Career Incentives and GDP Falsification*

Shengqi NI †

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Abstract

In organizations where multiple agents compete for promotion, individuals often engage in behaviors that enhance their promotion prospects without contributing to actual output. This paper develops a tournament model in which agents compete by choosing between productive effort and performance falsification. Agents vary in career lengths and costs of effort. The model predicts that agents with longer remaining careers exert more effort and falsify more, while those with lower costs engage in less falsification. Applying this model to GDP growth data from 277 Chinese prefecture-level cities, we successfully explain the following empirical patterns: younger politicians, who face stronger career incentives but lower development costs, yield higher real economic growth, engage in less falsification, and are more likely to be promoted. Within individuals, falsification decreases as the career horizon shortens. These results suggest that whether promotion tournaments achieve positive selection depends on the alignment between career incentive strength and the cost of real effort.

Keywords: Political Selection, Career Incentive, Data Manipulation
JEL Codes: D73, M52, P26

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†Department of Economics, Boston University, lightni@bu.edu.

1 Introduction

A fundamental challenge in organizational design is the multi-tasking problem: when agents can improve their measured performance through productive effort or through gaming the measurement itself, incentive systems designed to motivate the former may inadvertently encourage the latter (Holmström and Milgrom 1991) [1] . Less is known, however, about how the intensity of manipulation varies across agents with different characteristics, and within an agent over the course of a career. We develop a tournament model in which agents compete for promotion based on reported performance, and can improve their standing through two activities: productive real effort and outright falsification of the performance metric. These activities are substitutes in determining the contest outcome, creating the classic multi-tasking distortion: tournament pressure simultaneously incentivizes real effort and manipulation. We extend the model by introducing heterogeneous costs of real effort across agents. We show that when agents differ in the cost of productive effort, the multi-tasking distortion is not uniform. Agents for whom productive effort is cheap substitute real output for falsification even under strong career pressure, generating higher actual performance and less manipulation simultaneously. Standard career concern models (Holmström 1999; Gibbons and Murphy 1992) predict that agents with longer career horizons exert more effort to signal ability, but say nothing about how career pressure is divided between productive and manipulative effort. The multi-tasking literature (Holmström and Milgrom 1991) shows that incentive pressure increases falsification for a given cost structure, but abstracts from agent heterogeneity. Tournament models study how competition shapes effort (Lazear and Sherwin Rosen 1981; Green and Stokey 1983; Nalebuff and Stiglitz 1983), and recognize that contests also reward unproductive activities such as sabotage (Lazear 1989), but typically assume homogeneous agents. Our model nests all three and shows that their interaction, combined with cost heterogeneity, generates qualitatively new results. In particular, the relationship between career incentive strength and falsification is non-monotonic across agents: stronger career concerns increase falsification for high-cost agents but decrease it for low-cost agents who substitute toward real effort instead.

We apply this framework to study GDP falsification among prefecture-level officials in China. This setting is ideal for three reasons. First, local officials compete in a well-documented promotion tournament evaluated primarily on reported economic growth (H. Li and L.-A. Zhou 2005; Xu 2011; Jia, Kudamatsu, and Seim 2015), creating precisely the

[1] Evidence of such gaming is widespread, particularly among government officials who control the statistics by which they are evaluated: GDP growth rate (Martinez 2022), air quality readings (Ghanem and J. Zhang 2014), accidental death counts (Fisman and Y. Wang 2017), and birth statistics (Suárez Serrato, X. Y. Wang, and S. Zhang 2019)

incentive structure our model analyzes. Second, regional GDP statistics are compiled by local statistics bureaus under direct control of local governments, giving officials a direct channel through which to falsify performance metrics.[2] Third, career incentives vary sharply and quasi-discontinuously with age: officials above age 58 become ineligible for promotion to Deputy Minister level, removing the promotion incentive entirely (Zeng and Q. Zhou 2024). This institutional feature provides clean variation in career horizon that maps directly to our model's career concern dimension.

To measure GDP falsification — the key outcome that prior work cannot directly observe — we adapt the statistical framework of Pinkovskiy and Sala-i-Martin (2016) to decompose reported GDP growth into real and falsified components. We use four alternative economic indicators unlikely to be manipulated by local governments: satellite nighttime light intensity, bank loan disbursement, electricity consumption, and total freight volume. The identification relies on two assumptions. First, the measurement error of satellite nighttime light — collected by U.S. satellites without any reliance on local statistical agencies — is uncorrelated with measurement errors of the other indicators. Second, the expected true GDP growth rate of each prefecture-level city equals the national reported growth rate. We validate our falsification measure against news reports of exposed falsification cases, geographic patterns consistent with received wisdom, and within-tenure dynamics that match the incentive structure of the officials. The resulting panel covers 277 prefecture-level cities from 2003 to 2013.

Our empirical findings align precisely with the joint predictions of our theoretical model. *Across individuals*, younger city leaders deliver significantly higher real GDP growth, engage in less falsification, and are more likely to be promoted — despite the fact that stronger career concerns should, under a career-concern-only model, generate more of both effort and manipulation. *Within individuals*, falsification decreases over a politician's career, consistent with weakening career concerns as the promotion horizon shortens. The negative correlation between realized growth and falsification — a 1 percentage point decrease in real growth corresponds to approximately a 0.95 percentage point increase in falsified growth — is consistent with productive effort and falsification being substitutes, exactly as our model predicts.

We advance the career concern literature (Holmström 1999; Gibbons and Murphy 1992; Dewatripont, Jewitt, and Tirole 1999). Holmström (1999) shows that career concerns are

[2]Anecdotal evidence abounds. Henglan County in Guangdong Province reported 8.51 billion RMB in industrial output in 2012; after audit by the National Bureau of Statistics, the true figure was 2.22 billion RMB, less than one-third of the reported value. In January 2017, the Liaoning Provincial Governor publicly acknowledged large-scale statistical deception at city and county levels from 2011 to 2014. The Inner Mongolia government admitted in 2018 that industrial added value in 2016 was padded by 40 percent.

self-enforcing — agents exert effort to signal ability without explicit incentives — and are strongest early in an agent's career. Gibbons and Murphy (1992) show that explicit incentives and career concerns are substitutes, with optimal contracts providing stronger explicit incentives to older workers. Our model adds a second task (falsification) to this framework and shows that the career-concern mechanism has heterogeneous effects across the two tasks depending on agent cost types. For low-cost agents, stronger career concerns increase real effort more than falsification, producing the counterintuitive prediction that the most motivated agents are the least manipulative. Empirical evidence on career concerns has largely focused on mutual fund managers (Chevalier and Ellison 1999) and security analysts (Hong, Kubik, and Solomon 2000), who respond to career pressure through risk-taking and herding rather than outright fabrication. Our paper provides the first direct evidence on how career concerns shape the tradeoff between productive effort and performance manipulation in a setting where both are measurable. We contribute to the tournament literature (Lazear and Sherwin Rosen 1981; Green and Stokey 1983; Nalebuff and Stiglitz 1983) by studying tournaments with heterogeneous agents and multiple tasks. our paper shows that asymmetry in task costs generates systematic differences in the mix of productive and manipulative behavior, yielding new predictions about selection and sorting that purely ability-based models cannot produce.

Our paper extends the extensive literature on how career concerns shape politicians' behavior. In democratic settings, career concerns manifest through electoral incentives: politicians adopt expansionary fiscal and monetary policies in election years (Nordhaus 1975; Alesina and Roubini 1992; Drazen 2000), increase police forces before elections (Levitt 1997), and exert more effort when reelection is possible (Aruoba, Drazen, and Vlaicu 2019; Besley and Case 1995; Ferraz and Finan 2011). In authoritarian settings like China, career concerns operate through promotion incentives rather than electoral accountability. Existing studies have documented how promotion incentive influence fiscal policy (Lü and Landry 2014), city expansion (Z. Wang, Q. Zhang, and L.-A. Zhou 2020), and the timing of IPOs (Piotroski and T. Zhang 2014). Our study advances this literature in two respects. First, we show that promotion incentives shape not only how hard officials work, but how they work — specifically, whether career pressure is channeled into genuine economic development or statistical fabrication. This distinction matters for understanding the efficiency properties of promotion tournaments as governance mechanisms. Second, and more importantly, we show that the direction of the effect depends critically on politicians' types. The most closely related paper is S. Chen, Qiao, and Zhu (2021), who construct a two-period model in which officials choose between "chasing" (real) and "cheating" (falsified) effort, and find that county officials in their first term manipulate more than those in their second term. This

within-individual result is consistent with our career concern mechanism. However, their model — in which all officials have identical costs — cannot explain the across-individual pattern we document: that younger officials simultaneously deliver more real growth and falsify less than older officials. Without cost heterogeneity, standard career concern logic predicts that younger officials (with stronger career concerns) should manipulate more, not less. Our heterogeneous-cost framework resolves this contradiction and generates a unified explanation for both within- and across-individual variation. Zeng and Q. Zhou (2024) provide complementary evidence that GDP manipulation is higher among officials eligible for promotion, using the age-58 cutoff as a discontinuity; we build on this insight to study the full age profile of falsification and its interaction with real performance.

Our findings have implications for the design of performance-based promotion systems in organizations where agents can manipulate performance metrics. The standard prescription from multi-tasking theory — reduce incentive intensity — may be unnecessary if the principal can select agents with low productive effort costs. Our results suggest that the Chinese promotion tournament achieves a form of positive selection: the officials who are most capable of generating real growth are also the least likely to falsify, and are the most likely to be promoted. This is a more optimistic view of performance-based promotion in imperfect information environments than the existing literature suggests. At the same time, our findings imply that high-cost officials — those for whom genuine development is difficult — face the strongest temptation to falsify, pointing to the importance of developing independent verification mechanisms such as the online reporting system introduced by China's National Bureau of Statistics in 2012, and of using alternative indicators that are less susceptible to local manipulation.

The remainder of the paper proceeds as follows. Section 2 develops the theoretical framework. Section 3 describes the data, the empirical strategy for measuring GDP falsification, and validation exercises. Section 4 presents the empirical results. Section 5 concludes.

2 Model: Career Concern with Heterogeneous Agents

2.1 Basic Setting

To simplify the analysis, we posit a system with two hierarchical positions: low-level and high-level. The net value of promotion is $V = V_H - V_L$, where V_H and V_L are the per-period utilities associated with holding the high- and low-level positions respectively[3]. N players start their careers at the low-level position and face decisions regarding the level of effort e

[3]Adding different continuation values of retirement from different levels of positions would not affect our conclusions.

and falsification f, Effort e captures activities like spending time to attract entrepreneurs and making strategic investments through local government financing vehicles, which determines realized GDP growth $g(e)$. We assume $g'(e) > 0$ and $g''(e) \leq 0$. Falsification f represents the inflation of reported statistics above actual performance. The reported GDP growth rate is therefore $s = g(e) + f$.

Falsification is a risky behavior: higher f boosts reported performance and raises the probability of promotion, but also increases the probability of being detected and punished by the Party. In the broad interpretation of the model, f encompasses any action that inflates measured performance at a cost — including falsifying statistics, exempting connected firms from regulation, paying bribes to buy protection from audit, or other forms of institutional manipulation.

Costs. The cost $C(e, f)$ of the two activities is additively separable and strictly convex: $\frac{\partial C}{\partial e} > 0$, $\frac{\partial C}{\partial f} > 0$, $\frac{\partial^2 C}{\partial e^2} > 0$, $\frac{\partial^2 C}{\partial f^2} > 0$. The convexity of C captures the escalating difficulty of larger manipulations. Modest inflation can exploit the loopholes that exist naturally in the statistical system — discretionary adjustments, favorable treatment of borderline cases — but each additional unit of fabricated growth must be reconciled with an expanding web of related records (enterprise surveys, fiscal accounts, neighboring jurisdictions' figures), coordinated across more subordinates, and concealed from increasingly probable detection as the gap between reported and true performance exits the range of plausible noise. Growth falsification also compounds: inflating this year's level raises the base from which next year's growth is measured, so sustaining inflated growth requires geometrically increasing level fabrication.[4]

The contest. Officials compete for promotion on the basis of reported performance. The promotion probability $p(s_i, s_{-i})$ is continuously differentiable, anonymous, strictly increasing in the official's own score, strictly decreasing in the opponent's, and satisfies the *trailing contestant property*:

$$\frac{\partial p}{\partial s_i}(s_i, s_j) \;\geq\; \frac{\partial p}{\partial s_j}(s_j, s_i) \qquad \text{whenever } s_i \leq s_j.$$

[4] An alternative way to model the cost of falsification is through detection risk: with probability $q(f)$, increasing in f, falsification is detected and the official's career ends. Career horizon then enters with opposing signs: a younger official gains more from falsifying, but also loses more upon detection. The net effect is ambiguous and depends on the detection technology, the discount rate, and the relative value of promotion versus remaining in office. Detection risk appears empirically weak during our sample period: GDP falsification was rarely treated as a serious disciplinary offense, and exposed cases seldom ended officials' careers. We therefore capture the cost of falsification in reduced form through the convex cost, which yields sharp testable predictions and can be interpreted as embedding any (small) expected punishment.

The property states that the marginal return to reported performance is higher for whoever is behind in the contest. Intuitively, competitive pressure concentrates on the trailing side: for the official who is ahead, an additional unit of reported performance largely pads a lead and buys little extra promotion probability; for the official who trails, the contest hangs in the balance and each additional unit meaningfully shifts the odds. The leading example is the contest success function (CSF) in the tournament literature (Tullock 1980; Skaperdas 1996)

$$p(s_i, s_{-i}) = \frac{\phi(s_i)}{\sum_{j=1}^{N} \phi(s_j)}$$

with $\phi(s_i)$ strictly increasing, $\phi(0) = 0$, and concave. In a special case, we assume the Tullock ratio form $h(s) = s$ to deliver closed-form solutions.

Note that real output $g(e)$ and falsification f enter the contest only through their sum: they are perfect substitutes in determining promotion probability. This substitutability is the key source of the multi-tasking tradeoff — when real effort becomes cheaper, falsification becomes relatively less attractive even as the overall incentive to perform rises — and it reflects the informational premise of our setting: the promotion committee observes reported growth but cannot separate its real and falsified components.

