

環境関連財政支出および企業の環境対策による

マクロ的経済効果に関する日中比較研究

名古屋大学図書

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はじめに

新興工業国は、経済発展の初期段階から一般の公害対策に加えて地球規模での環境問題への対応が迫られている。この点で先進工業国が、当初主として局所的な環境問題（公害）への対応することで経済成長を成し遂げてきた発展過程と大きく異なる。先進工業国は経済成長を成し遂げた後に地球規模の環境問題への対応が迫られるようになったことで、先進工業国の側に、新興工業国が現在抱える環境・経済問題解決のための十分な理解があるとは言えない状況にある。経済成長とともに加速する新興工業国の環境問題解決のためには、先進工業国は、環境汚染の内部化に成功したプロセスにおける政府・企業の役割（対策）を明らかにし、新興工業国がとるべき環境対策の方向を示して行く必要がある。

現代の新興工業国（中国およびアジア NIES）は、国際市場における工業製品の飽和を考慮すれば、いっそう厳しい経済条件下で環境保護を進める必要にさらされている。この現実をふまえ、本研究は、新興工業国側の要請に基づき、環境政策がそのマクロ経済全般にもたらす効果を明確にすることを試みたもので、経済成長の維持と地球規模での環境保全を合わせた持続的経済成長のための政策立案に対し有効な情報提供を通して、新興工業国が自らの環境対策を進めていくため指針の提供を目指してきた。

この報告書は、大きく二つの部分からなっている。第一部の「**Economic Development : Environment Perspective**（経済発展：環境の視点）」は、主としてこの研究に携わった研究者の経済発展と環境保護にかかる研究成果をまとめたものである。ここでは、2000年にこの科研プロジェクトの一環として開催した国際シンポジウム「**Environment and Our Sustainability in the 21st Century: Understanding and Cooperation between Developed and Developing Countries**」において報告いただいた中国国家環境保護総局司長（部長）の彭 近新氏およびシカゴ大学経済学部ジョージ トーリイ教授の論文をプロシーディングスから再録させて頂いた。

第二部の「**Economic Growth: Regional Perspective**（経済発展：地域の視点）」は2000年に寧夏大学と共催した『中国西部経済発展国際シンポジウム』において報告された論文のうち地域開発の視点から経済発展を分析した研究を収録している。地域開発の論文を同時に収録したのは、環境問題の解決にはその地域それぞれの政府と民間の地道な取り組みがわけても重要であると私が考えたことに他ならない。発展途上国の環境問題を解決に導く鍵が、地域の経済発展パターンの厳密に分析を通して得られる可能性が高い。

第二部にも、シカゴ大学経済学部のトーリイ教授が『中国西部経済発展国際シンポジウム』に出された論文を収めさせて頂いた。この論文は、寧夏大学の呉教授や私が、シカゴ大学でトーリイ教授の主宰されている中国の西部開発に関する研究会のメンバーに加えて頂いていたことから、このシンポジウムのために書いてくださったものである。また、名古屋大学大学院法学研究科の加藤久和教授、同経済学研究科の塚田弘志教授は、この科

研のメンバーではなかったが、それぞれご専門のお立場から中国の環境問題と地域開発に資するためということで論文を用意してくださるとともに本報告書への掲載を快く了承してくださった。

本報告書の構成にかかる話に加えて、寧夏大学と『中国西部経済発展国際シンポジウム』を共催するに至った経緯、この科研プロジェクトがもたらした思わぬ波及効果およびこの報告書が英語で編集された理由について簡単に触れさせて頂きたい。

現在の中国の重点政策である「西部開発」と「環境保護」の研究を進めるべく寧夏大学西部発展研究センターが2001年10月に設立されたことから、寧夏大学副学長で同センター主任（当時 現寧夏省社会科学学院院长）の呉海鷹教授からの強い研究協力要請があった。この要請に対し、研究分担者の大分大学の薛進軍教授と相談の上、この科研プロジェクトの最終報告会を寧夏大学の『中国西部経済発展国際シンポジウム』に併せて開催することにした。中国の環境問題への貢献姿勢を明確できかつ我々の研究成果を公開できる絶好の機会ととらえ、積極的な協力を行うこととなった。もともと我々の研究は、先にも述べたとおり、先進国の公害克服の経験を経済学的に明らかとすることで環境問題に直面している新興工業国の環境政策に寄与することを目的としたものであることから、寧夏大学においてこのような形で我々の研究成果を発表する機会が与えられたことは、誠にうれしいことであった。

この研究プロジェクトでは、2002年度に西安市、桂林市、南寧市、2003年度には寧夏省で、政府の環境政策と企業の対応に関する質問票調査を実施した。この調査では、国家環境保護総局の彭近新司長および北京大学環境科学研究所の栾胜基教授の研究協力をお願いし、栾先生の大学院生をそれぞれの環境保護局に派遣してもらい、その院生が現地での調査員の指導を行うという形で企業調査を進めることができた。3人の北京大学の院生が協力をしてくれた。寧夏大学でのシンポジウムに栾先生がこの3名の大学院生を伴っていらしたが、驚いたことにはこの院生たちが、集めたデータをもとに自分たちですでに企業の環境対策に関する分析を始めており、その成果をシンポジウムで報告してくれた。寧夏大学の呉先生も、寧夏省での質問票調査のデータをもとにこの報告書の第7章に収録した研究をまとめられていた。

私は、この瞬間まで、中国において、研究者自らがデータを採りそれをもとにして自らが環境政策と企業の対応に関する分析を行い自らが政策提言を行うようになるには今しばらくの時間がかかると考えていた。このゆえに、「公害先進国・環境先進国」の日本が主導する形で、中国の環境をテーマとする研究プロジェクトを進めた。ところが、研究成果の公刊においても、寧夏大学の呉教授に先を越されてしまうといううれしい誤算が生じた。我々の研究チームの報告を含む『中国西部経済発展国際シンポジウム』での報告論文は、中国語に翻訳され《中国西部経済発展理論と実証研究》として一足先に中国经济出版社から出版された。

出版の計画段階から、この科研プロジェクトに対して研究協力をしてくださった多くの方々、さらにはこの科研の研究分担者や研究協力者から、一連の研究成果を英語版として編集してほしいとの希望が出されていた。特に、中国の研究者に、この要望が強かった。この要請に応えるべく、また我々の研究のいっそうの国際化を図るという目的を兼ね、この報告書は英語で編集することとなった。本報告書が、表紙と前書きを除き、英語版となったのはこの事情による。

