Incentivizing Lockdown Policies: A Principal-Agent Perspective

Qitian Hu 18340686048

January 11, 2021

Abstract

In this paper, I connect theories on principal-agent problem to the policy choices of local Chinese officials during the COVID-19 pandemic. With evidence from multiple datasets, I found that older government officials tend to be more risk-averse and adopt more stringent policies. This might be indicative to the existing mechanisms within the government.

1 Introduction

Ever since December 2019, the novel COVID-19 virus has rapidly spread around the world. As the country in which the virus is first identified, Chinese government has adopted a number of containment measures to suppress the virus, including enforcing strict quarantines, prohibiting gatherings, and locking down entire cities. The pattern of these policies is not entirely determined the by the spread of virus or socio-economic conditions of the city. For example, while Inner Mongolia is a large, sparsely populated region with few COVID cases, it adopts strict quarantine policies [1], and Dongyin, Shangdong, a city without any confirmed case throughout the initial period, locked itself down as early as the end of January [3]. These instances show that the policy choice is not entirely a rational balance between virus control and socio-economic life, but must have involved the personal calculations of the city-level officials.

1.1 Chinese politics and COVID-19

The internal mechanism of Chinese government would be depicted from the incomplete contract and ownership perspective. Due to the limit of any predetermined allocations, the owner of capital usually have the residual right of control, and the ownership structure has crucial influence on the incentive structure [17]. Chinese government operates in a similar central-local governance structure. The upper-level government chooses delegates to lead local governments, and uses a different set of control rights to solve the incomplete contract between them. Based on the administrative subcontracting theory of Chinese governmance, there are three of such control rights that are particularly important [8] :

1. The right to set goals. e.g. the Chinese Central government urges local governments to tackle COVID-19.

2. The right of inspection. e.g. provincial or central governments examines whether the quarantine measures are taken.

3. The right of allocation (reward and punishment). e.g. central or provincial governments punish officials that failed to contain COVID-19 [2].

If upper-level governments have perfect control to these goals, they have a tight grip over the lower-level governments. However, facing the unique challenges of the pandemic, upper-level governments are not able to perfectly use these rights to tackle the virus. The most important friction is that the long-lasting incentive for economic development will complicate the goal of containing COVID-19. In China, upper-level governments select officials based on the economic performance of the corresponding region, and use relative ranking within province to allocate the limited promotion opportunities. This "GDP Championship" creates a deep-rooted investment and production-driven policy pattern, and it has created significant difficulty when the central government tried to set up new goals like environment protection [10].

In the early weeks of the pandemic, the exact infectivity and lethality of the virus are still unknown. Local leaders face the decision that whether to adopt strict quarantine policy at the cost of economic development, or to take a bet that the virus will not attack her region and allow more socio-economic activities. I focus my analysis on the city level, because based on data I collect, it is the smallest administrative unit that has sufficient autonomy on COVID policies. I also argue that the policy decisions of individual cities is primarily made by party secretary of the city. The reason is that while mayors are responsible to the day-to-day operations, the party secretary has the final say. During the pandemic, Chinese cities form "Leading Groups" (疫情防控领导小组) to coordinates different bureaus and institutions; party secretary is almost always the leader of that group.

Decision of the party secretary is affected by numerous factors, but I will focus on age. The forced age of retirement is 60 for city-level leaders [11]. If they have not been promoted by then, they will 'retire' to unimportant positions. Evidence have shown that this rule has strong incentive implications on policies on environmental protection and city construction [13, **?**].

As a summary, I argue that the lockdown policy choice in the early weeks in Chinese cities can be approximated by a principal-agent setting, where the party secretary (agent) faces two policy choices: no lockdown (risky, but has economic benefits) or enforce lockdown (safer, at the cost of economic development). In particular, I am interested in the ways age and career concerns affects risk preference.

1.2 Literature on principal-agent problem

The setting above is similar to a number of classical models in corporate governance, where the principal are the shareholders and agent the manager. Similar to party secretaries, managers also concern their careers and adjust the risk and benefit of their investment choices accordingly. However,

prior theoretical works offer conflicting prediction on this topic, and I will examine representative works in each strand.