Officials differ along two dimensions: their remaining career horizon (career concern channel) and their marginal cost of real effort c_e (cost heterogeneity channel), and the central result arises from their interaction. To see what each force contributes, we first analyze each dimension in isolation to build intuition, then combine them.

2.2 Special Case I: Career Concerns Only

Consider $N = 2$ politicians who are identical except in their remaining career length. A young politician has two terms remaining before retirement, and an old politician has only one. Both share the same cost function $C(e, f)$, so any difference in behavior is driven purely by the career horizon.

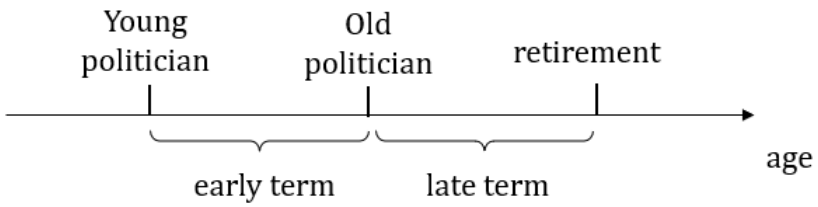


Figure 1: Timing of the Two-Period Contest. The old politician competes in the first period and then retires; the young politician competes in the first period and, if not promoted, competes again in the second period against a new young entrant.

The old politician plays a one-shot contest:

$$\max_{e_o,\, f_o} \quad \underbrace{p\big(s_o,\, \hat{s}_y\big)}_{\text{prob of promotion}} \cdot \underbrace{V}_{\text{prize}} - C(e_o, f_o), \qquad \text{where } s_o = g(e_o) + f_o.$$

The young politician's problem can be solved by backward induction. If promoted at the end of the first period, he enjoys the high-level position for two periods, worth $2V$. If not promoted, in the second period he faces exactly the old politician's problem against a new young entrant.[5] let $W \equiv p(s_o^*, s_y^*)\, V - C(e_o^*, f_o^*)$ denote the equilibrium value of that continuation problem. His first-period problem is therefore:

$$\max_{e_y,\, f_y} \; p\big(s_y,\, \hat{s}_o\big) \cdot 2V \;+\; \big(1 - p(s_y, \hat{s}_o)\big) \cdot W \;-\; C(e_y, f_y),$$

which, given the constant W, is a one-shot contest with the *effective prize*

$$V_y \;\equiv\; 2V - W \;>\; V \;=\; V_o.$$

The inequality holds because $W < V$: the continuation value of an unpromoted politician is strictly less than the prize itself, since promotion next period is uncertain ($p < 1$) and costly to pursue ($C > 0$). The career concern channel is thus summarized by a single statistic — the young politician competes for a strictly larger effective prize.

Each politician $i \in \{young, old\}$ chooses (e_i, f_i) to maximize $p(s_i, \hat{s}_{-i})\, V_i - C(e_i, f_i)$. The first-order conditions are

$$\frac{\partial p}{\partial s_i}\, g'(e_i)\, V_i = \frac{\partial C}{\partial e_i}, \tag{1}$$

$$\frac{\partial p}{\partial s_i}\, V_i = \frac{\partial C}{\partial f_i}. \tag{2}$$

and in equilibrium each politician's conjecture is correct, $\hat{s}_{-i} = s^*_{-i}$. Dividing (1) by (2) yields:

$$\frac{\partial C}{\partial e_i} = g'(e_i)\, \frac{\partial C}{\partial f_i}, \tag{3}$$

which pins down each politician's division of the score between effort and falsification. Since both share the same cost function, they operate on the same expansion path: by the convexity of C and the concavity of g, effort and falsification increase together along this path. The comparison between the two politicians therefore reduces to a question of scale — who chooses the higher score on the common path — and scale is determined by the effective

[5] Assuming instead that he faces a new young or a new old competitor with some random probability does not change our conclusions.

prize.

Proposition 1 (Career concerns only)**.** *If the two politicians differ only in career horizon, then in any interior equilibrium the young politician exerts more effort ($e_y^* > e_o^*$), falsifies more ($f_y^* > f_o^*$), reports higher performance ($s_y^* > s_o^*$), and is more likely to be promoted ($p(s_y^*, s_o^*) > p(s_o^*, s_y^*)$).*

Proof. We prove by contradiction. Suppose that $f_y^* \leq f_o^*$. By the common expansion path, this implies $e_y^* \leq e_o^*$ and hence $s_y^* \leq s_o^*$.

The FOC in (2) give

$$\frac{\partial C}{\partial f_y^*} = \frac{\partial p(s_y^*, s_o^*)}{\partial s_y} V_y \; > \; \frac{\partial p(s_o^*, s_y^*)}{\partial s_o} V_o = \frac{\partial C}{\partial f_o^*},$$

where the inequality uses $s_y^* \leq s_o^*$ together with the trailing contestant property of p and $V_y > V_o$. Since C is strictly convex, $\frac{\partial C}{\partial f_y^*} > \frac{\partial C}{\partial f_o^*}$ implies $f_y^* > f_o^*$, a contradiction . Hence $f_y^* > f_o^*$, and the common expansion path delivers $e_y^* > e_o^*$ and $s_y^* > s_o^*$. □

Proposition 1 has a natural interpretation through the effective prize. The young politician competes for a strictly larger stake, $V_y = 2V - W > V$, for two reasons. First, winning is worth more to him: promotion delivers the high position for two periods rather than one. Second, losing is not fatal — he retains the option to compete again — but this consolation is worth strictly less than the prize itself ($W < V$), because next period's promotion is uncertain and costly to pursue against more motivated young competitor. The larger stake pushes the young politician to a higher point on the common expansion path: more effort *and* more falsification. Proposition 1 also admits a within-individual interpretation: the same politician exerts more effort and falsifies more in the early stage of her career than in the late stage, as the effective prize she competes for shrinks with her horizon. Table 1 summarizes. [6]

	young politician	old politician
effort	high	low
falsification	high	low
reported performance	high	low

Table 1: Predictions: Career Concerns Only. When politicians differ only in career horizon, the younger official competes for a larger effective prize and therefore exerts more effort, falsifies more, and reports higher performance.

The result also extends to any number of contestants; see Appendix D for the derivation.

[6] Under the quadratic cost specification $C(e, f) = \frac{1}{2}c_e e^2 + \frac{1}{2}c_f f^2$ with the linear CSF $p(s_i, s_{-i}) = \frac{s_i}{\sum_{j=1}^{2} s_j}$, where $s_i = e_i + f_i$, the equilibrium admits a closed form solution. See Appendix E for the detailed derivation.

The two-period structure extends naturally to M periods: by backward induction, a politician with m periods remaining competes for an effective prize $V_m = mV - W_{m-1}$, where W_{m-1} is the equilibrium continuation value of a politician passed over for promotion with $m-1$ periods remaining. Because each period's contest takes the same form as the static game, the analysis of this section applies period by period with V_m in place of V_{young} and V_{old}; the within-career decline in effort and falsification then follows whenever the effective prize V_m declines with the remaining horizon. A full analysis of the resulting sequence of elimination contests, in the spirit of Shwerwin Rosen (1986), would additionally generate dynamic selection: officials who survive to older ages without promotion are disproportionately those for whom real performance is costly. Such selection reinforces — and indeed provides one microfoundation for — our maintained assumption in Section 2.4 that the old politician faces higher costs of real effort.

The critical limitation of the career-concerns-only model predicts is that younger officials should falsify *more* than older officials. This is exactly the opposite of the empirical pattern we document, in which younger city secretaries falsify significantly less. Resolving this tension requires a second dimension of heterogeneity.

2.3 Special Case II: Heterogeneous Costs Only

We now consider two politicians who differ only in their cost of real effort, holding the career horizon fixed: both have one term remaining and compete for the same prize V. The low-cost politician's marginal effort cost is lower at every effort level: $\frac{\partial C_l}{\partial e} < \frac{\partial C_h}{\partial e}$ for all $e > 0$; both face the same falsification cost $\frac{\partial C_l}{\partial f}$. [7]

The first-order condition for politician i is

$$\frac{\partial p(s_i^*, s_{-i}^*)}{\partial s_i}\, g'(e_i^*)\, V = \frac{\partial C}{\partial e_i^*}, \tag{4}$$

$$\frac{\partial p(s_i^*, s_{-i}^*)}{\partial s_i}\, V = \frac{\partial C}{\partial f_i^*}. \tag{5}$$

Proposition 2 (Heterogeneous costs only)**.** *If two politicians differ only in the cost of real effort, then in any interior equilibrium, the low-cost politician exerts more real effort ($e_l^* > e_h^*$), falsifies less ($f_l^* < f_h^*$), reports higher performance, and is promoted with higher probability ($s_l^* > s_h^*$).*

Proof. We prove by contradiction. By the trailing contestant property and the strict convexity of C, equation (5) implies that the falsification ranking is inverse to the score ranking:

[7] Common $\frac{\partial C}{\partial f}$ reflects that the cost of falsification is largely institutional — the difficulty of influencing the local statistics bureau and the ambient detection environment — and hence roughly uniform across officials, while the cost of real development varies with individual human capital and connections.

$f_l^* \geq f_h^*$ if $s_l^* \leq s_h^*$, and $f_l^* \leq f_h^*$ if $s_l^* \geq s_h^*$, with strict inequalities when the scores differ strictly. It therefore suffices to rank the scores.

Now suppose $s_l^* \leq s_h^*$, this implies $f_l^* \geq f_h^*$. Then $g(e_l^*) = s_l^* - f_l^* \leq s_h^* - f_h^* = g(e_h^*)$, so $e_l^* \leq e_h^*$.

Dividing each politician's effort condition by his falsification condition yields the mix condition

$$\frac{\partial C_i}{\partial e}(e_i^*) = g'(e_i^*)\,\frac{\partial C_i}{\partial f}(f_i^*).$$

Using $e_l^* \leq e_h^*$ and the convexity of C_h in e,

$$g'(e_l^*)\,\frac{\partial C_l}{\partial f}(f_l^*) \;=\; \frac{\partial C_l}{\partial e}(e_l^*) \;<\; \frac{\partial C_h}{\partial e}(e_l^*) \;\leq\; \frac{\partial C_h}{\partial e}(e_h^*) \;=\; g'(e_h^*)\,\frac{\partial C_h}{\partial f}(f_h^*).$$

But $f_l^* \geq f_h^*$ implies $\frac{\partial C_l}{\partial f}(f_l^*) \geq \frac{\partial C_h}{\partial f}(f_h^*)$, and concavity of g with $e_l^* \leq e_h^*$ gives $g'(e_l^*) \geq g'(e_h^*)$, so the left-hand side is weakly *larger* than the right-hand side — a contradiction. Hence $s_l^* > s_h^*$.

Given $s_l^* > s_h^*$, (5) delivers $f_l^* < f_h^*$. Finally, $g(e_l^*) = s_l^* - f_l^* > s_h^* - f_h^* = g(e_h^*)$, so $e_l^* > e_h^*$. □

The intuition is clean. A lower marginal cost of effort makes real output relatively cheap, so the low-cost politician tilts his mix toward real effort and, reduce falsification, on top of that, produces a higher total score, because reported performance is cheaper for him at the margin. Table 2 summarizes.

	low-cost politician	high-cost politician
effort	high	low
falsification	low	high
reported performance	high	low

Table 2: Predictions: Heterogeneous Costs Only. When politicians differ only in the cost of real effort, the low-cost politician exerts more effort, falsifies less, and reports higher performance.

Comparing Tables 1 and 2 reveals the central tension of the model. Career concerns alone push younger politicians toward more falsification; cost heterogeneity alone pushes lower-cost politicians toward less falsification. The key question is which force dominates when we bring both dimensions together.

2.4 The Combined Model and Key Assumption

We now incorporate both dimensions of heterogeneity simultaneously. The *young* politician has the longer career horizon and the lower cost of real effort; the *old* politician has the shorter horizon and the higher cost. As in Section 2.2, the horizon difference is summarized

by the effective prizes, $V_y > V_o$; as in Section 2.3, the cost difference is a pointwise ranking of marginal effort costs, $\frac{\partial C_y}{\partial e} < \frac{\partial C_o}{\partial e}$ for all $e > 0$.

The two special cases pull the falsification comparison in opposite directions: career concerns push the young politician toward *more* falsification (Proposition 1), cost heterogeneity toward *less* (Proposition 2). For scores and effort, by contrast, the two forces are aligned, and the following holds at full generality.

Proposition 3 (Combined model)**.** *Fix the old politician's common marginal falsification cost, and the effective prizes $V_y > V_o$. If the young politician's marginal effort cost is low enough — then in any interior equilibrium the young politician falsifies less than the old politician, $f_y^* < f_o^*$, while continuing to exert more effort, report higher performance, and win promotion with higher probability.*

Proof. Given the opponent's equilibrium score, the first-order conditions for the young politician are:

$$\frac{\partial p(s_y^*, s_o^*)}{\partial s_y}\, g'(e_y^*)\, V_y = \frac{\partial C_y}{\partial e}(e_y^*), \tag{6}$$

$$\frac{\partial p(s_y^*, s_o^*)}{\partial s_y}\, V_y = \frac{\partial C}{\partial f}(f_y^*), \tag{7}$$

and for the old politician

$$\frac{\partial p(s_o^*, s_y^*)}{\partial s_o}\, g'(e_o^*)\, V_o = \frac{\partial C_o}{\partial e}(e_o^*), \tag{8}$$

$$\frac{\partial p(s_o^*, s_y^*)}{\partial s_o}\, V_o = \frac{\partial C}{\partial f}(f_o^*). \tag{9}$$

Dividing each politician's effort condition by his falsification condition yields the mix conditions

$$\frac{\partial C_i}{\partial e}(e_i^*) = g'(e_i^*)\, \frac{\partial C}{\partial f}(f_i^*), \qquad i \in \{y, o\}. \tag{10}$$

First, we want to show $s_y^* > s_o^*$. Suppose $s_y^* \leq s_o^*$. By the trailing contestant property and $V_y > V_o$, the falsification conditions in (7) and (9) give $\frac{\partial C}{\partial f}(f_y^*) > \frac{\partial C}{\partial f}(f_o^*)$, hence $f_y^* > f_o^*$; then $g(e_y^*) = s_y^* - f_y^* < s_o^* - f_o^* = g(e_o^*)$, so $e_y^* < e_o^*$. But the mix conditions (10) are then inconsistent: their left-hand sides satisfy $\frac{\partial C_y}{\partial e}(e_y^*) < \frac{\partial C_o}{\partial e}(e_y^*) < \frac{\partial C_o}{\partial e}(e_o^*)$ by the pointwise cost ranking and convexity, while their right-hand sides satisfy $g'(e_y^*)\, \frac{\partial C}{\partial f}(f_y^*) > g'(e_o^*)\, \frac{\partial C}{\partial f}(f_o^*)$ by concavity of g and $f_y^* > f_o^*$ — a contradiction. Hence $s_y^* > s_o^*$.