この文部科学省科学研究費補助金『環境関連財政支出および企業の環境対策によるマクロ的経済効果に関する日中比較研究』を終えるにあたり、このプロジェクトに対しさまざまな形でご助力をくださった方々に対して、研究チームを代表しお礼を申し上げたい。わけでも、名古屋大学名誉教授飯田経夫先生、中国国家環境保護総局司長彭 近新氏、シカゴ大学経済学部名誉教授ジョージ・トーリイ氏、韓国エネルギー経済研究所所長李 相驥氏、中国寧夏省社会科学院院長呉 海鷹氏からはなにもものにも代え難い貴重なご助言と多くの支援を受けた。この方々のご理解なしにはこの研究プロジェクトはけっして成立しなかったといっても過言ではない。

最後に、名古屋大学経済学研究科事務局の効率的にしてかつ心のこもった研究サポートに対して感謝の意を表したい。事務長の鈴木宏治氏（ご退官）、同古田牧夫氏、庶務掛長の中山聖英氏、会計掛長の小林雪子氏（ご退官）、同林 光治氏、会計掛主任の伊藤 誠氏、会計掛事務官大場 亮氏、同小椋友明氏ほか大勢の方々の研究支援に対し感謝申し上げたい。

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Chapter 6

An Analysis of the Environmental Behavior of the Enterprises in Ningxia

Haiying WU[†]
Xiaomeng ZHANG^{††}

1. Introduction

Under Deng Xiaoping's "Open Door" policy, China enormously succeeded in its economic reform and economic development. Western region's development also made distinct progress. Its developing speed exceeds the level of previous 30 years. The western region including Ningxia, however, has been left behind with widening disparities between the east and west with regard to such conditions as economy, infrastructure, social development and so forth.

Being different with eastern China in many aspects, western region realized rapid economy growth under rather fragile ecological environment, relatively backward economy and technology. It makes insufficient resources and fragile environment face to more serious pressure. It is not possible and not permissive for the western region to follow the extensive pattern of economic development of the eastern region, which is "improvement after pollution" or "improvement during pollution". Instead, sustainable development should be followed and be made the strategic choice in the regional economic development to realize coordinated development of economy, society, resource, and environment.

In Ningxia, an Autonomous Region of western China, with its increasing growth of GDP, the industrial pollutants have increased year by year. As every yuan of GDP is produced, the amount of waste gas, SO₂, smog, waste water and solid pollutants emitted by some industrial enterprises of Ningxia is 3.4 times, sometimes even 4.83 times, the average level of the whole country, and 2.08 times the average level of the west of China. Compared with the average level of the whole country and

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that of the west of China, the disposal of “Three Wastes” in Ningxia is less effective for the reasons of being short of funds, hands and organizations of environmental protection, lack of initiative of waste disposal as well as using coal and electricity as the main energy resources. As the result of “negative externality” in economic development, the priority of the economic growth in the backward areas, low-level industrial structure and imperfect legal system of environmental protection, the environmental pollution is comparatively serious in Ningxia. Therefore, we should regard a strong sense and a good atmosphere environmental protection as a prerequisite; scientific legislation, strict enforcement of the law and effective supervision as a guarantee; reasonable and effective incentives and high-quality environmental protection staff as the motive forces; suitable technology and strict business management as the strong backing of environmental protection.

The paper is organized as follows. Section 2 reviews relationship between economic development and environment. Section 3 describes present environmental situation of western China and Ningxia, and analyzes enterprises’ environmental behavior in Ningxia. Section 4 explores the reason of environmental pollution of enterprises. And Section 5 provides environmental protection system for enterprises. Section 6 concludes the paper.

2. Relationship between economic development and environment

Economic development accumulates the wealth of the society and promotes the raising of the people’s living, meanwhile, it brings many environmental problems, which restricts the sustainable economic development the other way around. Therefore, environmental protection and economic development invariably promote and restrict each other.

When entering the age of industrial economy from that of agricultural economy, the human race takes it for granted that “development” means economic growth and neglects the harmony in the environmental, social and economic developments. When the workforce is rapidly raised the human race extorts more and more wealth from the nature and more environmental problems arise. First, the indiscriminate exploitation harms the environment, for instance, the gopher of petroleum, metals and coal quickly deduces the exploitable reserves and some resources tend to be exhausted. Second, the rapid development of industrial economy and the change of people’s consumption bring the problem of environmental pollution.

Since the 1950s, coal and petroleum have been the main energies, industries of organic and inorganic composition chemicals have been developing rapidly discharging more and more sulfur dioxide, nitrogen oxide, smoke, acid, alkali and organic waste and, environmental pollution spreads from parts of areas to the whole areas, coming to a severe public nuisance. With the increasing worsening of the global environment, more and more countries, regions and enterprises are giving environmental protection its strategic position. Western China, comparatively backward in economy, is confronted with two tasks when the Chinese government starts the Western Exploration, one being economic development and the other, environmental protection.

Economic development has to be placed on the first place to raise the social workforce, to strengthen the regional economy and to better the living of the people. Meanwhile, it gives the insufficient resources and fragile environment more pressure to develop the economy quickly in Western China where the ecological environment is fragile and the economy, science and technology are comparatively backward. It is not possible and not permissive for the Western regions to follow in its economic development the extensive pattern of economic development of the Eastern regions, which is "improvement after pollution" or "improvement during pollution", instead, sustainable development should be followed and be made the strategic choice in the regional economic development to realize the coordination of economic, social, resources and environmental developments.

3. Present environmental situation of Western China and Ningxia

3.1 Present environmental situation in Western China

China's western region includes 11 provinces, autonomous regions and municipalities under the direct administration of the central government. These include the following: Shaanxi, Qinghai, Sichuan, Yunnan, Guizhou, Ningxia, Xinjiang, Inner Mongolia, Gansu, Tibet and Chongqing. The region covers 6.8 million square kilometers, 72% of the country's land area, and has a population of 355 million people, 28% of the total population of the nation.

Despite its relatively vast size, relatively low population density, ecological environment's situation in the region is not optimistic, conversely, it makes one worried very much.

Main cities in the western region are facing to rather serious industrial pollution. Its industrial pollution intensity produced by per value-added of the industry

is much bigger than that of the national average. Air pollution index of provincial capitals in the region substantially surpasses the set standard.

