00	11.69	1.00	0.00	12.58	0.24
	2010	10.50	12.62	1.00	0.00	13.75	0.31
	2011	12.00	13.27	1.00	0.00	13.20	0.08
	2012	11.05	12.82	1.00	0.00	14.08	0.05
Gansu	2005	10.00	10.44	1.00	0.23	11.78	0.76
	2006	10.05	11.57	1.00	0.00	13.11	0.71
	2007	10.05	11.62	1.00	0.00	12.94	0.52
	2008	11.00	12.00	1.00	0.00	13.79	0.55
	2009	10.00	11.33	1.00	0.00	12.87	0.41
	2010	10.05	11.41	1.00	0.00	13.13	0.27
	2011	12.00	13.85	1.00	0.00	14.18	0.45
	2012	12.05	14.14	1.00	0.15	15.42	0.39

Notes:

1. Column (1) lists the provincial annual growth targets in three provinces from 2005 to 2012.
2. Columns (2) - (4) report the summary statistics across 33 prefectures in three provinces from 2005 to 2012. Column (2) reports the average prefectural targets, column (3) the percentage of prefectures with amplification, and column (4) the percentage of prefectures with missing targets due to the lack of data availability. A prefecture with amplification is defined as the one whose prefecture-level target is lower than the average targets of all its subordinate counties.
3. Columns (5) - (6) report the summary statistics across 290 counties in three provinces from 2005 to 2012. Column (5) reports the average county targets, column (6) the percentage of counties with missing targets due to the lack of data availability

Table 12: Targets and the Number of Counties

	Dependent variable: Prefectural target			
	(1)	(2)	(3)	(4)
County number	-0.070***	-0.057***	-0.042***	
	(0.014)	(0.010)	(0.010)	
Effective county number (70%)				-0.054**
				(0.026)
Provincial target	1.098***	0.854***	0.854***	0.853***
	(0.054)	(0.134)	(0.135)	(0.135)
Realized growth, lag 1		0.178	0.178	0.178
		(0.110)	(0.110)	(0.110)
Log avg. distance to capital			-0.173	-0.243
			(0.148)	(0.155)
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Log GDP per capita, lag 1	Yes	Yes	Yes	Yes
Observations	3195	3195	3195	3195
Adjusted R^2	0.417	0.452	0.453	0.452

Notes: This table includes 319 prefectures from 2004 to 2014. Robust standard errors are reported in the parenthesis. Coefficients marked with *, **, and *** are significant at 10%, 5%, and 1% respectively.