Next, we show $e_y^* > e_o^*$. If $e_y^* \leq e_o^*$, then $s_y^* > s_o^*$ forces $f_y^* > f_o^*$, and (10) yields the identical contradiction.

Dividing the falsification conditions across the two politicians,

$$\frac{\frac{\partial C}{\partial f}(f_y^*)}{\frac{\partial C}{\partial f}(f_o^*)} = \underbrace{\frac{\partial p(s_y^*, s_o^*)/\partial s_y}{\partial p(s_o^*, s_y^*)/\partial s_o}}_{<1 \text{ by Step 2 and the trailing property}} \times \underbrace{\frac{V_y}{V_o}}_{>1}. \tag{11}$$

whether the young politician falsifies more or less than the old is determined by whether the right-hand side of (11) exceeds or less than one — and the right-hand side is the product of two counteracting channels.

The first is the *career concern channel*: the young politician competes for a strictly larger effective prize, $V_y/V_o > 1$, which raises the return to every unit of falsification and pushes his falsification up.

The second is the *cost channel*, operating through the contest. The young politician's cost advantage makes him the leader, and by the trailing contestant property the leader faces strictly less marginal competitive pressure — the more so the larger his lead. Since falsification responds only to this pressure, the cost advantage pushes the young politician's falsification down.

The resolution is therefore a horse race between the two channels. The young politician falsifies less when the second channel dominates: his cost advantage is large enough that the pressure ratio falls below V_o/V_y. □

Under the quadratic cost specification $C(e, f) = \frac{1}{2}c_e e^2 + \frac{1}{2}c_f f^2$ and the linear CSF $p(s_i, s_{-i}) = \frac{s_i}{\sum_{j=1}^{2} s_j}$, where $s_i = e_i + f_i$, the cutoff on the young politician's marginal cost can be derived explicitly. The falsification first-order conditions are:

$$\frac{s_o^*}{(s_y^* + s_o^*)^2} V_y = c_f\, f_y^*, \qquad \frac{s_y^*}{(s_y^* + s_o^*)^2} V_o = c_f\, f_o^*, \tag{12}$$

and the mix conditions to $c_e^i e_i^* = c_f f_i^*$, so that $f_i^* = \frac{c_e^i}{c_e^i + c_f}\, s_i^*$. Dividing the two conditions in (12) and substituting the mixes,

$$\frac{f_y^*}{f_o^*} = \frac{s_o^* V_y}{s_y^* V_o} = \frac{c_e^y\,(c_e^o + c_f)}{c_e^o\,(c_e^y + c_f)} \cdot \frac{V_y}{V_o} \cdot \frac{f_o^*}{f_y^*}.$$

Hence,

$$\frac{f_y^*}{f_o^*} = \sqrt{\frac{V_y}{V_o} \cdot \frac{c_e^y\,(c_e^o + c_f)}{c_e^o\,(c_e^y + c_f)}}, \tag{13}$$

the parametric form of the two-channel decomposition (11): the prize ratio pushes the young politician's falsification up, the cost asymmetry pushes it down. The young politician falsifies

less, $f_y^* < f_o^*$, if and only if the expression under the root falls is less than one, which is

$$c_e^y \;<\; \bar{c}_e \;\equiv\; \frac{c_e^o\, c_f\, V_o}{(V_y - V_o)\, c_e^o + V_y\, c_f}\,. \tag{14}$$

The comparative statics of the cutoff show several features. As the prize gap widens, the cutoff tightens — stronger career concerns demand a larger cost advantage. The cutoff also rises with the falsification cost c_f: when manipulation is expensive for everyone, a smaller effort-cost advantage suffices for the reversal, whereas as $c_f \to 0$ the cutoff collapses to zero — with falsification nearly free, both politicians compete through manipulation and the career concern channel dominates.

This assumption of $c_e^y < c_e^o$ is grounded in the institutional characteristics of the Chinese political system. Summary statistics comparing younger and older city secretaries (Table 3) reveal systematic differences: younger politicians are more likely to have college degrees, have stronger connections to provincial leaders, and tend to govern less-developed cities with greater growth potential. Each of these characteristics reduces the cost of delivering real economic growth. Better-educated officials command more human capital for economic management; well-connected officials can attract investment and mobilize resources more easily; and officials in less-developed regions can generate high growth rates from a lower base. Beyond these observable factors, unobservable characteristics likely reinforce the same pattern. The promotion system itself selects younger officials who have risen quickly through the ranks — a signal of exceptional ability or a strong network that is difficult to quantify directly. Physical energy and cognitive capacity, which tend to depreciate with age, also lower the personal cost of the sustained effort required for economic development. These observable and unobservable dimensions together constitute the empirical counterpart to c_e in the model: they capture the fundamental ease with which a politician can translate effort into real output. Our within-politician specification addresses unobservable cost differences directly by including individual fixed effects, which difference out all time-invariant characteristics regardless of whether they are measured.

Empirical predictions. Combining Propositions 1 and 2 under the assumption that younger politicians have significantly lower development costs generates four testable predictions:

1. **Across individuals, younger politicians falsify less.** The cost channel ($c_e^{young} < c_e^{old}$) dominates the career concern channel, so young officials substitute real effort for falsification despite facing stronger career incentives.

	Young (≤52)	Old (>52)	Difference	
	Mean	Mean	young-old	p-value
Age	48.88	54.94	-6.05***	(0.00)
College degree	0.64	0.48	0.17***	(0.00)
Female	0.06	0.02	0.03**	(0.00)
Minority	0.07	0.06	0.01	(0.50)
Years since join the CCP	22.55	24.18	-1.63***	(0.00)
University Management	0.02	0.00	0.01*	(0.01)
County leadership	0.51	0.50	0.01	(0.82)
SOE Management	0.16	0.20	-0.04*	(0.04)
Public finance experience	0.13	0.10	0.04*	(0.04)
worked in the provincial government	0.49	0.45	0.03	(0.19)
worked in the central government	0.08	0.06	0.02	(0.11)
Youth league experience	0.26	0.10	0.16***	(0.00)
Connected provincial leader	0.42	0.34	0.08***	(0.00)
Corrupted	0.10	0.10	-0.00	(0.98)
Initial GDP per Capita	23954.51	29299.19	-5344.68***	(0.00)
Initial Population	385.10	428.46	-43.35***	(0.00)
Initial fiscal revenue	757406.14	1102600.32	-345194.18**	(0.00)
Initial fiscal expenditure	1410692.62	1837489.32	-426796.70**	(0.00)
Initial 1^{st} industry share	9.29	7.60	1.69***	(0.00)
Initial 2^{nd} industry share	49.24	51.24	-2.00**	(0.00)
Initial 3^{nd} industry share	-57.53	-57.84	0.31	(0.57)
Observations	726	703	1429	

Table 3: *Summary Statistics of Politicians' Characteristics* We divide politician into two groups depending on whether their age is below or above the median age of 52 and report summary statistics of these two groups.

2. **Within individuals, falsification decreases over a politician's career.** As a politician ages, his career horizon shortens, weakening the career concern channel. Conditional on costs remaining roughly stable within a career, this reduces both effort and falsification, consistent with Proposition 1.

3. **Lower realized growth is associated with higher falsification.** Since effort and falsification are substitutes in the CSF, politicians who produce less real output compensate by falsifying more: real growth and falsification are negatively correlated across individuals.

4. **Younger politicians deliver higher real growth and are more likely to be promoted.** Both their lower costs and stronger career concerns push young officials toward higher real effort. Higher real output, combined with lower falsification, translates into higher reported performance and therefore higher promotion probability.

3 Data and Empirical Strategy

3.1 Econometric Specification

To examine how politicians' characteristics influence falsification behavior, we estimate the following baseline specification:

$$\text{falsification}_{p,c,i,t} = \beta_0 + \sum_{j=40}^{60} \alpha_j \cdot \mathbb{1}(age_{i,t} = j) + \boldsymbol{\beta}'\mathbf{X}_{c,t-1} + \boldsymbol{\beta}'\mathbf{Z}_{i,t} + \eta_c + \gamma_{p,t} + (\zeta_i) + \varepsilon_{p,c,t}$$

where p, c, i, t index province, city, politician, and year respectively. The dependent variable is the estimated falsification index — the gap between reported and estimated real GDP growth. The main independent variables are age dummies $\mathbb{1}(age_{i,t} = j)$ for politician i at year t, allowing for a flexible nonlinear relationship between age and falsification. $\mathbf{X}_{c,t-1}$ is a vector of lagged city-level economic controls: log GDP, log population, log fiscal revenue, log fiscal expenditure, primary industry share, and secondary industry share. We lagged controls one period to mitigate endogeneity. $\mathbf{Z}_{i,t}$ is a vector of politician characteristics including gender, education, tenure, ethnicity, and political connection to provincial leaders, measured for both the city secretary and the mayor. City fixed effects η_i capture the time-invariant heterogeneity across cities, such as geographical location and traditional culture. Province-year fixed effects $\gamma_{p,t}$ capture the common variation for all cities within the same province across different years, for example, leadership change and regional policy changes at the provincial level. In some specifications, we control for the individual fixed effects

ζ_i, which absorb all time-invariant individual characteristics including unobservable human capital and political network quality. This specification allows identification from within-career variation in falsification. Standard errors are clustered at the province level.

3.2 Data

The main sample includes all prefecture-level cities in mainland China, excluding districts under centrally administered municipalities. After dropping cities with missing data, the resulting panel includes observations from 277 cities from 2003 to 2013.

Data on provincial and city-level leaders are drawn from the China Political Elite Database (CPED), which contains the biographical information of municipal, provincial, and national leaders in China since the late 1990s. For each leader, the database provides information on gender, age, education, ethnicity and detailed work experience. We focus on the two most important positions at the prefecture level: city party secretary and mayor. When multiple individuals hold the same position within a year, we retain the official who served the longest in that year. Political connections between city leaders and provincial leaders are defined following Jiang (2018): a city leader C is connected to a provincial leader P if C was promoted to a city leadership position while P was serving as the provincial party secretary.

Economic variables are collected from the China City Statistical Yearbooks, supplemented by Statistical Communiqués of local governments. These include GDP, population, fiscal revenue, fiscal expenditure, and the shares of primary and secondary industry.

3.3 Estimating the GDP falsification level

Since GDP falsification is unobservable by construction, we estimate it by decomposing reported GDP growth into a real component and a falsified component. We adapt the statistical framework of Pinkovskiy and Sala-i-Martin (2016) and use four alternative economic indicators that are unlikely to be manipulated by local governments: the growth rates of bank loan disbursement, electricity consumption, total freight volume,[8] and satellite nighttime light intensity. Nighttime light data are obtained from the Chinese Research Data Services Platform (CNRDS). Loan disbursement growth rates are adjusted for regional inflation. The estimation period runs from 2002 to 2013. Figure 2 plots the growth rates of all five series.

Let i index cities and n index the N alternative economic indicators. Each indicator's

[8]The original Keqiang index uses railway freight. Due to measurement inaccuracies and volatility at the city level, we use total freight (highway, railway, and airway combined).

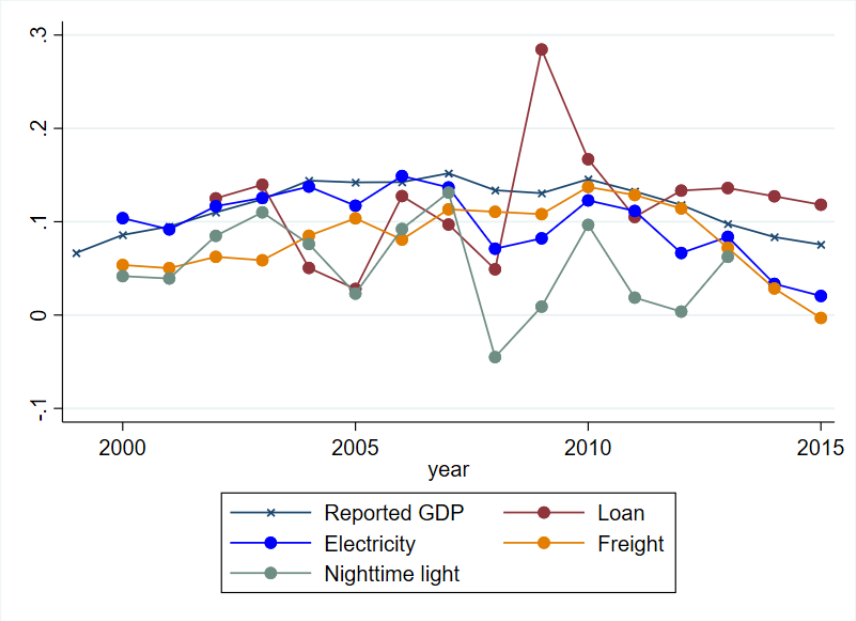


Figure 2: Average Growth Rate of Economic Indicators. This figure shows the GDP-weighted average growth rate of reported GDP and four alternative indicators at the city level. Data sourced from China City Statistical Yearbooks and CNRDS.

growth rate is related to true GDP growth g_i^y by a linear signal equation:

$$g_{ni}^x = \beta_n g_i^y + \varepsilon_{ni} \tag{15}$$

where $\beta_n > 0$ is the elasticity of indicator n with respect to true GDP growth and ε_{ni} is a measurement error with zero mean. The error terms may be correlated across indicators. True GDP growth g_i^y is unobservable; reported GDP growth equals $g_i^y + f_i$, where f_i is the falsification component.