Table 1 demonstrates the proportional structure of the populations, economies and industrial pollutions of Eastern China, Middle China and Western China in the years 1999 and 2000, from which it is noticed that the proportion of pollution in the three parts of China to the whole country is not proportional to that of economy and population. In 2000, the population of Eastern China is less than 39% of that of the national total, but the GDP and industrial value added are respectively 57% and 63% and the discharged industrial waste gas, sulfur dioxide, smoke, waste water and solid waste are respectively 50%, 44%, 32%, 48% and 38% of that of the national total, while the population of Western China is 28% of that of the whole nation and the territory area is 72% of the national total, but the GDP and industrial value added are respectively only 17% and 14% and the discharged industrial waste gas, sulfur dioxide, smoke, waste water and solid waste are respectively 23%, 32%, 33%, 23% and 29% of that of the national total.

For every *yuan* of GDP created the discharged industrial waste gas, sulfur dioxide, smoke, waste water and solid waste in Western China are respectively 1.34, 1.87, 1.94, 1.35 and 1.56 times of that of the national average and 1.5, 2.4, 3.5, and 1.6 times of that of Eastern China (see Table 2). The intensity of environmental pollution of Western China is much greater than that of Eastern China and the whole country in its economic development.

In the internal setup of labor division having formed in a rather long period, the enterprises in Western China, who mainly specialize in energy and raw materials including coal, electric power, petrochemicals, natural gas, non-ferrous metals, salt chemicals, paper and fertilizer, are for the most part pollution-intensive ones of large water and energy consumptions and heavily pollute the air, the water body and the solid waste with their backward technology and low harnessing of pollution, which helps form the economic setup of "high consumption of energy" and "high discharge of pollution", though the total amount of industrial pollution is not large, compared with other areas in China the pollution intensity per GDP is higher in Western China, where most of the industries are located in a few central cities and discharge pollutants in a concentrative way, severely polluting the environment of cities, for instance, Ulumqi, Lanzhou and Chongqing in China are three of the ten cities in the world where the air is most seriously polluted^①.

3.2 Present environmental situation in Ningxia and the environmental protection behavior of enterprises

3.2.1 Environmental situation and its discharging pollutants' situation of enterprises in Ningxia

With the economic growth in Ningxia, industrial pollution has become more severe. As Figures 1, 2, 3, 4, 5 have shown, from the discharged amount of industrial waste water, waste gas, sulfur dioxide, smoke and dust, it is noticed that the discharge of pollutants tend to increase with the growth of GDP.

According to an investigation of 233 enterprises in Ningxia by the Ningxia Environmental Protection Bureau in 2000, the industrial waste gas mainly comes from five industries in Ningxia, judged by the statistics of the standard pollution duty of industrial waste gas the accumulated duty ratio of 37 enterprises is 88.43% of that of all the enterprises investigated in the Region, the standard duty ratio of pollution of 7 electrical industries is 61.18%, ranking the first in the Region; that of 10 building material and cement industries is 9.30%, ranking the second; that of 9 chemical industries is 8.59%, ranking the third; that of 9 non-ferrous smelting and processing industries is 1.26%, ranking the fourth and, that of the other 14 industries is only 11.57%.

Judged by the statistics of the standard pollution duty of industrial waste water, the industrial waste water mainly comes from two industries in Ningxia, one being the papermaking industry, the most severe and noticeable industry in pollution, whose accumulated duty ratio is 84% of the duty ratio of all the enterprises investigated in the Region, the other being food processing industry, whose accumulated duty ratio is 3%. The main pollutant in the industrial waste water is chemical oxygen demand and its standard duty ratio of pollution exceeds 70%; that of volatile phenol is 16%,; that of volatile phenol is 16%, that of is 16%; that of suspended matter is 9%; that of petroleum is 1.6% and the accumulated standard duty ratio of pollution is 97%. The accumulated discharge percentage of sulfur dioxide in Ningxia reaches 85.7% and there are 14 enterprises discharging pollutants in the five trades of electric power, chemicals, papermaking, cement, iron and steel.

There are 14 major enterprises discharging smoke in the six main trades of electric power, metal smelting and processing, papermaking, cement manufacturing and chemicals, whose discharged amount is 89.13% of the total discharged amount in the Region.

There are 23 major enterprises discharging industrial dust in the trades of cement and building materials and non-ferrous metal smelting, whose accumulated discharged amount is 86.06% of the total discharged amount in the Region.

Table 3 demonstrates that for every *yuan* of GDP created, the discharged industrial waste gas in Ningxia is 3.83 times of that of the national average and 2.84 times of that of Western China; the discharged dioxide in Ningxia is 3.95 times of that of the national average and 2.11 times of that of Western China; the discharged industrial smoke in Ningxia is 4.83 times of that of the national average and 2.49 times of that of Western China; the discharged industrial waste water in Ningxia is 2.05 times of that of the national average and 1.52 times of that of Western China and, the discharged industrial solid waste in Ningxia is 2.41 times of that of the national average and 1.38 times of that of Western China.

3.2.2 Analysis of pollution control of enterprises in Ningxia

In May, 2002, sponsored by the project group of Nagoya University (Japan) and enthusiastically supported by the Yinchuan Environmental Protection Bureau, we performed a special field investigation of the environmental behavior of the enterprises in Ningxia, giving out 50 copies of questionnaire and succeeded in collecting 30copies. The following questions are noticed from the in light of the statistic data: As Table 4 has shown, the control ratio of “the three wastes” of enterprises is not balanced, with the control ratio of waste water lower than the national average by 23% and lower than the average of Western China by 12% and, the control ratio of waste gas is on the whole equal to that of the average of the country and Western China. The annual control of industrial solid wastes is not balanced. The large enterprises generally have environmental protection behavior, but the control ratio is low, while the small enterprises, have no environmental protection behavior, discharging the produced waste water, gas and matter directly into the environment without any handling. Though large in number, the small enterprises do not pollute the environment heavily each.

The capital for environmental protection is fairly insufficient and concentrated. Though the total annual investment for environment keeps growing, it is limited to a few large papermaking industries among the enterprises investigated. In the year 2001, the total accumulated investment for environment of Zijinhua Co. Ltd, the 9597 Plant, the Helan Papermaking Plant, the Qingtongxia Papermaking Plant and the Meili Paper Industry reaches 81.9442 million *yuan RMB*, accounting for 49% of

the total investment of the enterprises investigated for environment. In the second place, the total investment of the Darong Chemical Co. Ltd for environment accounts for 13% and that of the Ferroalloy Plant of the North-West Bearing Co. Ltd, 21.5%. The capital for environmental protection mainly comes from the profit of the enterprises and the loan from banks and that from the government and from the returned discharge expenses. During 1999-2001, the investment of the enterprises investigated for environmental protection from the retained profits was 95.7025 million *yuan RMB* (of which the Darong Chemical Co. Ltd invested 85.83 million *yuan RMB*), accounting for 28% of the total investment for environmental protection; the loan from the government for environmental protection accounts for 0.6%; the returned discharge expenses accounts for 1.57% and the loan from banks accounts for 42%.

