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THE EVOLUTION OF CHINA'S COAL INSTITUTIONS

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The Evolution of China's Coal Institutions

Wuyuan Peng[1]

Abstract

Coal is the major primary energy which fuels economic growth in China. The original Soviet-style institutions of the coal sector were adopted after the People's Republic of China was founded in 1949. But since the end of 1970s there have been major changes: a market system was introduced to the coal sector and the Major State Coalmines were transferred from central to local governments. This paper explains these market-oriented and decentralizing trends and explores their implications for the electric power sector, now the largest single consumer of coal. The argument of this paper is that the market-oriented and decentralizing reforms in the coal sector were influenced by the changes in state energy investment priority as well as the relationship between the central and local governments in the context of broader reforms within China's economy. However, these market-oriented and decentralizing reforms have not equally influenced the electric power sector. Since coal is the primary input into Chinese power generation, and power sector reform falls behind coal sector reform, the tension between the power and coal sectors is unavoidable and has raised concerns about electricity shortages.

Key words:

China coal, market-oriented reform, decentralization, power sector, political economy

I. Introduction

Coal is the major primary energy which fuels economic growth in China. China has abundant coal but much less oil and gas resources. Other alternatives, like hydro and nuclear power, cannot keep up with the speed of economic growth due to their high cost and controversy around issues like residential reallocation, ecological degradation and safety concerns. Therefore about 70% of primary commercial energy in China comes from coal.

When the People's Republic of China was founded in 1949, its annual coal production was only 32.4 million metric tons. China's coal production has since grown into the largest in the world. In 2008, coal production was approximately 2.72 billion metric tons, accounting for about 40% of the world's production of coal.

Soviet-style central planning of the coal sector was adopted after the People's Republic of China (PRC) was founded in 1949. But since the end of the 1970s there have been major changes to the institutions in the coal industry: market mechanisms were introduced to the coal sector and the Major State Coalmines were transferred from central to local governments (Table 1). In 1985, the central government initiated a general contract system to regulate the input and output of unified distribution coalmines which are under central planning and have access to railway transportation.[2] Construction of key mines belonging to the Shenhua Group[3], the largest coal project in China, also started in 1985. During the same period, the permitting procedure for small sized coalmines was transferred to the local government and made much simpler than before. In 1993, except for power generation and agricultural use, the coal price was

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[2] The central government delegated power to and shared profit with state-owned enterprises through general contract system.

[3] As a major state coalmine, Shenhua Group does not belong to the unified distribution coalmines because it has captive rail lines.

liberalized, and the unified distribution coalmines were pushed to market competition. In 1995 the Shenhua Group was founded as a central firm under the direct administration of the State Council. In 1998 the administration of the unified distribution coalmines was transferred to the local governments, further decentralizing control of the coal sector. By 2002, all the prices of coal, even for power generation, were relaxed. In about twenty years the coal sector had shifted from central planning to a market-based and decentralized system.

Table 1 Trend of coal institutions' evolution in China

	Applying central planning (1949-1978)	Introducing a market system (1979-1992)	Establishing a market system (1993-current)
Administration	Hierarchy by central agency	Two-level system by central and local governments	Local governments after 1998 except Shenhua, China Coal and Yimin*
Finance**	State budget	State budget switching to state loan	State creditor switching to shareholder
Pricing**	Regulated and under-priced	Two-track system	Relaxed

Note: *The total raw coal production share of Shenhua, China Coal and Yimin is between 10% and 15% nationwide.
**This refers to the Shenhua Group and unified distribution coalmines which are the mainstays of coal sector.

This paper explains these remarkable market-oriented and decentralizing trends and explores their implications for the power sector, now the largest single consumer of coal. There is little existing research on the institutional evolution of the coal sector within China. The World Bank Energy Sector Management Assistance Program (ESMAP 2004, 2008) identified many of the problems that China's coal mining industry needs to address on the path towards sustainability, for example, safety, health and environmental problems. The International Energy Agency (IEA 2007, 2009) has addressed coal supply and clean coal technology in China. The China Energy Group in Lawrence Berkeley National Laboratory has researched energy efficiency and strategy (Sinton, et al. 2005; Zhou et al. 2007). The Industrial Performance Center in MIT published several working papers relevant to China's coal sector (Lester and Steinfeld 2006, 2007), with an emphasis on the pattern of coal uses. The Australian Bureau of Agricultural and Resource Economics and Japanese Institute of Energy Economics have done a series of research studies on China's coal, with a focus on China's coal import and export projection (Ball et al. 2003; Schneider 2004; Sagawa and Koizumi 2007, 2008). Thomson (2003) used the coal industry in China as a case study of the country's economic development as a whole. Rui (2005) analyzed different types of Chinese coal mining enterprises in the context of global change in the coal industry and their implications for China. Wang (2006) explored the imbalanced development of coal and power sectors, and proposed that the imbalance was caused by government intervention. Zhang and Heller (2007) explained why China's power sector reform stalled. Rosen and Houser (2007) analyzed China's energy demand and supply system and its global impacts.

Some work has been done by Chinese researchers on the coal in China. Pan *et al.* (2002) compared the coal market concentration between China and the USA and argued that the market concentration in China was too low. Yu and Yu (2006) proposed the vertical integration model between coal and power to solve the conflict between the two sectors. Lin et al. (2007) estimated the long term coal demand in China and proposed that the coal supply capacity should expand rapidly to match the demand. Xiao et al. (2008) used a Vector Auto Regression (VAR) model to analyze the effect of coalmine safety regulation, finding the long term effect is significant. Shi (2008) evaluated the opening up and reform program of the energy industry in China, but did not explore the driving forces and implications of the reforms. Most of the research inside China has put an emphasis on coalmine safety, coal demand projection, and vertical integration, but very little on the cause and effect of coal institutional evolution in China.

The hypothesis of this paper is that the market-oriented and decentralizing reforms in the coal sector were influenced by the changes of state energy development priority as well as the relationship between the central and local governments in the context of broader reforms within China's economy. However, those reforms have not influenced all related sectors equally. Although the central government had allowed substantial market-oriented reforms in coal, those reforms have not easily extended to the power sector. The fragmented character of these reforms has had significant implications. Since power sector reform lags coal sector reform, coal prices have become market oriented while power prices are tightly regulated. Because coal is the primary input into Chinese power generation, the tension between the power and coal sectors is unavoidable and has raised concerns about electricity shortages.

The rest of the paper is organized as follows: Section II illustrates the initial conditions of coal institutions' evolution in terms of administration, finance and pricing in China; Sections III and IV discuss the coal institutional evolution in the subsequent stages of reform; and Section V concludes the study.

II. Applying Central Planning to the Coal Industry (1949-1978)

After the People's Republic of China was founded in 1949, Soviet-style central economic planning was adopted. From the beginning of socialism in China, it had been regarded as an unalterable principle to abolish the market system and establish a planned economy characterized by highly centralized administrative coordination, following the example of the Soviet Union. After the outbreak of the Korean War in 1950, China had to give top priority to national defense related industries. Chinese leaders chose the institutional arrangement that would mobilize and allocate resources through central planning so that limited resources could be used to build up heavy industries, especially its core military industry.

Under the priority of heavy industry development, all of the energy sectors, like coal, electric power and petroleum, were put under central planning and given priority to develop.[4]

The local governments under the central planning system had little authority but instead obligations to implement the planned tasks. In the Soviet economic planning system production was organized hierarchically, with targets set by the central authorities. In the final quarter of each year, the State Planning Commission (SPC)[5] prepared the following year's preliminary balances for all commodities and capital goods under state control. These goods were referred to as being 'under unified distribution' or simply 'under plan'.

Administration

In 1949 the new government nationalized most coalmines, and from 1953 the first five-year plan was implemented. The foreign coalmines and Nationalist (or Kuomintung) government coalmines were taken over by the central government, and the remaining coalmines were transferred to Local State Coalmines and Township and Village Coalmines[6] with compensation according to the size of coalmines. In terms of coal production, the shares of state owned, public and private joint venture, and private coalmine were 68.2%, 3.5% and 28.3% respectively in 1949. Five years later, the share of private coalmines had decreased to 6.1% (Zhang, 1989).

As coal was given one of the top priorities to develop it was necessary to set up an independent ministry in charge of the coal sector. The Ministry of Coal Industry was separated from Ministry of Fuel Industry as an independent body in 1955, with greater autonomy and a more coherent planning structure.[7]

[4] There were 24 coal projects within the 156 key projects designed with aid from the former Soviet Union during the 1950s.
[5] SPC was later reformed to the National Reform and Development Commission (NDRC).
[6] Township and Village Coalmines are also named small coalmines since they are typically much smaller.
[7] The ministry responsible for the coal industry during this period was variously designated as the Ministry of Fuel Industry

Each ministry under the planned economy was given proposed output targets which were communicated to all the various sub-units. Additionally, balance tables were also drawn up to schedule the mode and route of transportation for every commodity under plan.

