Anti-Corruption, NSNP and Coal Mine Deaths——Evidence From China

Xueyuan Zhang[1, a], Fengwei Sun[2, b]

[1]School of economics, Sichuan University, Chengdu 610000, China

[2]China Finance 40 Forum, Beijing 100009, China

[a]zxy19871212@126.com, [b]sunfw@cf40.org.cn

Abstract: This study evaluates the complementary effect of anti-corruption and "no safety, no promotion" laws on coal mine mortality in China. We argue that the collusion–mortality relationship should be heterogeneous, the pursuit of economic performance and rent-seeking both can induce a looser safety regulation. Based on the panel data of 25 coal-producing provinces from 2006 to 2015, we find evidence that provinces have been adopted NSNP policies with stronger anti-corruption efforts experienced a significantly larger decrease in coalmine death rates. This result is robust to a vast array of sensitivity checks.

1. Introduction

China is a big county of coal production and consumption. Coal has been always "fueling" China's rapid economic growth since 1978, making up above 60% of the total energy consumption and around 70% energy production. In the meantime, China has an appalling record of fatality rates in her coal mine industry. Measured by the number of miners killed per million tons of coal output, in 2000, a coal miner in China is nearly 150 times more likely to get killed by coal mine accidents than an American miner is (Wang, 2006) [1]. It is assumed that collusion between local officials and coal mine firms is a cause of accidents.

While the Chinese government has responded to this stern reality by introducing a vast array of new legislations and regulations, as well as updating the corresponding institutional arrangements to make the State Administration of Coal Mine Safety (SACMS)/the State Administration of Work Safety (SAWS) an independent agency with full ministerial- rank. Since 2004, China has followed a safety production targeting system, whereby the central government assigns a "death ceiling" to each province, and the provincial government is responsible for allocating the "quota" among municipalities (Peng 2004). Guangdong was the first province to adopt "no safety, no promotion" policy in 2005, that made promotion of safety regulators and other local government officials contingent on meeting the safety target set for their region ("yi piao fou jue zhi" in Chinese), while others followed suit only much later. In the same year, China had also launched a campaign to clean up the coal mines where officials have taken stakes.

Right after the 18th CPC National Congress, a large-scale anti-corruption campaign launched by President Xi Jinping, which may affect coal mine deaths. With the corrupt bureaucrats being removed from office, the specific connected coal mine firms lose their "protective umbrella". More importantly, the large-scale crackdowns can generate a very strong deterrent effect, which might deter officials from engaging in collusion with mine owners, at least during the campaign. We argue that the collusion–mortality relationship should be heterogeneous, the local officials, especially senior ones who pursuit economic performance for promotion will also conduct a looser safety supervision on coalmines. Our empirical analysis shows that anti-corruption and NSNP are complements for improving coal mine safety.

2. Theoretical Framework

There are three types' coal mines in China: key state coal mines, local state coal mines, and

township and village coal mines. According to their ownership, scale and workplace safety, the key state coal mines are much larger and safer then village coal mines, the latter are often privately-operated.

Jia et al. (2017) [2] focus on the key state coal mines, they argue that a native safety regulator (the safety regulator in a province is the vice governor responsible for industrial-production safety, which includes coal mine safety) may have lower transaction costs of collusion, thus increasing the death rates, especially during the decentralization period. In fact, over 1986-2008 period, the village coal mines that was chief culprit, had only been produced 36.8% total coal extracted but accounted for 68.9% deaths by accidents in China. Bai et al., (2012) [3] argue that shutdown policy leads to a higher shutting down probability (or lower property rights stability) of village coal mines. They find that shutdown policy significantly decreases output while also increasing mortality in village coal mines. Fisman and Wang (2015) [4] expand the research to frim-level, based on the data of listed firms in China, they find that the worker death rate for connected companies is two to three times that of unconnected firms, and NSNP is associated with lower worker death rates, primarily among connected companies. Using quarterly data from prefecture-level cities in China, Shi and Xi (2018) [5] find evidence of safety race, the number of accidental deaths in a city is positively associated with those in its political neighbors. Their empirical analysis shows that neighborhood effect are weaker in cities where party secretaries have local ties measured by birthplace.