“The Three-simultaneous System” is paid attention to by most enterprises. Among the 30 enterprises investigated, 20 of them have implemented the system, accounting for 67%; 8 of them have not, accounting for 27% and 2 of them did not give reply to this question.

The enterprises do not pay sufficient attention to environmental protection. It is noticed in the investigation that most of the enterprises do not have special organizations of environmental protection and the function of environmental protection is performed by the “Production Section ” or “Administrative Section of the Enterprise”, with only 2 or 3 part-time employees responsible for environmental protection, who know little of the situation or data of environmental protection of the enterprises.

The energies consumed by the enterprises are mainly coal and electric power. All the 30 enterprises investigated consume coal and electric power and no enterprise consumes natural gas.

4. Analysis of the reason of environmental pollution of enterprises

4.1 The external diseconomy

“The external diseconomy” is the economic source of environmental pollution. The environmental problem is characterized by external diseconomy, namely, the unfavorable effect of the behavior of the market body to the environment is born by the third party —— other person or successor. External diseconomy demonstrates itself evidently in common resources and goods such as sea fish, stray, air and water. When a market body is allowed to overexploit the common resources without control or payment and discharge pollutants to the environment, it obtains all the positive benefit

and leaves the negative benefit to other developers, exploiters and successors. It is because the cost of environmental pollution is not undertaken by the polluter that the polluting body is not willing to spend a lot of money on protecting the environment and other actions. Therefore, protection of the environment becomes “an blind area” in the market economy.

4.2 “Priority to economic growth” and “Local protectionism”

The thoughts of “priority to economic growth” and “local protectionism” in backward regions indulges environmental pollution. Situated in the West of China, Ningxia is the 29th in the total GDP in the recent years, only slightly higher than Tibet and the Qinghai Province, so the large economic difference makes unavoidably the government’s principal thought of surrendering environmental protection to economic growth.

4.3 Weak legal system of environmental protection

Weak legal system of environmental protection cannot hold back environmental pollution. Either in the developed or underdeveloped regions, a steering thought in the present system of environmental protection is that environmental protection is the government’s task and the consumers and enterprises have to obey passively the regulations, who are not encouraged to obey the regulations consciously and who take the opportunity of the defects in the policy to make their own profits when the supervision is weak or the law is not forcefully executed.

4.4 Low level of industrial structure

The principal reason for environmental pollution in the enterprises in Ningxia is the industrial structure of low level. The industrial production is at present concentrated on coal, electric power, metallurgy, chemicals, papermaking and mechanical processing and most of the industrial enterprises heavily pollute the environment, who discharge a large amount of pollutants and control pollution insufficiently due to the low level of technology (See Table 5).

5. Supplying environmental protection system for enterprises

5.1 The popularization of environmental protection conception

The popularization of environmental protection conception is the guidance to the design and implementation of the system. The forming of environmental protection concept is the guidance to the environmental protection behavior, so the consciousness of environmental protection of all the citizens ought to be raised through media reports, public supervision, lectures of environmental knowledge, picture propaganda and other forms. The discharge of pollutants, accidents of pollution, the discharge of enterprises heavy in pollution and their products ought to be exposed at random on the media and supervised by the public. Great social pressure ought to be given to the polluting enterprises so that a fine atmosphere of environmental protection forms in the whole society.

5.2 Sound legal environment

Sound legal environment guarantees the environmental protection behavior of the enterprises. The existing standards of pollutants discharge, the charging system, “the three-simultaneous system” and the discharge license system ought to be strictly practiced. Legislation ought to be paid attention to and, the enforcement of the law of environmental protection and the legislation of environmental protection ought to be placed on the same important position. The law ought to be seriously and strictly obeyed and practiced and whoever breaks the law ought to be punished. The enforcement of the law of environmental protection appears more important since environmental pollution is evidently characterized by “external diseconomy”.

5.3 The suitable advanced technology

The suitable advanced technology is the material support for the environmental protection behavior of enterprises. Most of the industrial enterprises in Ningxia are characterized by backward production technology, aged technological equipments, high consumption and low use ratio of resources and energy, severe pollution by “the three wastes”, which raise the production costs of enterprises and restrict the further development and market competitiveness of the enterprises. The severe pollution of industrial enterprises can only be changed completely by scientific

and technological advances, the raising of scientific and technological contents of products, the regulation of product setup and the realization of the strategic shift of industrial production.

5.4 The reasonable and efficient encouraging system

The reasonable and efficient encouraging system is the source and power of the environmental protection behavior of the enterprises. The behavior of the economic body is constrained by the system and the regulation and implementation of the system directly decides the operating effect of the system. An efficient system has simultaneously the constrained system and the encouraging system, the former guarantees the efficient implementation of the system and the latter helps the economic body behave consciously in accordance with the system in order to decrease the implementation cost of the system. The introduction of the constrained system and the encouraging system guarantees that the economic body chooses the consumption and production styles favorable to environmental protection from the angle of their effectiveness and maximization of profits.

5.5 The encouraging system of prevention and remedy of pollution

The encouraging system of prevention and remedy of pollution of enterprises ought to be established. The principle “whoever pollutes the environment pays and whoever remedy the pollution gains” ought to be introduced to the enterprises in the Region. The Environmental Protection Bureau of the Region is responsible for the report and registration of the property right of the environmental resources, check the computation and carry out a general investigational survey of the environmental contents, programs the total amount of discharged pollutants and discharge plan of the whole Region in light of the environmental situation and social-economic demand of the enterprises in the Region and, allocates the total discharged amount of pollutants by auction or invitation to bid. Only when enterprises have obtained the right of discharging pollutants can they discharge pollutants, otherwise, unauthorized discharge of pollutants is severely punished.

5.6 Transfer of the right of discharging pollutants and the amount of discharging pollutants

The right of discharging pollutants and the amount of discharging pollutants can be transferred so that the environmental cost is considered in the decision-making of the enterprises and the environmental polluters chooses the consumption, management and production styles favorable to environmental protection from the angle of their economic profits. Once the right of discharging pollutants and the amount of discharged pollutants are implemented, environmental protection and enterprise profits are related and the enterprises can reduce the discharged amount of pollutants by raising the efficiency of the installations for environmental protection, meanwhile, they can also transfer the amount left for discharging pollutants to make profits, only to make the enterprises take efficient measures to reduce environmental pollution.