Monopoly administration of the coal sector under central planning was used to boost the downstream heavy industries. The state tried to tailor both forward and backward economic linkages through the coal industry. The national agencies (State Bureau of Material, Ministry of Railway and others) arranged the supply of input materials, like timber, explosives and electric power, and also directly coordinated the sales, allocation, and transport of all coal under plan through the annual National Coal Ordering Conference[8] to match the coal supply to the demand from key sectors. The state also tried to balance the total amount of coal produced and consumed by each region.

Unified distribution coalmines[9] dominated the coal sector during the central planning period. China's coalmines were divided into three main categories according to the type of ownership: the Major State Coalmines, the Local State Coalmines, and Township and Village Coalmines.[10] The former two were state-owned enterprises. The Major State Coalmines were controlled by the central government through the administration of National Agencies with most production being allocated under central plan. The Local State Coalmines were operated either by provincial, prefectural, or county governments, while Township and Village Coalmines were operated by townships, communes, or collectives. Both the Local State Coalmines and Township and Village Coalmines were administrated by a Provincial Coal Industry Bureau. The output from the Local State Coalmines was also generally under unified distribution while the output from the Township and Village Coalmines was not. Because the Township and Village Coalmines' production was not put under central planning, it could not be sold freely, even to the neighboring communities.

Finance

The leading characteristic of the financial system under the planned economy was the integration of public finance and business finance. Important economic decisions of firms were never based on financial considerations. Decisions about which investments to undertake were made by government planners and financed from the government budget. Firms that possessed a monopoly position forwarded their cash surplus to the government, which made up the main source of government revenues.

The state bank was considered the cashier for the state fiscal system under central planning, and a single institution played the roles of both the central bank and commercial banks. From 1949 to 1978, the People's Bank of China (PBC) was the only state bank in China, integrating the functions of the central bank such as financial supervision with those of policy banks and commercial banks, such as savings and loans.

The state coalmines were financed from the state budget allocation. During the central planning period the government provided over 90% of the funding in the coal sector. State-owned enterprises did not function as independent firms with management responsibility, the ability to allocate assets, or control over expenditure of their earnings. A year-end plan target for total capacity specified where and how their goals should be achieved, whether by new mine construction or by renovation and expansion of existing mines. Prospecting, surveying, and designing teams were assigned for each project. The amount of new capacity

(1949-55), Ministry of Coal Industry (1955-70), Ministry of Fuel and Chemical Industry (1970-75), and Ministry of Coal Industry (1975 onwards). For consistency, the Ministry of Coal Industry is used throughout this paper.

[8] The National Coal Ordering Conference was hosted by the central government to arrange the following year's coal production, consumption and transportation under unified distribution. It was renamed the National Coal Negotiation Conference in 2002. For consistency the National Coal Ordering Conference will be used throughout this paper.

[9] The unified distribution coal was usually transported by the railway.

[10] These three categories were formed under central planning. For consistency, their original titles will be used throughout this paper even though they were renamed later.

created each year was directly related to the investment funds allocated to the Ministry of Coal Industry from the state budget allocation. The Ministry of Coal Industry also oversaw investment in coal washing plants, machinery plants, and railway branch lines. Between 1953 and 1978 China's coal industry received a total of 349.5 billion RMB[11] in state investment compared to 457.7 billion RMB for the electricity industry (National Statistical Bureau, 1981).

Pricing

In the Chinese centrally planned economy, prices had several main functions. First, price was used as an accounting device in the tabulation of the annual and five-year plans. The inputs and outputs of each enterprise, as well as targets for sales, profits, taxes, etc., were calculated by the central planners and expressed in value terms; enterprise managers were evaluated on the basis of their fulfillment of these targets. Prices were based on average production costs, and may have included a turnover tax or subsidy and a wholesale and/or retail profit margin. There was no consistent relationship between prices and demand. Second, prices were used for mobilizing resources in that the prices of agricultural and upstream products were kept artificially low while the prices of final industrial and downstream products were kept high. The distorted price system meant that state owned downstream industrial enterprises were extremely profitable, thus giving the government the fiscal capacity to mobilize resources.

The prices of coal from the unified distribution mines were tightly regulated and set very low by the central government in order to boost downstream activities, like electricity production, as well as to prevent inflation. The 'producer' or 'supply' price of coal in each of the provinces was strictly a function of production costs plus local transportation costs. The production costs were calculated as the average of annual operating costs per ton incurred by the state underground mines operating at peak levels, and excluded any investment costs sustained in the preliminary stages of mine development. From 1949 to 1985 there were only four nationwide increases in average state mine producer prices (Table 2).

Table 2 Coal price adjustments nationwide Unit: Yuan/ton

	1958		1965		1979		1985	
Raw coal	Before adjustment	After adjustment	Before adjustment	After adjustment	Before adjustment	After adjustment	Before adjustment	After adjustment
Selling price	10.99	13.44	15.33	17.34	15.91	20.98	23.81	26.86
Cost	9.28	10.20	14.34	15.78	13.54	17.80	17.80	23.37

Source: Zhang, 1989. Note: Some local price adjustments in interim periods not shown here.

The under-pricing of coal resulted in a severe shortage of coal supply. From roughly 1972 onwards the non-state mines were allowed to sell their coal at market negotiation prices in order to increase the output and mitigate the coal supply shortage.

Performance

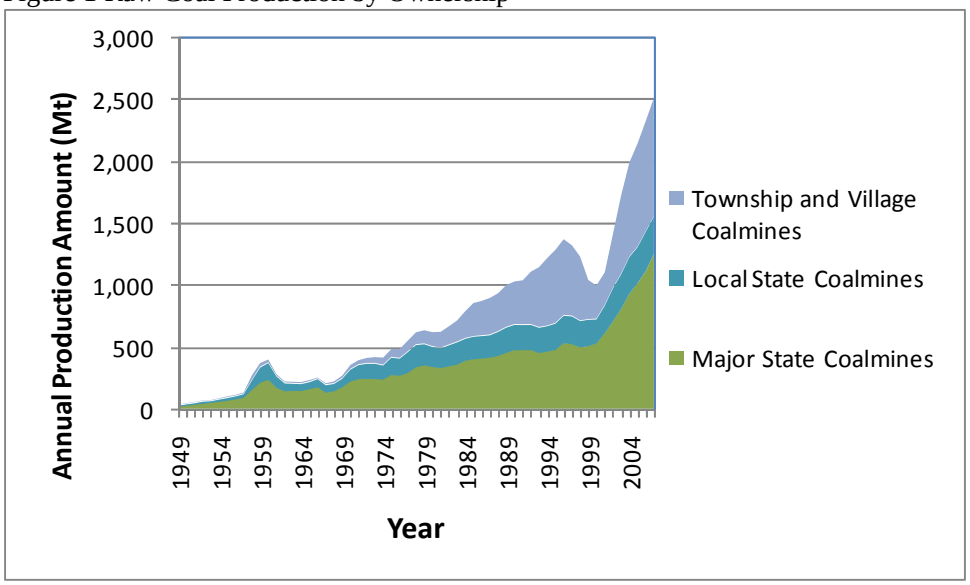
Productivity improvement was slow even though in 1978 China's coal production was nearly 618 million tons, placing it third in the world after the USA and the USSR (in 1949 China's coal production was ninth in the world). Output per man shift, rising from an average of 0.36 tons in 1949 to 0.93 in 1978, was a fraction of what it was in the other large coal producing countries. For example, in 1974 this average was 2.44 in the USSR, 3.41 in the UK, 4.06 in West Germany, 4.15 in Austria and 9.60 in the USA. Output per

[11] RMB is the currency unit in China. The exchange rate of RMB was over-valued by Chinese government during the central planning period. In 1993 a market-based exchange rate of RMB was initiated. In 2008 1 US dollar equals to about 6.8 RMB.

man shift in China was similar to India's 1970 output of 0.73. Therefore, the growth of coal production was mainly attributed to higher labor input, not capital investment. From 1957 to 1978, the employees of the state coalmines increased from 0.3 to 4.1 million, but the mechanization level (extraction and tunneling) increased from 4.1% to only 32.8%.

Although production was dominated by the central coalmines, local coalmines also developed steadily in number and capacity. In 1952 1.4% of the national output came from the Township and Village Coalmines; by 1978 this total was 15.4% (Figure 1). This was partially due to its price limit on non-state mines being lifted in 1972.