This paper is enlightened by the idea of Xu et al. (2018) [6], Zhang and Sun (2018) [7]. Xu et al. (2018) apply a difference-in-differences (DD) identification that exploits the temporal and spatial variation in anti-corruption intensity induced by the nationwide anti-corruption campaign, where they compare coal mine death rates before and after the campaign, from provinces that experienced a large increase in the crackdown on bureaucrats (i.e., the treatment provinces) and provinces that saw relatively small increase in the crackdown (i.e., the comparison provinces). They find evidence that provinces with stronger exposure to the anti-corruption campaign have experienced a significantly larger decrease in coalmine death rates. Zhang and Sun (2018) investigate the effect of collusion heterogeneity on two types of coal mines (see Fig.1). Senior officials are more likely to collude with large state coal mines for economic performance, and Grass-root officials tend to collude with small private coal mines by rent-seeking activities. Then the collusions can be divided into two types: neutral collusion and corrupt collusion. They find that "neutral collusion" can increase the death rates of key state coalmines significantly, the impact of decentralization on accidents is much larger for native safety governors. "Corrupt collusion" is correlated with an increase in coal mine death rates of township mines under the decentralization and shutting down period. The one cannot explain the other. If collusion heterogeneity truly exists, Anti-corruption or NSNP can not impact the total mortality of coal mines alone, in other words, they are complements.
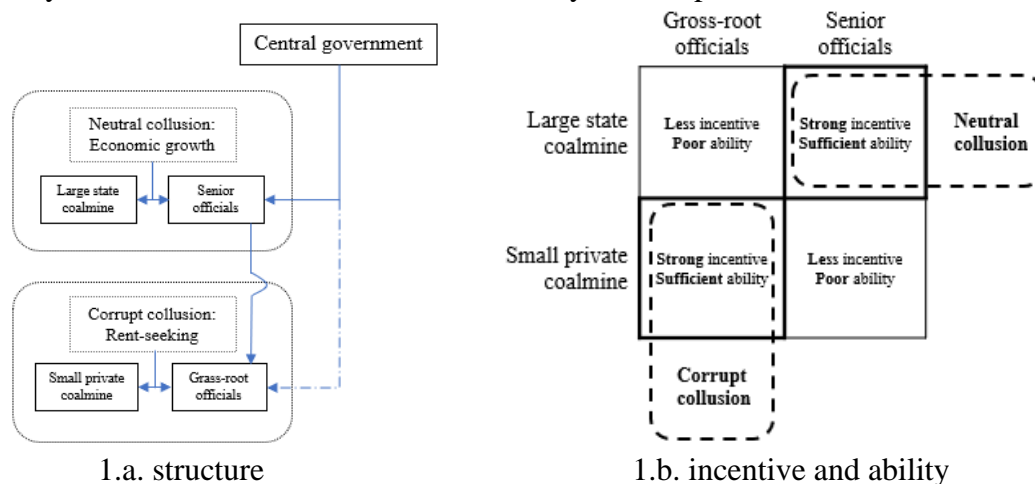

1.a. structure   1.b. incentive and ability

Figure 1. Two types of collusion

3. Data

We collect a panel data set on the coalmine accidents, NSNP policies, provincial anti-corruption efforts and characteristics for 25 provinces across China between 2006 and 2015. Among the excluded provinces, Tianjin, Shanghai, Tibet and Hainan do not produce any coal at all, Guangdong has shut down all coal mines since 2006, while Zhejiang has produced less than 50,000 tons since 2006, shut down all coal mines since 2013. We focus on the period 2006 to 2015 for three reasons. First, the State Administration of Work Safety (SAWS) became an institute with full ministerial-rank, and the State Administration of Coal Mine Safety (SACMS) was upgraded to vice- ministerial level in 2005. In the same year, Chinese government cleaned up the coal mines where officials had taken stakes. The regime of coal mines safety has been stable since 2006. Second, 2006 is the first full year when provincial government NSNP laws came into force. Third, the large-scale anti-corruption campaign launched at the end of 2012, samples up to 2015 can reflect the obvious change in anti-corruption efforts.