Optimal weights. We estimate true growth as a weighted average of the observable indicators:

$$\hat{g}_i^y = \sum_{n=1}^{N} \lambda_n g_{ni}^x \tag{16}$$

The optimal weights $\{\lambda_n\}$ minimize the mean squared error subject to the unbiasedness constraint:

$$\begin{aligned} &\min_{\lambda_n} \; E\left(\hat{g_{y_i}} - g_{y_i}\right)^2 \\ &s.t. E\left(\hat{g_{y_i}}\right) = g_{y_i} \end{aligned} \tag{17}$$

The constrained optimization problem can be expressed as:

$$\begin{aligned} \min_{\lambda_n} \quad & \text{Var}\left(\sum_{n=1}^{N} \lambda_n \varepsilon_{ni}\right) \\ \text{s.t.} \quad & \sum_{n=1}^{N} \lambda_n \beta_n = 1 \end{aligned}$$

The optimal weights depends on the following unknown parameters:

$$\begin{cases} \beta_1, \ldots, \beta_N & N \text{ unknowns} \\ \sigma_1, \ldots, \sigma_N & N \text{ unknowns} \\ \sigma_{ij} & N(N-1)/2 \text{ unknowns} \\ E(g_i^y),\ \sigma_{g_i^y} & 2 \text{ unknowns} \end{cases}$$

where β_n is the elasticity of indicator n with respect to GDP; σ_n is the measurement error of the indicator n; σ_{ij} is the correlation of the measurement errors of indicator i and j; $E(g_{y_i})$ is the expected true GDP growth rate and $\sigma_{g_{y_i}}$ is the standard deviation of the true GDP growth rate.

Observable moments. From the data we can compute:

$$\begin{cases} E(g_{ni}^x) & N \text{ moments} \\ \text{Var}(g_{ni}^x) & N \text{ moments} \\ \text{Cov}(g_{ni}^x, g_{nj}^x) & N(N-1)/2 \text{ moments} \end{cases}$$

The number of unknowns exceeds the number of moment conditions, so the system is under-identified without further restrictions. Two assumptions restore identification.

Assumption 1: Independence of nighttime light measurement error. The correlation of measurement errors comes from several sources. First, if a region's statistical system is weak and tends to record biased statistics in the same direction, then the error terms will be positively correlated. Second, if some indicators are closely related to certain sectors of economic activity, then a common shock in these sectors will result in correlations between errors. A special feature of nighttime brightness is that it has a completely different data-generating process compared to other indicators collected by the statistical bureau. Nighttime light intensity is recorded by U.S. military satellites without any involvement of local statistical agencies. Its measurement error arises from atmospheric conditions, satellite sensitivity, and other physical factors unrelated to local economic reporting practices. We

therefore assume:

$$\sigma_{\text{light},j} = 0 \quad \text{for all } j \neq \text{light} \tag{A1}$$

This assumption reduces the number of unknowns by $N-1$ and eliminates $N-2$ redundant moment conditions.[9] Assumption (A1) is standard in the literature and is also made by Pinkovskiy and Sala-i-Martin (2016), Henderson, Storeygard, and Weil (2012) and X. Chen and Nordhaus (2011).

Assumption 2: National GDP as anchor. The National Bureau of Statistics constructs national GDP using micro-data from surveys, economic censuses, and administrative records, without relying on aggregated local statistics (W. Chen et al. 2019). The NBS has also actively investigated and prosecuted falsification: it reported 89 fraud cases in 2019 alone, resulting in penalties for 1,289 officials and entrepreneurs.[10] [11] We therefore treat national GDP as a more reliable benchmark and set:

$$E(g_i^y) = E(g_{\text{national}}^y) \tag{A2}$$

Note that we are not trying to argue that the national-level data is entirely reliable. The national-level data per se may be overstated or understated. What we identify is the difference in over-reporting between prefecture and national levels. As a robustness check, we perturb this anchor by adding or subtracting a constant and verify that our main results are unchanged.

Estimation. Under Assumptions (A1) and (A2), the number of equations equals the number of unknowns and the system is exactly identified. Tables 4 and 5 report the observable moment conditions and estimated parameters, respectively.

The falsification index for city i in year t is then:

$$\hat{f}_{it} = g_{it}^{\text{reported}} - \hat{g}_{it}^y$$

where g_{it}^{reported} is the GDP growth rate reported in the city statistical yearbook and $\hat{g}_{it}^y$ is the

[9] To see why $N-2$ conditions become redundant: with three indicators where the third is nighttime light, $\frac{cov(g_1,g_3)}{cov(g_2,g_3)} = \frac{\beta_1\beta_3\sigma_y^2}{\beta_2\beta_3\sigma_y^2} = \frac{\beta_1}{\beta_2} = \frac{E(x_1)}{E(x_2)}$. Once the covariance of light with one indicator is known, the covariances with all other indicators are pinned down by the ratio of their means.

[10] http://www.stats.gov.cn/tjgz/tzgb/201912/t20191230_1720560.html

[11] For China, the debate on the reliability of national GDP statistics is less settled. Rawski (2001) and W. Chen et al. (2019) document systematic overstating of official GDP figures, while Holz (2014) and Clark, Pinkovskiy, Sala-i-Martin, et al. (2020) argue national-level statistics are broadly reliable. Ma et al. (2014) document large discrepancies between the sum of provincial figures and national aggregates, while Fernald, Hsu, and Spiegel (2015) find evidence of systematic manipulation in trading partner data.

$E(g_{\text{loan}})$	0.119	$\text{Cov}(g_{\text{loan}}, g_{\text{electricity}})$	0.0004
$E(g_{\text{electricity}})$	0.110	$\text{Cov}(g_{\text{loan}}, g_{\text{freight}})$	0.0010
$E(g_{\text{freight}})$	0.096	$\text{Cov}(g_{\text{loan}}, g_{\text{light}})$	0.0008
$E(g_{\text{light}})$	0.055	$\text{Cov}(g_{\text{electricity}}, g_{\text{freight}})$	0.0008
$\text{Var}(g_{\text{loan}})$	0.009	$E(g^{y}_{\text{national}})$	0.102
$\text{Var}(g_{\text{electricity}})$	0.027		
$\text{Var}(g_{\text{freight}})$	0.022		
$\text{Var}(g_{\text{light}})$	0.006		

Table 4: Observable Moment Conditions from Data. The table reports the observable moments computed from the data: the average growth rate of each indicator, the variance of each indicator's growth rate, the covariances between indicators' growth rates, and the average national reported GDP growth rate.

β_{loan}	1.165	$\sigma_{\text{loan,electricity}}$	-0.0001
$\beta_{\text{electricity}}$	1.074	$\sigma_{\text{loan,freight}}$	-0.0002
β_{freight}	0.941	$\sigma_{\text{electricity,freight}}$	-0.0003
β_{light}	0.544	σ_{g^y}	0.033
σ_{loan}	0.088	$E(g^y)$	0.102
$\sigma_{\text{electricity}}$	0.162		
σ_{freight}	0.148		
σ_{light}	0.078		

Table 5: Estimated Parameters. The table reports the parameters recovered from the moment conditions in Table 4: the elasticity β_n of each indicator with respect to true GDP growth, the standard deviation σ_n of each indicator's measurement error, the covariances σ_{ij} between measurement errors of the non-light indicators, and the standard deviation σ_{g^y} of true GDP growth. Covariances involving nighttime light are zero by Assumption (A1).

estimated true growth rate from equation (16).

The resulting optimal weights are:

$$\hat{g}_{gdp} = 0.4828 \cdot g_{loan} + 0.1469 \cdot g_{electricity} + 0.1388 \cdot g_{freight} + 0.2744 \cdot g_{light}$$

Figure 3 plots the time series of average reported and estimated real GDP growth. The estimated growth rate exceeds reported growth in 2009, reflecting the extraordinary surge in bank lending during the fiscal stimulus response to the global financial crisis. Loan disbursement growth reached 29.5% in 2009 compared to 10.5% in 2008 and 20% in 2010. To address this anomaly, we conduct robustness tests by dropping bank loans from the indicator set and by excluding all 2009 observations.

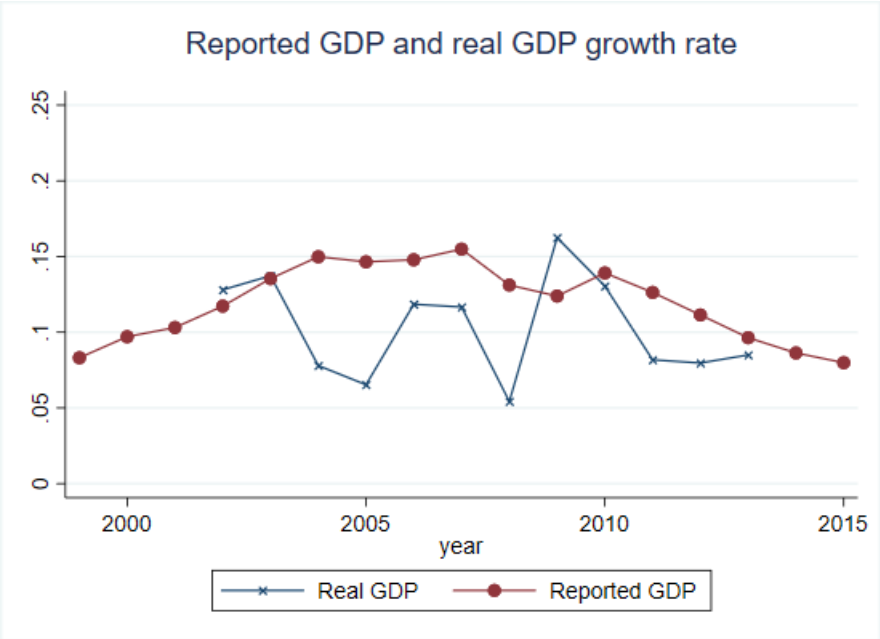


Figure 3: Reported and Estimated Real GDP Growth at City Level. This figure plots the GDP-weighted average reported growth rate from city statistical yearbooks and the estimated real growth rate from our decomposition using bank loan disbursement, electricity consumption, total freight, and nighttime light.

3.4 Validation Exercises

3.4.1 Validation based on News Report

Does our measure accurately capture variations in economic falsification over time and space? Given the hidden nature of falsification, direct verification can be difficult, but several validation checks make us confident in the measure. First, we conduct an extensive internet search to collect news reports exposing instances of growth falsification in China. The news reports that we found cover a total of 17 provinces and mention the names of

41 specific prefectures. While these cases obviously do not exhaust all falsification activities that took place in China, it is safe to assume that exposed localities have higher-than-average falsification levels. Therefore, if our falsification measure is valid, it should exhibit a more positive value in those exposed cities compared to those where such activities have not been revealed. Table 6 displays the average falsification levels for three types of city-year spells: (1) those that were directly reported to be committing growth falsification, (2) those located in provinces where falsification activities have been reported, but not directly tied to any specific cases, and (3) those located in provinces without any exposed falsification cases. The gradation of falsification indices across these three groups aligns with our expectation: Cities whose names are directly mentioned in falsification reports indeed have the highest average falsification level—about 21% of a standard deviation above the mean. The average falsification level for not publicly implicated cities in provinces with exposed falsification is somewhat lower, but still positive and much higher than provinces without reported cases.

Locality	**Average Falsification Level**
Exposed cities (n=41)	4.34
	[3.67, 5.01]
Non-exposed cities in exposed provinces (n=148)	3.25
	[2.91, 3.59]
Other provinces (n=95)	1.70
	[1.27, 2.12]

Table 6: Falsification Level in different localities. The table reports the average falsification level in GDP growth rate in cities that were directly reported to be committing growth falsification, cities located in provinces where falsification activities have been reported, but not directly tied to any specific cases, and cities located in province without any exposed falsification cases. 95% confidence interval in brackets.

3.4.2 Within-term dynamics

Second, We examine how falsification varies with a city secretary's time in office. Incentives to inflate growth are weakest in the first year: officials may assume office mid-year and have limited influence over policies set by predecessors; early performance is typically attributed to the predecessor; and a low starting point makes subsequent improvements easier to claim. Figure 4 plots the average falsification level by tenure year, controlling for city and province-year fixed effects. Falsification is lowest in the first year, rises steadily, and peaks around the fourth year — one year before the end of the typical term.[12] This within-term pattern is consistent with career concern incentives building as the prospect of promotion approaches.

[12]The formal term length is five years with the possibility of renewal. In practice, most city secretaries serve 3–5 years; the average tenure in our sample is 3.8 years.

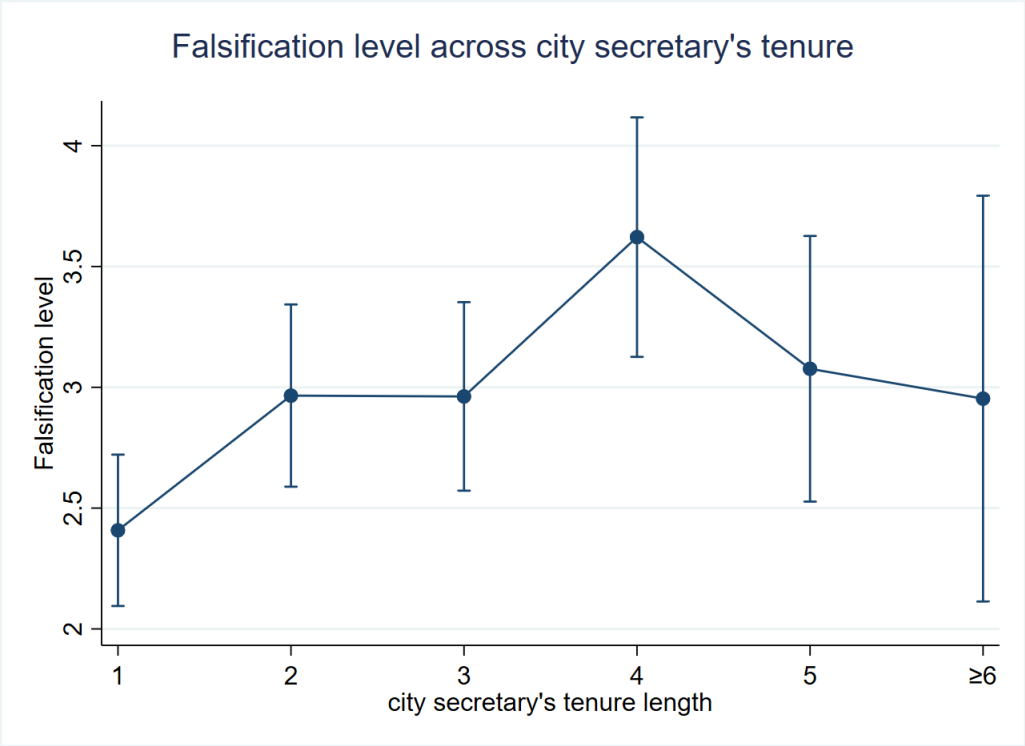


Figure 4: Falsification Level along City Secretary's Tenure. This figure plots falsification by tenure year after controlling for city and province-year fixed effects. Circles indicate point estimates; vertical bars indicate 90% confidence intervals.