5.7 The fund collection system

The fund collection system of enterprises for environmental protection ought to be established to ensure the investment for environmental protection. The investigation shows that the investment of enterprises for environmental protection are generally insufficient for environmental protection. For this reason, a system of special fund for environmental protection can be established in enterprises (the specific composition: special fund of the enterprise from the annual budgets, the divided part of the profits of environmental protection project and the yearly interest of the fund for environmental protection). The fund for environmental protection can be guaranteed by applying a proportion of low-interest loan from the banks and a portion of subsidy fund for environmental protection from the governments of all levels.

5.8 The regulations for environmental protection

We ought to establish and perfect the regulations of environmental protection for enterprises, train special workers of environmental protection to raise their political and professional qualities in order to ensure the implementation of the regulations of environmental protection for enterprises. The enterprise ought to pursue clean production and control the industrial pollutants during the whole process of production, reducing the discharge of pollutants as much as possible under the existing

technological condition.

6. Conclusion

Environment and economic development are two sides of unity of opposites. Environment provides material base and space of ability for human's life and development of society and economy. Environmental pollution is often accompanied with economic behavior of enterprises. Environmental behavior of enterprises is the main body in the discharging and controlling pollution. It directly influences environmental pollution's situation of regions. Therefore, environmental protection system's supply is necessary and of the utmost importance. The paper gave the system integrated with analysis of environmental behavior of enterprises in Ningxia.

The popularization of environmental protection conception is the guidance to design and implementation of the environmental protection's system. Sound legal environmental guarantees the environmental protection behavior of the enterprises. The suitable advanced technology is the material support for the environmental protection behavior of enterprises. The reasonable and efficient encouraging system is the source and power of the environmental protection behavior of enterprises. The encouraging system of prevention and remedy of pollution of enterprises ought to be established. The right of discharging pollutants and the amount of discharged pollutants can be transferred. The fund collection system of enterprises for environmental protection ought to be established to ensure the investment for environmental protection. We ought to establish and strengthen regulations of environmental protection for enterprises, train special workers of environmental protection to raise their political and professional qualities in order to ensure implementation of the regulations of environmental protection for enterprises.

Note:

① According to a report by WHO in 1998, the ten cities in the world where the air is most seriously polluted are in order Taiyuan, Milan, Beijing, Ulumqi, Mexico City, Lanzhou, Chongqing, Shijiazhuang and Tehran.

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Table 1: Comparison between Eastern China, Middle China and Western China

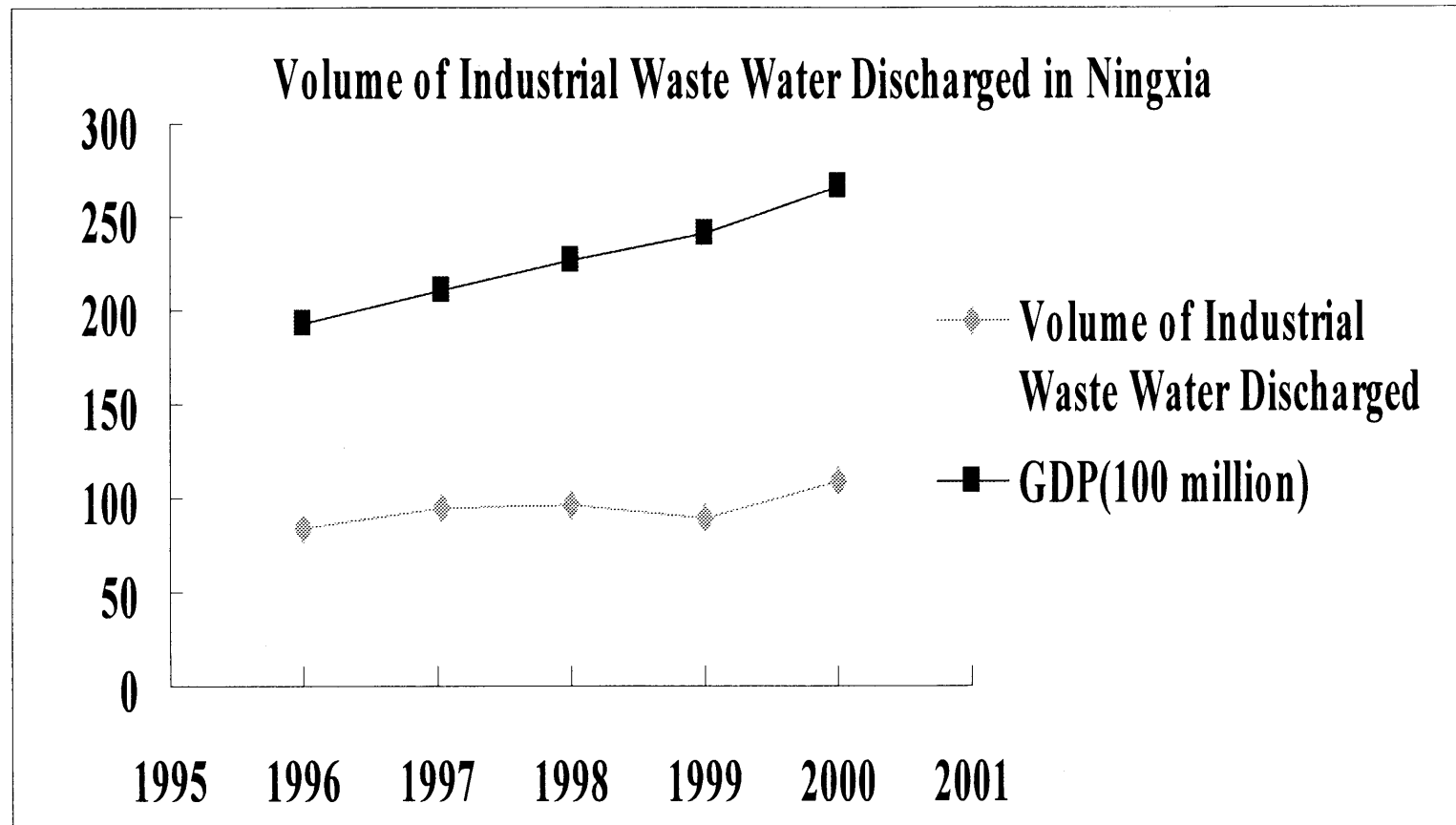
Region	Land Area (10000 sq.km)	Population	Gross Domestic Product (100million yuan)	Value-added of the Industry (100million yuan)	Total Volume of Industrial Waste Gas Emission (100million cu.m)	Total Volume of Sulphur Dioxide Emission (10000 tons)	Total Volume of Industrial Soot Emission (10000 tons)	Total Volume of Industrial Waste Water Discharged (10000 tons)	Total Volume of Industrial Solid Wastes Produced (10000 tons)
National	960.54	126583	97209.37	25394.80	138145	1615.32	953.33	1942405	81608
East	106.45 11%	48953 38.7%	55689.58 57%	16164.68 63%	69375 50%	712.65 44%	301.76 32%	939234 48%	31364 38%
Middle	165.93 17%	41564 32.8%	24865.17 26%	5571.28 22%	36887 27%	384.69 24%	335.45 35%	556004 29%	28402 35%
West	688.16 72%	35531 28.1%	16654.62 17%	3458.84 14%	31883 23%	517.98 32%	316.12 33%	447165 23%	21842 27%