Figure 1 Raw Coal Production by Ownership



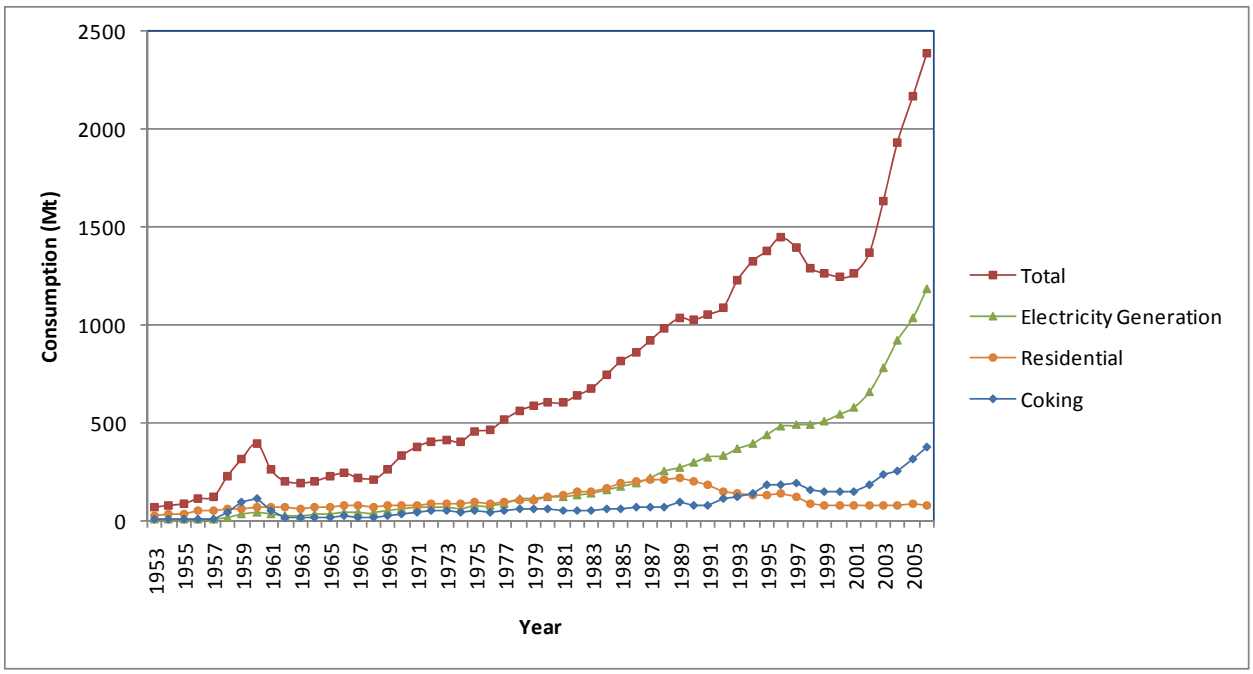
Source: China Coal Information Institute, various years.

The Ministry of Coal Industry was charged with the task of balancing the regional production and consumption of coal. China's highest quality coal, high in calorific value but low in sulphur and ash level, is found in West China: Shanxi, Shaanxi and Inner Mongolia. However, consumption was (and still is) much higher in East China.[12] In 1952, East China's production share of coal nationwide was 13.0% while its consumption share was 36.3%, leaving a deficit of 23.3%. In 1978, East China's production share increased to 17.3% while its consumption share decreased to 34.9%, leaving a decreased deficit of 17.6%. This regional imbalance required the central government to carefully co-ordinate the production, transportation and consumption of coal.

Under central planning, it was a priority to allocate as many resources as possible to develop the heavy industries. Steel production was initially prioritized, but afterwards the development of power generation was deemed more important (Figure 2).

Figure 2 Coal Consumption by End-use

[12] There are six administrative regions in China. East China includes Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong; North China includes Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia; Northeast China includes Liaoning, Jilin and Heilongjiang; Southcentral China includes Henan, Hubei, Hunan, Guangdong, Guangxi and Hainan; Southwest China includes Sichuan, Chongqing, Guizhou, Yunnan, and Xizang; Northwest China includes Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.



Source: China Coal Information Institute, various years.

Despite its growth, the coal industry was afflicted by the unavoidable flaws of central planning, such as economic inefficiency and chronic shortage. These inefficiencies existed because the coal sector faced soft budget constraints under planning administration. The state coalmines got their investment capital funding from the state budget allocation without the need to repay it, and the allocation for miners' salaries was based on the number of employees. The chronic shortage in coal production was due to under-pricing of coal. In 1957 50% of China's major mines had financial deficits and in 1977 the proportion of major mines nationwide with deficits had reached 73%. Instead of a steady increase in profits per ton, there were large fluctuations of outputs and profits. The volatility in profits greatly affected production in that there was never enough capital available on a sustainable basis to re-invest and to increase the levels of mechanization, processing and storage capacity. In turn, the chronic shortage in coal production led to a power supply shortage.

III. Introducing a Market System to the Coal Industry (1979-1992)

Market mechanisms were introduced to the economic system after the 'reform and opening up program' was initiated in 1978. Even though the central planning system and heavy-industry-priority strategy created an important heavy industrial base, efficiency was very low. The industrial growth rate was high in the 1950s, but slowed during the 1970s. The combination of a low industrial growth and high unemployment generated profound dissatisfaction with the Soviet central planning system. In response, markets were accorded a greater role in the planning process after the 'reform and opening up program' was initiated at the Third Plenary Session of the 11th Central Committee on December 18, 1978. The assumption was that system transformation from central planning to a market economy would have to take place concurrently with economic development. This reflected China's approach to economic transition; market incentives were introduced and combined organically with central planning. The overarching vision was that the process of economic development would drive market transition forward and guarantee its eventual success.

After the initiation of market-oriented reforms, the priority of state energy development was changed. The

focus of the Chinese government shifted away from national defense to overall economic development. The program of priority of heavy industry development was phased out and in turn the state direct investment in the coal sector was reduced. Electric power became the center of state energy development. Hydro power was given priority to develop because hydro power resources are abundant in China (Zhou and Wang, 2001).[13] By the initiation of the reform and opening up program in 1978, electricity shortages had become the main constraint on economic growth; 20%-30% of industrial production capacity could not operate normally due to the shortage of electricity. The consequence of the adjustment of state energy development priority was that the strategic position of coal in the central planning system was diminished. At the same time, coal production had to be increased very rapidly to meet the new demands of economic development. In 1982, the Twelfth Plenary Meeting of the Chinese Communist Party decided that GDP should be tripled by 2000 in the light of Deng Xiaoping's slogan 'development is the paramount force' (Wu, 2005). In order to fuel economic growth, coal production was to be doubled by 2000, from 600 million tons to 1.2 billion tons. This brought new challenges to the coal sector.

The local governments became important players after the initiation of the reform and opening up program. In addition to delegating power to and sharing profit with state-owned enterprises, the central government also delegated power to and shared profit with local governments in order to give local governments more incentives to develop the local economy. As a consequence, the central government's monopoly over industry was reduced. In the mid-1980s, the guiding principle of "keeping public ownership as the mainstay of the economy and allowing diverse forms of ownership to develop side by side" was put forward (Wu, 2005). This provided opportunities for non-state enterprises, especially rural industries, to take advantage of large potential profits in the industrial sector. Their activities were usually unregulated and lightly taxed.

A market system was introduced to the coal sector and regarded as the necessary way to increase coal output while mitigating the state fiscal burden. The "two-leg walking" strategy, which encouraged growth of both the central mines under central planning and local mines outside central planning (in particular Township and Village Coalmines) to develop, was adopted even though the central coalmines were much more important than local coalmines in terms of resources and technology.[14] These reforms caused a series of changes in the areas of administration, finance and pricing in the coal sector.