1.2.1 younger managers are risk-averse

The first strand of literature argues that in a principal-agent setting, younger managers should be more sensitive to risk, mainly due to their career concerns. Two important models, addressing reputation gaining from two different perspectives, is illustrated here.

In his 1999 paper[19], Holmstrom developed a model to characterize the effort distribution of a manager in a dynamic setting with career concerns. The performance of a manager at time t is determined by

$$y_t = \eta + a_t + \varepsilon_t, \quad t = 1, 2, \ldots, y^{t-1} = \{y_i\}_{i=0}^{t-1}$$

where η is the manager's ability, $a_t \in [0, \infty]$ her labor input and ε_t is a stochastic noise term. The principal pays according to the expected value of η and effort level, based on the information set available at time t, y^{t-1}.

Thus the wage at t is given by:

$$w_t = E\left[y_t \mid y^{t-1}\right] = E\left[\eta \mid y^{t-1}\right] + a_t\left(y^{t-1}\right)$$

The manager solves a utility maximization problem throughout her career, where she wants to maximize her wage while minimizing labor input. Thus, Holmstrom solves that, her optimal labor input should decrease overtime. The reason is simple: the principal will use all information to calculate $E\left[\eta \mid y^{t-1}\right]$, so making a lot of efforts in the early career could affect wage in every later period, thus have a maximum marginal utility. To the same reason, when risk of investment is involved, younger managers will be more risk-averse due to the long-lasting negative career implications.

Scharfstein and Stein derive the same conclusion from the perspective of herd behavior. In the model of their 1990 paper[20], smart managers observe accurate signals while dumb managers observe random signals, and they use signals to guide investment choices. Different from the principal's objective to maximize investment return, managers would like to look smart. With the assumptions that

1. managers themselves do not know whether they are smart or dumb, and receiving signals is uninformative to that fact.

2. the principal/labor market assumes that managers' acts are consistent with their signals.

Thus, observing manager A's investment decision, manager B will choose to follow her, because from the principal's perspective, observe the same signal for the two managers is relatively unlikely, and thus it increase the likelihood of either manager being smart.

The authors continue to argue that since young managers are more sensitive to career concerns, they should show more risk-averse herding behavior, and should be placed at the first position in a voting scenario.

1.2.2 younger managers are risk-seeking

Another strand of literature explores ways that younger managers could be risk-seeking. For example, Prendergast and Stole in their 1996 paper[21] describes a mechanism through which young managers are more impetuous.

Assume that in each period, managers receive private information regarding the investment opportunities, and talented managers receive more accurate information compared with dumb managers. Assuming managers are aware of their talent. In the first period, when managers receive information, talented managers will be more confident to their private information and are willing to take higher risk when following that information. This underlying mechanism is common knowledge, and every manager incentive to exaggerate her private information to present themselves as talented, causing risk-seeking behaviors.

As time goes by, the managers make more investment decisions and the market evaluation to their performance will be more and more relied on their past performance. To demonstrate that they are confident to their past decisions, the managers will reduce the effect of new information on their decisions and become more conservative.

Although these theoretical developments have provided us with different frameworks of analysis, it is still unclear that which model could best describe the urgent situation when the Chinese officials are making policy decisions. Empirical work is needed to clarify these problems.

2 Data

2.1 Lockdown policy data

To accurately measure the policies party secretaries adopt, I used data from two different published works. Both datasets are collected from government announcements and news reports.

The first dataset defines lockdown (referred to as lockdown) when all of the following measures were enforced [3]:

1. prohibition of unnecessary commercial activities in people's daily lives
2. prohibition of any types of gathering by residents
3. restrictions on private (vehicle) and public transportation.

Following their definition, 95 out of 324 cities were locked down, ranging from the Wuhan lockdown on Jan 23 to every city in Inner Mongolia on Feb 13.

Another dataset tracks whether cities have imposed family outdoor restrictions (referred to as outdoor restriction), and according to which "residents are confined or strongly encouraged to stay at home with limited exceptions" [5]. There are in total 123 cities that adopt this measure, ranging from Feb 1 to Feb 20.

