# Longitudinal relationship between economic development and occupational accidents in China

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## ARTICLE INFO

## ABSTRACT

The relativity between economic development and occupational accidents is a debated topic. Compared with the development courses of both economic development and occupational accidents in China during 1953–2008, this paper used statistic methods such as Granger causality test, cointegration test and impulse response function based on the vector autoregression model to investigate the relativity between economic development and occupational accidents in China from 1953 to 2008. Owing to fluctuation and growth scale characteristics of economic development, two dimensions including economic cycle and economic scale were divided. Results showed that there was no relationship between occupational accidents and economic scale during 1953–1978. Fatality rate per $10^5$ workers was a conductive variable to gross domestic product per capita during 1979–2008. And economic cycle was an indicator to occupational accidents during 1979–2008. Variation of economic speed had important influence on occupational accidents in short term. Thus it is necessary to adjust Chinese occupational safety policy according to tempo variation of economic growth.

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## 1. Introduction

Occupational safety is essential for a country to keep social stability and to develop national economy in healthy way. It can protect labors as well as normal production order; per contra, economic development can create social wealth and supply less-hazardous technical condition for workers, and a benign cycle thus can be formed. Hence there is an inherent certain relationship between occupational safety and economic development. Statistic studies (Wang, 2006a; Hämäläinen, 2009) have found that occupational safety situation was closely related to the social and economic development in different countries or in different historical stages. Generally speaking, occupational safety situation in developed countries are better than that of developing countries. According to the statistic data collected by International Labor Organization, fatality rate per $10^5$ workers in developed countries was rather low, which was 4 on average, while fatality rate per $10^5$ workers in developing countries were above 10 (Fan, 2003).

China economy has been developing in fluctuation during more than half past century since PR China established. With rapid economic development, occupational safety is uncomfortable. Above 10 000 people lost their lives in workplaces annually in recent years. More than 25 000 000 workers were exposed to various hazards, such as dust, poison and noise, etc. Economic loss caused by work accidents were about 200 billion Yuan (RMB) each year, accounting for about 2% of GDP (national gross domestic products) (Fan, 2003). According to a survey made by the Ministry of Human Resources and Social Security during 2003, above 50% of labor disputes were caused by occupational safety, health or employment injury insurance issues in the east part of China. As shown in Table 1, compared with other countries, China occupational safety situation was rather serious. Thus, how to reduce occupational accidents and gain economic growth in safer manner has attracted interest of politicians, managers and researchers.

This study aimed to explore longitudinal relativity between economic development and occupational fatal accidents in China over a long time span. It can be used for the ground work for exploring macrovariation laws of occupational safety in socioeconomic perspective.

## 2. Brief description of occupational accidents and economic development in China

### 2.1. Obvious vibration features of occupational fatalities and economic cycle during the planning economy period (1953–1978)

Fig. 1 showed evolution curves of yearly fatality rate per $10^5$ workers and economic speed. Thereinto, yearly fatality rate per

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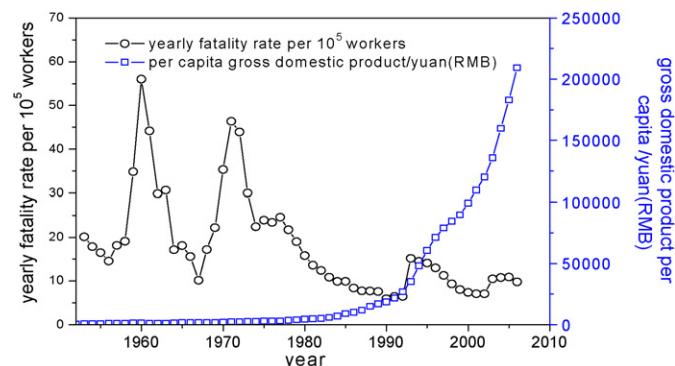E-mail addresses: lilysong@ustc.edu, chenpeng@cumtb.edu.cn (X. HE).

**Table 1**
Death toll and death rate in China and some other countries (2004).

| Country | Death toll (person) | Fatality rate per 100 000 workers $(1/10^5)$ |
|---|---|---|
| United Kingdom | 235 | 0.81 |
| Australia | 189 | 2.08 |
| United States | 5703 | 4.1 |
| Poland | 490 | 4.7 |
| Italy | 931 | 5 |
| China | 16497 | 10.8 |
| Russia | 3292 | 12.9 |
| Korea | 2825 | 27 |

Data source: Wang (2006a).



**Fig. 2.** Trends of occupational accidents and per capita gross domestic product in China, 1953–2008.
*Source*: per capita gross domestic product derived from China Statistics Yearbook, 1986–2008; data on occupational accidents come from China Work Safety Yearbook, 1999–2008.