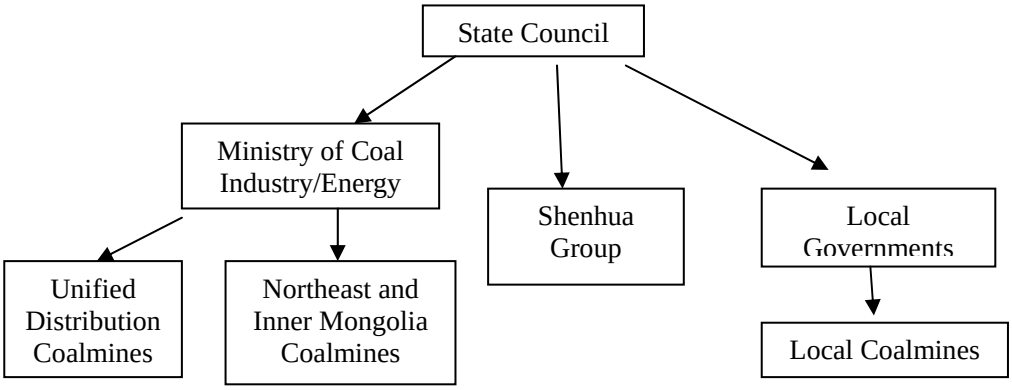
Administration

A 'two-level' administration system, central and local, was adopted in accordance with the "two-leg walking" strategy (Figure 3). At the central level, the Northeast and Inner Mongolia coalmines were separated from the unified distribution coalmines because in the Northeast region the coal resource was depleted while in Inner Mongolia the coal resource was rich but the public infrastructure (including transportation and power) was poor. The Ministry of Coal Industry, which was originally responsible for the unified distribution coalmines, lasted until 1988 and then merged into the Ministry of Energy. The central government started the construction of the Shanxi Coal Base[15] and created the China Coal Import and Export Corporation (China Coal) to absorb foreign direct investment[16] in 1982. Even more important, it initiated the general contract system for the input and output of unified distribution coalmines in 1985. The general contract system in the coal industry is a policy of delegating powers to

[13] Ministry of Electric Power and Ministry of Water Resource were merged in 1982 to facilitate the development of hydro power.
[14] Another way to spur the coal production was to increase the coal price, but it was not feasible because the inflation was severe in 1980s (the growth rate of retail price index was 8.8% in 1985 and 18.5% in 1988 respectively on a year-year basis).
[15] The Shanxi Coal Base includes the Shanxi, the northern part of Shaanxi, the western part of Inner Mongolia, Ningxia and the western part of Henan, which are all neighbors.
[16] The coal resource for opencast mines is mainly in Inner Mongolia. The use of foreign technology was stressed because it would be more expeditious to use the latest technology available elsewhere rather than develop China's own. The opencast mines were selected since they were suitable for big-sized mechanization technology. The production per year of opencast was generally twice as much as from underground mines, construction time length was at least 25% less, construction and operation costs were lower, and working conditions were safer.

and sharing profit with lower levels; the Ministry of Coal Industry entered into contracts with the state first, then sub-contracted with the unified distribution coalmines. The contracts included both production output and planned loss. The general contract approach abandoned the planning system of coal distribution, enhanced the enterprises' power of self-determination, and increased their production incentives.[17]

Figure 3 Administration of Coal Sector



The Shenhua Group remained outside of the Ministry of Coal Industry and was directly administered by the State Council. The central government initiated production at the Shenhua Group in 1985, which had the Shenfu Dongshen Coal Fields located on the border of Inner Mongolia and Shannxi. The total recoverable reserve of the Shenfu Dongshen Coal Fields is 22.3 billion tons compared to 110 billion tons nationwide. Because of these incredible resources, Shenfu Dongshen was planned as China's most important future coal base, with the Shenhua Group overseeing this project.

At the local level, the "two-leg walking" strategy transferred the administration of small sized coalmines from the central to local governments in order to increase overall output. Local governments or coal departments could approve mining permits to small mines. In April 1983, the State Council approved the "report on eight measures for accelerating the development of small scale coalmines" and ordered all jurisdictions to implement it (Zhou and Wang, 2001). Communes, brigades, and all trades and industries were encouraged to operate mines, and citizens were encouraged to pool finances to support the mines. Areas which were short of coal could operate mines in partnership with other areas that had abundant supplies. Small mines could extract resources belonging to the state mines that could not be mined by the large mines. The operators of locally produced coal could haul and sell their coal anywhere at a negotiated price. However, if rail transport was required, the coal would be put under unified distribution.

Finance

The fiscal budgetary system of China in 1980 was switched from the unitary system[18] to the responsibility system[19] in order to improve the efficiency of capital usage. The source of investment in fixed assets of state-owned enterprises shifted from state budget allocation to bank loans. A "revenue-sharing system" between central and local governments was introduced in order to bring into play the enthusiasm of local governments.[20] By doing so, the relations between the central and local governments

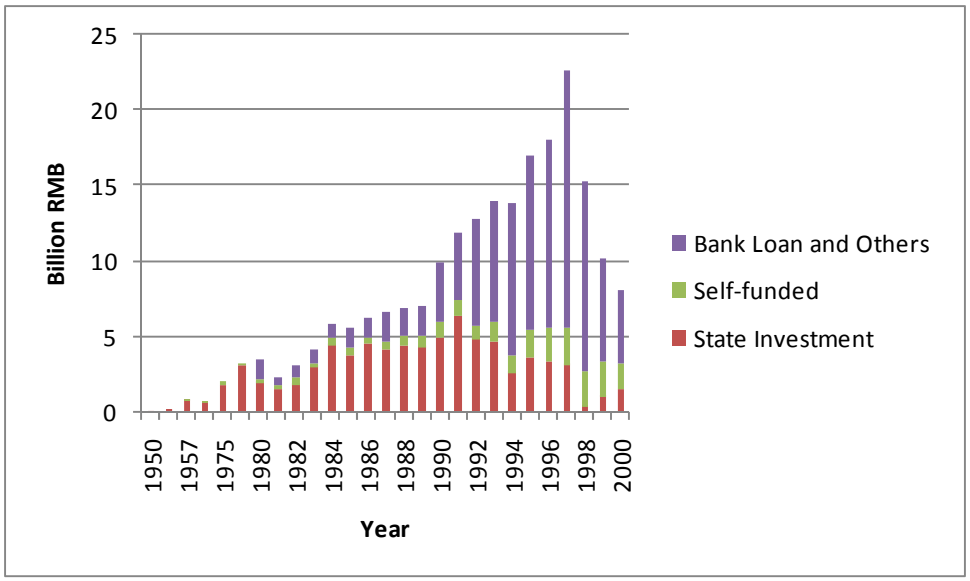
[17] The Ministry of Coal Industry took marketing authority back from National Material Bureau. Unified distribution coalmines could sell the coal directly to the end-users at the regulated prices.
[18] State-owned enterprises forwarded their profit to the government and also got funding from government budget allocation and were not required to repay the funds.
[19] Under the responsibility system firms must repay investment funds given as loans but have authority to choose projects.
[20] Under this new fiscal administration system, revenue usually was shared between the central and local governments according to predefined formulae.

were changed. The local governments were given incentives to boost the local firms including local coalmines.

After the initiation of market-oriented reform a series of financial reforms were put underway. From 1979 to 1985, specialized banks[21] were created and the People's Construction Bank of China became the bank specializing in financing investment in fixed assets. In 1983, the State Council decided that the People's Bank of China (PBC) should focus on its role as the central bank.

The fiscal and financial system reforms extended to the unified distribution coalmines. Under the 'general contract of input and output', the financing of basic construction investment in unified distribution coalmines shifted from state budget allocation to state loans and was operated by the Ministry of Coal Industry and the Energy Investment Corporation, which was established by the central government to deal with state loans for energy projects (Figure 4). At the same time, the profit-forwarding system shifted to a tax-collecting system, and the state coalmines were given the authority to retain a share of profit for re-investment. From 1985 to 1993, the amount of state loans awarded to mines totaled 35.2 billion RMB. The switching of financing for basic infrastructure construction from the state budget to state loans caused a heavy debt burden on Major State Coalmines mainly because the coal prices were not liberalized. During this period, multiple sources for financing outside of the tate budget plan were created, for example, 'coal replacing oil' loans (interest rate 2.4%), loans from People's Construction Bank of China (interest rate between 6.48% and 9.9%), construction bonds (interest rate 6%-11%), foreign government loans, and World Bank loans (interest rate 8%). From 1985 to 1993, the amount of bank loans exceeded 31.4 billion RMB.

Figure 4 Annual Investments at Major State Coalmines



Source: China Coal Information Institute, various years.
Note: State investment includes state loan under budget plan.

Only Shenhua Group[22] was the beneficiary of continued state budget allocation (Figure 4). The total

[21] There were four specialized banks: The Industrial and Commercial Bank of China, The Agricultural Bank of China, The People's Bank of China, and The People's Construction Bank of China. These banks later were converted to commercial banks.
[22] Another coal project, Yimin, was set up by the Huaneng Group which is the biggest electric companies owned by the central government, and planned to be put into operation in 1993. The planned capacity of coal production was 5 million ton per year and was used to generate electric power.

investment in Shenhua was planned to amount to 89 billion RMB from 1985 to 1995. By this time, the group was made up of the Shenfu Dongshen mines, pit mouth power plants, Shenhuang double tracking electrified railway and the Huanghua coal transport sea port.

After market access was relaxed under the 'two-leg walking' strategy, millions of local coalmines entered the market, receiving funding mainly from local communities.

Pricing

The unified distribution coalmines under the general contract adopted a dual-track pricing system: planned price and floating price. The non-unified distribution coalmines had a uniform pricing system: market price (negotiation or spot prices).