Table 2: Comparison of industrial pollution intensities between Eastern China, Middle China and Western China in 2000

Project	National	East	Middle	West
Volume of Industrial Waste Gas Emission (m³/ Yuan)	1.42	1.24	1.48	1.91
Volume of Sulphur Dioxide Emission (tons / 100 million Yuan)	166	130	154.7	311
Volume of Industrial Soot Emission (tons / 100 million Yuan)	98	54	135	190
Volume of Industrial Waste Water Discharged (tons / 100 million Yuan)	20	17	22	27
Volume of Industrial Solid Wastes Produced (tons / 100 million Yuan)	0.84	0.56	1.14	1.31

Data source: China Statistics Annual (2001)

**Figure 1: Discharged amount of industrial waste water in Ningxia
(Unit: 10 thousand tons)**



**Figure 2: Discharged amount of industrial waste gas in Ningxia
(Unit: 100 million m³)**

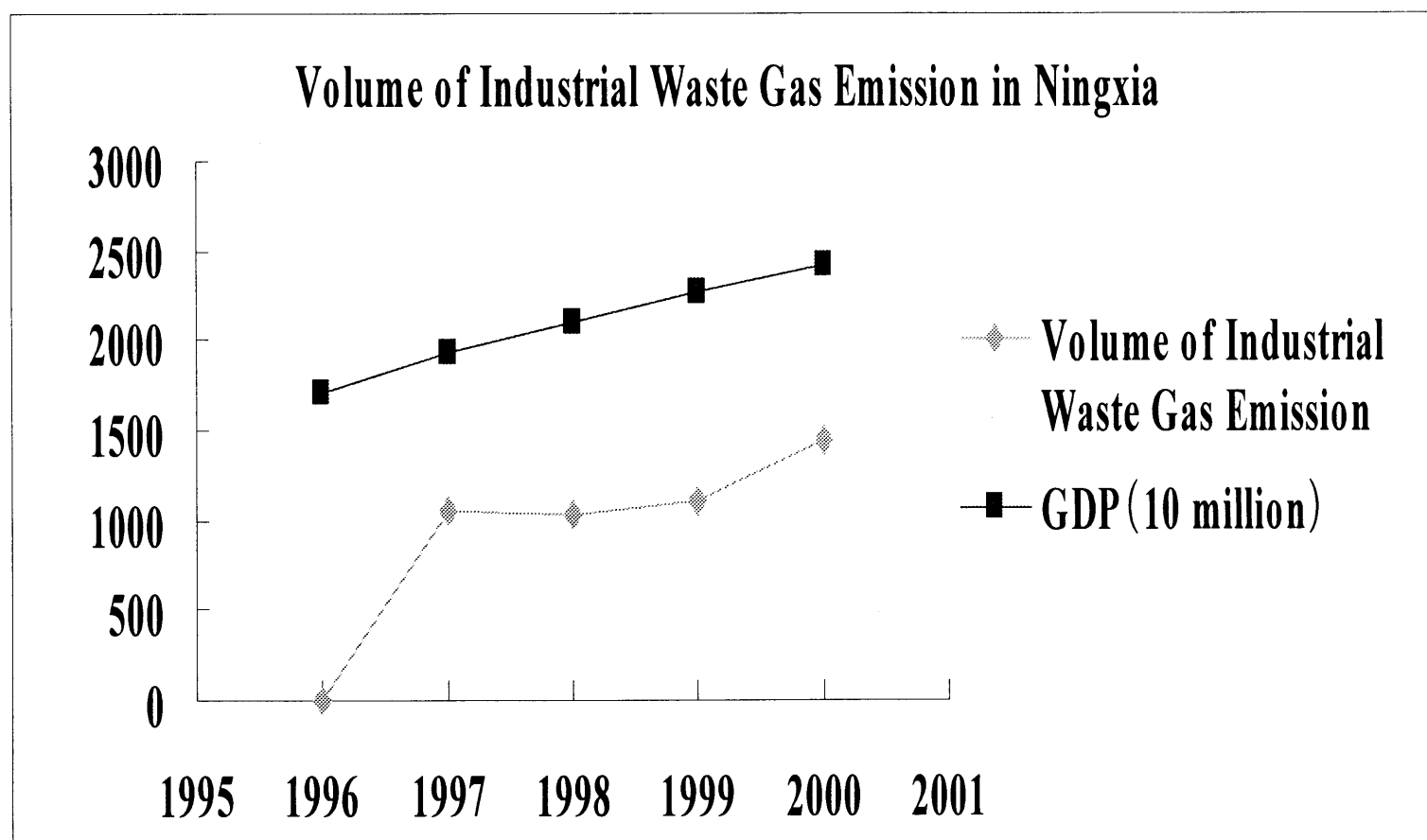
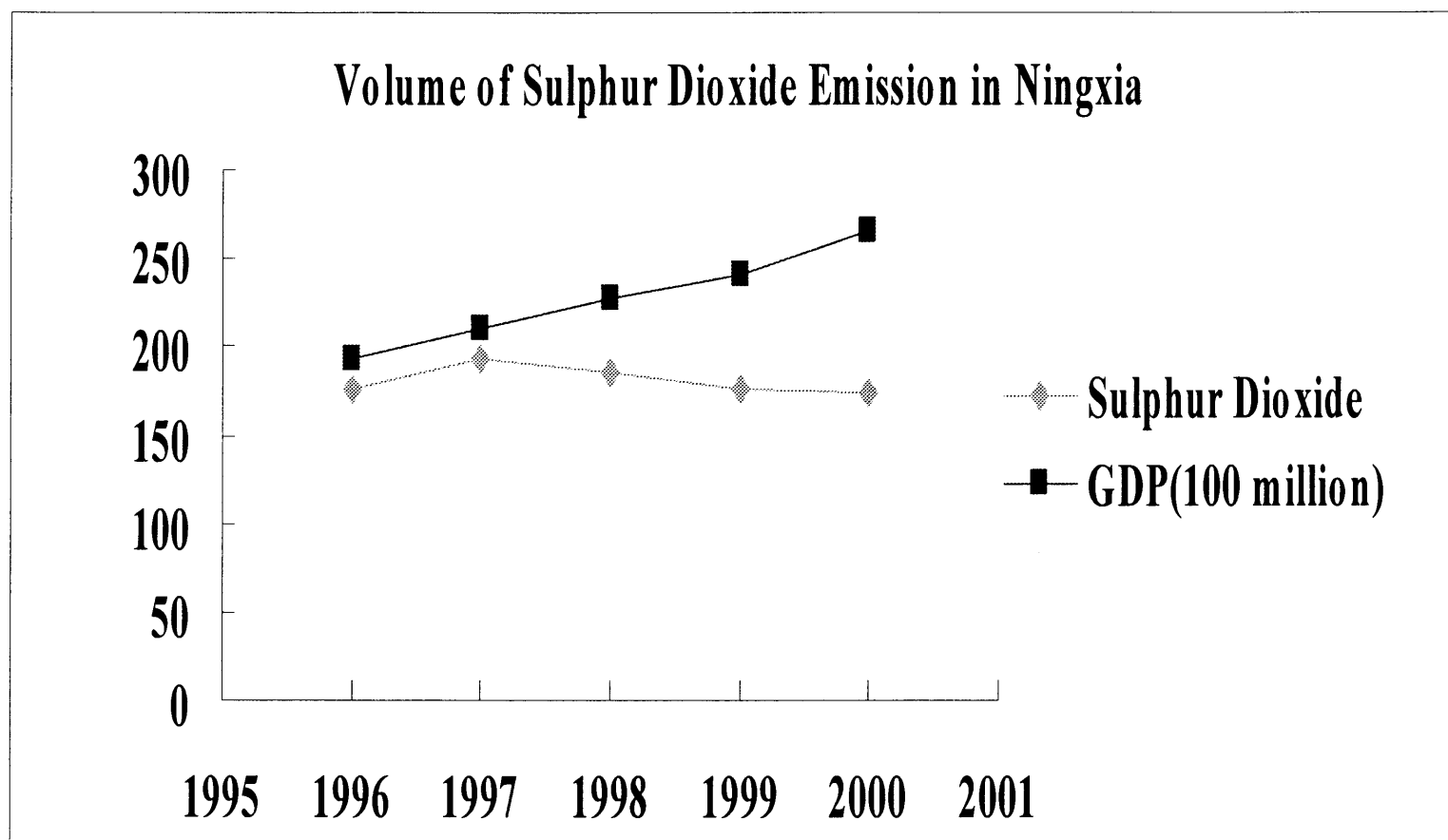