3.4.3 Geographic Variations

We further analyze geographic variations of the intensity of statistical fabrication. Figure 5 illustrates the average value of the falsification index for Chinese cities between 2002 and 2013, with darker colors representing more severe over-reporting. The geographic distribution of falsification is largely consistent with the received wisdom: In particular, falsification tends to be more severe in provinces located in the northeast (Liaoning, Jilin, and Inner Mongolia). In January 2017, Qiufa Chen, the provincial governor of Liaoning province, said "Liaoning was involved in large-scale statistical deception at city and county levels that lasted a long time and involved many people. The fiscal revenues in the province were inflated by at least 20 % from 2011 to 2014."[13] According to Liaoning's statistical report, the reported fiscal revenue in 2013 is 319.07 billion RMB, while this figure fell dramatically to 212.56 billion RMB in the next year. Similarly, the Inner Mongolia autonomous region government admitted falsities in its economic and budgetary data in 2018. The industrial added value in 2016 was padded by 40% [14]. In contrast, coastal provinces in the southeast, such as Zhejiang and Fujian, exhibit comparatively less over-reporting, even under-reporting,

[13] https://www.ft.com/content/b25d1b32-dd37-11e6-9d7c-be108f1c1dce
[14] https://www.chinadaily.com.cn/a/201801/13/WS5a5975caa3102c394518efc6.html

potentially driven by high fiscal surplus and the incentive to transfer less fiscal revenue to the central government.

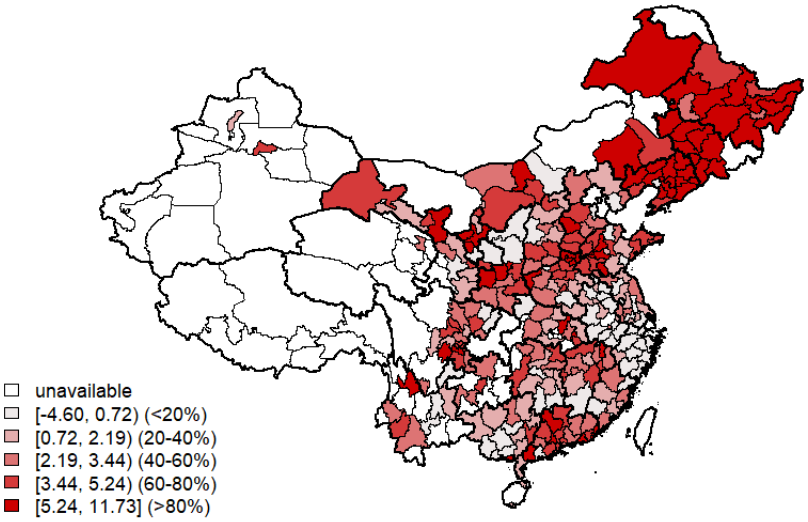


Figure 5: GDP Falsification at City Level. This figure plots the average falsification index for Chinese cities from 2002 to 2013. Darker shading indicates more severe over-reporting. Falsification is measured as the gap between reported and estimated real GDP growth.

4 Results

We test the four predictions of the combined model in turn. Section 4.1 examines the relationship between politician age and falsification across individuals. Section 4.2 examines how falsification evolves within an individual's career. Section 4.3 tests the substitutability between real growth and falsification. Section 4.4 examines whether younger politicians deliver higher real growth. Section 4.5 examines whether younger politicians are more likely to be promoted.

4.1 Falsification and Politician Age: Across Individuals

Table 7 reports the baseline results. The dependent variable is the estimated falsification index — the gap between reported and real GDP growth. Column (1) controls for secretary characteristics, economic covariates, and city fixed effects. Column (2) adds province-year fixed effects. Across both specifications, there is a strong positive association between city

secretary age and falsification: older secretaries are associated with significantly higher falsification levels. Column (3) restricts the sample to secretaries below age 58, who are eligible for promotion. The coefficient is larger and more precisely estimated. Results in Column (4) show there is an inverse U relationship between the falsification level and the secretary's age, though this pattern becomes linear when restricted to politicians below 58 years old. Column (6) includes mayor characteristics as additional controls and finds no significant relationship between mayor characteristics and falsification, confirming that city secretaries are the *de facto* decision-makers. Therefore, we focus on city secretaries henceforth.

Two additional findings are noteworthy. City secretaries with stronger connections to provincial leaders falsify significantly less, consistent with the model's prediction that well-connected officials face lower costs of real economic development and therefore rely less on manipulation. Higher-educated secretaries also falsify less. Both findings are consistent with connected and educated officials having lower c_e in the model.

Figure 6 presents the age profile of falsification using a fully flexible specification with age fixed effects, controlling for economic covariates, city fixed effects, and province-year fixed effects. Falsification remains low and flat for secretaries below age 47, rises sharply between ages 47 and 57 — the peak career-concern years when promotion to Deputy Minister level is both achievable and imminent — and drops sharply after age 58. On the contrary, such a pattern does not exist for mayors.

The drop in falsification level among older secretaries can be explained by the promotion age restrictions imposed by the Communist Party. Typically, officials above 58 become ineligible for promotion to the Deputy Minister level (Fu bu), including positions as deputy provincial secretary, governor, and deputy ministers of the State Council (Kou and Tsai 2014). This institutional cutoff removes the promotion incentive discontinuously at a specific age, while human capital, experience, and political connections change smoothly. The sharp decline in falsification at exactly this threshold — and not at any other age — is therefore strong evidence that career incentives rather than age-correlated individual characteristics drive the result, consistent with Zeng and Q. Zhou (2024), albeit employing a different method for estimating true GDP growth.

4.2 Falsification and Politician Age: Within Individuals

In this section, we investigate how the level of falsification evolves throughout a politician's career. The career-concern model predicts that falsification decreases within a politician's career as the career horizon shortens. We test this by including secretary fixed effects, which absorb all time-invariant individual characteristics and identify the effect of age from

Table 7: Politician's Characteristics and GDP Falsification

	Y: Falsification Index					
	(1)	(2)	(3)	(4)	(5)	(6)
Secretary's age	0.095**	0.071*	0.107**	1.947***	1.376*	0.068*
	(0.048)	(0.038)	(0.041)	(0.660)	(0.799)	(0.039)
Secretary's age^2				-0.018***	-0.013	
				(0.006)	(0.008)	
Connected city secretary	-0.541*	-0.705**	-0.651**	-0.698**	-0.641*	-0.769**
	(0.307)	(0.324)	(0.331)	(0.324)	(0.330)	(0.329)
Secretary's education	-0.274	-0.514*	-0.522*	-0.473*	-0.498*	-0.500*
	(0.320)	(0.268)	(0.273)	(0.267)	(0.273)	(0.269)
Secretary's tenure	-0.040	0.048	0.064	0.068	0.071	0.048
	(0.085)	(0.078)	(0.081)	(0.078)	(0.082)	(0.081)
Female Secretary	-1.101	-1.188	-1.192	-1.282*	-1.264*	-1.163
	(0.746)	(0.738)	(0.765)	(0.734)	(0.762)	(0.772)
Minority Secretary	1.353	1.163*	1.182*	1.095*	1.141*	1.128
	(0.933)	(0.668)	(0.685)	(0.661)	(0.681)	(0.730)
Mayor's age						-0.033
						(0.033)
Connected Mayor						0.121
						(0.346)
Mayor's education						-0.004
						(0.289)
Mayor's tenure						0.044
						(0.084)
Female Mayor						-0.263
						(0.513)
Minority Mayor						-0.164
						(0.648)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Prov×Year FE	No	Yes	Yes	Yes	Yes	Yes
Economic Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	<58	All	<58	All
N	2879	2861	2723	2861	2723	2848
Adjusted R^2	0.085	0.494	0.488	0.495	0.489	0.492

Notes: The dependent variable is the falsification index, defined as the gap between reported and estimated real GDP growth (in percentage points). Columns (3) and (5) restrict the sample to city secretaries below age 58, who remain eligible for promotion. Column (6) adds mayor characteristics. All specifications control for lagged city-level economic covariates: log GDP, log population, log fiscal revenue, log fiscal expenditure, and the shares of primary and secondary industry. Standard errors, clustered at the province level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

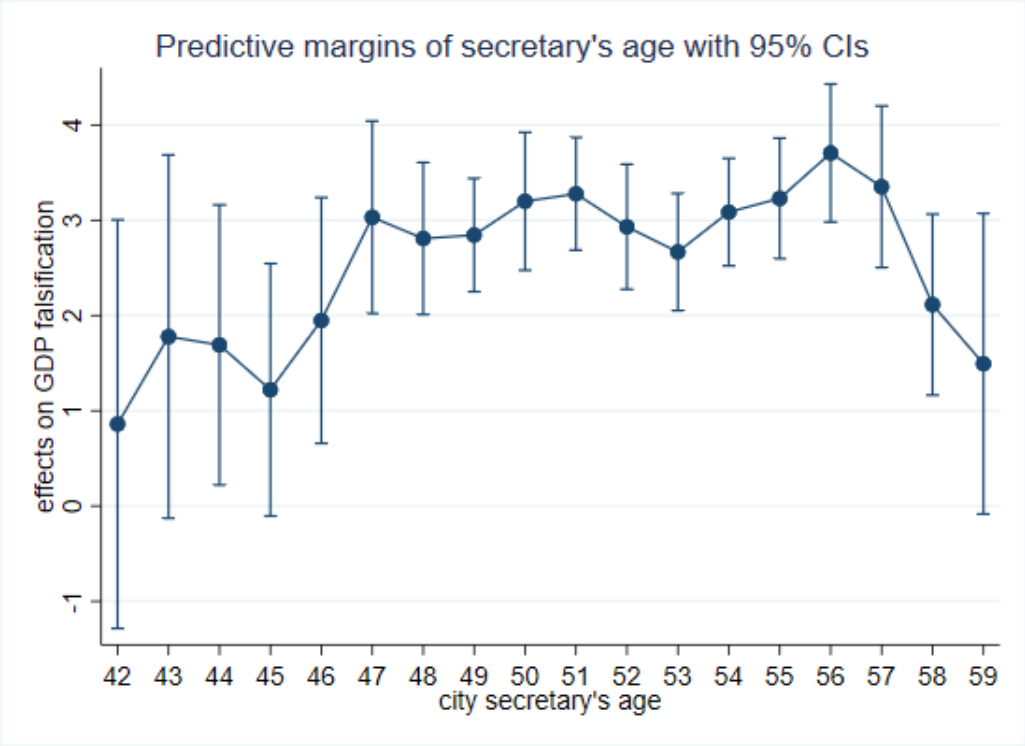


Figure 6: City Secretary Age and Falsification. This figure plots the age fixed effects from a regression of the falsification index on age dummies, economic covariates, city fixed effects, and province-year fixed effects. Vertical bars indicate 95% confidence intervals.

within-career variation.

Table 8 reports the results. Column (1) uses the Keqiang index and nighttime light as alternative indicators. Columns (2) and (3) add economic covariates and restrict the sample to secretaries below 58. To assess robustness of the falsification measure, Column (4) adds land revenue as a fifth indicator. We follow the same procedure to calculate the optimal weights. The realized GDP growth now can be calculated by:

$$\hat{g}_{gdp} = 0.46 \cdot g_{loan} + 0.16 \cdot g_{electricity} + 0.15 \cdot g_{freight} + 0.27 \cdot g_{light} + 0.02 \cdot g_{landsales}$$

Column (5) uses province-specific optimal weights, allowing the elasticities between GDP growth and the indicator's growth to vary with provincial economic and geographic structure. We assume the average true GDP growth rate of cities within a province equals the reported GDP growth rate by the provincial government. Column (6) drops all 2009 observations to address the bank loan anomaly during the fiscal stimulus. Across all six specifications, the coefficient on secretary age is negative and significant: as a politician ages within her career, falsification decreases. This within-individual result is consistent with the career concern mechanism — as the promotion horizon shortens, the marginal benefit of both effort and falsification falls.

Table 8: Falsification and Politician Age: Within-Individual Estimates

	Y: Falsification Index					
	Baseline indicators			Include land revenue	Province-specific weights	Drop 2009
	(1)	(2)	(3)	(4)	(5)	(6)
Secretary's age	-0.114	-2.439***	-2.461***	-3.831***	-2.524***	-1.507**
	(0.203)	(0.593)	(0.582)	(0.449)	(0.648)	(0.565)
Mayor's age	-0.018	-0.034	-0.018	-0.116**	-0.040	-0.009
	(0.078)	(0.072)	(0.072)	(0.055)	(0.085)	(0.090)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Secretary FE	Yes	Yes	Yes	Yes	Yes	Yes
Economic Covariates	No	Yes	Yes	Yes	Yes	Yes
Individual Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	<58	All	All	All
N	2670	2661	2522	2082	2661	2437
Adjusted R^2	0.007	0.053	0.039	0.067	-0.031	0.076

Notes: The dependent variable is the falsification index, defined as the gap between reported and estimated real GDP growth (in percentage points). All specifications include secretary fixed effects, so the coefficient on age is identified from within-career variation. Columns (1)–(3) use the baseline falsification measure constructed from bank loans, electricity, freight, and nighttime light; Column (3) restricts the sample to secretaries below age 58. Column (4) adds land sale revenue as a fifth indicator. Column (5) uses province-specific optimal weights. Column (6) drops all 2009 observations to address the bank loan surge during the fiscal stimulus. Individual covariates include education, tenure, gender, ethnicity, and connection to provincial leaders for both the secretary and the mayor. Standard errors, clustered at the province level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Real Growth and Falsification: Substitutability

The heterogeneous costs model predicts that real growth and falsification are negatively correlated across officials: politicians with low costs substitute real output for manipulation, so that high real growth and low falsification go together. Table 9 tests this directly by regressing the falsification index on realized GDP growth. Column (1) controls for province-year fixed effects, comparing cities within the same province. Column (2) adds city fixed effects. Column (3) further adds secretary fixed effects. Across all specifications and all alternative falsification measures, realized GDP growth is strongly negatively correlated with falsification. The point estimate is stable across columns: a 1 percentage point decrease in realized growth corresponds to approximately a 0.95 percentage point increase in falsified growth. This consistent negative relationship underscores the notion that politicians with lower costs tend to achieve higher actual growth while falsifying less.