The dual track pricing system was applied as an incentive to increase production. Above-quota output that the state mines produced could be sold to the state at 50% (later changed to 70%) above the plan price, or on the open market at a floating price. However, during the years the general contract was in effect, the average selling price of raw coal was lower than the production cost because the plan price was fixed while production cost increased rapidly due to severe inflation[23], causing most unified distribution coalmines to lose money. The general contract included clauses on losses. In order to make up for the difference between production costs and selling prices, the Ministry of Finance subsidized the industry by 300 million RMB per year between 1985 and 1990, with the provision later extended to 1992. If the enterprises incurred losses beyond those expected, they were to cover these losses. If, on the other hand, the losses were less than anticipated, the subsidy was to be shared, with 60% going to the enterprises and 40% to the state. However, the subsidies could not compensate for the losses and the mines did not have the capacity to invest and develop on their own. By 1988, 80 out of 86 unified distribution coalmine bureaus were operating at a loss.

Since 1972 non-unified distribution coalmines had been permitted to sell their coal at market prices, and as a result their coal selling prices were much higher than the planned price in the main coal consumption markets. For example, the market prices of coal were usually 50% to 100% higher than planned prices in Shanghai, Nanjing and Suzhou during this period (Tian and Qiao, 1991).

Already, the central government's reliance on limited market pricing to increase coal output was shifting production incentives away from the central government-owned unified distribution mines and towards locally controlled mines. The consequence was that a larger share of production was controlled at the local level and the local governments and miners became important players in subsequent reforms in coal sector.

Performance

Coal production in China witnessed a great expansion in response to the new incentives (the combination of output-based incentives and market signals) at both unified distribution mines and local mines. The "two-leg-walking" program helped increase coal production from 635.5 million tons in 1979 to 1.1 billion tons in 1992, close to the objective of 1.2 billion tons by 2000. Major State Coalmines' production increased from 357.8 million tons in 1979 to 482.5 million tons in 1992; local coalmines' production increased from 277.8 million tons in 1979 to 632.0 million tons in 1992, surpassing the Major State Coalmines (Figure 1). Local governments had many incentives to develop local mines: developing the local economy, creating jobs and improving living standards of local residents.

Productivity improvement was faster than before. Under the general contract system, the gross revenue of unified distribution coalmines was linked to the coal output, so the operators of the unified distribution

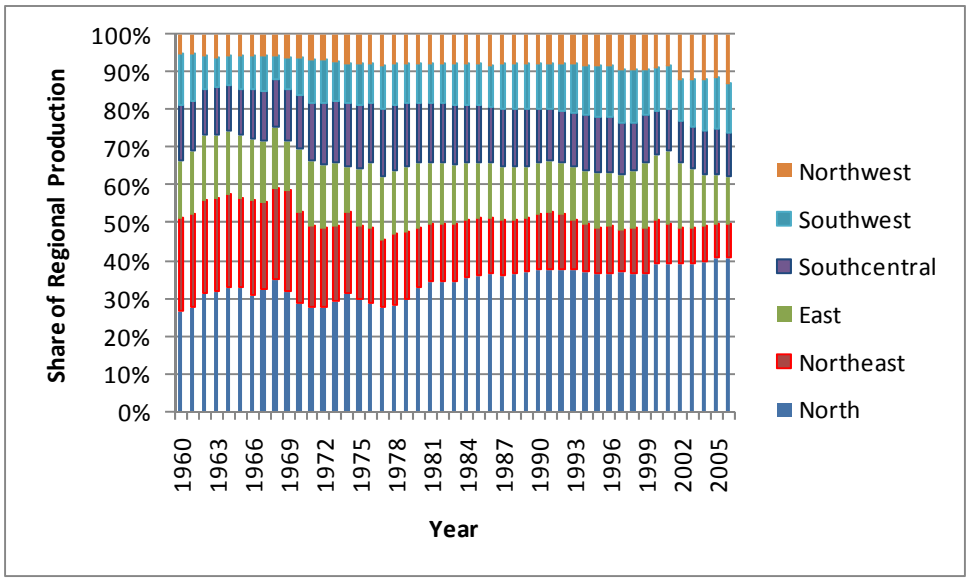
[23] The annual growth rate of the retail price index was 8.8% in 1985 and 18.5% in 1988, respectively.

coalmines had the incentive to increase the use of machinery and equipment and decrease the use of laborers. In terms of extraction, tunneling and loading, the mechanization level of Major State Coalmines increased from about 30% in 1979 to more than 70% in 1992. However, the size of the work force decreased; in 1985 the number of employees decreased by 110,000 while the production increased by 11.6 million tons. Productivity increased in that each unit increase in output required less labor input. Output per man shift at the Major State Coalmines improved from 0.912 tons in 1980 to 2.180 tons in 1998. Output at Local State Coalmines also increased from 0.583 tons in 1985 to 0.795 tons in 1994.[24]

The favorable policies for small coalmines and small thermal power increased the coal consumption for power generation, particularly in rural areas.[25] The share of coal for power generation increased from 20.3% in 1980 to 28.9% in 1990. By the mid-1990's, local coal-fired power generation was one of the main sources of rural electrification (Peng and Pan, 2006).

Regional coal imbalances widened as East China became the manufacturing base and coal consumption center while North China grew into the coal production base. In 1979, the central government began market-oriented reforms that spurred economic growth, in particular along the east coast. In 1985, East China imported 63.8 million tons of coal from other regions; by 1990, 109.5 million tons of coal were imported. The locations of coal production and consumption were now driven by market forces instead of central planning. Coal resources were much richer and mining cost was much lower in Shanxi, Shaanxi and Inner Mongolia. For example, in 1985 the production cost of local coalmines was 16.8 RMB/ton in Shanxi, 24.7 in Hebei, 25.5 in Henan and 32.6 in Shandong (Shanxi Academy of Social Science, 1986). There was a rush of mine development in Shanxi, Shaanxi and Inner Mongolia once the restrictions on local mines' development were lifted in 1983 (Figure 5). This regional imbalance affected internal coal flows and rail networks. In 1986, the coal transported by railway was 531.1 million tons; in 1992, this increased to 641.1 million tons. This increased the importance of transportation as well as the exposure to transportation constraints.

Figure 5 Production Share of Raw Coal by Region in China



[24] There is no nationwide data about the productivity of TVEs. But it should be very low due to primitive technology.

[25] Because the central government was unable to supply the financial resources required to satisfy the surging power demand, it issued 'provisional regulations on building power plants by fundraising and practicing multiple electricity prices' and 'regulations on electricity price of small thermal power plant'. The central government also transferred the administration of small thermal power to the local government. However, in 1999 State Council proposed 'notice of issues concerning the closing down small thermal power units' in order to improve the efficiency of coal-fired power generation (Zhou and Wang, 2001).

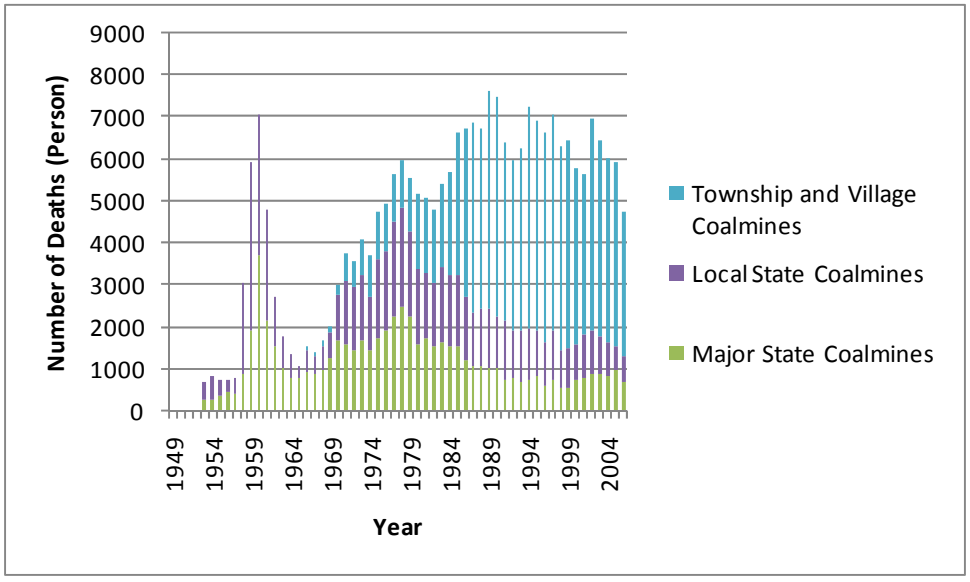
Source: IEA 2009, calculated by author.