Figure 3: Discharged amount of industrial sulfur dioxide in Ningxia
(Unit: 10 thousand tons)



**Figure 4: Discharged amount of industrial smoke in Ningxia
(Unit: 10 thousand tons)**

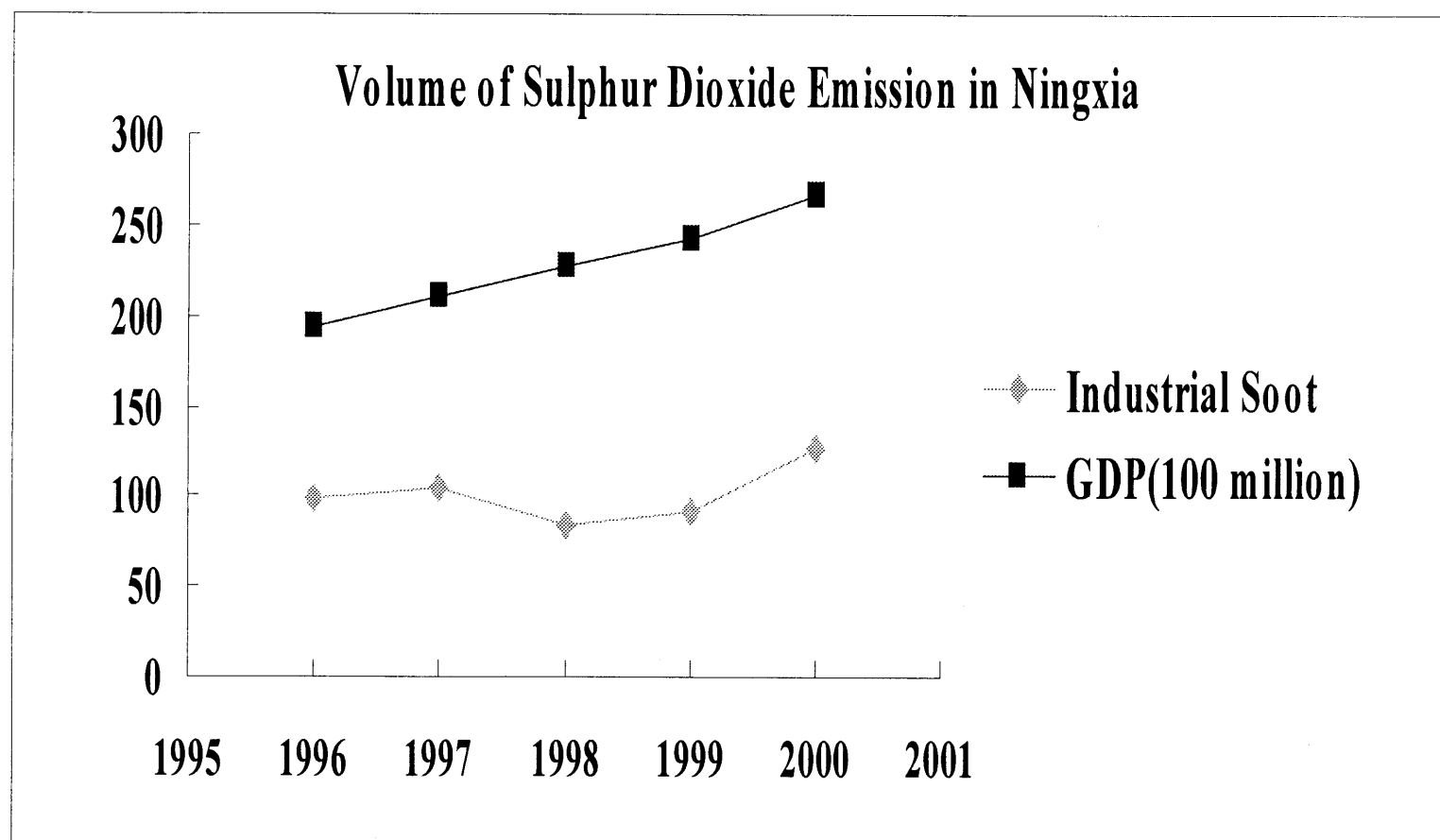


Figure 5: Discharged amount of industrial dust in Ningxia
(Unit: 10 thousand tons)