Coal mine death rate, the main dependent variable in this study, is calculated as the number of deaths per 100 million tons of coal production. The data on the number of deaths, as well as accident cases, are mainly derived from China Work Safety Yearbook, complemented by China Coal Industry Yearbook and the websites of provincial branches of SAWS/SACMS. Data on coal production mainly come from China Energy Statistics Yearbook. The key independent variable is anti-corruption. Similar to Nie and Wang (2016), we construct a proxy to measure provincial anti-corruption efforts, which is the ratio of officials of vice county-division rank (xianchuji) and above investigated in the registered cases (the number of offilcals above the vice county level per 100 registered cases). It stems from the Procuratorial Yearbook of China. Fig. 2 plots the time trend of this measure across 7 different regions in China.
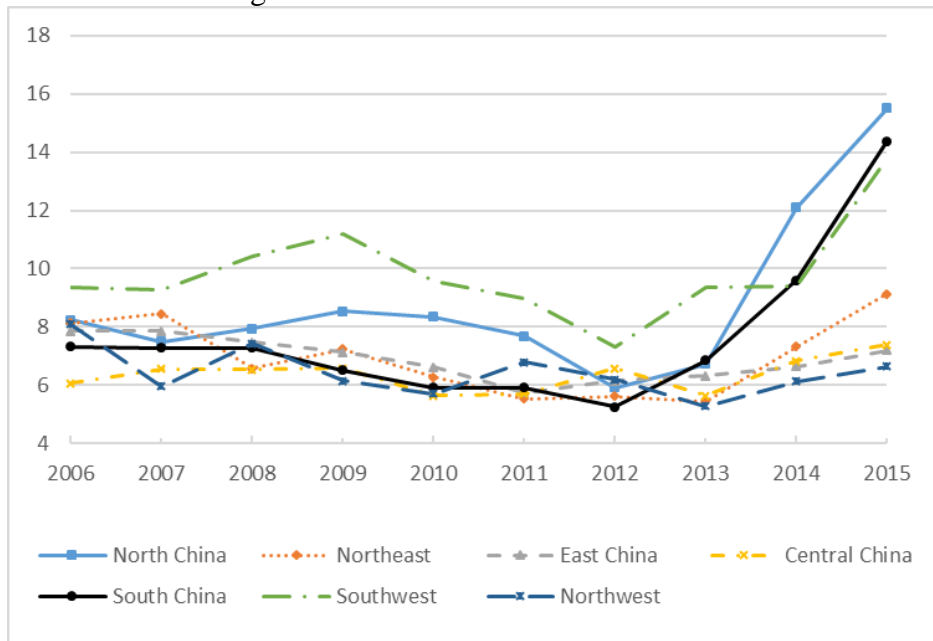

Figure 2. Time trend of Anti-corruption efforts of different regions in China (number of high level officials per 100 cases)

To examine the effects of regulator incentives, we define the variable NSNP to be a province-year variable denoting whether province p had passed an NSNP law in year t. We define NSNPpt as beginning in the first full year that a law was in effect (Our results are insensitive to defining NSNP instead on the basis of the fraction of days that a law was in effect during its year of passage). We also collect data on the characteristics of coal mines and safety regulators as well as a series of provincial socioeconomic variables from various sources (Table 1).