The market reforms did not influence all sectors equally. By the late 1980s the permitting procedure for small sized coalmines belonged to the local administration and was a much simpler process. But railway access was still limited to unified distribution coalmines, which limited the ability of local mines to bring coal to the market.

Since the unified distribution coalmines obtained access to the rail transportation while local coalmines did not, China's coal market has been divided into two distinct markets, national and local, that operate in fundamentally different ways. The national market is connected by railway transportation and populated by larger producers supplying higher quality coal. Often this coal is intended for consumption by the big end-users such as key national electric power generators. Price in the national market is still strongly influenced by the central government. The local market is usually populated by smaller producers, with transportation generally by truck and limited to shorter distances. The average delivery distance is about 80 km by road (compared to 550-570 km by rail in the national market). Cost structures and pricing mechanisms for these local coal producers are sensitive to localized political and economic factors, with market oversight occurring at the provincial or local level.

Even though the development of the Township and Village Coalmine operations spurred production, these mines had a harmful impact on other aspects of the Chinese coal industry. The Township and Village Coalmine wasted coal resources and caused frequent accidents. The average production capacity of a Township and Village Coalmine was just 1% of a typical Major State Coalmine, and its recovery rate was 10%-15%, compared to 70%-80% for Major State Coalmines. Furthermore, the safety record of Township and Village Coalmine was poor (Figure 6).

Figure 6 Number of Coalmine Deaths by Accident



Source: China Coal Information Institute, various years.

IV. Establishing a Market System in the Coal Industry (1993-Current)

By the 1990s, broader reforms in the Chinese economy were continuing to replace central planning with market mechanisms. Even though the combination of market and central planning increased output, it also caused market distortions. Each commodity had two different prices: the planned price and the market

price. Furthermore, the State Owned Enterprises had a much lower selling price and a much heavier tax burden compared to the Township and Village Enterprises. In order to reduce some of these obvious distortions in the economy, the Fourteenth Central Committee of the Chinese Communist Party in 1992 decided that China should work towards becoming a 'socialist market economy' (Wu, 2005). The objective of these reforms was to separate the government administration from business operations, create enterprises that were truly market players, and unify the market so that different enterprises could compete fairly in the market. The Company Law[26] was put into effect at the beginning of 1994. China entered into World Trade Organization (WTO) on December 11, 2001, which created a further push for investment liberalization and ownership diversification.

During the first period of reform, energy production developed rapidly and fueled economic growth, but efficiency was low, especially for small coalmines and small thermal power plants.[27] Furthermore, other energy supply situations changed significantly; hydro power could not keep up with the pace of economic development,[28] and in 1993 China became a net importer of oil. The new insufficiencies of energy supply for economic growth caused a shift in priority of state energy development in 1996. Energy conservation was given top priority, and a series of measures were adopted to improve energy efficiency.[29] First, energy production and consumption was to be restructured with the objective of increasing the size of enterprises to achieve economies of scale. Second, advanced technologies were to be disseminated in an effort to increase energy production efficiency. This adjustment of state energy development priorities was favorable to the Major State Coalmines but not favorable to the small coalmines, since small coalmines used more primitive technologies.

Management responsibilities between central and local governments were divided more clearly after the initiation of a program of separating government administration from business operations in 1993. The central government moved towards regulation and macroeconomic management, and the local governments played a pivotal role in implementing the central government's policies, with greater authority within their jurisdiction.

According to the objective of establishing a "socialist market economy" and the requirement under the new state energy development priorities to conserve the energy, the market was to be unified and the "two-leg walking" strategy was to be phased out in the coal sector; the unified distribution coalmines were to be pushed towards market competition; and the local coalmines were to be upgraded or closed. Market reforms now extended to the entire coal sector. All of these reforms caused significant changes in the areas of administration, finance and pricing in the coal sector.

Administration

In 1993 the Ministry of Coal Industry was reconstituted when the Ministry of Energy was phased out. The two-level, national and local, administrative system continued to the first half of 1998 and then dissolved. Later in 1998, the Ministry of Coal Industry was phased out and the relevant macroeconomic management functions were transferred to the State Economic Trade Commission and later to the National Development and Reform Commission (NDRC) because it was not considered necessary to have an independent coal ministry after the coal sector had been pushed to market competition. Following this, the administration of the 94 unified distribution coalmines bureaus was decentralized and transferred to the local authorities and the administration of the Northeast and Inner Mongolia coalmines was also transferred to the local governments. With the exception of Shenhua Group, the administration of the coal sector has been decentralized, and the central government focused more on administration of environmental protection and safety. The central government initiated several programs to upgrade or

[26] The objective of the Company Law is to separate the government administration function from business operations.
[27] The power generation efficiency of small thermal is about 600 gram coals per KWh, only one half of big thermal plants.
[28] That is due to the controversy issues of environmental degradation and residential reallocation, etc.
[29] The Energy Preservation Law in China was put into effect on January 1st, 1998.

close local coalmines. In March 1994, the State Council proposed a program of support, renovation, adjustment and upgrading for Township and Village Coalmines. In December of 1994, the State Council issued a management statute for intended to slow the production of local coalmines. In 1996, the "coal law" was put into effect to control the mining activities of Township and Village Coalmines. However these measures were not successful in slowing the boom in local mines, and the Township and Village Coalmines' production of raw coal kept increasing (Figure 1).

The key factor which led to the transfer of Major State Coalmines from central to local governments was the change of the relationship between central and local governments. Even though the central government wanted to reduce the output of local coalmines and give more market space to the Major State Coalmines, the local governments had every incentive to support the local coalmines, which competed for resources and market share with Major State Coalmines. During the Asian financial crisis of 1997, excess coal supply capacity started to appear. The brunt of the decline in demand was shouldered by the central mines because the local mines refused to roll back production. Sixty percent of Major State Coalmines stopped production partly or completely. By the beginning of 1998 the unused production capacity had reached 90 million tons. Major State Coalmines lost 3.75 billion RMB during the first three quarters in 1998. Because the Township and Village Coalmines competed for coal resources and market share with the Major State Coalmines the local government had little incentive to discourage their development. Out of a total of 61,000 small coalmines in 1998, 51,200 were illegal mines producing 430 million tons of coal. Of these illegal coalmines, 13,000 coalmines producing 114 million tons were located in the Major State Coalmines' fields. From 1993 to 1997, 639 floods and 57 gas explosions that were caused by local coalmines occurred in the fields of the Major State Coalmines and led to direct economic loss reaching 2.5 billion RMB. These circumstances drove the State Council's policy of transferring Major State Coalmines to local governments and closing small pits. According to the policy, from the end of 1998 to the end of 1999, 25.8 thousand illegal and wrongly located small sized coalmines were to be closed, and coal production capacity was to be decreased by 250 million tons.

In 1999, an experimental bankruptcy of Major State Coalmines was initiated. Of the 600 Major State Coalmines in operation at that time, more than 120 mines were running out of resources and facing large financial deficits while producing high sulfur and high ash coal. The annual production capacity of these 120 mines was 90 million tons, but in 1998 the actual production was only 50 million tons. Their deficit was 3.5 billion RMB which accounted for 88% of the total deficit of Major State Coalmines. When the central government wanted to transfer these coalmines to local governments, the local governments refused, thus forcing the mines into bankruptcy. Pilot projects including the Benxi, Longfeng, and Jixi coalmines went bankrupt, loans were cancelled, and employees and retired workers were re-settled.

Pushing the Major State Coalmines into the hands of the local governments did not mean that the mines were now independent. The local governments exerted strong influence over the behavior of the mines in the market, and the Major State Coalmines were now used by the local governments to boost the local economy and maximize local tax revenues. The consequence of transferring of Major State Coalmines is that these mines were now treated more favorably by the local governments.

The Shenhua Group started coal production in 1995 and has stayed as a central firm up to now. The first reason that Shenhua Group was not decentralized is that Shenhua Group is a vertically integrated firm requiring approval and coordination from more than four ministries and six provincial governments, each responsible for either the coalfield, or local land, or infrastructure. It would be very difficult for a local firm to coordinate these complex interests. The second reason is that Shenhua Group faces little competition from local coalmines. There are far fewer local coalmines in Shenfu Dongshen coal fields because the public infrastructure is poor.

Finance

New tax rules that applied equally to all economic participants were introduced in order to establish the

market. In 1994 the tax systems were unified, the revenue-sharing system was phased out, and the tax-sharing system between central and local governments was implemented nationwide.[30] These reforms changed the coal tax from a product tax with a tax ratio of 3% into a value-added tax with a tax ratio of 13%. They had a great impact on the coalmines,[31] with 337 billion RMB of the Major State Coalmines' former income becoming a value-added tax.