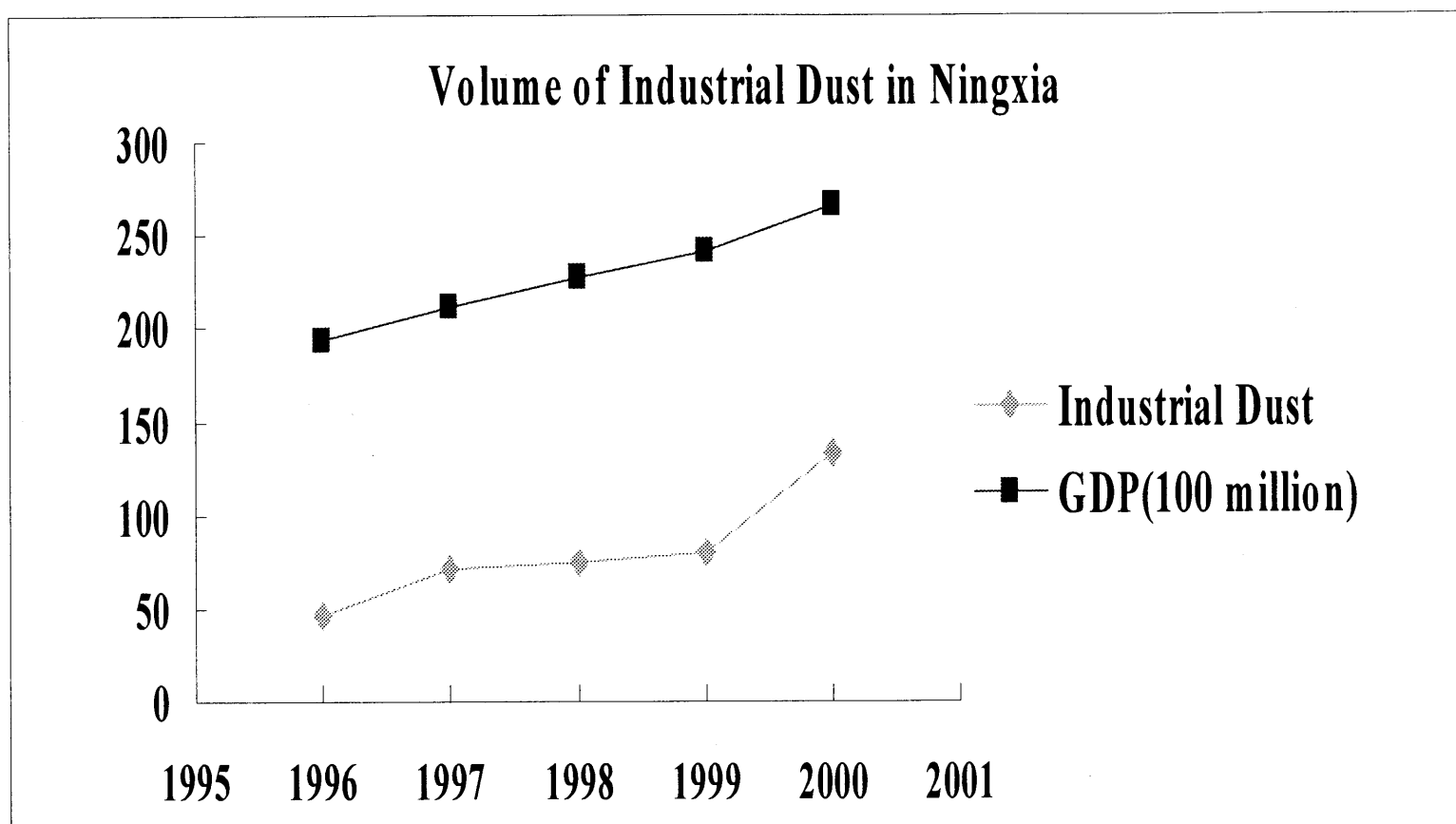


Table 3: Comparison of industrial pollution intensities between Ningxia, Western China and the whole country in 2000

Region	GDP (100 million yuan)	Industrial Waste Gas Emission (m³/Yuan)	Volume of Sulphur Dioxide Emission (Tons/100 million Yuan)	Total Volume of Industrial Soot Emission (Tons / 100 million Yuan)	Total Volume of Industrial Waste Water Discharged (Tons / 100 million Yuan)	Total Volume of Industrial Solid Wastes Produced (tons / 100 million Yuan)
National	97209.37	1.42	166	98	20	0.84
West	16654.62	1.91	311	190	27	1.31
Ningxia	265.57	5.44	656	473	41	1.80

Data source: China Statistics Annual (2001)

Table 4: Control ratio of the industrial “the three wastes” in Ningxia

Region	Years	Waste Water Disposal percentage	Waste Gas Disposal percentage	Industrial Solid Wastes Disposal percentage
National	1998	31%	85%	55%
	1999	36%	85%	59%
	2000	47%	83%	57%
West	1998	22%	80%	41%
	1999	25%	75%	41%
	2000	34%	82%	35%
Ningxia	1998	19%	84%	68%
	1999	13%	79%	41%
	2000	21%	80%	103.5%

Data source: China Statistics Annual (1999, 2000 &2001)

Table 5: Proportion of trades in Ningxia to the total industrial production value in 2000

Industrial lines	Coal	Paper Making	Cement Manufacturing	Metal Smelting	Electric Power	Rubber products	Raw Chemical Material and Chemical Products
Percentage	7%	5%	3%	19%	8%	7%	12%

Data source: Ningxia Statistics Annual (2001)