2.2 Other data

Different cities are at different levels of risk during the pandemic, and socio-economic characteristics like city size, population, and public health institutions all affect the party secretary's decision of lockdown. Some control variables are also recorded to rule out their effect.

There are in total 333 prefecture-level administrative regions in China. Due to data availability, autonomous regions and diqu (地区) are not included. There are in total 276 cities, or 94.1% of all the prefecture-level cities are included. The number of confirmed cases each day is from the open-sourced data repository of Dingxiangyuan.

Personal information of the party secretary is recorded from online sources [15, 16]. Other city characteristics are recorded from the 2018 Urban Statistical Yearbook or published paper [5].

As a preliminary demonstration, the graph below shows how does the likelihood of implement lockdown/outdoor restriction change by the age of party secretary. If we focus on the age range of 51 - 58 (most of the party secretaries are in this range), there is a trend that the older the party secretary is, the more likely that the city will be locked-down for both types of policies.

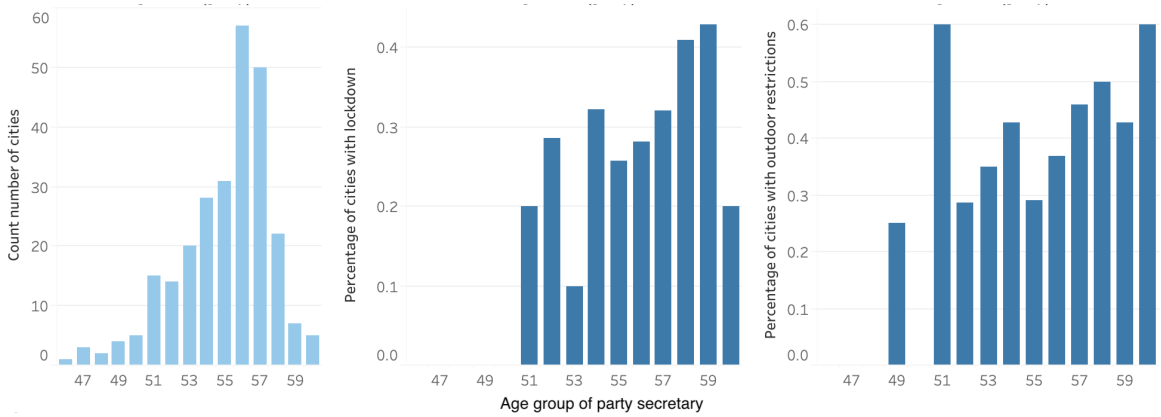

Figure 1: %Policy implemented by secretary age group

3 Empirical Results

In the following studies, I remove the 12 cities in Hubei, because Hubei, as the province where the virus was first identified, had disproportionately more confirmed COVID cases and officials have adopted the most strict policies. I conjecture that the motivation and behavior of Hubei officials are likely to be different than most other regions. The four direct-controlled municipalities (Beijing, Shanghai, Tianjin, and Chongqin) are also ignored, because their administrative ranking is comparable to provinces, and should be not compared with the city-level governments.

3.1 Regression with control variables

To depict the relationship between secretary age and the likelihood of, I used the the policy dummy (1 for policy adopted, 0 for not) as the dependent variable, and use multinomial logistic regression to fit the model.

The independent variable, secretary age, refers to the city party secretry's age in February 2020, rounded to the closest integer. Besides age, I conjecture that the most important factor that local leaders consider when making policies is the total number of confirmed cases. Since the policy dummy records whether the city adopted the policy by the end of February, the control variable COVID case records the number of confirmed cases on Feb 25, 2020 in that city.

I also incorporate two groups of controls. Province dummies is a 25-dimension dummy that indicates which of the 25 provinces the particular city is in. City characteristics refers to 5 covariates that I believe are important to the transmission and containment of the pandemic: 1) log population in 2018, 2) GDP per 10,000 population, 3) population density, 4) percentage of employment in the secondary industry 5) number of doctors per 10,000 population. These variables can accurately depict city size, level of development, potential speech of virus transmission, industrial structure, and level of medicare, and should cover most factors party secretary consider when making decisions.