Table 9: Real GDP Growth and Falsification: Substitutability

	Y: Falsification Index					
	Baseline measure			Include land revenue	Province-specific weights	Drop 2009
	(1)	(2)	(3)	(4)	(5)	(6)
Real GDP growth	-0.902***	-0.945***	-0.978***	-0.952***	-0.960***	-0.954***
	(0.014)	(0.013)	(0.010)	(0.015)	(0.011)	(0.012)
City FE	No	Yes	Yes	Yes	Yes	Yes
Prov×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Secretary FE	No	No	Yes	No	No	No
Economic Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N	2850	2849	2662	2254	2849	2438
Adjusted R^2	0.878	0.900	0.859	0.904	0.922	0.842

Notes: The dependent variable is the falsification index, defined as the gap between reported and estimated real GDP growth (in percentage points). The independent variable is estimated real GDP growth. Columns (1)–(3) use the baseline falsification measure constructed from bank loans, electricity, freight, and nighttime light, progressively adding city and secretary fixed effects. Column (4) adds land sale revenue as a fifth indicator. Column (5) uses province-specific optimal weights. Column (6) drops all 2009 observations to address the bank loan surge during the fiscal stimulus. Individual covariates include age, education, tenure, gender, ethnicity, and connection to provincial leaders for both the secretary and the mayor. Standard errors, clustered at the province level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.4 Politician Age and Real GDP Growth

Both career-concern-only and heterogeneous-costs model predicts young politicians can deliver higher actual growth. To test this, we regress actual GDP growth on politicians' age. All regressions control the same economic covariates and individual covariates as before.

Column (1) controls for province-year fixed effects; the coefficient on secretary age is negative but imprecisely estimated. Column (2) adds city fixed effects and yields a significant negative coefficient, indicating that younger secretaries deliver higher real growth within the same city over time. The pattern strengthens when restricting to secretaries below 58 in Column (3), where promotion incentives are uniformly active. Column (4) uses age-group dummies and finds that secretaries below age 45 deliver substantially higher real growth than all other groups, while differences among older groups are small and insignificant. Mayor age is not significantly related to real growth in any specification, again consistent with city secretaries being the primary decision maker of local policies.

Table 10: Politician's Age and Real GDP Growth

	Y: Realized GDP Growth			
	(1)	(2)	(3)	(4)
Secretary's age	-0.055	-0.076*	-0.108**	
	(0.035)	(0.040)	(0.044)	
Mayor's age	0.006	0.041	0.052	0.040
	(0.036)	(0.036)	(0.037)	(0.035)
Secretary's age < 45				1.592**
				(0.633)
Secretary's age 45–50				0.191
				(0.384)
Secretary's age 50–55				0.067
				(0.326)
City FE	No	Yes	Yes	Yes
Prov×Year FE	Yes	Yes	Yes	Yes
Economic Covariates	Yes	Yes	Yes	Yes
Individual Covariates	Yes	Yes	Yes	Yes
Sample	All	All	<58	All
N	2857	2848	2711	2859
Adjusted R^2	0.439	0.484	0.483	0.485

Notes: The dependent variable is estimated real GDP growth (in percentage points), constructed from bank loans, electricity, freight, and nighttime light. Column (1) controls for province-year fixed effects only; Column (2) adds city fixed effects; Column (3) restricts the sample to secretaries below age 58, who remain eligible for promotion. Column (4) replaces the linear age term with age-group dummies; the omitted category is secretaries aged 55 and above. Individual covariates include education, tenure, gender, ethnicity, and connection to provincial leaders for both the secretary and the mayor. Standard errors, clustered at the province level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.5 Politician Age and Promotion Probability

Lastly, we delve into the relationship between a politician's age and the probability of promotion. Both the career-concern-only and heterogeneous-costs model predicts young politicians are more likely to be promoted. In our main analysis, Promotion is defined as a binary variable equal to 1 if there is a rise in official's rank[15]. Figure 7 plots the unconditional promotion probability of city secretaries across ages, revealing a non-linear pattern with two peaks: a first peak at ages 43–44, corresponding to the conclusion of the youngest secretaries' first term, and a second peak at ages 55–58, the last window in which promotion to the next level remains eligible. This bimodal pattern reflects the institutional structure of the promotion system.

Some higher-rank positions carry little real authority, such as seats in the People's Congress or People's Political Consultative Conference. We construct a narrower definition of promotion restricted to positions with substantive power, including roles in provincial governments, party committees, central state-owned enterprises, the Communist Youth League, People's Courts, and People's Procuratorates. Figure 8 plots this refined measure and reveals a clear monotone decreasing pattern: promotion probability falls steadily with age throughout the career.

Table 11 reports the regression results. Columns (1)–(3) use the linear probability model, logit, and probit respectively with the rank-based promotion definition; all three yield consistent and significant negative coefficients on secretary age. The point estimate in Column (1) implies that each additional year of age reduces the probability of promotion by 0.4 percentage points, controlling for economic conditions and individual characteristics. Columns (5) and (6) use age group dummies and confirm that the youngest secretaries are significantly more likely to be promoted under both promotion definitions. These results are consistent with the model's prediction that younger politicians, who combine stronger career incentives with lower development costs, outperform older politicians in the promotion tournament and have a higher likelihood of promotion.

5 Conclusion

This paper develops a tournament model to study how career incentives shape the tradeoff between productive effort and performance manipulation. Agents competing for promotion

[15]The ranking system of civil servants in China are as follows: National leader, Sub-national leader, Provincial/Ministerial level, Sub-Provincial/Ministerial level, Bureau/Director level, Deputy-Bureau/Director level, Division/Head level, Deputy-Division/Head level, Section-Head level, Deputy-Section-Head level. Most party secretaries and mayors of prefecture-level cities are at the Bureau-Director level.

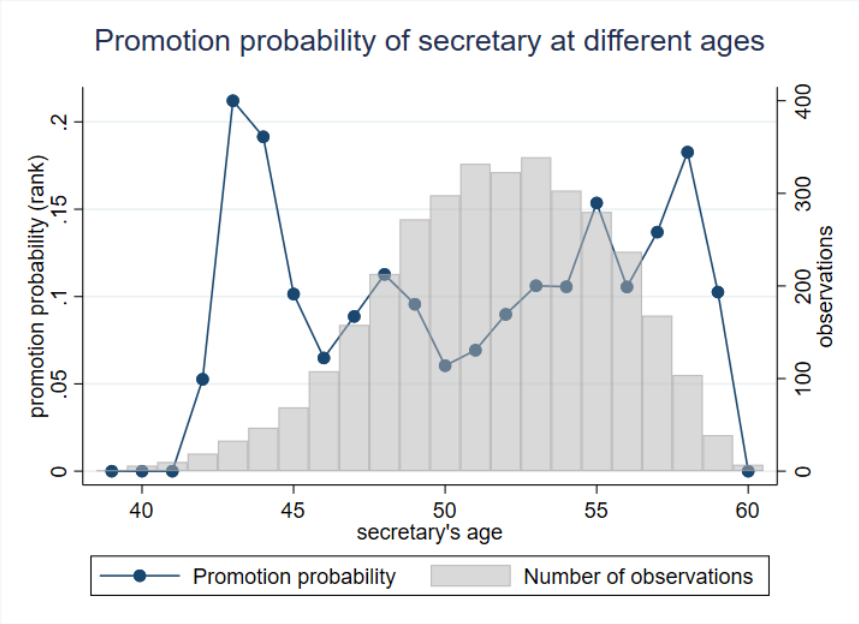


Figure 7: Promotion Probability across Ages (Rank-Based). This figure plots the unconditional probability of promotion at each age. Promotion is defined as any rise in official rank.

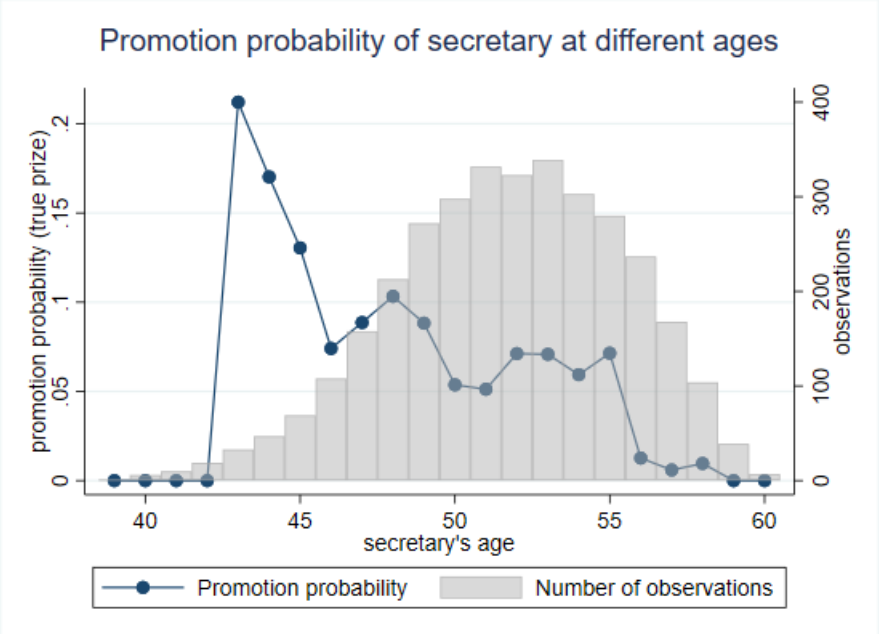


Figure 8: Promotion Probability across Ages (Real Power). This figure plots the unconditional probability of promotion to positions with substantive authority at each age.

Table 11: Politician's Age and Promotion Probability

	Y: Promotion (rank-based)					Y: Promotion (real power)
	(1) OLS	(2) Logit	(3) Probit	(4) OLS	(5) OLS	(6) OLS
Secretary's age	-0.004**	-0.066***	-0.039***	-0.005**		
	(0.002)	(0.025)	(0.013)	(0.002)		
Secretary's age < 45					0.102***	0.169***
					(0.029)	(0.024)
Secretary's age 45–50					0.030	0.107***
					(0.018)	(0.014)
Secretary's age 50–55					0.021	0.081***
					(0.016)	(0.011)
City FE	No	No	No	No	No	No
Prov×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Economic Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Individual Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	All	<58	All	All
N	3078	1831	1831	2915	3067	3067
Adjusted R^2	0.114			0.112	0.114	0.058

Notes: The dependent variable in Columns (1)–(5) is a binary indicator equal to one if the secretary experiences a rise in official rank; in Column (6) it equals one only for promotions to positions with substantive authority. Columns (2) and (3) report logit and probit coefficients, not marginal effects. Column (4) restricts the sample to secretaries below age 58. Columns (5) and (6) replace the linear age term with age-group dummies; the omitted category is secretaries aged 55 and above. Individual covariates include education, tenure, gender, ethnicity, and connection to provincial leaders for both the secretary and the mayor. Standard errors, clustered at the province level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

can improve their standing through real economic development or through falsification of reported statistics. The model has two dimensions of agent heterogeneity: career horizon, which determines the strength of career concerns, and the cost of real effort, which determines how agents respond to those concerns. The key theoretical result is that cost heterogeneity reverses the multi-tasking distortion identified by Holmström and Milgrom (1991): while career concerns push all agents toward both more effort and more falsification, low-cost agents substitute real effort for manipulation, generating higher actual output and lower falsification simultaneously. This prediction can only arise from the interaction of career concerns and heterogeneous costs — neither dimension alone is sufficient.

Applying the model to 277 Chinese prefecture-level cities from 2003 to 2013, we find four empirical patterns that align with the model's predictions. First, younger city secretaries deliver higher real GDP growth and engage in less falsification than their older counterparts — a pattern that contradicts the career-concern-only model but is explained by the cost channel once we recognize that younger officials face systematically lower costs of genuine economic development. Second, within individuals, falsification decreases over a politician's career as the career horizon shortens and career concerns weaken. Third, realized growth and falsification are negatively correlated across cities and individuals, consistent with productive effort and falsification being substitutes in the promotion contest. Fourth, younger politicians are significantly more likely to be promoted, reflecting both their higher real output and lower manipulation.

The results carry a cautiously optimistic policy implication. The Chinese promotion tournament, despite operating under severe information asymmetry, achieves a degree of positive selection: officials who are most capable of generating genuine growth are also least likely to falsify, and are most likely to advance. This suggests that performance-based promotion need not be inherently distortionary if the principal can screen for agents with low productive effort costs. At the same time, the model makes clear that high-cost officials — those for whom real development is genuinely difficult — face the strongest temptation to falsify. Reducing their incentive to manipulate requires either improving their capacity to deliver real growth, or reducing the information advantage they hold over the principal. Our measurement approach, which uses satellite nighttime lights and other hard-to-manipulate indicators to estimate true GDP growth, illustrates one practical path: developing alternative performance metrics that are less susceptible to local manipulation makes the falsification strategy less rewarding and the effort strategy more competitive.

Several extensions remain for future work. First, the model treats the cost of real effort as exogenous; an enriched framework would allow costs to respond to institutional investments such as infrastructure, regulatory reform, or administrative capacity building. Second, while

we focus on GDP falsification, the multi-tasking framework applies equally to other statistics tied to promotion incentives — air quality indices, poverty rates, fiscal revenues — and a unified analysis of multi-dimensional manipulation would be valuable. Third, the positive selection result depends on the assumption that costs and career horizon are negatively correlated across politicians; testing this mechanism in other hierarchical systems, democratic and non-democratic, would clarify the generality of the finding.