New financial rules were introduced in order to increase financial prudence. During the second half of the 1990's the banking system underwent fundamental restructuring with the objective of separating government involvement from the banking operations.[32] In 1998 the PBC was finally given a new organizational structure with a renewed mandate to conduct monetary policy. State run commercial banks soon found themselves facing tougher budget constraints, which created a ripple effect among clients in state owned enterprises. In 1993, the National Development Bank was established and started offering policy loans to spur infrastructure investment.[33]

When the 94 Major State Coalmine Bureaus were transferred to the local governments in 1998, the central government shifted from the role of creditor to role of stockholder because the coalmines did not have the capability to repay state loans. Before the Major State Coalmines were transferred to the local government, the central government continued the pattern of investment in Major State Coalmines. From 1993 onwards, the National Development Bank started offering the Major State Coalmines policy loans for infrastructure investment since most Major State Coalmines operated at a loss, mainly due to the tax policy change (Figure 4). After this transfer, the central government only invested in Shenhua Group and provided some loss subsidy to the Major State Coalmines.

Restructuring and ownership diversification of the coal sector was initiated, especially after China entrance into the WTO. The Major State Coalmines were transformed into limited liability companies, some of which had diversified ownership on domestic and foreign stock exchanges, although the state retained a controlling interest (Table 3). Local mines were absorbed into state-owned and/or private company structures.

Table 3 Coal mining enterprises by ownership in 2005

Ownership	Number of enterprises	Share of national total %	Design capacity in 2005 Mt per year	Share of national capacity %
State-owned or state-held shares	4,185	16.9	1,340.5	59.2
Collective and co-operative	11, 695	47.1	642.9	28.4
Private	8,919	35.9	278.8	12.3
Foreign joint ventures	14	0.1	2.1	0.1
Total	24,813	100	2,264.3	100

Source: China Coal Information Institute, 2006.

Pricing

[30] This fiscal reform was designed to a broader tax base by implementing the value-added tax and other business taxes and also to stabilize tax revenue relationship between central and local governments.

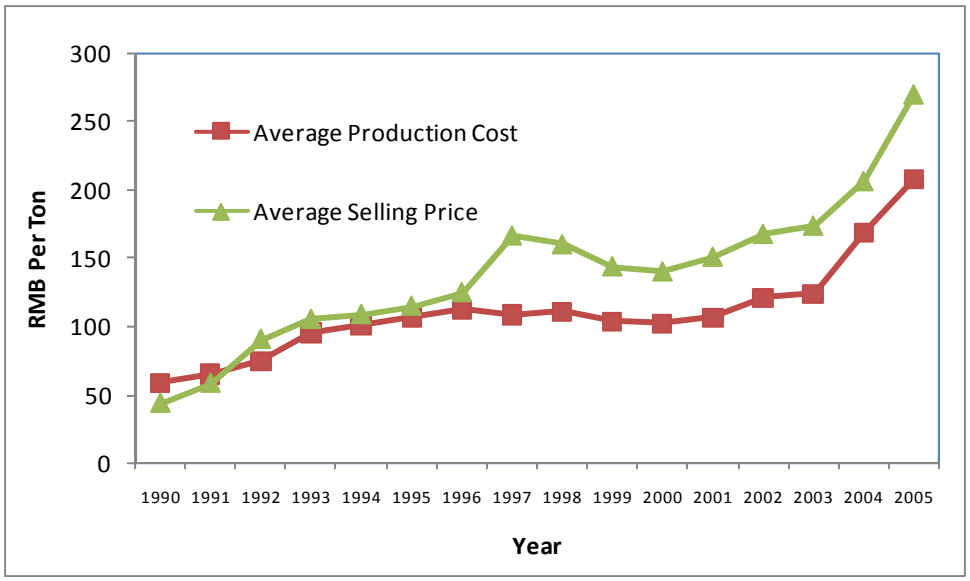
[31] From this period, coalmine is also named coal enterprise.

[32] The PBC had been nominally established as a central bank in 1983, but at that time it remained beholden to government officials at both central and provincial levels.

[33] A policy loan is usually used for public goods production or loss subsidy due to policy changes. The interest rate is very low.

The coal price of Major State Coalmines was liberalized in 1993, with the exception of coal for power generation (power coal) and agricultural uses in order to push these mines into the market. After China's economy recovered from the Asian financial crisis in 2001 power coal demand increased rapidly. But the local governments and power coal producers had no incentive to increase the power coal supply because the price of power coal was held at artificially low levels. In order to increase the production and delivery of power coal, the central government further relaxed price controls over power coal and set a guidance price for term contracts between unified distribution coalmines and key national power generators[34] at the annual Coal Ordering Conference. Since 2002 the central government has no longer directly controlled any coal price (Figure 7). In 2002, about half of China's power coal was sold by term contract through the annual National Coal Ordering Conference and half was sold in spot markets with the Qinghuangdao port increasingly acting as the leading benchmark. Since the central government no longer controls the power coal price but still controls the power price, this creates a conflict between the coal and power sectors.

Figure 7 Average Production Cost and Selling Price of Major State Coalmines



Source: China Coal Information Institute, various years.

Performance

The market-establishing and decentralizing reform of the coal sector improved productivity and, safety of operations, and the Shenhua Group grew to be the world's largest coal producer. Under the pressure of market competition, the Major State Coalmines managed to solve the overstaffing situation by re-locating employees. From 1993 to 2001, the number of employees in Major State Coalmines decreased from 3.5 million to 2.8 million. The mechanization level of Major State Coalmines increased from 70.0% in 1992 to 85.5% in 2006, and the number of deaths by accident decreased from 7,239 in 1994 to 4,746 in 2006 (Figure 6). In 2007 the Shenhua Group produced 235.8 million metric tons of coal production.

In 2000, the central government announced that the policy to close small coalmines had been successful. In 1998 and 1999 approximately 31,000 small mines with about 19% of the annual production capacity of China's coal market were closed. But throughout this period, some closed coalmines reopened surreptitiously, and many analysts argue a certain amount of coal output went unreported (IEA, 2009).

[34] There are five key national power generators in China: Huaneng, Huadian, Datang, Guodian and Zhongdiantou.

Although the central government has allowed substantial market reforms, these reforms have not easily extended to the power sector—the largest single consumer of coal to this day. In 1998, the Ministry of Electric Power Industry was eliminated and the State Power Company was created with the goal of further separating government administration from business operations. In December 2002, the central government announced its intent to create more competitive power markets. The State Power Company was dissolved and five big power companies, two grid companies and the State Electric Power Regulatory Commission were established. This unbundling and the competitive market model fit the country's general effort to replace central planning with market mechanisms. However, a "true" power market has not been established because the power price is still tightly regulated by the central government.

Because coal is the primary input into Chinese power generation[35] and coal prices have become market oriented while power prices are tightly regulated, the tension between the power and coal sectors is unavoidable and has raised concerns about electricity shortages. Since 2002 the government has been dealing with the consequences of reforms not being extended to all sectors. As the gap between term contract power coal prices and spot market prices widened (Table 4), the tension between coal producers and power generators deepened. Coal producers become increasingly reluctant to enter into contracts and key power producers have been pinched and are reluctant to pay the market price. In the National Coal Ordering Conference for 2003, coal sellers wanted to use the Qinghuangdao spot price as the benchmark for term contracts, but the coal buyers refused to accept it; eventually, the central government set a 5% price increase. Despite the price increase, 50% of coal term contracts were not signed which resulted in electricity shortages in most provinces. In the following years the government set a "price linkage mechanism" allowing power plants to apply for higher prices based on coal price increases. Because the "price linkage mechanism" would encourage coal suppliers to boost coal prices and cause the inflation, it was later cancelled. The power prices are still strictly controlled by the government.

Table 4 Average production cost, term contract price and spot price of power coal for Major State Coalmines Unit: RMB/ton

	Average production cost	Term contract price (FOB)	Spot price in Qinghuangdao
2002	121.4	132.0	270.0
2003	123.9	138.6	280.0
2004	169.0	162.5	370.0
2005	208.0	212.8	440.0

Source: Term price is from China Yearbook of Coal Industry, various years; Qinghuangdao spot price and railway transportation cost come from the China Coal Market network (CCTD).
Note: Railway transportation cost is not included in the term contract price; and average rail transportation cost is about 100 RMB/ton nationwide.