Table.1. Summary statistics and sources of variables

Variable	Definition	Obs	Mean	Min	Max	Sources
	Provincial coalmine data					
Death rate	Deaths per million tons of coal	250	1.615	0.000	15.737	1
Deaths	Number of deaths	250	90.864	0.000	698	1
Coalmine Ratio	Coalmine industrial sales/GDP	250	6.626	0.161	56.184	2,3
ln Production	Coal production (logged)	250	8.725	6.055	11.554	4
ln Coalmine Invest	Fixed investments of comine industry (logged)	250	13.367	7.090	16.420	4
ln Mine Wage	Wages of coalmine industry (logged)	250	10.606	9.638	11.412	3
State Sales Ratio	Ratio of state coalmine industrial sales	250	53.223	1.083	100.000	2,5
	Key explanatory variable					
NSNP	No safety no promotion laws	250	0.396	0	1	6
Anticorr1	Number of high-level officials per 100 cases	250	6.989	1.541	31.841	7
	Other controls					
ln population	Population (logged)	250	8.226	6.306	9.195	3
ln electricity	Electricity consumption (logged)	250	7.037	5.499	8.540	3
ln GDP per capita	Real GDP per capita (logged)	250	10.252	8.657	11.576	3
GDP Growth	Real GDP growth	250	11.596	3.000	19.200	3
GDP Target	Target GDP growth	250	10.316	6.000	15.000	8
	For robust test					
Native	Native vice governor in charge of safety	250	0.548	0	1	9
Internet	Internet availability rate	250	0.316	0.038	0.759	3
Traffic Deaths Rate	Traffic deaths per capita	250	5.271	1.735	12.722	3
Sources: 1. China Work Safety Yearbook; 2. China Industrial Statistical Yearbook; 3. Website of National Bureau of Statistics; 4. China Energy Statistics Yearbook; 5. Provincial Statisitcal Yearbooks; 6. http://www.pkulaw.cn/; 7. Procuratorial Yearbook of China; 8. Xu et al. (2018); 9. Provincial government documents collected by the authors.						

4. Empirical Results

To examine whether the complementary effect of anti-corruption and "no safety, no promotion" laws on coal mine mortality, we explore both within-province variations. The specification is as follows:

$$Deathrate_{pt} = \alpha' Anticorr_{pt} + \beta' NSNP_{pt} + +v' NSNP_{pt} \times Anticorr_{pt} + \gamma' Controls_{pt}$$

$$+\delta' Controls_{pt} \times Period + \theta_p + t + \tau_{pt}$$

To take into account the concern of serial correlation and capture the fact that there are two periods (before and post anti-corruption), where period equals 1 over the period 2013 to 2015, we cluster the standard errors by province × period. The results are presented in table 2. Column 1 includes both Anti-corruption and NSNP, also controls for province and year fixed effects. Neither the coefficient of Anticorr1 nor NSNP is significant. Column 2 includes the interaction of Anticorr1 and NSNP, the coefficient of interactions term is negative, significant at the 5% level. Column 3 further includes a series of controls, the coefficient of Anticorr1 × NSNP keeps negative and significant at the 5% level. In Column 4, we includes the interaction of controls and regime, Column 5 controls target GDP growth, Column 6 includes all the controls, the coefficients of Anticorr1 × NSNP are always negative and significant. The results show that provinces have been adopted NSNP policies with stronger anti-corruption efforts experienced a significantly larger decrease in coalmine death rates. There exists a complementary effect of anti-corruption and "no safety, no promotion" laws on coal mine mortality.

Table.2. Baseline test: Anti-corruption, NSNP and death rate of coalmine

	(1)	(2)	(3)	(4)	(5)	(6)
Anticorr1	0.037	0.066	-0.036	0.000	-0.035	0.000
	[0.040]	[0.045]	[0.046]	[0.043]	[0.047]	[0.044]
NSNP	-0.033	0.720	0.271	0.311	0.256	0.288
	[0.360]	[0.547]	[0.524]	[0.557]	[0.520]	[0.567]
Anticorr1×NSNP		-0.125**	-0.079**	-0.104***	-0.081**	-0.102***
		[0.048]	[0.037]	[0.033]	[0.036]	[0.033]
Controls			Yes	Yes	Yes	Yes
Controls×Period				Yes		Yes
GDP_target					Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
#Obs	250	250	250	250	250	250
R^2	0.73	0.74	0.79	0.82	0.79	0.82