Table 1: logistic regression on two policy measures

dependent:	lockdown				outdoor restriction			
secretary age	0.17***	0.16**	0.18*	0.15**	0.11**	0.10*	0.09	0.09*
	(0.06)	(0.06)	(0.10)	(0.07)	(0.05)	(0.05)	(0.06)	(0.05)
COVID case		0.01***	0.04***	0.01**		0.01**	0.00	0.01***
		(0.00)	(0.01)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

In general, there is a positive relationship between secretary age and likelihood of lockdown, meaning that an older secretary is likely to be risk-averse. The relation is stronger for the lockdown, but is also present in the outdoor restriction measure. Possibly due to the large number of independent variables compared to dependent variables, the regression involving province dummies have lower significance level.

To further test for the robustness of the above results, I use an alternative measure of age. Work age refers to the duration that the city secretary has joined the labor market. Even if her first job is not in the government, it is still counted as work age. This is another common measure used in

Chinese government reports to rule out the effect of factors like different education levels.

Table 2: alternative measure of age

dependent:	lockdown				outdoor restriction			
work_age	0.11***	0.12***	0.13*	0.11**	0.10***	0.10***	0.08**	0.11***
	(0.04)	(0.04)	(0.07)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
COVID case		0.01***	0.04***	0.01**		0.01**	0.00	0.01***
		(0.00)	(0.01)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Observe that the results are much stronger significance for all policy measures and control variables. Since work age is a better measure of working experience than age, this increased significance corresponds to the theory of Prendergast and Stole that past working experience is the source of risk-averse behaviors.

The results above are also repeated for linear regression, and similar patterns are observed. Regression tables are attached in appendix.

3.2 Additional Explorations

3.2.1 Mayor age effect

As the second most powerful leader of the city, mayor might also have significant influence in policy-making. I also collected age, and work age information for city mayors in Feb 2020, and added to the baseline regressions above. Although mayor did extract some of the party secretary effects, since party secretary has the final decision on the most important issues, the influence of mayor age/work age is less than that of party secretary, measured in both magnitude and significance. Detailed regression tables are in the appendix.

3.2.2 RD Design

There are prior evidence showing that the effect of the age of city leader is not gradual but abrupt, and the break point is closely related to the mechanism of promotion and forced retirement. For example, Huang et al 2020 shows that the motivation for economic reform sharply changes around the age 57.5 of local city leaders.

I used regression discontinuity to explore this effect. However, with the set of controls explored above, there is no significant break point in the range of age or work range considered. As an urgent public health crisis, local officials might not be able carefully think through the career implications, and did not fully incorporate the subtle details of their career concerns into the decision-making process.

4 Conclusion

In this paper, I examine the behavior of local Chinese officials during the COVID-19 pandemic from a principal-agent perspective. I discovered that age influences the risk-preference behaviors of party secretaries, and older officials are more likely to implement stringent policies to minimize risk. In addition, the effect is stronger if measured in work age, and this fact confirms to the Prendergast and Stole's model that the more working experience the manager has, the more risk-averse she will be.

References

[1] Inner Mongolia http://wjw.nmg.gov.cn/doc/2020/02/14/292018.shtml

[2] https://www.reuters.com/article/hubei-reshuffling-0213-thur-idCNKBS2070EW

[3] He, G., Pan, Y., & Tanaka, T. (2020). The short-term impacts of COVID-19 lockdown on urban air pollution in China. Nature Sustainability, 3(12), 1005-1011.

[4] 百度迁徙 https://qianxi.baidu.com/

[5] Qiu, Y., Chen, X., & Shi, W. (2020). Impacts of social and economic factors on the transmission of coronavirus disease 2019 (COVID-19) in China. Journal of Population Economics, 1.

[6] Huang, Z., Liu, J., Ma, G., & Xu, L. C. (2020). The Transformative Effects of Privatization in China: A Natural Experiment Based on Politician Career Concern. World Bank Policy Research Working Paper, (9261).

[7] Lee, D. S., & Lemieux, T. (2010). Regression discontinuity designs in economics. Journal of economic literature, 48(2), 281-355.

[8] 周雪光. (2017). 中国国家治理的制度逻辑. 北京: 生活· 读书· 新知三联书店.