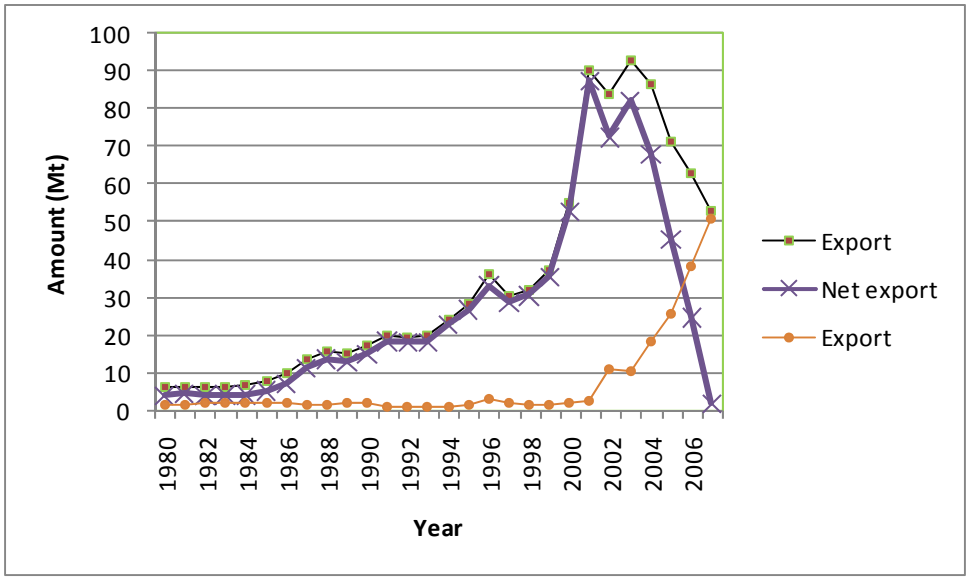
The tension between the coal and power sectors is in reality between the central and local governments. Coalmines with about 85% - 90% of China's coal production are administered by local governments. For example, Shanxi, Shannxi and Inner Mongonia together have more than 50% term contracts for power coal. Shanxi province even established a coal distribution group to manage the coal selling price. The key national power companies consume about 50% of power coal and are owned by the central government. The central and local governments need to be carefully coordinated so as to avoid disruptions to coal supply.

The tension between the coal and power sectors has had repercussions in the international coal market. Under the pressure of price increases from domestic coal suppliers, the power sector responded by going to overseas markets to purchase coal. The option to acquire coal in the international coal market is an important source of leverage for the power companies because it reinforces the negotiating power of power companies in the domestic coal market. In 2007 the amounts of imported coal increased rapidly, eventually equaling the amount of exports (Figure 8). This led to repercussions in the international coal

[35] About 80% electricity in China comes from coal.

market as Chinese power firms entered the market in response to impasses in domestic negotiations. China's reform imbalance in this way contributes to volatility in domestic and international market when firms enter and exit the market erratically.

Figure 8 China's International Coal Trade



Source: China Coal Information Institute, various years.

Conclusion

The coal sector is integral to the Chinese economy. It provides about 70% of the nation's primary commercial energy supply, generates about 80% of the electricity, and supports millions of employees.

After the PRC was founded in 1949, the coal sector was put under central planning and given priority to develop in order to boost the downstream heavy industries. The market-oriented reforms initiated by the Chinese central government influenced the coal sector directly as well as changes in the state's energy development priority and the relationship between central and local governments. Under the influence of the broader reforms in the Chinese economy, the priority of state energy development changed from the whole energy sector to electric power in particular, then later to energy conservation. Local governments were given more and more independent responsibility from the central government to boost the local economy. All of these objectives translated into market-oriented and decentralizing changes in the areas of administration, finance, and pricing in coal sector.

However, these market-oriented and decentralizing reforms have not equally extended to the power sector, now the largest single consumer of coal, and to the railway sector which connects the coal and power sectors. The fragmented nature of these reforms has had significant impacts. Because coal is the primary input into Chinese power generation, the tension between the power and coal sectors is unavoidable and has raised concerns about electricity shortages. Since 2002 the government has been dealing with the consequences of these reforms.

Even though the central government now encourages the vertical integration of coal and power to mitigate the conflict, it is important that the vertical integration process be very deliberate. The ownership of key national power companies belongs to the central government, which has control over

electricity prices and railway transportation, while Major State Coalmines except the Shenhua Group belong to the local governments, which have control over the coal prices. This creates a new tension between the central and local governments which needs to be carefully managed. The reform of electric power, as one of possible solutions to the tension between coal and power sectors, is critical.

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Reference

Ball, A., A. Hanstead, R. Curtotti and K. Schneider, *China's Changing Coal Industry: Implications and Outlook*, eReport 03.3, Australian Bureau of Agricultural and Resource Economics, Canberra,Australia, 2003.

China Coal Information Institute, *China Coal Development Report*, China Coal Industry Publishing House, Beijing, 2006.

China Coal Information Institute, *China Coal Industry Yearbook* (various years), China Coal Industry Publishing House, Beijing.

ESMAP, *Toward a Sustainable Coal Sector in China*, 2004.

ESMAP, *Economically, Socially and Environmentally Sustainable Coal Mining Sector in China*, 2008.

IEA, World Energy Outlook 2007, China and India Insights.

IEA, Cleaner Coal in China, 2009.

Lester, Richard and Edward Steinfeld, *China's Energy Policy: Is Anybody Really Calling the Shots?* Working Paper, MIT-ICP-06-002, 2006.

Lester, Richard and Edward Steinfeld, *The Coal Industry in China and Secondly India,* Working Paper, MIT-ICP-07-001, 2007.

Lin, Boqiang, Wei Weixian, and Li Pidong, "Long Term Demand of Coal in China: Impact and Policy Choice", *Economic Research*, 2007.2 (in Chinese).

National Statistical Bureau, China Yearbook of Statistics. Various Years, China's Statistical Press (in Chinese).

Pan, Kexi, Pujin and Xiangtao, "A Study on Market Concentration in China's Coal Sector", Management *World*, 2002. 12. (in Chinese)

Peng, Wuyuan, Jiahua Pan, "Rural Electrification in China: History and Institution." *China and World Economy*, 2008, No. 1, Blackwell Publishing.

Rosen, Daniel, and Trevor Houser, *China Energy: A Guide for the Perplexed*. Peterson Institute for Institutional Studies, 2007.

Rui, Huaichuan, *Globalization, Transition and Development in China: the Case of the Coal Industry*. RoutledgeCurzon, 2005.

Sagawa, Atsuo and Koichi Koizumi, *Present State and Outlook of China's Coal Industry,* Institute of Energy Economics, Japan, 2007.

Sagawa, Atsuo and Koichi Koizumi, *Trends of Import and Export of Coal by China and Its influence on Asian Market*, Institute of Energy Economics, Japan, 2008.

Schneider, Karen, *China's Energy Policy: Recent Developments and Outlook*, Australian Bureau of Agricultural and Resource Economics, Canberra, Australia, 2004.

Shi, Dan, “Review and Survey of 30 Years Reform and Opening Up in Energy Industry”, *China Energy, 2008, 6.*

Sinton, Jonathan, Rachel Stern, Nathaniel Aden, Mark Levine, *Evaluation of China’s Energy Strategy Options*, 2005. China Energy Group in Lawrence Berkeley National Laboratory.

Thomson, Elspeth, *The Chinese Coal Industry: an Economic History*. RoutledgeCurzon, 2003.

Tian Yuan and Qiao Gong edited, *Research on Price Reform in China*, 1984-1990. Beijing, 1991, p.390 (in Chinese).

Wang, Bing, “An Imbalanced Development of Coal and Electricity Industries in China.” *Energy Policy*, 2007, V35, p.4959-4968.

Wu, Jinglian, *Interpreting and Understanding the China’s Economic Reform*, Singapore: Thomson, 2005.

Xiao, Xinzhi, Qi Yingfei, and Li Hongjuan, “An Empirical Research on Effect of Coalmine Safety Rerulation in China”, *China Industrial Economy,* 2008.5 (in Chinese).

Yu, Lihong and Yu Yihong, “A Study on Vertical Regulation Model between Coal and Power Based on Value Chain Efficiency”, *China Industrial Economy,* 2006.6 (in Chinese).

Zhang, Chi and Thomas Heller, “Reform of the Chinese Electric Power Market: Economics and Institution”, in *the Political Economy of Power Sector Reform: the Experiences of Five Major Developing* Countries, edited by David Victor and Thomas Heller, Cambridge University Press, 2007.

Zhou, Fengqi and Wang Qingyi, *50 Years of Coal Industry in China*, China Power Press, 2001 (in Chinese).

Zhang, Mingli edited, *Coal Industry in Contemporary China*. Social Science Press in China, 1989, (in Chinese).

Zhou Nan, M. A. McNeil, D. Fridley, Jiang Lin, L. Prices, S. de la Rue du Can, J. Sathaye and M. Levine, *Energy Use in China: Sector Trends and Future Outlook,* Paper No. LBNL-61904, Lawrence Berkeley National Laboratory, 2007.