$10^5$ workers is ratio of death toll caused by occupational accidents to total number of employees each year. Economic speed is usually described by yearly growth rate of GDP (gross domestic product). Fig. 2 compared evolution curve of yearly fatality rate per $10^5$ workers with that of economic growth scale. Thereinto, economic growth scale is usually described by gross domestic product per capita. China gross domestic product per capita increased rather slowly during the planning economy period (1953–1978), while economic speed as well as death rate fluctuated explicitly and obviously. Fatality rate per $10^5$ workers decreased steadily during the initial stage of PR China. The first peak of occupational fatality appeared during 1957–1961, death toll caused by occupational accidents ascended to 12 850 (1958) from 3704 (1957). 21 938 workers died during 1960, which was 5.9 times that of 1957. Along with uptrend of occupational accidents, growth rate of GDP down sharply and arrived its valley bottom during 1961. Fatality rate per $10^5$ workers declined sharply during 1961–1965, while growth rate of GDP increased obviously. Fatality rate per $10^5$ workers increased rapidly during and reached the second peak value during 1971, about 17 610 people died in workplace during 1971, and yearly fatality rate per $10^5$ workers mounted up to 46.35 at the same time. Meanwhile economic speed took on obvious vibration. Above two sharp fluctuations of death rate and economic speed all appeared in special historic periods. One was a great famine disaster in 1960, the other was a political event named "Great Culture Revolution" in 1970s, during which anarchism overflow and safety administration system was disturbed. Natural disaster and political factors may be the cause of abrupt fluctuation of both death rate and economic speed.
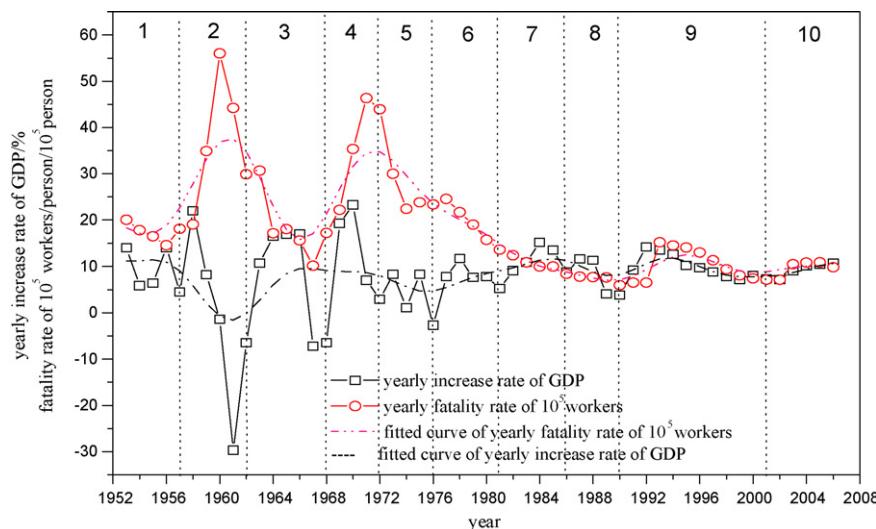
## 2.2. Smooth features of occupational fatalities and economic cycle during 1979–2008

China has put reformation and open-policy into effect since 1978, market economy has boosted up self-adjustment abilities of economic development, the characteristics of economic cycle in China changed accordingly. As shown in Fig. 1, China economy has kept rather stable growth speed since 1979. Wave amplitudes of growth rate of GDP curve abated steadily during 1979–2008. Economic growth scale has kept rapid uprising since 1978, gross domestic product per capita increased quickly, shown in Fig. 2.

Both death toll and yearly fatality rate of $10^5$ workers declined stably during 1979–1992. About 14 363 workers died in workplace during 1978, while death toll down to 7994 during 1992. Yearly fatality rate per $10^5$ workers declined from 21.71 (1978) down to 6.47 (1992). The rise of death toll as well as fatality rate of $10^5$ workers during 1993 was mainly due to variation of statistical range of occupational accidents. Besides accidents occurred in state-owned enterprises and above-county collective enterprises, accidents occurred in villages and towns' enterprises have been recorded since 1993. Occupational fatalities fluctuated with a downtrend during 1993–2000. About 19 820 people died in workplace during 1993, but 11 681 death during 2000, fatality rate per



**Fig. 1.** Trends of fatality rate per $10^5$ workers and economic cycles in China, 1953–2008.
*Data source*: annual growth rate of GDP derived from China Statistics Yearbook, 1986–2008; fatality rate per $10^5$ workers come from China Work Safety Yearbook, 1999–2008.