Notes: This table presents the baseline results on the complementary impact of the anti-corruption campaign and NSNP on the mortality rate in the coal mine industry. Standard errors reported in the parenthesis are clustered at the Province $\times$ Period level. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

Our baseline estimates evaluate the average effect of the interactions term. We can allow for more flexible specifications and evaluate the dynamic effects. The results are presented in Figure 3. This result indicates that the complementary effect of anti-corruption and NSNP on coal mine deaths began to take place immediately after the anti-graft campaign was launched.
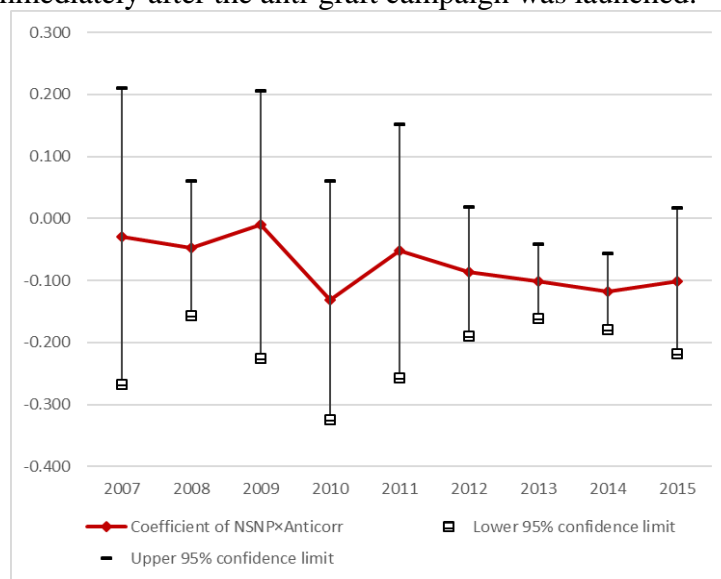

Figure 3. The dynamic impacts

5. Conclusion

Based on the panel data of 25 coal-producing provinces from 2006 to 2015, we find evidence that provinces have been adopted NSNP policies with stronger anti-corruption efforts experienced a significantly larger decrease in coalmine death rates. There exists a complementary effect of anti-corruption and "no safety, no promotion" laws on coal mine mortality.

References

[1] Wang, Shaoguang. 2006. Regulating Death at Coalmines: Changing Mode of Governance in

China. *Journal of Contemporary China*, 15 (46): 1-30.

[2] Jia, Ruixue and Huihua Nie. 2017. Decentralization, Collusion and Coalmine Deaths [J]. *Review of Economics and Statistics*, 99 (1): 105-118.

[3] Bai, Chong-en, Xin Wang, and Xiaohan Zhong. 2012. Regulation or Property Rights: The Effect of China's Coal Mine Shutdown Policy on Work Safety, *China Economist*, 7 (3): 114-127.

[4] Fisman, Raymond and Yongxiang Wang. 2015. The Mortality Cost of Political Connections. *Review of Economic Studies*, 82 (4).

[5] Shi, Xiangyu and Tianyang Xi. 2018. Race to Safety: Political Competition, Neighborhood Effects, and Coal Mine Deaths in China, *Journal of Development Economics*, 131: 79-95.

[6] Xu, Gang, Go Yano and Rong Zou. 2018. Anti-corruption, Safety Compliance and Mining Accidents: Evidence from China, *Ssrn Electronic Journal*.

[7] Zhang, Xueyuan and Fengwei Sun. 2018. Heterogeneous Collusion and Coal Mine Deaths in China: Evidence based on the Decentralization and Shutdown Policy, 5th China Conference on Organizational Economics (CCOE), *Working Paper*.