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Online Appendix

Career Incentives and GDP Falsification

A Descriptive Statistics: Politician Ages and Tenure

Figures A1 and A2 show the age distributions of city secretaries and mayors in our sample. Both distributions are approximately bell-shaped and centered around age 50. City secretaries tend to be slightly older on average, consistent with the city secretary being the senior of the two positions. The right truncation at age 60 reflects mandatory retirement rules.

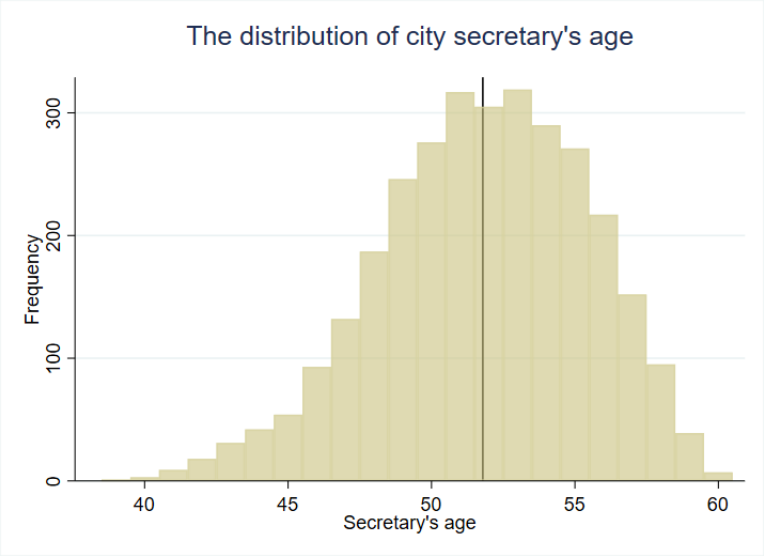


Figure A1: Age Distribution of City Secretaries. The figure shows the distribution of city secretary ages in the sample. The vertical line marks the median age.

Figure A3 shows the distribution of tenure length among the 854 city secretaries who completed a full term between 2003 and 2015. The modal tenure is three years, with the average at 3.8 years, shorter than the formal five-year term due to mid-term reassignments and promotions.

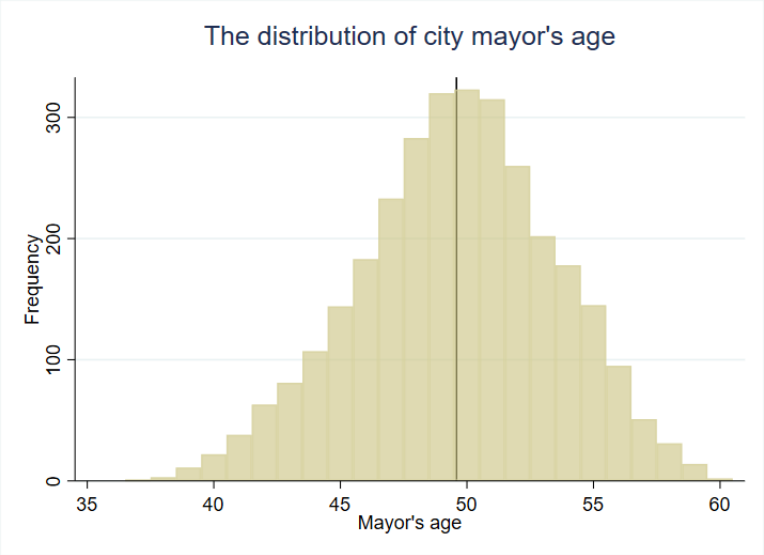


Figure A2: Age Distribution of City Mayors. The figure shows the distribution of mayor ages in the sample. The vertical line marks the median age.

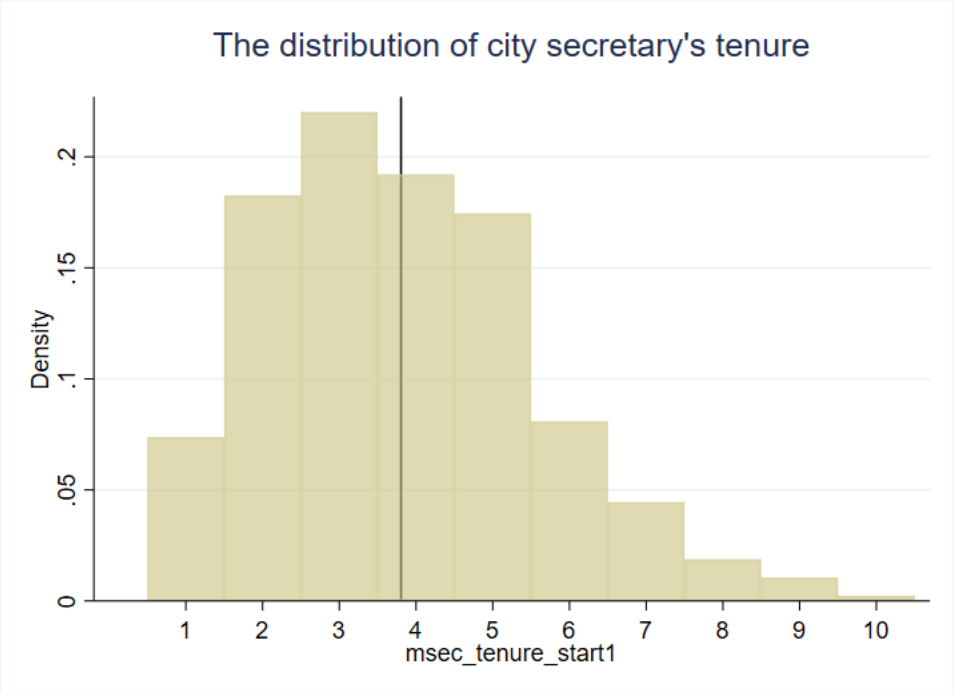


Figure A3: Tenure Distribution of City Secretaries. The figure shows the distribution of tenure length among 854 city secretaries who completed their term during 2003–2015.

B Promotion Probability across Tenure

Figure A4 plots the unconditional probability of promotion at each year of tenure for city secretaries, using the rank-based promotion definition. Promotion probability rises with tenure up to years five through seven, then falls sharply. This pattern reflects the institutional norm that promotions typically occur at the conclusion of a full term: secretaries who survive to the end of a longer tenure have demonstrated sustained performance and become strong candidates for advancement. The sharp decline after year eight corresponds to secretaries who have been passed over for promotion multiple times and face diminishing prospects.

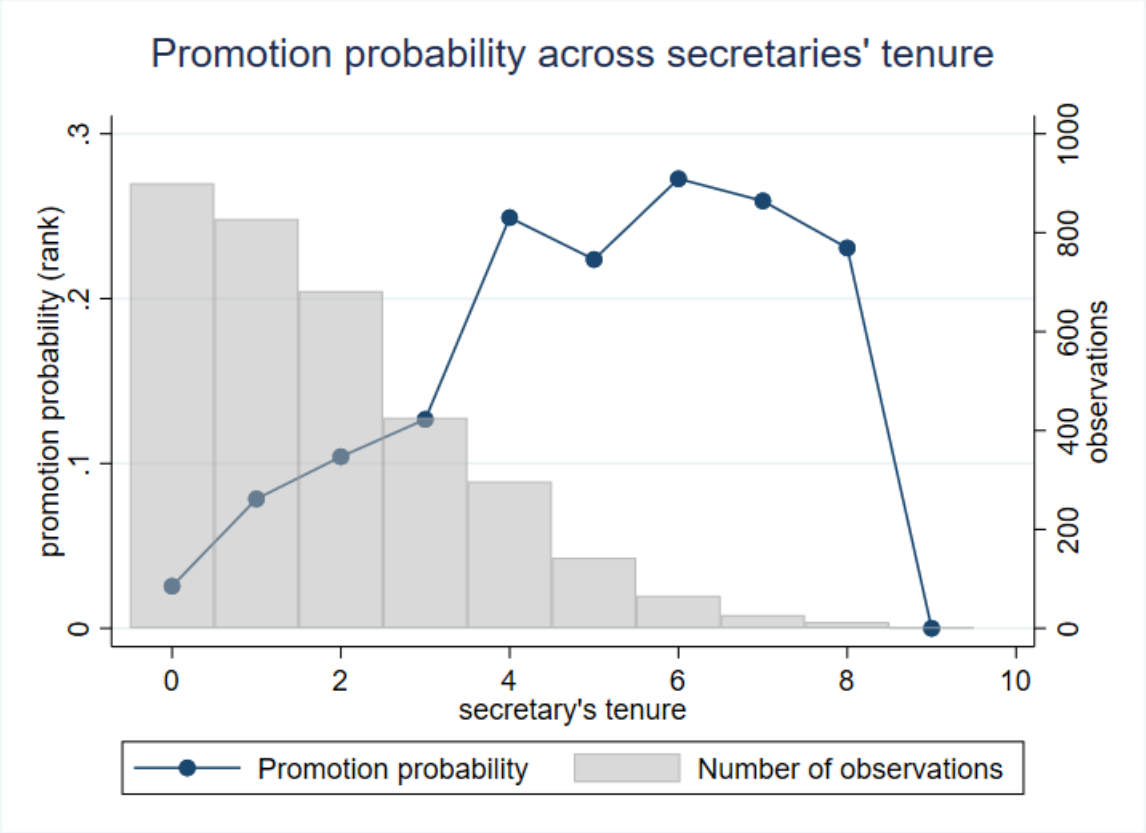


Figure A4: Promotion Probability across Tenure. This figure plots the probability of promotion at each year of tenure for city secretaries. Promotion is defined as any rise in official rank.

C GDP Growth Targets and Falsification

This section examines the relationship between GDP growth targets and falsification, providing additional context for the career incentive mechanism. Target setting in China follows a top-down cascade: the central government sets the national plan, and provincial and prefectural governments sequentially establish their own targets (X. Li et al. 2019). Prefectural annual targets are collected from the annual Report on the Work of the Government issued by each prefectural government. Figure A5 plots realized against planned GDP growth.

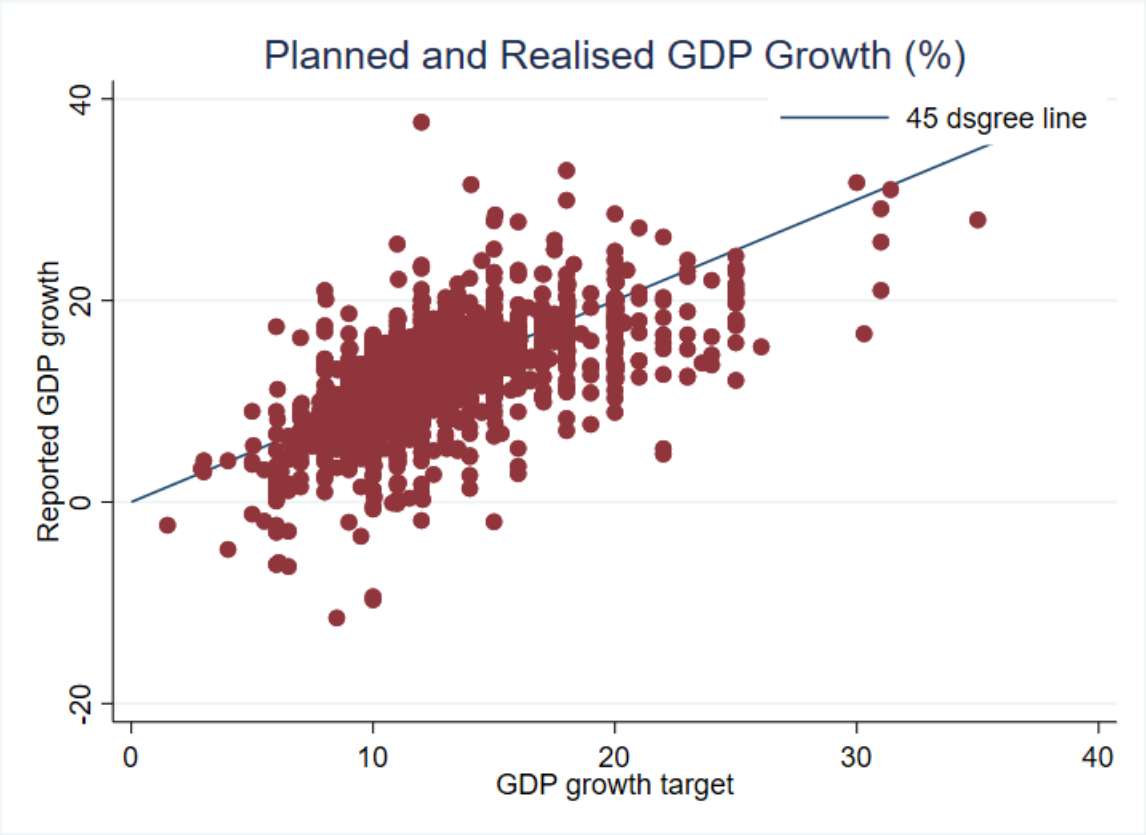


Figure A5: Planned and Realized GDP Growth. Each point represents a city-year observation. The 45-degree line indicates exact target achievement. Observations above the line report growth exceeding the target; those below fall short.

Table ?? formalizes this relationship. Column (1) shows that cities which meet their growth target falsify significantly less. Column (2) documents a strong linear relationship between the shortfall relative to the target (realized growth minus planned growth) and falsification: when realized growth falls 1 percentage point below the target, falsified growth increases by 0.91 percentage points. Column (3) shows that conditional on realized growth, a higher target independently increases falsification. These findings complement the main results: career concerns operate not only through age and career horizon but also through

the pressure of meeting explicit performance benchmarks set by superiors, consistent with the promotion tournament framework.