[9] 耿曙, 庞保庆, & 钟灵娜. (2016). 中国地方领导任期与政府行为模式: 官员任期的政治经济学. 经济学 (季刊), 15(3), 893-916.

[10] 周黎安. (2007). 中国地方官员的晋升锦标赛模式研究 (Doctoral dissertation).

[11] https://baike.baidu.com/item/

[12] 耿曙, 庞保庆, & 钟灵娜. (2016). 中国地方领导任期与政府行为模式: 官员任期的政治经济学. 经济学 (季刊), 15(3), 893-916.

[13] 金刚, & 沈坤荣. (2019). 地方官员晋升激励与河长制演进: 基于官员年龄的视角". 财贸经济, 4.

[14] 杨刚强, 程恒祥, 吴斯 (2020), 晋升压力、官员任期与公共服务供给效率———基于中国7 0 个城市的实证

[15] zh.wikipedia.org

[16] http://ldzl.people.com.cn/dfzlk/front/firstPage.htm

[17] Holmstrom, B., & Roberts, J. (1998). The boundaries of the firm revisited. Journal of Economic perspectives, 12(4), 73-94.

[18] Serfling, M. A. (2014). CEO age and the riskiness of corporate policies. Journal of Corporate Finance, 25, 251-273.

[19] Holmström, B. (1999). Managerial incentive problems: A dynamic perspective. The review of Economic studies, 66(1), 169-182.

[20] Scharfstein, D. S., & Stein, J. C. (1990). Herd behavior and investment. The American economic review, 465-479.

[21] Prendergast, C., & Stole, L. (1996). Impetuous youngsters and jaded old-timers: Acquiring a reputation for learning. Journal of political Economy, 104(6), 1105-1134.

A Supplementary Regression Tables

A.1 Linear regression results

Table 3: linear regression on two policy measures

dependent:	lockdown				outdoor restriction			
secretary age	0.03***	0.03**	0.01*	0.02**	0.02**	0.02*	0.02	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
COVID case		0.00***	0.00***	0.00**		0.00**	0.00	0.00***
		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
R^2	0.03	0.11	0.59	0.16	0.02	0.04	0.28	0.11
Adj. R^2	0.03	0.11	0.54	0.13	0.01	0.03	0.20	0.08
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 4: linear regression: alternative age measure

dependent:	lockdown				outdoor restriction			
work_age	0.02***	0.02***	0.01**	0.02***	0.02***	0.02***	0.02**	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
COVID case		0.00***	0.00***	0.00***		0.00***	0.00	0.00***
		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
R^2	0.03	0.12	0.59	0.16	0.03	0.06	0.29	0.13
Adj. R^2	0.03	0.12	0.54	0.14	0.03	0.05	0.21	0.10
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

A.2 Mayor added as control

Table 5: logistic regression for age (mayor added as control)

	1a	1b	1c	1d	2a	2b	2c	2d
secretary age	0.16***	0.15**	0.17*	0.15**	0.09*	0.09*	0.08	0.08
	(0.06)	(0.06)	(0.10)	(0.07)	(0.05)	(0.05)	(0.06)	(0.05)
mayor_age	0.03	0.01	0.03	−0.00	0.07*	0.06*	0.07	0.09**
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
COVID case		0.01***	0.04***	0.01**		0.01**	0.00	0.01***
		(0.00)	(0.01)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 6: logistic regression for work age with (mayor added as control)

	1a	1b	1c	1d	2a	2b	2c	2d
work_age	0.11***	0.12***	0.12*	0.11**	0.10***	0.10***	0.08**	0.11***
	(0.04)	(0.04)	(0.07)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
mayor_work_age	0.04	0.03	0.08	0.02	0.06**	0.05*	0.07*	0.06**
	(0.03)	(0.03)	(0.06)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
COVID case		0.01***	0.03***	0.01**		0.01**	0.00	0.01***
		(0.00)	(0.01)	(0.00)		(0.00)	(0.00)	(0.00)
province dummies (n=25)	-	-	Yes	-	-	-	Yes	-
city characteristics (n=5)	-	-	-	Yes	-	-	-	Yes
Num. obs.	264	264	264	264	264	264	264	264

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$