Table A1: Target and GDP falsification

	Y: Falsification Index		
	(1)	(2)	(3)
meet target (=1 if meets)	-6.767***		
	(0.256)		
distance to the target		-0.908***	
		(0.014)	
real GDP growth			-0.938***
			(0.013)
GDP growth target			0.453***
			(0.072)
Secretary's age	0.015	-0.009	-0.007
	(0.032)	(0.020)	(0.021)
Secretary's education	-0.457**	-0.247*	-0.341**
	(0.227)	(0.139)	(0.133)
Female Secretary	-0.652	-0.165	-0.151
	(0.615)	(0.285)	(0.297)
Secretary's tenure	0.092	0.099***	0.099***
	(0.066)	(0.037)	(0.036)
Minority Secretary	0.887	0.016	-0.064
	(0.671)	(0.451)	(0.380)
Connected city secretary	-0.641**	-0.455**	-0.411**
	(0.279)	(0.176)	(0.163)
City FE	Yes	Yes	Yes
Prov*Year FE	No	No	No
Economics Covariates	Yes	Yes	Yes
N	2850	2485	2485
Adjusted R^2	0.619	0.894	0.903

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

D Extension to N Contestants

This appendix extends the two special cases of Section 2 to contests among $N \geq 2$ politicians. By anonymity, the promotion probability of politician i can be written $p(s_i;\, s_{-i})$, where $s_i = g(e_i) + f_i$ is his own score, s_{-i} collects the opponents' scores, and p is invariant to permutations of the opponents. We assume p is continuously differentiable, strictly increasing in the politician's own score, and decreasing in each opponent's. The *trailing contestant property* takes the following form: for any pair of scores $a \leq b$ and any common profile $\mathbf{z}$ of the remaining $N-2$ contestants,

$$\frac{\partial p}{\partial s_i}\big(a;\, b, \mathbf{z}\big) \;\geq\; \frac{\partial p}{\partial s_i}\big(b;\, a, \mathbf{z}\big), \tag{1}$$

with strict inequality when $a < b$. In words: comparing two contestants who face the same field of remaining opponents, the one with the lower score has the higher marginal return. At $N = 2$ the residual profile is empty and (1) is exactly the property assumed in Section 2. The leading case is the additive family $p = h(s_i)/\sum_{j=1}^{N} h(s_j)$ with h strictly increasing and $h(0) = 0$: since swapping a and b leaves the denominator $H = h(a) + h(b) + \sum_k h(z_k)$ unchanged, (1) reduces to the requirement that the marginal contest return $h'(s)\big(H - h(s)\big)$ be decreasing in s given H, which holds in particular for any concave h.

Each politician i chooses a score s_i at cost $C_i(s_i)$, and the first-order condition in any interior equilibrium is

$$\frac{\partial p}{\partial s_i}\big(s_i^*;\, s_{-i}^*\big)\, V_i \;=\; C_i'(s_i^*). \tag{2}$$

D.1 Career Concerns Only

Politicians share the cost function $C(e, f)$ and differ only in their remaining career horizons. We order politicians from young to old, so that the effective prizes satisfy $V_1 > V_2 > \cdots > V_N$, as in Section 2.2, a longer remaining horizon translates into a larger effective prize

Proposition 4 (Career concerns only, N contestants)**.** *In any interior equilibrium, politicians with longer career horizons exert more effort ($e_1^* > e_2^* > \cdots > e_N^*$), falsify more ($f_1^* > f_2^* > \cdots > f_N^*$), report higher performance ($s_1^* > s_2^* > \cdots > s_N^*$), and are promoted with higher probability.*

Proof. Take any pair $i < j$, so that $V_i > V_j$, and suppose $s_i^* \leq s_j^*$. Let $\mathbf{z}$ denote the equilibrium scores of the other $N-2$ contestants, which i and j face in common: politician i faces the opponent profile $(s_j^*, \mathbf{z})$ and politician j faces $(s_i^*, \mathbf{z})$. Applying (1) with $a = s_i^*$ and $b = s_j^*$,

$$\frac{\partial p}{\partial s_i}\big(s_i^*;\, s_j^*, \mathbf{z}\big) \;\geq\; \frac{\partial p}{\partial s_j}\big(s_j^*;\, s_i^*, \mathbf{z}\big),$$

so multiplying by $V_i > V_j$ makes the left-hand side of (2) strictly larger for i than for j. With a common strictly convex cost, $s_i^* \leq s_j^*$ implies $C'(s_i^*) \leq C'(s_j^*)$. The two first-order conditions are therefore inconsistent, a contradiction; hence $s_i^* > s_j^*$ for every such pair, which delivers the score ranking.

Because all politicians share the same cost function, dividing the effort and falsification first-order conditions gives the common mix condition:

$$\frac{\partial C}{\partial e_i} = g'(e_i)\,\frac{\partial C}{\partial f_i},$$

along which effort and falsification both increase with the score, so the score ranking passes through to effort and falsification; monotonicity of p in own score delivers the promotion ranking. □

D.2 Heterogeneous Costs Only

Politicians compete for the same prize V and share the marginal falsification cost — $\frac{\partial C_i}{\partial f}$ is the same strictly increasing function of f for all i, denoted $\frac{\partial C}{\partial f}$ — but differ in their marginal effort costs. We order politicians by their marginal effort cost: $\frac{\partial C_1}{\partial e} < \frac{\partial C_2}{\partial e} < \cdots < \frac{\partial C_N}{\partial e}$ for all $e > 0$.

Proposition 5 (Heterogeneous costs only, N contestants)**.** *In any interior equilibrium, politicians with lower costs of real effort exert more effort ($e_1^* > e_2^* > \cdots > e_N^*$), falsify less ($f_1^* < f_2^* < \cdots < f_N^*$), report higher performance ($s_1^* > s_2^* > \cdots > s_N^*$), and are promoted with higher probability.*

Proof. Take any pair $i < j$, so that $\frac{\partial C_i}{\partial e} < \frac{\partial C_j}{\partial e}$ pointwise, and suppose $s_i^* \leq s_j^*$. Let $\mathbf{z}$ denote the equilibrium scores of the other $N-2$ contestants, which i and j face in common: politician i faces the opponent profile $(s_j^*, \mathbf{z})$ and politician j faces $(s_i^*, \mathbf{z})$.

The falsification first-order conditions of falsification level are:

$$\frac{\partial C}{\partial f}(f_k^*) = \frac{\partial p}{\partial s_k}\big(s_k^*;\, s_{-k}^*\big)\, V, \qquad k \in \{i, j\}. \tag{3}$$

Applying the trailing contestant property (1) with $a = s_i^*$, $b = s_j^*$, and the common residual profile $\mathbf{z}$ gives $\frac{\partial p}{\partial s_i}(s_i^*;\, s_j^*, \mathbf{z}) \geq \frac{\partial p}{\partial s_j}(s_j^*;\, s_i^*, \mathbf{z})$, so (3) implies $\frac{\partial C}{\partial f}(f_i^*) \geq \frac{\partial C}{\partial f}(f_j^*)$; since the marginal falsification cost is common and strictly increasing, $f_i^* \geq f_j^*$. Then $g(e_i^*) = s_i^* - f_i^* \leq s_j^* - f_j^* = g(e_j^*)$, so $e_i^* \leq e_j^*$.

Dividing each politician's effort condition by his falsification condition yields the mix condition

$$\frac{\partial C_k}{\partial e}(e_k^*) = g'(e_k^*)\,\frac{\partial C}{\partial f}(f_k^*).$$

Because $e_i^* \leq e_j^*$, and C is convex,

$$g'(e_i^*)\,\frac{\partial C}{\partial f}(f_i^*) = \frac{\partial C_i}{\partial e}(e_i^*) < \frac{\partial C_j}{\partial e}(e_i^*) \leq \frac{\partial C_j}{\partial e}(e_j^*) = g'(e_j^*)\,\frac{\partial C}{\partial f}(f_j^*).$$

The Concavity of g with $e_i^* \leq e_j^*$ gives $g'(e_i^*) > g'(e_i^*)$, so $\frac{\partial C}{\partial f}(f_i^*) < \frac{\partial C}{\partial f}(f_j^*)$. But FOC 3 established $\frac{\partial C}{\partial f}(f_i^*) \geq \frac{\partial C}{\partial f}(f_j^*)$ — a contradiction. Hence $s_i^* > s_j^*$ for every such pair, which delivers the score ranking.

Given $s_i^* > s_j^*$, the strict form of (1) applied at $a = s_j^*$, $b = s_i^*$ with the common profile $\mathbf{z}$ makes the right-hand side of (3) strictly smaller for i than for j, so $\frac{\partial C}{\partial f}(f_i^*) < \frac{\partial C}{\partial f}(f_j^*)$ and hence $f_i^* < f_j^*$. Then $g(e_i^*) = s_i^* - f_i^* > s_j^* - f_j^* = g(e_j^*)$ implies $e_i^* > e_j^*$, and monotonicity of p in own score delivers the promotion ranking.

□

E Example: Closed-Form Equilibrium

This appendix derives the explicit equilibrium of under the quadratic cost specification $C(e, f) = \frac{1}{2}c_e e^2 + \frac{1}{2}c_f f^2$ with the linear CSF $p(s_i, s_{-i}) = \frac{s_i}{\sum_{j=1}^{2} s_j}$, where $s_i = e_i + f_i$.

E.1 Career Concern Only

Each politician competes for an *effective prize* V_i: the value of winning the current contest relative to losing it. For the old politician, $V_o = V$. For the young politician, $V_y = 2V - W > V_o$.

The first-order conditions of politician $i \in \{y, o\}$ are

$$\frac{s_{-i}^*}{(s_y^* + s_o^*)^2} V_i = c_e\, e_i^*, \qquad \frac{s_{-i}^*}{(s_y^* + s_o^*)^2} V_i = c_f\, f_i^*. \tag{4}$$

Dividing the two conditions within each politician gives the mix, $c_e e_i^* = c_f f_i^*$: each politician pushes both instruments until their marginal costs are equal, so the division of any score depends only on relative costs:

$$e_i^* = \frac{c_f}{c_e + c_f}\, s_i^*, \qquad f_i^* = \frac{c_e}{c_e + c_f}\, s_i^*. \tag{5}$$

Dividing the falsification condition in (4) across the two politicians gives $\frac{s_o^*}{s_y^*} \cdot \frac{V_y}{V_o} = \frac{f_y^*}{f_o^*}$, and by (5) the right-hand side equals s_y^*/s_o^*. Cross-multiplying,

$$\frac{s_y^*}{s_o^*} = \frac{e_y^*}{e_o^*} = \frac{f_y^*}{f_o^*} = \sqrt{\frac{V_y}{V_o}} \;>\; 1 : \tag{6}$$

with identical costs, the two politicians differ only in scale, and every margin — effort, falsification, reported performance — exceeds the old politician's by the square root of the prize ratio. Substituting $s_y^* = \sqrt{V_y/V_o}\, s_o^*$ back into the old politician's condition in (4)

delivers the levels,

$$s_o^{*2} = \frac{c_e + c_f}{c_e c_f} \cdot \frac{\sqrt{V_y V_o}}{\left(1 + \sqrt{V_y/V_o}\right)^2}, \qquad p(s_o^*, s_y^*) = \frac{1}{1 + \sqrt{V_y/V_o}}, \tag{7}$$

with e_o^* and f_o^* given by the shares in (5) and the young politician's levels by scaling with $\sqrt{V_y/V_o}$. The contest's intensity is governed by the geometric mean of the two stakesv ($\sqrt{V_y V_o}$): a contest is fought hard only if it is worth winning for both sides, and a large prize for one politician cannot sustain an intense contest against an opponent with little at stake. The cost factor is the sum of inverse costs ($\frac{1}{c_e} + \frac{1}{c_f}$): a higher cost of either activity lowers the equilibrium score. In equilibrium, the promotion probability depends on the relative size of stakes.

E.2 Heterogeneous Costs Only

Both politicians have one term remaining and compete for the same prize V; they differ only in the cost of real effort, $c_e^l < c_e^h$, with a common falsification cost c_f.

The first-order conditions of politician $i \in \{l, h\}$ are

$$\frac{s_{-i}^*}{(s_l^* + s_h^*)^2} V = c_e^i \, e_i^*, \qquad \frac{s_{-i}^*}{(s_l^* + s_h^*)^2} V = c_f \, f_i^*. \tag{8}$$

Dividing the two conditions within each politician gives the mix, $c_e^i e_i^* = c_f f_i^*$. The shares now differ across politicians:

$$e_i^* = \frac{c_f}{c_e^i + c_f} \, s_i^*, \qquad f_i^* = \frac{c_e^i}{c_e^i + c_f} \, s_i^*. \tag{9}$$

The low-cost politician assembles any level of reported performance with a larger effort component and a smaller falsification component: cost heterogeneity, unlike career concerns, operates on the composition of performance, not only on its scale.

Dividing the falsification condition in (8) across the two politicians gives $\frac{s_h^*}{s_l^*} = \frac{f_l^*}{f_h^*}$: with a common falsification cost and equal prizes, each politician falsifies in proportion to the competitive pressure he faces — the pressure exerted by his opponent's score. Substituting the shares (9) and cross-multiplying relates squared scores, and

$$\frac{s_l^*}{s_h^*} = \sqrt{\frac{c_e^h \left(c_e^l + c_f\right)}{c_e^l \left(c_e^h + c_f\right)}} > 1, \qquad \frac{f_l^*}{f_h^*} = \frac{s_h^*}{s_l^*} < 1, \qquad \frac{e_l^*}{e_h^*} = \sqrt{\frac{c_e^h \left(c_e^h + c_f\right)}{c_e^l \left(c_e^l + c_f\right)}} > 1. \tag{10}$$

The score ratio exceeds one because cheap real effort makes reported performance itself cheap at the margin, so the low-cost politician competes at a larger scale. The falsification ratio is

the inverted score ratio: high-cost politician — choose a lower effort level and produce less real output, so he leans on more falsification to remain competitive.

Substituting the score ratio (10) into the politicians' conditions in (8) delivers the levels in closed form.

$$s_h^{*2} \;=\; \frac{\sqrt{\dfrac{\left(c_e^h + c_f\right)\left(c_e^l + c_f\right)}{c_e^l\, c_e^h\, c_f^2}}}{\left(1 + \sqrt{\dfrac{c_e^h\left(c_e^l + c_f\right)}{c_e^l\left(c_e^h + c_f\right)}}\right)^2} V, \qquad p(s_l^*, s_h^*) \;=\; \frac{1}{1 + \sqrt{\frac{c_e^l\,(c_e^h + c_f)}{c_e^h\,(c_e^l + c_f)}}}, \tag{11}$$

with e_i^*, f_i^* given by the shares in (9) and s_l^* obtained by scaling s_h^* with the score ratio in (10). Scores scale with $\sqrt{V}$, as in the career-concerns case: stakes intensify the contest at the square-root rate.